



Agenda item 4.4
For information

Council

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***Review of International Salmon-Related Literature
Published in 2000***

The attached literature review, covering articles published in 2000, is presented to the Council, for information, in accordance with Article 12, paragraph 2, of the Convention. It has been prepared by carrying out a computer-based search of the relevant databases and includes material abstracted from the scientific literature and the press (articles written in English only). Only selected information considered to be most relevant to the Council has been included in the attached review. A complete listing is available from the Secretariat.

Secretary
Edinburgh
9 April, 2001

***Review of International Salmon-Related Literature
Published in 2000***

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PRESS ARTICLES

Slump in Tay salmon catches is being halted

Aberdeen Press and Journal, 7 January 2000

The dramatic slump in the number of salmon and grilse in the River Tay is being halted, claims the Tay District Salmon Fisheries Board. Its annual report shows that the river system was at its peak in the 1960s-70s, with 104,429 fish caught by nets in 1969, and 14,076 salmon caught by rod in 1973. But numbers plummeted over the past few seasons, with only 8,721 recorded landings of salmon and grilse in 1997, and 8,474 the following year. Board chairman Michael Smith says in the report: "We have overseen the end of almost all interceptory coastal and estuary netting within the Tay Board District. "We have also funded and equipped an excellent team of bailiffs, stocked headwaters, encouraged angler restraint through voluntary catch-and-release programmes and introduced a statutory ban on the use of shrimps and prawns as bait." But Mr Smith says the increase in predators, deep sea and industrial fishing, and the "iniquitous" drift-net fishing off North-east England make the recovery "less predictable". Effluent from fish farms and indiscriminate stocking of non-indigenous trout by clubs and proprietors also exacerbated the situation and were a cause of real concern, he says. Mr Smith suggests that the most cost-effective and sustainable way to increase the number of salmon is to increase the areas accessible to adult fish. Twenty tributaries of the Tay which are not accessible to spawning salmon were "planted" with a total of 372,000 fry in spring 1998. Board fisheries manager David Summers says that such steps were of long term value to the Tay rather than a "quick-fix" solution.

Genetic Salmon reported to edge wild species out

Xinhua News Agency Bulletin, 9 January 2000

Wild salmon species are being threatened by an increasing "genetical contamination", warned Canada's Ottawa Citizen newspaper Sunday. Accidental tinkering with genes in prized Atlantic salmon has put whole populations of fish on the verge of extinction, the newspaper quoted the Atlantic Salmon Federation as saying. Canadian and American scientists of the federation say that in the Gulf of Maine and the Bay of Fundy, so few wild fish are breeding that each river's population "is teetering on the brink of extinction." It's not that the wild fish are fished out. Rather the problem is competition from domesticated salmon raised in pens, which escape and breed with the wild fish, weakening the gene pool. Two or three times each year, a storm will flip a cage over, and all 10,000 or more fish in it escape, reported the newspaper, adding that seals can also chew holes in cages to get at the salmon inside. The result is a dilution of the gene pool. Domesticated fish are breeding fat, lazy, but growing quickly. They don't have the sleek shape and muscle development of the wild fish. When they escape and breed with wild fish, they pass on their particular traits to a degenerated population, which may not know where to spawn, or may try to swim down to the sea or upstream at the wrong time of year. The federation scientists are afraid that genetic changes are forever and will some day come out of the lab restriction to push their wild cousins off the map, the newspaper said.

Scientist hopes to find way to boost salmon numbers

The aim of an experiment, in which 40,000 eggs are being held in quarantine, is to determine if the fish pass a deadly disease onto their young

Telegraph Journal, 10 January 2000

Fish scientists around the world are watching a careful experiment in Fredericton that could offer a partial solution to the mysterious decline of the mighty Atlantic salmon. Salmon numbers have been drastically dropping for the last few decades, and the few remaining wild stock that are returning to New Brunswick rivers are being infected by a deadly disease spread from the region's many fish-farming operations. The fish virus, called infectious salmon anemia, has the potential to wipe out the dwindling numbers of wild fish that are returning to the rivers. Salmon cages have become factories for the disease, spreading ISA in the urine, feces and skin mucus of infected fish - then washing it into the sea with the powerful tides of the Bay of Fundy. The disease has shown up in Norway and recently in both wild and farmed fish in Scotland. Conservationists and fish farmers alike despise the disease, and until now, had no idea how to fight it or restore healthy wild salmon to the province's rivers. Atlantic Salmon Federation chief scientist Dr Fred Whoriskey told a conference over the weekend about a bold experiment that may succeed in restocking at least one New Brunswick River with wild fish. Dr Whoriskey has taken 40,000 eggs from infected wild fish from the Magaguadavic River near St George and quarantined them in a holding tank at the Research and Productivity Council building in Fredericton. Scientists aren't certain whether fish pass the disease onto their young, so Dr Whoriskey is holding his breath, hoping the disease won't show up in the Magaguadavic eggs. He plans to raise the eggs in quarantine until maturity, and is hoping the aquaculture industry will provide a healthy environment for the fish to live until they can be released. The project is expected to take at least two years to complete, but the hope is that this expensive process will result in a new method to boost wild salmon numbers in New Brunswick rivers. It costs about \$31,000 to hold the eggs for six months in quarantine, money that has been provided by the province's Wildlife Nature Trust program from a levy on hunting and fishing licences. Dr Whoriskey is hoping the provincial government and the fish farmers will also see the value in the experiment and help out with some of the costs. The Magaguadavic is particularly threatened, and Dr Whoriskey says just 24 wild fish returned to the river last year compared with hundreds during the 1980s. In that time, he says, aquaculture escapees have outnumbered

the wild fish, their numbers gradually increasing until they reached a peak of 10 escapees for every one wild Atlantic salmon in the mid-1990s. With so few wild fish, he said, it is nearly impossible to secure the future of the species in that river - which is why he and other scientists are working so diligently on the quarantine experiment. "If we can save those eggs, then we are potentially in a position to be able to kickstart this program," he said. "The Norwegian and Scottish researchers are not doing this kind of work, so the eyes of the world right now are on us in terms of whether we can use this as a strategy. This is brave new ground for everyone.... If it works then we have the tools, and then we need the money and the will to apply the model to other rivers."

Atlantic salmon face more threats

Protocols for governing aquaculture need revision

Fredericton Daily Gleaner, 19 January 2000

The Atlantic Salmon Federation and its Canadian regional councils want the Department of Fisheries and Oceans to maintain protection protocols for the endangered game fish. The groups are going to DFO's Atlantic salmon advisory committee meetings in Montreal this month to push their agenda. There is particular concern about the future of the North Atlantic Salmon Conservation Organization protocols for the introduction and transfer of aquaculture salmonids, which are designed to protect wild Atlantic salmon, said federation president Bill Taylor. In 1999, DFO proposed revising the protocols governing the introduction and transfer of salmonids to allow the aquaculture industry to use non-native strains. "This is not acceptable, especially at this time, when Canada's wild Atlantic salmon populations have declined to an all-time low," said Taylor. "Populations of large wild Atlantic salmon of Canadian origin have declined about 90 percent over the past 25 years." He said the use of non-native salmon strains violates NASCO protocols and the principles of precautionary management. Canada is a member of NASCO's North American commission and Canadian scientists and government resource managers helped draft these protocols to minimize the impacts on wild salmon from the aquaculture industry, he said. "Any weakening of the protocols will further threaten our wild salmon and is simply unacceptable," said Taylor. DFO is legally responsible for protecting Canadian's population of wild Atlantic salmon, but it is also responsible for developing Canada's aquaculture industry. Taylor said this places DFO in a position of working towards conflicting goals regarding the protection protocols. Because of that conflict, the federation believes it is imperative that groups interested in conserving wild Atlantic salmon populations concern themselves with maintaining strong protocols, he said. Taylor said wild salmon have genes that have been passed on for centuries, adapting them for survival in particular river systems and along certain saltwater migration routes. Moving salmonids from one area to another risks the future of wild Atlantic salmon through loss of genetic integrity of wild stocks, transfer of diseases and parasites and loss of natives through competition. The aquaculture industry has no foolproof containment methods and there are many instances of tens of thousands of salmon escaping into the wild, he said. In Europe, when farmed salmon entered the rivers, wild gene pools were weakened and the resulting hybrid lacked the necessary instincts for survival in the wild, said Taylor. The federation has been studying the interactions between wild and farmed salmon in the Magaguadavic River, located near the center of New Brunswick's aquaculture industry, since 1992. Taylor said the wild salmon run declined from 293, or 80 percent of the river's conservation requirement in 1992, to only 24, or less than two percent of the conservation target in 1999. To add to the bad news, both farmed and wild Magaguadavic salmon have tested positive for infectious salmon anaemia which has caused tremendous losses for the aquaculture industry, he said. "Another cause for concern is the emerging interest in transgenics to produce larger, faster growing salmon," said Taylor. "At a time when wild Atlantic salmon populations are in decline, relaxing NASCO's protocols endangers their very survival," said the federation president. "Decisions made at these meetings could well determine the preservation or ruination of this species. We must ensure that Canada does not subject our wild Atlantic salmon to any unnecessary risks."

Greenpeace sounds alarm on 'super' fish: Future of species in danger, group warns

Ottawa Citizen, 21 January 2000

A Newfoundland company on the verge of bringing the first genetically modified fish to market is toying with a risky technology that can wipe out large populations of its unmodified relatives if released into the wild, Greenpeace says. In a report released yesterday, the environmental group accuses the firm, A/F Protein Canada Inc., of St. John's, of ignoring potentially disastrous impacts on the world's fish stocks in its rush to commercialize genetically engineered trout and salmon. The company, with U.S. financial backing, is leading a worldwide race to develop fish containing the genes of a hormone that occurs naturally in chinook salmon. The hormone can make the fish grow several times faster than their wild cousins. According to Greenpeace, the fish are already being bred in fibre glass tanks at farms in Newfoundland, Prince Edward Island and New Brunswick. An A/F Protein spokesman contacted yesterday confirmed his company aims to have its first genetically engineered fish approved and available for breeding in commercial farms within two or three years. Garth Fletcher says the company has also conducted a small-scale taste test of its genetically engineered trout to determine whether consumers eating the fish can tell the difference between modified and unmodified varieties (they could not). Greenpeace cited recently published research by Purdue University in the United States to support its position that the commercialization and research of genetically modified fish should be halted and banned. "Genetically engineered fish know no borders. Once they're out there, they will travel around," says Greenpeace activist Louise Gale. A U.S. report published last year in the Proceedings of the National Academy of Sciences raised alarm at what could happen if genetically modified fish confined to farms were to be accidentally released into the wild. Using a computer model to test the hypothetical situation, Purdue University researcher Howard Muir concluded that just a small number of genetically

growth-enhanced fish could crossbreed with their wild relatives, affect mating behaviour and ultimately weaken the gene pool of their otherwise healthy, unmodified cousins. The result, researchers say, could lead to hybrid offspring that die at a young age. Over the long term, that could devastate fish stocks and put some species on the verge of extinction. Genetically modified fish can also harm the environment in other ways, a California State University plant geneticist told a Greenpeace-sponsored news conference. Since growth-enhanced fish can also have large appetites, any species that accidentally escapes into the wild could become a super predator, devouring smaller fish at alarming speeds, says Doreen Stabinsky. But Mr. Fletcher of A/F Proteins dismisses Greenpeace's concerns. He says it's in the interest of companies that have invested millions of dollars and years of development into a genetically engineered fish protected by patents to ensure these creatures don't make it into the wild. "Why would we risk giving away proprietary fish? We're talking about fish that would be grown in contained facilities." Ms. Stabinsky disagrees. "There's no way for people to assure that there's 100-per-cent containment of fish."

Escaped fish harm wild salmon: Leaked Fisheries report backs up claim that farmed fish hurting wild stocks

Ottawa Citizen, 22 January 2000

Escaped farm salmon have indeed damaged Canada's fragile stock of wild salmon by interbreeding with them, an internal report from Fisheries and Oceans Canada admits. The report, made in preparation for next week's meeting of Canada's advisory committee on Atlantic salmon in Montreal, backs up the claims made by conservation groups who warn of dangers to Atlantic salmon. Damage has already occurred, says the draft report, which has not been publicly released. It comes shortly after a statement by Yves Bastien, Canada's commissioner of aquaculture, that there is no evidence farmed fish cause genetic disruption for wild Atlantic salmon. U.S. federal fish agencies had already warned that interbreeding between wild and domestic fish was weakening the gene pool of salmon in the Gulf of Maine. Now the Canadian DFO scientists are saying the evidence of genetic damage does exist. A copy of the report obtained by the Citizen says: - All Atlantic salmon are not genetically the same. Each local population of salmon has its own distinct genetic fingerprints that are important because they allow salmon to adapt to local conditions. For instance, the salmon native to a river that melts in early spring will need spawning instinct that are different from salmon in a river where the ice goes out much later. They are also adapted to different acidity levels in different rivers. "Genetic differences have been observed between wild and cultured (farmed) salmon." The greatest differences are between domesticated fish originally from European stock and wild fish native to North America. - "Wild and escaped domesticated Atlantic salmon can interbreed, and in some cases escaped domesticated salmon form the majority of fish in the spawning population." - A cross between wild and domesticated fish does nothing good for the wild fish. But "there is evidence to indicate that there has been a reduction of fitness in the wild populations in the short terms when wild and domestic salmonids have interbred." Salmonids are fish in the salmon family, including trout. This point is "the central issue of concern," the report says. It quotes a 1997 study that says the smolts (young salmon) born from escaped salmon, and from hybrids of wild and domestic salmon, are less likely to survive than wild fish. However, the study notes, the domestic and hybrid fish grow faster in their early months of life than young wild salmon. This allows them to crowd out the wild fish in the competition for food and survival. The salmon meetings scheduled for Monday and Tuesday are not directly connected with another set of Montreal meetings - an international attempt to lay out a "protocol" on trade in genetically modified food. But Greenpeace argues the salmon are a perfect example of the environmental dangers of genetically modified foods. Greater than the danger from simple farmed fish is the danger that some day genetically engineered salmon will escape, says Miranda Holmes of Greenpeace. These fish, still in the lab, are two or three years away from commercial release. Combining Chinook and Atlantic salmon genes, they eat voraciously and grow faster than natural salmon. But she said Fisheries Minister Herb Dhaliwal should prohibit the commercial use of transgenic fish. "The primary responsibility at DFO is the protection of wild stocks," she said.

Wild salmon face battle for survival

Introduction of genes from farmed fish threatens Atlantic species

Ottawa Citizen, 31 January 2000

Accidental tinkering with the genes in prized Atlantic salmon is such a threat that whole populations of the fish face likely extinction, government and private scientists say. In the Gulf of Maine and the Bay of Fundy, so few wild fish are breeding that each river's local population "is teetering on the brink of extinction," says Bill Taylor, the president of the Atlantic Salmon Federation. It's not that the wild fish are fished out. Rather the problem is competition from domesticated salmon raised in pens, which escape and breed with the wild fish, weakening the gene pool. And meanwhile, research continues into ways of giving the farmed salmon genes from other fish species - in the hope of creating fish more suited to farming. Genes to grow faster. Genes to resist freezing. Genes brought from European salmon. Genes that just sort of adapted in the unnatural world of a fish farm's cages. "Genetic changes are forever," Mr Taylor warns. And he's alarmed that these transgenic fish - so far restricted to the lab - will some day push their wild cousins off the map. "We're having terrible trouble getting our message out," says Sue Scott, vice-president of the federation, which represents salmon-lovers in central and eastern Canada and the United States. "They are experimenting with the Chinook genes (in Atlantic salmon) for faster growth," she says. "The name of the game is productivity, and that means making salmon bigger." "We're trying to nip things in the bud here," she says. "We're trying to prevent the weakening of protocols that could control this problem. We could learn from Europe." But transgenic fish aren't the only genetic worrying point. Ordinary

breeding - the same thing farmers have done with chickens and pigs and cattle for thousands of years - can also cause a gradual but disturbing shift in the genetic makeup of Atlantic salmon. "It makes it grow much faster in the first years of its life ... five or six times faster," he says. The adult salmon is the same size as Atlantic salmon with normal genes, but the transgenic fish reaches full size sooner. You cut a year off production time. Time is a lot of money and risk of getting diseases, risk of environmental problems. The longer you keep them in the water, the greater your risk." There's been no threat of cross-breeding between wild fish and Chinook-Atlantic hybrids so far, he says, because the fast-growing hybrids haven't left the lab. "The industry's not doing it yet. We're still going through the R & D on it. They (the industry) are all in a wait-and-see mode. They're afraid of eco-terrorists." And Mr Fletcher argues that building a better fish - or a transgenic corn of wheat plan - is harmless, and just another step in the intense breeding that turned wild plants into farm crops years ago. "I can understand some of the frustrations of the farmers," he said. "You're suddenly asking questions, and they're saying, 'Where were you 50 years ago when we were doing some of the hybridizations?' Some of the environmentalists' arguments are purely: We don't like it. Stop it!" Or Greenpeace's rather smug approach that the British superstores now are no longer having transgenics in their crops. "They've seen the light, and why don't Canadian superstores stop this too?" Well that's not a satisfactory answer either. If you convince the public of some danger and you do this on the basis of no data, the stores make a business decision to abandon GM foods. They've just decided it's not good for the bottom line, nothing else. There's no facts." Fish farms breed salmon in huge pens submerged in the cold ocean water, each with thousands of fish. While they aren't splicing in genes, "they pick particular traits," Ms Scott says. "They're breeding fat, lazy fish that grow quickly. They don't have the sleek shape and muscle development of the wild fish, and then they escape and breed with wild fish. The result is a dilution of the gene pool." Two or three times each year a storm will flip a cage over, and all 10,000 or more fish in it escape. Seals can also chew holes in cages to get at the salmon inside. Two US agencies, the Fish and Wildlife Service and the National Marine Fisheries Service, concluded this fall that Atlantic salmon in Maine are edging towards extinction. Blame genetic interference by the aquaculture industry for part of it, they say. "The use of European/North American hybrids by the industry appears to be increasing," they say in a grim report. This refers not to crossing different species of salmon, but to mixing strains of Atlantic salmon from Europe and North America, which look the same but have adapted to different living conditions. "Aquaculture practices continue to pose a serious threat to the genetic integrity of the Gulf of Maine (salmon)," the report says. And when you mess up the salmon's genes, they say, the resulting armed fish "have the potential to disrupt, displace and genetically contaminate" their wild cousins. Salmon are funny that way. Each wild fish belongs to a specific population, hatched and raised in a particular stream. Fish from the Miramichi River don't spawn in the Restigouche, period. And the scientists say that throwing fish from Iceland or Scotland into the mix will disturb normal breeding patterns. Wild Atlantic salmon are already breeding in numbers far below the level needed for a stable population, says Mr Taylor. Wild salmon are so specialized that they spawn and swim up or downstream at different times in different rivers, adapting to local river conditions over millennia. The trouble with bad genes is that fish lose the ability to spawn and survive. They may not know where to spawn, or may try to swim down to the sea (as young fish) or upstream (as spawning adults) at the wrong time of year. In Europe, the same problem exists. "One of the joys of the Atlantic salmon is that they're not a standard product," says Jeremy Read, president of the Atlantic Salmon Trust, a British conservation group. "The fish are different from stream to stream, area to area." Yet farm salmon are bred in Scotland to have standard characteristics: Tolerance to crowded cages and early maturity, for example. And there, too, the farm fish breed with wild ones, spreading their domestic-genes. After one mass escape of farm fish in Scotland, trackers managed to fit radio transmitter tags to some of the escapees and followed them upstream as they spawned. They also detected in some of the fry (newly hatched fish) a type of synthetic protein that is put in feed pellets in fish farms, but doesn't exist in natural food. This proved some of the fry had farm fish as parents. At Memorial University in Newfoundland, professor Garth Fletcher has been transferring genes from one fish to another since 1982. In the old days he was extracting the bit of DNA that lets flounder create its own chemical antifreeze solution, and using a needle to inject that same gene into the eggs of Atlantic salmon. Flounder resists cold temperatures much better than salmon do. In the wild, that's not a problem for salmon: They migrate far out to sea and find water that's warm enough for them to survive. But domestic salmon in sea cages can't migrate anywhere, and the cold can hurt them. Ice crystals can actually form in their blood, killing them. That work, funded by Canada's Natural Sciences and Engineering Research Council (NSERC) continues to this day. Similar transgenic work in Pacific salmon is being carried on in British Columbia by fisheries and Oceans Canada. Mr Fletcher says it's still a long way from being useful to fish farms. But in 1989 they added a new avenue of fish research, transferring a gene controlling growth hormones from a west-coast Chinook salmon into the Atlantic species.

Move by salmon netsmen hailed

Aberdeen Press and Journal, 4 February 2000

A new initiative to conserve early-running salmon stocks has been welcomed by Scottish Fisheries Minister John Home Robertson and the Association of Salmon Fishery Boards. The Salmon Net Fishing Association of Scotland wants its members to defer the opening of their netting season by six weeks. This is in response to a fall in salmon - particularly early-running - and sea trout numbers. Mr Home Robertson said this was a boost for declining stocks and he hoped all Salmon Net Fishing Association of Scotland members and other netsmen will respond positively. "It obviously goes without saying that a decrease in salmon and sea trout stocks - particularly early-running salmon - is a matter of the utmost concern. Measures such as postponing the opening of the season for nets and rods, catch and release by anglers and in general any measures which will allow fish to spawn and boost stocks deserve every encouragement." Andrew Wallace,

director of the Association of Salmon Fishery Boards, said: "This is an extremely positive move by salmon netmen who share our concern about early-running stocks of salmon. This move complements the considerable and ever-growing amount of work being conducted by fishery boards all over Scotland."

Action urged as salmon flood from fish farms

Aberdeen Press and Journal, 19 February 2000

Fishing representatives yesterday urged the Scottish Executive to take immediate action after it was revealed that 150,000 salmon had escaped from Sutherland fish farms in the past month. They called on the Government to publish the findings of a report on the problem of escaped farm fish and how best to tackle it. They also want salmon farmers to be obliged to report fish escapes immediately and to be liable for the costs of recovering them. Five escapes have occurred at Sutherland fish farms since mid-January. The first two outbreaks happened on January 18 and 21. Newly established Scourie fish farming company Loch Duart Ltd reported that 9,108 smolts had escaped from a net at Loch na Thuille, a freshwater loch near Rhiconich. Days later, between 8,000 and 9,000 fish got away during a grading operation by Assynt-based Ardvair Salmon at Loch Droighniche, a sea loch near Drumbeg. More recently, the Alness-based Aquascot Group revealed they had lost about 15,000 year-old fish after gale force winds damaged a cage in Loch Clash, Kinlochbervie. The remaining two break-outs were at fish farms in Loch Eriboll and in Enard Bay, run by Norsk-Hydro GSP. The West Sutherland Fisheries Trust calculates that, of the estimated 150,000 fish involved, as many as 70,000 could have escaped alive. Andrew Wallace, director of the Association of Salmon Fishery Boards, called for a long-awaited report by a Scottish Executive Rural Affairs Department committee looking into farmed salmon escapes to be published as soon as possible. He also urged a change in the law so that salmon farmers have to reveal a fish escape straight away. Other measures which are desired by the board are some form of identification for farmed fish and a review of the design and structure of cages. Mr Wallace also called for a rapid response force to contain fish escapes and for fish farmers to be required to take out insurance for the cost of the recovery operation. He commented: "There has to be some form of agreement with fish farming companies so the cost of recovery is covered by the companies themselves or through insurance." Mr Wallace gave the example of a recent escape of 13,000 salmon from a farm on Loch Roag, Lewis, which the Western Isles Fisheries Trust spent 402 hours of time on. Patrick Fotheringham, director of the Salmon and Trout Association Scotland, said: "We are extremely concerned about the level of escapes from marine caged salmon farms. This highlights the necessity for the escapes committee of the Scottish Executive Rural Affairs Department to report."

Anglers return 18,000 salmon to boost stocks

Scotsman, 7 March 2000

Anglers who pay up to £500 a day to fish prime beats on the Tweed have thrown back 18,000 salmon worth at least half a million pounds to help conserve the river's stocks. In what was described yesterday as the biggest natural stocking programme in the United Kingdom, the actions of the fishermen have guaranteed an extra 30 million salmon eggs for Borders rivers. The voluntary system in which every other salmon caught is released is being copied on 22 Scottish rivers amid concern that angling as a sport will collapse unless the numbers of Atlantic salmon can be radically increased. Riparian owners recognised the need for drastic measures six years ago, when it was proposed that about half of the annual rod catch of 10,000 salmon should be put back. At the time hardly any salmon were being caught between the start of the season in February and the autumn runs in September. Scientific research and analysis of catches showed that rod fishers were taking 5,000 spring salmon a year in the 1960s. But the early season catch had fallen to fewer than 2,000 by the early 1990s, even though there had been a considerable increase in the number of anglers fishing the Tweed's 2,000 square mile catchment. So the call was made for rod fishers to give up every other fish caught before 30 June each year. The fish are tagged and must not be killed under the Tweed's conservation code. Instead, the tagged fish are allowed to swim unhindered to the spawning grounds. The River Tweed Commissioners, the body responsible for salmon fishing, says it is vital to protect the fishery, which is said to support more than 500 full-time jobs and generates £12.5 million a year for the Borders. The annual meeting of the commissioners yesterday was told that 4,200 salmon had been thrown back in 1999, representing 45 per cent of the total rod catch. At the same time there was a 55 per cent increase in reported catches of spring salmon compared with 1998, with 870 (more than 50 per cent) released to contribute an additional 2.75 million eggs. John Lovett, the chairman of the commissioners, said: "Increasing numbers of anglers appear to recognise the importance of protecting these early running fish. It was encouraging to hear from our bailiffs that by the close of the season the headwaters were full of breeding salmon." A programme of improvements has opened 400 miles of streams to spawning salmon and Dr Ronald Campbell, the Tweed Forum biologist, said more of the catchment is accessible to fish than at any time in the past 200 years. Dr Campbell explained that a number of tributaries had been virtually blocked off by weirs and caulds constructed in the 19th century. But many of those had been cleared or breached. Judith Nicol, the clerk to the commissioners, said that rod catches on the Tweed were holding up well. "There is a risk of talking everything down so far as salmon stocks are concerned. But the statistics show the Tweed is not a river in danger. In fact it is now one of the most productive salmon rivers in the world," she said.

MacKay calls for grey seal cull to save salmon

The Herald, 11 March 2000

Lord MacKay of Ardbrecknish wants a cull of grey seals - or at least contraceptive injections to control their numbers - in a

bid to reverse the serious decline of wild salmon in Scottish waters. But he has a battle on his hands: the seals, whose pups are widely regarded by the public as being cute and cuddly, are a protected species. On a scientific level, there is no evidence to justify a cull, according to pressure groups such as the Worldwide Fund for Nature. However, even the fund was not adverse to tugging heart strings yesterday, arguing seals should not shoulder the blame. "After all," said a spokesman, "dolphins eat a lot of fish, but we believe no-one would ever dare call for them to be culled." Seals are one of three "villains" named by the former Scottish Office Minister for dramatic declines in anglers' salmon catches. Numbers of grey seals in Scotland have soared from 67,000 to 110,000 between 1989 and 1998, the latest available figures - and each animal gets through two tonnes of fish a year. Add common seals, and total consumption is a "monster" 286,7000 tonnes, said Lord MacKay, who insisted: "There is simply no logic in considering these animals an endangered species needing special protection." Lord MacKay demanded in his provocative article in this month's Trout and Salmon: "Have a seal cull or, if that is too much to ask, get on with the development of a contraceptive injection for seals." He also wrote: "If one looks at the population rise over the past 10 years, it will not be long before the seal is eating half a million tonnes. Will the Government and pressure groups act then, or when we get to a million, or not until the seal has eaten themselves and us out of house and home?" Lord MacKay, a keen angler, acknowledged seals' predominant prey may be cod, whiting, and sandeels, but argued: "Given the state of cod stocks - every bit as serious as salmon - it cannot be sensible to allow seals to eat 300,000 tonnes, at least some of which would be available for catching and for spawning." His two other villains were commercial drift-netting for salmon and catch quotas for sandeels, set at some 970,000 tonnes throughout the EC. He questioned why salmon drift-nets are illegal in Scotland, but allowed in England where it is estimated up to 80% of fish taken were destined for Scottish rivers. He also questioned why sandeel quotas are set well above current catches, fearing that will only encourage more landings of a basic food for many birds as well as fish. Salmon farming, blamed by many for the collapse of wild salmon in Scotland's west coast waters, warranted only a brief mention in his article. He called for "sensible means" to allow fish farming to co-exist with wild salmon "before the virtual extinction of salmon and their sea-trout cousins spreads to every west Highland river." A Worldwide Fund for Nature spokesman said: "There are bigger issues to embrace than seals in the decline of salmon. The problem for fish stocks lies in management of the marine eco system. A broad strategy is required." Scottish Tory leaders and the Scottish National Party believe there is a need to control seals to preserve fish stocks, but the Labour Party has demanded no return to mass slaughter of seal pups. Protective legislation dates back to 1914 when seals were hunted to only a few thousand. Their recovery led to controversial culls in the early 1980s, followed by plummeting numbers later in the decade due to a deadly virus. They have since prospered, although their abiding allure does not sit well with a notoriety for taking one bite from a fish before moving on to another. Scottish Natural Heritage, the quango responsible for many sites where seals breed, declined to express an opinion, arguing salmon, seals - and culling - are matters for the Government.

