



Agenda item 5.4
For information

Council

CNL(02)14

***Review of International Salmon-Related Literature
Published in 2001***

The attached literature review, covering articles published in 2001, 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
12 April, 2002

***Review of International Salmon-Related Literature
Published in 2001***

Contents

	<u>Page No.</u>
Press Articles	1
Scientific Journals	46

PRESS ARTICLES

Bill 'could ban salmon fishing in Scotland'

Daily Telegraph, 1 January 2001

Salmon fishing could be made illegal in Scotland under a Bill that receives its final debate in the Scottish Parliament next week, anglers warned yesterday. Fishermen, conservationists and the former Scottish law lord, Lord Morison, are concerned that the Salmon Conservation Bill gives too many powers to the Scottish Executive to close fisheries or impose onerous conservation measures. Angling groups at first supported the Bill because it gave greater powers to district salmon fishery boards to impose conservation measures, such as mandatory catch and release of spring fish, already imposed by the Environment Agency in England and Wales. But in addition to the new powers for district boards, recommended by Lord Nickson in his report on salmon conservation in Scotland, the Scottish Executive has given itself blanket powers to impose conservation measures without consultation, up to and including banning fishing altogether if salmon stocks were in disastrous condition. Proprietors of salmon beats are also afraid that a more Left-wing administration in Scotland could use the regulations to allow greater access for trout fishermen to salmon beats. Permits are currently sold on some rivers under "protection orders" that could be varied by the new Act. Lord Morison told the Daily Telegraph that the Bill, as drafted, was "uneven in its effect, discriminatory, unfair and possibly illegal" under the Human Rights Act as it could conceivably take away the right of a riparian owner to profit from salmon fishing. He said angling interests were now "horrificed" by the implications. "This Bill, which has been whistled through by the Scottish Executive, gives the Executive powers to impose a system of regulation on salmon fishing in Scotland not imposed on any other activity and not imposed on rivers in England and Wales," he said. At the very least, conservation measures should be time-limited, as they were in England and Wales, he said. Jamie McGrigor, Conservative MSP for the Highlands and Islands, who is opposing the Bill, said: "I don't know why the Scottish Executive needs these powers when all the problems facing the salmon, such as drift netting, are in the marine environment." Patrick Fotheringham, director of the Salmon and Trout Association, Scotland, supports the Bill but has written an article in this month's Trout and Salmon magazine setting out what anglers and proprietors of fishing believe are crucial amendments to the Bill. The Executive, however, has so far ignored them. These include time-limiting all conservation orders, requiring ministers to consult district fishery boards, backing the local regulation of rivers and giving the Executive the right to intervene only in emergencies. He said: "If anglers believe that their sport is becoming more restricted angler confidence will fall and the income derived from fisheries will inevitably be reduced. If that revenue should fall, then it would follow that the quality of management of our fisheries would also fall." The Bill, which applies only to Scotland, receives its third and final debate on Jan 11.

Prince Charles warned Wilson about threat to Scottish salmon

Scotsman, 1 January 2001

Prince Charles waged a war of words with Prime Minister Harold Wilson to protect salmon fishing on Scottish rivers, it was revealed. He warned that the combination of a virulent disease in Atlantic salmon and over-fishing off Greenland was reducing numbers to such an extent that rod and line catches on sporting estates were suffering. Wilson responded to the Prince's public criticism by forcing civil servants to work through the weekend to produce a response. By Monday morning, David Williamson, assistant secretary at the Ministry of Agriculture, Fisheries and Food, was able to report to Downing Street that they agreed with the Prince. He wrote: "If the high seas fishing were to go on escalating, the effect could be very serious for salmon stocks. The Scottish tourist industry would be hard hit in areas where it is an important part of the local economy." The official added that as far as they could tell the disease, the cause of which was unknown, caused a substantial number of deaths but would diminish naturally. They were more concerned about drift net fishing by the Danes, Norwegians and Germans. Wilson then tried to involve the government's chief scientific adviser, Sir Solly Zuckerman, who refused to be drawn other than to dispute that the research going on was 'considerable.' At the beginning of August 1969, the Prime Minister wrote to Prince Charles, enclosed Williamson's note and explained that they were seeking a ban on drift net fishing. He offered to have Cledwyn Hughes, the agriculture minister, and his officials "wait upon you to discuss the whole question". It was not enough to mollify the 21-year-old prince, who sent a six-page handwritten note to Wilson a month later, when the Prime Minister was about to join the Royal Family at Balmoral. It commented: "People are notoriously shortsighted when it comes to questions of wildlife, and several species have been wiped out because no-one has woken up in time to the danger. I don't want to say that the same will happen to the salmon but modern methods of fishing seem to allow the fish absolutely no chance. You may not have fished yourself with rod and line but to do so for salmon is immensely exciting. This sport has a huge following internationally and, as a result, I would have thought there is great value to be gained from protecting it." He concluded with a jocular reference to a sand trap on the local golf course where Wilson had apparently come to grief in the past. Their conversation at Balmoral is not recorded but more than six months later, in May 1970, Wilson wrote to say that an international agreement had been reached restricting the type of fishing gear used in the north-east Atlantic.

Wild salmon nearly extinct as habitat turns hostile

Scotland on Sunday, 7 January 2001

It is an image of Scotland as enduring as haggis or heather. But the wild salmon, romantically known as 'the king of fish', is facing extinction after another disastrous year of decline in its numbers. Conservationists monitoring the fish say it has

died out altogether on the once abundant west coast of Scotland and are warning that numbers in the world-renowned salmon runs in the east are catastrophically low. They fear that without urgent action to help restore wild salmon numbers, the decline could be irreversible. Figures released by the conservation group, the Atlantic Salmon Trust, show that 1999 was a disastrous year, with catches 40% down on previously record low catch totals. Even a slight upturn in last year's total is far below that required to prevent the fish dying out. Conservationists blame parasite infections spread from west coast salmon farms, climate change which has damaged the fish's natural habitats, and continued netting by English fishermen. Jeremy Read, the Trust's director, said: "Stocks are in a considerable trough, lower than they have ever been before. West coast stocks in particular are in very severe decline and have nearly collapsed. On the east coast the main problem is with the spring fish. Last year was better but I do not think we have turned the corner." Campaigning environmental group WWF Scotland said that without concerted action the downward trend would continue until wild Atlantic salmon were wiped out. "That prospect is staring us in the face at the moment," said senior policy officer Elisabeth Leighton. Despite the decline in numbers, visiting anglers are still prepared to try their luck and inject millions of pounds every year into the rural Scottish economy. Each fish caught is worth around £2,000 to local businesses. The position in Scotland reflects the international crisis affecting the wild Atlantic salmon. Populations of large Atlantic salmon of Canadian origin have plummeted 90% in the past 25 years. The numbers of adults returning to rivers in North America have declined by up to two-thirds over the same period. North Atlantic catch statistics - both net and rod-caught - show the total fell from 11,000 tonnes in 1973 to 2,400 tonnes in 1998. Similar precipitous falls have been recorded in Scotland, with the west coast particularly badly affected. The worst hit area is from the north-west tip of Scotland down to Argyll and the islands, where most of the country's 300 fish farms are located. "We are certainly looking at an extinction scenario," said James Butler, a marine biologist with the Wester Ross Fisheries Trust, which is currently trying to get an accurate picture of the state of rapidly dwindling west coast stocks. "What we do is count how many young salmon (smolts) go to sea every year and then how many come back as adult fish. I suspect very few. It's a great shame because when you look at the smolts going to sea they are almost miracles of natural engineering, built to travel thousands of miles. No matter how fantastic mother nature is at producing these long-travelling, long-surviving fish, we seem somehow to be able to cock it up." Smolts from both sides of the Atlantic migrate to a breeding site off the coast of Greenland before returning, around a year later, to their home rivers to spawn. Scientists from several countries now believe that west coast salmon facing their annual migration have to run such a gauntlet of man-made and natural hazards that fewer are surviving every year. One problem is sea lice, the parasite common among farmed fish despite attempts to eradicate it. In a BBC documentary, *Warnings From The Wild*, to be broadcast tonight, Butler claims recent research has shown that in the spring, sea lice boost their production of larvae which then discharge and drift away from fish farm cages out into open lochs. "Therefore, any wild smolts coming out from the rivers have to come through this veil of parasites to get out to the open sea and consequently get infected in high numbers," he said. According to Norwegian fisheries scientist Dr Jens Christian Holst, tests have shown that sea lice eventually eat their hosts alive. Holst is currently monitoring the state of salmon stocks off the Greenland coast. Scientists believe climate change is raising the temperature of the water, restricting the area in which the salmon have congregated for centuries, leading to food shortages. On the east coast, in famous angling rivers such as the Spey, the Dee and the Tay, hopes are being placed on artificial restocking schemes, recreation of damaged natural habitat and new catch-and-release schemes. A Salmon Conservation Bill presently winding its way through the Scottish Parliament will help, say environmental groups. But according to WWF Scotland, a wider approach encompassing the fish-farming industry is also needed. "If we are to save this species then a truly international effort is required," said Leighton. However, Scottish Office minister Brian Wilson this weekend attacked the BBC for "crass irresponsibility" over its documentary, which also claims Scottish salmon contain unusually high levels of dangerous toxins. Wilson said the claims were made in order to publicise the programme, but had been denounced as "complete nonsense" by the scientist whose work they were based on.

Conservationists attack law to save salmon

Independent, 12 January 2001

Scotland's Parliament passed a law yesterday to prevent the decline towards extinction of Britain's wild salmon. But conservation groups and anglers' associations immediately criticised the Salmon Conservation Bill as inadequate to rescue the king of fish. "The Bill misses the point," said Don Staniford of Friends of the Earth Scotland. "Its powers stop where the problem starts. It focuses solely on what happens to salmon in freshwater rivers, while the major problems lie out at sea." Mr Staniford was supported by a variety of groups who, while welcoming the Bill, said its impact would be limited. "Its measures add up to only a very small part of what needs to be done to save the wild salmon," said Jane Wright of the Scottish Anglers National Association. "We have great concerns about the impact of salmon farms on the west coast of Scotland on wild stocks. Salmon have become extinct in seven west coast rivers. In some other areas, fewer than 1 per cent of the juveniles who leave the rivers return from the sea as mature fish." Bruce Sandison, one of Scotland's top angling writers, said: "We pursue them relentlessly in rivers, on their Atlantic feeding grounds and with commercial netting. We have degraded their spawning habitat in our rivers by chemical farming practices and inappropriate management."

Scottish rivers empty of salmon as season opens

Independent on Sunday, 14 January 2001

After 25 years of steady decline, the old and distinguished sport of salmon angling may finally be doomed in Scotland. Catch levels have been falling for a quarter of a century, and - as this year's salmon season opens on the Tay tomorrow -

total collapse looms. According to Scottish Office figures, the total salmon and grilse catch for 1996 - at 425 tonnes - was 27 per cent down on the previous year. And conservation agencies say the 1987 figure of 296 tonnes was an all-time low. As Carole Hawkes, owner of a one-time top west coast fishing hotel in Inverness-shire, said last week: "Salmon has been in free fall for 20 or 30 years - it's as simple as that. We didn't get a single fish last year and only two the year before that. We just don't bother putting a boat in the water any more." And George Burrell, co-owner of the Logierait Hotel at Ballinluig on the Tay, in the heart of Rob Roy country, added: "Prospects for the season are never good nowadays. The fishing has been going down for years, and it doesn't look like there is anything going to stop it." At Kinlochewe in Wester Ross, vast numbers of salmon were once landed. But last week the owner, Roderick McCall, said: "The fishing is abysmal. We have pictures here of this hotel in the Fifties and Sixties - there was fish all over the road outside. There were enormous catches in those days but now, frankly, it's bugged." Some rivers now enjoy the effects of breeding-and-release programmes. Catch-and-return policies are also increasingly common. But still salmon numbers are massively down on historical levels. Early in the 19th century, 46,000 fish were netted in one season from just three pools on the Don, and another 10,000 taken from cruives, or fixed traps, on the same pools in the same season - which is about half the number of all the fish now caught in all the pools on all the rivers of Scotland in a season. Why salmon numbers have crashed is uncertain. Some have blamed seals in coastal waters; others small-scale local poaching, or drift netting in offshore waters. Legal bag-netting at tidal river-mouths also came under suspicion, as did general levels of industrial pollution, and even global warming. But in recent times, the finger of blame has swung with increasing conviction towards commercial salmon farming. This is a matter of considerable sensitivity in the western Highlands, where fish farms are often the principal employer in remote districts. But 300 of these farms have appeared in Scottish waters in the last 25 years, mostly on the west coast. Now, there can be more caged salmon in one sea-loch than wild salmon on the entire coast. And the associated epidemic of parasitic sea-lice may be at the bottom of the collapse. Whatever the reason, the situation is unlikely to improve quickly, if ever.

£5,000 a fish as top salmon beat is sold

Express, 15 January 2001

One of Scotland's top salmon beats has been sold for nearly £1.5million - around £5,000 for every fish caught. Businessmen David Mayhew and Alan Parker are the new owners of Islamouth, near Stanley in Perthshire - considered to be the best fishing beat on the River Tay. William Jackson, of agents Finlayson Hughes, said: "Mr Mayhew and Mr Parker know the beat well and have fished Islamouth for many years." Around 300 salmon were caught on the beat last season.

Salmon making comeback to Derwent

Yorkshire Post, 17 January 2001

Think of a salmon river and the Yorkshire Derwent is hardly the first to spring to mind - but it was not always that way. Before the Industrial Revolution, the leaping game fish was a familiar sight on the Derwent but burgeoning estuary pollution put traditional spawning grounds in the Vale of Pickering out of reach. Now, 200 years on, with the Humber clean-up, experts are confident that the salmon is making a return to the waterway. Their optimism has been fuelled by the discovery of the first adult male salmon in the river for 12 years, during a routine patrol by Environment agency officials at Costa Beck north of Malton. The 8lb salmon they found was dead but the body was sent to Agency scientists in York for analysis. They confirmed that the fish had been dead for three days but established that it had spawned before it expired. Further investigations of the scales revealed that the fish had spent two years in fresh water before entering the sea for two years and finally returning to the river at the end of last summer. Derwent fisheries officer Shaun McGinty said: "We suspected that there were one or two salmon in the Derwent and after last summer's surveys we knew that they were once again breeding." The Agency's fisheries team leader John Shannon said an increasing number of adult salmon were now entering rivers from the Tees to the Wharfe. "There have been major improvements in water quality and we have been working alongside major polluters in the Humber and tidal Ouse to this end. A number of wet years resulting in heavy flows in rivers such as the Derwent have also helped." Mr Shannon added: "These are native salmon, there's no restocking involved. It's very exciting, for instance, to know that salmon now regularly swim up the Ouse through the centre of York on their way to spawn."

Anglers protest over wild salmon tagging scheme

Irish Times, 18 January 2001

Some 150 anglers protested at the Laune River near Killarney, Co Kerry, on the opening day of the salmon fishing season in the south-west yesterday over the Department of the Marine's new wild salmon tagging scheme. The anglers claimed the scheme "aims to tag anglers, not fish", and would make poaching "and the laundering of wild salmon" easier. The protesters were joined by representatives of FISSTA - the Federation of Irish Salmon and Sea Trout Anglers which represents 11,000 anglers nationwide. Anglers' organisations are asking their members not to comply with the tagging scheme and not to take fish from the river. They said they would also refuse to pay the £500 fines for first-time offences under the new scheme. FISSTA Chairman Mr Noel Carr said the anglers' protest was "completely about conservation". He added: "Drift-netters can now buy a rod licence and hoard tags until after their season closes in July, which is two months earlier than the recreational angler." Anglers catch only 3 per cent of salmon but that figure will rise "artificially" with the entry of commercial fishermen under the guise of sport, they predicted. They are also worried about breaches of their civil rights, claiming the logbook which has to be filled regardless of fish caught infringes on their freedom of

movement. However, Mr Aidan Barry, CEO of the South Western Regional Fisheries Board, said the purpose of the scheme is to provide valuable information on catches and is a vital means of conservation. "In other countries the experience has been very positive," he said. Meanwhile, the first salmon of the season in the south-west was caught down-river of the protest at the mouth of the Laune. The 13lb fish was caught and tagged by Mr Donal Duggan from the Glen Ryan Angling Club in Cork. He caught the salmon on the first cast, shortly after 8 a.m. He said he did not agree with the scheme nor did members of his club. But he said he wanted to comply with the law. "The new scheme is not for the anglers' benefit," he said. If fisheries people were worried about conservation, they would stop the drift-netting of wild salmon, he added.

Salmon are set for welcome return to the River Culm

Mid-Devon Gazette, 23 January 2001

Thousands of baby salmon will be released into the River Culm, a major tributary of the River Exe, over the next five years in a special joint project between local industry and the Environment Agency. Hele-based paper-maker Mead Specialty Paper is sponsoring the initiative to restock the river with as many as 8,000 fish a year to encourage salmon to return to the Culm system. Last month, agency fisheries staff carefully stripped eggs from 11 spawning female salmon on the River Barle, one of the premier salmon rivers in the South West. These eggs are now being reared at the agency's hatchery in Snowdonia and the juvenile salmon that they produce will be released into the upper reaches of the Culm during September and October this year. The Culm and the Barle are both part of the River Exe system and by using native fish the agency is helping to ensure the genetic integrity of the salmon. "This work would not be possible without the generous support of Mead who are paying for the costs of hatching the salmon eggs and we are very grateful for their interest in the project," said Chris Lawson of the Environment Agency. Water quality in the Culm has improved enormously over the last few years and a number of man-made barriers to fish migration now have fish passes installed. "With many barriers to migrating fish removed, and the improved water quality, salmon will have a real chance of becoming established in the Culm. We are very hopeful that other Culm mills, which have associated obstructions, will be able to work with the agency over the next few years to have fish passes installed. This will allow salmon unimpeded access to the best spawning areas found in the upper reaches of the river system," said Chris Lawson. Last year, Mead showed its concern for the local river environment with the building of a fish pass at the paper mill and the company is excited at the prospect of salmon returning to the River Culm after such a long absence. "Sound environmental practice and tangible actions are a cornerstone of how Mead conducts its business activities world-wide and this investment is a positive way to demonstrate the scale of our commitment," said Mead spokesman Phil Burrows. The Culm scheme complements a similar project on another Exe tributary, the River Lowman. The River Exe and Tributaries Association are hoping to stock the Lowman this year with several thousand young salmon which also originate from the Barle catchment. The Lowman is a much improved river and the agency is having a fish pass installed in one of the major obstructions in the river at Chiefflowman.

Salmon legislation could go down hook, line and sinker

Sunday Herald, 28 January 2001

With the devolution of rural affairs under the Scotland Act, many anglers believed we would finally see some long awaited changes on our blighted freshwater fisheries. Nearly two years on, though, and the only result is a package of legislation introduced by civil servants and their ministers who, lacking an in-depth knowledge of the issues, are making damaging decisions based on party politics. In the new Scotland, it seems, field sports and their followers have become political footballs. Some observers have pointed out that proposed legislation debated recently by the Rural Development Committee will, in fact, have the very opposite effect of the original remit. Take the bill to ban hunting with dogs, for instance. Presumably its intention was to reduce animal cruelty - an aim which most countryside lovers would support wholeheartedly. Experienced gamekeepers, though, who work tirelessly to keep a balance in the countryside's fragile ecology, point out that the alternatives are far crueller. Nevertheless, the cry of the urban pressure groups, with their under-current of class war instinct, has drowned out the voice of reason and, without the House of Lords to block its passage, the Scottish Bill looks set to become law in the very near future. Closer to home, though, was the news that the Salmon Conservation Bill was passed earlier this month by an overwhelming majority. This was in spite of the fact that every expert witness called to the committee debate disagreed with its limited scope and contents. The new law allows for the Scottish Executive to restrict angling on any water should they deem it necessary for conservation purposes, with measures that stretch to banning angling completely. The long-term results of this are likely to be the removal of vital conservation funding into fisheries provided by the sale of angling permits. In other words, the salmon, which it aims to protect, will end up worse off under the hopelessly misguided measures. By restricting the anglers themselves, the lawmakers have alienated the very people who have been protecting the species for many generations. Fishermen and their representative bodies have always been more than capable of policing themselves and restricting their harvest of wild fish. While fish farmers have been polluting the inshore environment and netsmen plundering the high seas, Scottish anglers have, for some time now, been operating a wholly voluntary system of catch and release on particularly vulnerable fisheries. Many resent the unnecessary interference into the status quo. Giving the Executive such unfettered powers fails to acknowledge that private sector money has been underpinning salmon fishing in Scotland for years. The west coast fishery trusts, for instance, are largely funded by river owners who are receiving virtually no income on their stricken rivers but, until now, have been happy to support research. Should such private finance be withdrawn it is hard to see this government footing the bill so generously. Your average Scottish angler is hardly an elitist creature. Nevertheless, some

of the top beats in the country bring in some of the highest-spending tourists to our countryside. On the east coast, for instance, it is estimated that for every wild fish caught £2000 is spent locally. I'll bet the French government don't see skiing as a bad thing for the Alps or the Algarve authorities seek to restrict golfing. Yet our politicians feel the need to bite the very hand that feeds our most deprived rural areas.

Netsmen hit by new restrictions on salmon

Western Morning News, 29 January 2001

Netsmen on the Rivers Teign, Taw, Dart and Torridge are fearing for their livelihoods following further restrictions on the times they are allowed to fish for salmon. From this summer, the fishermen will no longer be able to catch salmon in August, cutting the period they are allowed to net the fish to 43 days a year. The Environment Agency's regional fisheries, ecology and recreation advisory committee has decided to follow a recommendation by the Ministry of Agriculture to bring in the restrictions for net fishing. The measures will be voluntary to begin with, but if they are ignored, the committee will seek bylaws to enforce the restrictions. The committee would like to have further talks with netsmen and rod fishermen to see if there are any other ways of reducing fishing pressure. The salmon stocks are threatened due to over-fishing and environmental factors, and the committee hopes these extra conservation measures will help the species recover. But Wes Highgate, who held a salmon fishing licence until two years ago, feels the netsmen have already made enough concessions and said more should be done to restrict the number of anglers and the amount of fish they are allowed to catch. He said: "There are nine licences available to netsmen but we voluntarily only take four of these. There are no restrictions on the number of rodsmen. The Environment Agency will issue as many licences as they want. The rodsmen are taking as much per head as the netsmen now, and they don't have to register their catches each month as the netsmen do. If the netsmen take more than a week to register their catches they are threatened with prosecution. There should be the same treatment for both sets of fishermen. This will only encourage more people to get a rod licence. If the rodsmen keep catching as much as they are, the stocks of salmon will continue to fall to even more worrying levels."

Escaping salmon raise pollution fears

Scotland on Sunday, 4 February 2001

The number of fish escaping into the wild from salmon farms on the Scottish coast has almost doubled in the last year, prompting fears of "genetic pollution" being passed on to increasingly rare wild salmon. In a damning indictment of industry practices, the latest figures show more than 440,000 fish broke free from their cages last year, compared to 255,000 in 1999. The scale of the escapes has risen despite assurances made by fish farming companies that they were solving the problem. Genetic pollution caused by farmed and wild fish cross-breeding is believed to be a major factor in the dramatic decline of wild Atlantic salmon stocks in Scottish rivers. Environmental groups are calling on the Scottish Executive to order a series of emergency measures to prevent further outbreaks. "The situation is getting out of hand," said Kevin Dunion, director of Friends of the Earth Scotland. He added fish farms should be relocated away from the mouths of salmon rivers or licences revoked in unsuitable areas and reporting of escapes made mandatory. Scotland has currently around 350 fish farms, stretching from Argyll to Orkney and Shetland. According to the Scottish Executive's Rural Affairs Department, major escapes were recorded from Loch Lochy in Lochaber, Loch Droighniche near Drumbeg, Loch Clash near Kinlochbervie, Loch na Thuille, Loch Eriboll and Enard Bay, all in Sutherland. The indication from river catch statistics is that the number of farmed salmon in some Scottish rivers is now seven times that of wild varieties. The figures mirror those from other European countries where fish farming has been established for long periods. Runs of salmon in some Norwegian rivers now consist of 80% farmed fish, and in the Baltic Sea, wild salmon represent less than 10% of the catch. The position is so alarming that the North Atlantic Salmon Conservation Organisation has called fish-farming countries to a meeting in Ottawa, Canada, this week to discuss the containment of their stocks. A spokesman for the Scottish Executive said it hoped a new code of practice introduced by the industry in Scotland last November would see a decline in the number of escapes. The code, drawn up by Scottish Quality Salmon, is designed to improve containment standards through improved engineering and the introduction of environmental management systems. Farms that do not comply with the code, enforced by SQS inspectors, would be refused membership. Lord Jamie Lindsay, the chairman of SQS, said: "Our aim is 100% containment. If we place stock in a farm it is not in our interests to let it escape."

Minister backs the tagging of wild salmon

Irish Times, 5 February 2001

The Minister for the Marine, Mr Fahey, is supporting the tagging scheme for measuring the state of wild salmon stocks, despite protests over the weekend by the Federation of Irish Sea Trout and Salmon Anglers. The National Salmon Commission, which initiated the scheme with the Minister and fisheries boards on January 1st last, is due to meet next week. "The Minister respects the advice of the commission, which he established last year," a spokesman for Mr Fahey said. "We need to know more about the size of the stock, and this is why tagging of salmon and sea trout and use of logbooks was introduced." Anglers and commercial salmon fishermen signed up to the tagging measure as one of a series recommended by a Government task force on management of the stock in 1996. Figures just released by the Central Fisheries Board (CFB) show a rise in the wild salmon catch last year, but the new scheme will give a more accurate picture, according to the chief executive of the CFB, Mr John O'Connor. The total recorded Irish salmon catch for last year is estimated at 225,400 fish, weighing 615 tonnes. This compares to an estimated catch of 180,477 salmon, weighing

515 tonnes, in 1999. Some 623 tonnes were recorded in 1998. The estimated proportion of the rod-and-line catch as a percentage of the total was 16 per cent last year, down from 19.1 per cent in 1999. This is attributed to a 35 per cent fall in numbers of fish caught by the Eastern Regional Fisheries Board. Overall catches were up in all other fishery board regions. The south-west took the largest share, at 61,982 fish, followed by the north-west with 38,677. The drift-net fishery accounted for 72 per cent of the total catch, a rise of 5 per cent over 1999. The proportion taken by the draft-net fishery fell to 11.3 per cent, from 12.8 per cent the previous year. The CFB notes that the catch taken by other commercial methods has fallen below 1 per cent for the first time, largely due to the cessation of trapping on the Moy and Corrib systems, and a reduced take by snap-net users. Overall, stock levels still remain "seriously low", Mr O'Connor says. Catches have reduced by 54 per cent in the last five years, he notes.

Signs of hope for salmon stocks?

Scotsman, 10 February 2001

After some desperate years of declining catches there are encouraging signs in the salmon fishing world. Last year was a good one on the Tay, and although official figures are not yet released, a record number of salmon passed through one of the fish counters on the river system. The end of the year sees the culmination of a long-term project to re-stock the river with hatchlings derived from the Tay's own wild fish population. And the government announced in December that it would contribute £750,000 towards the buyout and closure of the only remaining drift-net fishery (off the north-east coast of England), which looks likely to take place later this year or early next; the Tay should benefit instantly, with at least a ten per cent increase in fish numbers.

New plan calls for agreed local approach to conserve salmon

Irish Times, 27 February 2001

Today in Dublin the Minister for the Marine and Natural Resources, Mr Fahey, will start a campaign which is seen as a vital part of a plan aimed at saving salmon stocks. The idea is to draw in all the "stakeholders" with a vested interest in a healthy national salmon resource - anglers, draft- and driftnet fishermen and tourism bodies - and find a consensus. How should our fisheries be managed? What is the best approach? Is it possible for each of the interested parties to give a little for the common good? The plan is described as a catchment management initiative. Noble though the plan may be, putting it into practice will be another matter. The sizeable angling lobby, for example, is against the catchment management approach as it is opposed to plans for anglers' logbooks and a tagging system to record their total catch. There are murmurings in the air, protests have already been staged and participants in the otherwise peaceful and recreational sport are suggesting that an ugly "rod war" could break out again. The start of the campaign, Source to Sea, which will involve a video, brochure and posters, comes, ironically, as the annual report of the South Western Regional Fisheries Board (SWRFB) claims a significant success for a pilot catchment management project in Co Kerry. This is despite local anglers withdrawing their support. Catchment management, says Mr Aidan Barry, chief executive of the SWRFB, is a "bottom-up" approach to conserving stocks rather than one which hands down edicts to anglers. Its sole aim, he says, is to preserve and increase Irish salmon stocks and to do so by involving each of the strands in a working relationship at local level. He says the very name of the project implies that those who reap the stocks of salmon in a particular region, whether for sport or commercial purposes, will draw up a plan for that region with their fisheries board and manage it themselves. The anglers claim the approach is merely another mechanism to curb their traditional rights. When taken together with the proposed tagging and logbook requirements, they claim, it amounts to a double infringement of those rights. Anglers will not stand for it, says Mr Richard Behal, president of the Federation of Irish Salmon and Sea Trout Anglers (FISSTA). The mood of defiance within the angling community was growing and unless sensible solutions could be found there would be trouble. Meanwhile, the pilot catchment management scheme on the Laune in Co Kerry proves, according to the SWRFB, that when ownership of a fishery is transferred to local interests there are benefits for all. The proof, says Mr Barry, is that some 3,000 more salmon went up the Laune last year than in the previous year because the participants agreed to cap their fishing quotas or were compensated for not fishing. He says that, while the anglers stayed aloof, the draft- and driftnet interests combined with other sectors in the river system to promote conservation in a practical manner and ensure the development of the catchment. The board's report says that while major pollution in the catchment is a decreasing problem, moderate pollution is increasing by about 1 per cent a year. One of the highlights of the year in the region was that the Kerry Blackwater became a model fishery with a rod-catch ratio of 1.1:1. This means almost a fish a day if you are an angler. Mr Behal says there are growing suspicions within the angling community that catchment management may be used to diminish or curb the rights already held by angling clubs throughout the State which may first have to surrender ownership of their fishery to the management scheme and then seek to have it restored under new arrangements. He cites one club on the Flesk river in Kerry which began such negotiations under the Laune catchment plan only to be told its title to the fishery had no standing in law. He says there are also fears about traditional access rights to the lakes of Killarney. The tagging issue, he adds, raises concerns because it will be open to widespread abuse by those with no love for the sport, namely poachers. Any purported angler, he argues, can apply for tags when heading for a day on the river, and all the signs are that the number of tags will not be limited to the five per day suggested under the scheme. What's to stop poachers becoming anglers and abusing the tagging scheme? he asks. Mr Behal rejects suggestions that anglers are against tagging because it will restrict them catching and selling salmon to commercial organisations. "Of course, there may be greedy anglers, but 95 per cent are genuine and interested only in conservation and developing the sport." The logbook, which will require clear identification of an angler's movements, is unconstitutional and restrictive, FISSTA claims, but there are signs the

Government will compromise on that issue to the satisfaction of the anglers. Their opposition to tagging and catchment management, however, remains deep rooted. Without their goodwill it is debatable whether any long-term plan can be successful.

Salmon make vast journey back to rivers

Western Morning News, 6 March 2001

Thousands of magnificent salmon are now making their journey across hundreds of miles of open water towards the Westcountry rivers where they will spawn this spring. The Atlantic salmon - which is widely regarded as the king of fish - will be navigating the vast distance based on their sense of smell to return to the rivers in Devon and Cornwall where they were born. Once in one of the region's 19 salmon rivers, the fish, which can grow up to a metre-and-a-half in length and leap three metres, will fight their way upstream to their spawning grounds. In recent years, the Environment Agency has carried out substantial work to help boost the dwindling numbers of the much-revered species. The vital gravel beds which the salmon need to spawn successfully have been restored, while monitoring schemes have also aided their recovery. But last year 85 per cent of the rivers in the region were producing insufficient fish for the populations to be sustainable. And the plight of the fish in the region mirrors the experience in other parts of the country as salmon populations have plummeted in the last five years. Over-fishing, global warming and pollution clogging spawning grounds have all been blamed for the huge decrease. "The salmon was once extinct in the River Tamar because of the amount of pollution which was entering the river from the metal and workings on the riverbank," Doug Herdson, from the National Marine Aquarium in Plymouth, said yesterday. "They were successfully reintroduced in the Victorian era using stocks from Scotland, but now sadly we find ourselves in a situation where salmon numbers are dwindling again."

Land plans could destroy fishing for wild salmon

Herald, 6 March 2001

New land reform proposals from the Scottish Executive could deal a devastating blow to the conservation of wild salmon and to the economic benefits they bring in remote Highland communities. Tom Murray, an Edinburgh lawyer who is a salmon angler and an expert in fishing law, claims they could even lead to job losses along Scotland's premier salmon rivers in areas where employment is already scarce. He says the Land Reform (Scotland) Bill demonstrated the total failure of the Executive to understand the fragile balance in the rural economy. "It is not the rapacious landowners of the Highland clearances who are being penalised but the conservationists of the twenty-first century," said Mr Murray, who is a partner at Gillespie Macandrew. Mr Murray's views come despite his firm numbering crofters among its client base as well as landowners. The Executive fired back a strong reply yesterday, backing both the legislation and the crofters. Dr Michael Foxley, Fort William GP, crofter, and chairman of Highland Council's land and environment committee, said: "It does not help to make such hysterical responses." Mr Murray said that, until now, those who governed Scotland had always appreciated salmon fishing rights were unique and had a particular economic value all of their own. For this reason they had always been treated separately from the land through which they flowed and they had always been capable of being owned separately. "Despite the fact this system has worked to everyone's advantage for generations, the Scottish Executive now proposes sweeping away this distinction, giving communities the right to buy salmon fishings when they are put on the market and, more worryingly, giving crofting communities the right to compulsorily purchase them at valuation." The new bill would give communities the right to once again start exploiting salmon netting stations at very low valuations, regardless of the effect they may have on their neighbours and regardless of the effect they will inevitably have on conservation, Mr Murray said. That could have a very damaging effect in a place such as Lewis, he insisted. Some rivers, like the Carron and Shin in Sutherland, flow through crofting and non-crofting country, and a number of individual beats on these rivers are partly adjacent to crofting land and partly adjacent to other forms of agricultural land. "The owner whose fishing is being compulsorily purchased will not be compensated for the loss of value to the rest of his fishings. The whole will inevitably be worth far more than the sum of the parts and so the difference in value is effectively being confiscated from the landowner," he said. However, an Executive spokesman said: "It is unreasonable to presume the crofting communities will consist of anything other than sensible local people who understand angling is more sustainable and more profitable for the local community than netting. The crofting community right to buy can only be exercised with the consent of ministers who have to be satisfied that the proposals are in the public interest and sustainable. It is unlikely permission to reopen netting stations would be considered as such."

Warning on stocks of salmon

Belfast Newsletter, 8 March 2001

Atlantic salmon could disappear from Ulster rivers unless urgent action is taken to tackle offshore fishing and pollution, it was claimed today. The stark warning was made at the launch of a major report into the state of the Province's inland fisheries and the prospects for improving recreation and tourism. Eamonn O'Neill, Chairman of the Culture Arts and Leisure Committee, which held an eight-month inquiry into the issue, said he was shocked at the poor condition of many of Northern Ireland's waterways. "I am so concerned about the state of things that, if something isn't done about this issue, I'm convinced that our wild salmon stocks would disappear from our rivers," he said. The report calls on the Department of Culture, Arts and Leisure to end commercial netting by buying out the licences of fishermen who net the wild salmon at river estuaries. The estimated cost to the department would be £1.5 - £2 million. The document follows a scathing report last week from the Public Accounts Committee on the record of the Direct Rule administration on controlling pollution. Mr O'Neill said his committee's report echoed many of the findings of the Public Accounts

Committee. "Pollution incidents are also far too frequent and are having devastating effects on fish stocks and habitat quality. Sound, well-targeted advice, effective safeguards and stringent enforcement of existing regulations is absolutely critical," he said. He called for a cross-departmental approach to tackle the problems and urged Culture Minister Michael McGimpsey to seek EU funding for radical improvements. The committee was sharply critical of the Northern Ireland Tourist Board's promotion of angling. Although the NITB strongly defended its record in its submission to the committee, Mr O'Neill attacked the lack of information available at ports and airports. "We found that while there was no literature relating to fishing in Northern Ireland at Aldergrove, you were quite likely to get information on the west of Ireland," he said. The report also calls for an overhaul of the licensing system for anglers. "From a tourism point of view it is unnecessarily complex. What we need is a simpler system. At the moment tourists have to get a fishing permit and then a licence for a particular stretch of water," said the chairman. "In some cases if they move to another part of Northern Ireland they have to get another licence." During its inquiry, the committee visited Galway to observe how EU-funded projects were helping to restore river life. "They were able to do it through the EU tourist angling measure," said Mr O'Neill. "We want the department to investigate the possibility of getting this measure introduced here." He said the message was not all doom and gloom if steps were taken to improve and promote one of Northern Ireland's greatest natural resources. "We have great hopes for the potential of angling as a tourist commodity for the future. We think we have some of the best rivers in the whole of Ireland for fishing if they were properly managed and developed," said Mr O'Neill. During the inquiry, the committee received 76 written submissions from a variety of groups. It heard 32 oral submissions from individuals, angling clubs, Government departments and other organisations with responsibility for inland fishing.

Joy of experts as salmon return to the Swale

Yorkshire Post, 10 March 2001

Fisheries experts are celebrating the return of salmon to a North Yorkshire river for the first time in living memory. A salmon was spotted by angler Peter Wilkins in Cod Beck, near Thirsk, a tributary of the Swale, during a fishing match. He retrieved the fish, which had recently died, and sent it to the Environment Agency's Dales area headquarters in York for analysis. Experts had thought Cod Beck was unsuitable for salmon because of the acidic nature of the water in the Swale. But they found that the 4lb 3oz fish had lived in fresh water for two years before, as salmon do, entering to the sea, spending the winter there, then returning to fresh water to spawn. The fish had been unable to find a mate and had died before laying her eggs. Environment Agency scientist Paul Frear said: "This is a clear indication that the river quality in the area is reaching levels not experienced for many years. It's a shame the fish was unable to spawn, but at least we've been able to gather plenty of information about it. Last summer we also found a couple of young salmon while carrying out surveys on the Swale. This shows that at least some salmon are finding their way up the river and successfully spawning. We'd be very interested in hearing from any other people who have spotted any salmon in the Swale system." The Agency believes the Swale's acidic quality has been reduced by the recent wet weather, which has allowed more fresh water than usual to flow through the river system to the North Sea. Improved water quality in industrial areas on the Humber and Ouse has played a part in giving salmon a better chance of swimming upstream. Mr Wilkins, of Knayton, near Thirsk, said: "It's wonderful to think we could be seeing salmon returning to this area regularly."

Salmon dam angler faces action

Scotsman, 26 March 2001

An angler who built a dam across the Scottish half of the River Tweed to divert salmon to the English side faces court action after defying an order to demolish it. Property developer Brian Weightman, from Alnmouth, Northumberland, sent a mechanical digger onto Scottish soil to create a 150-foot croy or pier across the river, the centre of which marks the Anglo-Scots border. Mr Weightman, who owns the fishing rights along half a mile of the river on the English side, claims he was replacing an old dam which had been eroded and washed away. But the dam has infuriated anglers on the Scottish side of the river and provoked a fierce cross-border row involving politicians, environmental watchdogs and planning chiefs. Catherine Home Robertson, a councillor and wife of the former Scottish Fisheries Minister, John Home Robertson, is demanding Scottish Borders Council take legal action against Mr Weightman after he ignored an enforcement notice to remove the dam. She said she was "disgusted" by his defiance and warned his actions were putting a strain on Anglo-Scots relations. "How dare this man dump his rubble on someone else's property. His audacity is breathtaking," she said. Mr Weightman insists he built the dam to improve fishing for everyone. But his argument does not hold water with anglers on the Scottish side of the river, who complain their catches have suffered while their English counterparts are enjoying a salmon bonanza. Scottish Natural Heritage has also entered the fray, claiming dams such as the one built by Mr Weightman disrupt flow patterns and cause erosion. A spokesman for Mr Weightman said: "He has offered to modify the croy and to commission a report from experts to assess the likely impact on river flow and bank erosion, but the planning authority seems to be rushing things through." Scottish Natural Heritage said the Tweed had been designated a site of Special Scientific Interest and the dam was potentially damaging.

Stocks will suffer if sick salmon come into Scotland

Sunday Herald, 1 April 2001

As the foot-and-mouth outbreak continues to cause devastation among farmed livestock around the country, news of the re-emergence of a highly virulent and lethal fish disease has sent ripples of panic among proprietors of wild salmon fishing. A fresh outbreak of Infectious Salmon Anaemia (ISA) has been reported on a fish farm in the northern Faroes,

posing a serious threat to wild Scottish salmon stocks that feed in the North Atlantic before returning to the rivers of their birth. The Faroese authorities believed that they had eradicated the disease last April when it initially appeared on their shores: they slaughtered nearly one million caged salmon with an export value of \$10 million in an effort to contain it. The same sad drama is currently being played out on livestock farms around the British Isles. We can only hope that foot-and-mouth disease responds more favourably to the widespread killings, as the ISA virus has obviously survived the measures taken last year and a slaughter of another million of these so-called fake fish will be necessary. As farmed salmon represents 25% of the Faroe Islands exports, rest assured that protection of wild fish will be the last thing on the farmers' minds. The fish farming industry always put their own profits before the environment and the shadow of ISA, which first appeared in Scotland in the Nineties from imported Norwegian salmon smolts, at one point threatened every wild salmon river before it was brought under control. Last year's Faroese outbreak was found to have originated from salmon feedstuffs from Norway where ISA is still widespread. The only salmon-producing country in the North Atlantic not to have recorded the disease is Iceland but, as the industry continues to operate irresponsibly under very little governmental control, many believe that it is only a matter of time before the killer disease reaches their shores. If the current foot-and-mouth outbreak has achieved one thing, then it has surely made us question the way in which we make our food. Farming hundreds of thousands of fish in tiny cages makes battery hen operations look positively organic by comparison. In spite of the lesson of BSE, the industry will happily slaughter 3,000 tonnes of wild sea fish to render enough fishmeal to produce 1,000 tonnes of man-made salmon. Not only do their farms produce billions of parasitic sea lice that have already all but destroyed our west coast sea trout populations, once abundant estuaries have now become choked with their raw and deadly effluent. The cavalier fashion in which the food industry treats the Scottish environment was further demonstrated recently when John West came to the banks of the Dee to film a TV ad. Using the Aberdeenshire river as a stand-in location for Alaska, the food-giant allegedly flew a box of six ungutted Pacific salmon into the country without permission. Scientists from the Scottish Executive's Fisheries Research Lab apparently retrieved one of the fish that had floated downstream and have reported the incident to MAFF. Salmon anglers should also be aware that restrictions are to continue this season on many local rivers. This is to avert the risk of spreading another lethal threat, *Gyrodactylus Salaris*. Barely visible, this parasite infects the fins of freshwater fish and has already wiped out salmon populations on many Norwegian rivers. It can survive for several days in damp conditions such as wet jackets and fishing tackle, so anyone who has been fishing abroad recently must ensure all their equipment is suitably sterilised. The most effective method is deep-freezing all gear for at least 24 hours. The Kyle of Sutherland Fishery Board are insisting that all equipment must come with certificate of sterilisation before access to their rivers is allowed.

Fishermen may agree plan to conserve wild salmon

Irish Times, 3 April 2001

An Icelandic businessman who has spent a decade trying to convince Ireland to abandon commercial netting of wild salmon believes that the majority of fishermen in Ireland now support his proposals. Mr Orri Vigfusson, chairman of the North Atlantic Salmon Fund, says it just requires a commitment from the Government to achieve a successful buy-out of the sector. Mr Vigfusson has spent the last week in Ireland with a delegation from the fund, and says that Ireland is ready to join the international effort to conserve the fish. "The sea fishermen of Iceland, the Faroe Islands and Greenland are already playing their part," he says. Recently, Britain agreed to give financial support to a buyout there, and the fund is in negotiation with Northern Ireland on a similar scheme. Mr Vigfusson hasn't set a price on compensation for more than 1,400 licence holders in the Republic, but believes that the package should be both voluntary and "generous" to reward fishermen for loss of income. He says it should be financed by a combination of support from EU structural funds for tourism, Exchequer funds and a levy of £10 to £20 on anglers' licences. The fund delegation met representatives of fishermen and anglers at four meetings over the past week in Cork, Kerry, Limerick and Sligo, and Mr Vigfusson says that support for his initiative was "almost 100 per cent". He also met the Minister for the Marine and Natural Resources, Mr Fahey, and says he received a positive response. A spokesman for the Minister said that Mr Fahey had stopped short of giving a firm commitment, but had asked Mr Vigfusson to submit detailed proposals. Mr Vigfusson says he is aware of the work achieved by the National Salmon Commission over the past year to introduce conservation measures, starting with a tagging and logbook scheme to count the wild stock, but believes this work is not proceeding quickly enough due to lack of Government support. He has also met Prof Noel Wilkins, the former chairman of the commission, who resigned recently over an intervention by the Minister in the controversial tagging scheme. Prof Wilkins has been succeeded in the chair by Mr Joey Murrin. Prof Wilkins has argued strongly for "set-aside" of licences, rather than a buy-out, on legal grounds. Mr Vigfusson says his preference is for a buy-out - depending on the fishermen themselves. He says he is aware that poaching might continue, but says that an element of self-policing among participants in the scheme would discourage this. "We shouldn't stop conservation measures because of the actions of a few criminals," he says. Irish salmon stocks have begun to make a recovery, but Mr Vigfusson says that they are still "much lower" than several decades ago.

Shetland succeeds in stopping all salmon escapes from farms

Aberdeen Press and Journal, 6 April 2001

Salmon farmers on Shetland have revealed there were no escapes of salmon from sites on the isles last year. The Shetland Salmon Farmers Association's statistical report will be published later today. It says that ever-improving standards and an increasing concern for the environment are responsible for the success. Shetland has also undergone a 9% increase in employment in the industry in the past year, with the value of salmon farming to the local economy having risen by £6 million to more than £77 million. The association's general manager, David Sandison, said: "Much has been made in

some recent media reports about the impact of farmed salmon escaping into the wild. In Shetland, we have clearly demonstrated the high standards of our industry and the continued vigilance of the farmers. This plays a huge role in preserving the magnificent environment in which we operate. No farmer wants to lose any of his or her stocks and we have seen over recent months a total commitment by salmon farmers both to continuously improve their equipment and to develop their already excellent husbandry skills." Mr Sandison explained: "Throughout 2000, for example, a programme of installation of blood water treatment plants in packing stations contributed to a significant reduction in disease risk and environmental pollution. To be able to report low incidences of disease, which has been such a problem to salmon farmers in recent times, also indicates the quality of Shetland salmon farmers' expertise and the health of our salmon stocks. This is an outstanding achievement. It has resulted, in 2000, in very good growth rates, which in turn benefits our customers." In March 2000, the association formally adopted the Code of Best Practice for Shetland Salmon Farming, which was produced by the North Atlantic Fisheries College. The guide offers a practical guide to farming as well as an extensive guide to detailed procedures. Association chairman Gibbie Johnson added: "Last year has been very successful for Shetland's salmon farming industry. The association is committed to building on this and increasing the industry's well-being in 2001."

Salmon men net a £1.5m buy out

Belfast Newsletter, 7 April 2001

The dominoes have started to fall and Ulster Angling Federation Chairman Jim Haughey believes it will be only a matter of time until commercial fishing for salmon and sea trout is a thing of the past in these islands. Jim was referring to the fact that the Northern Ireland Assembly had announced a payment of £1.5 million to compensate salmon netmen in the Fisheries Conservancy Board area for giving up commercial fishing. UAF director Newell McCreight was understandably delighted with the Assembly announcement. He saw it as the result of 20 years of hard work by the Federation and later by the North Atlantic Salmon Fund which is dedicated to buying out commercial fishing in Northern Ireland. Neither man could tell me what the netmen could expect from the award. But, clearly, it could be quite substantial. There are around 30 salmon netmen in the FCB area and according to my arithmetic if each got equal amounts (which they won't) the pay-off could average £50,000 apiece. Some will get much more than that and some will get less depending on the effectiveness and viability of their nets. On top of that anglers will again be expected to put their hands in their pockets to help out the poor netmen by further increasing the pool of funds available for distribution among the needy. Much discussion and hard bargaining needs to be done before final figures are worked out for each netsman. I understand that to help them make up their minds the carrot of a bonus of up to 10 per cent may be on offer to those who come into the buy-out scheme immediately. But there may be noises, too, in the hobnail boot department. I understand that the Fisheries Conservancy Board will be meeting on Monday and on the agenda will be a proposal to further strictly limit the number of salmon netmen may catch. This may be done by way of limiting the length of time nets can be in the water. A rough guide to what may be in the offing was the recommendation that netting catches needed to be reduced by 66 per cent to give the salmon a chance to recover. The prospect is that any netsman not taking up the buy-out offer might find fishing to be uneconomical even if the proposals now being made resulted in a much needed increase in salmon populations. Newell McCreight tells me that a committee will be set up involving government representatives and the NASF to work out a compensation formula. It will require the wisdom of Solomon to satisfy even a majority of netmen. The award of the monies was welcomed by NASF. It said: "NASF acknowledges that many additional factors affecting salmon stocks, most notably pollution and deterioration of the freshwater habitat, must also be addressed if stocks are to be restored to a level of true abundance. NASF congratulates the Assembly on this bold and forward-thinking initiative and is confident that the scheme will be welcomed by salmon netmen." In addition to the £1.5 million buy-out money, the Assembly announced £5.6 million for farm waste management which should greatly reduce farm pollution and an additional £1 million for nutrient management. A statement from the UAF said: "These monies will have a significant impact on our salmon and the water quality in our rivers and lakes. Wild salmon stocks are under stress. Department scientists based on the River Bush have called for a two-thirds reduction in exploitation to restore salmon stocks. The report of the inquiry into inland fisheries by the Assembly's Culture, Arts and Leisure Committee which was presented last month made 67 recommendations to address the problems relating to inland fisheries. These included the ending of commercial salmon fishing and several proposals to address water pollution. The announcement (of the new money) goes a long way towards addressing these recommendations. These innovative and forward-looking programmes are a great boost for those working to develop a substantial tourist angling industry in Northern Ireland. The Ulster Angling Federation, with 10,000 members throughout Northern Ireland, has lobbied for many years to end commercial fishing for salmon and for the development of tourist angling which would bring substantial benefits to the Northern Ireland economy."

Atlantic fish farms face virus disaster: Deadly disease forces farmers to kill 50,000 salmon, threatens wild Atlantic stocks

Ottawa Citizen, 16 April 2001

Salmon farmers in Maine knew there was a time bomb ticking in their waters. Last month, it exploded. Infectious salmon anemia (ISA), the virus that has ravaged the salmon aquaculture industry in Canada, Norway and Scotland, has appeared in two sea cage sites in Cobscook Bay near Eastport. Fish farmers at the infected sites were forced to kill 50,000 salmon, losing about a half a million dollars in the process. Since the virus started killing fish in salmon farms off the coast of Norway 17 years ago, ISA has been the foot-and-mouth of the sea. Fish farmers have slaughtered millions of salmon in an effort to control the spread of the virus, a member of the flu family, which passes from fish to fish in the water. The virus

is not harmful to humans. In salmon, it causes internal bleeding and destroys organs. The virus has cost the salmon farming industry hundreds of millions of dollars worldwide and continues to spread. In addition to this latest outbreak off the coast of Maine, the wide-ranging virus has recently appeared in sea cages off the coasts of Chile and Denmark's Faroe Islands. On the east coast of Canada, ISA has already cost fish farmers \$70 million. During the past three years, 4.5 million salmon have been killed in the Bay of Fundy in an attempt to control the spread of the disease. The virus first appeared in the Bay of Fundy in 1996 and had spread to cages as close as 10 kilometres to the United States border. "The real surprise about this, is that it took as long as it did for it to be detected across the border in Maine," says Fred Whoriskey, Vice-President of Research for the Atlantic Salmon Federation, a wild-salmon conservation group based in St. Andrews, N.B. Sebastian Belle, the Executive Director of the Maine Aquaculture Association, says fish farmers in the State are preparing to do whatever it takes to contain the disease. In recent years, Maine fish farmers have been paying a special tax to the State Government to fund a rigorous biosecurity program that employs an independent veterinarian to inspect all sea cages and processing facilities. Maine fish farmers have the advantage of having learned from the mistakes of other countries, which failed to control the virus before it reached epidemic proportions. When fish started dying in sea cages in the Bay of Fundy in 1996, it took scientists almost a year to identify the source of the mysterious illness. By the time scientists confirmed the virus was a variation of the Norwegian ISA, there was a full-blown epidemic in Canadian waters. "We have known for a long time that ISA has been lurking in State waters," Mr. Belle says. "If you don't know what you're dealing with, it's impossible to develop a management strategy. I am much more alarmed about things that we don't understand than I am about ISA." Clearly, the people with the most to lose are the companies themselves, and they are monitoring the situation aggressively." Nelle Halse, a spokesperson for the New Brunswick Salmon Growers Association, says the industry in the Bay of Fundy is starting to control the spread of the disease and will help fish farmers in Maine deal with the outbreak. "It's really a disease that has to be managed; it may never go away," she says. "As soon as Maine knew they were into this, they were talking to our fish health committee." The Canadian fish farmers have been controlling the spread of the virus through good husbandry - killing all fish at an infected site and allowing the waters to lie fallow to break the cycle of infection. When Canadian salmon farmers receive a positive test for ISA, they kill first and ask questions later, without waiting for fish to become sick. "It removes the pathogens immediately," Ms. Halse says. "For us it was a real learning experience." While the Federal and Provincial Governments have paid more than \$20 million in compensation to Canadian farmers who killed their salmon because of ISA, fish farmers recently established an industry-funded compensation program. When farmers know there's compensation coming, they will act more quickly to remove the virus from their site. The Canadian farmers are spreading out their cages and trying to stock only a single year-class of fish in each bay, so if the virus is detected, a bay can be cleaned out without destroying several year-classes of fish. The Salmon Growers Association has been lobbying the Provincial Government to approve more sea-cage sites to allow farmers to spread out their operations and allow more bays to lie fallow. Federal Department of Fisheries and Oceans scientists are now testing a vaccine for the virus, and preliminary results have been encouraging. The number of infected sites in Canadian waters has been reduced during the past three years from 40 in 1999, to 17 last year, and to just one so far this year, although the industry is now entering the most dangerous period for the emergence of the virus as the water warms. However, the ISA story doesn't end at the sea cages. Two years ago, scientists discovered ISA in wild fish, a development that alarmed conservationists of wild Atlantic salmon, who are desperately trying to protect a species already on the road to extinction. In 1999, Mr. Whoriskey detected the virus in both wild salmon and escaped farmed fish in the Magaguadavic River in southern New Brunswick. The virus was also found in wild brood stock Mr. Whoriskey had collected to help restock the river. Instead of killing the infected brood stock, he bred them to determine whether the disease was "vertically transmitted" to their offspring. As soon as the eggs began hatching, the salmon fry tested positive for the disease. Mr. Whoriskey ordered the fish be destroyed. ISA has also been detected in wild fish in Scotland and the Shetland Islands. In January, the Department of Fisheries and Oceans released a troubling report that suggested salmon from the St. John River in New Brunswick, the Morell River on Prince Edward Island and the Margaree River on Cape Breton had tested positive for the virus. However, Mr. Whoriskey says questions are being raised about the testing methods in these rivers and he remains hopeful these latest reports are "false positives." Nevertheless, conservationists remain concerned about the interaction of escaped farmed salmon and wild salmon. Mr. Whoriskey has found that escapees and wild fish are breeding on the Magaguadavic River, altering the genetics of an endangered strain of fish. Salmon regularly escape from sea cages. In December last year, 100,000 salmon escaped from a site in Machais Bay off the Maine coast during a storm. There are few wild salmon left in Maine. The salmon in eight Maine rivers were added to the federal endangered species list last year. One of these rivers, the Dennys, flows into Cobscook Bay, where the ISA outbreak occurred. "I'm not pushing the panic button, because they are going to immediately implement all the measures that have been used to control the disease in Norway, Scotland and Canada," Mr. Whoriskey says. "They had plenty of advance warning that it was coming. I'm relatively optimistic that this thing is going to be contained." Obviously it doesn't help to have additional centres of the virus particles that can infect wild fish in an area where populations are depressed. There's still great concern about this disease, but also hope that it will be brought under control so it will pose a minimal risk to the wild stocks." Ms. Halse has been watching the news reports about the foot-and-mouth livestock crisis in Europe with a certain measure of sympathy and understanding. "It might help people understand what it is all about," she says. "It is not about carelessness and greed. This is the kind of stuff that happens on a farm. It's about eradicating and killing off animals, and the losses are devastating."

Anglers offered whisky for returning salmon to the River Spey

Aberdeen Press and Journal, 20 April 2001

Anglers are being offered a tempting bounty for every spring salmon they return to the Spey, in an attempt to conserve stocks. The fishermen can claim a free bottle of malt for every one that gets away, under a scheme from a local distillery. Inver House Distillers, which runs the Speyburn Distillery, has teamed up with the Brae Water Trust and the Gordon Lennox Estate to ensure salmon numbers survive the busy spring season. For every spring salmon anglers tag and return before the end of May, they can claim a full bottle of 10-year-old Speyburn. They must record the tag number of the fish and its location in order to help researchers monitor their movements. If they catch a salmon which is already tagged and then let it go, they will get a miniature of the malt. The only catch is that anglers are limited to two bottles a day. Nial Mackinlay, the distiller's sales director, said: "The Speyburn Distillery is situated close to the banks of the River Spey, putting us in the perfect position to play a part in the study of this important species. We hope by offering this incentive, more fishers will take part in the catch-and-release scheme and this will reward those anglers returning fish." John Macnab, factor of the Gordon Lennox Estate, said: "We are delighted that Speyburn is supporting this voluntary catch and release scheme and look forward to the results." He added: "We have noticed over the past few years that salmon stocks have dropped drastically and we hope this will help raise awareness of the problem to salmon fishermen."

Judge threatens to close salmon beat

Scotsman, 24 April 2001

A former senior judge is threatening to close off a major stretch of salmon fishing on the River Ericht because of abuse by anglers. Sir William Macpherson of Cluny, who headed the inquiry into Stephen Lawrence's murder, said he is considering the drastic step to try and save the river's salmon stocks. The former English High Court judge has accused fishermen of plundering the river for several salmon every day. And he has warned that if they do not start putting the fish back he will close down the beat to the public. Sir William said a number of anglers were abusing the access. The Perthshire landowner's family have owned the salmon beat near Blairgowrie for several generations. Both he and his father before him have leased the two-mile stretch of water to the Blairgowrie & District Angling Association for a nominal rent. But now Sir William said he has been forced to rethink after hearing reports of anglers taking up to five fish a day to sell on. "I think it is important that local anglers and visitors should have access to salmon fishing, but I have been disturbed by the reports I have been hearing. I would ask the anglers who are doing this to think about their action," Sir William said. "It is a complete abuse of the rights we have given them for 60 years and if it goes on I could take these back." He urged all fishermen to restrict themselves to keeping just one fish each day at most - and not sell on for profit. "I feel that selling fish goes against the spirit of the sport of angling," said Sir William, himself a keen angler. He said he had been made aware that a small handful of anglers were responsible for the problem, but warned that they could halt access for everyone. The former judge said he was also concerned to hear that fish, which had been tagged and returned to the River Tay, were being killed in the River Ericht. Blairgowrie & District Angling Association river convener Paul Jamieson said an investigation had been carried out. He said association members had heard similar reports, but had not come up with concrete evidence of any systematic abuse. Committee member Grant Kelly said selling fish contravened club rules and anyone caught doing so would be punished. "More fish have been put back by club members than ever before," Mr Kelly said. "Even people who have never put a fish back before have been returning them." Salmon stocks in the area's river systems have fallen consistently in recent years, despite conservation efforts. In 1969, more than 104,000 salmon and grilse were caught in the River Tay, but 30 years later the number had fallen below 9,000.

Illegal nets destroyed in fight to save salmon

Western Morning News, 4 May 2001

Miles of illegal fishing nets used by poachers to snare the Westcountry's precious wild salmon stocks were destroyed yesterday in an Environment Agency clampdown. Enough net to stretch between Saltash and Liskeard about ten miles in all was seized from the water around Plymouth Sound by bailiffs during late night raids over the last 18 months. Strict rules protect important stocks of migratory salmon and sea trout as they head towards spawning grounds on the upper reaches of the Tamar and its tributaries. But the Environment Agency said it needed to keep up the pressure on poachers to preserve the Westcountry's most prized fish. Spokesman Ben Woodhouse said: "If we catch fishermen poaching then that's a bonus, but our main focus is to get the nets out of the water immediately. It is a large problem because there is a lot of money to be made on the black market for wild salmon, but there are also huge court fines if you are caught." He said the largest single net seized over the last 18 months was 1,000 metres. With nets costing around £1 a metre, the agency hopes to hit poachers in the pocket. "People understand the poachers are profiteering from a criminal act. The bona fide anglers and netters are sensitive to the fact that these people are hurting the long-term survival prospects for one of the most important species of fish in the South West," he said. Using high speed fisheries patrol boats and infra-red binoculars, water bailiffs also check riverbanks upstream. Mark Pilcher, fisheries team leader for the agency, said: "When you see the size and amount of net we have captured you start to appreciate the threat illegal fishing is causing our salmon population."

Finnie in the firing line over threat to salmon and sea trout

Sunday Herald, 6 May 2001

A powerful group of Scottish anglers has called for the resignation of Ross Finnie, the environment and rural development minister, following his rejection of calls for an independent inquiry into the environmental impact of salmon farming. The Salmon and Trout Association, who represent the interests of more than 100,000 fishermen in the UK, are incensed that Finnie has appeared to ignore the advice of two committees in deciding that an in-house inquiry will be held instead of the independent one they had recommended. Patrick Fotheringham, director of the S&TA, said: "The inquiry had been recommended and endorsed by both the rural development and transport and the environment committees, and the decision Mr Finnie has taken represents a blatant disregard for both the democratic process and the environment." After fears that the aquaculture industry is responsible for decimating wild salmon and sea trout stocks on the West Coast of Scotland, a petition was submitted to parliament on February 3 last year by Allan Berry, a former shellfish farmer from Cannich. Petition PE96 requested that parliament hold an independent and public inquiry into the effects of sea cage fish farming, and the regulatory failure to both recognise and prevent significant damage to our natural heritage, the environment, and other interests dependent on the integrity of our Scottish waters. The petition, which was supported by both the RSPB and WWF Scotland, followed mounting scientific and public concern over fish farm operations. Any angler who fishes the once bountiful spate rivers of the West Coast can tell their own tragic tales of spilled effluent and pollution, evidence of illegal toxic chemicals, mass escapes from damaged cages and horrific sea lice infestation on the precious few wild fish that remain. The petition demanded that the inquiry be independent, as the Scottish Executive are perceived in some quarters as being involved in permitting the aquaculture industry to make a profit at the expense of the environment. On the western Scottish seaboard escaped farmed salmon now outnumber catches of wild salmon by 7 to 1 and several rivers have now been declared extinct of their indigenous sea trout populations. With this in mind and following preliminary investigations, Andy Kerr MSP and Alex Johnstone MSP, who chair the two Scottish Parliament committees involved, wrote to Mr Finnie on February 8 this year to recommend that ministers establish an independent inquiry into the £260 million industry. It emerged this week though, through a leaked letter written by Mr Finnie in reply to their request, that the Scottish Executive will not be following their advice. Back in January this year, a BBC documentary, *Warnings From The Wild: The Price of Salmon*, showed how the authorities could defend their so-called Saviour of the Highlands. It filmed Andy Walker, of the Scottish Executive Freshwater Fish Laboratory, being gagged by minders while about to answer questions about the effect of fish farm sea lice on wild salmon populations. But senior civil servants have always denied the allegations, saying that Dr Walker's area of expertise is sea trout and he was not qualified to speak about lice infestation. Considering that the decline of the former is due to the explosion of the latter, I would think that this fisheries scientist is more than qualified to act as a spokesman. Alan Berry has remained philosophical as news of recent events unfolded. "I am not surprised," he said. "The Scottish Executive is again treating the parliament as a joke. A properly constituted inquiry would have opened up a huge can of worms about salmon farming pollution." So what we are now left with, some may feel, is the Scottish Executive having an inquiry into their own malpractice. So much for open and accountable government.