100,000 young salmon to boost Dee's stocks

Scotsman, 23 March 2000

More than 100,000 young salmon will be released into the River Dee this summer in an initiative to safeguard the future of one of Scotland's best salmon rivers. The smolts will be introduced to reverse the dramatic decline in the stocks of spring salmon, the lifeblood of the Dee angling industry. Salmon angling contributes more than £6 million a year to the local economy and accounts for the equivalent of more than 400 full-time jobs. But the river has been in crisis since a marked drop in stocks five years ago. The river's new salmon egg hatchery, officially opened yesterday by Orri Vigfusson, the chairman of the North Atlantic Salmon Fund, is the latest in a series of initiatives aimed at reviving the Dee's fortunes. A river manager has been appointed to co-ordinate enforcement, protection and stock regeneration measures, an advisory group has been set up to offer specialist scientific advice on the river's future, and anglers have been following a voluntary catch-and-release code to help to protect the fishery. Mr Vigfusson, speaking after his visit to the hatchery on the outskirts of Banchory, said: "I praise the efforts of all those who have voluntarily taken on the task of reversing the catastrophic decline in salmon stocks that has occurred in recent years on the River Dee. I sincerely hope that the stocking from the hatchery, coupled with all of the improvements carried out on the burns in the area, will result in a marked improvement in the numbers of fish that migrate to this area of a truly magnificent river." The hatchery, which will produce 125,000 salmon for release in July, has been funded by the Middle Dee Project, a group of fishery owners, ghillies and tenant fishermen established to address the potentially devastating effect on Deeside's tourism economy of diminishing salmon numbers. A recent study by Grampian Enterprise revealed a 60 to 65 per cent decline in the annual salmon catch since the early 1990s, with some Deeside fishing-beat owners experiencing a five-fold reduction in their seasonal rents in recent years - from an average 30 week lets a year to only six. Robert Strang Steel, the treasurer of the Middle Dee Project, said: "The hatchery is to give the natural production of salmon a kick-start, and the group hopes that within about ten years the hatchery may be redundant due to natural breeding."

Tweed riversiders fight netsmen for rights to salmon

Guardian, 27 March 2000

The confrontation between landowners guarding their prime beats along the Scottish border and humble English drift netters offshore has become, according to some, a salmon war. Angry words are exchanged, threats sometimes made. 'They're plundering the deep, public enemy number one,' cry the owners. 'Greedy, rich and arrogant,' scream the netsmen. At stake is the nationality of a fish whose complex lifestyle remains a mystery to many. The owners - who charge anything from £50 to £2,000 a rod for a day's fishing - claim it is Scottish because it was born in the Tweed before

heading out to sea. The netters say it is multinational and can be caught off England. Now Scottish angling proprietors, including some of Britain's biggest landowners, have been told by a committee established by the Ministry of Agriculture, Fisheries and Food that they should be prepared to pay millions in compensation if they want the netsmen to stop fishing. The aristos are crying foul. 'Not a chance,' sighs the Duke of Roxburghe, whose three-mile stretch of the Tweed includes two of the best salmon beats on the river. 'The north-east [English] drift netters pay zero towards the management of this river and benefit largely from the salmon which we know are coming to Scotland. They're indiscriminately, unfairly, harvesting a wild fish.' Derek Hesleton, a drift netter for almost 40 years, whose 45ft inshore trawler Nicola Joanne is being prepared for the new season, countered: Some of them are just plain greedy. Ours is a family business. They are multi-millionaires, with vast resources at their disposal. As we say in these parts, they're certainly not waiting for next week's wages, are they?' What no one disputes, however, is that last season marked a very good year for the netsmen. Although their number has dropped from 142 to just 72 in seven years, they bagged almost 25,000 fish - 7,500 more than 1998 - and much of it was apparently heading for the Tweed. The MAFF committee, which has been reviewing fishing legislation, says in a report that 80% of salmon netted off the north-east coast is probably of Scottish origin - born in rivers, like the Tweed, before heading for the north Atlantic and returning up to three years later. It speaks of conflicting evidence, but concludes that a phase-out of netting would be 'desirable'. To achieve this, it recommends that the proprietors should pay a major element of compensation to the displaced netters - with the government chipping in with extra funds - on the grounds that they would gain 'substantial economic benefits'. Sums of millions of pounds have already been mooted - and Derek Hesleton, who is also chairman of the National Federation of Fishermen's Organisations, says his members are certainly tempted by the cash. But he denies that drift netting in the North Sea has depleted salmon stocks in northern rivers. Earl Haig, of Bemersyde, who owns a mile-long stretch of the Tweed, has described netting as 'enemy number one'. He says he has no spare cash to offer in compensation. 'Fewer people are now coming to fish because catches are so poor.' Drift netting off the Scottish coast was banned in 1962 to conserve stocks.

Escaped farm salmon sparks new virus fears

The Herald, 3 April 2000

A potentially devastating virus has been identified for the first time in an escaped farmed salmon, leading to fresh fears that wild stocks may be under threat. Friends of the Earth Scotland (FoES) yesterday revealed that the infectious salmon anaemia (ISA) virus had been found in a fish caught by scientists at Loch Eil, near Fort William. The environmental group has written to the Scottish Executive calling for more testing of escapees and greater transparency in light of the discovery. Researcher Don Staniford said the find backed up suggestions that the virus, and perhaps the disease that can develop from it, are passed from farmed fish to declining wild populations. He added that, as 400,000 fish have escaped since 1997, it could represent only the "tip of the iceberg" and also the spread of ISA to a previously unaffected loch. Mr Staniford said: "This first positive case in an escaped farmed salmon turns the tide of scientific data back towards farmed fish infecting wild fish, and not the other way around. Farmed salmon escapees are clearly acting as carriers of not just sea lice parasites, but also infectious viruses. Serious questions must now be asked of the implications of this positive result and why yet again it has taken so long for the result to emerge. As only eight samples of escaped salmon have been tested, this could be only the tip of the iceberg. By backing the expansion of intensive salmon farming at the expense of wild populations, successive governments have sold wild fish down the river. The Scottish Parliament must now listen to calls for an independent inquiry and hold to account the industry and those charged with regulating it." Lochaber and District Fisheries Trust senior biologist Dr Jon Watt caught the infected fish at the head of Loch Eil in June last year. He said there was no doubt that it was a recently-escaped salmon, which can be identified by their different body shape, fins, tails and gills. He explained that distinguishing farmed and wild fish was similar to "the difference between a domestic dog and a wolf". He said: "It is very difficult to know the significance of this at this stage but it is very worrying, particularly in view of the very large number of escapes that have happened up and down the west coast in the year-and-a-half since ISA has been identified. The fact that some are getting out and carrying very threatening infections is clearly of concern." He added that the system for reporting escaped fish could be improved. An Executive spokesman acknowledged that it appeared to be the first case of the ISA virus in an escaped salmon, although claimed the evidence was not conclusive. He added: "It is too early to extrapolate this into some kind of environmental crisis. We are monitoring this closely and will continue to do so." He said that ISA appeared to be endemic in the natural environment, adding that the fish could have caught the virus from a wild salmon. He denied that it had taken a long time to process the tests results. There was confusion over the origin of the infected fish, with FoES claiming it came from a Marine Harvest fish farm at Loch Eil and the company denying it had any escapes at the time or any suspect sites in the area. Since the original ISA outbreak in May 1998, the disease has been confirmed at 11 fish farms and suspected at 24 others. The Government's escapes committee, which was set up in 1997, is expected to issue a report on the problem in due course.

Survey shows Mainers support endangered listing for salmon

Bangor Daily News, 7 April 2000

Nearly two-thirds of Mainers support protecting the state's wild Atlantic salmon by putting the fish on the Endangered Species List, according to a poll released Thursday. Statewide, 83 percent of residents polled said it was important to protect the fish from extinction and 64 percent said they supported listing the salmon under the federal Endangered Species Act to provide additional protection and funding for the fish. The poll results run counter to the stance taken by the state's top politicians, said a representative of the environmental group that paid to have three questions about salmon included on

the survey, which was conducted in late March by Strategic Marketing Services of Portland. The telephone survey of 400 residents has a margin of error of 5 percent. "These data suggest that the governor and our state senators are on a collision course with public opinion on the issue of salmon protection," said Laura Rose Day, the watershed project leader for the Natural Resources Council of Maine. Two federal fisheries agencies last fall proposed to list Atlantic salmon in eight Maine rivers as an endangered species. Five of the rivers are in Washington County. Gov. Angus King and U.S. Sens. Olympia Snowe and Susan Collins have vehemently opposed such a listing because they say it will ruin the economy of the poorest parts of the state. According to the poll, 61 percent of residents in northern and Down East Maine support the endangered species listing. That region is made up of Aroostook, Hancock, Penobscot, Piscataquis, Somerset and Washington counties. This was the lowest level of support in the state. Sixty-nine percent of respondents in southern Maine said they supported the proposed listing, while 62 percent in central and western counties said they did. In the northern-Down East region, just 9 percent of those asked said they strongly oppose the listing. In southern Maine, 3 percent said they were strongly opposed. A spokesman for Gov. King said the questions were worded in such a way as to garner the responses the Natural Resources Council wanted. If the pollsters had asked if people supported listing salmon knowing that it will cost thousands of jobs, the answers would have been very different, Dennis Bailey said. Pete Didisheim, advocacy director for the council, said the governor's office has no knowledge that thousands of jobs will be lost if salmon are listed. "The experience of the Endangered Species Act throughout the country does not fulfill their apocalyptic views of economic decapitation," he said. Bailey also questioned the poll results because he said the sentiments voiced at three public hearings were overwhelmingly opposed to the listing proposal. "Where were these people?" he wondered. "The governor is absolutely in favor of protecting salmon but he doesn't believe the Endangered Species Act is the proper way to do that," said Bailey. The governor has repeatedly said he would consider suing the federal government if the salmon are listed. According to the poll, 59 percent of those asked opposed "the use of taxpayer dollars to sue the federal government to prevent the addition of Maine's wild Atlantic salmon to the Endangered Species List." The way the question is worded, people could be objecting to the use of taxpayer dollars or the concept of the lawsuit, Bailey said. The poll results do not change Sen. Snowe's thinking on the issue either, said her spokesman Dave Lackey. "The poll re-enforces what we already believe - that Atlantic salmon need to be protected," he said Thursday. "The question is: What is the best mechanism for that protection?" The senator continues to believe the State's own conservation plan is the best protection, Lackey said. If the federal government is so concerned about Maine's salmon, why are they not allocating money for their protection, Lackey asked rhetorically. The National Marine Fisheries Service asked for only \$3 million next year to protect Maine salmon while federal agencies have requested more than \$100 million to protect Pacific salmon. Those fish are listed under the Endangered Species Act. Snowe has asked for \$8 million in federal funds to be devoted to salmon conservation efforts in Maine. Late last year, Gov. King allocated \$800,000 in state funds for salmon restoration efforts.

Saving the salmon threatens to kill off the coracle

Sunday Telegraph, 9 April 2000

The ancient practice of coracle fishing will be killed off if Ministry of Agriculture proposals aimed at conserving salmon stocks are agreed. Coracle fishing was first mentioned by Julius Caesar in 55 BC. The tradition was formally established eight centuries ago under the Magna Carta. But the number of coraclemen - once found on rivers throughout Britain - has shrunk to only 25 licence holders in West Wales. The Welsh coraclemen, who fish on three rivers - the Towy, Teifi and Taf - say that if the Government phases out part-time fishermen to conserve salmon stocks, it will spell the end of their traditional way of life. The coraclemen, who fish only at night, have for years fought a battle with the powerful angling lobby which they claim wants to force them off the rivers to expand the lucrative sports fishing industry. They say the ministry's proposals, which recommend that the Environment Agency should have power to cut the number of fishing licences immediately "where this is necessary for conservation purposes", will be the last straw. They point out that the committee advising the agency is dominated by the angling lobby. The proposal, in the Salmon and Fisheries Review, would also deprive the fishermen of their right to appeal to the Secretary of State for a public inquiry - a right which they say has helped them to keep coracle fishing alive. Mike Elias, 50, whose family has netted on the Towy for 300 years, said: "The coracle is part and parcel of Welsh life. We've already had to take other jobs because we are not allowed to fish full-time. Now they are trying to get rid of us altogether. The angling lobby blame us for dwindling stocks, yet they catch twice as many fish as we do. The difference is they have more people in influential positions." Raymond Rees, a coracleman for more than 50 years, is so incensed by the ministry's review of the 1975 Freshwater Fisheries Act that he is seeking legal advice. "Netsmen are being made scapegoats," he said. Mr Rees, 66, said a shortened season would conserve existing stocks and enable fish to spawn. Pat O'Reilly, the chairman of the Environment Agency's fisheries advisory group, said he agreed with the report but hoped that coracle fishing could be saved. However, he said: "Conserving fish stocks is the most important thing. We have to maximise the value of fisheries to benefit hotels, restaurants and the tourism industry which includes angling. We have to think about the wider rural economy." Dr Geraint Jenkins, a historian and author of two books on coracle fishermen, is not impressed by this argument. He said: "I am disgusted by this report. They are demolishing a great and old tradition. Coracle fishing has bound communities together for centuries. In 1860 there were 400 coracles on the River Tywi alone. The boats would be hung outside the door of every cottage." A spokesman for the Welsh Office said the report was for consultation and that no final decision would be taken until after the consultation closed in August.

Nutreco Rejects Transgenic Salmon

HET Financier Dagblad, 13 April 2000

Amsterdam-listed animal and fish feed group Nutreco, which leads the world market in salmon farming, said yesterday it will never adopt gene modification in its fish-farming activities. 'We're against the practice out of principle,' said spokesman Dimitri Casteleyn. 'There is no way we would get involved. Besides which it is not something European consumers want,' Casteleyn said. Casteleyn was responding to recent reports that US firm AF Protein is close to going commercial with a GM fish it has developed in Canada. If cleared by the authorities, the fish would become the first genetically modified animal approved for consumption. The Massachusetts-based company has inserted growth hormone genes from one fish, and genes from another fish which can activate them, into Atlantic salmon. As a result, at the age of 18 months, the salmon are five times the size of their unmodified counterparts. For AF Protein, the new technique could cut the cost of raising salmon and trout by 50%. The company has quashed environmentalists' fears that the GM fish might breed with wild fish by insisting that all its experimental fish are infertile. Similar trials were carried out in 1996 at a salmon farm in Scotland. Nutreco, which has 9% of the world's salmon farming market, expects to finalise the acquisition of Norway's Hydro Seafood later this month. Hydro holds 11% of the global market and the takeover will make the Dutch company the world's biggest salmon farming group. Nutreco also has major salmon farming interests in Scotland.

Canada's GM salmon grow five times faster than normal: Fish farmers excited, environmentalists alarmed

Ottawa Citizen, 13 April 2000

A Newfoundland company will ask the federal government this spring to let it start commercial production of transgenic salmon that grow five times faster than regular Atlantic salmon. Aqua Bounty Farms has been producing the AquAdvantage salmon for 12 years. The fish uses a genetic "promoter" from other fish - flounder or ocean pout - to make its growth hormones flow all year long instead of for only a season at a time. The result is a fish that reaches full size a year or so before its genetically unchanged cousins. It doesn't grow any larger in the long run, but could potentially save farmers money by reaching the market a year earlier. Now, says the company, the fish is fully developed and ready to sell. But first it needs permission from Fisheries and Oceans Canada and the U.S. Food and Drug Administration. Its application is already filed in the U.S., and company spokesman Elliot Entis expects to submit formal research data in Canada "in the next couple of months." If approved, the salmon would be the first transgenic animal raised commercially in North America. And already it's making conservation groups nervous, especially those like the Atlantic Salmon Federation that worry escaped transgenic fish will breed with wild salmon and change the species forever in the wild. "We are always concerned about the problem of fish farm escapes," said Jeremy Read of the Atlantic Salmon Trust, which oversees wild salmon in Britain. Domestic salmon are already known to escape from pens and breed with wild fish, weakening the gene pool, according to British, Canadian and U.S. fisheries officials. Escapes by genetically modified fish, says Mr. Read, "could be even worse." Won't happen, says Mr. Entis. The AquAdvantage fish are sterilized by applying heavy air pressure to their eggs, he said. This makes the salmon cells grow a third strand of DNA for each of the two normal strands in a cell, and this "triploid" DNA makes the fish sterile. The result, he says, is a fish that looks and tastes just like any salmon, only it grows faster and can't breed. A company called Ovatech, a marketing group representing fish farmers in Prince Edward Island, has an agreement to market the fish. "Our fish have no environmental advantage. All work ever done on this kind of modification suggests you give your fish a disadvantage (in the wild) when you give it these traits," he said. Wild fish thrive by remaining small in their early months in streams, and only putting on a growth spurt later when they leave for the ocean. A fish that grows too fast from the start, like AquAdvantage, "are remarkably unsuited to survive in the wild," Mr. Entis says. "That means that these problems are self-limiting," because an escaped AquAdvantage fish wouldn't likely live long and breed successfully. "I feel this is far safer than what we have today," which is a system where ordinary domestic fish escape in healthy breeding condition. "Have they tried it?" wonders Jeremy Read of the Atlantic Salmon Trust, the British association that oversees wild salmon. "No? Therefore, I'm sorry, but this is one of those cases where I prefer to err on the side of being over-cautious." "I know that the stock are triploid and therefore guaranteed sterile. (But) I think I'm right in saying that sterility cannot be absolutely guaranteed," he said. "We're very concerned about the risk." Now it will be up to regulators in Canada and the U.S. There's no formal timetable in either country for making a decision. "One of the things we absolutely need to be able to tell the public is that this product is absolutely, 100-per-cent safe, period," Mr. Entis said. "We know that that's the case, but we have to prove that to regulators." Beyond transgenic salmon Aqua Bounty would like to raise transgenic versions of other fish commercially. "In addition to Atlantic salmon, similar techniques are being applied to other finfish, such as Arctic char, trout, tilapia, turbot, and halibut," its Website says.

Bid to help salmon migrate

Press and Journal, 18 April 2000

Road engineers have switched their attention from land to water, in a bid to help smooth Scottish salmon's passage to the sea. Guidelines have been drawn up to encourage construction of bridges, weirs and culverts which would not hinder the progress of migratory fish from lochs and rivers to sea waters. The design of some crossings is seen as limiting the spawning area open to salmon, trout and other fish. The new guidelines are expected to play a part in preserving fish stocks. The recommendations have been drawn up by the Scottish Executive with engineers, designers, environmental

consultants and district salmon fishery boards. Deputy Rural Affairs Minister John Home Robertson said: "Migratory fish such as salmon and sea-trout are an important recreational and commercial resource in Scotland but populations are under pressure. "Much of the cause of decline has been attributed to changes in the ocean. While there is little we can do there, we can ensure that the freshwater environment is as productive as possible." The move was welcomed by members of the Scottish Parliament's rural affairs committee yesterday. Committee convener Alex Johnstone said: "This seems like a sensible way to proceed. I only hope they are going to consider the financial implications of this, especially where local authorities are very cash-strapped at the moment, and we need to ensure it is adequately funded." SNP fisheries spokesman Richard Lochhead said: "This is a welcome measure, given that our freshwater fish stock, and in particular the salmon population, need every bit of help they can get. Stocks have been dwindling and our famous salmon fishery is under threat, so this is a welcome example of joined-up government."

Tracing system to stem illegal salmon supply

Irish Times, 19 April 2000

Restaurateurs who serve up illegally caught wild salmon may be traced under a new surveillance measure due to be initiated next month. A tagging programme for all wild fish will ensure that only legally caught fish can be sold on, according to the Minister for the Marine and Natural Resources, Mr Fahey. The programme is one of the first tasks facing a new salmon management commission which the Minister has set up. Prof Noel Wilkins of NUI Galway's Department of Zoology will chair the long-awaited commission, which was recommended in a task force report which he drew up four years ago. The 21-strong commission aims to represent all the stakeholders in the resource, and has been charged by the Minister with moving immediately on tagging all angling and commercially-caught wild salmon this year as a conservation and stock management measure. A 30-day consultation period has been initiated, dating from Friday April 14th, on the framework for implementing the tagging programme during this season. The tagging programme will "underpin future salmon conservation and management strategies", Mr Fahey has said. "Anglers and commercial salmon interests all have a part to play in protecting and managing our salmon stocks," he said, and the tagging programme would create a "quality brand" for wild Irish salmon. Draft regulations have been published in the national and provincial press. Prof Wilkins's report on salmon management is widely regarded as representing the views of all competing interests, while also taking into account the role of coastal communities. The task force which he chaired was established by former junior marine minister Mr Eamon Gilmore.

'Feed the world' opportunity seen for GM salmon

Guardian, 22 April 2000

Refusal to accept genetically modified fish as food was a rich man's stance that would be a 'terrible mistake, a moral mistake', the president of a US company expecting to market GM salmon said yesterday. Responding to critics, Elliot Entis cited a United Nations estimate that a sevenfold increase in the production of seafood was needed in the next 25-30 years if the present per capita consumption of fish was to be maintained for a growing world population. Transgenic fish, he argued in an interview with the Guardian, were likely to be one of the few ways of providing protein for millions of people at a reasonable price. Mr Entis, president and chief executive of Aqua Bounty Farms in Boston, believes that his group could soon get regulatory approval from the US food and drug agency to produce transgenic salmon for the retail market, with the first fish appearing on supermarket shelves in the US by 2002. Mr Entis has run into serious resistance in Europe, not only from environmental groups but also from salmon farmers, and he acknowledged that consumers in Britain were 'not yet ready' for his product. But, he argued, objecting to GM foods was 'a rich white man's argument': activists in Europe had this luxury because people in their region had enough to eat. Outside the US, Mr Entis is to target his fish particularly at Asia; China is avidly interested in using fish modification to feed its population of more than 1bn. Criticising some campaigners and some British media, the Guardian included, Mr Entis said: 'I feel very deeply that all this focus on the disadvantages merely ignores and puts to one side any benefits. There are many benefits to this technology. Bio-technology can lead to greater productivity, far less use of noxious chemicals we all complain about, and far better use of land and water. I think that to ignore or put in the trash can this kind of technology is a terrible mistake, it's a moral mistake.' If civilisation was to survive with everyone having enough to eat, he argued, exploitation of bio-technology was essential. But, he added: 'I am not stuffing it down people's throats' - capitalism weeded out products based on whether they met a need. He was critical of some of the assertions made about transgenic salmon. Fish with four to six times normal growth rates did not grow into salmon 12ft long weighing 200lb - they grew to the same size as wild fish, but in a shorter time. In natural conditions salmon grew to 60 to 70 grammes (less than three ounces) in 15 months. With a growth gene inserted, this weight was achieved in three or four months. After that, the growth rate began to slow, and at the end of 14-18 months the genetically modified salmon were between one and three kilogrammes (2.2 and 6.6 lbs). Once the fish reached sexual maturity the growth rate slowed to normal rates, he said. 'Quite why this is, we do not fully understand; but we are on the fourth generation of these fish, and we have bred thousands of them and the results are the same.' He said that the largest fish his firm had ever produced, called 'Bertha', weighed in at 16 kilos (35 lbs), well below the record sizes of wild Atlantic salmon. He thought most concerns regarding the technology centred on potential mixing and mating with wild species, rather than on food safety. He predicted that permission for transgenic salmon might initially be given for breeding them on shore in tanks, rather than in sea pens. Critics argue that sea-based captive breeding could see transgenic salmon escaping and interbreeding with wild species. Mr Entis said that all his salmon were bred to be sterile and, although no system could be perfect, in the thousands of tests, not one of his fish had been found to be fertile.

Bid to reverse salmon decline

Aberdeen Press and Journal, 26 April 2000

A comprehensive review of the broad range of issues affecting all freshwater fish and fisheries in Scotland was launched yesterday by Scottish Fisheries Minister John Home Robertson. The announcement comes at a time when catches of salmon in Scotland in 1999 have reached an all-time low. And the minister called for appropriate action to conserve stocks but also pointed to the need for a more fundamental review of fishery management and a fresh approach to public access to fishing on rivers and lochs. The review highlights the key questions which need to be asked about policies for managing freshwater fish and fisheries. And the Scottish Executive wants views on the best strategy for future management. The consultation document has been produced by the Scottish Executive and Scottish Natural Heritage. It takes a comprehensive look at issues including: Measures to conserve freshwater fish stocks; Present and potential threats to the fish; The current status of fisheries and how they are managed; Scope for wider access to angling; The prevention of introduction of non-native fish species to Scotland. Mr Home Robertson said: "The Scottish Executive is determined to give our world-renowned freshwater fisheries the priority and profile they undoubtedly deserve. I want to work with all interests in shaping a new framework for freshwater fisheries in Scotland. This process has to be inclusive - and I believe that this review is a very important first step." Scottish Liberal Democrat Highlands and Islands spokesman John Farquhar Munro MSP called for greater co-ordination between marine agencies to preserve stocks of freshwater trout and salmon in the region. "All in the industry need to work together. The marine and fresh water research agencies are instrumental in trying to reverse the sudden decline that has afflicted stocks in lochs and in-shore waters in the Highlands and Islands." The consultation exercise, conducted by the Scottish Executive asks interested parties to submit views by August 4.

Efforts to save salmon stocks

The West Briton, Truro, 26 April 2000

Comprehensive plans to safeguard salmon will be discussed against a background of the worst run of breeding results seen in recent years. The Tavy, which rises on the western fringes of Dartmoor to meet the sea close to Plymouth, has seen a steady decline in its salmon stocks over the past 20 years. Since close monitoring of breeding levels began in 1975, there have been three periods where estimated spawning fell seriously below the minimum level required for a healthy stock. The latest episode, which has been ongoing since 1995, is the longest ever. This represents a serious challenge for those seeking to maintain salmon stocks for the future. A Salmon Action Plan will go before the Environment Agency's Regional Fisheries, Ecology and Recreation Advisory Committee next week. The committee will be told: "This action plan sets out the ways in which the Environment Agency, working with other interested parties, seeks to maintain the wild breeding Tavy salmon close to its optimal status to ensure sustainability. This approach creates the best position to be in to prevent further damage to stock through future developments and may lead to opportunities for enhancement of the River Tavy salmon stocks. The basic requirements to do this are seen as getting as many salmon to return to the river as possible, maintaining the quality of those salmon, getting the greatest economic value from surplus stocks and then meeting the cost of all the management and monitoring." The impact of chemicals and effluent on salmon will also be a priority. The agency will also seek to maximise anti-poaching patrols. The report will be presented to the committee on Friday.

Deadly heart disease is found at salmon farms

Independent, 2 May 2000

A serious new disease has been found in salmon on Scottish salmon farms. The disease, cardiomyopathy syndrome (CMS), produces heart failure in the fish. Although CMS presents no threat to humans it is invariably fatal to the fish as there is no known treatment. It has been found in one and possibly two Scottish farms: in the first case, where it has been positively identified, it wiped out 60 per cent of a stock of 27,000 large adult salmon in a west coast sea loch over five weeks, with the remainder having to be destroyed at a cost of many thousands of pounds. The outbreak of CMS in Britain is reported for the first time in the current edition of *The Veterinary Record*. It is the third of a trio of severe disorders of farmed salmon that have occurred first in Norway, where salmon farming was pioneered, before turning up in Scotland. The other two, sea-lice infestation and infectious salmon anaemia, are now established in Scotland and have caused serious economic and environmental problems. CMS itself is "probably one of the most serious diseases in some fish farming areas of Norway", where more than 100 farms have been affected, according to the authors of the *Veterinary Record* paper, Hamish Rodger and Tom Turnbull. Dr Rodger, formerly of the University of Stirling and now at the University of Pennsylvania, and Mr Turnbull, an aquaculture vet for a big Scottish salmon-farming company, examined eight fish from the west coast sea loch incident, which occurred in December 1997 and January 1998. They found them to have symptoms indicating CMS, including bulging eyes, pitting of the skin, haemorrhaging of the stomach and heart abnormalities. Tissue samples of fish from a second farm, which was experiencing "significant mortalities", displayed similar symptoms, they report. Dr Rodger said at the weekend that it was too early to say whether CMS presented a serious economic threat to the Scottish salmon farming industry. "But if there were more cases, it would be," he said. Gordon Rae, technical director of Scottish Quality Salmon, the trade association for most of the industry, said there had been no further reports of CMS since the incidents described. "There is no cause for concern," he said. What is not known is how CMS arises but an infectious agent is strongly suspected, although none has been detected so far. Dr Rodger said the cause was possibly a virus carried by salmon, which was harmless in wild fish but became malignant in the more stressed conditions of salmon farming.

"There is no known treatment because we don't know exactly what we're dealing with," he said. The £260m Scottish salmon farming industry, mainly based in the Highlands and Islands region, employs 6,500 people and produces 120,000 tonnes of fish a year. Salmon fishermen are angry at disease spreading to wild fish from the farm cages, in particular infestation with sea lice. Last year Professor David Mackay of the Scottish Environmental Protection Agency said it was "beyond reasonable doubt" that sea lice damage from farm cages could be very serious to wild fish. Infectious salmon anaemia, which broke out in farm cages two years ago, is also fatal but even more serious in its environmental effects as it can spread into wild fish populations, as it is now believed to be doing in Scotland. Farms where it has occurred have had to destroy their stocks and go into quarantine. But there was no evidence that CMS could spread into wild fish, Dr Rodger said.

Breakthrough by scientists in salmon lice study

Aberdeen Press and Journal, 2 May 2000

The problem of sea lice which infest salmon may be solved by researchers in Aberdeen who have found a way of tricking the lice. Lice are attracted to salmon by the strong smells that the fish release into the water. By manipulating the chemicals that produce these very smells, it is possible to trick lice into believing they are on their way to a tasty lunch, when in fact they are being lured into a trap - a far cry from tasty salmon nibbles. "What we have found so far is that lice actively respond to water in which salmon are kept, as opposed to other fish, so we know for sure that it is the chemicals released by salmon that attract the lice," said Jenny Mordue, project leader at the University of Aberdeen. "We are now trying to establish a simple push/pull strategy in which lice would be both distracted away from their natural target, salmon, while being drawn towards traps containing salmon smells," she added. The theory is that the push part of the process can be achieved by disrupting the salmon smells which are currently released from salmon cages and are obviously attractive to lice. The pull part of the strategy would be created through the release of salmon smells elsewhere, creating the potential for lice to be drawn into a trap, removing them from the farm site. Modifying or changing sea lice behaviour is not only a short-term solution to lice infestation of salmon. Long-term control can also be achieved through similar methods. Many parasites use chemical cues such as smells to identify and find mates, therefore it should be possible to disrupt mating by causing confusion in mate location by a simple adaptation of the push-pull strategy. Other traditional methods of controlling lice involve the use of sea lice treatments to which lice can easily develop resistance.

Group wants radical action to save wild salmon

Irish Times, 9 May 2000

The Government has gravely underestimated the decline in wild salmon and needs to initiate radical measures, including curbs on commercial fishing, a group campaigning to conserve the species has claimed. The Wild Salmon Support Group said yesterday that over-fishing and failure to ensure more fish got upriver to spawn had "ominous implications for both commercial and recreational salmon fishing". Current policy was aimed more at sharing a dwindling resource than at its replenishment, according to WSSG, a voluntary body representing angling, tourism, and some private fishery interests. The group also includes a number of salmon experts including Dr T.K. Whitaker, former senior civil servant and economist, and Mr Fionan O Muirheartaigh, former secretary of the Department of the Marine. The gravity of a "prolonged and steep downward trend" in wild salmon numbers, in Ireland and throughout the North Atlantic, was not fully appreciated, according to the group. Last year's Irish catch of 515 tonnes was less than a third of the average for the 1970s when catches averaged 1,580 tonnes a year, the WSSG said. Dr Whitaker said there were people who would claim catch figures along Irish coasts were unreliable. But while the figures were not the absolute truth they were an indication of trend, he insisted. The figures over three decades clearly indicated a need for more radical action, not only to protect stocks but to regenerate lost numbers. In recent decades, greatly reduced numbers of fish were reaching spawning beds. "Unless this trend is soon reversed, both commercial and recreational fishing for salmon are doomed. Within another decade or so our salmon stocks will have virtually disappeared," he added. Unfortunately, policy appeared to be more concerned with equitable sharing of this dwindling national resource than with the primary and urgent imperative of ensuring more fish were allowed to ascend the rivers to spawn. This was the nub of their concerns, Dr Whitaker said. Tagging - which tracks salmon, helps determine their catch and sale, indicates extent of conservation and provides information on the true state of stocks - is due to come into force next January. It may lead to better statistics and equitable access to incoming salmon, but the group was not confident it would effectively restrict the interception of fish on their way to spawn. Policy should, in the group's view, be "more directly and surely aimed at markedly reducing (preferably ending with appropriate compensation) the commercial interception of wild salmon". Angling may also need to be curtailed on impoverished rivers, the group accepted. Ireland is the only North Atlantic country that has not yet moved towards ending drift-netting for salmon and must expect to come under increasing pressure to do so, the WSSG added. The countries near the salmon feeding grounds - Greenland, Iceland and the Faroes - had accepted quotas limiting their catch but were complaining they were constrained to conserve stocks "only to see them slaughtered by Irish and English fishermen". The gross annual value of the Irish commercial catch has fallen to about £2.5 million. "This suggested a net sum of under £2 million was available for some 1,200 licensed netsmen and their helpers; hardly so significant a support that it could not be replaced by a combination of reasonable compensation for ceasing to fish for salmon and help in developing sounder alternatives," according to Dr Whitaker. It was often claimed, he added, that such activity was vital to coastal communities, but based on such figures this could not be so. Moreover, there may be more national benefit by exploiting the fish recreationally. "We are not out to eliminate netsmen without consideration of their livelihoods," he

added.

Whisky water nurtures salmon

Aberdeen Press and Journal, 10 May 2000

A salmon hatchery is being created using the same water source as supplies a world-famous distillery. The water pumped around the Spey District Fishery Board site will be the same as is used to create top-quality malt whiskies at Glenlivet Distillery. Yesterday fishery workers released a batch of tiny salmon from their old plant at Knockando. Approximately 400,000 salmon fry which hatched in February were released into various tributaries of the fast-flowing Spey. It is hoped that the hatchery will be up and running later this year. "We have decided to move because in recent years we have had increasing problems with the pH (an index of hydrogen ion concentration in an aqueous solution) of the water at Knockando," said Jim Woods, the board's water bailiff. "Factors such as flash flooding can cause too many fluctuations in the pH levels because the water up there is very peaty. "The new hatchery will also allow us to increase our capacity and we will be able to have more than one million salmon hatching at any one time." Knockando still operates successfully and will continue to be used as a hatchery, but will produce a different quality of water. The board works closely in conjunction with the Spey Research Trust, who study the levels of salmon in different parts of the river. The aim is to increase the number of stocks in sections which are identified as being underpopulated. Mr Woods said that it is vital that checks are kept on the number of fish so that declines can be halted. It is impossible for stocks to be kept at a high level without a helping hand from humans. Mr Woods added: "The hatchery will have a number of different benefits. For example, many of the fish in the river at this tender age would not have been able to cope with the recent flooding - they would simply have been washed away with that kind of flow. If a quarter of the fry we have released today go on and survive we would class that as a very successful operation. We are sure that the new hatchery will be a great asset. We know that the water here is the best we can get because it is after all used to make one of the finest drams on Speyside."

Senators ensure salmon funding. Snowe and Collins say money should deter government from listing species

UMI, Bangor Daily News, 11 May 2000

U.S. Sens. Olympia Snowe and Susan Collins say the \$5 million they secured for salmon conservation efforts shows that the species does not need an Endangered Species Act listing to get help from the federal government. Snowe and Collins, both R-Maine, have questioned data showing that salmon from eight Maine rivers are a separate species that needs to be protected. Mainers including Gov. Angus King are concerned about the economic impact an endangered listing would have on the Down East economy. King wants the state's conservation efforts to be given more of a chance to show Laura Rose Day, watershed project director for the Natural Resources Council of Maine, said the extra funding is helpful but "certainly does not indicate that there is no need for listing." "The fish are in extremely dire straits and need the full protection of the act," she said. "This \$5 million is good, but it won't do the job." She said the Endangered Species Act would give state agencies tools for controlling water pollution and drainage that isn't possible with just money. The \$5 million that has cleared the Senate Appropriations Committee is twice the amount proposed by President Clinton. Half would go to the U.S. Fish and Wildlife Service's conservation efforts. The \$2 million going to the Maine Atlantic Salmon Commission would almost quadruple that agency's budget. The National Academy of Sciences would get \$500,000 for a review of the data that the National Academy of Sciences used in proposing the federal listing.

West coast salmon facing extinction

Sunday Times, 21 May 2000

Salmon are dying out in many rivers along the west coast of Scotland. New scientific research has found an unexpected number of rivers have lost their salmon populations entirely or are very close to doing so. The revelation comes as salmon farmers and anglers have reached a deadlock over plans to restock the worst affected rivers. The plight of wild salmon in many small highland rivers was discovered when scientists sampled 32 rivers in Wester Ross and Lochaber which had been tested 10 years before. In eight of the rivers there were either no salmon at all or they were "effectively extinct" and the rivers are likely to become empty within the next two years. All the tested rivers are small and run into sea lochs containing salmon farms. James Butler, one of the scientists who carried out tests for the Wester Ross Fisheries Trust, said: "These are only the rivers that we know about. The problem could be greater, we just don't know. It seems from the results we got that if the river is less than three miles long and flows into a sea loch with a salmon farm in it then it is dead. There are lots of problems but fish-farming does seem to be the straw that is breaking the camel's back on the west coast." Fish farms produce polluting slurry and cause an increase in sea lice, a parasite which infests the water in large numbers and eats salmon alive. Butler said there was little point in restoring the rivers with fresh stock if the young fish faced the same problems. "We're not saying farms are the only reason for this, but they are a reason that we can try to do something about to alleviate problems for the wild fish until they are re-established." But Jane Wright, president of the Scottish Anglers' National Association (SANA), said the farming industry had refused to make any concessions during talks chaired by the government for the past 18 months. "We had hoped either for a synchronising of sea lice treatment or for the industry to agree to lengthening fallow periods, but they won't. We can't see a way forward," she said. Only one Area Management Agreement (AMA) - a voluntary contract between fisheries boards and fish farms - has been signed, although a number of pilot AMAs were supposed to be announced this month. A spokesman for the Scottish executive denied the

talks had stalled, saying discussions had been "constructive". He added that the government hoped to make a positive announcement soon about the AMAs.

Salmon get their drift

Birmingham Post, 30 May 2000

Drift nets which rob the Rivers Wye and Usk of their salmon stocks have been removed by a conservation group. For the first time in years, salmon returning to spawn in the rivers will not be running the gauntlet of 'putcher' traps and drift nets which decimate their numbers. A group including the Wye Foundation charity and United Usk Fishermans' Association has bought the Usk drift nets and five years rights to use Goldcliff Putchers. The Wye Foundation has, with the Environment Agency, managed to remove the Slime Road Putchers site from the mouth of the Wye, near Chepstow. 'The benefit is that an additional 1,200 mature salmon will return,' said Wye Foundation committee chairman Dr Stephen Marsh-Smith.

Salmon escapes prompt calls for farm controls

Daily Telegraph, 6 June 2000

Tighter regulation of salmon farming was urged yesterday after the Scottish Executive disclosed that a record 395,000 salmon escaped from farms in the first five months of this year. Conservationists and anglers say the escapes - which outnumber catches of wild salmon by four to one - carry the risk of spreading lethal diseases, parasites and causing the genetic pollution of wild populations which have evolved over thousands of years in their native rivers. The 10 major farm escape incidents so far this year compare with six incidents in 1998, liberating 95,000 salmon, and 15 such incidents last year, losing 225,000 fish. Kevin Dunion, of Friends of the Earth Scotland, said: "The situation is getting out of hand. The Executive is not showing the kind of urgency necessary to deal with the problem." Chris Poupard, of the Salmon and Trout Association, said: "Self-regulation has clearly failed and strict legislation is urgently required."

Canadian summit hopes to save Atlantic salmon

Reuters News Service, 6 June 2000

International officials met in Canada on Tuesday in an attempt to save the wild Atlantic salmon, the "king of fish," which is increasingly endangered by fish-farming, overfishing and environmental changes, they say. "The situation is indeed grave," said Malcolm Windsor, secretary of the North Atlantic Salmon Conservation Organisation, a treaty group consisting of salmon producing and harvesting countries bordering the North Atlantic, from Canada and the United States to the European Union. "We have received sound advice this morning which shows that abundance is the lowest we've ever seen since records began," Windsor said. The organisation, holding its 17th annual meeting this week in Miramichi, New Brunswick, on Canada's east coast, listened on Tuesday to warnings from conservation groups saying that unless action is taken quickly the Atlantic salmon is bound for extinction. Among signs of decline, the World Wildlife Fund said, is the number of large salmon returning to spawn in rivers in North America. That count has fallen to present levels of 80,000 a year from 800,000 about 25 years ago. With fewer than 100 returning to spawn this year in eight once-vibrant rivers in Maine, the salmon are ripe for the state's endangered species list, said Bill Taylor, president of Atlantic Salmon Federation, a conservation group attending the meetings as guests. Catches of salmon in the main North Atlantic fisheries fell to about 2,170 tonnes in 1999 from 12,000 in the mid-1970s, hit by factors such as the damming of rivers, according to figures from the WWF. In the same period, annual production of farmed salmon rocketed to almost 700,000 tonnes from virtually none. Conservationists are worried that farmed salmon, which escape from time to time, carry diseases that can kill the wild fish. They are also concerned that U.S. and Canadian production of genetically modified Atlantic salmon could breed with the wild fish. Non-government organisations also told the treaty group that more research is needed to find out what changes in the ocean environment have led to the fish's decline.

Executive and farm owners caught up in salmon row

The Herald, 6 June 2000

Friends of the Earth and the Salmon and Trout Association joined forces yesterday in an attempt to name and shame the Scottish Executive and fish farm owners after it emerged that escaping farmed fish now outnumber catches of wild salmon by four to one. The two organisations said that in one escape in Orkney in January about 256,000 salmon won their freedom in the sea. They said the figures had increased fourfold since 1998: from 95,000 to 395,000 for the first five months of this year alone. The move came as the Executive announced a consultation exercise on plans for new legislative powers to enhance the conservation of wild salmon and sea trout stocks, which have been in decline for years. Friends of the Earth and the association listed Aquascot, Hydro Seafood GSP, Kames, Marine Harvest McConnell, Wisco and Orkney Sea Farms as the worst offenders. They also criticised the Executive's working group, established in 1997, for producing a draft report on the subject which they claimed lacked substance and failed to identify the offenders because of commercial confidentiality. Submissions to the final report are due by Friday. Mr Kevin Dunion, director of Friends of the Earth (Scotland), said: "The situation is getting out of hand. The Executive is not showing the kind of urgency necessary to deal with the problem, and their report smacks of shutting the cage door after the fish have bolted. Determined actions such as re-locating sites away from high-risk areas or revoking licences in unsuitable locations need to be considered, as well as mandatory recording of escapes, a public register and compulsory tagging." Mr Patrick Fotheringham, director of the

Salmon and Trout Association (Scotland), said: "It is a damning indictment of the Government's fisheries policy that this whitewash of a report has taken so long to see the light of day." He added: "In pursuing a policy that promotes salmon farming expansion at the expense of wild fisheries, the Government have sold wild salmon down the river." A spokesman for the Scottish Executive rebutted claims of its not taking the problem seriously. "We will not hesitate to take tough action against any fish farms which breach any rules." Regulations prevented the Executive naming farms. "But we do not rule out the possibility of an amendment to the legislation in future to make it possible to name and shame cases of bad practice."

International delegates praise Canada for ending commercial salmon fishery

Telegraph Journal, 7 June, 2000

Canada, Greenland and the Faroe Islands in Scandinavia appear to be the good guys in the salmon world. The delegates and observers at the 17th annual meeting of the North Atlantic Salmon Conservation Organizations are holding the three countries up as an example to Ireland and the United Kingdom over the issue of commercial salmon fishing. Both delegates of other nations and international non-governmental organizations praised Canada yesterday for spending \$70 million to end its commercial salmon fishery. They also acknowledged the sacrifices by the Greenlanders and Faroes by reducing their catches of salmon to basically subsistence levels in recent years. These islanders now catch less than 1 per cent of the total number of salmon taken from the Atlantic Ocean every year. Yet, said Kaj Mortensen of Denmark - speaking for Faroe Islands and Greenland at a session yesterday, said, "It is impossible to detect any effect on the stocks that our sacrifice has made." Emanuel Rosing, a member of the Greenland delegation said in an interview that his country has a quota of 20 metric tonnes per year - and does not normally catch that much. "How low can we go? That's a myth that if only we can stop the Greenland fishery, all the salmon are going to be back," he said. Mr Rosing said studies have shown 90 per cent of the salmon off Greenland come from North America. Canadians in particular complained for years about the Greenland fishery that intercepted large numbers of salmon from East Coast rivers - which feed in waters off Greenland before returning home to spawn. Instead, as many delegates and observers note, that numbers keep dropping - to the lowest levels since the last ice age, as Henning Roed of the World Wildlife Fund Norway puts it. Sport fishing representatives, especially, yesterday criticized Ireland and to a lesser extent, Britain for allowing commercial salmon fishing in their territorial waters. As Mr Mortensen explained, Greenland and Faroe follow rules set by North Atlantic Salmon Conservation Organizations since they fish in international waters. But, NASCO rules do not apply in home waters which allows the Irish to catch fish headed for home rivers in Spain, Portugal and France. Chris Poupard of the United Kingdom Trout and Salmon Association, speaking at a news conference sponsored by non-governmental organizations, called for pressure in the news media to end this commercial fishery. Richard Behal of the Federation of Irish Salmon and Sea Trout Anglers criticized his own country - saying in an interview that Ireland caught 518 metric tonnes of salmon a year according to official figures. There are 700 drift netters at sea. "Unfortunately Ireland has the biggest drift net fishery in the world" he said. It adds up to a massive commercial fishery. Ireland does not impose catch and release rules on anglers, so the sport fishery takes about 3 per cent of the total catch. Mr Roed directed some heavy criticism at his own country, Norway, for a lax approach to enforcing rules for the aquaculture industry.

Wildlife organization urges world nations to save salmon

Times Transcript, 7 June 2000

The threatened Atlantic salmon found some new friends on the Miramichi River yesterday when the World Wildlife Fund as well as scientists and river associations on both sides of the Atlantic Ocean leaped to its defence. The groups are calling on governments wherever salmon live to take drastic action to counter alarmingly low numbers of the fish returning from the migrations in the north Atlantic Ocean. The numbers are the lowest they've been in the past 10,000 years. "We haven't seen these low levels of salmon since the last ice age," said Henning Roed, the senior fisheries officer in Norway for the influential WWF. Countries with salmon rivers report an alarming trend: while many of their rivers are producing abundant or at least sufficient, young salmon, most of those fish fail to return to their home pools after making their migratory trip out into the Atlantic Ocean. Returns have declined 75 per cent in the last 20 years. "We are seeing the lowest survival rate ever of young salmon going out into the ocean, and then returning to their rivers," said Bill Taylor, president of the Atlantic Salmon Federation. The groups are calling on the 14 nations represented here this week at the North Atlantic Salmon Conservation Organization's first-ever meeting in Canada to take four concrete steps to ensure the species' survival: stop ocean fishing from devastating the stocks; clamp down on lax aquaculture practices; invest in research at sea into why the fish are disappearing; and ban genetically modified farmed salmon. "Clearly we have an international problem," Tom Grasso, the WWF's Director of marine conservation said. "It deserves an internationally based solution." Chris Poupard, director of the Salmon and Sea Trout Association of the United Kingdom, said the four steps are merely the four most critical initiatives towards saving the species from extinction in many of the planet's rivers. Aquaculture has grown enormously around the world in the past 15 years, he said. "The problem is the regulation of aquaculture by government has not kept pace with that growth." For example, Poupard cites the case of Norway, where 10 years ago there were 100 wild salmon for every farmed specimen. Today that ratio is exactly the reverse. Escaped fish from salmon farms are interbreeding with wild salmon, diluting the gene pool which makes it harder for the fish to survive in the harsh, wild environment. As well, aquaculture salmon are suspected of harbouring diseases which then spread to wild fish. Many nations - Poupard cites Ireland as a prime example - have strict, modern rules governing fish farms. Yet many - he names Ireland as the worst offender - don't enforce those rules. Roed told of massive escapes from fish farms in

Norway - seven of them in recent years that coincided with the death of seven salmon rivers, now devoid of a single spawner, all while the Irish commercial fishery continues as the world's biggest killer of salmon. The groups further urge the NASCO nations to place an outright ban on genetically modified salmon. So-called "Frankenfish" are not a matter for science fiction movies. Already a group on Prince Edward Island has applied for a licence to farm genetically altered salmon. A company in Massachusetts claims it can grow genetically modified salmon that could reach 12 feet (four metres) in length and weights of up to 200 lbs, or 90 kilograms. The third problem on which the groups are calling for action is the ocean fishery for wild salmon. While Canada spent \$70 million buying back all commercial salmon licences over many years, other countries have not done the same. Salmon are swimming out to sea from Canadian rivers only to be caught in foreign nets. As well there are some ships secretly harvesting salmon on purpose, and still more who pick up the fish accidentally, as by-catches and don't report it. It's wreaking havoc with the stocks, Poupard said. "We want much firmer action to phase these fisheries out." Roed said that in England, 82 fishermen are taking a huge proportion of fish that spawn in Scottish rivers. In Ireland, fishermen are taking salmon spawned in rivers from other European nations. "We spend billions and billions of Euros trying to restore the fish to these rivers and yet they keep catching them," Roed said. "The European Union has to clean up its act."

NASCO nations must reduce salmon quotas

Delegates to international meeting must agree to implement 'precautionary approach' to salmon management

Times Transcript, 7 June 2000

Perhaps the most difficult task facing the North Atlantic Salmon Conservation Organization this week will be reconciling the variety of goals and hopes of its more than one dozen member nations. There is little disagreement here that salmon are disappearing during their ocean migrations. There is little agreement as to why, or as to what to do about it. "We are in a situation of very low abundance in salmon stocks and no matter the sacrifices we have made, it doesn't seem to help," says NASCO president Einar Lemche of Copenhagen. But NASCO won't stop trying to reach agreement on what action to take. The almost 200 delegates here hope their meetings end Friday with agreement to implement a "precautionary approach" to salmon management. That new task would involve a total change of attitude towards the task at hand. In previous years when a species was in trouble and the cause was suspected, but not proven, nations would fail to act in the absence of solid evidence. "Of course, by then they would be gone," NASCO executive secretary Dr Malcolm Windsor of Edinburgh says. The precautionary approach is the exact reverse: salmon nations would act first to ensure the preservation of the species and ask the questions later. "The absence of scientific advice should make us more cautious," Windsor explains. However, the various NASCO nations all have different goals and objectives, which could make consensus elusive. Kaj Mortensen, the delegate representing Denmark, the Faroe Islands and Greenland, underlined how his countries have reduced their commercial salmon fisheries to a subsistence fishery with radical cuts to quotas. "Yet it is impossible to detect any effect on the stocks from the sacrifices we have made," Mortensen says. He can only conclude that the fishery in his part of the world has little, if any, effect on the stocks. "NASCO will have to develop a more (diverse) approach than just addressing the oceanic fisheries." Some of the other countries here don't agree, emphasizing that all measures should be undertaken to preserve the troubled species. "All quotas fished by NASCO nations must first be severely reduced," insists Icelandic delegate Eidur Gudnason. Ole Tougaard, representing the European Union, points out that for every wild salmon on the planet, there is now a tonne of farmed salmon. Aquaculture is suspected of causing massive problems for wild salmon, from contaminating the wild gene pool to polluting salmon-bearing areas. Therefore, another main goal of these meetings is to reach an accord to compel the world's salmon farms to contain escaped fish and improve other ways they do business. "We must face up to our choices," says Tougaard. "Either we live up to our responsibilities with the wild salmon or risk losing it forever." The aquaculture question is an important one even in Russia, where there are no salmon farms but where they are finding farmed fish in their salmon rivers - escapees from Norway, it is suspected. "So it is one of the key issues," says Vladimir Moskalenko of the Russian Federation delegation. Aquaculture, as well as other issues such as the mystery of salmon disappearing at sea, the adoption of a precautionary approach to salmon management - all of it will require a huge international effort, Moskalenko says. Dr Ray Owen, chef de mission for the United States, points out that his delegation here this week numbers 18 people; precisely half as many people as there are salmon left in one of Maine's formerly fabled salmon rivers. "Our stocks in the US are in very, very grave danger," Owen says, pointing out how the fish are on the verge of being declared an endangered species in the US. "There is a serious risk that our salmon stocks will be extinct in the very, very near future." While in many parts of the world, smolt (young salmon) production in rivers remains at high levels notwithstanding the fish's disappearance after they go out to sea, many American rivers now display signs that very few smolt are being produced. "This is not a time to try to determine who is at fault," Owen says. "It is a time to recognize that we must all take action."

Salmon not cuddly enough to spark public's interest: conservationists

Dollar drain: money needed to save the fish is used to save pandas, tigers

Telegraph Journal, 9 June 2000

The problem, it appears, is you can't hug a salmon. Groups attending the annual conference of the North Atlantic Salmon Conservation Organization bemoaned yesterday how readily people sink money into saving "cuddly" animals while overlooking less-appealing aquatic species. "We spend more money as Canadians on saving panda bears and tigers in

foreign countries that we do on fish conservation in our own waters," said Bill Taylor of the Atlantic Salmon Federation, an international conservation organization and one of the organizers of the Miramichi conference. Money is one of the most critical factors in saving the endangered wild Atlantic Salmon. People like Mr Taylor fear if something isn't done quickly, the so-called king of the fish will go the way of the great auk and the passenger pigeon. "If we can't save the Atlantic salmon, what chance do we have to save the cod, the flounder, the crab or other less romantic, and mystical species?" Mr Taylor said. "If any fish can capture the hearts and imaginations of Eastern Canadians, it has got to be the salmon. And if we can't save the salmon, that's a sign that everything else is going to go down the tubes." The once teeming schools of the great silver fish have dwindled to alarmingly low numbers, not only in the five Eastern Canadian provinces, but throughout the nations that border the North Atlantic. The Miramichi River in northern New Brunswick is considered one of the world's greatest salmon rivers, and the plight of the fish in the Miramichi illustrates its rapid decline. In 1992, 150,000 grilse - or small salmon - and 35,000 large salmon returned to the Miramichi. Last year 15,000 grilse and 15,000 large fish returned home. "In (the) Miramichi watershed, and on a declining number of other rivers around the North Atlantic, I believe we are fighting the last stand for the salmon's survival," said J W (Bud) Bird of the Miramichi Salmon Association. "There are mysterious forces at work in the salt water estuaries and in the black hole of the ocean that are steadily and rapidly depleting the foundation stocks of this great fish." Salmon experts attending the week-long Miramichi conference, which concludes this weekend, agree there needs to be more research into the salmon's life-cycle at sea. Mr Taylor's organization, based in St Andrews, is leading the way with a high-tech programme that involves implanting electronic transmitters into young salmon heading into the Bay of Fundy. This year the federation plans to follow the fish into the open ocean and trap them alive. The fish will then be assessed for their overall health and condition. Mr Taylor said he hopes the federal government will contribute at least some of the money needed to expand the test programme into the North Atlantic - a project that would cost at least \$10 million is only a fraction of the \$400 million Ottawa plans to spend on Pacific salmon conservation and restoration on the West Coast. "The biggest threat to the Atlantic salmon's survival is low survival at sea," Taylor said. "The only way we're going to figure out what's happening is if we spend the money and do the research that's needed."

Atlantic Salmon - NASCO action insufficient to save species

Canada Newswire, 9 June 2000

The Atlantic Salmon Federation and the World Wildlife Fund believe that "progress made at the North Atlantic Salmon Conservation Organization (NASCO) meeting in Miramichi falls far short of what is needed to ensure the survival of the wild Atlantic salmon." According to the two conservation organizations, while a few nations are making significant strides - Canada, the United States, Greenland and Norway among them - others including Ireland and the United Kingdom threaten progress in saving the species. In a news release issued at the close of the weeklong meetings of delegates to NASCO, the Atlantic Salmon Federation (ASF) and the World Wildlife Fund (WWF) commended Canada and West Greenland for their continued restraint in disallowing commercial ocean fisheries for salmon. However, Ireland and the United Kingdom were castigated for intercepting salmon destined for the salmon rivers of many nations. Ireland kills about 150,000 salmon and the UK about 50,000 salmon annually in legal fisheries and thousands more are thought to be taken illegally. "NASCO will only achieve its conservation objectives when all of its member countries make saving the wild Atlantic salmon a priority. Canada's and Greenland's commitment to conservation is threatened by the failure of the European Union to deal with the continued slaughtering of salmon in commercial fisheries off the coasts of Ireland and the British Isles," commented Bill Taylor, President of the Atlantic Salmon Federation. Among the issues discussed at the NASCO meeting in Miramichi was the impact of aquaculture on wild Atlantic salmon. The ASF and WWF concluded that there remains much work to be done in implementing the international guidelines on containment to prevent aquaculture escapees from spreading disease, parasites and interbreeding with wild Atlantic salmon. At present there is no guarantee that national action plans based on these guidelines will have the government regulation, monitoring and enforcement required to ensure an environmentally responsible salmon aquaculture industry. "Until this plan has teeth, salmon farming will continue to be a major threat to the survival of wild Atlantic salmon. The plan must lead to real action by the industry," said Thomas Grasso, Director of the World Wildlife Fund's U.S. Marine Conservation Program. ASF and WWF were encouraged that NASCO parties reached a consensus to call for caution in introducing commercial farming of transgenic (genetically modified) salmon. As well, Canada and Norway were commended for taking a leadership role in acknowledging the urgency an internationally coordinated research program to identify and mitigate for the causes of high mortality of Atlantic salmon in the ocean. These were among the recommendations of the conservation organizations to NASCO. Scientists of the International Commission for the Exploration of the Sea (ICES) are predicting increased numbers of North American salmon in the ocean that are expected to return in 2001. This news provided a glimmer of hope to the ASF and the WWF and confirmation that cessation of the West Greenland commercial fishery for Atlantic salmon, where most of North American salmon migrate, is beginning to work. Continued long-term restraint is necessary to affect a full recovery, they say. Prior to the next annual meeting of NASCO, the World Wildlife Fund, the Atlantic Salmon Federation and their conservation partners throughout the North Atlantic will develop a report card to assess the performance of individual governments in their mandate to conserve and responsibly manage wild Atlantic salmon populations.

Canada continues to push for conservation-based management of Atlantic salmon at NASCO

Canadian Corporate News, 9 June 2000

Canada continues to push for a conservation-based, precautionary approach to the management of Atlantic salmon at the seventeenth annual meeting of the North Atlantic Salmon Conservation Organization (NASCO), which wrapped up today in Miramichi, New Brunswick. This was the first time the NASCO annual meeting was held in Canada. "Atlantic salmon is an internationally shared resource, and Canada is committed to doing its part to help conserve it," said Minister Dhaliwal. "I am confident that, by working together with our NASCO colleagues, we will continue to make great progress in protecting the health of this stock, which continues to be a concern." In 1999, NASCO parties adopted the Action Plan for Implementation of a Precautionary Approach to Salmon Management. This year, the plan was taken one step further with the adoption of a Decision Structure for fisheries management, which successfully moves the plan from theory to practice. This structure clarifies the roles of managers and scientists, and draws out the interplay between biological and socio-economic factors. In Canada, a precautionary approach is paramount in salmon management. Canada has closed its commercial Atlantic salmon fisheries, and manages its recreational fisheries on a regional multi-year basis. River classification systems and local community input and participation are essential elements in developing these plans. Activities are also underway in Canada to develop a risk management approach in Canadian fisheries and DFO fisheries managers will be working with the NASCO decision structure for fisheries management on a pilot basis for a limited number of rivers of different status, and will, with other NASCO Contracting Parties, present progress at the next meeting. The subject of salmon aquaculture was again on the NASCO agenda, as it was at the 1999 annual meeting. At that time, Canada was instrumental in helping to establish the North Atlantic Salmon Liaison Group between NASCO members and the salmon aquaculture industry. The Group met for the first time in February in London, England and agreed upon terms of reference for a working group to develop draft containment guidelines, which will apply throughout the area covered by the NASCO convention. NASCO approved the Liaison Group's constitution. The Group will continue its work in the coming year. "I am very pleased that we are making progress on developing internationally acceptable guidelines for the containment of aquaculture salmon," said Minister Dhaliwal. "This is key both for the conservation of wild salmon and the potential for development of the salmon aquaculture industry." Building on the 1999-2000 agreement to restrict catches in West Greenland waters to that amount used for internal consumption in Greenland, the Parties to the West Greenland Commission (the European Union, the United States and Canada) agreed to maintain the spirit embodied in the past year's agreement. In that context, they agreed to restrict the 2001 catch at West Greenland to the lowest possible level, unless a significant improvement is demonstrated in the conditions of stocks in the West Greenland fisheries. In order to better understand the causes of the decline in the abundance of Atlantic salmon, the Department of Fisheries and Oceans Canada has organized a special workshop. This workshop will take place at Dalhousie University in Halifax from June 12 to 14, 2000. Scientists from around the world will work together to develop the necessary research strategies to determine the causes of the low at-sea survival of Atlantic salmon. The results of this meeting will be the basis for Canada's participation in NASCO's five-year research program which is being developed. Following this workshop, research programs will be prioritised based on feasibility, fundability and the likelihood of success, thus laying out the groundwork for an integrated research campaign. NASCO's principal purpose is to promote the conservation, restoration, enhancement, and rational management of salmon stocks in the North Atlantic Ocean through international cooperation. "I am pleased to see that the Council unanimously elected Mr. Jacques Robichaud as President of NASCO. This is the first time that the presidency is held by a Canadian representative since its inception in 1983", said Minister Dhaliwal.