Review of bio-engineered salmon moves forward

Food Chemical News, 14 May 2001

While a government review of bio-engineered salmon is moving forward at FDA's Center for Veterinary Medicine, lawmakers joined with consumer and environmental groups last week to demand more stringent government regulation of bio-engineering in animal agriculture. Reps. Peter DeFazio (D-Ore.) and Dennis Kucinich (D-Ohio) joined consumer and environmental groups May 9 who unveiled petitions seeking a moratorium on the domestic marketing and importation of transgenic fish. "The FDA, without even consulting the government's own environmental experts, is rapidly and carelessly moving toward the approval of a transgenic fish that will further exacerbate the challenges faced by endangered species," DeFazio said. Speakers at the news conference focused on an ongoing review at CVM of growth-enhanced salmon, submitted by A/F Protein of Waltham, Mass. The groups criticized the lack of transparency in the review process, said sufficient toxicological studies are needed, and highlighted environmental concerns. "We more than anyone else want to do it right," Joseph McGonigle, vice-president at Aqua Bounty Farms, told Food Chemical News. Aqua Bounty is beginning to submit data and study protocols on food safety, McGonigle said. He told FCN that the company will conduct toxicological tests if there is a need for them. However, there are no indications of toxic effects at this point, he told FCN. The company is in the process of demonstrating the efficacy of the product, which it first submitted to FDA in 1995 as an investigational new animal drug. CVM has said it hopes to regulate bio-engineered animals under its current regulatory system for new animal drug applications under the Federal Food, Drug, and Cosmetic Act. From start to finish, the process of a drug approval at CVM can take six to seven years, and involves several stages, including first the investigational new animal drug application (INAD) and then the new animal drug application (NADA). The transgenic salmon are not out of the investigational stage at this point, but are at the later stages of product development, McGonigle told FCN. At this point, the company is working on demonstrating efficacy, environmental safety, food safety, and target animal safety, all of which are needed to file an NADA, which is the next phase in the drug review. DeFazio and Kucinich are crafting legislation that would tighten government regulation of bio-engineering in plant and animal agriculture. The legislation would span all genetically modified organisms, an aide to DeFazio told FCN. Kucinich has introduced legislation that would require mandatory labeling of bioengineered foods, and is a strong advocate of more stringent regulations. The legislation now under development would require agencies with environmental expertise to be included in the review of bioengineered foods, including genetically engineered fish. The action also would enhance pre

and post-market research and data collection, and improve the public's access to information about genetically engineered products. The Center for Food Safety and some 60 other consumer and environmental groups want the government agencies to coordinate their efforts on regulating transgenic fish. They submitted petitions to FDA, the Department of Commerce, USDA and the Department of Defense's Army Corps of Engineers. Andrew Kimbrell, director of the Center for Food Safety, believes that new laws and regulations are needed to address bio-engineered salmon because it is inappropriate for CVM to regulate these products under its existing rules, which were not expressly written for products produced through biotechnology. Kimbrell and the others are seeking a moratorium on domestic marketing and importation of transgenic fish until FDA completes a comprehensive environmental impact review as mandated by the National Environmental Policy Act. FDA must work with the departments of Commerce, Defense and Agriculture and comply with provisions of other various laws, they said. The groups also are demanding mandatory labeling of transgenic fish and all food products containing any ingredients derived from transgenic fish. The groups also want post-marketing monitoring, reporting and inspecting procedures for transgenic fish. They called upon FDA to establish regulations addressing the safety and efficacy of transgenic fish by requiring all transgenic-fish producers to complete a full review of transgenic fish as a new animal drug. Kimbrell warned that the groups may sue FDA if their petitions are not answered. The Center for Food Safety, along with many of the same groups, sued FDA a few years ago about its policy on plants derived from biotechnology. A federal judge upheld FDA's 1992 biotech policy last October and dismissed the groups' claims. One contentious issue appears to be whether Aqua Bounty performs toxicological tests as part of its government review. Aqua Bounty's McGonigle explained that the company will conduct toxicological tests if there is a need for them. Aqua Bounty's transgene is derived from two edible fish - Chinook salmon and ocean pout. The salmon are used for growth hormone production, and ocean pout for the regulator sequence, McGonigle told FCN. The transgene was micro-injected into the fertilized eggs of a third edible fish, Atlantic salmon, four generations ago. "Since the transgene results in nothing more than the expression of ordinary salmon growth hormone, there is no indication of potential toxicity," McGonigle told FCN. "Had there been such an indication, FDA would require us to do toxicology testing. Since there is none, we have not been required to run those tests." CVM is consulting with other FDA experts in human drugs and biologics, USDA and other agencies on the matter, and plans to convene a symposium on the issue later this summer, McGonigle told FCN. FDA wants to develop open lines of communication with industry and the public on the matter, he said.

Fish farms shun super salmon - expert leaves amid ferocious opposition from Europe

Herald, 19 May 2001

A scientist who produced genetically modified salmon which can grow twice as fast in farm pens as ordinary wild stock has turned his back on Europe after a backlash from the fish farming industry, environmentalists and consumers. Dr Arnold Sutterlin, of Aquabounty Farms, Prince Edward Island, Canada, told the Herald: "Trying to get our genes into Scottish fish farms is not a high priority for us right now. We have a year's work on regulations to get through here. It is too premature to develop marketing plans." Part of the GM company A/F Protein, of Massachusetts in the US, Aquabounty is reported to have 15 million genetically engineered salmon eggs ready for sale - producing fish capable of growing two to four times faster than ordinary salmon grown under the same conditions. The firm has just applied for licences - the first to do so - from the US Food and Drugs Administration to start farming their GM salmon commercially, and are hopeful of success. Scottish Quality Salmon, the major industry body, said it and the International Salmon Farmers' Association had rejected GM salmon as an option. A spokeswoman said: "We are very proud of our reputation on fish health and welfare and environmental safeguards." But Dr Sutterlin said he had been surprised at the scale and ferocity of European opposition. "I am finished with Europe and the European media. Between you and Greenpeace you have damaged us very badly. Television people came here and ate a 20lb smoked GM salmon and said they thoroughly enjoyed it. Then they went back to England and slaughtered us," he said. Aquabounty's applications have led to protests, with 60 environmental and fisheries groups calling on the FDA and four other US government agencies to implement a moratorium on GM fish being released into open waters. Greenpeace has added its weight to a number of legal actions filed by the US consumer group, Centre for Food Safety, in response to the applications. The FDA is insisting that no new regulation is required to deal with GM fish and treats the A/F Protein application as a new animal drug under the Federal Food, Drug and Cosmetic Act. Greenpeace International claims this view illustrates that the administration should not be making such "far-reaching, potentially irreversible decisions about future fish stocks and the ecology of the oceans". A/F Protein wants to develop faster-growing fish for farming as well as fish with "other economically desirable traits". Dr Sutterlin said a major benefit came from the fish reaching marketable size a year earlier, meaning savings in energy, feeding and labour costs - and savings to the environment. But the driving force behind GM salmon, he said, was not altruism, but economics. "In any farming operation, time is money," he said. "If we can take the products we are producing now and have them produced commercially we could feed twice as many people. If we had commercial success we could, at some stage, work on genetically engineered tilapia or grass carp and produce the fish equivalent of Golden Rice (genetically engineered rice capable of producing extra vitamin A to prevent child blindness in poor countries). "Right now these are third-world fish and problems, and there is no one to pay for them." Dr Sutterlin had been aware that there might be problems with the European market, but he said this had become a major concern. The salmon farming industry had turned its back on GM, making the environmentalists' task easy, he said, adding: "It's gone crazy in Europe." Salmon grow most strongly during the summer months, the dominant phase of growth hormone production. Dr Sutterlin has increased the Atlantic salmon's growing season by injecting a gene construct consisting of a gene from the larger Chinook salmon, a Pacific species, allied to a promoter sequence - a protein - from a colder water species, the pout, into the salmon egg. The resultant fish, with its modified genome, is theoretically capable of producing

salmon growth hormone all year round. Fears have been raised that escaped fish could interbreed, passing on their altered genes. Larger, more aggressive escapees would dominate the prey species chain and potential impacts on human health are unknown.

Atlantic salmon on brink of extinction: Scientists rush to deny claim of dramatic population rebound for wild stock

Ottawa Citizen, 31 May 2001

Wild Atlantic salmon are on the brink of extinction in hundreds of rivers in North America and Europe, according to a study released on the eve of a series of meetings in Spain that will set international fishing quotas. The World Wildlife Fund and the Atlantic Salmon Federation have concluded that wild Atlantic salmon have disappeared from more than 300 rivers and that populations in rivers in Canada, the United States, Estonia, Portugal and Poland are on the road to extinction. This new report is the opening shot in a behind-the-scenes conservation war that is expected to erupt in Madrid next week at meetings of the North Atlantic Salmon Conservation Organization, the international body that sets quotas for commercial salmon fisheries. The World Wildlife Fund report has been released in an attempt to counter a controversial new report that suggests the number of salmon in the ocean is rebounding after three decades of precipitous decline. Scientists from the International Council for the Exploration of the Sea have estimated that the number of large salmon feeding in the North Atlantic is now about 225,000, compared to an estimate of 93,000 last year. Even this new estimate is only a fraction of the 850,000 salmon that were feeding in the North Atlantic in the late 1960s. The Council's estimate is contentious because no one is actually counting fish. The scientists are tracking factors such as ocean temperature and using mathematical formulas to estimate how many fish should be in the North Atlantic. The problem is that the numbers may fit the formulas, but they don't match the bleak picture on many rivers where Atlantic salmon are rapidly disappearing. Conservationists will argue in Madrid that the International Council may in fact be projecting a recovery of "paper fish." The Council's estimate is crucial because it helps determine the quota for a wild Atlantic salmon net fishery off the coast of Greenland, where fish from North American and European rivers gather to feed in the winter. The Greenland quota has been reduced to just 20 tonnes for the past two seasons, but could increase to 200 tonnes if the new estimates are accepted. The commercial fishermen are expected to use the new numbers to argue for a quota increase. In the past, the Greenlanders have harvested as many as 2,700 tonnes of salmon a year. For Canadian conservationists, it's difficult to accept the conclusion that salmon populations are rebounding. In Canada, the most beleaguered Atlantic salmon populations are in the Bay of Fundy and on the eastern shore of Nova Scotia. "In those two areas we are absolutely at the point of biological extinction," says Fred Whoriskey, the senior scientist at the Atlantic Salmon Federation, an international salmon conservation group based in St. Andrew's, N.B. The Committee on the Status of Endangered Wildlife in Canada has concluded that the wild salmon in 33 inner Bay of Fundy rivers should have endangered species listing. Mr. Whoriskey says conservationists have been discouraged by the failure of the federal government to respond to the ecological disaster in the Bay of Fundy that has seen the salmon populations in these rivers fall from 40,000 two decades ago to fewer than five hundred last year. "When you're poised on the brink like that you'd expect all hands to be bailing the boat to keep it from going over the edge, and we're not seeing that," Mr. Whoriskey says. "These salmon are unique genetically, and they desperately need immediate protection and an infusion of new resources to prevent their extirpation." Salmon rivers in Maine are in a similar condition, reduced to a remnant population and placed on the endangered species list in the United States. Henning Roed of the World Wildlife Fund in Norway, who authored the new report, says scientists found no salmon in rivers in Germany, Switzerland, the Netherlands, Belgium, the Czech Republic and Slovakia where salmon were once abundant. Salmon have been driven from their home rivers by dams, water pollution and the relentless ocean net fishery. Conservationists have also raised concerns about a possible connection between salmon farming and the decline of wild fish. Farmed salmon escape from sea cages and breed with wild fish, diluting the genetic purity of each river's distinct population. Bill Taylor, President of the Atlantic Salmon Federation, who will be part of the Canadian delegation in Madrid, says governments must ban ocean netting of wild salmon immediately. "The nets indiscriminately kill wild salmon from rivers that have endangered populations," Mr. Taylor says. "The only way to protect the species is to end all ocean netting for Atlantic salmon."

Atlantic salmon face end of the line

Times, 1 June 2001

Wild Atlantic salmon stocks have collapsed and the species is at risk of disappearing without urgent international action, a report said yesterday. Wild salmon have been eliminated from more than 300 of the world's 2,000 rivers within their range and catches have plunged by 80 per cent in the past 30 years. The crisis is blamed on a combination of commercial salmon farming, overfishing, loss of habitat, global warming, man-made river obstructions and industrial and agricultural pollution. A four-year study by the World Wide Fund for Nature found that wild salmon have virtually disappeared from Germany, Switzerland, the Netherlands, Belgium, the Czech Republic and Slovakia. It is on the brink of extinction in the United States, Canada, Estonia, Portugal and Poland, leaving almost 90 per cent of the world's healthy Atlantic salmon population in only Scotland, the Republic of Ireland, Norway and Iceland. In those countries 85 per cent of wild salmon populations are vulnerable, endangered or critical. In England and Wales 29 of the 76 historically salmon-bearing rivers have healthy populations, with 11 classified as vulnerable, 19 endangered, ten critical and seven extinct. Less than 40 per cent of Ireland's 339 salmon rivers are healthy and 30 of Northern Ireland's 44 are vulnerable or endangered. More than 30 per cent of Scotland's 350 salmon rivers are endangered. Populations in 63 per cent of the rivers are healthy, second only to Iceland. Elizabeth Leighton, WWF's senior policy officer, gave a warning yesterday that without co-ordinated

international action to restore threatened rivers and protect those still healthy, "we could let the long-term future of the species slip away". She added: "When a river loses its salmon, that locally specialised population is lost for ever. The fate of the species is increasingly becoming a sad story of extinction peppered across Europe. The numerous threats and damaging human activities must be addressed." WWF and the Atlantic Salmon Federation called on countries attending the North Atlantic Salmon Conservation Organization, meeting in Spain next week, "to address the threats both at sea and in rivers". Among the biggest dangers to the wild salmon is the dominance of salmon farming, which produced 600,000 tonnes of the fish in 1999, the last year for which figures are available. That is more than 300 times the level of wild salmon caught that year. Scotland, Norway and Canada, the world's biggest Atlantic salmon farmers, have seen drastic reductions in wild salmon returning to their rivers in the past 20 years. In Scotland salmon farming production soared from 598 tonnes in 1980 to 111,918 tonnes in 2000. That same year in Norway production rose from 4,153 tonnes to 415,399 tonnes. Millions of farmed fish in the two countries have escaped into salmon rivers, where they compete with wild salmon for spawning partners and sites. That leads to interbreeding and the spread of diseases, including salmon lice, which can kill small and large wild salmon, the report says. Ms Leighton said that Britain should be seen to take a lead in conservation efforts. "As home to such a huge proportion of the world's wild Atlantic salmon, the British Isles, and especially Scotland, bears a huge responsibility to raise its game to protect the king of fish."

The fall of the wild - farming is threatening wild salmon

Financial Times, 2 June 2001

Farming is threatening wild salmon, say Leslie Crawford and Vanessa Houlder. A disgruntled City executive, just back from a barren week's fishing in Scotland, confirms what environmentalists have suspected for a while: wild Atlantic salmon are disappearing from the rivers of America and Europe. "My parents used to fish on the Dee," the London financier says. "Going back 10 or 15 years, they were guaranteed to catch eight or 10 fish in a week. Then the fish just ran out on the Dee. I got hooked when I caught three fish in one day. Then I didn't catch another for 10 years." The angler's sorry tale could be put down to bad technique or bad luck. But Sally Clarke, a London restaurateur who runs Clarke's in Kensington, says wild salmon has become increasingly expensive and difficult to obtain. Yesterday night was the first in the season for serving wild salmon from Scotland. There was a time when she could place an order and be confident of delivery. No longer. "Now it's touch and go whether we can get enough," she says, "which is a shame, because the flavour and texture of wild salmon bear no comparison with the cheaper, farmed variety." The dwindling number of wild salmon in Scotland is driving keen anglers as far away as Iceland and Russia. In southern Canada, where recreational fishing supports a C\$250m (£115m) a year industry, 33 rivers are in danger of losing their wild salmon populations. In New England, the situation is even grimmer. A new study published by the World Wildlife Fund has found there are only eight rivers left on the US Atlantic coast where wild salmon return to breed and their numbers are so low that the species is on the brink of dying out in these areas. "Last year, only 150 individual salmon returned to these eight rivers in the Gulf of Maine," says Bill Taylor of the Atlantic Salmon Federation, an environmental group. "Once you lose a river's population it is gone for ever, because salmon return to breed only where they were spawned." Under pressure from Mr Taylor's group, the US last year put wild Atlantic salmon on its endangered species list. The US and Canada have also banned commercial salmon fishing. Why is wild salmon under threat? The WWF study points to the usual suspects: overfishing at sea by commercial fishing fleets, particularly off the coasts of Greenland and Ireland; dams and other man-made obstructions that prevent a salmon's progress upstream; pollution; and the huge growth of salmon farming, which threatens wild salmon stocks through interbreeding and the spread of disease. The study is the first river-by-river assessment of wild salmon stocks in Europe and North America and it makes grim reading. According to the report, wild salmon has disappeared from 309 river systems in Europe and North America, including all of Germany, Belgium and the Netherlands. The species is nearing extinction in the US and southern Canada and in Estonia, Portugal and Poland. The US government has spent more than \$100m (£70.5m) in an attempt to repopulate the Connecticut river with wild salmon, with meagre results. Germany's failure has been even more dramatic. Dams and industrial pollution killed the Rhine's salmon population in the 20th century. But even after a Euros 50bn (£30bn) effort to clean up the Rhine, and more than Euros 20m devoted to breed wild salmon, only 60 fish were detected in the river last year. In 1885, by contrast, Germany recorded 250,000 wild salmon caught on the Rhine. WWF identified only four countries with healthy population stocks: Ireland, Iceland, Norway and Scotland's east coast rivers. Even in Scotland, though, the picture remains unclear. Henning Roed, author of the WWF report, says Scotland does not compile statistics on wild salmon stocks in different rivers. There are similarly no public records of the number of "fugitives" from salmon farms, located mainly on Scotland's west coast. Nevertheless, Mr Roed draws from a number of scientific publications to conclude that more than a third of Scottish rivers risk losing their wild salmon populations. Not everyone agrees. Paul Kingsley, a keen fly fisherman, says: "I've been fishing salmon for 20 years and the talk has always been of decline. I am not aware it is any harder to catch a fish than 20 years ago. If you go to the Tweed or the Beaulieu, you are in with a very good chance." Even Mr Kingsley, however, admits that angling on west coast rivers has been affected by the explosion in fish farming. Scottish Quality Salmon, which represents 75 per cent of the country's fish farms, hotly contests any suggestion that it might be to blame for the decline in wild salmon stocks. "If we are having an effect, fish farming is only one of many complex factors," the organisation says. Its members have adopted a code of conduct to contain the escape of farmed fish and to co-ordinate sanitary measures. Nevertheless, each farm guards the number of escapees as a close secret. The Salmon and Trout Association in the UK, which brings together fishing aficionados, estimates more than 385,000 salmon escaped from fish farms in Scotland in the first five months of last year. Norway, on the other hand, monitors salmon jailbreaks: 11m have officially escaped from their cages, and presumably bred with their wild cousins, since 1988. A bad storm, the predatory activities of seals or unsecured cages can lead to tens of thousands of fish escaping at a time. WWF

wants government members of the North Atlantic Salmon Conservation Organization (NASCO), which meets in northern Spain next week, to take seriously the threat of the extinction of wild salmon. The environmental group is calling for a ban on all commercial salmon fishing, stricter controls on the activities of fish farms and the creation of wild salmon gene banks to protect the species from the risks of interbreeding with farmed salmon. Greenland and the Faroe Islands are expected to ask NASCO for a bigger quota for their salmon fishing fleets based on figures that point to a recovery of stocks in the north Atlantic after 18 years of voluntary restrictions on commercial salmon fishing at sea. Yet Mr Taylor argues that commercial fishing cannot distinguish between a salmon that will return to a healthy north Canadian river and an endangered salmon that hails from a threatened US river. "They all converge in the same feeding grounds. When you drop a net into the ocean, you cannot know whether you are about to kill the last specimen of a particular salmon river in North America." The disappearance of wild salmon, argues Tom Grasso, director of the WWF's marine conservation programme, threatens not only recreational fishing but fish farming too, because the species is used as the industry's "brood stock". WWF and the Atlantic Salmon Federation want governments to establish a code of conduct for the industry, which farms more than 600,000 tonnes of salmon a year. "The industry should take a lead in investing in its own sustainability, otherwise it will pollute itself out of business," Mr Grasso says. Mr Roed also hopes that consumer pressure will lead salmon farms to clean up their act. "At present, farmed salmon is sold as if it had just leapt out of the river," Mr Roed says. "But if some farms adopt more environment-friendly production methods, there will be a choice." Until that happens, most salmon on diners' plates is likely to be of the farmed variety, while anglers on both sides of the Atlantic will be faced with this doubt: after all their skill, time, expense and effort, will they have hooked a wild salmon, a fish farm escapee, or a cross between the two?

Landowner attacked over plans to release his farmed salmon

Aberdeen Press and Journal, 4 June 2001

A Highland landowner has been heavily criticised for his plans to release farmed salmon into the wild, as environmentalists claim it may put at risk Scotland's remaining wild stock. In a bid to restock the River Kishorn which borders his land, Mark Pattinson, of Couldoran Estate, Wester Ross, has hit upon the plan of putting very young salmon or small fry into specially dug ponds beside the river. There, they will be able to grow into the larger-sized smolt and have a better chance at surviving in the sea, allowing more of them to later return. The World Wildlife Fund for Nature believe this will damage already depleting Scottish wild stock through genetic pollution and disease. The environmental group, however, are powerless as the recently passed Salmon Conservation (Scotland) Act does not apply to freshwater fish. The Scottish Executive said legislation aimed at closing the loophole would not come into force until the spring. Meantime, Mr Pattinson, a keen angler, is about to let thousands of fish from his fish farm into the river to increase next year's stock. He explained that, where possible, he will stock the river with native stock but where there is very little native stock left, he will introduce the farmed smolt. He went on to say that the method had produced impressive results on the Ranga River in Iceland. Ireland, Norway and Iceland hold over 90% of the wild Atlantic salmon stocks. Survive "I think many of these scientists have got it wrong and ought to see what's going on in Iceland. In Iceland, they are bringing them on in fry and half-fry stages to when they are big enough to go to sea at 40-70g and then they are much more likely to survive. If they are little babies, just after being hatched, that are released into the burns above the rivers then it takes four years for them to be ready to go to the sea then there are only a minute amount that return. If they are released as smolt it will take only a year before they are ready to go to sea." The World Wildlife Fund for Nature last week published a report stating that Scotland's salmon stock was in danger of extinction and that there was a huge responsibility for landowners and farmers to protect the native species. A spokesman for WWF explained the problems that he felt could arise as a result of this method. "Fish that are native to the river system are out-competed or interbred by the farmed salmon reducing the chances of the native species to survive. We are already struggling to maintain the species as they are already on the brink. The best long-term solution for native species is to do everything we can to protect them and this goes against those efforts."

Fears over genetically engineered salmon in Atlantic

Herald, 6 June 2001

Campaigners for the environment warned yesterday that putting genetically engineered salmon into the Atlantic Ocean could destroy the species. However, supporters of genetically modified fish-farming said it would allow increased production while relieving the pressure on wild stocks of Atlantic salmon. The dispute over genetically engineered, or transgenic, salmon flared as the Eighteenth Annual Meeting of the North Atlantic Salmon Conservation Organization (NASCO) got under way in Mondariz, Spain, with government representatives from the US, Canada, Russia and the EU. The transgenic salmon issue is expected to be handled later during the five-day meeting at the north-western spa resort. Lindsay Keenan, genetic engineering campaigner for Greenpeace, called on NASCO to take action to prevent the United States Food and Drug Administration from approving the cultivation of genetically modified salmon in ocean pens. "The future threat to the Atlantic salmon is from transgenic salmon and it should not be allowed anywhere near the oceans," Mr Keenan said, adding that "altered salmon could escape into the wild, adversely affecting the ecosystem". The environmentalist said transgenic salmon should only be grown in secured, self-contained land-based facilities, which is "not economically viable for those companies" that want to cultivate it. Greenpeace's protest was backed by 16 other ecologist groups. Environmentalists cited studies estimating that the introduction of 60 fertile transgenic fish in a natural population of 60,000 could destroy it in 20-30 years. However, Joe McGonigle, Vice-President of Aqua Bounty Farm and a member of the US delegation, said transgenic salmon was still in the research phase and dismissed the warnings. "It's

pretty clear that transgenic salmon or fish in general are not dangerous despite hysterical claims by the ecologists," said Mr McGonigle, whose firm is developing a genetically modified Atlantic salmon that grows to full adult size in 18 months instead of the normal 36 months. He said Aqua Bounty Farms has orders for 15 million eggs from genetically engineered Atlantic salmon that it has been raising in a research project on Prince Edward Island in Canada.

Greenlanders get go-ahead for limited salmon harvest: 'Best deal we could have hoped for' conservationist says

Ottawa Citizen, 8 June 2001

Despite dire warnings that wild Atlantic salmon are on the road to extinction, fishermen in Greenland have been allowed a limited salmon harvest this summer. During meetings in Mondariz, Spain, members of the North Atlantic Salmon Conservation Organization agreed yesterday to allow Greenlanders to harvest between 28 and 200 tonnes of wild salmon, depending on the number of fish in the sea. The fishery will be closely monitored by biologists from Canada, the United States and the European Union. The Greenland net fishery is one of the few remaining wild salmon ocean fisheries in the North Atlantic. Conservationists from Canada and the U.S. are launching a campaign to end the controversial fishery forever through a privately funded buyout program. Atlantic salmon feed off the coast of Greenland before returning to their home rivers in North America and Europe to spawn. More than half of the fish harvested off the coast of Greenland originated in North American rivers, most of them on the East Coast of Canada. Greenlanders, operating out of small open boats, harvest salmon from both rivers with healthy populations and rivers with fish populations that are nearing extinction. "It's the best deal we could have hoped for under the circumstances," said Bill Taylor, President of the Atlantic Salmon Federation, a conservation group based in St. Andrew's, N.B. "We can't tell them not to fish. There will be more biologists up there monitoring this fishery than ever before." Mr. Taylor, who represented Canada in the meetings in Spain, said he would approach members of the Greenland delegation today to begin negotiations to end the fishery through a privately funded program to pay Greenlanders not to fish and offer them other economic development opportunities. "As long as we continue to have mixed stock fisheries, our fragile and threatened rivers will never have a chance to recover," Mr. Taylor said. "The ultimate goal is to end this fishery." Mr. Taylor noted there would always be a food fishery off the coast of Greenland. However, he said, it is important for the survival of the species that yearly negotiations over quotas end, and that the ocean feeding grounds for Atlantic salmon become marine sanctuaries. The International Council for the Exploration of the Sea, the group that offers official scientific advice for the Greenland quota, had released a report suggesting the number of salmon of North American origin in the Atlantic Ocean jumped from about 100,000 last year to 295,000 this year. After several years of accepting a 20-tonne food fishery, the Greenlanders were suddenly being given the green light for a 200-tonne commercial quota. The Canadian and U.S. delegations convinced the Greenlanders that the scientific data was highly suspect and the fishery needed to be monitored before allowing a 200-tonne harvest. The fishery will begin in August with a quota of 28 tonnes. The fishery will close temporarily after a week to give a team of international observers a chance to determine whether the fish are abundant enough for the harvest to continue. Canada, the U.S., the European Union and Denmark must unanimously agree on the Greenland quota or the Greenlanders can set their own limits. During the meetings yesterday, Canada also made a commitment to do more monitoring of salmon returns to rivers on the East Coast. Only one-third of the rivers in Eastern Canada are monitored by federal biologists.

Fishermen accept bounty to protect salmon stocks

Scotsman, 18 June 2001

English fishing boat skippers accused of plundering salmon heading for Scotland's rivers are ready to accept a multi-million-pound bounty for their drift-net licences in order to conserve fish stocks. Organisers of the 68 vessels operating the north-east of England drift net fishery say this will be the last season in which boats from Northumberland, Durham and North Yorkshire intercept shoals of salmon returning to the Tweed, Tay, and other Scottish rivers. According to Derek Heselton, the South Shields skipper who represents the crews, "more than 95 per cent" of his colleagues will settle for generous compensation from a salmon industry fund in return for handing in their licences. He claimed the 30-year acrimony between owners of salmon angling beats in Scotland and the English drift netters had been swept away by the prospect of a deal with the North Atlantic Salmon Fund (NASF). Details of the buy-out came yesterday as environmental group Friends of the Earth Scotland (FoE) published a major new report containing a hit-list of areas most at risk from Scotland's fish farming industry. In the report, reviewing the £260 million industry's progress over the last decade, the organisation says Scotland's salmon industry must be "held to account for the harm which it is doing to the environment". FoE lists 18 areas, largely in the west coast of Scotland, where it believes fish farming is most likely to adversely impact on environmental and other economic interests. Kevin Dunion, FoE's Chief Executive, said the farming industry had polluted the marine environment and affected wild salmon stocks and shell fisheries. Lord Lindsay, Chairman of the Scottish Quality Salmon, which represents around 65 per cent of the tonnage produced by the Scottish salmon farming industry, accused the report's authors of taking a "critical and uninformed position". The licences buy-out was recommended last year following a fisheries review by the government. It followed reports that the north-east fleet had caught 100,000 salmon and 40,000 sea trout since 1995. Speaking from his office in Iceland, Orri Vigfusson, Chairman of NASF, told the Scotsman: "We expect to clear up the legal formalities and the drafting of the agreement within the next few days. After that the proposals will be sent to the fishermen for their consideration."

Tide turns on salmon farming

Herald, 18 June 2001

Environmental awareness is making times harder for the industry, claims Friends of the Earth. The tide is turning against sea cage salmon farming as people become increasingly aware of its environmental, economic, and social downsides, a new report by Friends of the Earth Scotland claims. People are realising that they do not have to live with the polluting discharges from cages in their lochs, says FoES, and scallop divers, creel fishermen, anglers, B&B owners and even fish farm workers "are blowing the whistle on the shoddy and sometimes illegal practices of some fish farms". The report, *The One that Got Away*, is the first time in 12 years that the campaigning organisation has taken a hard look at salmon farming, this time as a clear response to the refusal of the Scottish Executive to allow an independent inquiry into its environmental impacts. The report paints a picture of a vast, multinational-driven food industry heavily dependent on chemicals - many of them deadly - and heavily dependent on public relations and protection from the Scottish Executive for its continued expansion. Its message is that many huge questions about salmon farming's impacts remain unanswered. The industry, not unexpectedly, has hit back, expressing disappointment that Kevin Dunion, the director of FoES, "has failed to take up many invitations to discuss these issues, preferring to maintain a critical and ill-informed position". Lord Lindsay, Chairman of Scottish Quality Salmon, the main industry body, said: "If Friends of the Earth are genuinely looking for solutions, responsibility and sustainability from a vital Scottish industry, then surely they should be supporting SQS and its quality-driven initiatives on food standards and environmental considerations, not deriding the industry with shock tactics and unrealistic claims." He points out that salmon farming now accounts for 40% of all Scotland's food exports and is worth £650m to the economy. Ironically, as the FoES report is published, the Food Standards Agency Scotland announced the closure to scallop fishing of a large portion of the Minch off the east side of Lewis due to a "build-up of naturally-occurring Paralytic Shellfish Poisoning (PSP) toxins" - one of the first cases of what is now a regular occurrence each summer. FoES maintains that the "alarming rise in the incidence of algal blooms and shellfish poisoning events have cast doubts on the compatibility of the two activities" - salmon and shellfish farming, claiming that salmon farming is compromising the high quality of water on Scotland's west coast. The report says it is not surprising questions are now being asked, pointing to a SEPA calculation in 1999 which allegedly said that, for each tonne of salmon produced, approximately 100kg of nitrogenous compounds, including ammonia, were released into the sea. It adds: "Since ammonia is also known to trigger the algal blooms responsible for shellfish poisoning, the potential causal link is only too clear." The coincidence between the areas of the three main shellfish poisons and the high density of salmon farms is remarkable, the report adds. It says Scottish salmon farming is dominated by multinational companies driven by short-term economic priorities rather than long-term interest in the future of Scotland's environment. The estimated waste discharged from Scottish fish farms in 2000, says the report, was equivalent to almost twice the annual sewage discharged by the entire Scottish population. FoES concludes that there should be a shift to local, organic fish farming.

Poachers target River Dart salmon

Western Morning News, 21 June 2001

The River Dart is being targeted by poachers using the foot and mouth crisis as cover to illegally net valuable salmon and sea trout. In one incident strong-arm poachers threatened genuine anglers who caught them trying to haul salmon out of the Weirpool at Totnes. And in another nets were discovered stretched across the river at Holne. The Dart Angling Association is so worried it has warned its members to dial 999 and call the police the moment they spot poachers in action along the Dart. Mr David Pakes, the secretary of the angling association which boasts more than 100 members fishing the river from Totnes to Holne, warned: "There has been a lot of poaching on the Dart this year." He said Government cutbacks had reduced the number of bailiffs patrolling the river while at the same time large areas of the river bank have been closed to anglers because of the foot and mouth crisis. This has meant the river has been left largely unprotected and wide open for poachers after the salmon and sea trout which they can sell on the black market. Mr Pakes said the two illegal nets had been discovered on the river at Holne Chase while various people had been spotted fishing illegally at various times over the last few months. The corrugated iron roof from an isolated hut belonging to the association was ripped off in one incident and used to block the salmon path.

Pressure is mounting to do something about salmon farms

Economist, 23 June 2001

Thanks to intensive farming techniques, salmon is now one of the cheapest foods on the market. But cheapness comes at a price. Scottish National Heritage (SNH), a state-funded conservation body, says it is worried about the farms' impact on Scottish sea lochs; and in a report published this week, Friends of the Earth Scotland claims that the amount of waste discharged from Scottish fish farms last year was equivalent to almost twice the total amount of sewage discharged by Scotland's population. Twenty years ago, the output of Scotland's few small salmon farms was barely 800 tonnes. Last year, 340 farms - two-thirds of them owned by Norway's Norsk Hydro and the Netherlands' Marine Harvest - produced 127,000 tonnes. Salmon are kept at higher densities than battery hens. Packed in cages of up to 70m in diameter, holding up to 500,000 fish, they are fattened on a diet of the rendered remains of small fish. Anti-bacterial chemicals are used to ward off sea lice and other parasites. Colouring agents are included in their pellet food because, deprived of its natural diet of krill and shrimp, the flesh of a farmed salmon looks an uninviting shade of grey. Roche sells a colouring agent, called Salmofan, which allows salmon farmers to choose the exact shade of pink they like for their fish. Intensive feeding combined with heavy doses of chemicals inevitably causes environmental problems. Some of the food, together with large amounts of ammonium-rich salmon excreta, drops through the cages on to the sea bed. The startling decline in wild

Scottish salmon is being blamed on pollution and interbreeding between wild and farmed salmon. Early in the 19th century, 56,000 fish were netted or trapped in one season from just three pools on the Don. These days, Scotland's total annual wild salmon catch is around twice that. Scotland's rural affairs minister, Ross Finnie, has so far resisted calls for an inquiry made by two Scottish parliamentary committees. But SNH's support for an independent review will increase pressure on the government. The Scottish Executive's reluctance to interfere with an industry that has brought thousands of jobs to poor rural areas is understandable. But there are less destructive ways to farm salmon. In Orkney, some organic farmers produce salmon at about half the density of conventional farms, without toxic chemicals or colourings. Their food is coloured with crushed prawn shells, part of the salmon's diet in the wild. The strong tides in those northern waters wash through the farms, reducing the problem of sea lice and other ailments. These farms' costs are 50% higher than most. But if the resulting fish is better and more edifying than the usual slimy supermarket creature, it has to be worth it.