Environmental inquiry into salmon farming

Scotsman, 14 June 2000

The Scottish parliament is to launch an inquiry into the environmental impact of fish farming. The transport and environment committee decided yesterday to join forces with the rural affairs committee to investigate sea cage salmon farming after a petition by Allan Barry, who lives near Inverness, calling for an investigation into the "adverse environmental effects" of the industry. The Green Party MSP and committee member, Robin Harper, called for the remit of the inquiry to be expanded to include GM crops, insisting that there was similar public concern on both issues. He urged the executive to establish an independent committee with similar support and powers to the Cubie commission, established last year to investigate student tuition fees. After the meeting Mr Harper explained that both the rural affairs committee and the environment committee had a heavy workload and these issues were likely to be put back to the end of the year unless action was taken. He stressed that he did not mind how the inquiry was handled, either through a commission or by the committees, as long as it was done. The last government inquiry into fish farming took place ten years ago and called 71 witnesses and received 32 submissions. Since then, Mr Harper insisted, "the problems associated with fish farming, and the size of the industry, have grown exponentially". In the light of this it would be inappropriate to have an investigation that "just called half a dozen witnesses". The rural affairs committee chairman, Andy Kerr, said that the committee should look at whether a "short sharp" report could be produced.

Salmon and cod 'killed by soap'

The Times, 23 June 2000

A range of sea life, including migrating salmon, cod and oysters, is being damaged by common herbicides and chemicals used in soaps, new research shows. In Copenhagen next week, at the Oslo-Paris Commission conference on pollution in

the northeast Atlantic, environmentalists will demand that the offending substance be phased out. The commission, whose 15 members include Britain, has promised to draw up a list of "priority chemicals" that will be phased out by 2020. The World Wide Fund for Nature will demand today that nine commonly used substances need to be added to the list because of evidence showing their danger to fish. The chemicals include the widely used weed killer atrazine. Scientists have found that up to a third of salmon, exposed to atrazine as they move from salt water into freshwater, can die. Salmon catches in European rivers have fallen from 12,700 tonnes in 1973 to 2,300 tonnes in 1997. The group is also asking for a ban on four synthetic musks used in soaps, detergents, fabric softeners and other household cleaning products as low-cost fragrances. These chemicals enter the oceans after being discharged from sewage works and can accumulate in fatty tissues of animals.

Deal bid to end conflict between salmon sectors

Aberdeen Press and Journal, 12 July 2000

Details of a pioneering agreement aimed at ending conflict between the farmed and wild salmon sectors were unveiled yesterday by Scottish Fisheries Minister John Home Robertson. He said the new strategy meant positive progress in bringing together fish farmers and wild fish interests to find local solutions to local problems. The minister yesterday launched the Loch Laxford Area Management Agreement, which he said will help both interests - wild and farmed - to work together in the pursuit of sustainable salmon fisheries in the area. It was drawn up by Loch Duart Ltd, salmon farmers, the local estates, fishery trust and the North and West District Salmon Fishery Board. Mr Home Robertson said: "This is excellent news and represents an important first step in the process. It is vital that everyone with an interest in freshwater fisheries works together in pursuit of shared goals - wild fishing interests, farmed fish interests and, of course the Scottish Executive. I would like to congratulate all the parties in Loch Laxford for leading the way in this initiative and also those involved in the signed agreement at West Loch Tarbet, namely Marine Harvest and the Western Isles Fisheries Trust." Nick Joy, of Loch Duart Ltd, said: "In Sutherland, we have been co-operating with our neighbours and the other users of the marine environment for over 25 years now. Loch Duart Ltd is delighted to take the spirit of co-operation further by signing this agreement." Lord Lindsay, chairman of Scottish Quality Salmon said: "I think most people recognise that wild and farmed fish interests need to co-exist and work together for their mutual benefit. AMAs will build relationships between both groups and are good news for the areas concerned. I am hopeful other areas will follow suit in the near future." Andrew Wallace, of the Association of District Salmon Fishery Boards, said: "We are encouraged by the signing of these first AMAs which represent a significant step towards reconciling the differences between wild and farmed fish interests. The challenge here is to build on this approach in other parts of Scotland." A tripartite working group concordat and report was also published yesterday which puts in place a framework to allow for the development of the area agreements and provides a blueprint for areas wanting to set up similar schemes. Mr Home Robertson said: "The tripartite working group was a positive step forward as it brought the wild and farmed fish interests - along with the Scottish Executive - together to discuss shared issues of concern. That in itself is something of a cause for celebration - but I have been encouraged by the frank and constructive discussions which have taken place. For my part, I am determined that this strategy must deliver. The formal concordat concludes that the tripartite working group is going to drive this process forward and, as the chairman of the TWG, my department will be watching developments very closely. "We want the voluntary approach to work, but I am acutely aware that it could just take one back-slider to do a great deal of damage. If it were to emerge that we need extra powers to underpin the principles of the AMAs, I will not hesitate to seek such powers from the Scottish Parliament. The document they have produced and the associated concordat which the parties have signed is a significant positive step which can be of real benefit to freshwater fisheries in Scotland. I hope it will be viewed as a working document which will be used as a framework for further local agreements." As well as the Loch Laxford agreement one for West Loch Tarbet has been concluded. Other AMAs are in the process of being negotiated. Responding to the announcement, Kevin Dunion, director of Friends of the Earth (Scotland), said: "While Friends of the Earth are supportive of local solutions to the crisis in fisheries, voluntary measures are no substitute for independent regulation and statutory legislation. We welcome the minister's reference to 'extra powers to underpin the principles of AMAs' but urge Mr Home Robertson to seek such powers from the Scottish Parliament as a matter of urgency."

Dam removal frees East Machias River for salmon

UMI, Bangor Daily News, 19 July 2000

Atlantic salmon returning to their spawning grounds in the East Machias River are in for a pleasant surprise. For the first time in 74 years, the 37-mile Washington County salmon river will flow freely through the town of East Machias. Last week, reservists from the U.S. Air Force broke up the remnants of a former hydroelectric dam at the head of the tide, restoring the natural flows under the Pope Memorial Bridge. Breaching the dam was the all but final step in a two-month project that included demolishing the base of an old turbine house and the concrete-clad water gates farther downriver. "The river is open," biologist Norm Dube told the approximately 150 people who gathered on the riverbank to celebrate the event Monday evening. "Salmon can get there from here." Dube works for the Maine Atlantic Salmon Commission, the lead state agency in the dam removal project. The East Machias is one of eight Maine rivers that are home to the last wild runs of Atlantic salmon in the United States, according to U.S. Fish and Wildlife Service and the National Marine Fisheries Service. The two federal agencies will decide by November whether to list the Atlantic salmon in the eight rivers as an endangered species. Stewart Fefer, U.S. Fish and Wildlife Service's project leader for the Gulf of Maine Program, said the remnants of the old dam made it difficult for salmon to get upriver. And the river beyond the dam was getting

warmer and shallower, Fefer said. The number of salmon returning to the East Machias and the other rivers proposed for listing is very low, but that situation is expected to improve as early as next spring, Fefer said. Juvenile salmon born of East Machias brood stock at the Craig Brook National Fish Hatchery in East Orland were released into the river almost four years ago. Those fish, which went to sea last spring, will return in the spring of 2001 or 2002, Fefer said. The dam removal project began almost two years ago when East Machias selectmen, working with the Down East Salmon Federation, approached the USDA Natural Resource Conservation Service and asked for help in removing the old dam. The dam produced electricity for the Bangor Hydro-Electric Co. until the late 1960s when a section of wall blew out. The town purchased the dam from Bangor Hydro for \$1. East Machias Selectman Jack Gardner said the town was concerned about fish passage and safety issues. Children played on the dam, Gardner said. Bob Wengrzynek, the salmon and fisheries specialist for NRCS, said his agency got the Air Force reservists involved through the Coastal America Partnership, a group of federal agencies, including the Department of Defense, that works with state and local groups to protect coastal and ocean resources. Col. George Schlossenagle, the military liaison for Coastal America's national office, said the East Machias project was a perfect "real-world situation" for training military personnel who work in the field of civil engineering. "We've done hundreds of projects like this and the Coastal America Partnership can cut through a lot of red tape," Schlossenagle said. So, at no cost to the local and state partners, Coastal America arranged for approximately 16 reservists to work on the project under the direction of Chief Master Sgt. Gil Taylor. The federal government footed the \$300,000 bill, Schlossenagle said. Taylor and his crew of heavy-equipment operators, excavators and bulldozer operators began work in June. As of the end of July, the reservists will finish cleaning up the dam removal debris and move out. "It has been an honor to have you with us," Gardner told the reservists during Monday night's celebration. "Just two years ago, this project was just a hope and a plan." Maj. Gen. James Andrews, the deputy assistant secretary for Reserve Affairs, whose family included some of the first settlers of East Machias, gave the keynote address. The Innovative Readiness Program that brought the reservists to East Machias was organized so that reservists, who make up 54 percent of the armed forces, could give something back to the nation, Andrews said. Ralph Piscapia, the deputy regional director for the U.S. Fish and Wildlife Service, said removing the dam will help herring and American bald eagles as well as salmon. And with the dam gone, kayakers and canoeists will have better access to the river, Piscapia said. "This is putting your tax dollars to work for the future of the nation's fish and wildlife resources," he said. The next step of the project is to restore the riverbank below the dam and revegetate the area with native trees and shrubs. The work will be funded with a grant from the NRCS Wildlife Habitat Incentives Program and will be a joint project of the town, the U.S. Fish and Wildlife Service, the Maine Council of the Atlantic Salmon Federation, Trout Unlimited, the Down East Salmon Federation and the East Machias Watershed Council.

Large increase in Scottish salmon numbers reported

Independent, 14 August 2000

Fisheries Boards and anglers throughout Scotland are reporting huge increases in the number of young salmon returning this year to the country's rivers, just two months after official reports warned that the king of fish could be heading for extinction. However, Rebecca Wills, spokeswoman for the Scottish branch of the World Wide Fund for Nature, warned against over-optimism. "It seems to be true that unexpectedly large numbers of grilse [young salmon that have been at sea for only one year] began returning last month from the Atlantic to Scotland's rivers," she said. "We would caution, however, that this year's good runs need to be seen against the background of a steady and serious decline in salmon numbers." WWF Scotland said in a report published in June that the number of salmon caught by anglers in Scottish rivers last year was only 12 per cent of the figure of 30 years ago. "Wild salmon stocks have plunged to their lowest ever levels," claimed the report. "The wild Atlantic salmon, which spawns in freshwater but spends much of its life at sea, could be bound for extinction." Similar reports were issued by the Association of Salmon Fisheries Boards and the Atlantic Salmon Trust. Ms Wills and other experts said it was impossible to identify the cause of this year's healthy salmon runs. "All we can say is that it is probably due to something happening in the conditions at sea," said Dr Colin Adams, of Glasgow University's Department of Biology. "And as a scientist I would have to argue that there remains fairly good evidence of a long-term decline. Therefore, one good month does not represent a change in the long-term pattern." While most of the evidence for this year's increase in numbers is based on anecdotes of salmon catches and sightings, dramatic proof comes from an electronic salmon counter in a tributary of the river Tay, the Ericht, at Blairgowrie. "In the whole of last year there were less than 4,000 grilse through the counter. Already this year there have been 7,500," said Dr David Summers, manager of the Tay Salmon Fisheries Board. Dr Summers also emphasised that this year's numbers compared badly with those of more than 30 years ago. "But I'm an optimist," he said. "Already we've certainly got a much better spawning stock than last year."

Eye in the sky bid to protect salmon stocks

The Herald, 14 August 2000

Airborne anti-poaching patrols are to be launched to protect salmon stocks returning to the royal family's favourite fishing river. Bailiffs will use helicopters to crack down on illegal nets set in the sea off the coast of Aberdeen. The air patrols, beginning this month, will look for gill nets which trap salmon heading for spawning grounds in the River Dee. Mr Robert Fettes, river manager of the Dee Salmon Fishery Board, said the patrols were necessary to protect stocks. "We have really got to try to prevent illegal netting because salmon stocks have depleted so much in recent years," he said. "If the salmon became endangered, it would not be just the species that suffered. Rod fishing is worth around £6m annually to the local

economy and the industry supports around 400 jobs, from river staff to local restaurateurs." Prince Charles was taught to fish in the Dee by the Queen Mother during holidays at Balmoral. Mr Fettes said: "The royal family are very supportive of any conservation measures that we implement along with anything that can be done to improve the salmon stocks by artificial means." The helicopter surveillance will cover an area of coastline from the Dee estuary at Aberdeen to Dunnottar, south of Stonehaven. The patrols will fly to an irregular timetable so the salmon poachers are not able to predict their movements. Bailiffs in the sky will be supported by a stand-by vessel belonging to the Scottish Fisheries Protection Agency. If the bailiffs see anyone behaving suspiciously, they can report it to their colleagues on the water who can move in to take a closer look.

The reel thing - Jon Gibb warns that Scotland's salmon stocks are under threat from a seal population explosion

Sunday Herald, 20 August 2000

Possibly the most sensitive issue currently being discussed in the angling world is the perceived explosion of the seal population around the coast of Scotland. Ever since Greenpeace shocked the public's conscience with media images of battered and bloodied seal pups discarded on the ice floes of Greenland, the seal has become one of the world's most loved and best protected species. Any suggestion that a cull might again be necessary to curb the alarming growth in seal numbers is, politically, a hot potato, which no amount of scientific evidence would make the public swallow. Nevertheless, the fact remains that the Scottish grey seal population is expanding at a rate of 8% per annum, which is proving disastrous to many of its prey species. Although the seal's main diet is cod and sand-eels, with each animal consuming two tonnes every year, it is an opportunistic feeder and returning runs of Atlantic salmon are, if gamekeepers up and down the west coast are to be believed, being decimated by massive seal colonies patrolling the narrow mouths of river estuaries. Figures from the Sea Mammal Research Unit at St. Andrews University confirm that the grey seal population in Scotland has nearly doubled in less than a decade. In 1989 there was an estimated 67,000 adult seals around the Scottish coastline; by 1998 this had increased dramatically to 110,000. If you set this against statistics from the North Atlantic Salmon Fund that, over twenty years, Atlantic salmon has declined from 4 million to 0.8 million in 1996, you might be forgiven for adding two and two together. I don't believe it's that simple, but the time has surely come to clear the muddy waters and find out just what impact an entirely protected seal population is having on the rest of our marine environment. There is no end of anecdotal evidence to suggest that fish predation by seals has reached unacceptable levels. It is the one thing that salmon farmers and anglers agree upon. Indeed, perhaps the only thing. Fish farmers report thousands of pounds worth of damage every year caused by seals destroying their nets and killing their stock. And it is no longer any surprise to see seals far up the Tweed or Tay in search of salmon. However, many in the angling fraternity actually blame the fish farmers for the seal population explosion. In 1997 alone, 500,000 farmed salmon escaped from their cages and with no natural instinct to find the river of their birth, these fish, and many since, would have made an easy meal for hungry seals. The last Scottish seal cull was undertaken in 1977 but, due to public outcry, was abandoned in 1978 to await the results of more research into seals and fisheries. Such direct investigation has never been seriously undertaken. What many concerned parties are now, very sensibly, suggesting is that the Scottish Executive set up a Seal Commission, similar to the Red Deer Commission which advise estates on deer control, to assess seal numbers and implement initiatives to restore the balance in the inshore marine ecology. The Canadian government have recently been administering contraception to seals with some success, and any such non-lethal method of population control is bound to be more palatable to the general public. The current environmental protective measures make no sense whatsoever. The river Oykel, for example, is one of the new proposed Special Areas of Conservation, under the EU Habitats Directive, for its threatened salmon stocks. In its estuary, the Kyle of Sutherland, there will also be an SAC for grey seals. One species is declining, the other increasing and held partly responsible for the others demise; yet, both are being protected. In anyone's book, this has to be utter madness. Not until the Scottish Executive sit up and notice will the truth about seal predation be settled once and for all.

Leap now to turn tide on wild salmon stocks

Irish Times, 26 August 2000

It will be another year or more before official figures on this year's catches of wild Atlantic salmon become available. At that stage, we will probably have lost a further two generations of this endangered species to bad management, individual greed and official neglect. The prognosis is terrible. Anecdotal evidence from the main fishing grounds along the west coast suggests a collapse in stock levels. Time is not on our side. If the new Minister for the Marine is even mildly interested in creating a political reputation, he has the ingredients to hand: an endangered species; gross over-fishing; citizens who are increasingly aware of their environmental heritage. The coincidence of the threat to this noble fish that ranks prominently in our culture and our growing affluence as a society is auspicious. For the first time there is money in the Exchequer to pay for long-term remedial work. Saving the wild salmon should have particular relevance for voters in Galway West. Any city-dweller there can enjoy the marvellous sight from bridges of salmon waiting to move upstream to Lough Corrib. The fortunate ones can try their luck with fly, spinner or bait. Tourists and foreign anglers are entranced. It is a window into the past. As a spectacle and a sport it is replicated at the famous Ridge Pool in Ballina, but is rare in the rest of the world. We should go through fire to preserve it. There are, of course, voting considerations. Since the 1950s many Connemara fishermen have made good money drift-netting for salmon during the summer. The emergence of west

coast drift-netters as the main catchers of salmon, and the use of mono-filament nets, saw the gradual decline of shore-based, draft-net fisheries. Salmon were now being caught - often illegally - at sea, while fishing efforts ashore continued unabated. Successive governments turned blind eyes to the ravaging of the stocks. On the rare occasions the issue did surface on the political radar, it was the votes of the many drift-netters in coastal communities that counted. Fishery owners and anglers took a back seat. It was a perverse political reaction. And it hasn't gone away. It may reflect old attitudes to the Big House, to the gentry and to a "well-heeled" angling confraternity. A similar "them and us" mentality informed official thinking in the 1960s when some enlightened citizens tried to preserve Georgian Dublin. In the same way, salmon stocks and inland fisheries are not yet seen as part of our common heritage, to be protected and cherished. But the tide is slowly turning. The gradual change in official attitudes may have more to do with the collapse of salmon stocks than enlightened thinking. Ahead lies the cliff edge. We have only a few short years left to prevent disaster. And the issues involved are complex. While over-fishing at sea is the primary cause of the collapse of wild salmon stocks, it is not the only factor. Climate change, water pollution of nursery streams, afforestation, extensive poaching and a growing number of rod anglers have all contributed. Irish drift-nets take about 70 per cent of the recorded salmon catch, worth less than £2 million a year. Most of the 1,200 licensed netmen and their helpers fish off the west and south coasts and, if anecdotal evidence is to be believed, the salmon fishing was so bad this year that many of them abandoned it for crab and lobster fishing. Catches along the Galway, Mayo and Donegal coasts were said to be about one-third of 1999 levels which were, again, one-third of average catches from the 1970s. Even then, the shortage of wild fish didn't impact on prices. Irish households are now supplied with low-priced farmed salmon; netmen only received between £2.10 and £2.50 per pound for wild salmon at the height of their season. It is such a waste in fishery resource terms. There are so few wild salmon fisheries left that foreign anglers are prepared to pay a great deal to catch fish, even if they have to release them again. Access to salmon fishing for Irish citizens is still relatively cheap and manageable. Crashing stocks and low prices have made this a zero-sum game for netmen. Price is dictated by the cost of farmed fish, even as wild stocks decline. Generous Government compensation would, at this point, encourage many of them to give up their licences and would augment the stocks of wild fish coming into the rivers to spawn. At that point rod anglers, fishery owners and the State would have a responsibility to participate in further conservation and protection measures. For there is no point in phasing out netting if increased stocks are eroded by poaching and by greedy, thoughtless anglers and fishery owners. A first step in phasing out draft netting was taken by Michael Woods last December when he provided £200,000 to compensate licence-holders on the Munster Blackwater and on the Laune-Lane catchment in Co Kerry. On his appointment as Minister, Mr Fahey asked the National Salmon Commission to oversee the tagging of all wild fish to establish stock levels. But there has been no advance on the drift-net issue. Tagging as an anti-poaching measure was to have been introduced last April, having been first officially proposed 12 years ago by Brendan Daly. It didn't happen. Now officials are talking about next year. It's a shambles. The greatest mistake, however, lay in the Government's failure to join an international effort aimed at protecting the species. Ireland and Britain are the only north Atlantic countries that have not moved towards ending drift-netting. The countries close to the feeding grounds - Greenland, Iceland, Norway and the Faroes - have done so. But their fishermen now complain they are conserving stocks only to see them slaughtered by Irish and British netmen. Without radical Government action, our wild stock of salmon could disappear within a decade, and both commercial and recreational fishing will be doomed. Determined conservation and protection measures could halt that slide towards disaster. But they will involve pain for all those involved. For rod anglers, it could mean catch limits, catch-and-release in certain circumstances, and the curtailment of fishing on impoverished waters. Government and anglers will have to fund greater fishery protection measures to combat poaching. Saving the salmon could form the basis of a positive, forward-looking campaign. We have killed off the char populations of the great western lakes through low-level pollution. Hardly anybody noticed. But we are now investing millions in an attempt to improve the quality of our waters. That investment may relieve ecological stress on salmon and trout stocks. But what will be the point if we wipe the species out through over-fishing? Frank Fahey doesn't have all the answers in his Department. A comprehensive approach to conservation will require the co-operation and support of Noel Dempsey in Environment, John O'Donoghue in Justice and Joe Walsh in Agriculture. On top of that, Charlie McCreevy in Finance will have to open the purse-strings. Saving a fish species may seem relatively unimportant in a political climate that has been dominated by agricultural pressure groups. But the wild Atlantic salmon is a special case. Properly managed, a campaign to save that part of our heritage could become a big idea for the Coalition Government. And Frank Fahey could raise his profile.

Anglers 'eating seed' of the salmon stocks, committee is told

Irish Times, 6 September 2000

A radical overhaul of fisheries in the North is needed if inland fishing is to survive long into the 21st century, a committee of the Northern Assembly has heard. The Culture, Arts and Leisure Committee, which is conducting hearings on inland fisheries, was told that the North was "eating the seed" of its salmon stocks. Mr Frank Quigley, an angling enthusiast, called for a 10-year ban on netting both salmon and trout in order to allow stocks time to recover. If this was not done, very soon there would be no salmon to fish. "Somebody has to do something and we believe that you as our elected representatives are the people to do it," he said. The committee was also told that a culture of secrecy dominated the way government departments had managed angling and it needed to be broken. Another angler, Mr Harold Avery, told the committee he believed the Department of Agriculture's fisheries division, the Fisheries Conservancy Board and the Department of the Environment could be quicker to respond. Mr Avery alleged that over the past 42 years, more than 150,000 tonnes of contaminated aluminium sludge had been dumped in Northern Ireland's waterways. In some cases this

had been carried out by government departments, he said. The committee also received evidence from the Ulster Farmers' Union, Garrison and Lough Melvin anglers and Lough Neagh fishermen's co-op society.

Salmon catches lowest on record

Aberdeen Press and Journal, 21 September 2000

Salmon and sea trout catches last year were the lowest on record, the Scottish Executive admitted yesterday. The total number of salmon and grilse caught and retained by anglers and netmen was 55,538 - down 39.4% on 1998. The weight of salmon and grilse caught also fell below 200 tonnes for the first time since records began. In 1999, the catch was put at 197.8 tonnes, a 29.2% drop on the previous year. The mean weight of salmon was down by 0.5kg compared with 1998 while the average weight of grilse was down by 0.1 kg. The total number of sea trout caught was down 24.1% to 34,593. The total weight taken was 35.5 tonnes, also down 25.4% on 1998. Mean weights were the same as in 1998. Concern Scottish Fisheries Minister John Home Robertson said the statistics, although well trailed, were a serious cause for concern. He added: "The 1999 catches of salmon and grilse are officially the lowest on record. There is now absolutely no doubt that we need to take fresh initiatives to conserve stocks and to improve the regulation of fisheries." North-east MSP Richard Lochhead, the SNP fisheries spokesman, claimed successive Government had failed to respond to the catch figures which have been declined since 1973. He added: "The Government must now grasp the seriousness of the situation and get the Salmon Conservation Bill on the statute book as soon as possible as well as looking to additional longer term legislation and more research into the marine phase of the salmon cycle". MSP Jamie McGrigor, Tory fisheries spokesman Jamie McGrigor MSP said: "The Scottish Executive must act quickly to rectify this disastrous situation. They must instigate in-depth research into the causes of this staggering downturn and when they have some answers they must act decisively to protect this vital industry."

Anglers told to throw big salmon back in stock crisis

Sunday Mirror, 24 September 2000

Anglers the west of Ireland are being asked to introduce a voluntary catch-and-release system in a bid to protect valuable salmon stocks. The North Western Regional Fisheries Board has written to all angling clubs and fishery owners urging them to introduce the policy on their fisheries. It has also suggested the introduction of catch-and-release measures with effect from the beginning of next season. The Board, which controls the River Moy and Loughs Conn and Cullin, wants all fish weighing 10lbs or more to be returned alive to the water. Board manager Vincent Roche said it has also introduced lower bag limits on its own fisheries this month. And where bag limits are reached, rods will not be re-let in order to conserve stocks. Mr. Roche said: "We are particularly concerned about the serious decline in stocks of spring salmon over the past 10 years." Mr Roche said "each 10lb female spring salmon contributes an average of 6,000 eggs to a fishery which is needed to restock waters."

Aluminum threatens salmon. State biologist finds high levels down east

UMI, Bangor Daily News, 29 September 2000

Maine's Atlantic salmon rivers aren't very acidic, but aluminum in the soils around some tributaries could be harming the fish during acid rains, researchers told the Narraguagus Watershed Council Wednesday night. "The bad news is the aluminum," said Mark Whiting, a biologist with the Maine Department of Environmental Protection. "There are some very high levels." Whiting said tests he conducted this summer indicate the heavy metal in the soils around some Down East tributaries are leaching out into the streams. The Pleasant and Narraguagus rivers - particularly the West Branch - appear to have the most serious problems with aluminum, he said. Aluminum degrades fish gills - interfering with the salmon's ability to regulate the levels of salt in their bodies, according to John Magee, a researcher with the National Marine Fisheries Service. Magee told council members that aluminum could kill salmon because the salts leak from their bodies. Even if the fish doesn't die right away, it has to put more energy into counteracting the salt problem, he said. That can slow the salmon's growth rate and cause problems when the fish leave the fresh water for the ocean, he said. Magee said salmon are particularly sensitive when they make the transition to salt water and, if stressed, they don't appear to do as well at evading predators. The two scientists were the featured program speakers at Wednesday's meeting of the Narraguagus River Watershed Council, a volunteer group that is working to improve salmon habitat on the Narraguagus. The Narraguagus is one of eight Maine bodies of water for which the U.S. Fish and Wildlife Service and the National Marine Fisheries Service are proposing to list Atlantic salmon as an endangered species. The agencies will make a final decision in November. The role that acid rain may play in the dwindling number of wild salmon in Maine and Canadian rivers is coming under increasing scrutiny. Fred Kircheis, the executive director of the Maine Atlantic Salmon Commission, told council members that he'd just returned from a meeting in Nova Scotia where problems with acid rain are being blamed for the disappearance of Atlantic salmon in 33 of the 45 salmon streams on the eastern side of the province. The salmon in the remaining streams are on the verge of extinction, Kircheis said. Whiting said aluminum is found in shallow, sandy soils, where years of acid rain have driven out nutrients, leaving just the aluminum. Down East streams tend to be tannic - their tea-colored waters are an indication of dissolved organic carbons. Most of the time, those carbons wrap around the aluminum ions, making them nontoxic to fish, Magee said. But storms change the dynamics in the rivers, and aluminum ions tend to stay in a form that isn't benign, Whiting said. In addition to the Pleasant and Narraguagus rivers, Rocky Brook on the East Machias River has both high levels of aluminum and more acidic water.

according to Whiting's statistics. Whiting and Magee's research is continuing. More than 25 people attended Wednesday's meeting, where council members described a number of erosion control and bank stabilization projects they are pursuing on the Narraguagus. The work is being done by volunteers who just completed an extensive survey of the river, identifying the areas that need work. That information, when added to the surveys that interns for the Land Use Regulation Commission have done over the last two summers, have given the council a blueprint of what needs to be done to improve spawning and nursery habitat. Funds from the Maine Department of Environmental Protection, the federal Environmental Protection Agency and the Atlantic Salmon Commission are expected to cover the costs of materials and equipment for the improvement projects. Matthew Scott, the outgoing executive director of PROJECT SHARE, praised the Narraguagus council and said Rep. Edward Dugay, D-Cherryfield, had done a "great piece of work" in securing \$810,000 in funding for the Maine Atlantic Salmon Conservation Plan. The plan is the state's alternative to a federal endangered species listing and was facilitated by Project Share, which is composed of representatives of private industry, conservation organizations, salmon anglers, government agencies and municipalities. Local watershed councils are central to the state salmon conservation effort and Scott said he believes the Narraguagus watershed management plan will serve as a model for other watershed councils. Cherryfield - Maine's Atlantic salmon rivers aren't very acidic, but aluminum in the soils around some tributaries could be harming the fish during acid rains, researchers told the Narraguagus Watershed Council Wednesday night. Fred Kircheis, the executive director of the Maine Atlantic Salmon Commission, told council members that he'd just returned from a meeting in Nova Scotia where problems with acid rain are being blamed for the disappearance of Atlantic salmon in 33 of the 45 salmon streams on the eastern side of the province. Storms change the dynamics in the rivers, and aluminum ions tend to stay in a form that isn't benign, [Mark Whiting] said. In addition to the Pleasant and Narraguagus rivers, Rocky Brook on the East Machias River has both high levels of aluminum and more acidic water, according to Whiting's statistics.

Scottish salmon farming revolution that has left the seas awash with toxic chemicals

Independent, 2 October 2000

Scottish salmon, the fish which has gone from being a luxury to the ubiquitous filler of sandwiches and supermarket fish counters, is in trouble. Environmentalists have accused the salmon farming industry of poisoning shellfish stocks, thus creating toxic algal blooms around the coast which threaten the survival of wild salmon stocks. Fish farms have also been accused of using illegal toxic chemicals, leading to criminal inquiries by environmental regulators. Mass escapes of farmed fish have also led to claims that these will irrevocably damage the country's wild stocks. As a result, two committees of the Scottish Parliament have begun a joint inquiry into allegations that salmon farming - a booming industry which employs 6,500 people in the Highlands and Islands and earns £260m a year - is wrecking the environment. Salmon farming has become a multi-national industry over the past two decades and is now dominated by companies such as Norsk Hydro in Norway, and Marine Harvest in the Netherlands. In 1980, Scottish fish farms produced roughly 800 tons of fish. The latest annual figures put wild salmon catches at 198 tons, compared with 127,000 tons of farmed salmon produced by 340 farms dotted around the coast of Scotland, from Campbeltown in Argyll to Sutherland on the North Sea. Faced with such a sudden growth, some regulators believe the industry is in danger of upsetting Scotland's delicate marine environment. Balancing the environmental issues against the industry's economic value will be a key task for the parliamentary inquiry. At the same time, the Scottish Environment Protection Agency (Sepa) is preparing to tighten its already strict rules on the location of salmon farms, their use of restricted chemicals, and their discharge of waste into the seas. Under a stricter system of regulations aiming to combat an increase in pollution incidents, the agency has threatened to revoke licences and relocate fish farms. Eventually, its officials believe, the parliamentary inquiry could oppose the industry's further expansion unless it improves its waste technologies and its environmental record. But the green movement's charges have been dismissed by the industry as unsubstantiated or even malicious. Lord Jamie Lindsay, a Scottish Office environment minister under the last Tory government, who now heads the main industry association, Scottish Quality Salmon (SQS), agreed that the industry is now under intense pressure to improve. But he insists its record is generally very good. "Sensitivity towards the environment demands the highest possible practices," he said. "We recognise that simply complying with legal minimum requirements isn't good enough. Our sustainability strategy is leading to a level of discipline and quality which will guarantee a sustainable future." Meanwhile, Friends of the Earth Scotland believes recent events justify its criticisms. In July, one company was expelled from SQS and stripped of its "Tartan Quality Mark" after two former workers signed affidavits alleging that the company had illegally used two toxic chemicals - ivermectin and cypermethrin - to combat sea-lice. While legal in its correct formulation, the company allegedly used a cypermethrin product designed for horses. Ten days ago, the Veterinary Medicines Directorate (VMD) said it had found levels of ivermectin, a banned neuroinsecticide, four times above official "action levels" in three samples of farmed salmon out of the 30 fish tested. Using for the first time the statutory powers introduced in 1998, Sepa and the Ministry of Agriculture, Food and Fisheries have launched a criminal inquiry into the new discovery, which could lead to prosecutions. One source said the regulators had a simple policy: "Using inappropriate chemicals and medicines has the potential to do real environmental damage. We will prosecute if we find enough evidence." Kevin Dunion, the director of FoE Scotland, believes there are even more worrying statistics. The Salmon and Trout Association has reported 30 mass escapes of farmed salmon over the past three years, with at least 500,000 fish escaping this year. These larger, quicker-growing fish are interbreeding with wild stocks at a time when "wild" catches in Scotland have fallen by nearly 40 per cent from 1998 to 1999. Last year's 198-ton catch was the lowest on record. FoE Scotland also supports concerns over fish farming's alleged links to algal blooms, which were raised by Alan Berry, a former shellfish farmer from Beaulieu, near

Inverness, in his petition to the Scottish Parliament which led to the latest committee inquiry. Fish farms are also being blamed for increasing levels of nitrogen in the ocean. In the past two years, Sepa has detected 26 effluent pollution leaks, often involving nitrogen-rich fish droppings, compared with only nine in the previous two years. Naturally-occurring algae feed on this nitrogen and grow into large toxic blooms that help to close down other fisheries. Experiments by the government's Marine Laboratory in Aberdeen have found that, in laboratory studies, legal chemicals such as azamethiphos and cypermethrin can create an imbalance between plankton and algae populations, producing toxins such as diarrhetic shellfish poisoning or amnesic shellfish poisoning. Neither of these theories has been proved and Sepa officials remain sceptical about their accuracy, but other studies suggest ammonia in droppings stimulates the growth of another toxin, paralytic shellfish poisoning. Last week, there were 65 separate bans on the harvesting and farming of queen scallops, scallops, mussels and oysters across the Western Isles and mainland coast. Most of the bans were close to fish farms. While Mr Dunion stressed that these issues pose no real risk to consumers' health, Sepa and the Scottish executive now recognise that salmon farming does threaten the wider environment. "The industry will soon be operating in a much less forgiving regulatory regime," he said. "Also, consumers want to buy a quality product from sea to plate which doesn't do much damage. I think salmon is becoming a degraded product for consumers and food writers." Yet fish farmers such as Nick Joy, whose company - Loch Duart Ltd, in Sutherland, north-east Scotland - employs 26 people, insists such claims are false or exaggerated. Algal blooms and the decline in fish numbers have occurred naturally for decades, he said, for a wide range of unrelated and more complex factors. He has a thriving mussel farm next to his fish cages and two neighbouring salmon rivers, which have reported the best catches since the 1950s. He employs one person full time to deal with nine separate regulatory agencies and their strict licensing conditions. Despite its regular testing regime, the VMD has uncovered contaminated samples of fish on only two occasions since 1995, which proves how false FoE Scotland's allegations are, he said. He added: "I'm passionate about this industry, and I think we have a very good story to tell. It's far better that we end up with some sort of public inquiry to show what utter drivel these people are talking." According to Lord Lindsay, the Scottish Parliament investigation will serve to focus minds on the most critical issue of all: finding a proper balance between protecting the environment and supporting a valuable rural industry. "Our success to date should bode well for the future because the global demand for fisheries products by 2010 is going to be massive, and aqua-culture worldwide has to step in and take up that demand - because the oceans have no hope of doing so," he said. "Aqua-culture has an enormous contribution to make, and Scotland has proven in the past that it can compete on grounds of quality in that market."

Purge on poachers as salmon return

Northern Echo, 7 October 2000

Environmental groups have launched a crackdown on salmon poachers on the region's rivers after an increase in the number of fish returning to the area. Surveillance cameras have been set up at a number of places along the rivers Tees, Ure and Ouse, as part of the clampdown by the Environment Agency on illegal poaching. Officers are carrying out enforcement checks along the three rivers over the next two months in a bid to protect returning salmon and sea trout. David Bamford, fisheries officer for the Environment Agency, said: "It is important to stop the illegal capture of these wonderful fish so they can go on to produce the next generation. Numbers are finally increasing, but only very slowly, and if we want this rosy picture to continue then these fish must be allowed to reach their spawning grounds. We're keeping a close eye on the waters and taking a strong line against anyone caught poaching salmon and sea trout." The salmon and sea trout fishing season lasts until the end of this month, and the agency has warned that anglers going out to catch these fish need a migratory trout and salmon rod licence. A normal coarse fish and trout rod licence cannot be used. Mr Bamford said: "We ask legitimate anglers to return any fish caught to the water unharmed to continue their journey." Elsewhere in the region, hundreds of fish have been rescued after an emergency operation launched by the Environment Agency. More than 400 brown trout and dozens of other fish, including grayling, brook lampreys and crayfish, were saved on the River Rye between Helmsley and Duncombe Park, in North Yorkshire. Agency staff made the rescue after the fish were found to be in danger of becoming trapped in isolated pools with little oxygen. An electric current was used to stun the fish, and they were transferred to an unaffected part of the river. The agency's fisheries officer, Shaun McGinty, said: "This has been a successful rescue operation and it's certain that literally hundreds of fish have been saved. Thankfully, recent rain has now relieved the problem as the river fills up with water again. Notwithstanding this, we shall continue to monitor the situation. Staff are on stand-by ready to spring into action should the problem reoccur."

Government action on salmon sends out encouraging signals

Sunday Herald, 8 October 2000

As encouraging reports from most of Scotland's salmon rivers continue to come in, there can be little doubt that this season will go down as one of the best of the decade. The welcome improvement in the summer grilse runs seems to have been followed by a healthy early autumn run on many of the major systems. Returns, such as 22 salmon on the Upper Floors beat of the Tweed in a single day's fishing last week, give a flavour of some of the successes being enjoyed around the country at the moment. They say that one swallow doesn't make a summer and, in the light of the continued threat to the plight of wild Atlantic salmon, this column will not be eating humble pie as yet, but will continue to highlight the environmental perils that exist until this valuable species has convincingly turned the corner on the road to possible extinction. Fortunately, the Salmon Conservation (Scotland) Bill has made it on to the legislative programme for this session of parliament, and I hope to be reporting on its progress to the statute books over the coming weeks. As Scottish

Fisheries Minister John Home Robertson has said: "The Salmon Conservation Bill is an important step forward in safeguarding the future of salmon in Scotland and will broaden the range of conservation measures available. As Scottish Fisheries Minister, I am determined to do all I can to protect this national resource and ensure it has a sustainable future." The key word here is sustainable. Can the excellent runs of one-sea-winter fish that have been seen this year really be sustained, so that the progeny of these fish will reach adulthood to help redress the balance in the dramatically reduced population? In a year when an estimated 395,000 farmed salmon have escaped from their cages around the coast, posing a massive threat to the natural gene pool of these wild fish as they vie for space on the spawning redds, it could be argued that the future is still very much in the balance. Fish farming has undoubtedly played a part in the demise of wild fish over the past few years, but only recently have any real and constructive measures been discussed to curb its destructive influence. The final report of the joint Government/Industry Working Group on Infectious Salmon Anaemia has recently been published. Its most important suggestions include the zonal management of fish farms, with fire breaks between each zone to limit the spread of this lethal disease, while also limiting the effect of parasites such as sea lice. Such measures will shortly be discussed in the committee rooms of the Scottish parliament. As highlighted in this column, the rapid expansion of the grey seal population continues unchecked. It will be interesting to see whether the Ministers will have the courage to embrace this emotive issue. Anglers from the River Gruinard in Wester Ross have been recording any seal damage from their fish for several years. Interestingly, in 1997 and 1998 fewer than 1% showed any signs of predator damage whereas in 1999 this had increased to 11%. Strangely enough, Langley-Taylor in Edinburgh announced this week, on behalf of the owners, the sale of the entire River Gruinard system. The river's 10-year average is 150 salmon and 35 sea trout, and two major brown trout lochs are also included in the sale. Very rarely does a whole salmon river of such repute come on the market and interest is likely to be keen. With offers of over £750,000 invited (representing £5,000 per fish) the investment will not be for the faint-hearted, with the odds still so unfairly stacked against returning salmon on the west coast. Or perhaps those with a cool £1.25 million and a penchant for high risk will be interested in the announcement of the proposed sale of Islamouth, one of the most famous beats on the Tay which produces around 250 salmon every year. The counter on the Ericht at Blairgowrie, a tributary of the Isla, has already recorded 13,000 fish this year but, as an old punter at the racecourse once told me: "Son, never back a winner on the strength of one race."

Grant to support salmon restoration

UMI, Bangor Daily News, 10 October 2000

In 1999, an estimated 250 wild Atlantic salmon returned to spawn in seven of Maine's most important wild salmon rivers. That represents a decline of 90 percent from 15 years ago, and is 99.9 percent lower than historic levels. In the last two decades a complex set of natural-and human-caused problems have brought these last wild runs to the brink of extinction, according to Vanessa Bullwinkle, a spokeswoman for American Tree Farm System. To help save Maine's wild salmon, the National Fish and Wildlife Foundation has awarded a \$75,000 grant to American Tree Farm System and Trout Unlimited to help fund a cooperative conservation initiative called, "Shared Streams in Maine." The initiative will restore stream habitat on four demonstration sites owned by Certified Tree Farmers in northeastern Maine. For more information about taking part in a "Shared Streams in Maine" demonstration project, contact DeBerry at 202-436-5188. To help save Maine's wild salmon, the National Fish and Wildlife Foundation has awarded a \$75,000 grant to American Tree Farm System and Trout Unlimited to help fund a cooperative conservation initiative called, "Shared Streams in Maine."

Dead fish in Connemara lake are linked to salmon hatchery

Irish Times, 14 October 2000

The Western Regional Fisheries Board said yesterday that "substantial" numbers of dead fish had been found in Derryclare Lake, Connemara. The incident has been traced to a hatchery at Derryclare which produces salmon smolts on a commercial basis. The board has taken samples which, it said, confirmed the link with the hatchery, run by Murpet Fish, a Norwegian-owned company. The chairman of the Save Our Sea Trout campaign, Dr Graham Shaw, said the dead fish were washed into the lake when a hatchery sump was being cleaned, exposing wild fish in the system to potential disease.

Battle to save salmon undermined by cutbacks

Independent, 16 October 2000

The battle to save the salmon, one of the world's most threatened fish, is at risk by swingeing cutbacks in Government funding personally ordered by the Agriculture Minister Nick Brown, the Environment Agency believes. Mr Brown is slashing by a full third the money available next year for the agency's salmon conservation effort in England, from £4.6m to £3.1m. As a result, anti-poacher patrols on England's salmon rivers are to be cut by half, water bailiffs and scientists will be transferred to other jobs, and a whole raft of salmon conservation measures will have to be abandoned. Mr Brown has told Parliament he was imposing the cut because of the costs of the Pet Passport scheme and the BSE enquiry, and because the agriculture ministry had failed to sell a surplus building in London. But senior sources in the fishing world are convinced the real reason is Mr Brown's well-known and frequently-expressed hostility to all field sports. The cut has caused consternation in the Environment Agency, from the chairman, Sir John Harman, down, and so drastic are the effects expected to be that this week the agency is preparing to ask the Government to be relieved of its statutory duty to prepare Salmon Action Plans for England's 40-odd salmon rivers. Sir John, former Labour leader of Kirklees council in West Yorkshire, said yesterday: "The effect of the cut will be to severely affect the agency's ability to protect salmon and

maintain their numbers at a time when stocks are already under severe pressure. It is very difficult to understand the rationale behind it." Britain's salmon stocks are in fact at a historic low point, with catches on a prime river such as the Wye having fallen by 75 per cent in ten years. The reason is poorly understood, but thought to be connected with changes to the salmon's distant ocean feeding grounds off Greenland being brought about by global warming. Certainly, fewer adult salmon are returning from the sea than ever before, and 73 per cent of salmon rivers in England now have stocks that are too low to maintain themselves on a stable basis. On Wednesday the agency's board will be presented with a paper formally setting out the effects of the cuts. They include a big reduction in staffing levels, big reductions in river and coastal enforcement patrols, decreased fish monitoring, a virtual end to capital expenditure, and the likely sale of the agency's fishery enforcement vessel Northumbria Rivers. The areas affected most will be Cumbria, Northumbria and the West Country. Chris Poupard, director of the Salmon and Trout Association hit out at Mr Brown's action. "In terms of total Government expenditure, £1.5m is just petty cash," he said. "But in terms of salmon conservation in England it represents a huge sum. The cut is a disgrace. It's diabolical." The agency is now further worried that it may face further cuts from Mr Brown in future years. For fishery officer Mike Maslin the drop in funding will bring to a premature end the work he and his colleagues have been doing to turn Devon streams into ideal nurseries for baby salmon. Mr Maslin, 42, has been recently working on a tributary to the Devon Avon, a small river running off Dartmoor, much less well known than its Hampshire or Warwickshire namesakes, but one that nevertheless has a respectable salmon run. The Bickham brook is a stream that salmon swim up from the Avon to spawn in. "It's a very good stream for juvenile fish," Mr Maslin said. "It's got nursery areas, meanders, which create undercuts in the bank for the fish to hide in and a few deep pools. It's got the right diversity of habitat." Mr Maslin and a colleague have been trying to make it even better by loosening the gravel on the stream bed to make it easier for salmon to cut their redds, or egg laying sites, which they do by swishing their bellies from side to side. They have also been cutting back overhanging trees to allow more light onto the water, which promotes weed growth, which in turn promotes the insect life the young fish need for food. Mr Maslin said: "Out of about 5,000 eggs a fish lays, only one per cent will survive to be two years old. If we can give them a helping hand it can make a real difference."

Salmon are leaping back

Sunday Mail, 22 October 2000

Salmon are making a comeback after years of decline. Catches in Scottish rivers are leaping up - and anglers say it's because more seals are being culled. Sixty seals have already been shot this year - compared with 18 in 1995. A Scottish Executive spokesman said: "There will be an increase in the number of seals shot. Seals are more of a problem this year and the situation may be getting worse." Jeremy Read, director of the Atlantic Salmon Trust, said: "Many rivers - including the major trio of the Spey, Tay and the Tweed - have shown significantly improved catches." It's all welcome news for the £70million Scottish salmon industry.

Gene banking prescribed to save salmon

Bangor Daily News, 25 October 2000

Gene banking may be the last resort for saving wild Atlantic salmon from the "full-scale disaster" that acid rain is causing on Nova Scotia's eastern shore, a Canadian scientist said Monday. Dr. Fred Whoriskey said acid rain deposits have touched virtually all 65 rivers on Nova Scotia's Atlantic Coast, leaving only refuge populations of naturally reproducing wild salmon. More than half of the 65 rivers are too acidic for salmon. Only 13 rivers have a pH that is high enough to support salmon populations for the foreseeable future, he said. The pH is a measurement for acidity, and the higher the number, the lower the acidity. Short of dumping lime into the rivers - a practice that is common in Norway and Scotland to lower acidity levels of the water - there is no way to make the rivers less acidic. Natural recovery of the buffering capacity of soils in the watersheds will take 100 years, he said. No money is forthcoming from the Canadian government, which has closed its salmon hatcheries, Whoriskey said. Canada's proposed species-at-risk legislation - comparable to the U.S. Endangered Species Act - will not be voted on because Prime Minister Jean Chretien has dissolved Parliament and called for a November 27 election. Gene banking of live salmon from targeted rivers may be the last resort, Whoriskey said. Whoriskey works for the Atlantic Salmon Federation in St. Andrews, New Brunswick. He summarized the Canadian Department of Fisheries and Oceans' status report on the eastern Nova Scotia rivers during Monday's Atlantic Salmon, Acid Rain and Climate Change conference at the University of Maine at Machias. Coordinated by Project Share - Salmon Habitat and River Enhancement - and sponsored by the UMM science club, the conference also featured presentations by five researchers from the University of Maine at Orono. The presentations covered more than 20 years of research on Maine soils, water and air. None of the research findings or theories boded well for the Atlantic salmon in Maine rivers. Maine is in better shape than Nova Scotia because it has some wild salmon, according to Dr. Terry Haines, a fisheries biologist with the U.S. Geological Survey. Haines said there is no question that Atlantic salmon are sensitive to acidic water and especially to the aluminum that goes along with it. Aluminum interferes with a salmon's ability to regulate body salts, which is particularly important for a fish that spends time in both fresh water and salt water, he said. The emissions that produce acid rain, such as those from coal-burning plants, also produce mercury, Haines said. Mercury, a neurotoxin that is harmful to humans and fish, eventually works its way down from the atmosphere into lakes, streams and watersheds, he said. Experiments with high-mercury fish indicate that it takes twice as long for them to settle down after being startled by a potential predator, Haines said. And, they settle down in larger groups, making them more vulnerable to the predators, he said. "We don't know whether this would affect Atlantic salmon, but we've estimated that loon reproduction

is down 25 to 30 percent because of mercury content in dirt," he said. Dr. Steve Kahl, the director of UM's George K. Mitchell Center for Environmental and Watershed Research, said the 1990 amendments to the Clean Water Act have reduced sulfur emissions and the resulting sulfates in acid rain precipitation. But the anticipated reduction in the acidity of Maine bodies of water hasn't taken place, he said. Nitrate levels remain the same, and the Clean Air Act limits on nitrogen emissions won't be in effect until 2003, he said. "We thought the acids would go down, the pH would go up and it would be better for fish," Kahl said. "But the calcium and magnesium decreased faster than the sulfates and they offset the decrease in the sulfates." As a result, many Maine water systems are still acidifying, he said. Acid rain is the ultimate nonpoint-source pollution, but slightly lower pH isn't going to make a difference in Atlantic salmon, Kahl said. "But, what if declines in calcium are making these things relatively more toxic?" he said. "Nitrogen is clearly a player and nitrogen is going up. But what is the effect?" Dr. Steve Norton, a biologist and former dean of UM's College of Agriculture and Forestry, said Maine's environment has noticeably improved. People are no longer measuring lead in the air because levels have dropped since the advent of unleaded gas. Mercury levels in the atmosphere also have dropped, Norton said. But core samples taken from Maine lakes and peat bogs indicate that 100 years of mercury and lead deposits are still sitting in the watersheds, Norton said. Adding to that problem is the massive amount of aluminum in Maine soils, according to Dr. Ivan Fernandez of UM's plant, soil and environmental science department. "The aluminum in the soil is just ready to be stripped off if sulfate and nitrate move through the system," Fernandez said. Adding to those problems is climate warming, according to Dr. George Jacobson. Scientists believe that higher temperatures in the rivers and low flow rates translate to a low abundance of salmon, he said. The good news is that the rivers east of the Penobscot will stay cold longer and are much more likely to support salmon, Jacobson said. More than half of the 65 rivers are too acidic for salmon. Only 13 rivers have a pH that is high enough to support salmon populations for the foreseeable future, he said. The pH is a measurement for acidity, and the higher the number, the lower the acidity. The presentations covered more than 20 years of research on Maine soils, water and air. None of the research findings or theories boded well for the Atlantic salmon in Maine rivers. As a result, many Maine water systems are still acidifying, he said. Acid rain is the ultimate nonpoint-source pollution, but slightly lower pH isn't going to make a difference in Atlantic salmon, [Steve Kahl] said.

Down East salmon spawning. 1,083 fish were released into rivers last month

Bangor Daily News, 6 November 2000

Some of the more than 1,000 adult Atlantic salmon released into Down East rivers last month appear to be passing their first test. "We're already seeing some examples of pre-spawning activity on the Dennys River," said Tim Sheehan, a research fishery biologist with the National Marine Fisheries Service. Sheehan said that as of October 26, biologists with the Maine Atlantic Salmon Commission identified seven sites where the salmon are digging "test pits" in an attempt to determine the best areas to release and fertilize eggs. Whether the fish actually spawn will be determined in the next few weeks when the salmon commission staff begins canoeing the river to count spawning beds - referred to as redds, Sheehan said. But the test pits are good news in the collaborative effort between state and federal agencies and Maine's aquaculture industry to bring the Atlantic salmon in Maine rivers back from the brink of extinction. The redd counts will mark the beginning of an extensive tracking project by NMFS to determine how salmon move through the rivers, Sheehan said. A percentage of the fish released last month are equipped with ultrasonic tags, and detectors placed in several areas of the river will record their movements - from the time they were released, through spawning and to the point that they leave fresh water for the ocean. Some of that data will be collected from the detectors by the end of December although it will take several months to analyze it, according to John Kocik, a NMFS research fisheries biologist headquartered in Woods Hole, Mass. Other information, such as whether the descendants of the adult fish survive in the rivers, go out to sea and return to spawn, will be determined by the pit tags that were inserted into all 1,083 fish. The tags carry genetic information, including the parentage of each of the fish, Kocik said. If those fish return to the rivers - which will be equipped with weirs or traps - scientists will be able to tell just who they are, he said. By 2002, when the adult fish produced by this year's spawning return to the rivers, the scientists will know which percentage are descendants of the aquaculture-raised fish, he said. NMFS paid for the monitoring equipment and is conducting the research, and the aquaculture industry paid to raise the fish to adulthood. Prior to this experiment, juvenile salmon were used to stock the rivers. The fish released last month were spawned from brood stock collected from the rivers. Atlantic Salmon of Maine hatched the eggs and reared the juvenile salmon at their freshwater hatchery in Oquossoc. Wild salmon go out to sea before returning to their native rivers to spawn, but Atlantic Salmon raised the young fish to spawning age in the company's ocean pens off Machiasport. The hope is that the adult fish will produce the next generation of salmon in the Machias, East Machias and Dennys Rivers. The three Washington County rivers are among eight Maine bodies of water where federal fish agencies are proposing to list Atlantic salmon as an endangered species. That decision by NMFS and U.S. Fish and Wildlife Service is expected by November 17. In addition to determining how feasible it is to use net-pen reared adults to supplement wild populations in the rivers, the NMFS research will provide information for future stocking efforts, Kocik said. The fish released last month were put into the rivers near specific spawning areas. But if the detectors show that the fish moved throughout the river, seeking their own spawning grounds, the fish could be released in one area, he said. Sheehan said the aquaculture industry first proposed moving pens to the mouths of the rivers and releasing the fish. That would be much easier than trucking the fish to various points on the river, he said. But first, scientists have to determine if the fish can get up the river to find spawning areas. A few years ago, NMFS experimented with releasing hatchery-raised fish in the estuary leading to the Machias. But most of the fish were unable to get up over Bad Little Falls,

he said. Bad Little Falls is a formidable obstacle, but wild fish have gotten over those falls for hundreds of years, Sheehan said. "I don't think we have a good enough understanding of the differences between wild fish and hatchery fish that have had everything handed to them," he said. If those fish return to the rivers - which will be equipped with weirs or traps - scientists will be able to tell just who they are, he said. By 2002, when the adult fish produced by this year's spawning return to the rivers, the scientists will know which percentage are descendants of the aquaculture-raised fish, he said. Wild salmon go out to sea before returning to their native rivers to spawn, but Atlantic Salmon raised the young fish to spawning age in the company's ocean pens off Machiasport. The hope is that the adult fish will produce the next generation of salmon in the Machias, East Machias and Dennys Rivers. The three Washington County rivers are among eight Maine bodies of water where federal fish agencies are proposing to list Atlantic salmon as an endangered species.

Reports of buy-out plans for salmon licences 'not official'

Irish Times, 9 November 2000

Recent reports regarding proposals for a buy-out of commercial salmon licences for six-figure sums had no official status, the Minister for the Marine and National Resources, Mr Fahey, said. There was a long-standing body of opinion here and abroad which saw "buy-out" of commercial licences as the key to restoration of stocks. The situation was far more complex in reality. Experience internationally was mixed. He was awaiting the consensus advice of the National Salmon Commission in the first instance, but he would underline that overall policy would be informed by all the factors at work. It must also reflect the legitimate entitlements of commercial fishermen as stakeholders in the resource. "At present we are co-financing two pilot schemes at catchment level for voluntary set-aside of commercial fishing engines for salmon. Both of these schemes are based on matching contributions by other stakeholders, and I have asked all the regional fisheries boards to encourage the development of similar projects based on consensus and local contribution. Funding is available for such schemes subject to value-for-money considerations, local shareholder contribution and demonstrable benefits for salmon stocks." Mr Fahey said his principal policy objective was to increase returns of salmon, thus enhancing the availability of stocks for tourism and domestic sport angling to the national benefit. "It is without question, however, that all sectors must play their part where catch and escapement data show that stocks are under threat. No sector will be relieved of the obligation to reduce their share of mortality on salmon in catchments at risk." The Minister said the Bill also provided for a system of on-the-spot fines in relation to fisheries offences which would operate in a similar fashion to the on-the-spot fine system for minor traffic offences. In addition, it would provide the necessary technical amendments to earlier legislation to create offences and penalties in relation to the salmon-tagging scheme.

Norway: Nature Management Directorate seeks tight salmon fishing regulations

IPR Strategic Business Information Database, 12 November 2000

According to local press reports, the Directorate for Nature Management wants stricter regulations on salmon fishing next year. This year's good catches should not be regarded as a decisive factor when fishing regulations and periods are stipulated, according to a letter to the county governors.

Wild Atlantic Salmon on U.S. endangered species list. - Government action now can prevent same stringent measures being required in Canada

Canada Newswire, 13 November 2000

Jamie Rappaport Clark, director of the Fish and Wildlife Service, and Penny Dalton, administrator of the National Marine Fisheries Service today announced that remaining wild Atlantic salmon populations of the United States have been placed on the endangered species list. "This is not yet a time to rejoice," cautioned Bill Taylor, President of the Atlantic Salmon Federation (ASF), based in St. Andrews, New Brunswick. "It is, however, a time to move ahead on recovery programs to save wild Atlantic salmon from extinction in the U.S." In August of 1999, the Atlantic Salmon Federation and Trout Unlimited filed a lawsuit to force the federal agencies to protect Maine's last wild salmon under the Endangered Species Act. The suit was ASF's first in its 50-year history. "We just didn't feel the Maine Conservation Plan was going to turn the decline around fast enough," said Mr. Taylor. "We still don't know whether the listing can reverse the decline, but it is the last chance we have to prevent the real possibility of wild Atlantic salmon's extinction." "While we may disagree with Governor King on the appropriateness of the listing, we recognize the efforts he, the legislature and the Congressional Delegation have made over the past year, including increased funding, additional land protection and the establishment of Maine's Atlantic Salmon Commission," said Bill Taylor. "We need the Governor's continued commitment if salmon are going to be restored in Maine." Mr. Taylor pointed out the importance that this development has on Canadian stocks. "In Canada, we need government to provide leadership on this issue and one of the tests of leadership is the ability to recognize a problem and take action. We require action before we are forced to adopt the stringent measures necessary in the US," he said. The equivalent legislation in Canada - the Species at Risk Act (SARA) - died on the order paper when the current Federal election was called. Mr. Taylor called for a bi-partisan agreement to place swift passage of SARA at the first session of the new Parliament. "However," Mr. Taylor continued, "the conservation of the wild Atlantic salmon in Canada doesn't have to wait for legislation. We have advanced an action plan that is very simple: first, find out what is wrong, then fix it. We have proposed a commitment to a five-year research program to determine why wild Atlantic salmon are not returning from the ocean. We suspect a number of factors are involved. Research is required to identify the causes." ASF hopes that the decision announced today will put an end to the hotly contested debate. For the past 27 years,

the U.S. Endangered Species Act has successfully protected wildlife from extinction while striving to incorporate the needs of local people and economies into recovery efforts. From the more than two-dozen salmon runs protected under the ESA in the Pacific Northwest to the bald eagles and short nose sturgeon in Maine, businesses have learned to adapt and have continued to thrive in existence with rare wildlife.