Threat to salmon

Express, 2 July 2001

Wild Atlantic salmon could be wiped out by global warming. New research shows Britain's salmon and trout are suffering stunted growth in summer. And there are fears that this trend will worsen. The UN has warned that global warming is likely to increase temperatures by 6°C within 100 years. Wild salmon may stop returning to spawn in the streams where they were born if water temperatures rise. Exeter University researcher Aly Walsh said: "If streams heat up, populations of trout will disappear. The water will only have to be a little warmer for salmon to suffer the same fate." Chris Poupard of the Salmon & Trout Association described climate change as the "greatest threat" to survival of wild salmon at sea.

Warning over future of salmon fishing rivers

Herald, 3 July 2001

A lobby group warned yesterday that salmon and sea trout fishing could be badly affected if crofting communities exercised the right-to-buy under land reform plans. The Crofting Counties Fishing Rights Group (CCFRG) said it cost £2.5m to maintain fishing rivers in the Highlands and islands at present standards and crofting communities would have to find that money or oversee the demise of fishing in their area, directly threatening up to 1000 jobs. The Scottish Executive's draft land reform bill proposes extending the crofters' existing rights, allowing a community to buy land and rivers from an estate, whether or not it was willing to sell. The CCFRG stresses that it does not represent landowners. David Cotton, the group's clerk, said: "We are a totally independent body, representing grassroots salmon and sea trout river workers, including gillies, bailiffs, fishery scientists, managers, and hatchery operators. We have no political allegiance and no outside funding. We do not in any way represent the interests of land or river owners. There are about 1000 of us across the Highlands and islands and there are others in every community who would be indirectly affected. But the MSPs in Edinburgh have never heard of us. I have talked to people in different parts of the Executive and they simply don't know what is going on." Mr Cotton, a factor for the Strath Halladale and Bighouse estate in Sutherland, said: "The core of the estate is the Halladale river and just for maintenance on that river, on its banks, costs £25,000 a year. That is the same all over the crofting counties, amounting to £2.5m. If crofting community bodies are to take over fishings by compulsory purchase, as proposed under the land reform bill, the CCFRG feels the Executive should appreciate that this level of expenditure has to be met." About 1000 jobs have been lost in fish processing in the past year because of the crisis in the fishing industry. Robert Milne, Executive Director of the Scottish Fish Merchants' Federation, told a meeting of the North-East Scotland Fisheries Development Group, a lack of continuity in supply was causing major problems for the processors and the catchers also were in crisis.

Ministers asked to buy out salmon netting stations

Scotsman, 6 July 2001

The Scottish Executive has been asked to back an international campaign to buy out netting stations around the coast in a bid to boost stocks of wild salmon in rivers. But although it is claimed the netsmen have caught more salmon and sea trout than their English counterparts over the past decade, the drive to close Scottish coastal fisheries is unlikely to receive financial support from ministers. The North Atlantic Salmon Fund [NASF], currently raising money to buy out the north-east of England drift net fishery, says it is equally important to curtail the catches of interceptory fisheries north of the Border. An offer to buy out the licences of English skippers who catch tens of thousands of salmon heading north to Scottish rivers is likely to be tendered later this year. It is believed that well over 90 per cent of the 68 licence holders are ready to take the money on offer and will stop fishing for salmon after the current season ends in August. Once that deal has been concluded, the NASF hopes to devote more resources to buy off those fisheries in Scotland which are thought to be intercepting salmon. Orri Vigfusson, the fund chairman, says: "We are disappointed the (Scottish) Executive has not joined forces to stop coastal netting in areas such as Montrose Bay. The fishing grounds of Greenland and Iceland, where Scottish salmon feed, have already been closed to fishermen who used to catch them. Now those fishermen are beginning to ask why there has not been similar action in Scotland." He hopes NASF can buy out stations on a voluntary basis where there are fishery owners willing to sell their rights. "It is not a case of targeting individual fisheries. We want to achieve closures fairly and with adequate compensation," said Mr Vigfusson. "All of these commercial fishermen have rights, and if everyone entitled to fish for salmon actually went fishing they could take all of the salmon from the coastal waters." In 1999, the Scottish net fisheries caught almost 18,000 salmon, representing 32 per cent of the total salmon catch, and about 10,000 sea trout. But salmon catches are at their lowest level since records began in 1952, with the total

taken by net and coble down 23 per cent on the previous year, and fixed engine stations suffering a 59 per cent drop in the number of fish caught. The value of the coastal stations to the Scottish economy is believed to be considerably less than the estimated £11 million figure for 1998. The number of nets deployed is thought to be only a third of the total recorded in the 1998 study. Andrew Whitehead, the secretary of NASF[UK], said they had made it clear in a submission to a fishery review commissioned by the government that interceptory nets which took fish bound for more than one river were unhelpful to salmon management.

Iceland's success in salmon rivers

Herald, 7 July 2001

The Crofting Counties Fishery Rights Group are pessimistic about the future financial viability of purchasing salmon rivers within the land reform plans (July 3). The annual cost of £2.5m, quoted by CCFRG, to maintain fishing rivers in the Highlands and Islands no more than sustains the existing falling level of salmon caught by an increasing number of anglers. Many West Highland rivers, with a capital value per salmon caught of £7000 or a letting value of £300 per salmon killed, are almost devoid of salmon with the consequential fall in sales values. For the solution to the sustainability of salmon rivers, the CCFRG need look no further than to Iceland. A river in Iceland, the Ranga, invests £200,000 per annum in stocking 400,000 salmon smolts each year. Now there are almost 4000 caught each year. At a letting value of £300 per salmon landed on the bank, the Ranga revenue far exceeds the cost. For an additional 60,000 salmon caught in Scottish rivers to the present 60,000 taken on rod and line, six million smolts would need to be stocked at a cost of £3m. The revenue for 60,000 salmon caught at £300 per salmon is £18m. The added value for the increased tourist trade would also be considerable. In Iceland, the River Ranga is owned by approximately 50 local farmers. The farmers employ a manager who is responsible for raising the capital required and marketing the fishing and accommodation. Consequently Scottish river owners, whether they be existing river-beat, time-share, or CCFRG owners need not be concerned as to risk investment. The Icelandic river owners do not need government subsidies. The CCFRG or any river owners and managers, who are prepared to sow and consequently reap the harvest, should not require public money support.

Norway's Directorate of Nature Management considers salmon fishing ban

Norwegian News Digests, 11 July 2001

Norway's Directorate of Nature Management (DN) is considering the introduction of a ban on wild salmon fishing in the Hordaland county and the county of Sogn and Fjordane in 2002, DN wrote in a letter to the Norwegian Environment Ministry. The decision is based on an expert group's salmon-related report for the two counties.

Salmon count reaches lowest point in 18 years

Hartford Courant, 30 July 2001

The long and difficult effort to restore Atlantic salmon to the Connecticut River has taken another blow. The number of salmon returning from the sea as adults this year fell to its lowest level in 18 years - a mere 41 fish. "It sort of left us shell-shocked," said Steve Gephard, Supervising Fisheries Biologist with the State Department of Environmental Protection. Atlantic salmon, native to North America and Europe, are born in rocky freshwater streams, but at age 2 they leave fresh water, swimming to the seas off Greenland, where they grow to adulthood before migrating back to the very streams of their birth. "Something is happening between the time they leave and the time they come back," Gephard said. Over the past two decades the salmon run in the Connecticut has often been in the 200 to 400-fish range, though even those returns are but a tiny fraction of the number that restoration biologists hope will return each year. This year's total is the worst since 1983, when only 39 fish came back. The restoration effort on the Connecticut, which two centuries ago had a major salmon run each spring, began in 1967 and has cost well over \$100 million, much of it in fish passageways to get the salmon past the river's numerous dams. It was the creation of dams in the Connecticut Valley during the late 18th and 19th centuries that destroyed the strain of salmon that had evolved over millennia in the river. "We're trying to re-create that strain of salmon," said Robert A. Jones of South Windsor, one of three U.S. commissioners to the North Atlantic Salmon Conservation Organization, an international organization created by treaty. "It took an awful long time to create them in the first place." The problems in the Connecticut are not unique. Salmon anglers and salmon conservation groups are alarmed at a precipitous decline in salmon in recent years. The run in the Connecticut is still so small that there is no fishing season for salmon; in fact, it is illegal to keep one. "It is pretty clear worldwide stocks of salmon are down virtually everywhere," Jones said. "There are certain streams in pretty good shape, but generally worldwide stocks are down." One hypothesis for the decline is that a climatic condition known as the North Atlantic Oscillation has made water temperatures at sea unfavorable for salmon, probably reducing available food and thereby driving down populations in both North America and Europe. In Connecticut there also have been concerns that greatly increased numbers of striped bass in the Connecticut River could be devouring young salmon as they leave for the sea. Otherwise, however, restoration officials believe river conditions are not the cause of the problem, or not a major cause at least. "I don't think there is any one fixed idea that folks have glommed onto," said Janice N. Rowan, Connecticut River coordinator with the U.S. Fish and Wildlife Service. In 1967, Connecticut, Massachusetts, New Hampshire, Vermont - the four states that create the Connecticut Valley - joined with the federal government in an effort to restore salmon to the 410-mile-long river. Biologists took young salmon from Maine and Canada and released them into the Connecticut, hoping the fish would imprint on the Connecticut and return to it after they went to sea. By 1974, an adult salmon - typically about 30 inches long and weighing about 10 pounds - returned from the sea. In 1981, 529 fish returned. But the runs in subsequent years

dipped lower. The poor returns come as the federal government is preparing to reauthorize an interstate compact that oversees the effort, and as a new wave of funding for research and operations is pending. The biologists still believe the restoration can succeed. "The question is whether it can be done in the current context of the ocean, the climatic changes," Gephard said. "If these are short-term and the North Atlantic Ocean shakes this off and we shift back to what was normal 20 years ago, then the concept of salmon restoration is extremely viable." But, because North Atlantic salmon populations were reduced so low by fishing pressure in years past, if conditions do not improve in coming years, even salmon runs on established rivers will be in trouble, Gephard said, much less rivers like the Connecticut where the fish were once eliminated.

Salmon face wipe-out

Express, 30 July 2001

Salmon rivers and lochs are facing a disease threat that could see an equivalent of foot-and-mouth disease wipe out fish stocks. Plans have already been drawn up by protection officers to poison waters should parasites be found. The warning comes from scientists who have studied the effects of fish drawn from English rivers and introduced to Scottish lochs as bait. Anglers from England have been bringing their own bait, caught in murky waters that pass through industrial towns and cities, and releasing any surplus into Scottish waters, at the end of fishing. A study of Loch Lomond has already revealed four new species have taken hold over the past 15 years, disrupting the loch's food chain balance. One species, the Ruffe, multiplied from a few strays left over by a visiting angler, to over 15,000 just eight years later. Stirling-based fish conservation consultant, Professor Peter Maitland of Glasgow University, predicted disaster for inland waterways if tough legislation is not introduced: "There are already instances where fish have brought in parasites," he said. "None of these live baits is quarantined, and most will have diseases or parasites from some of the murkier waters further south. We could have a virus introduced that would knock everything out. We don't know what there is out there. It is possible for Scotland to suffer as the Norwegians did, with a foot-and-mouth-sized epidemic that required the poisoning of affected waters." Fisheries protection officers at the Marine Laboratory in Aberdeen confirmed contingency plans, to combat the fluke, have been drawn up. Also, the Scottish Executive is preparing a green paper on fishing and protection, the results of which are expected to be published in the autumn.

Some anglers will be able to avoid ban on sale of wild salmon, trout

Irish Times, 3 August 2001

Anglers from parts of Donegal and Louth will avoid a ban announced this week on the sale of wild salmon and trout to restaurants, hotels or shops. The anglers from Moville, Co Donegal, and Carlingford, Co Louth, fish on waterways under the jurisdiction of the Loughs Agency in Northern Ireland. The Salmon and Sea Trout Caught by Rod and Line Prohibition and Sale Order came into force in the Republic on Wednesday and it will operate from January 1st to October 31st annually. It is designed to stop poachers illegally using nets and other methods to catch fish and then selling them off as fish caught by rod and line. The Minister for the Marine, Mr Fahey, said the move was aimed at protecting fragile fish stocks from exploitation. "Conservation of stocks will be aided by reducing the incentive for individual anglers to take large numbers of salmon to sell as a means of supplementing their income," he said. The ban would also reinforce the view that angling should be a recreational activity, not a commercial one. However, the dual system operating in Louth and Donegal has raised concerns that some anglers might use their Loughs Agency fish tags to sell catches poached from rivers in the Republic. The Loughs Agency confirmed yesterday its anglers, including rod and line users in Carlingford and Moville, would still be permitted to sell fish caught by rod and line. The agency's chief inspector, Mr Stanley Thorpe, said there was a possibility some unscrupulous anglers might exploit the dual system to poach fish in rivers in the Republic and sell them as Loughs Agency produce. However, he said mass exploitation of the new law was unlikely, given the level of inspection of the waterways. "Anyone who decided on this course of action would be guilty of an offence and, if caught, could be prosecuted," he said. The Northern Regional Fisheries Board and the Loughs Agency use the same tagging system to mark the origin of salmon and trout. Each tag carries the respective authority's mark. A Buncrana Anglers' Association spokesman, Mr Tony Morrison, condemned the dual system as "a nonsense" and urged the Loughs Agency to adopt the new Department of the Marine prohibition order. "It is ridiculous for some anglers to be able to sell the fish they catch and others just up the road not being able to do so." However, the association welcomed the prohibition order, saying it was one way of preventing illegal net users selling their produce as rod and line.

30,000 salmon and trout killed by farm pollution

Herald, 9 August 2001

Nearly 30,000 fish have been killed following a major pollution spillage in an important river spawning area. Thousands of dead salmon, sea trout and brown trout were found scattered on the banks of a tributary of the River Earn, near Perth. A farmer is now likely to face prosecution after tests revealed the water had been polluted by chemicals used on his land. It is believed that several gallons of agricultural waste was allowed to enter the water having a devastating impact on the wildlife in it. The incident, which witnesses described as "an appalling sight", could affect the eco-balance of several miles of water for the next 10 years. A passer-by initially saw a few dead fish floating on the surface of the Duncrub Burn by Dunning, Perthshire, on Tuesday, July 31. They reported the matter to the Scottish Environmental Protection Agency (SEPA) who arrived to inspect the River Earn tributary the following day. By then, thousands of poisoned fish had been washed up on both banks of the vital spawning ground over several hundred yards. SEPA experts carried out checks to establish the source of the poison and pinpointed it to a single farm nearby. A SEPA spokesman declined to confirm the

source of the pollution yesterday but said a report on the incident would be passed to the procurator fiscal's office in Perth. If a criminal conviction is gained against the landowner, he or she could face a maximum penalty of a £5,000 fine. The spokesman said: "SEPA received a complaint about water quality in the Duncrub Burn near Dunning at 9.05pm on Tuesday, July 31. SEPA can confirm that upon inspection on Wednesday, August 1, around 27,000 fish were found dead. SEPA are further investigating the incident and will be considering appropriate enforcement action which could include the submission of a report to the procurator fiscal." She added that biologists were still testing water samples to find out the total potential impact of the pollution incident. As well as the salmon and trout which died, the poisonous chemicals have affected a number of vital plant species in the water. Witnesses reported seeing hundreds of dead fish floating on top of the water and many had been washed into the main body of the River Earn. The pollution incident has been described as an ecological disaster for the area which would affect other species like kingfishers and ducks. Dr William MacIndoe, chairman of the River Earn Angling Improvement Association, said the devastation of the river's wildlife was heartbreaking. He said: "If this sort of thing continues, the river will eventually become incapable of supporting normal aquatic life."

Salmon to get a lift

Evening Times, 10 August 2001

A famous beauty spot is to be transformed to help salmon who can't jump high enough to reach a spawning ground. Engineers are considering a series of steps at Cargill's Leap to help save hundreds of fish each year. Younger and weaker salmon struggle to overcome the four-metre leap upstream to reach the spawning ground. Last year 1000 dead fish were taken from the water below the tourist spot. Now a team based at Strathclyde University is working on models to make Cargill's Leap easier to negotiate for less developed salmon. The EnviroCentre team are working with the co-operation of Sir William McPherson of Cluny, the retired High Court judge who conducted the Lawrence inquiry and has the Leap on his estate. Team member David Hay said they'd looked at methods of slowing the pace of the water. He said the scheme could include raising the water level at the foot of the Leap or creating a series of "steps" for the fish. "Other than mature fish, the height of the waterfall is such that the salmon struggle to get upstream for breeding and laying eggs," said Mr Hay. "There's good habitat upstream for the fish but younger ones are trapped in the lower reaches. It's all to do with the jump height. At the moment it's three or four metres and only the biggest fish can do that. The main thought we have at the moment is to form some intermediate pools so instead of one big jump they can go up in stages. If it was around or below a metre at a time it will be a lot easier for the salmon." Initial research is being funded jointly by the Tay Foundation and the Tay Salmon Fisheries Board and a report will be submitted within a month. Cargill's Leap crosses the River Erich near Blairgowrie, Perthshire, and was named after 17th century covenanter Donald Cargill. There was a price on his head when he made a secret visit to his parents and was spotted in Perth and followed by dragoons. He was chased to the water's edge and knew from his childhood that the river could be jumped safely at its narrowest point.

Several rivers in Maine near, at record lows - Situation bad for salmon, berries

Bangor Daily News, 13 August 2001

Thanks to several weeks of hot, dry weather, Maine's rivers are at or near record low levels, and that's bad news for blueberry growers and Atlantic salmon. On Sunday afternoon, the flow of water in the Penobscot River tied the lowest flow rate that had ever been recorded on Aug. 12. Five of the eight rivers that are home to endangered wild Atlantic salmon had record low flow rates. The number of years flow records have been kept by the U.S. Geological Survey varies by river. On some rivers records have been kept for less than a decade and on others it's been more than 100 years. Sunday's flow on the Narraguagus River in Washington County, for example, was 26 cubic feet per second. The previous low recorded on that date was 32 cubic feet per second. Records have been kept on this river for 53 years. In midcoast Maine, the flow of the Sheepscot River on Sunday afternoon was 12 cubic feet per second, below the previous low of 14. Both rivers are home to Atlantic salmon populations that were put on the federal Endangered Species List last year. The Penobscot River in West Enfield was flowing at a rate of 3,300 cubic feet per second, tying the lowest level recorded for Aug. 12. The Penobscot has been monitored by the USGS for 98 years. "In some cases, we're setting daily flow records and we're not expecting any relief," said Bob Lent, district chief for the USGS in Maine. He said the situation is expected to worsen because river level typically drops in the last couple weeks of August, which are usually the driest of the summer. The only parts of the state where rivers are not at record low levels are in extreme eastern Washington County. In the Dennys River, another salmon river, for example, water was flowing at a rate of 50 cubic feet per second, well above the record low of 15. Flow in the St. Croix was also well above record lows. The low river levels mean less water is available to irrigate the State's wild blueberry crop. "We don't have as much water as we need with this type of weather," said Dave Bell, Executive Director of the Wild Blueberry Commission of Maine. Three weeks ago, blueberry growers were predicting a near record crop of 108 million pounds. That was before the hot weather set in and the rain stopped falling. Now harvest predictions are likely to be revised downward. Because of the drought, some fields owned by Jasper Wyman & Sons in Washington County simply won't be harvested because the berries have withered, said Fred Olday, the company's director of farm research. On Friday, the company did not know how many barrens would remain unharvested. Because wild Atlantic salmon in five Down East rivers have been declared an endangered species, water withdrawals from them are limited. Large blueberry growers have been moving to irrigation systems that use wells and storage ponds to reduce their reliance on river water. But the companies still take water from the rivers, when it is permissible, to refill their supplies. Wyman, for example, takes water from the Narraguagus to replenish its storage ponds. It has been allowed to take water from the river only three times since June 27. "We try to be good corporate citizens. We

don't want to negatively impact the salmon," Olday said. But not being able to take river water means fewer, smaller blueberries for the company. The company is not now able to water some of the fields that will bear fruit next year. Those fields are drying up, so next year's crop may well suffer from this year's lack of water, Olday said. The biggest problem, he said, is not with federal regulators trying to protect wild salmon, but with camp owners who don't want lake levels to drop so that blueberry fields can be watered. Both Wyman and Cherryfield Foods Inc. are allowed to withdraw water from Schoodic Lake, which is north of Cherryfield and Harrington. Since the lake is partially in unorganized towns and an unorganized township, different portions of the lake are governed by different regulations. Cherryfield Foods takes water from the side of the lake that is regulated by the Land Use Regulation Commission. Because of the lack of rainfall, it has been told by the agency to stop withdrawing water from the lake. Wyman's withdrawals from the same lake, on the other hand, are covered by Department of Environmental Protection regulations. Although the company has not been told to stop pumping water out of the lake, it has done so because some camp owners have complained to the DEP about low water levels. "Camp owners should be more sensitive to our needs," Olday said, noting that some exposed shoreline is less of a problem than a dead blueberry crop. Despite concerns that the hot, dry weather will harm them, the state's small population of Atlantic salmon has not been dramatically affected - yet. Salmon have strategies to cope with warm weather, said Norm Dube, a biologist with the Maine Atlantic Salmon Commission. He said they seek out cold pockets in streams and rivers and will burrow under rocks to keep cool. Still, "not every salmon will escape this type of weather," Dube said. Ken Beland, another biologist with the salmon commission, said there have been reports of dead juvenile fish. The full impact on salmon won't be known for several weeks, said John Kocik, director of salmon recovery for the National Marine Fisheries Service. It is possible that fewer salmon were born this summer, but it is too early to count them because they are still too small to be caught. Such counts will be conducted in late August and September. On the positive side, the warmer weather sometimes means that fish returning to their native rivers remain in the colder seawater longer. This means that more fish will come back to Maine later than usual. "There is reason to be optimistic," Kocik said. On Sunday afternoon, the flow of water in the Penobscot River tied the lowest flow rate that had ever been recorded on Aug. 12. Five of the eight rivers that are home to endangered wild Atlantic salmon had record low flow rates. Because wild Atlantic salmon in five Down East rivers have been declared an endangered species, water withdrawals from them are limited. Large blueberry growers have been moving to irrigation systems that use wells and storage ponds to reduce their reliance on river water. But the companies still take water from the rivers, when it is permissible, to refill their supplies. The full impact on salmon won't be known for several weeks, said John Kocik, director of salmon recovery for the National Marine Fisheries Service.

Salmon bonanza in 'dirty' city river

Evening Times, 13 August 2001

Freak weather sparked a salmon stampede at what was once one of Scotland's most polluted rivers. An incredible 32 fine North Atlantic Salmon were hauled out by children and stunned anglers at an inner-city stretch more familiar with oil drums and old boots than prized fish. As news of the bonanza quickly spread, the banks of the River Kelvin in Glasgow were thick with anglers seeking Salmon Galore. Doug Brown, Secretary of the River Kelvin Angling Association, said: "This has never happened before. We've heard of one or two being caught in a good year, but 32 salmon during a two-week period is a phenomenon." The sporting value of some of the fish - as big as 6.5lb - could be up to £2500, making the £10-a-year fishing permit on the Kelvin the bargain of the century. Most were hooked by schoolkids enjoying the holidays and the jobless keen to pass a few hours at the Bishop's Mill, adjoining the Kelvin Hall in the city's west end. Mr Brown said the freak catch was the result of several factors coming together at one time. Unseasonably heavy rain in July placed a layer of fresh water on the top of the Rivers Clyde and the Kelvin and the water was cleaner due to a massive sewage plant closure project by West of Scotland Water. North Atlantic Salmon at the mouth of the Clyde smelled the extra fresh water supply and swam towards it. Lord Provost Alex Mosson hailed the huge catch as further proof the city is shedding its grimy image. He said: "A couple of years ago, someone claiming to have landed salmon in Glasgow city centre would have been laughed out of town."

Tide turns in favour of salmon as Severn estuary fishermen face ban

Financial Times, 17 August 2001

The centuries-old tradition of fishing in the mudflats of the Severn estuary may have taken place for the last time yesterday as its summer season ended. The ancient practice is under threat from the Environment Agency, which is considering a 10-year ban on the Severn, Wye and Usk rivers to conserve dwindling salmon stocks. The last 30 or so fishermen, whose techniques have been passed on from father to son since the Middle Ages, say such a ban would finish them off for good. "This is a vitally important bit of heritage; what we are arguing is that the Environment Agency should consider other options," says John Powell, the fishermen's spokesman. Fifteen fishermen have licences for "lave net fishing", which means they tramp through the muddy shores of the river, scooping out individual fish with their nets. Chris Cadogan is one of the six with licences for putchers - ranks of baskets stretched out on the mud flats. Mr Cadogan rises every summer morning at 5am, pulls on his rubber waders and drives down to the banks of the Severn, where he spends up to three hours checking his nets. His row of 800 conical baskets faces the outgoing tide, so that fish are stranded as they swim back out towards the sea. Balancing precariously on the wooden structure, he clammers out across the strong currents of the estuary, examining each metal basket one by one for salmon, mullet, mackerel and flat fish. "I can't swim," he admits. "Not that it would make any difference if I could, no one could swim in this current." Sometimes he does not catch a single fish, despite spending three hours or more perched on the rickety edifice. In the old days, the

sea was teeming with a multitude of fish, but now they are few and far between. But the fishermen say they are not to blame. "It is the Spanish out at sea with their electronic gear and miles and miles of netting. They could block the entire estuary off if they wanted," says Mr Cadogan. "This estuary is two miles wide, and my nets are only 30 metres long." The Environment Agency insists that it is looking at a number of options in its attempt to save the Atlantic salmon, having recently shortened the length of the fishing season to three months. "By doing this we will protect salmon fishing long term," the agency says.

Ghillies lead battle to save the Tay's salmon

Evening News, 18 August 2001

Forty ghillies, half of the total employed on the river Tay, have formed an association in a bid to halt the continued drop in salmon stocks. Three years ago, a campaign was launched to raise funds to halt the decline of the river's valuable assets. In this short period they have raised £40,000 nearly half of which has been spent at the hatchery at Almondbank. So far two holding tanks and 26 hatching troughs have been bought to increase the restocking programme. The huge tanks will allow 200 extra kelts (salmon after spawning) to recover each year. The hatching troughs will more than double the total capacity, with, in theory, the capacity for over 1,300,000 eggs to be hatched annually. The smolts or young fry can then be released into the Tay, Tummel, Earn, Isla, Lyon and Garry to start a new generation of fresh-run fish. Funds are now being set aside for the possible buy-out of the Northumberland drift netters who are responsible for the taking of thousands of fish every year. The Association's ambitious plans to build a second hatchery at Killiecrankie are also well under way. The hatchery will have the capacity to turn out 2,000,000 eggs. The 'grants-for-all' scheme has given enough cash for the purchase of the hatching troughs which are under construction, and, hopefully, will be up and running by the end of the year. With the Tay's salmon industry estimated, with tourism, to be worth around £15million annually, much more needs to be done to preserve its natural heritage. Cheques are pouring in from all over Europe and the UK, and the ghillies are actively encouraging anglers to be a little more conservationally minded, not by mandatory catch and release or blanket bans, but in their attitude to the amount of fish they take. They are calling for a voluntary return of fish, or for them to be handed over to the programme at Almondbank.

Super-salmon: Part One: It grows more than 400 per cent faster than a wild salmon and at the end of a year is six times larger. If it makes it through the regulatory hurdles, it will be the first transgenic animal on North American dinner plates

Ottawa Citizen, 19 August 2001

Fortune, P.E.I. - Back before his super-salmon became the most feared fish on the planet, biologist Garth Fletcher would offer visitors free tastes of its genetically modified, fast-growing flesh. Politicians and journalists, mostly Americans from programs like 60 Minutes and newspapers such as the Washington Post, would arrive at his Aqua Bounty Farms and dine on smoked salmon on rye, prepared on the premises. "They'd stand around in tight groups gorging on fish and nodding at each other in enjoyment. They were always impressed with the taste," Fletcher says. He hoped they would return home to report that his salmon, which contained a gene from an ocean pout, tasted just like any other salmon, maybe even better, and that it wasn't the mutant people feared. Sometimes they did. Just as often, however, the salmon were billed as insatiable and unstoppable "Frankenstein fish." Imagine the leitmotif from the movie Jaws, the Da-da, Da-da, Da-Da, but instead of great white shark, think super-salmon. Still, Fletcher felt the taste test was the best way to allay fears about a scheme that seemed so fishy. But today, even before we're within a fishing-pole length of the deep green fibreglass tanks filled with salmon, Fletcher warns that this is a look, but no taste, visit. Health Canada cracked down on the tasting tours many months ago because it felt Fletcher shouldn't advertise fish that hadn't been approved for sale in Canada. Free samples were advertising. So there will be no sushi, no smoked salmon and no sneak preview. "But I can assure you, they taste just the same," he says, almost warily. Fletcher, a lanky, 65-year-old scientist with a soft Scottish lilt to his voice, shakes his head at the controversy surrounding his transgenic salmon. "Genetics used to be a fun business. We used to dream of how we could make animals and food production better. But that was before the backlash." The soft-spoken, yet highly driven scientist speaks of the "backlash" with some shock and naivete, as though he finished his scientific work, stuck his head out of the lab door, and was stunned to learn that the world wasn't quite on his side. Scientists are often accused of driving ahead with their "noble" ideas that they believe will benefit humankind, even when humankind isn't ready or doesn't want the so-called advances. Fletcher is in this position. Scientifically, the AquaAdvantage salmon, as it's been dubbed, is a marvel. In the first six months of life, an AquaAdvantage salmon grows so fast it weighs a whopping 100 grams, while a non-transgenic salmon of the same age weighs only 10 grams. At the end of one year, the transgenic salmon is six times bigger. The increased growth means the fish is ready for market a year sooner than domestic fish farm salmon. If it makes it through all the regulatory hurdles, it will be the first transgenic animal on North American dinner plates. Once it's approved, others will follow: chicken designed to resist illness-causing bacteria, beef that can grow twice as fast on less feed or the pigs recently engineered at the University of Guelph to produce manure that contains only a quarter of the phosphorus found in regular pig droppings. Research is under way worldwide to genetically modify at least 25 aquatic species, ranging from flounder and carp to lobster and shrimp. Inventors the world over are watching to see what precedents are set by the super-salmon as it goes through the regulatory process in the United States, and eventually Canada. Foes say the risks are considerable. The biggest concern is that AquaAdvantage salmon will escape into the ocean, mate with wild salmon, and eventually displace them. The application to bring the fish to market in the United States led to numerous protests, with 60 environmental and fisheries groups calling on the U.S. Food and Drug Administration and four other U.S. government agencies to put a moratorium on genetically modified fish being kept in

ocean pens. The inventors and supporters in the bio-tech industry, however, say a fish that goes to market a year faster will dramatically cut costs and lead to more efficiency and less waste. It will also spawn a revolution in food production. Both groups are so polarized it's difficult for consumers to determine what is believable, and reasonable. As governments weigh the risks against the benefits, the stakes are especially high. Both wild Atlantic salmon and some species of Pacific salmon are depleted or even officially endangered - the result of decades of overfishing and habitat destruction. Is this technology setting a dangerous precedent? What will AquaAdvantage do to wild salmon stocks and other marine systems if it escapes into the open ocean? What does altering this one gene do to all systems in the fish, its breathing and its mating behaviour? Does the need for more efficient food production outweigh environmental concerns? The debate is clouded with unknowns. Our conclusions about AquaAdvantage will determine what food we eat in the very near future. Aqua Bounty Farms is a soft-grey building with a gleaming blue tin roof, overlooking Fortune Bay on P.E.I.'s east coast and backing on to a farmer's field. In early July, the potatoes shoot up through the earth. Fletcher glances at the field and frowns. Ever since McCain Foods bowed to public concerns two years ago and stopped using potatoes genetically modified to repel potato beetles, he says farmers are spraying more. "They just douse the fields with pesticides now," he says. With Fletcher, everything is a lesson about why genetically modified plants and animals are more beneficial than a Greenpeace campaign leads consumers to believe. For the past decade, with the help of some private backers, he's travelled the globe, from New Zealand to China to Scotland, pitching his genetically modified salmon. He's become the man to watch at scientific conferences. Today he was in P.E.I., earlier in the week he was in California and B.C. I first met him three weeks before at a biotech conference in Ottawa where he met senior fisheries bureaucrats about regulations being drafted to govern genetically modified marine life. He motions toward the Aqua Bounty Farms sign on the front lawn. "I'd considered removing the sign," he says, "so it just looked like a farm house but the Greens obviously already know we're here." Inside, Aqua Bounty Farms couldn't be more different from a farm house. The air is thick with mist and it's very cold. Through the dimness are the outlines of dozens of tanks, each filled with salmon at a different stage of development. Fletcher estimates there are 10,000 salmon swimming in the tanks. In one tank, brothers and sisters battle for food, creating a froth. Some have inherited the growth-hormone gene, others haven't. The fry without the gene are the size of the tip of a pinky, while those with the gene are already a full-finger length and growing fast. The fast-growing salmon do indeed look handsome. They are slate grey, bulky and huge. Fletcher subscribes to the modern mantra that size matters, at least when it comes to crops and livestock. Broiler chickens are forced to grow so fat, so fast, they are ready for slaughter at just six weeks of age. Their legs snap under their weight, and if they're not slaughtered, they frequently die of congestive heart failure because their hearts and lungs haven't kept pace with their plump bodies. You've heard of the turkey baster? The Thanksgiving gobblers are now so rotund that they can't mount to reproduce so it must be done artificially. If our babies grew the way we force our chickens and turkeys, one estimate has infants weighing 1,500 pounds at five months of age. These colossal chickens and tubby turkeys are apparently a triumph in a hungry world. They are products of breeding programs where the scrawny and slow growers are repeatedly weeded out, and those with the most impressive growth are mated. We've expected the same, perhaps not as dramatically, from beef cows, pigs and fish. All their growth cycles have been manipulated through years of cross-breeding. Genetic modification promised to do the same thing, except faster. While the use of cross-breeding may only increase the size of each generation by 10 or 20 per cent, adding in a growth hormone gene from another species might cause the fish to grow to optimum size in one generation. "What would take 100 years through selective breeding, we thought we could do in one step." Or so Fletcher hoped. Fletcher grew up among fish and fishermen. Originally from Scotland, his family moved to Canada's west coast where his father managed a frozen fish plant in Prince Rupert, in northern B.C. As a teenager, Fletcher worked as a fish culler and grader. When he left home, his plan was to get as far away from fish as possible. After earning a PhD from the University of California, Santa Barbara, Fletcher moved to Newfoundland in 1971 to conduct research at the Ocean Sciences Centre of Memorial University at Logy Bay. He recalls being struck by the sea in winter, covered in ice and with water temperatures below zero degrees Celsius. This was not the temperate ocean of his childhood. Fletcher knew that most fish freeze in water at temperatures as cold as those during Newfoundland winters, but that some species could survive. He began studying the freeze protection mechanisms of the winter flounder to discover why it survived in icy northern waters. In 1974, a new researcher arrived at the ocean sciences centre. Choy Hew wasn't a marine biologist but a biochemist researching insulin. He was using codfish but hoped his work would have human applications. His 200 cod shared a tank with Fletcher's winter flounder. One winter morning, Hew learned that his codfish had frozen to death because the seawater had become so cold. Biopsies revealed the fish had ice in their hearts. Hew joked that he was the most popular guy in the centre that day. Everyone wanted to take his cod home for dinner. What surprised him was that there were some fish still swimming in the tank. Why hadn't they died? Fletcher said he suspected the flounder contained some sort of "anti-freeze molecules." That incident marked the beginning of Hew's career in marine biology and a partnership with Fletcher to study anti-freeze proteins, which eventually led to attempts to create transgenic fish. Hew quickly isolated a part of the flounder DNA that acted like a genetic switch. When the fish was exposed to cold, the genetic switch produced anti-freeze protein. Their venture into transgenic animals began in 1981 after a coffee-break conversation between Fletcher and Arnold Sutterlin, who was the salmon aquaculturist at the centre. Sutterlin lamented that for the past several years the sea water temperature had actually declined in the maritime regions, posing a threat to salmon farms. Atlantic salmon cannot tolerate freezing temperatures, which is one of the major obstacles to salmon farming in Atlantic Canada. Fletcher wondered if it was possible to produce freeze-resistant salmon by transferring the anti-freeze gene from the flounder to the salmon. About that time the first transgenic animal, a big fat mouse infused with a growth-hormone gene, was celebrated on the cover of *Nature*. "Maybe we were naive," recalls Fletcher, "but we all thought we could do gene transfer with fish." By 1985, they had produced the first transgenic salmon, but it wasn't the success they'd hoped. The salmon possessed the anti-freeze gene, but it didn't produce enough anti-freeze protein to make a significant difference to

its survival in cold water. Perhaps they would have better success making the fish grow larger than normal. They took a genetic on-switch from a cold-water fish called the ocean pout and this time attached it to a salmon gene that produces a growth hormone. The researchers wanted to see if this on-switch could govern more behaviour than just turning on anti-freeze protein. Then, they inserted the combination into fertilized salmon eggs. The result was a salmon with a genetic switch that appeared to stay turned on, producing a continuous supply of salmon growth hormone that, in turn, sped up the fish's development. Although the scientists hoped they could grow the largest salmon the world had ever seen, they quickly learned that their transgenic fish never reached a mature size that was larger than conventional fish farm salmon. They grew much faster, four to six times faster, but in the end they were the same size. In 1992, just before they published a paper about their work, Fletcher recalls speaking about the discovery at an international conference. "I joked about our big fish, but no one believed me. They all told me they were accidents in our tank, not the real thing." Fletcher chuckled at their disbelief. He knew he had the real deal. Scientists are a surprisingly competitive bunch. They clamour to be first to be published and claw for cash. Fletcher had always been irked by the mild-mannered Canadian way of doing things. He believes he is rare among Canadian university researchers or government scientists who have typically stood by as their employer or a private company licenses their ideas and reaps the potentially enormous benefits. Fletcher wanted to take his idea and make it succeed on his terms. By 1993, he found a business partner who began raising "angel money." Hew moved on, but retained shares and a directorship in the company. Sutterlin agreed to run the experimental fish farm and develop an infertile fish to deal with the inevitable environmental concerns. In order to generate cash and spread the technology, the company licensed the technique to a New Zealand company. Fletcher flew there in order to train a person on how to breed the fish. "The Green Party created a stink, alleging that our facility was set up in secret, which was totally not true," he says. The plant eventually went broke. They also performed gene injections in Scotland. Despite being closely watched by regulators, "people were so upset with us," says Fletcher. "We were in trouble from the Greens and the government. They kept requiring more and more permits. We had these beautiful fish, they were better than what we've done here." Sutterlin told a Scottish newspaper: "I am finished with Europe and the European media. Between you and Greenpeace you have damaged us very badly. Television people came here and ate a 20-pound smoked GM salmon and said they thoroughly enjoyed it. Then they went back to England and slaughtered us." Fletcher decided to concentrate efforts on the United States and Canada. Last year, his company began going through the approval process of the American Food and Drug Administration to produce and sell the fish. In Canada, Aqua Bounty has not applied for regulatory approval. Currently, their operations are governed by Environment Canada, while Fisheries and Oceans Canada is drawing up regulations, expected this fall, to govern production of these fish. Iola Price, Director of Aquaculture for Fisheries and Oceans Canada, would not comment on the content of the regulations but said any company seeking approval might have to prove their fish were sterile as one of the requirements to raise them in ocean pens. In the U.S., the FDA made the unlikely decision to judge AquAdvantage not as a food, but as an animal "drug," because the gene is added to the fish, in the manner of a drug, to change the animal's growth rate. The fish isn't expected to pose any danger to human health, so much of the FDA's assessment will involve assessing environmental risks. Aqua Bounty must conduct numerous studies, including one proving the fish do indeed grow faster. They have to provide a complete nutritional breakdown of the fish, show it doesn't cause allergies in consumers, and prove the fish can be rendered infertile. If approved, salmon farmers who purchase eggs from Aqua Bounty may need approval from the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, which have recently voiced opposition. The whole process could take a number of years. It seems impossible to weigh the risks and the benefits of this technology when the necessary experiments are so risky. Transgenic fish would have to be released at the head of a stream and researchers would have to trace their various effects as the fish travel down the river, move into the open ocean, then fight back up the stream to spawn. Fletcher has frequently listed the benefits he sees: the AquAdvantage is ready for market a year earlier; it will save production costs; this will lead to other transgenic products with similar efficiency. He also believes it will boost the Atlantic provinces' economy because people will develop specialized knowledge. Opposition is considerably thinner than it appears, he claims. Hype or hysteria get press. His firm is frequently contacted by international salmon growers to see when the AquAdvantage will be approved. But how can he say this fish is needed? Currently, 60 per cent of the salmon produced in the world comes from fish farms. There is so much, salmon prices have plummeted. Why does salmon need to get to market faster? Fletcher shrugs. "Forget the glut. There is a continually growing market in places like Norway and Chile." With salmon prices so low, fish farms need to cut costs further. His fish will do that, he says. Fletcher also maintains - and this is crucial to his arguments in favour of AquAdvantage - that they pose fewer risks than domestic, non-GM fish being used in fish farms around the world. He says domestic fish have been bred to grow fast and grow large and therefore pose all sorts of risks to the wild stocks, but they are not infertile. "Our fish are infertile." This means that they cannot mate with wild stocks. The threat to wild stocks is the major concern among Greenpeace and other environmental groups, who frequently cite the so-called "Trojan Gene" effect. A study by scientists at Purdue University in Indiana estimated that if 60 fertile GM fish escaped into a wild population of 60,000, the stock would be decimated in 40 generations. Critics don't believe that Aqua Bounty's GM fish will be 100-per-cent infertile. A biologist at the University of New Brunswick found that when he attempted to induce sterility in 450 Atlantic salmon, it couldn't be shown that it had occurred in 17 of the fish. That doesn't mean they weren't infertile: scientists just couldn't tell. For Aqua Bounty, this rate of sterility - about 96 per cent - was considered excellent. For Greenpeace, it's considered a serious ecological risk. "This is a rogue company and other scientists are against them," says Michael Khoo, Greenpeace's genetic engineering campaigner, who points out that the American Society of Ichthyologists and the North Atlantic Salmon Conservation Organization have also asked for a moratorium, while numerous fish farmers' associations don't want the fish. Khoo says the world hunger argument is bogus. Salmon are carnivores, so they actually deplete the amount of edible seafood in the world. It takes three to five pounds of fish meal and oil to create one pound of farmed salmon. These sardines, herring or

mackerel could otherwise be fed to people, he says. Khoo says it would be easy to dismiss Aqua Bounty if he weren't so concerned that the Canadian government might actually approve GM fish in ocean pens. Not only does Greenpeace want no transgenic fish in ocean pens, it doesn't want any GM fish used for commercial purposes. Underlying the opposition to the AquaAdvantage application is a growing mistrust of science. In Europe, the public has lost faith in science, as a result of Mad Cow Disease. In North America, people aren't as skeptical, but that could change. If any GM animal or crop approval results in irreversible effects on human health or the environment, the whole GM movement could be damaged. However, the debate is already so polarized, it's difficult for consumers to weigh the risks and benefits. In Canada, a panel of experts, hand-picked by the prestigious Royal Society of Canada, an organization consisting of hundreds of the country's top scientists and scholars, was asked to report on the state of the regulation of food biotechnology. The report was commissioned by Health Canada, Environment Canada and the Canadian Food Inspection Agency, in part to deal with Aqua Bounty's anticipated application to sell transgenic salmon, as well as other GM agricultural products. After analysing the research on the transgenic fish, the report's authors called for a moratorium on rearing transgenic fish in aquatic net pens; instead the salmon should be raised in land-based facilities. It also called for long-term research into the consequences of mixing wild and transgenic fish. Jeff Hutchings, an evolutionary fish biologist at Dalhousie University who authored portions of the report, ended up with many concerns, although he claims to have been neutral at the start. "I've seen these fish. They're like overheated engines. They're always moving. You've got the food costs, you've got the antibiotic costs. I'd really like to know what the economic benefits are of transgenic fish?" The report's authors also looked at the experience with non-GM fish raised in fish farms, which showed escapes do happen - last year in Maine, for example, 100,000 salmon escaped from a farm. Escapees have successfully spawned in rivers on both coasts and their progeny have lower survival rates than wild salmon. The report's authors also question whether transgenic fish can really be rendered 100 per cent infertile. Instead of informing the debate, many scientists wrote to the Royal Society and various newspapers claiming the report was a "Greenpeace hatchet job" and an "opinion piece". The authors were roundly criticized for focusing on studies that showed GM fish had deformities, and not mentioning that subsequent studies showed these deformities can be weeded out of the gene pool. The authors were also blamed for not looking at the benefits of transgenic crops and animals, particularly the claim that they will bring a dramatic increase in food production efficiency. Hutchings countered that it wasn't the panel's mandate to look at economics. The whole thing was a mess, the panel was disbanded and the call for a moratorium has not been acted upon. Those Canadians hoping to decide whether AquaAdvantage is a risk worth taking are still no further ahead. The answer, or at least the best guess, may come from a government lab on Canada's west coast where the chief investigator's opinions are enlightening.

Salmon galore after farmed fish break loose

Daily Telegraph, 29 August 2001

It had the flavour of Compton MacKenzie's Whisky Galore!, in which thousands of cases of the hard stuff drifted from a shipwreck to be washed into the arms of delighted Scottish islanders. After a mishap at a fish farm off the coast of Co Antrim, shoals of valuable salmon swam up the Glenarm and on to the hooks of massed anglers. But it was no sport as the farm-bred salmon, accustomed to being hand-fed rather than hunted, were landed with a minimum of effort. So easy was the exercise that even small boys were comfortably pulling out fish of up to 12lb. Christopher Matthews, 12, from Carnlough, was thrilled at his catch of two fine-looking salmon. "It was brilliant for me to catch my first two fish but it was all a bit too easy," he said, stressing that he had caught the fish by the legal means of "spinning". Before long, large specimens were being sold at the roadside on Northern Ireland's most popular holiday route for as little as £5 each, a bargain when two salmon steaks in supermarkets cost almost as much. Local fishermen estimated that tens of thousands of salmon had escaped from at least one cage operated by the Northern Salmon Company, although no one from the firm was available for comment yesterday. Despite the short-lived bonanza for locals there were fears that the influx of farmed salmon could ruin long-term game fishing. Frank Quigley, editor of Angling Ireland and past Chairman of the Larne and District Game Angling Association, close to Glenarm, said: "Escapes are always a matter of concern, especially at this time of year. The wild salmon have returned to our shores from Greenland and the Faroes and are now waiting for enough water to take them up the rivers to spawn. The farmed salmon, which have a different genetic strain, will run with the wild fish and the genes will be mixed. We could be left with no pure East Antrim wild salmon." Mannix McAllister, a former Antrim coast salmon fisherman, said: "The fear about such farms has always been that the escapees will run with the wild salmon and affect them genetically, resulting in a loss of the homing instinct and possibly the ruination of wild salmon fishing here." Some game anglers believe that the farming of so many fish in relatively small areas has created new diseases to which wild salmon have no natural defence.

Fortune begins to favour the salmon

Sunday Herald, 9 September 2001

As the Scottish salmon angling world awaits the autumn rains and the cream of the year's fishing, catch reports coming in for the first half of the season are encouraging, if not spectacular. Most rivers have recorded similar returns to last year's improved figures and the summer of 2001 will go down as a success compared with the doldrum years of the Nineties. Few would be brave enough to say so publicly, but there is tentative feeling among the country's fishery managers that, at long last, we could be seeing an upturn in the fortune of the wild Atlantic salmon. Highlight of the early season was undoubtedly the improved numbers of springers seen running the Tweed. "The best we've seen in well over a decade," said one ghillie on a premier beat around Coldstream, which reported more in a single week than the total for the whole of the last spring. June is normally the prime sea trout month in Scotland, but this year it was well into July before

significant shoals left the coast and nosed into their natal streams. The Solway rivers reported particularly heavy runs and the fish found luck on their side as many of the beats were closed when the fish remained fresh and catchable. On the South Esk in Angus, one of the country's most prolific sea trout fisheries, local rods were becoming concerned as the summer nights lengthened and still no sea trout were to be seen. When the fish eventually did migrate, though, it was in pleasing numbers and anglers were rewarded for their patience with some hefty bags. Only last week I was fishing the delightful Brechin Castle beat of the South Esk and saw several silvery fish running through the broken streams. Come July and all eyes were on the West Coast to see if the surprising improvements in last year's grilse run were a flash in the pan or a sign of better things to come. Although some rivers have undoubtedly been rendered extinct following years of fish farming, seal predation and high-seas netting, fortunately, the ones that have not passed this tragic point of no return did sustain last season's growing numbers. The Grimersta system in Lewis, for instance, had its best year since 1973, with one week in early July producing a staggering 98 fish to only eight rods. Later in the month, there were so many salmon the syndicate of owners ordered that fishing should be temporarily ceased for fear of foul-hooking them, until the bulk of the run had spread themselves upstream. Perhaps the highlight of the year, though, was the reversal in the fortunes of the River Lochy, which spills into the sea at Fort William. Ever since the birth of marine aquaculture in its estuary, there has been a steady decline in returning salmon, to the point that most fishermen had abandoned it as a dead loss. However, huge numbers of grilse and summer salmon reappeared this year and diehards who had not forsaken the Lochy were rewarded, with at least one party of anglers landing more than 60 salmon for their week's fishing. Although these reports augur well for the future, we should be wary of complacency. No doubt the fish farm industry will jump on them to attempt to exonerate themselves in this environmental catastrophe, but we are still nowhere near the numbers seen before they started to pollute estuaries with chemicals and mass escapes of farmed fish.

Salmon company announces support for East Machias weir

Bangor Daily News, 10 September 2001

Contrary to what some townspeople may believe, Atlantic Salmon of Maine supports a salmon weir proposed for the East Machias River, according to the company's environmental officer. Steve Page said he'd explain his company's position on the weir during a meeting in East Machias on Tuesday. Representatives of the Downeast Salmon Federation and the East Machias Watershed Council also will attend that meeting with East Machias selectmen and the town planning board. "We don't believe a fish weir on the East Machias is going to hurt our business," Page said. "We're committed to the idea of containment, and if fish get out of our pens, we'd like to hear about it." The East Machias is one of eight Maine rivers where wild salmon are an endangered species. The purpose of the weir is to keep escaping farmed salmon from entering the river and intermingling with the wild fish. The U.S. Fish and Wildlife Service and the National Marine Fisheries Service - the two federal agencies that listed the fish as endangered - identified the possibilities of disease and genetic intermingling between farmed and wild salmon among the largest threats to the wild fish. Salmon aquaculture pens are found near the mouth of all five Washington County rivers where wild salmon are an endangered species, and federal agencies gave the state \$1.2 million to construct the weirs on four of the five rivers. There already was a fish trap on the Narraguagus River and weirs were constructed two years ago on the Dennys and Pleasant rivers. Construction of a fish trap on the Machias River is expected to take place next summer. The Maine Atlantic Salmon Commission began constructing the East Machias weir in late June, but stopped the project in mid-July when the East Machias code enforcement officer issued a cease-work order on the grounds that the commission hadn't obtained a town permit for work in the shore land zone. The salmon commission applied for a permit, but the East Machias planning board voted last month to deny a permit for the project. The five-member board was unanimous in its decision that the project violated the town's shore land zoning ordinance. The salmon commission has until Sept. 13 to file a request for reconsideration with the town appeals board. Page said he is not trying to influence the decision of town officials other than to explain that his company doesn't oppose the project. Questions about how the weir would affect the salmon aquaculture industry and the jobs it brings to Washington County were among the concerns townspeople expressed during a July public meeting with Fred Kircheis, the Executive Director of the salmon commission. Page said Kircheis asked him to clarify his company's position to the town. The meeting will take place at 7 p.m. Tuesday at the East Machias town office.

Comments sought on Maine Salmon Plan

Environment News Service, 18 September 2001

Two federal agencies are seeking information and comment on the conservation of endangered Atlantic salmon in Maine rivers. The information will help the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) draft a recovery plan for the last population of wild Atlantic salmon in the United States. The endangered Atlantic salmon are found in eight rivers in eastern Maine ranging from the Sheepscot River to the Dennys River. Just 75-110 adult fish in this endangered population returned to spawn in 2000. This was the lowest estimated return in 10 years - less than half the estimated average annual returns of adult salmon over the previous nine years. Preliminary data for 2001 do not show any significant signs of improvement, although the complete picture of this year's returning adults will not be available until later this fall. Atlantic salmon in the eight Maine rivers were listed as endangered under the U.S. Endangered Species Act (ESA) in November 2000. The ESA requires the federal agencies to develop a recovery plan that identifies specific management actions necessary for the conservation and survival of the species, and measurable criteria for determining when recovery is achieved. The plan must also provide time and cost estimates for recovery activities. The recovery plan for Atlantic salmon is being written by staff from NMFS, USFWS, and the Maine Atlantic Salmon Commission. In July, informal meetings were held in Maine to present a preliminary recovery planning approach and to

provide the public an opportunity to review and comment on the proposed approach early in the recovery planning process. A formal public comment period will take place when a formal draft recovery plan is completed, around May 2002.

Salmon panel approves river plan - Blueberry growers face big challenge

Bangor Daily News, 19 September 2001

In an effort to curb the conflict between the needs of blueberry growers to irrigate their fields and Atlantic salmon conservationists concerned about the impact of low river levels on the fish, the State has developed a water use management plan for salmon rivers in Washington County. That plan was approved by the Maine Atlantic Salmon Commission on Tuesday. Federal regulators have long criticized the State for not having a water use management plan in place to ensure that the needs of blueberry growers do not come before those of Atlantic salmon. The federal government last fall declared wild Atlantic salmon in eight Maine rivers, five of them in Washington County, to be an endangered species. After Tuesday's meeting of the salmon commission, Mary Colligan of the National Marine Fisheries Service said the approval of the plan was "a big step." She said her agency was pleased that some blueberry companies have already taken steps to reduce their reliance on water from the salmon rivers. But she said implementation of the plan's recommendations remain a "big challenge." The plan, developed by the State's Land and Water Resources Council, seeks to strike a balance between competing needs. The problem is compounded because the fish need high water levels in the rivers at the same time of year that blueberry fields need to be irrigated. A key to the plan is for growers to use alternative sources of water rather than taking water directly from the salmon rivers. Covered by the plan are the Narraguagus and Pleasant rivers and the Mopang Stream, a tributary of the Machias River. These are the only streams and rivers, of the eight included in the federal endangered species listing, from which water is removed to irrigate blueberry fields. The alternatives include digging wells, withdrawals from nearby ponds or lakes with little or no connection to the rivers and stream, and withdrawing water in the spring, when river levels are high, and storing it for use during the hot, dry summer months. "There's probably enough water out there to meet the needs of the growers," said Henry Nichols, coordinator of the state's salmon conservation plan. "It's a timing issue." He said that skimming water off streams and rivers during spring's high flow would be an attractive option. Joan Trial, the commission's senior biologist, said companies may need to improve their irrigation techniques and equipment to ensure that they are using the least amount of water required. The plan calls for more than \$5 million to provide technical assistance and cost-sharing programs to help blueberry growers improve their water use practices. Congress has already appropriated \$500,000 toward that end through the National Fish and Wildlife Foundation. Dave Bell, Executive Director of the Wild Blueberry Commission, said the cost of moving to alternate water sources is the growers' biggest concern. The state's two largest blueberry growing and processing companies have already largely moved away from taking water from the salmon rivers. Also at Tuesday's meeting, Colligan said the federal government was moving ahead with crafting a salmon recovery plan as required by the Endangered Species Act. While her agency was still drafting the criteria that would have to be met in order for the fish to be removed from the federal list, Colligan said a technical draft recovery plan should be completed by the end of the year. Her agency will collect public comment until Nov. 8 on what information should be included in the plan. The technical draft will be reviewed by interested parties and further refined into a draft recovery plan to be completed by next May. Public comments will again be solicited before the recovery plan is made final by May, 2003.

Science panel tours fish farms - Members are reviewing Atlantic salmon endangered species listing

Bangor Daily News, 21 September 2001

Members of a National Academy of Sciences panel that is reviewing the status of Maine's wild Atlantic salmon got a firsthand look Thursday at the two industries that say they are most threatened by last year's decision to put the fish on the endangered species list. At the request of Congress, the panel is reviewing the decision by two federal agencies to put populations of Atlantic salmon in eight Maine rivers on the list. There is much debate over whether the fish in question are truly wild and worthy of federal protection. Much of the material the panel has considered has been about genetics, but on Thursday members headed to Washington County to see for themselves the region most affected. Five of the eight rivers are in Washington County as are two industries - fish farms and blueberry fields - that are most concerned about the implications of an endangered listing. In proposing the ESA listing, the federal agencies were critical of fish farms because of their potential to spread disease and genes to wild fish, and of blueberry growers for taking water from rivers that are home to salmon. Last year Maine's governor and congressional delegation predicted the "economic decapitation" of the county and the death of the fish farming industry if the listing went forward. On Thursday, the seven panel members who made it to Maine - half the total - saw an aquaculture company poised for expansion and a blueberry industry finding alternative sources of water. The first stop was a fish farm in Machiasport owned by Atlantic Salmon of Maine, the State's largest aquaculture company, where the panel ate salmon fillets. While moored beside a fish pen at Cross Island off Bucks Harbor, the scientists were most interested in how often and why fish escape from the mesh enclosures. Each submerged cage holds 35,000 salmon. Alf Aarskog, ASM's farm manager said no fish had escaped from this site, which has been in use since 1989. However, during an especially bad storm last winter, pens were smashed off nearby Stone Island and nearly 100,000 fish escaped. Aarskog blamed that incident on the federal government because it did not allow the company to replace rigid steel cages with mesh ones that would have been better able to withstand a storm with 120 mile per hour winds. Still, panel member Ian Fleming, a fisheries and wildlife professor at Oregon State University, wanted to know how fish get out of pens, because farm-raised fish are found swimming in the

rivers that are home to wild populations. Aarskog said most escapes are caused by boats with uncovered propellers getting too close to pens and cutting holes in the mesh. This is what happened last fall off Eastport, releasing as many as 13,000 farmed salmon. That pen was owned by Heritage Salmon Inc., not ASM. Another member of the panel, Mart Gross, a conservation biology professor at the University of Toronto, wanted to know why neither the industry nor the government had any good data on the number of fish that escape. "Every time we share information, we get sued," said Sebastian Belle, Executive Director of the Maine Aquaculture Association. "That's a very strong disincentive in this country." Despite such misgivings, Maine salmon farmers earlier this year signed an agreement with several conservation groups to develop better protocols for preventing escapes and for studying the possibility of marking farmed fish so it would be possible to determine where they came from. Industry officials also took issue with the charge their operations spread infectious salmon anemia, a deadly salmon disease that was found in Maine this year after being in New Brunswick for several years. To date, the disease has only been found in farmed fish in North America. Earlier this summer, a fish in the Penobscot River was thought to have ISA, but the test turned out negative. Dan McPhee of Stolt Sea Farms said ISA could just as easily have been transmitted from wild fish to their farmed brethren as vice versa. The reason the disease has been found in aquaculture fish is because they are tested and examined so much, while wild fish are not subjected to routine physical examinations. At the next stop, a small blueberry farm in Whitneyville, the panel was once again reminded that the economy of Washington County is heavily dependent on natural resources. The aquaculture industry contributed \$102 million to the state economy last year while blueberries pumped in \$76 million. But, wondered Jon Sutinen, an economics professor at the University of Rhode Island, how much could a seasonal industry like blueberry farming that relies heavily on migrant labor benefit local people? Lincoln Sennett, the owner of the 150-acre farm on Route 1, said he usually employs 80 people for the month of August. About a third of them come from the area. The rest are migrant workers. While labor is his biggest cost, ensuring he has enough water to irrigate his crops is his biggest headache, Sennett told the members of the panel who are in Maine for three days. "I would have been ruined this year without irrigation," Sennett said. The problem with irrigation is that blueberry growers need water during the hot summer months when rivers are at their lowest. Many growers used to take water directly from the rivers. Under a water use plan approved by the Maine Atlantic Salmon Commission on Tuesday, growers must find alternative sources. The large growers and some smaller ones have already done so. Four years ago, Sennett built a holding pond to collect spring water and rain to use on his fields. He also dug a well. The pond holds enough water to irrigate his largest field, 75 acres, for two weeks. The rest of the water he needs comes from the well. Since he has been irrigating, his harvest has increased by 50 percent, although he also made other improvements to his fields at the same time. While he makes enough money farming so that he doesn't have to hold down another job, he supplements his blueberry income by raising bees and making wreaths. The panel also visited a large commercial blueberry farm, a salmon weir and a federal fish hatchery. Panelists will hold a public meeting Friday afternoon at the Four Points Sheraton in Bangor to gather more information. Public comment will be accepted from 4:45 p.m. to 5:45 p.m. The panel will meet in private Saturday morning to begin drafting an interim report that is due by the end of the year. A more comprehensive report is due in November 2002.

Wild salmon taking a leap into the abyss

Sunday Herald, 23 September 2001

Standing by the famous Falls of Dochart at Killin last week, where the tumbling river spouts over ancient rocks among fragrant pines before its descent into Loch Tay, I witnessed the most magical sight that the Scottish autumn has to offer as a huge red cock salmon leapt suddenly from the frothy white water and hurled itself at the pounding waterfall. As the usual crowd of American and Japanese tourists at this well-known bus tour stop-off reached hurriedly for their Nikons, I stood in silence and marvelled at the driving primal instinct of these valiant wanderers from the high seas. Like sprung bars of silvery muscle, they nose in from the tide and push their way into our turbulent rivers, powering through the rapids and hurling themselves at the roaring falls of upland streams, intent only on reaching the spawning grounds of their birth. As a child, I would be mesmerised by this sight, standing for hours on end at a falls close to home, where the salmon would leap through the brown and leafy torrent of the autumn river. Now tourists are soon to be offered a more sanitised version of this spectacle. Fish farms in Ireland and Norway, in a further bid to improve their damaged public image, are beginning to offer boat trips to visitors out to their marine cages to watch thousands of fake fish flopping around in their pens. The scheme is proving so popular in Connemara, for example, that it is probably only a matter of time before we see Scottish fish farmers follow suit; an idea that will no doubt prove hugely popular with this Government who, for some time now, have seemed intent on turning the countryside into a theme park. What people can possibly see in watching the inhabitants of the marine equivalent of a battery-hen farm is quite beyond me, but perhaps they have never witnessed the true spectacle of the wild Atlantic salmon making their courageous journey. One thing they will not be told though, is how the presence of these fish farms have driven the natural species to near extinction in some areas. The fact that catches of wild fish on the west coast of Scotland have plummeted 91% since 1960 will probably not be in the guidebooks. Nor will they tell of the half a million fish that escape from fish farm cages in this country every year, damaging the genetic integrity of their wild cousins when they invade the breeding grounds on their rivers. The illegal chemicals, untreated wastes and algal blooms that are now suffocating once pristine coastal waters will not be matters troubling their visitors. Take their recent public relations disaster in Shetland, for instance. On the eve of a visit to Shetland salmon farms last month by Scottish environment minister Rhona Brankin, three empty containers of a product called Barricade were found by a fisherman off Scalloway. The lids of the tins had been removed and holes punctured in their sides. The use of Barricade, which is made for the treatment of lice on horses and can have devastating effects on aquatic life, is illegal on fish farms. The Shetland industry's PR machine tried to call foul, but they were left red-faced with their reputation in tatters. Away from all this madness, though, I can recommend a day trip for any sightseers of the wild inclination to head

for Buchanty Spout in Perthshire's Glen Almond this autumn. Should the river be swollen in spate, it is one of the best places in Scotland to witness the true magic of the spectacular leaping antics of the genuine wild Atlantic salmon.

Salmon trial a lice success

Sunday Mail, 23 September 2001

A fish has come to the aid of salmon farmers by eating millions of sea lice - which cost the industry £15 million-a-year. In a £49,000 trial project on the Isle of Lewis, Goldsinny - a type of wrasse - were put in with 700,000 salmon smolts. Now after two years of tests it has been found the wrasse have eaten so many lice that the need to use normal chemical controls has been halved. The trials show it will take 21,000 wrasse to eat the sea lice attracted to 700,000 salmon. The trial will now be expanded to other fish farms.