U.S. lists salmon as endangered 8 Maine rivers affected - environmentalists cheer

Bangor Daily News, 14 November 2000

The federal government Monday announced that wild Atlantic salmon in eight Maine rivers will be listed as an endangered species, a decision that set off a storm of protest from state and industry officials, but was praised by environmental groups. Gov. Angus King, who was informed of the listing decision by Secretary of the Interior Bruce Babbitt Monday morning, said he was disappointed that the federal government moved ahead without definitive scientific answers about the fish's genetic makeup. Last October, two federal fisheries agencies proposed listing the fish as endangered, saying it was on the brink of extinction. Since that time officials have held public hearings, collected public comments and reviewed scientific data. The debate has locked federal officials in a battle with the state over whether genetic analyses by scientists support the federal contention that the wild fish here are a "distinct population segment." Gov. King said he is counting on a study to be done soon by the National Academy of Sciences to prove they are not a distinct population. Because millions of salmon have been stocked in Maine's rivers for more than a century, King said it is ludicrous to consider any of them "wild" fish. King said Monday that the government should have waited for the results of that study before listing salmon as an endangered species. "I've never encountered a stranger process than this," King said, adding that the government has fought tooth and nail to avoid providing genetic information about the fish to the state. The governor said he was assured by James Baker, undersecretary for oceans and atmosphere at the Department of Commerce, that if the Academy study finds that the Maine fish are not genetically unique, they will be removed from the endangered species list. The listing won't go into effect for more than 30 days. King said that while it is too early to predict its precise impact, the listing could devastate the fish farming industry that has long been described as the economic salvation of Washington County. "There's at least a 50-50 chance it will end the aquaculture industry in Maine," King said, because of costly changes that might be ordered to keep farmed fish from mixing with wild salmon. King said it was too early to say whether the state would appeal the decision to a federal court. The decision to list the fish was announced by the U.S. Fish and Wildlife Service, a branch of the Interior Department, and the National Marine Fisheries Service, part of the U.S. Commerce Department. The listing includes the Dennys, East Machias, Machias, Narraguagus and Pleasant rivers in Washington County; Cove Brook, a tributary of the Penobscot River in Winterport; the Ducktrap River in Waldo County, and the Sheepscot River in Lincoln County. Federal officials said Monday that the Penobscot River, its tributaries and some coastal streams could be added to the area covered by the listing at a later date. Including the fish on the federal endangered species list is necessary because so few wild adult salmon are returning to the rivers, federal officials said during a teleconference. Chris Nolin, assistant director for endangered species at the U.S. Fish and Wildlife Service in Washington, D.C., said her agency conducted an "exhaustive review" and concluded that it was "essential to go forward with the listing at this time." This year, only 27 wild adult salmon were documented as returning to the eight rivers. In the Dennys River, only one wild fish was found, while 29 aquaculture escapees were documented. Paul Nickerson, the Fish and Wildlife Service's chief of endangered species for the Northeast Region, said his agency would consider the National Academy study once it is complete and see if it necessitates changes in the listing. But, he said, the continuing scientific study should not deflect attention from protecting the fish. "Let's not let this study dissuade us from working to save this fish," he said. "We need to focus on backing this critter away from the brink of extinction." Now that the fish are on the list - joining only two other federally endangered animals in Maine - the agencies have 30 months to develop a recovery plan. When the listing becomes effective in about a month, however, projects near the salmon rivers that require federal permits or are funded with federal money, will come under closer scrutiny. Any federal agency that could issue such a permit must consult with the two fisheries agencies to ensure that the project will not adversely affect wild Atlantic salmon. Aquaculture operations require permits from the U.S. Army Corps of Engineers, as do many road and pier projects. Mary Colligan of the National Marine Fisheries Service said a workshop was planned for early December to discuss what issues the corps should consider when evaluating permit applications. She and other federal officials stressed that the two agencies would work closely with industries - primarily blueberry growers and fish farms - that will be affected by the listing. "We do not believe that this listing in any way means the end of the aquaculture industry or any other industry," Colligan said. However, she stressed that the fish farms would have to change the way they do business. Changes her agency has recommended include better efforts to prevent farmed fish from escaping from pens and putting a stop to the use of fish with European genes. Aquaculture officials say they need to use the European stock because it grows faster and tastes better. However, the use of European strains of fish is prohibited in Canada. Des Fitzgerald, president of Atlantic Salmon of Maine, said the listing process has "put the [aquaculture] industry on ice." Existing companies have not expanded and new ones have not come here, he said. He said federal officials needed to stop blaming his industry for the problems with wild salmon. "There is not a shred of evidence that the aquaculture industry in Maine has done any harm," he said. The federal government has been trying for more than a century to restore salmon runs in Maine's rivers, Fitzgerald said. The only thing that is going to change now is that perhaps more money will be designated for Maine's limited recovery program. Federal officials said additional money had been requested, but they didn't know if more federal funds would be designated to efforts to recover the fish in Maine. The Maine Pulp & Paper Association attacked the decision as "misguided." "This listing will allow radical environmental extremists both inside and outside

Maine to file suit against critical Maine industries such as aquaculture, blueberries and forestry," said Jeff Toorish, the group's president. Members of the state's congressional delegation attacked the decision and the fact that the federal government has not committed enough resources to help the fish. "Today's heavy-handed decision by the administration is particularly troubling given the fact that regional officials of the U.S. Fish and Wildlife Service have informed us that they anticipate a budget shortfall of \$10 million in the fiscal year for Atlantic salmon activities in Maine," Sens. Olympia Snowe and Susan Collins said in a press release. "At the same time, they will be spending five times this amount of money to restore artificial Atlantic salmon runs in southern New England." U.S. Rep. John Baldacci said he was "bitterly disappointed" by the listing decision and thought the agencies should have waited until the National Academy study is completed. Several environmental groups cheered. "This is the right decision," said Charles Gauvin, president of Trout Unlimited, which along with the Atlantic Salmon Federation sued the federal government to compel it to put the fish on the endangered species list. "Today's endangered listing substantiates the dire biological status of Maine's salmon populations." "The Endangered Species Act can help attract the funding, attention and scientific expertise needed to help bring back Maine's wild salmon that once swam in rivers throughout the state," said Laura Rose Day, watershed project director for the Natural Resources Council of Maine. David Carle of the Conservation Action Project in New Hampshire, one of the groups that first sued the government seven years ago seeking endangered species listing, said it was a "wonderful start." But, he said, if the entire Penobscot River watershed is not included in the listing, restoration efforts will all be for naught.

Salmon on danger list

Sunday Mail, 19 November 2000

Scotland's salmon stocks could soon be wiped out unless the Government acts urgently. Outgoing Chairman of the Tay District Salmon Fisheries Board Michael Smith has called for a ban on the sale of rod-caught salmon and trout to protect dwindling stocks. He said wild salmon were being killed by sea-lice from fish farms and large numbers of seals in coastal waters and added: "The limited powers of the fishery board can only go some way toward compensating for Government neglect."

SQS bid to halt salmon escapes

Aberdeen Press and Journal, 22 November 2000

Vital new measures to prevent the escape of farmed salmon into Highland lochs and rivers were cautiously welcomed yesterday. The Scottish Quality Salmon code of practice, which will apply to its 70 members, is a bid to stop the stream of escapes from salmon farms in Scotland. Since 1997, there have been about 525,000 escapes from Scottish fish farms, with 322,000 of those this year alone. The code will require SQS members who suffer losses due to "accident, act of God or criminal activity": to report escapes to the Scottish Executive Rural Affairs Department; to implement a system of regular checks on cages and nets; to keep records of checks and losses. SQS chairman Lord Lindsay stressed that escapes accounted for less than 1% of fish farmed. But he added: "It doesn't make great commercial sense to grow fish and see them escape and therefore we have adopted a mandatory code of practice." The code of practice has been cautiously welcomed by angling and environmental groups, which have been campaigning for a clamp-down in the number of escapes in Scotland. Friends of the Earth director Kevin Dunion said the code was a step in the right direction but wanted to see it in practice to see if it was effective or not. Patrick Fotheringham, director of anglers group, the Salmon and Trout Association, said he had not had time to consider the details of the code. He said: "I would welcome the fact the industry is taking escapes seriously. However, we need to see a real reduction in the number of escapes or the code is not worth the paper it is written on." Highlands Council land and environment committee chairman Michael Foxley also welcomed the code. SQS also announced yesterday that Professor Joan Stringer will be the new independent convenor of a new product standards committee. The committee will review and develop standards in terms of the entire food chain and ensure the quality of the product.

Murmansk region to breed salmon

Severinform, 23 November 2000

The interdepartmental ichthyology commission has approved plans for breeding salmon in the Pechenga Bay, Murmansk Region. Up to 10,000-15,000 tonnes of salmon is expected to be bred per year. A Norwegian company intends to invest about \$20 million (£23.2m) in this project.

Bill should stop salmon decline

The Times, 24 November, 2000

New legislation giving ministers more powers over Scotland's salmon rivers will help to secure the long term future of wild salmon fisheries, Rhona Brankin, the Deputy Rural Affairs Minister said yesterday. But she told MSPs that in practical terms it would take five years - the amount of time it takes for a salmon to reach adulthood - for any conservation measure to take effect. The minister was opening a Stage One debate on the new legislation, the Salmon Conservation (Scotland) Bill. She told Parliament that Scotland was one of the four top producers of wild Atlantic salmon in the world, but action was needed now against a background of declining stocks, she said. The Bill inserted five new sections into existing legislation dealing with salmon fisheries and did nothing to alter the make-up of local management boards. "It

does provide powers to Scottish ministers to introduce conservation measures for the purposes of better fisheries management, either in response to an application from the local fisheries managers or on their own initiative," she said. "The aim is to reduce the numbers of salmon killed, but only where and when this is necessary," she said. The Bill now goes forward to committee.

Could the climate pose a hidden threat to salmon?

Scotsman, 27 November 2000

If anything symbolises the purity and wild nature of Scotland, it is salmon. But in recent years the numbers of salmon - and sea-trout - have fallen, particularly in the rivers of the west coast. This is expected to have a significant impact on the future of salmon fishing as a sport in Scotland - an important attraction for overseas visitors who are drawn by world-renowned rivers. Approximately 110,000 visitors fish in Scotland every year, generating just under £30 million for the economy. Much of the blame for the decline has been directed at the fish farming industry, but there is growing concern that climate change is also to blame. Don Staniford, an aquaculture spokesman for Friends of the Earth Scotland, said the figures for salmon caught in Scotland last year were the lowest on record. "There have been suggestions that climate change is playing a role in the decline of wild salmon," he said. "Whether global warming is a factor is open to debate. Seals, salmon farms and the spread of sea lice have to be considered, but global warming is being put forward as a factor in the decline of wild salmon. Global warming could lead to fundamental changes in the way fisheries in Scottish waters are composed." If the predictions about Scotland becoming wetter prove right, the increased rainfall is likely to have a huge impact on river fish. Rising winter rainfall, associated with storms, causes flooding which can alter the depth and position of river channels, damaging fish habitat and removing salmon eggs from the river bottoms where they are laid. In summer, lower rainfall would reduce the "wetted area" of river systems, decreasing feeding habitat and oxygen concentration. Feeding of the salmon may be prevented, reducing growth rates and final production. Higher temperatures and lower oxygen concentration are unfavourable to salmon, sea-trout and trout, and might tip the competitive balance towards less valuable coarse fish, such as pike. There is also evidence that changes in ocean currents are affecting sea temperatures and might be contributing to the decline in wild salmon by reducing their survival at sea. The sensitivity of fish to climate change alters as they pass through the different phases of their life cycle. Many fish species undertake annual migrations: salmon and sea trout spend part of their life cycle in freshwater and part in the sea, so are affected by changes in both these environments. Fish can survive in water over only a limited temperature range. Temperature affects the growth rate of fish, by altering the efficiency of conversion of food into body tissue. The upper and lower limits of the temperature range vary among species, and are one of the factors that determine geographical distributions. Many Scottish rivers saw salmon stocks plummet in the Nineties and the 1999 catch was the lowest on record, while sea trout figures dropped by 24 per cent. Earlier this month the Scottish parliament approved the principles of the Salmon Conservation (Scotland) Bill as part of efforts to save wild salmon stocks. Rhona Brankin, the deputy minister for rural development, said fishery managers had asked for more powers to enable them to balance conservation and exploitation. "Salmon numbers in Scotland are at an all-time low and action is needed now to address that alarming decline," she said.

Mishap releases farmed salmon - boat tore open aquaculture pen

Bangor Daily News, 30 November 2000

Atlantic salmon in eight Maine rivers had been on the endangered species list for just a week when a potential threat to the wild fish became a reality. On November 20, a boat slammed into an Eastport aquaculture pen, tearing a hole in the netting and releasing as many as 13,000 farmed salmon within striking distance of at least one of the rivers where wild salmon are now listed as endangered. But Heritage Salmon Inc., a division of Connors Bros. Aquaculture, isn't in line for any sanctions under the Endangered Species Act, according to Mary Colligan, the chief of protected resources for the National Marine Fisheries Service. "They did everything we'd asked them to do," said Colligan. "They contacted us and made every effort to capture the fish." In deciding to list the Maine salmon as endangered, both the National Marine Fisheries Service and the U.S. Fish and Wildlife Service identified interactions between farmed salmon and Maine's few remaining wild salmon as a serious threat to the genetic integrity and health of the wild fish. Colligan said last week's escape was a concern because the Eastport pen is close to the Dennys River, one of five Washington County rivers where the salmon are listed as endangered. But Colligan said she'd be more concerned if the fish that escaped into Passamaquoddy Bay were sexually mature. She also remarked that this was the first time the aquaculture industry reported an escape to the federal fish agencies. George LaPointe, commissioner of the Maine Department of Marine Resources, called her last Wednesday, she said. DMR and Maine's salmon aquaculture industry have been at loggerheads with the federal fish agencies for years. Salmon growers and state officials maintain that farmed salmon do not pose a threat to wild salmon and that additional regulations - such as reinforced cages and discontinuing the use of European-strain salmon - aren't warranted. Despite the accident, Bill Robertson, director of aquaculture operations for Heritage Salmon Inc., said his company continues to believe they've taken every precaution to keep the farmed fish in their cages. What happened last week was "clearly an accident," he said. Robertson said an independent contractor was moving salmon from one site to another last Monday night when his boat hit one of the salmon cages. The pen contained 72,000 2-to 2½ -pound salmon that had been put into ocean cages last spring. Robertson said the company has accounted for 57,000 of those fish. The accident occurred about 8 p.m. and the company immediately attempted to employ a seine net around the boat and the cage, he said. Divers were on the site within an hour and a half to two hours and, after the seine was in place, the boat was extracted from the net, he said. "We immediately started pumping fish out, and we worked all night and all through Tuesday," Robertson said.

Workers threw feed into the water to attract escapees back to the site, but with little success, he said. Robertson said DMR has issued Heritage Salmon a temporary gill net license until the end of December so that the company can catch escapees in the bay. Heritage Salmon has offered to rebuild the weir on the Dennys Stream to keep any escapees from entering the river, he said. "We're also reviewing our fish recovery protocol," Robertson said. Calls to DMR were not returned Wednesday afternoon, but Fred Kircheis, executive director of the Maine Atlantic Salmon Commission, said the escaped salmon would probably mill around in the ocean. "Atlantic salmon don't have a need to go into rivers until they are sexually mature," he said. "These salmon won't be sexually mature for another two years and I don't think they'll survive that long." Kircheis said he believes Connors Bros. did everything right, including immediately notifying DMR of the situation. Representatives of the federal fish agencies, Maine's aquaculture industry and DMR have been meeting to discuss new regulations for several months. Colligan said the group hasn't met since the listing, but that the recommendations the fish agencies have made to the Army Corps of Engineers are on the agenda for the next meeting. NMFS and U.S. Fish and Wildlife have asked the Corps to include a number of conditions in the permits it issues for aquaculture sites, according to Paul Nickerson, the chief of endangered species for the Northeast Region of the U.S. Fish and Wildlife Service. In an interview after the listing, Nickerson said those conditions include: better containment systems; marking of all aquaculture salmon so that escapees can be traced back to the company that raised them; no use of European-strain salmon; contingency plans for recovering escapees; and long-term monitoring. On November 20, a boat slammed into an Eastport aquaculture pen, tearing a hole in the netting and releasing as many as 13,000 farmed salmon within striking distance of at least one of the rivers where wild salmon are now listed as endangered. In deciding to list the Maine salmon as endangered, both the National Marine Fisheries Service and the U.S. Fish and Wildlife Service identified interactions between farmed salmon and Maine's few remaining wild salmon as a serious threat to the genetic integrity and health of the wild fish. DMR and Maine's salmon aquaculture industry have been at loggerheads with the federal fish agencies for years. Salmon growers and state officials maintain that farmed salmon do not pose a threat to wild salmon and that additional regulations - such as reinforced cages and discontinuing the use of European-strain salmon - aren't warranted.

Maine appeals endangered species listing for salmon

Environment News Service, 11 December 2000

The state of Maine has appealed the federal government's decision to list Atlantic salmon in eight Maine rivers as endangered under the Endangered Species Act. The appeal, filed by the state attorney general's office last Thursday, notes that less than two years after determining that salmon was "not likely to become endangered in the foreseeable future," two federal agencies changed course and decided to list salmon under the Endangered Species Act. The state argues the reversal in policy was arbitrary and an abuse of discretion. The federal government's contention that the salmon in the eight Maine rivers listed constitute a "distinct population segment" is not supported by sound science, the suit claims. The state also charges that many of the fundamental reasons the federal government offered to support the listing conflict with positions it has taken in this and other cases. "This is certainly not how government is supposed to work, and I truly wish we had an option other than court," said Governor Angus King Jr. "However, we feel very strongly that Maine's restoration program is on the right track, and the federal agencies simply aren't listening." King also said that the federal government appears to agree that current restoration efforts may prove successful. In its listing in the Federal Register, the federal agencies noted that significant returns of adult salmon are likely to appear within the next several years. U.S. Republican Senators Olympia Snowe and Susan Collins, and Democratic Representative John Baldacci, all from Maine, said they support the state's appeal. The text of the suit is available at: <http://www.state.me.us/governor>.

Poachers warned about illegal wild salmon

Irish Times, 13 December 2000

Illegal wild salmon catching is a very "anti-social activity", according to the Minister for the Marine, Mr Fahey. He intended to make it a "hot season" next spring for poachers. "I have already addressed one community where they have earned a reputation for themselves for poaching wild salmon," he said. "I've told them that if they're not going to be responsible and deal with people in their community dealing with this greedy practice, we will come down with the full force of the law on those people." He said everybody had a responsibility to "stop those greedy people who are involved in the poaching of wild salmon". More resources would be put into monitoring poaching and illegal fishing. "If we could get across a greater ethos of it being such a greedy and unsocial behaviour that would be a help." He warned deputies that no matter how much resources the Minister made available, or how great the effort by the fishery boards and their officers, "if people are going to poach salmon and catch salmon illegally they're going to do it". Mr Fahey also said the sale of farmed salmon as wild salmon was illegal and "where that is going on we will certainly attempt to have it stopped". The Minister was responding to a debate on the Fisheries Amendment Bill which gives effect to the 1999 Fisheries Act in dealing with the salmon industry in the State. Mr Michael Bell, Labour's marine spokesman, said that 40 per cent or more of the salmon caught on rivers on the east coast "are sold by those who caught them out of the backs of their cars". He said in his constituency in Louth signs can often be seen saying: "For Sale - Salmon". He said people would approach whoever was selling the salmon and "they will haggle over the prices and usually £10, £20, £40 or some other amount will change hands. On many occasions I have seen the total catch from the river Boyne being sold to tourists and others wanting to obtain fresh salmon."

Mink threat to salmon

The Mirror, 14 December 2000

A TD has clashed with a government minister over the damage caused to trout and salmon stocks by wild mink. Minister for the Marine Frank Fahey claimed the harm to fish supplies is not as extensive as many anglers believe it to be. He said: "Fish constitute only about 25 per cent of the diet of mink." But Fine Gael's public enterprise spokesman Jim Higgins disputed the minister's assertions, which were contained in a letter sent him by the minister. He said that the vast majority of anglers, who have first hand experiences of the problems, would strongly disagree with him.

MAFF - Boost to conservation of salmon and freshwater fisheries

UK Government Press Releases, 20 December 2000

Agriculture Minister Nick Brown today reaffirmed the Government's commitment to protect declining stocks of salmon and freshwater fisheries in England. Outlining his response to the Salmon and Freshwater Fisheries Review, Mr Brown announced: an increase of £3 million a year in fisheries grant-in-aid to the Environment Agency with effect from April 2002 (this will enable the Agency to increase its work on conserving and restoring salmon stocks, and improving controls over unauthorised transfers of coarse and non-native fish); up to £750,000, subject to matching funds from interested parties, to launch compensation arrangements designed to accelerate the phase out of mixed stock salmon net fisheries on a voluntary basis; a commitment to introduce proposals for new salmon and freshwater fisheries legislation when Parliamentary time permits; a full response to the Salmon and Freshwater Fisheries Review Group's report as early as possible in the New Year. Fisheries Minister Elliot Morley said: "This announcement demonstrates the Government's commitment to the future of our salmon and freshwater fisheries. The laws in this area are long over-due for reform and the Review Group's report has been invaluable in focusing attention on the issues. "Fisheries grant-in-aid in England will increase to £6.292 million in 2002/03 and 2003/04. This is a 30 per cent increase on the 2000/01 allocation. The extra grant-in-aid for the Environment Agency will enable many of the specific fisheries recommendations in the report to be implemented. "I am also very pleased to be able to offer matching funds of up to £750,000 to accelerate the phase-out of mixed stock salmon net fisheries. Representatives of both the rod and net fishermen have indicated they support this recommendation of the Review Group. It will give a major boost to our conservation effort."

Aid for salmon anglers

Daily Telegraph, 21 December 2000

A buy-out scheme to end drift-net fishing for salmon off north-east England and improve sport on the Tweed and other rivers was announced yesterday. Under the voluntary scheme the Ministry of Agriculture will spend £750,000 to buy existing net licences over the next two years as long as angling organisations and the owners of river fishing rights provide matching funds. Nearly 27,000 salmon a year, more than half the total caught in and around England and Wales, are netted off the Northumberland coast. It was also announced that grants to the Environment Agency to help to conserve and restore salmon stocks are to be increased by £3 million to £6.2 million a year.

Republic of Ireland: Shannon salmon undergo genetics test

Irish Times, 23 December 2000

Genetic sampling of salmon in the River Shannon has begun as part of an international project to test the success of a fish-stocking programme on the River Rhine in Germany. The conservation scheme involves salmon ova, or eggs, being supplied to two German companies by the ESB and other Irish hatchery operators. At Parteen Weir, 11 miles upstream from the Ardnacrusha power station, a piece of tail fin from the male and female salmon is put in alcohol. A DNA sample is taken and catalogued. The fertilised eggs of these "parents" are then sent to Germany. In four years, salmon which have returned to the Rhine to spawn will be examined to see what their ancestry is. This month, DNA samples were taken from 130 salmon by ESB staff on the Shannon and by the Marine Institute at Burrishoole, Co Mayo. Mr Paddy Barry, hatchery manager at Parteen Weir, said the aim is to introduce as many Multi-Sea Winter (MSW) salmon as possible both in the Rhine and the Shannon. These winter in the sea for two or more seasons and return weighing more than 15lbs. In the glory days of the River Shannon, up to the 1940s, salmon weighing up to 60lbs were being caught. "We feel we are making a big contribution because our fish are very big here. The Germans have overcome the first hurdle. Their next step is to see who is making the best contribution," Mr Barry said. Proof of the German programme's success was evident last summer, when a 20lb fish was taken from the Rhine. Although the Irish would like to lay claim to it, its lineage cannot be proved. It will take eight years for a full scientific analysis of the programme to be available when the first four year cycle is completed. Early in the new year, the orders for 300,000 fertilised eggs will be dispatched at a cost of £50 per 1,000. Staff have been "stripping" 800 salmon, and extracting the eggs and sperm for the breeding programmes. Fertilisation takes place externally. Mr Gerry Gough, ESB fisheries manager, said the German orders do not interfere with the 10-year-old Parteen breeding programme. Between the natural spawning of wild salmon and the nursery project, the objective on the Shannon is to put 2,000 salmon up beyond the Parteen Weir. Last year, about 900 passed through the weir to spawn, considerably up from the 1980s when numbers were as low as 300. "We have a 45 per cent success rate on that objective which was set two years ago," Mr Gough said. The Parteen hatchery has about 3.6 million salmon eggs for breeding purposes, most of which will be placed in nursery streams on the Shannon system as "unfed fry", the first stage of the salmon's life after hatching. They will have a survival rate of about 0.1 per cent of returning from the sea to spawn.

About 150,000 are reared until they reach smolt stage, which occurs after 12 to 15 months, and they are tagged and released. A survival rate of between 2 and 3 per cent is normal after they spend a year or more in the seas around Greenland. However, they are not referred to as "wild". It is an irony of history that Irish-bred salmon are swimming in the famous European river. In the 1920s, the Rhine supplied salmon for the restocking of the River Feale in Co Kerry.

Rod & Gun - Salmon ban is welcomed

Belfast Newsletter, 23 December 2000

After receiving a number of brickbats from various sources, many of them unwarranted, the Fisheries Conservancy Board has come out fighting in support of the Atlantic salmon. In an unprecedented move, it has recommended to the Department of Culture, Arts and Leisure that there should be a two-year moratorium on all commercial fishing for salmon within the Board's jurisdiction. Welcome as the FCB proposals are, they fall short of those by the North Atlantic Salmon Fund which seek to phase out all commercial salmon fishing within the FCB area. There is no two-year time limit on the NASF proposals. Significantly, the FCB has also recommended that angling for salmon be restricted to the practice of catch and release for a similar period. At the same time, it has recommended that appropriate compensation should be paid to those who suffer financial loss as a result of the implementation of its proposals and it has urged the Department to seek funding for this purpose as a matter of urgency. Earlier in a Press release the North Atlantic Salmon Fund (NI) let it be known that it had tabled a plan to phase out all salmon netting off the coast of Northern Ireland. The scheme is initially aimed at removing all drift nets, draft nets and bag nets in the FCB area by paying the owners not to fish. The NASF proposals were tabled at a meeting with Culture, Arts and Leisure Minister Michael McGimpsey. It said if the deal was accepted the necessary funding would come from public as well as private sector resources. NASF has volunteered to undertake the negotiations with the fishermen. NASF said it hoped the Assembly would provide funds to be placed with private sector contributions in a joint conservation account from which compensation payments could be drawn when individual agreements were concluded. It said commercial men had been taking about 10,700 salmon per annum and if the nets were removed it would double the numbers of spawning salmon entering the Northern Ireland river systems. Meanwhile, the FCB took its decisions at a meeting earlier this month after what it says was very careful consideration of the issues raised by the various stakeholders during a period of consultation. It is known that commercial operators in the FCB area which covers that part of Northern Ireland outside the Foyle and Carlingford area had a poor year last year. Some either lifted their nets early or did not put them out at all. Anyone who sold derelict nets will be laughing all the way to the bank. It will be for the Department of Culture, Arts and Leisure to make a final decision on the FCB's proposals but after receiving a mass of information on the state of our inland fisheries during the course of the CAL committee of inquiry it is reasonable to assume that the will to act on the FCB advice will be uppermost in many Department minds. The stumbling block, if there is one, is likely to centre on the availability of funds to effectively buy off the commercial men. The Board has done well to publicise its decisions at this time. It will give anglers a chance to decide whether they want to take out FCB licences for the pleasure of catching and releasing salmon. Some at least may elect to look for their sport elsewhere. Undoubtedly, while the FCB and NASF proposals represent a radical step so drastic has been the decline in salmon stocks that it has been left with little option. In a statement the FCB said that in October scientists from the Department of Agriculture and Rural Development gave a presentation to the Board highlighting the dramatic decline in the marine survival of salmon over the past two years and recommended that the introduction of precautionary measures to reduce exploitation of salmon stocks should be considered. It said that the position would be reviewed at an appropriate time in the light of scientific evidence then available. The statement said: "The Board recognises the serious implications of the implementation of such precautionary measures to reduce the exploitation of salmon stocks for all those concerned and is grateful for the constructive attitude of all those who participated in the consultation process. At its meeting on December 11 the Board was advised that the Northern Ireland Assembly has approved the award of £150,000 in grant aid to the Board for the year 2001-02. It is understood that it is intended to provide funding to enable the Board to undertake additional responsibilities which have been placed upon it. While warmly welcoming the provision of grant aid, the Board remains strongly of the view that the provision of full core funding is essential to enable it to discharge its statutory responsibilities efficiently and effectively." The statement says the Board understands that part of the grant aid was to fund the implementation of the salmon carcass tagging scheme which the Board hoped to implement with effect from January 2002. Strangely, it says preparations for the implementation of the scheme will now continue but the date of its implementation will form part of the discussions which the Board hopes to have with DCAL about its proposals. I say 'strangely' because if no salmon are being caught, except those intended for release it will be hard to tag them. The tags were intended as a check on the sale of salmon for consumption. But in spite of the reservation some observers had about the tags, they could come in handy if and when salmon stocks improve. And trout anglers should prepare themselves for an increase in licence fees - this at a time when salmon fishing may be either banned or limited to catch and release. The Board statement says the Fisheries (Amendment No 3) Byelaws (Northern Ireland) 2000 are now before the Assembly for approval. The byelaws designate the number of waters as rainbow trout waters and increase the licence duties payable from January 1. It says the new licences are unlikely to be available by January 1. All those who want to see our inland waters getting better protection will be glad to hear that the Board intends to increase the numbers of its field staff with a consequent decrease in the size of its management team. The Board says consultations are underway with staff representatives and it is hoped to introduce the new arrangements as early as possible in 2001. Anything that results in more bailiffs on the river banks will be most welcome. Preparations have been made for a busy holiday period at Straid trout fishery. A number of big fish have been tagged and the three heaviest fish caught will earn their captors valuable

prizes with £400 of vouchers or £200 cash for the heaviest; £250 of vouchers or £100 cash plus £50 in vouchers for the second heaviest and £125 in vouchers or £50 cash plus £25 in vouchers for the third. As well, any angler catching a tagged fish can select from a range of prizes.