Encouraging moves to help stocks of Atlantic salmon

Western Morning News, 25 September 2001

For the second year running more fish are surviving to return from sea - providing cautious encouragement for the Atlantic Salmon Trust (AST). There are also signs of progress in a number of salmon management issues. Despite there being a long way to go and a few potential setbacks on the horizon, the Trust is cheered that salmon and other fisheries interests are continuing to work closely together in seeking to influence government to improve a whole range of aspects for salmon and sea trout fisheries. They feel the overall impression is positive. The AST says, after the welcome announcement that the Government would provide financial support for ending mixed stock interceptory netting, the full response to the review group's report was published in January. All but five of the 195 recommendations were accepted in full or in part. However, much was left unanswered as regards funding. Nothing has been done to restore the cut in grant to the Environment Agency (EA) imposed for 2001/2002, and although there is to be a substantial increase from 2003 onwards, the additional £3 million still leaves a very real gap between the cost of the EA's aspirations for executing its fisheries policy, and what it will actually receive. It is nonetheless encouraging that "conservation and restoration of salmon stocks" is included as one of the Government's priority areas. It was also welcome that the Government recognised the objectives of fisheries legislation and reaffirmed the EA's duty to maintain, improve and develop fisheries. Approaches to the management of fish habitats, including the control of pollutants (especially sheep dip), the effects of agricultural support policy and the use of riparian buffer strips, and the impact of forestry were all well stated. The needs for impact assessments for abstraction applications, and for the maintenance of acceptable flow regimes, were recognised. Important issues which remain unresolved include: - The establishment of a single statutory body with responsibility for water quality. - Easier procedures for licensing applications for the control of fish-eating birds. - Realistic funding for research and development. - The control of fish farms and sea trout rivers. Says the AST: "In principle, our concerns over the regulations of fishing have been accepted, including the importance of a real understanding of salmon population dynamics, the proper use of net limitation orders, and, of course, the phasing out of mixed livestock fisheries. We hope that Elliot Morley, who retains the fisheries portfolio in the Department for the Environment, Food and Rural Affairs, will give vigorous leadership to the implementation of the review group's recommendations. The encouraging news of the work of the tripartite working group (set up to develop collaborative action by Government, fish farmers and wild fishery interests, to address the problems caused by salmon farming) is that a total of five area management agreements have now been signed and work is progressing in a number of other areas. Most notably, an "umbrella agreement" for the very complex Lochaber district (including Linnhe, Lorne and the Sound of Mull) has been signed by Marine Harvest and Hydro Seafoods and work is going on to achieve individual subsidy agreements, especially in the Linnhe/Lorne production area. In general these agreements provide for co-ordinated fallowing and stocking to break the pattern of lice infestation and co-ordinated treatments at the appropriate time in the production cycle. Progress is being slowed by the time that it takes to ensure the safety of clearances for the newest and most effective in-feed treatment - one which offers a real chance of eliminating egg-bearing female lice at the time of the smolt run. The Trust emphasises that these agreements are in no way a substitute for effective regulation of the establishment and operation of fish farms, but they have offered a way of making worthwhile progress without waiting for the possibility of legislation. However, the Scottish Executive has been carrying out a consultation on improvements in the regulatory system and the Trust has responded with firm proposals for pulling together the current disjointed system and providing for the enforcement of compliance with effective codes of practice. We await the response. Despite the impression given in a television documentary, the Executive has formally accepted the problem posed to wild fish by sea lice levels in farms, although the question of a full inquiry into salmon farming and its effects, for which there is widespread support, remains unresolved at this time. The Trust stands ready to give evidence to whatever enquiry eventually transpires. Work continues to prepare support for salmon and sea trout stock restoration, once conditions for wild fish have improved. A detailed study on the feasibility of a central supportive breeding facility is nearing completion, and a system for providing advice and technical support for local restoration projects will be developed.

40,000 acres eyed to protect salmon habitat - Cost of Machias River easements, land buys could total \$25 million

Bangor Daily News, 26 September 2001

Federal officials announced Tuesday they are contributing \$2 million toward the purchase of a 22,000-acre conservation easement from International Paper Co. along the length of nearly all of the Machias River in order to protect habitat for wild Atlantic salmon. In addition, the State will purchase 18,000 acres near the river from International Paper to ensure

that the Machias River and its tributaries continue to provide habitat for salmon, which is on the federal endangered species list, and other rare plants and animals. The total cost for the project will be between \$15 million and \$25 million. The rest of the money will come from the State and Federal governments, the Land for Maine's Future program and private sources. Officials said they didn't know the specific breakdown for each funding source on Tuesday. The Machias, one of eight Maine rivers included in the federal salmon listing, is home to a fifth of the remaining spawning grounds for wild Atlantic salmon, according to the U.S. Fish and Wildlife Service. Last year scientists estimated only 45 wild salmon returned to the river to spawn. "When completed, this project will permanently protect 86 percent of Atlantic salmon habitat in the Machias River System," said Mamie Parker, Acting Regional Director for the service's northeast region. The agency announced the \$2 million grant to the State of Maine during a press conference in Portland on Tuesday. The grant is part of \$17 million to be parceled out to 25 States to promote the conservation of endangered and threatened species. Maine's grant is one of the biggest. The area to be protected is in Washington and Hancock counties, stretching from Whitneyville to the top of Third Machias Lake. It covers about 40 miles of river and tributaries, said Stewart Fefer, the agency's Gulf of Maine project leader. The easement and purchase only involves land owned by IP so the entire watershed is not included, Fefer said. It also includes land between Fourth and Fifth Machias Lakes and along the West Branch of the Machias to Lower Sabao Lake. On other branches of the Machias River, the protected area runs along Old Stream to First Lake and along New Stream to First Chain Lake. The purchased land will be managed by the Maine Department of Conservation. The Maine Atlantic Salmon Commission will hold the easement on the other land. Cutting will be restricted near the river and its tributaries to ensure that sediment does not end up in the water, and that water temperatures are not increased because too many trees are cut. In addition, no development will be allowed in the protected areas, but recreation will continue to be allowed. Fefer acknowledged that State regulations already limit cutting near water bodies and that IP has done a good job of protecting the river, but he said forestland is often sold and laws can change. The easement and purchase will forever ensure that the land is properly managed, he said. While this is the largest salmon protection project in Maine to date, \$11 million in private funds and \$2 million federal funds have already been spent to protect 8,000 acres of habitat on the other protected rivers. The Nature Conservancy is helping with easement negotiations and may help with fund-raising, Fefer said. He said other salmon rivers, especially those in IP's ownership, are being considered for similar protection efforts. Asked if his agency would like to see all eight rivers protected, he said: "It is a hope." Not everyone thinks that having the State own the riverside land is such a good idea. "The State never takes care of the land they own," said Nathan Pennell, the Secretary of the Machias River Watershed Council, a group formed to help implement the state's salmon recovery effort. Plus, the State "locks out local people" who seek to use its property for recreation. Pennell said IP was doing a good job of managing the land, and there is no need for state ownership. The money spent to buy the land could be better used by the watershed council to undertake specific projects to restore and protect salmon habitat, he said. Pennell acknowledged that not everyone on the council felt as he did, and some members are very pleased the land will be acquired by the State. In fact, the council's president was one of the speakers at the Portland press conference in favor of the deal. Pennell said he was also concerned that the purchase of land by the state meant a move away from letting local watershed councils call the shots on how the rivers should be protected. "It's the end of the world as far as the watershed councils are concerned," he said. Fefer said the watershed council will remain important and will play a major role in monitoring activities on the river. It is unclear how the purchase and easement could affect plans by Bangor Hydro Electric Co. to build a new power line across eastern Maine. The line is proposed to cross the Machias River just south of Second Machias Lake. IP has objected to Bangor Hydro's plan and has proposed that the line follow the Stud Mill Road, a private dirt logging road and cross the river in the same spot where the road and a gas pipeline cross it. The Natural Resources Council of Maine wants the line to go much farther north to avoid the salmon rivers entirely. The Maine Board of Environmental Protection will resume a hearing on the line location next week.

Concern over salmon despite rise in catches

Scotsman, 27 September 2001

The number of wild salmon caught in Scotland last year rose by 44 per cent, but catches are still among the lowest for half a century. The figures were released by the Scottish Executive which warned that, despite the increase, they still represented the third lowest level since records began 50 years ago. Rhona Brankin, the Fisheries Minister, said the low-level catches were still a "particular worry". She said: "While I welcome the increase in catches, they still give me great cause for concern. This situation clearly shows a need for ongoing action." Ms Brankin urged fishery managers to use the opportunities put before them under the Salmon Conservation (Scotland) Act, introduced by the Executive this year. Ms Brankin said: "This legislation aims to ensure sustainable management of what is one of our most precious resources." The total weight of wild salmon, 76.2 tonnes, was the second lowest on record. The number of sea trout reported caught and retained in 2000 was up on the 1999 catch by 14.7 per cent. The total weight caught was 46.8 tonnes, a 31.6 per cent increase on the 1999 figures. Compared with 1999, catches taken by anglers, including catch and release, were up by 18 per cent.

Salmon poachers targeted in region

Northern Echo, 28 September 2001

A clampdown is planned on salmon poachers in a bid to protect the fish as their numbers increase in the region's rivers. Specialist teams from the Environment Agency are to carry out extra checks along the Ouse, Ure, Esk and Tees over the next two months. Surveillance cameras have also been set up at key locations along the waterways in an effort to spot the

poachers at work. "It is important to stop the illegal capture of these wonderful fish, so they can go on to produce the next generation," said fisheries team leader John Shannon yesterday. "Numbers are finally increasing in the Ouse system, but only very slowly, and if we want this rosy picture to continue then these fish must be allowed to reach their spawning grounds." He said: "We're keeping a close eye on the waters and taking a strong line against anyone caught poaching salmon and sea trout. We ask legitimate anglers to return any fish caught to the water unharmed to continue their journey." The trout fishing season ends this weekend while the salmon and sea trout fishing season continues until the end of October. Moves are also under way to renew the River Esk Tideway Bylaw, which restricts fishing and is due to expire in February. It was introduced in 1987 to reduce the adverse effects of both legal and illegal fishing on the tidal stretch and was renewed for five years in 1987. The Agency says the by-law has produced significant results during the past 14 years and needs to be retained as there has been a rise in the number of sea trout and a levelling out in the decline of salmon stocks. Fisheries, ecology and recreation manager Frank de Planta said: "The Agency's proposed approach safeguards the long-term needs of sea trout and salmon along the length of the Esk. The Esk is a superb river and it is our job to ensure that fish are allowed to return to spawn along their traditional gravel beds upstream of Ruswarp weir."

Note to wild Atlantic salmon - if you ride at night, wear white

Bangor Daily News, 29 September 2001

There's a bumper sticker that reads, "A woman without a man is like a fish without a bicycle." Two quick observations: This gag - attributed to Gloria Steinem - is funny because of the surprising incongruity that follows the expectation of a logical comparison of parallel features, and; men, this is not meant as a compliment. How about this one - "A restoration plan for wild Atlantic salmon without any sense of priorities or regard for the economic condition of the already impoverished region affected by the Endangered Species Act listing is, like, what we've got." No, it's not funny. And, federal and State officials who are responsible for imposing and managing the listing, it's not meant as a compliment. It has been nearly a year since the National Marine Fisheries Service and U.S. Fish and Wildlife held hands and announced that, because there weren't enough wild Atlantic salmon left to feed a smallish family reunion, the species was on the endangered list. The listing covers eight Maine rivers, seven in poor Washington County. The announcement cited escaped fish and disease from salmon aquaculture and the impact of blueberry irrigation on crucial salmon watersheds as the most urgent problems most in need of fixing. Aquaculture and blueberries are the mainstays of the economy in poor Washington County, but, not to worry, the federal agencies said, with the listing come piles of money to help. The first major pile is on the way, and what a pile it is. Some \$15 million to \$25 million is about to be spent, but not, as a rational person might suppose from the above-mentioned urgent problems, to keep penned fish from going over the wall or from sneezing on wild fish, or to slake the thirst of blueberries in a wild salmon-friendly way. It's going to buy land. For fish. Now that's funny. The land is some 40,000 acres along the banks of the Machias River. A federal grant of \$2 million will leverage the rest from a variety of federal, state and private sources (according to the Nature Conservancy, which brokered this arrangement, about half will be public money). Land right along the riverbank will be bought outright and turned over to either the Maine Department of Conservation or the Maine Atlantic Salmon Commission. The rest, a strip about 1,000 feet deep, will be held in a conservation easement, one of those deals where the landowner keeps the land but sells some of the development rights. What could be a pretty complicated deal is simplified greatly by the fact that all of the land being sold and eased belongs to International Paper. It's a sweet deal for that fine Connecticut-based corporation, especially since the easement will stop it from doing what it, by company forestry policy, already does not do and what state land-use law and the Endangered Species Act would prevent it from doing even if it wanted to. Considering that IP bought this land just a couple of years ago, when the ESA listing already in the works and the potential restrictions on cutting trees on the banks of salmon rivers were well known, it's absolute confection. Too bad other businesses don't get a taste. Washington County blueberry growers and fish farmers aren't the sort of individuals who go around asking for help, but they sure could use some. If restoring wild Atlantic salmon is as much a public benefit as everyone says it is, they deserve some. Aquaculture, for example, has to use stronger cages with stronger nets to withstand the storms, seals and other hazards that lead to mass escapes. Sebastian Belle, head of the Maine Aquaculture Association, says this upgrade, already well under way with no public help, could cost the industry \$8 million. Beyond that, there is a very real possibility that the federal agencies will require Maine growers to put an identification tag on each and every fish so the source of escapees can be identified. This is something no other aquaculture industry in the world is required to do and the cost of this and other mandatory operational changes being considered are sure to be enormous. One rationale for the IP deal is that the trees lining the river need to be preserved to provide shade that will keep the water sufficiently cool for breeding salmon. Another is that the buffer zone will prevent silt from clouding the water. There's no denying that lukewarm, murky water is not conducive to salmon reproduction (many humans find it off-putting as well), but a 1,000-foot setback seems a bit of overkill - unless the Machias watershed is home to some very tall trees and highly mobile silt. Silt is a big problem and causing it in an endangered-species river is not allowed. But while one company is about to get millions for not violating the law, there are hundreds, truly hundreds, of water-clouding situations that exist on these eight rivers that could be fixed cheaply if there was money to do them. On just one river, the Narraguagus, there are 130 and counting. Charles Corliss, chairman of the Narraguagus Watershed Council, says they range from a couple of hundred bucks to replace faulty culverts, to a few thousand for such things as fixing eroded banks and moving ATV trails. The individual projects are small, but the costs add up fast, especially in Washington County. Then there's some bigger-ticket items. The council's trying to get the money - \$60,000 - to buy an abandoned store in Cherryfield that sits on major erosion problem right above a stretch of the Narraguagus especially conducive to salmon mating. State assistance was promised three years ago but never delivered. Another erosion site would cost \$40,000 or so to fix, but with no government help, it might as well be a billion. One of the biggest pollution sources on the Narraguagus is Milbridge's salt

and sand pile. A shed would cost \$300,000. Or maybe it's a bazillion. Blueberry growers need help, too. A recent State study found that developing alternative irrigation sources - such as wells, containment ponds and impoundments - could cost \$25 million or so. Many growers already have done a lot of this work, none expect taxpayers or anyone else to pay for it all. On the other hand, the combination of drought and ESA-related restrictions on water withdrawal from rivers and lakes shriveled the crop and cost a lot of people their jobs this summer, just in case anybody in Washington or Augusta is interested. It's quite an incongruity, though not at all surprising, that what started out as saving wild salmon gets turned into a real-estate transaction. There is, however, a benefit to this Machias River deal that goes beyond making one of the eight rivers better for salmon. The federal and state agencies, and the private conservation groups, that put this deal together say the preserved land will remain open to the public and may even get some enhancements for recreation - canoe launches, picnic areas. And for the fish, maybe some bicycle paths.

Scientist: send salmon to school

The Halifax Daily News, 7 October 2001

An Australian scientist is studying an idea that could help school Nova Scotia's hatchery-raised salmon to the rigours of life in the wild. The province's hatcheries will release about 710,000 juvenile salmon into rivers this year. But our salmon population has declined by 75 per cent over the past quarter century. "The principal problem is, if you look at the survival rate of any fish that's been bred in captivity and then released, it's well below five per cent," said Culum Brown, a zoologist studying behavioural ecology at Cambridge University. Cape Breton's Margaree River hatchery, for example, will begin releasing up to 110,000 year-old salmon this week. By Brown's estimate, fewer than 5,500 will still be swimming come Halloween. Hatchery-raised fish spend their formative months in what looks like a swimming pool, "just jammed packed with heaps of other salmon," Brown said. Coddled with constant temperature and light, all they do is eat high-energy fishmeal pellets, he said. Released into the wild, they face a foreign environment. "Suddenly, they've got to fend for themselves," Brown said. With no daily delivery of pellets, the salmon are forced to find their own dinner. "Trouble is, they don't know what food looks like," Brown said. "Most people think that fish, basically, use their instincts - that they know how to forage, they know how to recognize predators, they know what to do when they see a predator. But, in fact, that is not the case. They actually have to learn about these things." So Brown suggests hatcheries give salmon a few lessons before setting them free. Hatcheries could supply young salmon with an occasional meal of live insect larvae, "so they at least recognize that you can eat this stuff." Salmon could also use a self-defence course to protect themselves from predators, Brown said. "They're highly vulnerable to anything that's bigger than them," he said. Birds will feast on hatchery-reared salmon that don't have enough sense to dive when a shadow passes overhead, Brown said. "If you rigorously slap the surface of the water and scare the daylights out of them every time they see some sort of shadow pass over the tanks, that would certainly be a really good way of training them," he said. Hatchery workers could also slip the occasional predatory fish into the tank, "so that they know this thing's going to chase them around," he said. Or they could place a few "sacrificial" salmon behind a transparent and porous screen with a predator fish and let the rest of the school watch. "What happens is they learn very quickly that those other ones get annihilated," Brown said, adding the method could improve hatchery-raised salmon survival rates by up to 85 per cent. "It makes a lot of sense," said Bill Taylor, President of the Atlantic Salmon Federation. "It sounds like he's on to something." Two-thirds of Nova Scotia's 72 salmon rivers are closed to angling because there are too few spawners. Stocking them with smarter salmon may help turn that situation around, said Taylor, a biologist. "We need to bring some new thinking - some more creative thinking - to salmon restoration" he said. "I don't think this would fix the problem on its own, but anything that helps, we would like to pursue."

Conservation pays off for salmon catches

Aberdeen Press and Journal, 11 October 2001

Salmon catches on the River Dee have shown a marked increase this year, according to fishery board members who look after the stretch of water. Dee District Salmon Fishery Board members heard at their recent AGM that the catch from 12 beats had reached 1,411 salmon by the end of August, compared with a five-year average of just 667. Board chairman Andrew Bradford gave the news of the 110% increase, which follows the implementation of a wide-ranging conservation and recovery strategy in the 1990s. Mr Bradford reminded beat proprietors that continued restraint in fishing on the river would be necessary to ensure complete recovery of salmon stocks. He said: "It looks as though this policy (of conservation) is beginning to pay off - for the last three years the river has been full of young salmon. Our stock conservation policy continues, as does work to improve habitat. There is much to do before we can be content that we have done everything possible to restore this wonderful fishery." John Foster, proprietor of beats at Park, was installed as the new chairman of the Dee Board.

Maine rivers stocked with Atlantic salmon

Environment News Service, 11 October 2001

Almost 800 adult Atlantic salmon are being stocked in three Maine rivers this week in a multi-agency effort to conserve and restore wild Atlantic salmon populations in U.S. rivers. The stocking in the Dennys, Machias and St. Croix rivers is the final phase of a collaborative project begun in 1997 by the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (USFWS), Maine's Atlantic Salmon Commission (ASC) and private aquaculture companies in Maine. "Atlantic salmon stocking programs usually consist of putting sexually immature fish into the rivers years before they are ready to spawn," said Mary Colligan, head of the NMFS team working to help save the endangered population of

wild Atlantic salmon now found in eight Maine rivers. "In this stocking program, we are able to put adult fish into the water just when they are ready to reproduce." The fish being stocked were spawned from broodstock at the USFWS's Craig Brook National Fish Hatchery in 1997, and were transferred as fertilized eggs to freshwater rearing stations run by Atlantic Salmon of Maine, a private aquaculture company. When they reached the smolt (or ocean-going) stage in 1999, they were transferred to ASM's marine sea cage facility. The stocking in the Dennys and Machias is river-specific stocking, which means that the fish going into those rivers are offspring of broodstock that were collected from those rivers as juveniles. The scientists plan to stock 84 adult salmon into the Dennys and 109 into the Machias. "We have made several important changes to this year's stocking effort based on what we learned last year," said Tim Sheehan, a NMFS biologist. "Last year we focused on the movement of the stocked fish in an effort to gauge their ability and desire to seek out suitable spawning habitat. This year we are also going to assess their spawning to see whether these adults are successfully depositing viable, fertilized eggs in the rivers." The five-year stocking program is the first attempt to stock adult Atlantic salmon in U.S. waters. "This year we are going to monitor every step of the spawning process to see how well these fish are doing, from sperm and egg through to fry," Sheehan said.

Holyrood - move in salmon inquiry

Aberdeen Press and Journal, 16 October 2001

An influential Scottish Parliament committee called for written evidence yesterday as it announced the remit of its inquiry into the fish-farming industry. The first phase of the transport and environment inquiry will look at the regulatory framework and review future development plans for sea-cage fish-farming. The committee decided to carry out a "rolling" inquiry after Environment and Rural Development Minister Ross Finnie rejected a plea from MSPs to hold an independent public inquiry into the £260 million-a-year industry. Both the transport and environment and rural development committees felt an independent inquiry was needed to ascertain the truth regarding allegations of environmental damage. Opponents claim the fish farms may be responsible for the destruction of Scotland's wild salmon and poisonous algae blooms that have led to the closure of the shellfish industry. Andy Kerr, convener of the transport and environment committee, said the aquaculture industry was of great importance to the economy, providing employment. "However, there has been considerable concern surrounding the regulation of the industry which has been brought to this committee's attention through the Parliament's public petitions process," he said. "After consideration, our committee has agreed to instigate a 'rolling' inquiry process, which will ensure that work by the Executive and other relevant organisations to develop a sustainable aquaculture strategy is subjected to full public scrutiny." Written evidence for the first phase of the rolling inquiry must be submitted to the committee by November 9. The committee will monitor and review on an ongoing basis the work of the Executive and other relevant bodies to the industry. Its remit will include: the extent of which the proposed strategy for aquaculture addresses the concerns of relevant bodies and the extent to which it provides incentives to encourage best environmental practices; the extent to which the current research programme recognises and addresses the needs of relevant bodies; locational guidelines for sea-cage fish-farming; voluntary codes of practice and area management agreement; the proposed transfer of planning controls for fish-farming to local authorities; the extent to which current regulatory systems can be harmonised and made more effective. David Sandison, general manager of Shetland Salmon Farmers' Association, said comments already submitted on the review of regulations would be forwarded to the committee. "The Scottish Executive process for Review of Regulation and the Development of a Strategy for Aquaculture is the result of an extensive amount of lobbying by the Scottish industry and is seen as crucial for the future," he said. "Major investment decisions and infrastructure developments need to be based on a clear and decisive strategy to take our sector forward, within a regulatory framework that addresses the need to monitor the industry's environmental impact whilst not being a hindrance through inefficiency or duplication as at present."

Clean up rivers, say experts, and Atlantic salmon will come

Bangor Daily News, 16 October 2001

Things are bad for wild Atlantic salmon all over, but that doesn't mean people should stop trying to help the fish, which are classified as endangered in Maine in eight rivers. That was the message at a salmon habitat workshop at the University of Maine that drew experts from the West Coast, Canada and Europe. Maine has the last wild Atlantic salmon in the United States. Conference organizer Mike Herz, President of the Sheepscot Valley Conservation Association, kicked off the daylong event with some sobering statistics. Of the 2,005 known wild Atlantic salmon rivers in the world, nearly 300 have lost their fish completely. Another 403 have populations that are endangered and populations are in critical conditions on another 236 rivers. Salmon have become extinct in 294 rivers. The vast majority of the healthy populations are in only four countries - Norway, Iceland, Ireland and Scotland. These figures are from a just released report on the status of salmon put together by the World Wildlife Foundation. Despite the bleak numbers, Herz said, he and his fellow salmon advocates had to remain positive about their task. "We have got to remain optimistic ... that our influence will make a difference," he said in an interview. Herz said he organized the conference to reassure Mainers that their efforts to help salmon will pay off. That's why he brought in experts from around the world who have been at the business a lot longer. One success story happened on the River Tweed in Scotland. The Tweed Foundation, a charitable group set up by the government to care for the river, has devoted much of its money and energy to removing impediments to salmon's upstream travel. It disassembled dams, rebuilt bridges and dug up culverts. In some cases salmon returned to the river just a year after the impediment was removed, said Duncan Glen, the Foundation's director. Increasing the number of fish in the River Tweed was important because it had a direct financial impact on the local economy, he said. The rural area is heavily dependent on tourism, and fishing accounts for 70 percent of the region's outdoor recreation. Up to 10,000 Atlantic salmon are caught in the river each year. In that situation, it was easy to show that spending money to

build a fish passageway, for example, was justified because each fish in the river meant more tourism dollars, Glen said. Finances also played a role in salmon restoration in Ireland, said Martin O'Grady of that country's Central Fisheries Board. There, however, the cost of restoration had to be justified to accountants, O'Grady said. If the cost was between 23 cents and 45 cents per baby fish it was acceptable. In the last 20 years, the government has spent \$15.5 million on salmon restoration. In the heavily agrarian country, many projects focus on stopping livestock from crossing and wading in streams and stopping the erosion of riverbanks. O'Grady stressed, however, that projects that help salmon help an entire ecosystem. One stream where sheep used to graze, for example, was rehabilitated and not only did the number of salmon significantly increase, so too did the number of birds and other animals that live there. "Whether your river is in Ireland, Scotland, Maine or New Mexico, if you restore the natural stream and have no excessive water outtakes, these projects will work," O'Grady said. Projects don't have to be high-tech, said Don Duff, who is on loan from the U.S. Forest Service to Trout Unlimited in Salt Lake City. His group has used old refrigerators and coolers to create on-stream incubation facilities in several Western states to restore trout. The same technique could be used to help salmon, he said.

Salmon expected to return to Elbe as water quality improves

CTK Daily News, 23 October 2001

The quality of River Labe (Elbe) water has markedly improved over the past decade as proved by the fish population having been grown by 30 species, German Environment Minister Juergen Trittin said, on the eve of a meeting of the German-Czech Elbe Protection Commission to be held in Prague. The 1154 km long river has its source in the Czech Republic and flows across Germany to Hamburg where it empties into the North Sea. In 1990, 68 fish species were counted in the river, while now it is 98 and salmon, which only lives in very pure water, is expected to return to the Elbe soon, Trittin said. Since 1990 as many as 239 community water treatment plants have been built along the Elbe and all towns with a population of over 20,000 are now equipped with this environment protection facility. "International cooperation on the Elbe yields visible fruit," Trittin said, thus indirectly hinting at Germany having co-financed a number of water treatment plants on Czech territory. The ecological balance of the river has been gradually restored and the density of environment protection sections is big. "Therefore the proposal to include the Elbe in the UNESCO Natural World Heritage list can be deemed justifiable," Trittin said.

Atlantic salmon invade the Pacific

World Watch, 1 November 2001

Large numbers of Atlantic salmon have escaped from fish farms in Pacific waters and are now thriving in 77 rivers in British Columbia, according to a recent report by the Canadian Parliament's Senate Committee on Fisheries. In introducing the fish, aquaculture proponents had claimed that Atlantic salmon would not be able to compete with native Pacific salmon, but the large number of these invasive fish living in Pacific waters may now pose a serious threat to wild salmon species. Experts warn that Atlantic salmon could undermine the health of native species by competing for food, interfering with migrations and spawning, displacing juveniles, and digging up eggs. Farmed salmon could also spread diseases, which occur with regularity in aquaculture pens, due to the physical stress and confined conditions. The report finds that between 1994 and 1998, about 44,000 farmed salmon escaped each year from Canadian aquaculture pens. Canada produces just 3 percent of the world's farmed salmon, and it is likely that the ecological problems are more intense in countries with larger operations. In Norway, the largest farmed-salmon producer, escapes have become so numerous that 87 percent of the 30 rivers currently monitored had farmed fish living in them. Escapees now make up almost one-third of the fish population in Norwegian rivers where they are found. "Aquaculture-escaped Atlantic salmon are capable of spawning in B.C. streams," said John Volpe, an aquaculture expert at the University of Victoria. "We have shown this to be true beyond any shadow of a doubt." The effect that these escapees will have on wild populations is unknown, but one of the greatest risks is the potential loss of genetic integrity in native species. There are over 5,000 genetically distinct strains of Pacific salmon in British Columbia alone. Interbreeding with the Atlantic salmon could homogenize this diversity and destabilize native salmon populations by, in effect, erasing traits essential for long-term survival. Despite the potential risks of the spread of Atlantic salmon, the Canadian Senate Commission expects worldwide salmon farming to double to a yield of almost 2 million tons in the next 10 years.

Irish accused over failing salmon stocks

Herald, 1 November 2001

A salmon-tagging exercise by mainland European nations shows that efforts to try to restore the fish to river systems are being thwarted by the Irish, international conservationists claim. Germany, in particular, is spending huge sums on restoration programmes which are bound to fail because Irish boats are killing salmon in the Atlantic. Ironically, scientists in Ireland helped with the restoration plans and the Germans even bought their salmon eggs from Irish hatcheries. The Irish, who according to one German conservation leader have "a medieval approach to sustainability", and the English are the last main salmon nations which permit a drift-net fishery - the nets are miles long and often entire river stocks returning to spawn are destroyed in one night. The North Atlantic Salmon Fund said salmon had been intercepted to their virtual extinction by Irish nets targeting mixed stocks. Garcia de Leaniz, senior scientist at the Centro Ictiologico Institute in Cantabria, told a conference in Spain that recoveries of tagged Spanish salmon revealed they were being netted along Ireland's west coast. However, a spokesman for the Irish government said that it was already doing a vast amount to regulate its fishery. A tagging scheme for salmon carcasses had been introduced to trace all fish, as well as a ban on sales of fish caught by anglers, he added.

After foot-and-mouth, now it's salmon

Scotsman, 8 November 2001

Slaughter to control animal disease is becoming increasingly contentious. Most attention is on foot-and-mouth disease, where more than a dozen inquiries are being held into an epidemic in which more than six million cattle, sheep and pigs have been slaughtered. One of those inquiries is an independent one by the Royal Society of Edinburgh. But the society is also carrying out an inquiry into a disease of farmed salmon, which raises similar questions about causes and methods of control or eradication. Infectious salmon anaemia (ISA) is a viral disease which, like foot-and-mouth, poses no threat to human health. The first case of ISA was found in 1998 in a Loch Nevis salmon farm and, to date, it has spread to 11 farms and has been suspected on a further 25 in Skye, Orkney, Shetland and the Western Isles. Again like foot-and-mouth, infection by the virus does not necessarily produce severe clinical signs of the disease or death, but European legislation requires that, once a fish farm has been designated as infected, all fish must be slaughtered, the site disinfected and left fallow for six months. However, unlike foot-and-mouth and a crucial difference for salmon farmers, there is no government compensation for lost stock. Compensation payment claims from fish farmers have been resisted by the Scottish Executive, and a decision is now awaited from the European Court of Justice. Sir Roderick MacSween, the chairman of the Royal Society of Edinburgh working party, and emeritus professor of pathology at the University of Glasgow, said: "We wish to examine the evidence for ISA being an exotic and not an endemic infection in salmon in Scotland." Sir William Stewart, President of the Royal Society of Edinburgh, said of the ISA inquiry: "This is a complex issue for environmentalist, business and local communities. Our inquiry must be focused on the science underpinning it and advice must be wholly independent and scientifically robust." Brian Simpson, the Chief Executive of Scottish Quality Salmon, recently pointed out the "huge contribution" made to Scottish life and economy by farmed salmon: 6,500 jobs, £300 million of sales ex-farm generating £600-700 million retail sales - worth more than Highland beef and lamb combined and accounting for 40 per cent of all food exports. The counter-argument is that the industry is causing environmental damage and that farming fish produces unexpected side-effects, such as ISA. The Crown Estate is to provide a further £600,000 for research over three years to help fish farming to "achieve its environmental goals". Advice on its allocation will come from an industry-wide committee. Scientists from the Fisheries Research Services and the University of Aberdeen have started a £1.4 million research project to find out if global warming is to blame for the disappearance of some fish from Scottish waters. The first work is to survey declining stocks of the zooplankton species *Calanus finmarchicus* - a vital food for fish like cod, herring and mackerel. Professor Peter Boyle of Aberdeen University said: "The purpose of our expeditions is to discover more about how climate change is affecting the supply of food to fish in our seas - then we can have more confidence in predicting what the fisheries of the future will be like."

Eight thousand young salmon will be placed in the River Dove at Eaton Dovedale on Wednesday

Derby Evening Telegraph, 10 November 2001

Eighty thousand young salmon will be placed in the River Dove at Eaton Doyedale on Wednesday. This will be the first stage in a five-year programme during which the Trent Salmon Trust will continue to stock the river with salmon on an annual basis. The Trust will also build fish passes on the weirs to help adult salmon to return to their home river to breed. The young salmon to be placed in the Dove will be paid for by Severn Trent Water with money from the Landfill Tax Credit Scheme. Over the next five years, the Trust intends to raise about £1.5m to continue this work through further donations from various sources. Trust company secretary David Hunter said: "The Trust will build on its work and hopefully, one day soon, we will see these magnificent fish at home throughout their native river."

Salmon-stocks problem highlighted

Irish Times, 10 November 2001

The Icelandic businessman who has been campaigning to conserve Atlantic salmon stocks has accused Ireland of "standing in the way of salmon restoration in Europe". Mr Orri Vigfusson, Chair of the North Atlantic Salmon Fund (NASF), says he is disappointed that the Government has failed to subscribe to "any solution" that could save up to 500,000 salmon a year. Mr Vigfusson, who met the Minister for the Marine, Mr Fahey, in Ireland earlier this year, has submitted detailed proposals relating to a buyout of Irish driftnet licences and catch quotas, and an angling tourist plan. However, the Minister has already established a National Salmon Commission, which favours set-aside rather than buy-out of licences, and recognises that driftnetting is already a dwindling occupation due to the farmed salmon market. The Commission has introduced a new tagging and logbook system as part of a review of salmon stocks. Its chairman, Prof Noel Wilkins, recently resigned and was replaced by Mr Joey Murrin. Mr Vigfusson's organisation had already offered to negotiate buy-outs and set-aside programmes for the Irish fisheries, and he says that a "vast majority" of professional netsmen had agreed to take part in a three-sided deal involving angling and conservation interests and the Government.

Mystery of salmon deaths in estuary

Rod & Gun, 10 November 2001

A report in a weekly newspaper that substantial numbers of salmon are dying from disease in the Erne estuary has come as something of a surprise to both the Fisheries Conservancy Board and the Department of Agriculture and Rural Development. The report in the *Impartial Reporter* by Chris Donegan said: "Despite a costly investigation involving

scientists working in three separate laboratories on both sides of the border the cause of the salmon fatalities remains a mystery. "The only finding of significance has been that many of the salmon died when the water temperature rose above 15° Celsius. There is no evidence to suggest that the controversial fish pass which the salmon have to negotiate to get over the ESB's hydro-electric dam at Cathleen's Fall is to blame. The ESB's fisheries conservation manager, Gerry Gough, has denied that the pass has played any part in the deaths of the salmon. One possibility may be that the salmon may already be carrying the disease when they enter the estuary. However, the Erne is the only water in Ireland which has seen salmon die in these circumstances." The report goes on to say that fishery biologist Dr Dennis Doherty said that 50 per cent of salmon going up the fish pass were diseased while only between nine and 34 per cent of salmon smolts survived the outward journey to the sea. The newspaper report caused some eyebrow-raising in Belfast. A Fisheries Conservancy Board officer said he had no knowledge of the report. He said the definitive report of the Erne Salmon Management Programme, which was financed by the EU, had not yet been issued. The report, which is certain to be wide-ranging, is eagerly awaited. So far, only a draft report has been made available to members of the Erne Salmon Management Programme committee and is not yet in the public domain. Assembly Member Jim Wilson has been asking searching questions in the Assembly about the Erne. Doubtless, a lot more will be asked when the ESMP report is published.

Cleaning up on salmon

Daily Star, 10 November 2001

What's the world coming to? Salmon in the Mersey and broadbill swordfish at Skegness! The 15lb salmon trapped in the River Mersey is a sure sign that the river has been cleaned up in a hugely successful manner. It's not only the Mersey either. The Environment Agency this week published statistics that showed rivers to be cleaner than at any time since the Industrial Revolution. Some of this is obviously down to the decline in Britain's manufacturing industry but much of any praise going should be heaped upon the EA and groups such as the Anglers' Conservation Association. Anglers deserve a huge pat on the back because we are the ones who have paid for much of the work, through rod licence fees and membership of the ACA. Only one sour note in the EA report ... the water in many of our rivers may have improved but in some areas litter and dog fouling spoil the waterside habitat. As responsible waterside users we must do our bit by making certain none of the litter is down to fishing. Unfortunately the Mersey fish may have had a wasted journey, as do many of its kind now returning to once-great salmon rivers. The gravel beds which are essential to spawning are often hidden under silt, caused by excessive boat traffic or flood relief work. As for the Skeggy swordfish, it is unlikely it swam there. Far more likely that currents carried it dead or dying from the warmer waters around the Canary Islands or Spain. This isn't the first broadbill that has turned up unexpectedly: another mysteriously appeared, dead, in a Scottish sea loch a few years back.

Ireland hit by mutant salmon

Sunday Times, 18 November 2001

First it was the drift nets, then it was the sea lice. Now wild Irish salmon face a lethal new menace - mixing with the wrong sort. Experts say that farmed salmon, which have escaped from captivity in recent years, are corrupting the genes of their wild counterparts. In recent months, hundreds of mutant fish, the product of liaisons between wild and farmed salmon, have started to emerge in rivers around the country. The cross-breeds have weakened immune systems that result in a host of deformities such as hump backs, misshapen jaws and cataracts. The Marine Institute first predicted the problem would emerge three years ago. In its 1998 annual report, the organisation said: "Escapes of diploid stocks from cage culture operations are considered a threat to wild salmon populations, particularly to small indigenous populations in local rivers." Experts now claim interbreeding could hasten the extinction of the country's famed wild salmon and trout. Last week, up to 50,000 farmed rainbow trout escaped into Clew Bay in Co Mayo and anglers say the extremely important Corrib System in Galway is now infested with cultivated fish. Noel Carr, of the Federation of Irish Salmon and Sea Trout Anglers, said: "We are not against these fish farms but we would like to see more care being taken. At least put them further out to sea, away from salmon spawning areas. We cannot have these fish escaping, they are causing havoc and we would like the (marine) minister to think before investing a further £22m in the industry." It is estimated that up to one-quarter of Irish salmon and trout water courses have lost their wild fish populations. Up to 85% of the country's stock is intercepted in drift nets off Irish coasts. Drift nets claim more than 500,000 salmon a year. Sea lice, attracted by intensive farming, wreak havoc and scientists say Atlantic salmon could be extinct by 2010. The Irish Salmon Growers' Association rejects allegations that escaped fish are destroying wild salmon. Richie Flynn, a spokesman, said: "Of course, there is a certain percentage of any population of animals that is not perfect. But it is ridiculous to say that there are large numbers of fish with deformities populating rivers. Natural selection will weed out the farmed salmon but there is no difference in the genetic make-up of the salmon." In June, Norway, the world's leader in fish farming, said 39 rivers and 22 fjords were no-go areas for aquaculture. The government said fish farming had wiped out wild salmon populations in 40 rivers. Norway produces 500,000 tonnes of farmed fish a year. Ireland creates 35,000 tonnes. Professor Graham Shaw, of Save Our Sea Trout, said escapes from fish farms are concealed. "We are getting unofficial reports of a huge escape in Kenmare and it has very serious implications for our native strains of sea trout and salmon. Farmed fish are not part of the ecosystem and they are not adapted to surviving in each particular environment," he said.

Infectious salmon amnesia forgotten disease

Bangor Daily News, 24 November 2001

Infectious salmon anemia is the scourge of Maine aquaculture. It is caused by a nasty little virus that sweeps through fish pens, killing the crop, defying remedy. Fortunately, ISA is not harmful to humans. Unfortunately, there is another salmon-related malady that preys exclusively on our kind. It affects the memory, wiping it clean of any recollection of plans, perspective, even promises. It first manifested itself in Augusta, but seems to be spreading. It's called infectious salmon amnesia. This wicked insidious ISA afflicts those who fret a lot about wild Atlantic salmon, the endangered type. Medical science is baffled as to why, but there is speculation that excessive excitement of the brain's worry nodes creates just the opening this contagion exploits. The course of the disease is varied, but the outcome is always the same - people who start out knowing that whatever is going wrong with wild Atlantic salmon occurs out in the ocean end up believing that the very best thing to do for troubled fish that can't cut it at sea is to buy them land. Not just some land, but vast expanses of it. The two land-for-fish proposals now in the most advanced stages call for State ownership (a combination of outright purchase and conservation easement) of more than 28,000 acres along the mighty Machias River - the entire 80-mile shoreline - and more than 3,400 acres along the smaller Dennys. The cost could well exceed \$25 million, but money is no object since taxpayers will provide great heaping gobs of it. Besides, these two rivers, and three more slated for such action, are in poor, declining Washington County, which will soon be emptied of people anyway. Plus, all the land in question now belongs to the International Paper Corp., so the money's going to a good cause. Memory, they say, comes in two varieties, long-term and short-term. Into which category events of four years ago fall is open to debate, but infectious salmon amnesia seems first to erase any recall of 1997. That's the year the two key agencies of Maine government, the State Planning Office and the Maine Atlantic Salmon Commission, were putting the finishing touches on a conservation plan intended to head off a federal endangered species listing. This SPO/MASC plan is an enormous document, an encyclopedia of all that is known of wild Atlantic salmon and an exceedingly detailed blueprint for their recovery. The blueprint, though stressing that the real fixes lie beyond Maine's jurisdiction, identifies such things as agricultural irrigation, fish farm escapes, stream bank erosion and pollution from stuff like faulty septic systems as the major impediments to salmon procreation that the State can remove. It notes that state regulations and current industry practices make forestry an improbable culprit, but warns that tighter regulations would be imposed by 2000 if needed. It also says that 80 percent of "critical spawning and nursery areas" should be protected by December 2002 and here's where amnesia rears its brain-numbing head. The meaning of the word "critical" is forgotten, "spawning and nursery areas" once implied precise locations within rivers but now encompass entire rivers. "Protected" becomes "buy." Given all that, it's pretty amazing that the SPO and the MASC still can remember what "salmon" are. The State's share of these land buys will come from the Land for Maine's Future fund, and 1997 was an important (you might even say "critical") year for that enterprise as well. Under the guidance of the SPO, which also administers the fund, a special Land Acquisition Priorities Advisory Committee reported to Gov. King on what direction the program should take. That direction, stated again and again in the document, is south - southern Maine has the most people, the greatest biological diversity and the greatest shortage of public land. Voters might remember how often they heard during the successful 1998 campaign for the \$50 million bond issue spawned by this report that it was southern Maine's turn and how effective that message was in reassuring Northern Maine that its private land was not going to be gobbled up for some vast nature preserve. Voters might remember (voters in Northern Maine absolutely remember), but for State officials it's almost as though the report and the campaign never happened. Most places, Land for Maine's Future purchases are modest - hundreds of acres, perhaps a couple of thousand, specific parcels of extraordinarily high recreational or ecological value threatened by development. In Washington County, which could do a lot of real good with \$25 million, it's tens of thousands of acres under no such threat. (In case you think this special attention is just Washington County's bad luck for having salmon rivers, consider this: The only major river included in the Endangered Species Act listing not Down East is the Sheepscot in the Augusta area, and its banks are not being targeted for state-funded acquisition. There, SPO and MASC officials say, merely educating riparian landowners on salmon-friendly practices will suffice. Of course, the Sheepscot's riparian landowners are regular people and thus more prone to remember what they are taught than are large corporations, which can never remember a blasted thing unless large sums of cash are involved.) The effects of infectious salmon amnesia are not limited to specifics - even the most fundamental beliefs and philosophies become vague and fuzzy under its influence. It has caused the current administration, for example, to quite forget that one of its primary objections to the federal Endangered Species Act listing was that it would lead to a massive government takeover of private property. It has caused the State Planning Office, which administers the fund it openly advocates tapping, to quite forget that an essential of good government is independent, multi-agency review to ensure that bad ideas don't go unquestioned. - In fact, the only part of the memory that infectious salmon amnesia does not seem to affect is that place where bad ideas reside.

Camouflage, night vision sights and secret manoeuvres... welcome to the hi-tech battle against salmon

Scotland on Sunday, 25 November 2001

Camouflage, night vision sights and secret manoeuvres... welcome to the hi-tech battle against salmon poaching. "Meet me at 20:00 hrs. Wear something dark and subdued. And do exactly what you're told." The voice on the other end of the telephone barked briefly. This was no time for idle small talk. This was business. The cloak and dagger intrigue was not misplaced. I wasn't entirely certain what I was letting myself in for when I persuaded a senior figure in one of Scotland's least-known law enforcement agencies to let me accompany him and his men on a covert nocturnal reconnaissance trip deep into hostile territory. But I knew enough to know that it could end in violence. The next evening, at 19.58, two

4WD vehicles pulled up at an empty car park on the outskirts of Grangemouth. Eight huge men in camouflage gear spilled out onto the tarmac, eyeing me suspiciously but saying nothing. As they checked their kit, one finally broke the silence, gruffly telling me "At least you're on time" before gesturing that I should climb into the truck. An hour later we were holed up in a fox-hole on the treacherous mudflats of the Firth of Forth, scanning the water with army regulation night-sights for the tell-tale signs of the enemy. As midnight came and went, the only sounds on the estuary were the crackle of the two-way radio and the distant hum from far-off factories which filtered across the dark night tide. The quiet was reassuring, but misleading. Tonight there were no signs of the poachers or of their buoys bobbing in the water or illegally cast nets scooping up the precious silver haul of salmon. Just days before this particular outing, the mudflats had been the scene of a violent confrontation: on one side there were the police, sniffer dogs and a posse of water bailiffs; on the other a gang of six poachers who, when challenged, fought back before disappearing into the faceless backdrop of Stirling, smashing up two water bailiffs' cars as a casual afterthought. Welcome to the front line in the increasingly vicious war on poaching. According to the police, poaching is the second most profitable criminal activity in Scotland after the drugs trade. Stand aside prostitution, car theft and counterfeiting; the poachers are coming through, taking millions a year out of the Scottish economy in the process. "What gets me," Superintendent Bill Cunningham of Forth District Salmon Fishery Board told me, "is that people seem to think that there's something innocent and romantic about salmon poaching." It's true. To the non-angling public, poaching is regarded as a romantic country pursuit, practiced by shady but lovable rogues who steal from the rich to give to the poor. It conjures up an image of a crafty old Highland crofter slinging out his well-worn net over a darkened river, no doubt with a fattened pheasant stuffed under his jumper. That idealised image doesn't square with the truth. There is an identikit modern poacher: he is a full-time criminal; he is from the city; he is part of a criminal network which is probably also involved in selling drugs. "One-for-the-pot" chancers are few and far between. One of the most troublesome gangs operating on Cunningham's beat is "a group of smackheads who've worked out that poaching is easier and more lucrative than dealing drugs". Technology has revolutionised poaching. As the number of wild salmon caught has fallen from 2117 tonnes in 1967 to 198 tonnes this year, so its price has soared up to 8 pounds per pound in Home Counties restaurants, and 5 pounds in Edinburgh. The advent of lightweight mono-filament nets that fit in jacket pockets means even the clumsiest gang of poachers can clear a pool of over a hundred 10lb autumn fish in minutes, pocketing up to £8000 in the process. Those nets, coupled with declining stocks, have ensured that poaching is more lucrative than ever. "In fact," says Cunningham, "we have five gangs of professional poachers, with up to eight men in each, on my patch and none of them would go out unless they could guarantee getting at least 100 fish in a night." After a quarter of a century in the navy, Cunningham became the Superintendent for the Forth District Salmon Fishery Board, one of two dozen such men charged with co-ordinating the fight against poaching in Scotland. His job description is to prevent illegal fishing activity over a mammoth sixteen hundred miles of riverbank from Balquidder, in the foothills of the Trossachs, to Dunbar in East Lothian. Helped by one full-time bailiff, ex-gamekeeper and deerstalker Chris Foley, he is assisted by 12 volunteer water bailiffs who "may be out in the freezing cold many nights of the year, yet do it for no more than a drink at Christmas from the Board. Some are anglers, some are concerned about the environmental impact of poaching - and yes, maybe some even like the adrenalin - but we couldn't do this job without them". Water bailiffs have the power of search and arrest under the Salmon and Freshwater Fisheries Act, but the ever-present threat of violence means that, on big stake-outs, Cunningham enlists the help of local police. Yet despite the proven links between poaching and organised crime, getting sheriff courts to take the offence seriously remains difficult, no matter how persistent the offender. "In a recent case at Falkirk Sheriff Court, the defendant was one of a gang and had been caught stringing a net under Kincardine Bridge," recalls Cunningham. "The sheriff summed up with the comment, 'Well, it's hardly the most serious crime in the world', and promptly admonished him, even though he had pled guilty in the first place." The only exception is a poacher unfortunate enough to meet a sheriff who happens to be an angler himself. The biggest fine ever handed down was four years ago, when a well-known Borders poacher was fined £5000 in Duns Sheriff Court for being discovered in illegal possession of six fish. Less than a month later, Cunningham caught the same individual in possession of nine salmon, but the offender was let off with a £300 fine at Haddington Sheriff Court. "I've had many cases," the Superintendent explains, "where the court has not even confiscated their nets." Criminal poachers - those who have no wish to actually eat the fish - have even used the vermin poison, Cymag, which removes all oxygen from the water, killing every creature for miles downstream. The sickening sight of the white bellies of a flotilla of dead trout, eels and minnows bobbing down a 'cymagged' river is an unforgettable sight. The economic impact of poaching is unseen, but it can gut communities. Scottish salmon-angling is worth in excess of £100m to the economy; fishing on the Tweed alone brings £12.5m into the Borders each year. For every fish landed by an angler, he or she spends £2000 in local hotels, shops and restaurants. A successful strike from a gang of poachers can remove 150 salmon from a river system, denying fragile rural economies of anything up to £250,000 in a single night. Around rivers like the Ayr and Dumfriesshire's Nith, which have been particularly badly hit, the impact can be severe. The average poaching fine is £300, irrespective of the number of fish caught. Someone who was no stranger to repeated arrests by water bailiffs and thousands of pounds worth of fines was the notorious East Lothian criminal, Ted Ingle. He poached salmon throughout the Lothians and beyond before being battered to death in his Tranent home by his baseball bat-wielding partner, Rosie Blake, in 1994. His two remaining sons, Edward and Andrew, are themselves carrying on the dubious family trade. "Let's just say that these particular individuals are very well known to us," says Cunningham. Regulars in Edward Ingle's East Linton pub have gone on record, relating how Ingle bragged that he nets (literally) over £1000 a week from his poaching exploits, despite being repeatedly brought before the courts. Earlier this year Edward spoke about his father's life, attempting to portray him as a lovable rural rogue; a man who would, in his son's words, "take tatties and cabbages from the fields and give them to the old folks in the pub". "He thought the law was a joke," said Edward. "He was once up in court for poaching and he had a boot-full of salmon in the car outside. He

was fined £180 and he rushed off to sell the fish to pay the fine." Like father, like son. Edward works as an abseiler in the oil industry. "The first night back from the rigs, I go to the river," he said when asked how he has paid the many fines that have been levied on him for poaching. He is also putting together a book of his dad's homespun wisdom, entitled *Poacher's Pie*, while his headstone in its Haddington graveyard sums up the image that the poachers would have us believe - below a carving of a leaping salmon are the words: "Scotland will never see his like again." In fact the water bailiffs are coming across more and more of his 'like' every day of the week. Nor is this trend of violent crime confined to the Lowlands; the old rascal poacher of Highland lore is as much a thing of the past in Mallaig as he is in Motherwell. As far back as the Sixties, there were notorious and lethal Cymag attacks on the Ullapool River in Wester Ross. Today, entire sections of this delightful little spate river, which tumbles from the hills through a steep glen of heather and rowan trees, have been cordoned off with Colditz-style barbed wire fencing and impenetrable corrugated iron doors. Poaching is a nationwide problem. The Grimersta estate lies on the western shores of the island of Lewis and is one of the most productive salmon fisheries in Europe. When Chris Foley, Cunningham's assistant for the last two years, describes his previous job as head bailiff at Grimersta as "hairy", he is guilty of wanton understatement. Grimersta Fishery is a chain of uninspiring-looking hebridean lochs, interlinked by short peaty rivers, which supports the most magnificent run of Atlantic salmon throughout the summers. In 1888 it secured a place in angling history when an estate guest, Mr Naylor, caught 54 salmon to his own rod in a single day's fishing, a record that still stands. Since then, however, it has become just as famous as the site of bloody battles between poachers and gamekeepers. Much of Grimersta's water runs alongside the crofting township of Ballalan, a community where many residents have a natural mistrust of the estate's absentee owners, and see netting for salmon as their heritable right. In recent years the hatred has reached such a level that, one summer, the poachers turned their attention from the fish and left a £55,000 trail of destruction across the estate. They smashed fishing huts, burnt buildings and ripped apart a sheet-metal dam. A fishery manager spoke out against the poachers and, the next morning, found all of his rowing boats had been sawn in half. Water bailiffs and gamekeepers were routinely threatened with baseball bats out on the moor in the middle of the night. I was once in a small boat that now has a hole in the front after a poacher shot at us with a rifle. Eventually, ex-Special Forces security staff were employed by the Grimersta Estate. Given the financial rewards poaching brings, it is not difficult to understand why violent confrontation is now commonplace. Cunningham says the police know beyond doubt that a commercial gang of poachers previously ran two refrigerated lorries every week out of Stornoway to the mainland, full of poached salmon and venison. It was salmon poaching on an industrial scale - All-Terrain Vehicles, radio scanners and many miles of monofilament netting were used at the sharp end of the business, while a complex network of buyers was in place to distribute the thousands of fish that were taken illegally every year. It was a business worth millions a year to the poachers. In Wester Ross, the problem remains. One local angler, who wished to remain anonymous for fear of reprisals, told me: "Fish farms have wiped out the salmon on a lot of the rivers, but the ones without cages in their estuaries, like the Kerry and Badachro, are still pulling fish in. Come the first rains in July, you see these groups of lads in balaclavas and cammo jackets descend on the rivers in search of the fish. And these blokes are not from around these parts." Many riverbanks are now no-go areas inhabited by poachers masquerading as anglers. Instead of nets, in a lethal method known in lowland dialect as "howking", they employ huge treble hooks attached to a stout fishing rod and line, which they rip through the deep holding pools in a river. The unsuspecting salmon, waiting for the next rise in water level to take them upstream, are gashed in their sides, bellies or heads and, if the hook holds, are hauled ashore. It does not take long for a gang of men to remove every salmon trapped in the limited confines of a rocky pool with this horrifically cruel technique. Although he's had years where he's caught one group of poachers every week during the season, Cunningham and his team are fighting a losing battle on the dark banks of our rivers. Even so, he believes the battle can be won. "A poacher is a creature of habit," he says. "We know who they are; we know where they operate. And it's only a matter of time before we bring them before the courts." And then they'll get a £300 fine and be back on the river by nightfall.

Terminal threat to salmon in two rivers

Daily Telegraph, 28 November 2001

The building of a 400-acre container terminal on Southampton Water would wipe out the already-endangered salmon of the rivers Test and Itchen, the Environment Agency will tell a public inquiry today. The two rivers are the most famous chalk streams in the world and the birthplace of fly fishing. Both the salmon, runs of which are at an all-time low, and the Itchen itself are protected under European law; as are the Solent and Southampton Water for their population of overwintering wildfowl. Three Government agencies are opposing the proposed Dibden Bay development, the largest in the south of England for many years, at a public inquiry which began in Southampton yesterday. Lawrence Talks, the agency's fisheries and ecology manager for Hampshire and the Isle of Wight, said: "The salmon of the Test and Itchen pass by Dibden Bay twice in their life cycle, once as mature salmon to spawn and once as smolts venturing out to sea. They have nowhere else to go." He said the development proposed by Associated British Ports, near where the Test and Itchen each joined Southampton Water, would entail the dredging of 12 cubic kilometres of mud, the piling of 1.8 kilometres of quays and an extra 10,000 shipping movements a year. The result would be an increase in suspended sediment, the stirring up of contaminated material and a reduction in dissolved oxygen levels which at worst would kill fish and at best delay their migration. The piling, which would take two years, would disturb fish away from their migration route, he said. Salmon numbers in both rivers have declined steeply since the war as a result of netting on the high seas and the silting up of spawning beds caused by agriculture around the rivers themselves. Some 600 salmon ran the Test last year and 200 ran the Itchen. The Test and Itchen are two out of only six chalk streams in the country which still have a run of salmon, the agency will tell the inspector. The proposed development is also being opposed by Nature and the Countryside Agency. English Nature, the Government's conservation advisers, argues that it would have an

adverse effect on wintering grounds for curlew, ringed plover, redshank, dunlin, widgeon, teal and Brent geese. It will also take up fields on which 30 pairs of lapwing, nationally in decline, breed. Associated British Ports says the development is essential to preserve Southampton's status as one of the country's major container ports. It says the development would create 1,200 jobs at the port and a further 500 in the Southampton area.

Salmon staircase gives fish a leg-up

Western Morning News, 28 November, 2001

A £4,000 river "staircase" which will give salmon and sea trout much needed help on their migratory journey up-stream, has been completed by an Environment Agency workforce. Until now a weir on the River Mardle at Buckfastleigh, a tributary of the River Dart, has proved a difficult obstacle for fish. A decision to make their travels easier prompted the involvement of local firm Buckfast Spinning Company in conjunction with Devonia Products, who worked closely with the agency on the project and contributed £1,200 towards the scheme. There has also been liaison with the Dart Biodiversity Project involving Dartmoor National Park Authority. English Nature, Duchy of Cornwall and the South Dartmoor Leader II Project. The problem was the way this particular weir is configured it has no depth of water beneath it so the fish don't have something to jump out of. And there is no depth of water over the top of the weir so that fish can't swim through it. The fish pass consists of two stepped pools that have been created to allow the fish to travel up the weir and wall. Nigel Reader of the Environment Agency said: "This feature will have such an important beneficial effect on the fish and we are delighted to take opportunities like this to work together with local businesses to improve the environment." The fish pass at Merryfield Weir is a vital link in the journey of salmon and sea trout in a river that is well used by so many species." The partnership with Buckfast Spinning has been a valuable part of the project. Alan Chafe from the firm said: "The construction of the run has the vision of allowing the fish to return to the highest reaches for spawning and in time, returning fish stocks to previous levels. The staircase is made out of natural material so it fits in with the surrounding habitat. There are fish staircases on most weirs in the Westcountry, but because money is tight the Mardle weir needed European money to adapt it.

Pig slurry spill spells disaster for salmon

Scotsman, 1 December 2001

Fears of an environmental disaster in the north-east grew last night after half a million litres of pig slurry polluted the largest tributary of one of the area's principal salmon rivers. The slurry spilled from a large tank which burst at Mill of Carden farm near the village of Oyne, Aberdeenshire, and close to the main Aberdeen to Inverness road on Thursday night. Gordon Stephen, the owner of the farm, and neighbouring farmers built make-shift earthworks and moved scores of bales of hay in an effort to stem the flow of pollution. But by yesterday morning, the pollution had spread from the nearby Gadie burn into the River Urie, the largest tributary of the Don, and into the main river itself. The pollution has hit the river and its tributaries at the height of the spawning season. Jim Kerr, the superintendent of the Don and District Fishery Board, said last night: "It's a disaster." Mr Kerr said all the eggs in the River Urie would have been completely wiped out and thousands of adult salmon and trout killed as the slurry robbed the river of oxygen. He said: "The slurry is in the Gadie burn and in the whole of the Urie and into the River Don itself. The spawning season is at its height right now because of mild weather and all the eggs which have been laid in the Urie and are due to hatch in March will have been potentially wiped out, along with all the adult fish and small fish in the Urie. Just how many fish have been killed we won't know until tomorrow, when the river clears. But it's going to take the Urie years to recover from this." The nearest fishing beats most likely to be affected by the pollution of the River Urie are owned by Aberdeenshire Council and are stretches of the rivers where members of the public can purchase tickets to fish for salmon. The beat at Kintore, once owned by the town council, is also likely to be affected, as is a private beat owned by a fishing club at the Inverurie paper mill operated by International Paper UK. Mr Kerr stressed that although the spill represented a major environmental disaster for the Urie, there were high hopes the Don itself would not be seriously affected and that the fishery would remain viable for the opening of the new season on 11 February. He explained: "Although the Urie is the largest tributary, it is in the Lower Don and there are another 60 miles of river and other tributaries above that." A spokesman for the Scottish Environmental Protection Agency (SEPA) said an estimated 450,000 litres of pig slurry had been spilled. He said: "SEPA officers have notified all known water abstractors downstream of the incident and the River Don District Salmon Fishery Board has been informed and advised to take appropriate precautionary measures. SEPA officers are on site to ensure that any adverse environmental effect is mitigated." He added: "This is obviously a very serious incident and the impact on the Gadie Burn and the River Urie will be significant. SEPA officers responded quickly but the causes of the discharge are still under investigation. In these circumstances, if appropriate, enforcement action may be taken." The spill is the second pollution incident within two years at Mill of Carden Farm. On 23 October last year, the Carden Livestock Company was fined £500 at Aberdeen Sheriff Court for allowing 5,000 litres of slurry to pollute the Gadie burn in July 2000.

Salmon farm threatens Tweed fishings

Scotsman, 6 December 2001

Owners of the internationally renowned salmon beats on the River Tweed have warned that plans to set up the first salmon farm in the Scottish Borders could wreak havoc among the pristine stocks of wild fish. The proposals have provoked widespread alarm among fishermen and conservationists, who fear that there would be a risk of pollution coupled with inevitable escapes of farmed salmon, resulting in inter-breeding and disease. A planned £4 million investment in the

existing Kendal rainbow trout farm on the River Ettrick at Selkirk would transform it into a salmon-rearing unit, producing up to four million juvenile salmon, known as smolts, each year. The smolts would then be released in sea sites around the world. Lighthouse of Scotland Ltd, the Norwegian-owned company behind the plans, claims that the scheme would boost the local economy and pose no environmental threat. The company's assurances, however, have failed to mollify those involved in the Tweed salmon beats, which bring in £13 million a year to the Borders economy and support more than 500 jobs. Millions of pounds are currently being spent to protect and strengthen the Tweed's native fish stocks, with much of the investment concentrated on the Ettrick, an extremely important breeding ground for salmon. The entire Tweed river system was recently renotified as a Site of Special Scientific Interest (SSSI) and proposed as a Special Area of Conservation under the EU Habitats Directive in recognition of the international importance of its salmon stocks. According to the River Tweed Commissioners (RTC), the body which manages and protects salmon and trout stocks, salmon farming is a completely inappropriate form of activity for the Borders. It says that the plans by Lighthouse, the new owner of the Kendal facility, would pose a massive threat to wild salmon by importing eggs from outside the Tweed catchment and possibly even from outside Scotland. Yesterday, Judith Nicol, the clerk to the commissioners, said: "The unique Ettrick stock is the jewel in the Tweed's crown, and studies over the last ten years have shown salmon from that river are supporting the first seven months of our ten-month fishery. We are shocked that anyone would come forward with a proposition which could jeopardise that." She said the wild salmon population of the Ettrick produced 100,000 smolts each year, with 4,000 adult fish returning to the river from the sea each year. If one million "imported" smolts escaped from the fish farm, 10,000 adults would return to the Ettrick, with disastrous results for the Tweed as a salmon river. The impact of stocks inter-breeding was well documented, said Mrs Nicol. John Lovett, the chairman of the commissioners, said: "This is now one of the very few remaining large, natural wild salmon fisheries in the world. No matter what assurances are given, ultimately there are no guarantees against technical failures and human error as witnessed at so many sites elsewhere in Scotland. That would pose a wholly unacceptable risk to the Tweed's unique, internationally important, pristine wild salmon stocks." But Lighthouse, which farms salmon at 25 Scottish locations, said its Selkirk plans would offer sustainable economic prospects locally and would not pose any increased threat to the Tweed salmon resource. Alan Sutherland, the company's production manager, said Lighthouse would require planning consent for work planned at Selkirk. But there had been no opposition to its proposals, apart from the strong concerns being voiced by RTC. According to Lighthouse: "Unless the fish we produce in Selkirk are disease-free, we will not be allowed to transfer them to sea, so a disease-free operation is an absolute necessity. In fact, the threat of disease transfer is more realistically from the wild fish to the farm rather than the other way around." There were well-proven methods available to reduce the risk of escapes to a minimum, he added.

Helping to save the salmon

Evening Herald, 13 December 2001

Salmon anglers on four Cornish rivers are giving up their prized catches to ensure the survival of the species - and their future sport. Many salmon anglers now use barbless hooks and return their fish unharmed to the river instead of knocking them on the head for the pot. But fishers on the Tamar, Fowey, Camel and Lynher are going one better by giving their fish alive and kicking to an Environment Agency hatchery at Milton Abbot. The fish are hand-stripped of their eggs and milt by experienced staff, allowed to recover and then returned to the estuary, from which they will swim back out to sea. Eggs from two or three hen fish are mixed with milt from one cock fish to fertilise them and placed in trays of gravel submerged in pure, cold spring water. When the fry hatch out and are big enough to fend for themselves, they are planted out in their parents' home river, with no cross-river mixing allowed, to keep individual rivers' strains pure. In the wild, long journeys from marine feeding grounds, prolonged fasting in fresh water and the stress of spawning mean very few Atlantic salmon survive to return and breed a second time. Mark Pilcher, the Environment Agency's team leader for fisheries enforcement in the Cornwall area, said: "So far we have had more than 30 fish donated by salmon anglers, and while the hens are not huge, at an average seven pounds, each one can produce 4,500 eggs. Our aim is to improve the productivity of headwaters, a lot of which are silted up by land use. The adult salmon are laying their eggs, but often they become covered in silt and don't hatch properly. By putting the fertilised eggs in boxes of gravel they have a much better chance of hatching, and when stocked as fry back in their home river are less affected by the silt than eggs would be. Anglers have taken to the Salmon Egg Box Participation Project in a big way," Mr Pilcher said. He said salmon taken legally but late in the season might look fresh and silver, especially if newly-run from the sea, but because the fish were close to spawning the flesh was soft and of poor quality. The hatchery has more tank space available and is hoping for donations from the Plym and the Yealm if rain brings a late run of fish into the West Devon rivers for anglers to catch.