Buying off the salmon nets

Scotsman, 26 December 2000

Up and down the country, anglers have been operating a catch-and-release policy in order to conserve dwindling salmon stocks, for the king of fish is under threat as never before. Yet netsmen from Northumberland and North Yorkshire have taken 100,000 salmon, most of them bound for Scottish rivers, and 40,000 sea trout since 1995 - and this in a period when stocks have been declining at an alarming rate. It is unfair to blame the netsmen. They, after all, are operating under licence in an effort to make a legitimate living. Nevertheless, it is heartening news for conservationists that they are to be bought off. A government initiative will provide £750,000 to help pay for compensation. The remainder will have to be found by Scottish riparian owners. This buying-off of net fishermen has already happened on the Tay and, while catches continue to decline on the whole, there have been signs that summer runs may be picking up again. The down side is that the river owners are likely to pass on the cost to the anglers fishing their beats. Truly, it is the anglers who, hooked on their sport, are unlikely to be the ones that got away.

One that was thrown away - rewards for returning salmon to the Tay

The Guardian, 29 December 2000

For once, anglers on a Scottish river will be able to prove they really did throw that huge fish back. But the evidence to back up their stories is somewhat unusual: a crate of lager. Under a scheme to be introduced on the Tay, salmon anglers will be offered clothing and lager if they return their catch to the water or donate them to a restocking programme. The number of wild salmon returning to Scottish rivers has been dwindling markedly and the programme is an attempt to reverse the trend. From the start of the new salmon season on January 15, anglers handing in the heaviest live fish will win £50 worth of tackle vouchers as well as a case of lager to toast the one they let go. Although the Tay remains one of Scotland's premier salmon rivers, the number of fish being caught in recent years has fallen dramatically. This has badly affected the area's fragile tourism industry and the livelihoods of those who work on sporting estates. David Summers, of the Tay district salmon fisheries board, said the scheme would particularly help the early salmon - the fish which return to the river at the beginning of the year - which have declined significantly. The very early salmon have declined a great deal. In the last 10 years they have become quite scarce. The catch in January and February has gone from about 500 fish 20 years ago down to below 100 in recent years,' he said.

Conserving Salmon

Irish Times, 30 December 2000

The salmon angling season opens on a number of rivers in the State on Monday and some hardy rod fishermen will brave the elements and attempt to catch the first fish of the new year. The day will also herald the introduction of a new conservation mechanism designed to establish the stock levels of this wonderful fish and to protect it for future generations. After more than ten years, the long-heralded tagging of wild Atlantic salmon will begin and it will become an offence to possess, display or to sell a fish that has not been tagged. At a stroke, the system will make it extremely difficult for poachers - on the high seas or inshore - to dispose of illegally caught fish. And because the conservation system will operate on a catchment by catchment basis, it will also, in the long term, allow fishery boards set realistic catch levels for this endangered species. There are rumblings of dissent from some elements of the angling confraternity over the introduction of the tagging system. They regard it as an intrusion into their right to declare, or to keep secret, their catch levels. And they worry that bag limits may be imposed in the future. These concerns may be valid in themselves. But they do not take account of changing circumstances and the need for conservation. Anglers, as much as netsmen, can be greedy and short-sighted. There is no point in reducing the netting of salmon at sea if the surplus is automatically culled in the rivers. Rod fishermen must be prepared to take their share of the pain in the interests of conservation. In fifteen years, stock levels have fallen by about 60 per cent and less than 200,000 wild salmon were caught by all methods last year. It is nothing short of a crisis. The Government has responded by establishing voluntary, set-aside netting provisions in two rivers. And there has been vague talk about a voluntary buyout of drift net licences. Last week's decision by the British Government to make money available for such a scheme off Scotland and North-East England may encourage such a development here. In the meantime, however, we should carefully plot the curve of stock levels. The Minister for the Marine, Mr Fahey, has displayed commendable energy since taking over responsibility for the preservation of wild salmon stocks, last January. One of his first actions was to establish a National Salmon Commission to assist and advise on conservation and management strategies. That was one of the key recommendations of a salmon management task force that reported in 1996. The introduction of a salmon tagging system is a considerable advance. And it is now up to all concerned interests to ensure it is a success. Fines ranging from £500 to £1,500 can be imposed for breaches of the law and the various fishery boards are to be provided with extra funding by Mr Fahey to police the system. It is a positive step forward in the conservation of a threatened species. And it deserves a fair wind from anglers and netsmen.

SCIENTIFIC JOURNALS

Evaluation of the effects of catch-and-release angling on the Atlantic salmon (*Salmo salar*) of the Ponoï River, Kola Peninsula, Russian Federation

Whoriskey F G; Prusov S; Crabbe S

Ecology of Freshwater Fish 9 (1-2):118-125

We studied the effects of catch-and-release fishing upon the Ponoï River's Atlantic salmon populations. The Ponoï River is located on the Kola Peninsula of the Russian Federation, and has recently been developed for sports fishing. Angler exploitation rates are estimated to range from 10.4% to 19% of the river's salmon, thus the possibility of significant levels of post-release mortality is of concern. We radio-tracked fish caught and released by anglers in 1995 and 1996. Despite our simple equipment and the large size of the river, we were able to relocate most fish. These fish had high rates of survival, and anglers recaptured about 11% of them per year a second time. This is very similar to the recapture rates observed for Floytagged fish released in an angler-based mark-recapture assessment. We also held 62 angled fish for 24 hours in a live cage to evaluate rates of delayed mortality. Only one of the 62 fish died, and it was heavily scarred with gillnet marks. Most fish that are fatally stressed by angling die within 24 h. In 1996, up to 10% of our Floy-tagged fish were angled and released twice, and about 0.5% were angled and released three times. No significant biases were detected in the post-angling movement patterns of these fish. The multiple captures and lack of movement bias suggest that fish behavior was little altered by the angling experience. Nine fish Floy-tagged prior to spawning have been recovered as typical emaciated kelts. Three were killed, and a post-mortem exam showed all had spawned. Parr numbers at all monitored sites have been steadily increasing since the advent of catch-and-release fishing. By contrast, parr growth rates are generally unchanged or significantly better.

An evaluation of the use of triploid Atlantic salmon (*Salmo salar* L.) in minimising the impact of escaped farmed salmon on wild populations

Cotter D; O'Donovan V; O'Maoileidigh N; Rogan G; Roche N; Wilkins N P

Aquaculture 186 (1-2):61-75

The impact of escaped farmed salmon on wild populations may have potentially negative genetic and ecological effects. There is widespread evidence that farmed salmon interact with wild salmon. The use of sterile fish in culture has been proposed as a means of eliminating genetic interaction and minimising the ecological effect of farmed salmon. In this study, the migration behaviour of groups of triploid salmon were investigated through the controlled release of microtagged triploid and diploid stocks on the western coast of Ireland. Mixed-sex and all-female stocks of ranched grilse origin were triploidised using hydrostatic pressure. Smolts were ranched from the hatchery of origin and two groups of post-smolts were released from cages in a marine site. The return of adult salmon from these experimental release groups to coastal and freshwater capture sites was monitored as part of the Irish national coded wire tag recovery programme. The return of triploid salmon from each of the release groups, both to the coast and to fresh water, was significantly reduced compared to diploid salmon. The highest percentage return to fresh water (2.25%) was in the ranched mixed-sex diploid group. In contrast, no salmon from the cage release groups returned to the hatchery location on the Burrishoole river system and recoveries in other freshwater systems were low (< 0.01%). The return of a small number of hormonally deficient, sterile triploid female fish suggests that migration to fresh water is not inextricably linked with reproduction. The substantially reduced return of hormonally competent triploid males to the coast and to fresh water, indicates that other factors may have an effect on their marine survival. The reduced return of triploid salmon to the coast and to fresh water, together with their inability to produce viable offspring, demonstrates the potential for triploidy as a means of eliminating genetic interactions between cultured and wild populations, and of reducing the ecological impact of escaped farmed fish.

Linkage between ocean climate, post-smolt growth, and survival of Atlantic salmon (*Salmo salar* L.) in the North Sea area

Friedland K D; Hansen L P; Dunkley D A; MacLean J

ICES Journal of Marine Science 57 (2):419-429

We examined two long-term tagging studies with wild salmon stocks in the North Sea area. The salmon stocks, the Figgjo in southern Norway and the North Esk in eastern Scotland, reside in relatively un-impacted rivers that continue to sustain healthy runs of salmon. The return rates for one-sea-winter fish (1SW), the predominant age at maturity for both stocks, were highly correlated. An analysis of sea surface temperature distributions for periods of high versus low return rate showed that when low sea surface temperatures dominate the North Sea and southern coast of Norway during May, salmon survival has been poor. Conversely, when high sea surface temperatures extend northward along the Norwegian coast during May, survival has been good. Ocean conditions can be further related to the recruitment process through growth studies for the North Esk stock. Post-smolt growth increments for returning 1SW fish showed that enhanced growth was associated with years during which temperature conditions were favorable, which in turn resulted in higher survival rates.

The implicit linkage between growth and survival suggests that growth-mediated predation is the dominant source of recruitment variability. Mechanisms by which ocean climate may affect post-smolt growth are discussed.

Growth patterns of Labrador Sea Atlantic salmon post-smolts and the temporal scale of recruitment synchrony for North American salmon stocks

Friedland K D; Reddin D G

Canadian Journal of Fisheries and Aquatic Sciences 57 (6):1181-1189

We measured post-smolt growth patterns from scales of Atlantic salmon post-smolts captured in the Labrador Sea and adult returns from stocks at the southern end of the range of salmon in North America. Because Labrador Sea post-smolts are believed to represent the juvenile nursery for the entire stock complex, the growth variation for southern stocks may yield insights on the timescale of stock mixing during the post-smolt year. Circuli spacing patterns were extracted from the scales of 1525 salmon for 3 smolt years. For 2 of the 3 years, growth trajectories for fish from the southern stocks intersected the trajectories for Labrador Sea post-smolts after 4-5 circuli pairs. The time that it takes to deposit a circulus during the spring and summer seasons suggests that distribution patterns for regional groups begin to overlap or stocks begin to experience similar environmental conditions by June or July of the post-smolt year, or 1 to 2 months after their migration to sea. In some years, however, it would appear that this mixing does not occur until fall. These data provide the first indication of the timescale of events during the post-smolt year that regional influences may be acting on stocks to produce synchronous recruitment.

Lifetime success and interactions of farm salmon invading a native population

Fleming I A; Hindar K; Mjølnerød I B; Jonsson B; Balstad T; Lamberg A

Proceedings of the Royal Society Biological Sciences Series B 267 (1452):1517-1523

Farm Atlantic salmon escape and invade rivers throughout the North Atlantic annually, which has generated growing concern about their impacts on native salmon populations. A large-scale experiment was therefore undertaken in order to quantify the lifetime success and interactions of farm salmon invading a Norwegian river. Sexually mature farm and native salmon were genetically screened, radio-tagged and released into the River Imsa where no other salmon had been allowed to ascend. The farm fishes were competitively and reproductively inferior, achieving less than one-third the breeding success of the native fishes. Moreover, this inferiority was sex biased, being more pronounced in farm males than females, resulting in the principal route of gene flow involving native males mating with farm females. There were also indications of selection against farm genotypes during early survival but not thereafter. However, evidence of resource competition and competitive displacement existed as the productivity of the native population was depressed by more than 30%. Ultimately, the lifetime reproductive success (adult to adult) of the farm fishes was 16% that of the native salmon. Our results indicate that such annual invasions have the potential for impacting on population productivity, disrupting local adaptations and reducing the genetic diversity of wild salmon populations.

Escaped farmed salmon, *Salmo salar* L., in the Glenarm River, Northern Ireland: Genetic status of the wild population 7 years on

Crozier W W

Fisheries Management and Ecology 7 (5):437-446

A previous study described genetic changes in a wild Atlantic salmon, *Salmo salar* L., population resulting from the spawning of escaped farmed salmon in the Glenarm River, Northern Ireland, in 1990. This study reports an extension of the original investigation with a further follow-up sample that was taken from the river in 1997 to assess the genetic status of the wild population two generations after the original hybridization between the wild population and the farmed strain. Overall genetic variation across eight polymorphic allozyme loci indicated that the wild population remains significantly different from the pre-escape population and from the immediate post-escape population, the presence of an allele not having been previously detected in this population (GPI-1,2*140), suggesting that further incursion(s) of farmed salmon may have taken place.

Relationships among fat weight, body weight, water weight, and condition factors in wild Atlantic salmon parr

Sutton G; Bult P; Haedrich L

Transactions of the American Fisheries Society 129 (2):527-538

We investigated the relationship between fat content and condition indices in Atlantic salmon *Salmo salar* parr sampled from a wild population on a seasonal basis. Condition of individual fish was indexed by residuals from the least-squares regressions of fat weight, dry weight, wet weight, and water weight (separately on fork length) as well as by relative condition factor, Fulton's condition factor, percent fat, and percent water. For all fish analyzed in the study ($n = 284$), residualized fat weight accounted for 81% of the variation in percent fat, for 58% of the variation in residualized dry weight, for 46% of the variation in residualized wet weight and relative condition factor, for 41% of the variation in Fulton's condition factor, for 35% of the variation in residualized water weight, and for 28% of the variation in percent

water. All indices except Fulton's condition factor, residualized water weight, and percent water were significantly correlated with fat weight for all combinations of sex and season. The indices based on fat weight provided the most information about seasonal and gender differences in terms of nutritional status, followed by the index based on dry weight, the indices based on wet weight, and the indices based on water weight. Residual indices are useful for testing the relationship between physiological and morphometric condition indices, and they provide an alternative to more traditional condition indices when the assumptions underlying the use of traditional indices are not valid.

Alternative competitive strategies in juvenile Atlantic salmon (*Salmo salar*): Evidence from fin damage

MacLean A; Metcalfe N B; Mitchell D

Aquaculture 184 (3-4):291-302

Dorsal fin damage in salmonid fishes is primarily caused by aggression. While undesirable in fish culture, it can nevertheless be a useful tool to study social interactions in large groups of fish where it is difficult to study the behaviour of known individuals directly. We used low temperature treatment to manipulate the growth rates of juvenile Atlantic salmon (*Salmo salar*) in the spring and followed the development of fin damage in tagged individuals. Fin damage did not develop until mid-summer, possibly because of a qualitative change in the nature of aggressive attacks. The probability of having fin damage was strongly related to relative body size (fork length) within each group of fish: the largest fish in a tank were up to six times more likely to have damaged fins than the smallest fish. While studies of small groups of salmonids have demonstrated that subordinates are the main recipients of fin damage, the results of this study indicate that the reverse is true in larger groups. We propose that this is because dominant fish compete aggressively amongst themselves and incur fin damage, while less aggressive individuals adopt alternative feeding strategies that result in lower levels of food intake and growth, but reduce the risk of injury. Similar studies could be used to assess the success of feeding regimes in reducing the level of aggression in cultured populations.

Life-history strategies and protein metabolism in overwintering juvenile Atlantic salmon: Growth is enhanced in early migrants through lower protein turnover

Morgan I J; McCarthy I D; Metcalfe N B

Journal of Fish Biology 56 (3):637-64

The specific growth rate (length) of early migrant juvenile Atlantic salmon *Salmo salar* was significantly greater than that of delayed migrants in November and February. However, there were no differences in the fractional rate of protein synthesis (ks) of white muscle tissue between the migrant groups at any time. Early migrants had significantly greater fractional rates of protein growth (kg) of white muscle in February and significantly lower fractional rates of protein degradation (kd) in May. These results suggest that, compared to delayed migrants, Atlantic salmon adopting the strategy of early seaward migration maximize their overwinter growth by minimizing their rate of protein turnover.

Acid toxicity levels in Nova Scotian rivers have not declined in synchrony with the decline in sulfate levels

Watt W D; Scott C D; Zamora P J; White W J

Water Air and Soil Pollution 118 (3-4):203-229

The Atlantic salmon (*Salmo salar*) resource of eastern Canada is impacted by acid rain in the Southern Upland (Atlantic Coast) area of Nova Scotia. Salmon runs in this area have become extinct in 14 rivers, are severely impacted in 20 rivers, and lightly impacted in 15 rivers. Water chemistry and fish communities in nine Southern Upland salmon rivers were studied from 1982 to 1996 as part of the effort to monitor the effects of the emission control programs in Canada and the United States. There has been no statistically significant change in total ion content of Southern Upland river water, but there was a significant decline in sulfate levels that was balanced by an increase in organic anions, and declines in calcium and magnesium that were balanced by increases in sodium and potassium. A geochemical scenario is proposed to account for these chemical changes. River water pH levels showed no overall linear trend, but at borderline toxicity sites the year-to-year variations in pH were correlated with changes in juvenile salmon population densities. Ten fish species were collected, but none showed any significant overall time trend in population density. Fish species diversity was positively correlated with pH.

Marine netpen farming leads to infections with some unusual parasites

Kent M L

International Journal for Parasitology 30 (3):321-326

Marine netpen farming of salmonid fishes is a rapidly growing industry in several countries. With this relatively recent industry, new or unusual infections by parasitic pathogens have been observed. This is due to different hosts being reared in new geographic areas, or by indigenous species being reared in a different environmental condition, i.e. the marine netpen. Examples of the former include *Kudoa thyrsites* (Myxozoa) and *Hemobaphes disphaerocephalus* (Copepoda) infections in Atlantic salmon (*Salmo salar*) reared in the Pacific Northwest, *Ceratomyxa gaudichaudii* (Isopoda) infections

in Atlantic salmon reared in Chile, *Neoparamoeba* (= *Paramoeba*) sp. (Sacromastigophora) from salmonids reared in Tasmania, and *Stephanostomum tenue* (Digenea) infections in rainbow trout (*Oncorhynchus mykiss*) reared in Atlantic Canada. Chinook salmon (*Oncorhynchus tshawytscha*) reared in its native region, the Pacific Northwest, provides some examples of unusual or more severe infections than those normally seen in wild or freshwater reared chinook salmon. These include infections by *Loma salmonae* (Microsporidia), *Gilguina squali* (Cestoda) and the rosette agent, an undescribed fungus-like organism related to choanoflagellates. As the industry continues to expand, it is certain that more novel host-parasite relationships will be observed, providing challenges for fish farmers and parasitologists.

Freshwater habitat of Atlantic salmon (*Salmo salar*)

Bardonnnet A; Bagliniere J-L

Canadian Journal of Fisheries and Aquatic Sciences 57 (2):497-506

This perspective summarizes our knowledge of the freshwater habitat of Atlantic salmon (*Salmo salar*). The article is organized by life stage and identifies areas where more research is needed. For example, little is known of the kelt and pre-smolt life stages despite their importance in stock maintenance. We also believe that further investigation is required to assess the relevance of variables currently used to characterize habitat and that more attention should be focussed on adult and embryo-larva habitat requirements. We also discuss the fact that the majority of research is directed at habitat at the micro (i.e., immediate area around the fish) and macro scales (area of the geomorphological unit), while the influence of habitat at higher spatial scales should also be considered.

Feeding chronology of Atlantic salmon parr in subarctic rivers: Consistency of nocturnal feeding

Amundsen P-A; Gabler H-M; Herfindal T; Riise L S

Journal of Fish Biology 56 (3):676-686

During the ice-free season in three subarctic rivers in northern Norway and Finland, Atlantic salmon parr *Salmo salar* exhibited significant diel fluctuations in stomach content weights in August and September, the largest weights being recorded consistently at 0300 hours. Accordingly, the feeding rate of the parr was highest during the night and lowest in daytime, whereas during the other periods of the ice-free season, no pronounced diel fluctuations in food intake occurred. The consistent nocturnal feeding periodicity in early autumn in subarctic rivers may be associated with benthic feeding and an increased availability of benthic prey at night.

Physiological stress responses to confinement in diploid and triploid Atlantic salmon

Sadler J; Pankhurst N W; Pankhurst P M; King H

Journal of Fish Biology 56 (3):506-518

Confinement of juvenile Atlantic salmon *Salmo salar* from four different populations (all-female diploids, all-female triploids, mixed sex diploids and mixed sex triploids) either before (FW parr) or after (SW smolts) transfer to sea elevated plasma cortisol and plasma lactate from control levels irrespective of ploidy status. Both before and after confinement, plasma cortisol levels in SW smolts (6-174 ng ml⁻¹) were higher than those in FW parr (4-58 ng ml⁻¹), which possibly reflected the physiological challenge of acclimation to SW. Mixed sex populations of SW smolts had higher cortisol levels than all-female populations. The duration of confinement (1, 3 or 6 h) affected the magnitude of the plasma cortisol and lactate responses in SW smolts. Plasma cortisol levels in diploid and triploid SW smolts subjected to 2 h of confinement decreased to pre-stress levels within 6 h post-confinement. Plasma lactate levels were not significantly different from pre-stress levels 48 h after confinement. As no difference exists in primary and secondary stress responses of Atlantic salmon of differing ploidy status, it is unlikely that differences in mortality rates between diploid and triploid populations under commercial conditions can be attributed to differences in their physiological responses to periods of stress lasting up to 6 h.

Evidence of successful natural reproduction between brown trout and mature male Atlantic salmon parr

Gephard S; Moran P; Garcia-Vazquez E

Transactions of the American Fisheries Society 129 (1):301-306

Hybridization between Atlantic salmon *Salmo salar* and brown trout *S. trutta* is frequently reported, and the role of mature male Atlantic salmon parr has been suspected but never proven. Salmon fry were stocked into a headwater tributary stream of the Connecticut River, where no adult salmon are present. The stream has a self-sustaining population of brown trout. Enzyme electrophoresis revealed the presence of one hybrid (0.81% of the sampled population). The maternal species was identified as brown trout; therefore, the only possibility for the male parent was that it was a mature male Atlantic salmon parr. This is the first direct evidence of parr producing hybrid offspring in a totally natural setting and in the absence of any sea-return salmon.

Nest placement and egg distribution in Atlantic salmon redds

de Gaudemar B; Schroder S L; Beall E P

Environmental Biology of Fishes 57 (1):37-47

Atlantic salmon, *Salmo salar*, deposit their eggs in excavated depressions called nests. These nests are built from downstream to upstream within one or more redds, and each redd corresponds to a continuous area of the streambed disturbed by the female digging activities. Redd topographic measurements and egg excavation were performed to determine number of nests per redd and per female, nest depth, distances between successive nests, number of eggs deposited per nest, and egg survival in nests created by six grilse Atlantic salmon, five spawning in an experimental stream (Lapitxuri channel) and one in a natural stream (Lurgorrieta Creek, a tributary of the Nivelle River in southwest France). All females constructed a single redd, except one which built two redds in the channel. Redd surface area ranged between 2.3 and 5.7 m². Each redd had a raised mound of gravel or dome under which most of the eggs were located, and an upstream depression or 'pot'. Based on expected egg-to-juvenile survival rates previously obtained in the Lapitxuri channel and on juvenile recoveries, between 96 and 97% of the eggs deposited in the channel sections were retrieved. Each female constructed 7 to 11 nests over a period of 3 to 5 days. The first three nests had an average burial depth of 12.9 cm (+1.6 SD) which was greater than the last three nests (mean 9.5 cm +/- 2.6 SD). Eggs removed from the first three nests had higher fertility rates (95.5% vs. 87.2%), greater survival (83.5% vs. 63.1%) and lower occurrences of abnormalities (1.9% vs. 5.5%) than those deposited in the last three nests. Typically, the percentage of eggs deposited per female decreased from the first to the last nest, such that the last two to three nests possessed only a small number of scattered eggs. Similar results were observed in the redd located in Lurgorrieta Creek. The adaptive consequences of the topographic features of redds and the egg allocation patterns we found are discussed.

Size as indicator of origin of salmon lice *Lepeophtheirus salmonis* (Copepoda: Caligidae)

Nordhagen J R; Heuch P A; Schram T A

Contributions to Zoology 69 (1-2):99-108

Salmon lice *Lepeophtheirus salmonis* (Kroyer, 1837) from farmed Atlantic salmon have been implicated in the drastic sea trout and salmon stock declines found in Ireland and Norway. Can salmon lice from farmed and wild fish be distinguished? The hypothesis has been advanced that the treatment of salmon infested with salmon lice with organophosphate pesticides has resulted in the evolution of early maturing, smaller female lice, which are favoured because they have the chance to reproduce before treatment. Salmon lice on wild fish have been reported to be larger and have more eggs in their egg strings (sacks) than lice on farmed fish. The question is whether the size differences between the lice are genetically fixed or an expression of phenotypic plasticity. In this study, lice from wild and farmed fish were collected and measured, and it was found that the former were significantly larger. When larvae from these two sources were raised on salmon at the same temperature, they had the same growth rate and morphology. Larvae from the wild lice were raised at 8.7°C and 12.2°C, and attained a significantly larger size at the lower temperature. These results suggest that the salmon louse size is plastic and consequently a poor indicator of salmon louse origin.

Utility of 18S rDNA and ITS sequences as population markers for *Lepeophtheirus salmonis* (Copepoda: Caligidae) parasitising Atlantic salmon (*Salmo salar*) in Scotland

Shinn A P; Banks B A; Tange N; Bron J E; Sommerville C; Aoki T; Wootten R

Contributions to Zoology 69 (1-2):89-98

Genetic differentiation within the salmon louse *Lepeophtheirus salmonis* (Kroyer, 1837), was investigated by the sequencing of specific nucleotide regions. Partial sequences of the 18S ribosomal RNA gene and the ribosomal internal transcribed spacer (ITS-1) region from single sea lice were amplified by the polymerase chain reaction (PCR). Lice were collected from wild and farmed Atlantic salmon (*Salmo salar* L., 1758) from nine selected localities around the Scottish coastline. A 0.9kb fragment of the 18S ribosomal RNA gene was amplified and compared for several samples of lice which showed no observable differences between the lice from different collection sites confirming the absence of cryptic species. The 454 nucleotide ITS-1 sequence showed differences between derived sequences from 13 sea lice samples from 4 collection sites which included 2 farm sites and 2 sites where lice were taken from wild fish. Across all samples, there was a 92.14% similarity in the ITS-1 sequence. The percentage similarity in the ITS-1 sequence in samples of lice from two fish farms were 99.71% (site A) and 95.72% (site D) but only 86.90% (site B) and 86.03% (site C) similarity was shown in lice samples taken from sites where wild salmonids were caught. The greater similarity between the ITS-1 sequence within farm sites may be attributed to a restricted gene flow within lice populations in Atlantic salmon cage sites.

Selection against late emergence and small offspring in Atlantic salmon (*Salmo salar*)

Einum S; Fleming I A

Evolution 54 (2):628-639

Timing of breeding and offspring size are maternal traits that may influence offspring competitive ability, dispersal, foraging, and vulnerability to predation and climatic conditions. To quantify the extent to which these maternal traits may ultimately affect an organism's fitness, we undertook laboratory and field experiments with Atlantic salmon (*Salmo salar*). To control for confounding effects caused by correlated traits, manipulations of the timing of fertilization combined with

intraclutch comparisons were used. In the wild, a total of 1462 juveniles were marked at emergence from gravel nests. Recapture rates suggest that up to 83.5% mortality occurred during the first four months after emergence from the gravel nests, with the majority (67.5%) occurring during the initial period ending 17 days after median emergence. Moreover, the mortality was selective during this initial period, resulting in a significant phenotypic shift toward an earlier date of and an increased length at emergence. However, no significant selection differentials were detected thereafter, indicating that the critical episode of selection had occurred at emergence. Furthermore, standardized selection gradients indicated that selection was more intense on date of, than on body size at, emergence. Timing of emergence had additional consequences in terms of juvenile body size. Late-emerging juveniles were smaller than early-emerging ones at subsequent samplings, both in the wild and in parallel experiments conducted in seminatural stream channels, and this may affect success at subsequent size-selective episodes, such as winter mortality and reproduction. Finally, our findings also suggest that egg size had fitness consequences independent of the effects of emergence time that directly affected body size at emergence and, in turn, survival and size at later life stages. The causality of the maternal effects observed in the present study supports the hypothesis that selection on juvenile traits may play an important role in the evolution of maternal traits in natural populations.

Ecological determinants and temporal stability of the within-river population structure in Atlantic salmon (*Salmo salar* L.)

Garant D; Dodson J J; Bernatchez L

Molecular Ecology 9 (5):615-628

A gene diversity analysis was performed using microsatellite loci in order to (i) describe the extent and pattern of population structure in Atlantic salmon (*Salmo salar* L.) within a river system; (ii) establish the importance of quantifying the signal:noise ratio in accurately estimating population structure; and (iii) assess the potential usefulness of two evolutionary models in explaining within-river population structure from the ecological and habitat characteristics of Atlantic salmon. We found weak, yet highly significant, microscale spatial patterning after accounting for variance among temporal replicates within sites. Lower genetic distances were observed among temporal samples at four sampling sites whereas no evidence for temporal stability was observed at the other three locations. The component of genetic variance attributable to either temporal instability and/or random sampling errors was almost three times more important than the pure spatial component. This indicates that not considering signal:noise ratio may lead to an important overestimation of genetic substructuring in situations of weak genetic differentiation. This study also illustrates the usefulness of the member-vagrant hypothesis to generate *a priori* predictions regarding the number of subpopulations that should compose a species, given its life-history characteristics and habitat structure. On the other hand, a metapopulation model appears better suited to explain the extent of genetic divergence among subpopulations, as well as its temporal persistence, given the reality of habitat patchiness and environment instability. We thus conclude that the combined use of both models may offer a promising avenue for studies aiming to understand the dynamics of genetic structure of species found in unstable environments.

Age, sex ratio and timing of the catch of kelts and ascending Atlantic salmon in the subarctic River Teno

Niemela E; Makinen T S; Moen K; Hassinen E; Erkinaro J; Lansman M; Julkunen M

Journal of Fish Biology 56 (4):974-985

By 15 June, 82% of the catch of Atlantic salmon *Salmo salar* kelts had been taken from the middle part of River Teno, northern Scandinavia. The median date of capture was 4 June for males and 8 June for females. Salmon of 1-4 sea-winters (SW) of both sexes survived spawning to return to sea as kelts. Among males, 1 SW kelts were caught earliest in the spring and 3 SW latest, but among females 4 SW were earliest, then 3 SW and finally 1 and 2 SW. There were 17 river and sea-age combinations among the kelts compared with 23 among the ascending salmon. The smolt age distribution and the mean smolt age differed significantly only between female 2 SW ascending salmon (3.97 years) and kelts (4.14 years). The proportion of 1 SW females was higher and that of 3 SW males lower among kelts than among ascending salmon. The proportion of males among 1 SW ascending salmon was 80% but among kelts only 57%. Similarly, the proportion of males among 3 SW fish was 21% for ascending salmon but only 7% for kelts. Hence overwinter mortality was higher among males. Male and female kelts of 1 and female kelts of 2 SW had a greater mean length than ascending salmon in corresponding groups indicating a better survival of larger fish within an age group. Grilse ascend rivers after most kelts have left, but the main catch of ascending 2-3 SW salmon takes place concurrently with kelts leaving the river, inadvertently targeting kelts in the fishery.

Behaviour of gill-net and rod-captured Atlantic salmon (*Salmo salar* L.) during upstream migration and following radio tagging

Makinen T S; Niemela E; Moen K; Lindstrom R

Fisheries Research (Amsterdam) 45 (2):117-127

The behaviour of radio-tagged Atlantic salmon (*Salmo salar* L.) was studied in the River Ohcejohka in subarctic Finland. The objective was to determine the effects of gill-net entanglement and catch and release angling on the behaviour of

upstream migrating salmon. 23 grilse and one 2 sea-winter (SW) salmon were tagged with radio transmitters and some were tracked for a period of over 3 months. Gill-net caught fish exhibited extensive downstream running, presumably caused by stress from capture and tagging. Post-tagging downstream movement in rod-caught salmon was also observed, but was not as extensive. Upstream migration was delayed in all tagged fish. The results of this study suggest that gill-net capture negatively impacts the upstream migration behaviour of Atlantic salmon and that the negative effects of capture and radio tagging can well exceed those proposed in current literature.

The effects of prior residence on behavior and growth rates in juvenile Atlantic salmon (*Salmo salar*)

O'Connor K I; Metcalfe N B; Taylor A C

Behavioral Ecology 11 (1):13-18

It is well documented that prior residence confers advantages in territorial disputes, but its impact on other aspects of behavior and fitness is less understood. We tested how prior residence influences the subsequent feeding behavior and growth performance of dispersing Atlantic salmon fry (*Salmo salar*) using experimental manipulations of residence in a seminatural stream tank. In replicated trials, groups of seven "primary" fish were released into the stream tank 3 days ahead of seven "secondary" fish. Standardized behavioral observations were made on each fish over the following 14 days, after which all fish were removed and measured. Primaries and secondaries were initially the same size and body condition and exhibited the same degree of site fidelity. However, primaries darted higher into the water column to intercept prey items, fed at a higher rate, and subsequently grew faster. Larger fish (in terms of body length) tended to be more dominant, and dominants grew faster than subordinates. However, there was no difference in dominance between primaries and secondaries. These results suggest that the well-documented advantage of early-emerging salmon fry over late-emerging fry cannot be completely attributed to intrinsic differences and that the advantage is partly mediated via a prior residence effect. Furthermore, prior residents gain foraging advantages without necessarily becoming more dominant.

Fish-Lift: A device for sampling live fish with trawls

Holst J C; McDonald A

Fisheries Research (Amsterdam) 48 (1):87-91

A device for collection of viable samples of salmonids and other fish by trawl has been developed. The FISH-LIFT is in principle a closed aquarium connected to the trawl cod-end, designed to produce the lowest possible turbulence inside. The low turbulence allows the fish to swim unharmed in the aquarium once caught. A grid may be mounted at the front of the aquarium to retain certain size groups and to prevent unwanted items like jellyfish from entering. The aquarium may be either hoisted or hauled onboard the vessel through the trawl slip. Three models have been tested so far during full-scale surveys with a total of 200 hauls. The device has proven successful and viable samples of up to 300 Atlantic salmon post-smolts with negligible scale losses have been caught. Successful laboratory experiments have been carried out with these fish. The FISH-LIFT is commended as a suitable tool for investigations requiring trawl caught live fish, as for the study of external parasites, for loosely scaled fish, for deep water fishes, for tagging experiments and for the collection of fish for other experiments and aquariums.

Quantitative electrofishing for juvenile salmon densities: Assessment of the catchability during a long-term monitoring programme

Niemela E; Julkunen M; Erkinaro J

Fisheries Research (Amsterdam) 48 (1):5-22

Yearly variations in catchability were analysed in a long-term electrofishing monitoring programme aimed at determining juvenile salmon densities. The mean catchability for both fry (age 0+) and parr (age $\geq 1+$) was significantly lower during the later nine years of the 18-year data set, without surround nets, than during the first nine years when surround nets were used. Some changes in the sampling technique were introduced between the periods, which impacted on the catchability. The catchability decreased with parr density, but the predictability of the regression between the density and the catchability was weak. The mean catchability over the years and sampling sites was as high as over 0.4 for fry and over 0.5 for parr which fulfilled the general criteria of proper population estimation. A three-removal electrofishing technique is considered adequately precise for a long-term monitoring. The crew should consist of experienced members and the sampling procedure should be as standardised and consistent as possible.

Evidence of natural reproduction of aquaculture-escaped Atlantic salmon in a coastal British Columbia River

Volpe J P; Taylor E B; Rimmer D W; Glickman B W

Conservation Biology 14 (3):899-903

We present evidence of the first successful natural spawning of Atlantic salmon (*Salmo salar*) documented on the Pacific coast of North America. Twelve juvenile Atlantic salmon composed of two year classes were captured in the Tsitika River, British Columbia. We analyzed restriction-length polymorphisms of PCR-amplified 5S rDNA and mtDNA to

confirm that these individuals were Atlantic salmon. Scale analysis strongly suggested they were the products of natural spawning by feral adults. The gut contents, size, and condition of these individuals suggest that Atlantic salmon are successfully maturing in the Tsitika River, British Columbia. This event has raised concerns that the presence and possible establishment of feral Atlantic salmon may further jeopardize the continued persistence of already fragile native Pacific salmonids through competition for resources and occupation of niches that are currently underutilized.

Modelling the probability of salmonid egg pocket scour due to floods

Lapointe M; Eaton B; Driscoll S; Latulippe C

Canadian Journal of Fisheries and Aquatic Sciences 57 (6):1120-1130

Flood disturbance plays a key but complex role in structuring lotic ecosystems. Empirical models proposed here allow salmonid resource managers to quantify the probability of egg pocket scour during floods and to predict how the expected losses vary with flood strength and reach characteristics. The models are based on comparisons between published salmonid egg pocket depth criteria and statistics on the intensity and spatial distribution of scour and fill produced by three flood events of widely different magnitudes in three separate reaches of a gravel-cobble Atlantic salmon (*Salmo salar*) river in the Saguenay region, Quebec. A simple substrate mobility index, based on reach-scale geomorphic characteristics and flood hydraulics, was shown to provide useful predictions (R^2 up to 74%) of the fraction of the area of potential spawning zones undergoing flood scour greater than 30 cm. Any Atlantic salmon egg pockets present in these deeply scoured areas would be destroyed. The models also predict the distribution of fill (net rise in bed) potentially causing fry entombment at redds. The flood disturbance data suggest that average probability of scour of an Atlantic salmon egg pocket in the study reaches ranges from under 5% for frequent-recurrence spring floods to approximately 20% for an extreme, multicentenary-recurrence flood.

Mitochondrial DNA diversity in North American and European Atlantic salmon with emphasis on the Downeast rivers of Maine

King T L; Spidle A P; Eackles M S; Lubinski B A; Schill W B

Journal of Fish Biology 57 (5):614-630

The displacement loop and NADH-1 dehydrogenase regions of mitochondrial DNA (mtDNA) were amplified by the polymerase chain reaction in 954 Atlantic salmon and digested with 40 restriction endonucleases. Variation was detected with 10 enzymes, resulting in 21 composite haplotypes which were strongly patterned geographically with a major discontinuity observed between most North American (NA) and European salmon. Significant heterogeneity of haplotype frequencies was found within and among all classification levels (continent, country, and river). Haplotype frequencies were significantly different across continents, within European samples, within NA samples, within Canadian samples, within wild Maine samples, within captive Maine strains, and between captive and wild Maine strains. Nine haplotypes occurred only in NA, seven in Maine, three only in Maine, and 11 occurred only in Europe. Some Maine rivers had only a single haplotype, suggesting that effective population sizes may be low. The second most frequent European haplotype occurred in tributaries to one Newfoundland river. Gene trees based on parsimony and genetic distance suggest that the haplotypes are monophyletic within each continent, and that the haplotype found on both continents is intermediate between those of Europe and NA, suggesting common ancestry of all haplotypes.

Influence of sexual maturity on feeding, growth and energy stores of wild Atlantic salmon parr

Arndt S K A

Journal of Fish Biology 57 (5):589-596

Maturing *Salmo salar* parr had significantly lower short-term energy stores (indicated by hepato-somatic index) in August, and significantly lower energy stores and growth rate (indicated by RNA:DNA) in September than immature parr captured from the same stream sites on the same date. There were no significant differences in gut fullness or protein concentrations, suggesting that up to early September the main energetic consequences of maturation were a reduction in allocations to growth and short-term energy storage, but not a mobilization of long-term stored energy in the form of proteins. These are the first observations of relative food intake and energy storage for maturing parr under natural conditions, and also the first to assess growth effects on wild fish before completion of the maturation process.

Infestations of wild adult Atlantic salmon (*Salmo salar* L.) by the ectoparasitic copepod sea louse *Lepeophtheirus salmonis* Kroyer: Prevalence, intensity and the spatial distribution of males and females on the host fish

Todd C D; Walker A M; Hoyle J E; Northcott S J; Walker A F; Ritchie M

Hydrobiologia 429 (1-3):181-196 25

The copepod *Lepeophtheirus salmonis* Kroyer is a specific ectoparasite of North Atlantic and Pacific salmonids in their marine phases. We compared infestations of *L. salmonis* on wild Atlantic salmon (*Salmo salar* L.) captured in estuarine (Firth of Tay, east Scotland; 1995, 1996) and marine coastal waters (Strathly Point, north Scotland; 1998, 1999). Host fish from the Tay were caught by sweep netting, whilst those from Strathly Point were trapped in anchored bagnets. Fish capture method and exposure of the parasites to brackish conditions may both have detrimental effects on the retention of

L. salmonis by the host, and hence possibly lead to their being underestimated on returning adult fish. At Strathy Point, we recorded (i) an infestation prevalence of 100%, (ii) mean log abundances of pre-adult + adult *L. salmonis* at 19 (1998) and 24 (1999) per fish, (iii) 85/93% of all *L. salmonis* as being adults and (iv) overall 68/69% females. Fish caught in the upper Firth of Tay showed significantly lower prevalences, intensities and abundances of *L. salmonis* and probably had lost part or all of their lice burdens prior to capture, whereas those sampled from Strathy Point were apparently minimally affected by capture method or brackish water influences. The loss of parasites for the Tay fish was not markedly biased to males or females, or to pre-adult versus adult developmental stages. There were significantly greater abundances of *L. salmonis* on two sea-winter fish (30 lice per fish) than on one sea-winter fish (17 lice per fish) sampled at Strathy Point in 1998. There are several possible explanations for such age-related patterns of abundance, but the indications are that (i) initial infestation of smolts occurs in coastal waters, (ii) infestation of hosts in the open ocean is a persistent event, and (iii) oceanic reinfestation outweighs mortality losses of *L. salmonis*. This parasite typically occupies rather few zones on the host fish covering only a small percentage of the total available body surface area. Female predominance appears to be characteristic of *L. salmonis* infestations of wild Atlantic salmon; this is in marked contrast to reports of extreme male dominance on farmed stocks. Adult females predominated on the epidermis adjacent to, and posterior of, the insertion of the anal fin and along the posterior dorsal midline between the dorsal and caudal fins. Males predominated on the sides of the head and along the dorsal midline between the head and the dorsal fin. Mate guarding/precopulatory pairs are formed between pre-adult II females and adult males. The significant correlation between the distribution of pre-adult females and adult males may be indicative of pre-adult females actively seeking out adult males, but more likely is due to the (large) adult females competitively ousting all smaller life stages (female and male) from those preferred zones. Given the relatively low fecundity of adult females, and observations of 100% prevalence of *L. salmonis*, the infective planktonic copepodid stage evidently is extremely efficient at locating and establishing upon its host fish in the pelagic environment.

Cross-tributary analysis of parr to smolt recruitment of Atlantic salmon (*Salmo salar*)

Whalen K G; Parrish D L; Mather M E; McMenemy J R

Canadian Journal of Fisheries and Aquatic Sciences 57 (8):1607-1616

We used estimates of Atlantic salmon (*Salmo salar*) parr and smolt density, estimated in three tributaries of the West River, Vermont, U.S.A., to determine (i) if smolt recruitment is density dependent or independent of parr density, (ii) if the proportion of parr migrating as smolts and cohort survival differ among tributaries, and (iii) the effect of parr maturity on smolt production and recruitment variability. We found that parr to smolt recruitment was best described with a linear function providing no evidence for density dependence in the recruitment dynamics of parr and smolts at the tributary scale. The proportion of age-1 parr recruiting to age-2 smolts did not systematically differ among tributaries or years (overall mean \pm 95% CL: 18 \pm 11%, range = 9-37%), and mean age-1 to age-2 survival ranged less than twofold among tributaries (27-46%) and was independent of cohort density. Survival of age-1 mature (39%) and immature (33%) parr was similar, but probability of smolting for mature parr (0.21) was threefold less than for immature parr (0.76). Quantifying smolt recruitment pathways involving parr maturation helped elucidate the population-level effect of parr maturation on smolt production and recruitment variability.

Incidence of hybridization between Atlantic salmon, *Salmo salar* L., and brown trout, *Salmo trutta* L., in Ireland

Matthews M A; Poole W R; Thompson C E; Mckillen J; Ferguson A; Hindar K; Wheelan K F

Fisheries Management and Ecology 7 (4):337-347

The substantial growth of the farmed salmon industry in Europe since the 1970s has highlighted concerns regarding the genetic impact of escaped farmed salmon on wild salmonid stocks. High incidences of salmon X trout hybrids have been recorded in rivers situated near intensive salmon farming in Norway and Scotland, which may be indicative of a breakdown in reproductive isolation between salmon, *Salmo salar* L., and brown trout, *Salmo trutta* L. In the present study, salmonid fry and 0+ parr were collected from rivers in western Ireland. Allozyme and minisatellite DNA analysis were carried out on fry to determine the frequency of F1 hybrids from 10 rivers located within 38 km of salmon farms and three rivers at least 80 km from salmon farms. A total of 49 hybrids were recorded from 4135 salmonid fry (frequency = 1.2%). Mitochondrial DNA analysis showed that all hybrids arose from Atlantic salmon female X brown trout male crosses. Hybrid parr were recorded from one of the low-risk rivers (1.0%), but were present in seven out of the 10 catchments located within 38 km of salmon farms, with frequencies ranging from 0.7% to 3.1%. The results of the present survey, which represents the first extensive record of the levels of salmon-trout hybridization in Ireland, are discussed in relation to the continued growth of salmon farming in this country.

A system for automatic recording of fish tagged with coded acoustic transmitters

Thorstad E B; Okland F; Rowsell D; Mckinley R S

Fisheries Management and Ecology 7 (4):281-294

A telemetry system designed to automatically record the presence and swimming direction of fish tagged with coded acoustic transmitters is described. The present paper presents results from an extensive mapping of signal strengths and the proportion of correctly identified codes from a transmitter at various positions outside automatic listening stations (ALS). The system is evaluated on the basis of two field seasons, during which 107 Atlantic salmon, *Salmo salar* L., were tagged

with acoustic transmitters in a fjord system in southwestern Norway. By installing one ALS (two at high water discharges) in the mouth of the River Suldalslagen and two ALSs in the Hylsfjord, the presence and swimming direction of all tagged salmon entering the river and the inner part of the 750-m-wide Hylsfjord were recorded.

Growth of Atlantic salmon parr in fluvial and lacustrine habitats

Halvorsen M; Svenning M-A

Journal of Fish Biology 57 (1):145-160

The growth of naturally recruited Atlantic salmon *Salmo salar* parr in fluvial and lacustrine habitats was investigated in three northern Norwegian watercourses. Salmon parr were sampled in autumn with small mesh gillnets in lakes, and by electrofishing in streams. In three northern Norwegian watercourses, lacustrine Atlantic salmon *Salmo salar* parr were larger in length and weight at age than fluvial parr. Back-calculated lengths indicated that lacustrine salmon parr were recruited from the fastest growing part of the populations and they had larger growth (length) increments between age intervals than fluvial parr. There was no consistent pattern in growth comparisons between parr from the inlet and outlet streams. Temperature regime alone could not explain the growth difference observed between parr from the different habitats.

Development and validation of numerical habitat models for juveniles of Atlantic salmon (*Salmo salar*)

Guay J C; Boisclair D; Rioux D; Leclerc M; Lapointe M; Legendre P

Canadian Journal of Fisheries and Aquatic Sciences 57 (10):2065-2075

We evaluated the ability of numerical habitat models (NHM) to predict the distribution of juveniles of Atlantic salmon (*Salmo salar*) in a river. NHMs comprise a hydrodynamic model (to predict water depth and current speed for any given flow) and a biological model (to predict habitat quality for fish using water depth, current speed, and substrate composition). We implemented NHMs with a biological model based on (i) preference curves defined by the ratio of the use to the availability of physical conditions and (ii) a multivariate logistic regression that distinguished between the physical conditions used and avoided by fish. Preference curves provided a habitat suitability index (HSI) ranging from 0 to 1, and the logistic regression produced a habitat probabilistic index (HPI) representing the probability of observing a parr under given physical conditions. Pearson's correlation coefficients between HSI and local densities of parr ranged from 0.39 to 0.63 depending on flow. Corresponding values for HPI ranged from 0.81 to 0.98. We concluded that HPI may be a more powerful biological model than HSI for predicting local variations in fish density, forecasting fish distribution patterns, and performing summer habitat modelling for Atlantic salmon juveniles.

Can Atlantic salmon smolt twice? Endocrine and biochemical changes during smolting

Shrimpton J M; Bjornsson B T; McCormick S D

Canadian Journal of Fisheries and Aquatic Sciences 57 (10):1969-1976

Smolting is characterized by morphological and physiological changes, some of which are reversible if fish remain in fresh water. Whether fish that smolt in the first year will repeat physiological changes associated with smolting a second time is not known. To assess whether Atlantic salmon (*Salmo salar*) can smolt more than once, we sampled hatchery-reared Atlantic salmon at monthly intervals for 2 years beginning the fall after hatching. Fish showed differences in rate of growth and were easily differentiated by size into upper mode (UM) and lower mode (LM) by the first fall. In the first spring, gill Na⁺,K⁺-ATPase activity of UM and LM fish increased six- and three-fold, respectively. Plasma growth hormone levels in spring were significantly elevated in UM fish but not in LM. Plasma cortisol levels changed little and gill corticosteroid receptor concentration did not differ between the groups. During the summer, gill Na⁺,K⁺-ATPase activity declined in both groups and remained low until the next spring. The second spring, growth hormone levels did not increase significantly and cortisol levels increased. The increase in gill Na⁺,K⁺-ATPase activity and cortisol and high saltwater tolerance indicate that UM Atlantic salmon can smolt in two consecutive years.

Laboratory and field investigations of salmon lice (*Lepeophtheirus salmonis* (Kroyer)) infestation on Atlantic salmon (*Salmo salar* L.) post-smolts

Finstad B; Bjorn P A; Grimnes A; Hvidsten N A

Aquaculture Research 31 (11):795-803

Hatchery-reared 1-year-old Atlantic salmon post-smolts (*Salmo salar* L.), artificially infected with salmon lice (*Lepeophtheirus salmonis* (Kroyer)) copepodids, were found to suffer from primary alterations (increased cortisol levels) at early lice stages. Secondary alterations, such as osmotic stress (increased chloride levels), first occurred after the preadult stages of the lice appeared. Fish with the highest salmon lice infections died throughout the experiment. Seven years of field investigation of Trondheimsfjorden showed that Atlantic salmon post-smolts descending coastal waters can become heavily infected with salmon lice. The migrating post-smolts were only infected with the chalimus stages, showing that the fish had only recently left the rivers. The infection level, however, varied considerably between the years, and, in 1998, the infection was higher than previous years. The experimental results have been combined with the field data to appraise the consequences of the infection.

Family differences in relative growth of diploid and triploid Atlantic salmon (*Salmo salar* L.)

Friars G W; McMillan I; Quinton V M; O'Flynn F M; McGeachy S A; Benfey T J

Aquaculture 192 (1):23-29

Comparisons of growth for diploid and triploid full sibs from 20 families of Atlantic salmon (*Salmo salar* L.), ranging from 4 to 24 progeny/family, involved 628 individuals. Length and weight data, after approximately 75 weeks in seawater, indicated higher within and between family variances in triploids than in diploids. Regression analyses revealed that improvement of triploid populations might require measurements on triploid sibs of the diploid to be involved in reproduction.

Spatial and temporal distribution of post-smolts of Atlantic salmon (*Salmo salar* L.) in the Norwegian Sea and adjacent areas

Holm M; Holst J C; Hansen L P

ICES Journal of Marine Science 57 (4):955-964

Knowledge of the migrations and geographic distribution of post-smolts of Atlantic salmon (*Salmo salar* L.) in oceanic waters is sparse. Surface trawl surveys were carried out by the Institute of Marine Research, Bergen, Norway, in the Norwegian Sea and adjacent areas in 1990-1998. Sampling was carried out south of 62°N in May-June, in the Norwegian Sea north of 62°N in July-August and in the Barents Sea in August-September. In a total of 955 surface trawl hauls, 535 post-smolts were caught. The highest incidences of post-smolts were in the slope current west of the British Isles, where the highest catch per unit of effort (c.p.u.e.) value was recorded between northern Scotland and the Faroes in June 1997. The lowest c.p.u.e. was observed in August/September 1998 in the Barents Sea, where no post-smolts were caught. The post-smolts appear to follow the main surface currents northwards into the Norwegian Sea where they spread in a fan-like distribution over an area covering most of the international waters between the exclusive economic zone (EEZ) of Norway, the Faroes and Iceland up to about 73-75°N. This pattern appeared to be stable between these years with the exception of 1997, when almost no post-smolts were caught in the northernmost areas, although catches in the south were similar to or higher than in the previous years. The geographical distribution of post-smolts of Atlantic salmon is associated with the warmer, saline Atlantic water.

Impact of low-head hydropower generation at Morgans Falls, LaHave River on migrating Atlantic salmon (*Salmo salar*)

Amiro P G; Jansen H

Canadian Technical Report of Fisheries and Aquatic Sciences (2323): p i-vi; 1-25

A low-head hydro-powered electric generation facility at Morgans Falls, LaHave River, Lunenburg County, Nova Scotia, opened in 1996. The facility is adjacent to an existing fishway and counting trap used to monitor salmon migration since 1972. The impact attributed to mortality of Atlantic salmon (*Salmo salar*) smolts migrating downstream on the salmon population above the falls is assessed. Operating conditions of the facility were established prior to licensing, and effects monitoring concentrated on estimating facility use, louver efficiency and turbine mortality rates through controlled release of hatchery-grown and differentially marked smolts. Estimates of facility use were 47.1% and 52.1%; louver efficiencies were 86.3% and 88.3% or 96% if smolts recovered from the bypass tank were included. Turbine mortality estimates ranged from 15.4% to 78.5%. The wide range in turbine mortality estimates was attributed to uncertainties about escapes from the experiment and the causes of mortality. Impact analysis was performed by simulation using uncertainties for all input variables. At the estimated 1997 wild smolt population of 17,289±256 and at an average louver efficiency of 87.3% the most probable smolt mortality was about 459 smolts or about 22 potential salmon returns over two years. At the 90th percentile of potential loss, impact was about 683 wild smolts or the equivalent of about 2.10/a of the historic count of adult salmon ascending the Morgans Falls fishway. The estimated level of loss in returns is indistinguishable in the existing assessment model. Comparisons with existing data, design criteria, formulae, problems associated with the design and recommendations for repeating portions of the experiment are made. The significance of the impact could not be assessed without an established allowable effect.

Prespawning migratory behaviour and spawning success of sea-ranched Atlantic salmon, *Salmo salar* L., in the River Gudena, Denmark

Aarestrup K; Jepsen N; Rasmussen G; Okland F; Thorstad E B; Holdensgaard G

Fisheries Management and Ecology 7 (5):387-400

The migratory behaviour of sea-ranched Atlantic salmon, *Salmo salar* L., was analysed by radio-telemetry in the River Gudena, Denmark. The main objectives were to: (1) estimate mortality of returning adults through the fjord; (2) observe rate of progression and migratory pattern in the fjord and river; and (3) record whether spawning occurs in the river. Forty-two returning salmon (19 males and 23 females of total body length from 60-97 cm) reared and released as smolts, were caught and equipped with external radio transmitters in the outer estuary of the River Gudena in 1994 and 1995. Of the tagged salmon, 18 (43%) were caught in the estuary, four (10%) were not recorded after release and 20 (47%) entered the river. The mean rate of progression through the fjord was 7.6 km d⁻¹ (range 1.4-18.2) in 1994 and 5.4 km d⁻¹ (range 1.6-17.1) in 1995. Eleven salmon were alive at the onset of the spawning period. Eight were retrieved dead from the river

during or after the spawning period; four with empty gonads assumed to be successful spawners, and four with intact gonads. In 1994, unsuccessful spawners (found dead with intact gonads) entered the river earlier and had a longer total migration distance in the river compared to successful spawners. This suggests that spawning success of sea-ranched salmon is associated with time of river entry and river migration length.

Occurrence of canthaxanthin in Atlantic salmon, *Salmo salar* L., fry in Irish rivers as an indicator of escaped farmed salmon

Poole W R; Webb J H; Matthews M A; Youngson A F

Fisheries Management and Ecology 7 (5):377-385

The rapid growth of Atlantic salmon, *Salmo salar* L., culture in north-western Europe has given rise to concerns regarding the biological consequences of fish farm escapes on wild salmonid populations. Canthaxanthin, a carotenoid pigment additive to farmed salmon feed which is passed from females to their progeny, may be used as an indicator of the numbers of escaped farmed salmon which spawn in the wild. In the present study, thin-layer chromatography and high-performance liquid chromatography (HPLC) were used to screen emergent Atlantic salmon fry sampled from seven river catchments in Ireland for canthaxanthin. The incidence of fry containing canthaxanthin at greater than trace levels (< 5% of total carotenoid pigment) was 0-4%, with an average of 1.7%, among the seven rivers sampled, indicating that the progeny of farmed salmon were present at similarly low frequencies. Canthaxanthin was detected at trace levels in an unexpectedly high proportion (35%) of salmon fry. Canthaxanthin was present at levels exceeding trace amounts in 24% of 21 non-anadromous brown trout, *Salmo trutta* L., sampled from six Irish rivers and present at trace levels in a further 57% of the fish, indicating that dietary canthaxanthin is freely available to salmonids in Irish rivers. The widespread presence of trace levels in salmon fry may be attributable, at least in part, to the increased sensitivity of the HPLC methods and to rapid dietary uptake during early post-emergence feeding.

Seasonal and diel changes in behaviour, microhabitat use and preferences by young pool-dwelling Atlantic salmon, *Salmo salar*, and brown trout, *Salmo trutta*

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There was a pronounced decline in activity of young pool-dwelling Atlantic salmon, *Salmo salar*, and brown trout, *Salmo trutta*, as the water temperatures dropped in the autumn and early winter, and the fish switched from a predominantly diurnal towards a nocturnal activity pattern. Such a switch in activity pattern has previously been observed in young brown trout, but the present study is the first documentation for juvenile Atlantic salmon under natural conditions. Juvenile fish fed actively even when water temperatures were below 0°C, although foraging behaviour at near-freezing temperatures was recorded exclusively during night surveys. This indicates that other proximate factors, in addition to water temperature, affect the activity of young salmon and trout in rivers. Trout kept feeding positions significantly higher above bottom than salmon in August and September, but both species reduced the height above bottom at the onset of winter, possibly due to reduced swimming performance and lowered food availability in the upper part of the water column.

Effects of courtship and relative mate size on sexual motivation in Atlantic salmon

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Both sexes of Atlantic salmon *Salmo salar* were very sensitive to the absence of their mate on the spawning ground, particularly females during the last hour before oviposition. The improvement of behavioural chaining just before oviposition might elicit the accurate timing of synchronized gamete release for successful fertilization. While the reproductive behaviour of the opposite sex could largely affect breeding activity, relative mate size appeared to be the prevailing sexual motivation factor in this species. Even in the absence of courtship, large mate size may constitute a supra-stimulus inducing an increase in spawning behaviour of the other sex. Females with smaller males delayed their first spawning activity, took longer to spawn and made more nests than those with large males. However, female egg retention was not influenced by relative male size.