Sexy salmon are put under the spotlight

Yorkshire Post, 20 December 2001

When salmon decide to get up close and personal, they prefer to do so away from prying eyes. But that could be difficult for the piscine inhabitants of Yorkshire rivers these dark, cold December nights. For Environment Agency staff are out on patrol with their spotlights to spy on frisky salmon indulging in a spot of nocturnal nookie. But the sudden conversion of agency officials into Peeping Toms is not born of some prurient interest in the sex lives of salmon but in the entirely honourable cause of ecological balance. Watching the spawning fish is part of a wide-ranging survey to check stocks on rivers across North Yorkshire. Experts agree that an abundance of salmon is an excellent indication that the river environment is being well maintained and even improved. The latest project will give scientists a chance to monitor increasing salmon numbers in rivers such as the Ure while potentially revealing clues why there are fewer young salmon

than expected in others such as the Esk, traditionally Yorkshire's premier salmon river but where numbers have struggled in recent years. The agency's fisheries team leader, John Shannon, said: "The fish are most active after dark and the 'nests' they create in the gravel show up very well under our spotlights. Our staff can then easily count the number of spawning sites along the rivers. The information gained from this survey will go a long way to finding out how the populations are changing. Results so far are fantastic, with more fish spawning than previously seen in recent times. Once we have sufficient information we can then concentrate on trying to see what we can do to rectify any problem areas and develop action plans." The information also helps prevent illegal fishing by identifying sections of the river that could be targeted by poachers as the number of fish increase further.

Population structure of Atlantic salmon (*Salmo salar* L.): A range-wide perspective from microsatellite DNA variation

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

Molecular Ecology 10 (4):807-821

Atlantic salmon (n = 1682) from 27 anadromous river populations and two non-anadromous strains ranging from south-central Maine, USA to northern Spain were genotyped at 12 microsatellite DNA loci. This suite of moderate to highly polymorphic loci revealed 266 alleles (5-37/locus) range-wide. Statistically significant allelic and genotypic heterogeneity were observed across loci between all but one pairwise comparison. Significant isolation by distance was found within and between North American and European populations, indicating reduced gene flow at all geographical scales examined. North American Atlantic salmon populations had fewer alleles, fewer unique alleles (though at a higher frequency) and a shallower phylogenetic structure than European Atlantic salmon populations. We believe these characteristics result from the differing glacial histories of the two continents, as the North American range of Atlantic salmon was glaciated more recently and more uniformly than the European range. Genotypic assignment tests based on maximum likelihood provided 100% correct classification to continent of origin and averaged nearly 83% correct classification to province of origin across continents. This multi-locus method, which may be enhanced with additional polymorphic loci, provides fishery managers with the highest degree of correct assignment to management unit of any technique currently available.

An evaluation of possible causes of the decline in pre-fishery abundance of North American Atlantic salmon

Cairns D K

Canadian Technical Report of Fisheries and Aquatic Sciences (2358):1-67

This document presents and describes 62 hypotheses for the decline in pre-fishery abundance estimates of Atlantic salmon of North American origin. Proposed hypotheses apply to six life stages (returning adult to egg, egg to hatch, hatch to smolt, smolt out-migration, ocean life, adult return through estuaries) in eight categories (fisheries, aquaculture, disease, predation, life history, chemical environment, physical/biological environment, thermal environment). The plausibility of each hypothesis was evaluated for salmon originating in 18 districts in Quebec, the Canadian Maritimes, and the north-eastern United States. Hypotheses were scored for Area (the proportion of habitat within each district affected by the hypothesized factor), Degree (the intensity of the hypothesized effect in the area where it applies), Magnitude (Area x Degree), and Trend (the degree of concordance between trends in the hypothesized effect, and changes in salmon populations). The 12 leading hypotheses, ranked by the product of Magnitude and Trend and weighted by egg conservation requirement for the district, included two hypotheses related to freshwater life and 10 hypotheses related to estuarine/marine life. However, one hypothesized marine mortality factor (that density-dependent effects in fresh water influence subsequent survival at sea) is based on a freshwater cause. Of the 12 top-ranked factors, five are related to predation, five are related to life history, one is related to fisheries and one is related to the physical/biological environment. The reliability of the plausibility scoring system is constrained by inadequate knowledge, especially in the estuarine and marine phases. Nevertheless, the scores may serve to identify hypotheses at both local and international scales that are worthy of further investigation.

Returns of transplanted adult, escaped, cultured Atlantic salmon to the Magaguadavic River, New Brunswick

Whoriskey F G; Carr J W

ICES Journal of Marine Science 58 (2):504-509

We transplanted escaped Atlantic salmon (*Salmo salar*) attempting to enter the Magaguadavic River, New Brunswick, distances of up to 50 km away from the river, to investigate if these fish showed any tendency to return. A single fish returned to the river in 1997 (n=78) and also in 1999 (n=34). By contrast, in 1998, 31 of 144 transplanted salmon were recaptured in the river following transplantation. The returnees were moved a second, and in some cases a third, time to see if the pattern would continue. The numbers returning fell with each additional displacement. However, the percentages of the large salmon (>63 cm) coming back stayed the same in successive transplants. By contrast, the fraction of small salmon returning increased. The results document a tendency on the part of escaped cultured Atlantic salmon to return to a specific river system at spawning time. However, the pattern of returns of the transplants was highly variable and unpredictable among years.

Spawning success in Atlantic salmon (*Salmo salar* L.): A long-term DNA profiling-based study conducted in a natural stream

Taggart J B; McLaren I S; Hay D W; Webb J H; Youngson A F

Molecular Ecology 10 (4):1047-1060

Spawning success of Atlantic salmon (*Salmo salar* L.) was investigated, under near-natural conditions, in the Girnock Burn, an 8-km long tributary of the River Dee in Scotland. Employing minisatellite-based DNA profiling, mating

outcomes were resolved over three spawning seasons by assigning parentage to progeny samples removed from spawning nests ('redds'). While individual spawning patterns differed markedly, consistent trends were present over the 3 years studied. Multiple spawning was found to be prevalent. More than 50% of anadromous spawners of both sexes contributed to more than one redd. Up to six redds for a single female and seven for a single male were detected. Both sexes ranged extensively. Distance between redds involving the same parent varied from a few metres to >5 km. Distances >1 km were common. Both males and females ranged to a similar extent. Range limit was not correlated to fish size. Pairs were not monogamous, both males and females mating with different partners at different sites. Size-assortative mating was apparent among 1991 spawners but was not detected for 1992 or 1995. Redd superimposition was found to be common (17-22% of redds over the 3 years), although it was not correlated to the number of anadromous spawners present. High levels of non-anadromous mature parr mating success (40-50% of total progeny sampled) were recorded, and these likely contribute greatly to the effective population size. The relevance of these findings at the individual and population level is discussed, with particular reference to management implications.

A genetic evaluation of mating system and determinants of individual reproductive success in Atlantic salmon (*Salmo salar* L.)

Garant D; Dodson J J; Bernatchez L

Journal of Heredity 92 (2):137-145

The primary objective of this study was to use highly polymorphic microsatellite loci to estimate individual reproductive success in Atlantic salmon based on the number of surviving juveniles (young of the year) at the population level under natural conditions. We inferred reproductive strategies adopted by both sexes by applying a maximum likelihood method to determine parent-offspring genotype relationships. A high degree of variance in individual reproductive success for both males and females was revealed. The high number of mates used by both sexes is not concordant with previous behavioral studies proposing that females are mainly monogamous in this species. We found little evidence supporting the prediction from previous reports of a positive relationship between individual size and realized reproductive success for either males or females. For both sexes, however, there was a significant correlation between the number of mates and the number of offspring. These results indicate that this species' mating system is more flexible than previously thought and suggest that factors such as potential genetic benefits or environmental uncertainty may also be driving the evolution and the plasticity of mating systems in Atlantic salmon.

Behavioural and heart rate responses to predation risk in wild and domesticated Atlantic salmon

Johnsson J I; Hojesjo J; Fleming I A

Canadian Journal of Fisheries and Aquatic Sciences 58 (4):788-794

Artificial culture may relax the selective pressures from predators, thereby altering behavioural and heart rate responses to predation risk. Culture may also impose new selection that adapts fish to confinement. Predictions from these hypotheses were tested by comparing seventh-generation farm Atlantic salmon (*Salmo salar*) with wild Atlantic salmon from the principal founder population of the farm strain. Wild age 1+ salmon had higher standard heart rates and showed a more pronounced flight and heart rate response to a simulated predator attack than did farmed salmon. However, wild fish were closer to the model predator at attack, which may have accentuated these differences. Both strains habituated to the threat, showing less response to the second attack than to the first. In contrast with age 1+ fish, wild age 2+ salmon had lower standard heart rates than farmed fish. Moreover, in age 2+ salmon, domestication effects were less clear and the response to predation threat considerably weaker, suggesting that environmental effects of culture override genetic effects as time in captivity increases. Domestication selection may thus alter reaction norms of farmed animals over environmental gradients and time. This should be considered when attempting to predict the consequences of release or escape of domesticated animals in the wild.

Feeding habits of wild and escaped farmed Atlantic salmon, *Salmo salar* L., in the North-east Atlantic

Jacobsen J A; Hansen L P

ICES Journal of Marine Science 58 (4):916-933

The stomach contents of 2,992 wild and 863 putative escaped farmed Atlantic salmon caught on floating long-lines in a Faroese research fishery in the late autumn (November-December) and winter (February-March) in the North-east Atlantic (63-66°N and 1-10°W) during three consecutive fishing periods 1992/1993-1994/1995 were analysed. Hyperiid amphipods of the genus *Themisto*, euphausiids and mesopelagic shrimps are important sources of food for salmon in the autumn period and various mesopelagic fish such as lantern fishes, pearlsides and barracudinas become equally important during the late winter period. The occasional presence in the stomachs of larger fish such as herring, blue whiting and mackerel is not considered to be evidence that these fish are a main source of food for salmon in the sea north of the Faroes. The proportion of stomachs containing food was significantly lower during autumn (53%) than during winter (78%). However, temperature-dependent evacuation rates could partly explain the apparent lower stomach content during the autumn, since the average ambient sea-surface temperature is 7°C in autumn compared to 3°C in winter. There was evidence of selective foraging. Fish were preferred over crustaceans, and amphipods were chosen over euphausiids. Large salmon (3+SW)

tended to be more piscivorous than smaller fish. There was no difference in condition factor, number and weight proportions of prey, or in diet between wild and escaped farmed salmon, which suggests that escaped farmed salmon adapt well to the "wild" life in the ocean.

Seasonal differences in the origin of Atlantic salmon (*Salmo salar* L.) in the Norwegian Sea based on estimates from age structures and tag recaptures

Jacobsen J A; Lund R A; Hansen L P; O'Maoileidigh N

Fisheries Research (Amsterdam) 52 (3):169-177

To test if the population structure of Atlantic salmon (*Salmo salar* L.) at the feeding areas in the Norwegian Sea north of the Faroes is stable throughout early (November-December) and late (February-March) winter, river and sea age distributions were estimated from 2,350 scale samples obtained in the early and late winter during four consecutive fishing periods 1991/1992-1994/1995. The origin of recaptures of salmon tagged as smolts in different European countries were also compared between early and late winter. The fish were classified as being of wild or fish farm origin from scale characteristics, and farmed salmon were excluded from the analyses. Age compositions in samples from the four fishing periods showed consistent patterns. The average smolt age (\pm S.E.) was significantly lower in the early than in the late winter (2.5 ± 0.04 and 2.7 ± 0.03 , range 1-5) as was average sea age (1.9 ± 0.03 and 2.2 ± 0.02 , range 1-6). As salmon from southern European countries tend to smolt at an earlier age and produce more one-sea-winter salmon than in northern Europe, we suggest that a significant proportion of the salmon caught in the Faroes area during early winter originate from southern European countries and that fish from northern regions appear to be more abundant in the late winter period. Recaptures in the Faroese fishery during early and late winter of salmon tagged as smolts in different countries support this.

Relationship between freshwater angling catch of Atlantic salmon and stock size in the River Bush, Northern Ireland

Crozier W W; Kennedy G J A

Journal of Fish Biology 58 (1):240-247

Over 25 years rod catches of Atlantic salmon *Salmo salar* increased proportionately as stock size increased ($r^2=0.581$, $P<0.001$), with no overall trend between exploitation rate and stock size ($r^2=0.016$, $P>0.5$). On a 15-year sub-set of these data, annual effort ($P=0.804$) and flow ($P=0.339$) had little significance relative to stock size ($P<0.01$) on variation in rod catches. Stock size, time, effort and flows had no influence on inter-annual variation of rod exploitation rate ($r^2=0.094$, $P=0.880$). Pairwise correlation between variables confirmed these results. In 1998, weekly effort contributed significantly to overall catch variation ($P<0.001$), while weekly flow did not ($P=0.438$). These results are discussed in relation to the utility of rod catch data for deriving estimates of stock for spawning target compliance purposes.

Stocking Atlantic salmon (*Salmo salar* L.) and brown trout (*Salmo trutta* L.) in rivers: Diet selectivity and the effects on the macroinvertebrate community

Arnekleiv J V; Raddum G G

Nordic Journal of Freshwater Research (75):109-126

This paper reviews the literature on diet selectivity and the effects of fish predation on the invertebrate community in streams. Further we give examples from Scandinavian investigations and stocking programs aiming to give state of the art knowledge on how fish stocking can influence and structure invertebrate communities in running water. Several studies have shown weak or no effects of fish predation, whereas others have shown strong cascading effects. Benthic-feeding fish have greater impact on benthic prey than drift-feeding fish like Atlantic salmon and brown trout. Predator impacts seem to be less apparent when prey replenishment rates are high. Terrestrial prey in the drift may reduce the impact on lower trophic levels. Several Scandinavian studies conducted on stocked fish and their nutrition indicate that stocking of anadromous fish probably has little effect on abundance and biomass of invertebrates, particularly if the river stretch already has juvenile fish of the same species. There is a need for laboratory and comparative field studies and experiments aimed at testing specific hypotheses related to predator-prey interactions in running water.

Annual variation in size-selective mortality of Atlantic salmon (*Salmo salar*) fry

Good S P; Dodson J J; Meekan M G; Ryan D A J

Canadian Journal of Fisheries and Aquatic Sciences 58 (6):1187-1195

We investigated the size-selective mortality of Atlantic salmon (*Salmo salar*) fry during two consecutive summers that differed markedly in weather conditions. We sampled fry shortly after emergence in June and at the end of August to compare the distributions of back-calculated body size at hatching by examining otolith microstructure. Size-selective mortality was observed in both summers; however, the direction and strength of mortality differed. During the drought conditions of 1995, selective mortality was relatively weak and directed towards the smaller fry in the population. During the flood conditions of 1996, selective mortality was relatively strong and directed towards the larger fry of the same population. Inter-annual variability in size-selective mortality contributed to significant differences in the mean size of fry at the end of their first summer of life. Size-selective mortality rates estimated from the shifts in fish length at hatching

observed during the first summer of life were comparable with published estimates of total mortality of Atlantic salmon fry, indicating that early mortality may be largely size-selective. Mortality associated with hydroclimatic events can select against either small or large fish and is a key determinant of mean size attained by the end of the first summer of life.

Spatial and temporal effects of inter-specific competition between Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*) in winter

Harwood A J; Metcalfe N B; Armstrong J D; Griffiths S W

Canadian Journal of Fisheries and Aquatic Sciences 58 (6):1133-1140

Previous work has shown that juvenile stream-dwelling salmonids become predominantly nocturnal during winter by emerging from daytime refuges to feed, with several species having been shown to prefer slow-flowing water while active at night. We used semi-natural stream channels, landscaped to provide a choice of water depths, and hence velocities, to test whether Atlantic salmon, *Salmo salar*, and brown trout, *Salmo trutta*, show similar habitat preferences during winter. We also tested whether there was any spatial or temporal displacement of Atlantic salmon when in sympatry with brown trout. Night-time observations revealed that Atlantic salmon did have a preference for slow-flowing water. However, when in direct competition with trout, salmon either remained predominantly nocturnal but occupied shallower water, or became significantly less nocturnal, spending more time active during the day than when in allopatry. These results, which were especially marked in relatively larger fish, indicate that competition between the two species for food and resources is not restricted to the summer months and may affect both the short- and long-term growth and survival of over-wintering wild Atlantic salmon.

Social status, access to food, and compensatory growth in juvenile Atlantic salmon

Maclean A; Metcalfe N B

Journal of Fish Biology 58 (5):1331-1346

Juvenile Atlantic salmon *Salmo salar* subjected to three weeks of cooler temperatures were 8.5% smaller than controls at the end of the temperature manipulation, but had caught up in size 20 weeks later. The behavioural means is examined by which this catch-up or compensatory growth is achieved. While on average compensating fish did not spend more time feeding, dominant fish within each group gained more exclusive access to the feeding area during periods of catch-up growth. Therefore the extent to which compensatory growth could be achieved was dependent on both the social status of the individual and the dominants' ability to monopolize the food patch.

The influence of energetic requirements on the preferred temperature of over-wintering juvenile Atlantic salmon (*Salmo salar*)

Morgan I J; Metcalfe N B

Canadian Journal of Fisheries and Aquatic Sciences 58 (4):762-768

We used a horizontal temperature gradient to investigate the effect of alternate life history strategies and nutritional state on the preferred temperature of over-wintering juvenile Atlantic salmon (*Salmo salar* L.). Contrary to our prediction, there was no significant difference in final preferred temperature between juvenile Atlantic salmon that will migrate to sea the following spring (early migrants) and those that show reduced growth and delay migration for at least another year (delayed migrants). Both migrant groups preferentially selected relatively low temperatures (<10°C), likely owing to their low appetite and growth rates. Food deprivation resulted in a significant increase, rather than our predicted decrease, in the final preferred temperature of the juvenile Atlantic salmon of approximately 2°C. We suggest that this is due to the need for an increased foraging effort to offset the projected energy deficit later in the winter. The final preferred temperature of delayed migrants increased from winter to spring, as predicted, coincident with increases in natural food availability and endogenous seasonal increases in appetite and growth rates. We conclude that the preferred temperature of over-wintering juvenile Atlantic salmon may be influenced by future energetic requirements rather than the current level of energy reserves.

Potential impact of climate warming on recreational fishing opportunities for Atlantic salmon, *Salmo salar* L., in Newfoundland, Canada

Dempson J B; O'Connell M F; Cochrane N M

Fisheries Management and Ecology 8 (1):69-82

Potential impacts of climate warming on recreational fishing opportunities were addressed by assessing the frequency and extent that Atlantic salmon, *Salmo salar* L., rivers in Newfoundland have been closed over a 25-year period (1975 to 1999) because of warm water temperatures and low water levels. On average, approximately 28% of all salmon rivers were temporarily closed annually, with over 70% affected in some years. This has resulted in a loss of 35-65% of the potential fishing days available in some salmon fishing areas with the collective 1995 to 1999 period being impacted the most over the past two decades. Geographically, west and south-west coastal rivers were affected less from environmental closures than east and some south coast fishing areas. A trend for increased closures of rivers related to environmental reasons could reduce the economic importance of the recreational salmon fishery and also make it more difficult to assess the status of Atlantic salmon stocks, which is a requirement for conservation of the resource.

Functional models for growth and food consumption of Atlantic salmon parr, *Salmo salar*, from a Norwegian river

Forseth T; Hurley M A; Jensen A J; Elliott J M

Freshwater Biology 46 (2):173-186

1. The chief objectives were to analyse and model experimental data for maximum growth and food consumption of Atlantic salmon parr (*Salmo salar*) collected from a cold glacier-fed river in western Norway. The growth and feeding models were also applied to groups of Atlantic salmon growing and feeding at rates below the maximum. The growth models were validated by comparing their predictions with observed growth in the river supplying the experimental fish. 2. Two different models were fitted, one originally developed for British salmon and the other based on a model for bacterial growth. Both gave estimates for optimum temperature for growth at 18-19°C, somewhat higher than for Atlantic salmon from Britain. Higher optimal temperature for growth in salmon from a cold Norwegian river than from British rivers does not concur with predictions from the thermal adaptation hypothesis. 3. Model parameter estimates differed among growth groups in that the lower critical temperature for growth increased from fast- to slow-growing individuals. In contrast to findings for brown trout (*Salmo trutta*), the optimum temperature for growth did not decrease with decreasing levels of food consumption. 4. A new and simple model showed that food consumption (expressed in energy terms) peaked at 19.5-19.8°C, which is similar to the optimal temperature for growth. Feeding began at a temperature 1.5°C below the lower temperature for growth and ended about 1°C above the maximum temperature for growth. Model parameter estimates for consumption differed among growth groups in a manner similar to the growth models. Maximum consumption was lower for Atlantic salmon than for brown trout, except at temperatures above 18°C. 5. By combining the growth and food consumption models, growth efficiency was estimated and reached a maximum at about 14°C for fast growing individuals, increasing to nearly 17°C for slow-growing ones, although it was lower overall for the latter group. Efficiency also declined with increasing fish size. Growth efficiency was generally higher for Atlantic salmon than for brown trout, particularly at high temperature.

Deferred costs of compensatory growth after autumnal food shortage in juvenile salmon

Morgan I J; Metcalfe N B

Proceedings of the Royal Society Biological Sciences Series B 268 (1464):295-301

Growing animals are often able to offset the effects of periods of reduced food availability by subsequently undergoing a phase of elevated compensatory or 'catch-up' growth. This indicates that growth rates are not normally maximized even when food is not limiting, suggesting that fast growth may be costly. Here, we show experimental evidence of a long-term deferred cost of compensatory growth after a period of food shortage. Juvenile salmon subjected to a short-lived low-food regime in autumn subsequently entered a hyperphagic phase, leading to complete restoration of lipid reserves and partial recovery of lost skeletal growth relative to controls. However, several months later they entered a prolonged phase of poorer performance (despite food now being freely available), so that by the following spring they were substantially smaller than controls and had lower lipid reserves for their body size. The incidence of sexual maturation in males the following breeding season was also reduced. Salmon thus appear to trade off the benefits of short-term restoration of fat stores prior to winter against long-term performance.

Intra-specific food resource partitioning in Atlantic salmon (*Salmo salar*) parr in a sub-arctic river

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

Aquatic Living Resources 14 (4):257-265

The food utilisation and partitioning between three age-groups of Atlantic salmon parr were studied in the sub-arctic river Tana (70°N, 27°E) by analysis of fish stomach contents and invertebrate composition in the three main lotic feeding habitats: bottom substratum, water column and surface. The salmon parr exhibited large seasonal variation in their food choice, but the different age-groups had a similar diet, dominated by mayfly and stonefly nymphs in May, flying insects and simuliid larvae and pupae in July, and caddis fly larvae in August and September. Some differences in the food resource use of the three age-groups were however also observed, mainly related to size-dependent differences in feeding abilities, but partly also to different use of feeding habitats. Small-sized stonefly and mayfly nymphs and simuliid larvae and pupae decreased in importance with increasing fish age, whereas Trichoptera larvae and flying insects increased. The low resource partitioning between the different age-groups of salmon parr suggests that intra-specific competition for food may occur. All age-groups mostly fed on prey types associated with the bottom habitat, and substantial drift feeding was only observed in July, probably due to low drift rates throughout most of the summer season in this sub-arctic river.

An assessment of the potential for the application of two simple models to Atlantic salmon, *Salmo salar*, stock management in chalk rivers

Hilton J; Welton J S; Clarke R T; Ladle M

Fisheries Management and Ecology 8 (3):189-205

Many salmon populations in the UK are under threat, which is assumed to result from a combination of anthropogenic and natural factors. Positive management is required to bring them back to their former productivity levels. An attempt has been made to use two simple models to assess the suitability of several management approaches for use on chalk rivers. One model is based on the survival rates at each stage of the salmon life-cycle and the other estimates the predation of young salmon by other fish. This work highlights the paucity of data available to calibrate even the simplest salmon management models. For those variables where data are available, the variability is very high. Despite the poor quality of input data, the outputs are close to observed numbers in the River Frome, a chalk river in Dorset, UK. The models were used to assess the effect of managing the fishery using reduced rod catches, pike culling, gravel cleaning and trout stocking on adult salmon and smolt numbers.

Genetic differences in physiology, growth hormone levels and migratory behaviour of Atlantic salmon smolts

Nielsen C; Holdensgaard G; Petersen H C; Bjornsson B Th; Madsen S S

Journal of Fish Biology 59 (1):28-44

Out of five strains of Atlantic salmon *Salmo salar* of 1+ years released upstream of a fyke net in the River Gudena in 1996, three (Lagan, Atran and Corrib) migrated immediately, 50% of the recaptured fish reaching the net in 3-6 days. Burrishoole and Conon fish migrated with a 15-19 day delay. Smolt development in 1997 at the hatchery showed a spring surge in gill Na^+ , K^+ -ATPase activity in all strains which was correlated with increased seawater tolerance. Differences in the timing of gill enzyme development matched the observed migration pattern well. Lagan, Atran and Corrib strains reached high enzyme activity earlier than the Burrishoole and Conon strains, and strains with delayed enzyme development and migration showed a delayed regression of seawater tolerance compared with the early strains. Inter-strain differences in plasma growth hormone profiles could not be related to the observed patterns of Na^+ , K^+ -ATPase and seawater tolerance development. The study gives evidence of genetic influence on the timing and intensity of smolting and subsequent migration in Atlantic salmon.

Feeding and prey selection of wild Atlantic salmon post-smolts

Andreassen P M R; Martinussen M B; Hvidsten N A; Stefansson S O

Journal of Fish Biology 58 (6):1667-1679

The diet of post-smolt Atlantic salmon *Salmo salar* caught in the Trondheimsfjord and Frohavet in central Norway, based on stomach contents analysis, showed a gradual change during migration from the river to the estuary, fjord and coastal areas. Post-smolts caught in the estuary had eaten inter-tidal gammarid amphipods, while post-smolts caught further seawards preyed upon available marine prey such as *Calanus spp.*, adult euphausiids and fish larvae. The frequency of adult insects was high in all post-smolt stomachs. The gradual change in diet suggested that feeding conditions in the early marine phase were important for post-smolt survival and growth. With the exception of the copepods, there was no overall similarity between species composition of the plankton samples and the stomach contents. Although the hypothesis that the post-smolts are opportunistic feeders cannot be rejected, the composition of the stomach contents suggests a possible selectivity of advantageous prey.

Density-dependent refuge use among over-wintering wild Atlantic salmon juveniles

Armstrong J D; Griffiths S W

Journal of Fish Biology 58 (6):1524-1530

Sheltering behaviour of wild juvenile Atlantic salmon in an indoor stream was found to be density-dependent; the proportion of fish sheltering decreased significantly with increasing population density. The mean number of fish occupying refugia was ≤ 1.5 fish per refuge even at very high densities (potentially 5 fish per shelter). These results suggest that shelter availability has potentially important consequences for the carrying capacity for natural populations of salmon in streams.

A model of salmon louse production in Norway: Effects of increasing salmon production and public management measures

Heuch P A; Mo T A

Diseases of Aquatic Organisms 45 (2):145-152

Salmon lice *Lepeophtheirus salmonis* Kroyer have caused disease problems in farmed Atlantic salmon *Salmo salar* L. since the mid-1970s in Norway. High infection intensities and premature return of wild sea trout *Salmo trutta* L. were first reported in 1992. Later emaciated wild Atlantic salmon smolts carrying large amounts of lice have been observed both in fjords and offshore. The Norwegian Animal Health Authority regulations to control the problem, which came into operation in 1998, included compulsory louse level monitoring in farms and maximum legal numbers of lice per fish.

Here, we present a model of salmon louse egg production in Norway and show that the effect of the current public management strategy is critically dependent on the yearly increase in salmon production. This is because the infection pressure is the product of the number of fish in the system, and the number of lice per fish. Due to the much larger number of farmed than wild salmonids, it is highly likely that lice originating from farmed salmon infect wild stock. Estimated tolerance limits for wild salmonids vary widely, and the level of louse egg production in farms which would be needed to decimate wild populations is not known. Two possible thresholds for total lice egg production are investigated: (1) 1986 to 1987 level (i.e. before adverse effects on sea trout were recorded), and (2) a level corresponding to a doubling of the estimated natural infection pressure. The farm lice per fish limits that would have to be observed to keep louse production within the 2 thresholds are calculated for the period 1986 to 2005. A steady decrease in the permitted number of lice per fish may keep the total louse production stable, but the number of salmon required for verification of lice numbers will increase as the prevalence to be verified is decreased. At threshold (2), the model estimated that lice limits should have been 0.05 louse per fish in 1999. This would require 60 fish from each pen to be collected, anaesthetised and examined for a good estimate at a confidence level of 95%. Such sample numbers are likely to be opposed by farmers. The use of national delousing programs to solve the problem is discussed.

Assessing introgression of foreign strains in wild Atlantic salmon populations: Variation in microsatellites assessed in historic scale collections

Martinez J L; Dumas J; Beall E; Garcia-Vazquez E

Freshwater Biology 46 (6):835-844

1. Genetic variation at five microsatellite loci was analysed in a collection of scales (1970-97) sampled from Atlantic salmon adults returning to the Nivelle River (South France). 2. Native and foreign fish (from an allochthonous Scottish stock introduced into the river to increase population size) were clearly identified as all foreign individuals released in the river were physically marked. 3. Introgression of foreign genes into the native gene pool has occurred, although the reproductive success of foreign Atlantic salmon in the wild was lower than that of native individuals. 4. The utility of old scale samples for investigating the impact of foreign stocking on wild fish populations is demonstrated in this work.

The impact of two pesticides on olfactory-mediated endocrine function in mature male Atlantic salmon (*Salmo salar* L.) parr

Moore A; Lower N

Comparative Biochemistry and Physiology Part B Biochemistry & Molecular Biology 129B (2-3):269-276

Short-term exposure of the olfactory epithelium of mature male Atlantic salmon parr to either the pesticide simazine (concentrations 1.0 and 2.0 $\mu\text{g l}^{-1}$) or the pesticide atrazine (concentration 1.0 $\mu\text{g l}^{-1}$) significantly reduced the olfactory response to the female priming pheromone, prostaglandin $\text{F}_{2\alpha}$. In addition, the reproductive priming effect of the pheromone on the levels of expressible milt was also reduced after exposure to the individual pesticides (simazine 0.1, 0.5, 1.0 and 2.0 $\mu\text{g l}^{-1}$ and atrazine 0.5 and 2.0 $\mu\text{g l}^{-1}$). When the olfactory epithelium was exposed to a mixture of simazine and atrazine, (concentrations of 0.5:0.5 and 1.0:1.0 $\mu\text{g l}^{-1}$), there was no significant reduction in the olfactory response when compared to the single pesticides at equivalent concentrations. In addition, exposure to a mixture of simazine and atrazine had no synergistic effect on the priming response, and plasma levels of testosterone, 11-ketotestosterone and 17,20 β -dihydroxy-4-pregnen-3-one were similar in the groups of male parr exposed to the individual pesticides. Although the levels of expressible milt were reduced in all groups, there were no significant differences between the different pesticide treatments. The results of the study suggest that the two *s*-triazine pesticides have an additive and not a synergistic impact on olfactory-mediated endocrine function in mature male salmon parr.

Genetic and life history differentiation between donor and derivative populations of Atlantic salmon

Martinez J L; Gephard S; Juanes F; Perez J; Garcia-Vazquez E

Transactions of the American Fisheries Society 130 (3):508-515

We examined the genetic structure of two North American populations of Atlantic salmon *Salmo salar*, those of the Connecticut and Penobscot rivers. The native population in the Connecticut River (at the southern edge of the species' natural distribution) was extirpated nearly 200 years ago. A restoration population was founded about 30 years ago with individuals from the Penobscot River, 400 km north of the Connecticut River. We investigated the current variation of both populations at enzymatic and microsatellite loci to assess the genetic changes that have occurred in the Connecticut River population with respect to the predominant (brood source) population. Significant differences between the two stocks were found at both enzyme and microsatellite loci and in the age of maturity of returning adults.

Estimation of marine exploitation rates on Atlantic salmon (*Salmo salar* L.) stocks in Newfoundland, Canada

Dempson J B; Schwarz C J; Reddin D G; O'Connell M F; Mullins C C; Bourgeois C E

ICES Journal of Marine Science 58 (1):331-341

Marine exploitation rates were estimated for nine Newfoundland Atlantic salmon (*Salmo salar* L.) populations, separately for small and large salmon size components. Estimates were derived using counts of salmon returning to fish counting facilities rather than from tagging studies and thus adjustments were not required to account for tag loss, handling or tagging mortality, or tag reporting rates. For all stocks combined, the overall marine exploitation rate during the period 1984-1991 averaged 45.3% (29.6-57.1%) on small salmon and 74.2% (57.7-83.7%) on large salmon. These estimates are considered minimum values. Concerns related to declining salmon abundance resulted in the closure of the Newfoundland commercial salmon fishery in 1992. Results are discussed in relation to previous estimates derived from tagging, and highlight the importance of accounting for marine exploitation when examining trends in salmon survival and return data even when commercial fisheries have been closed.

Use of sterile triploid Atlantic salmon (*Salmo salar* L.) for aquaculture in New Brunswick, Canada

Benfey T J

ICES Journal of Marine Science 58 (2):525-529

Induced triploidy is the only effective method currently available for mass production of reproductively sterile salmonids for aquaculture. Repeated studies at the Atlantic Salmon Federation's hatchery (St Andrews, New Brunswick, Canada) have shown only minor differences between triploids and diploids in survival to S1 smolt age (15 months), percentage of the population which became S1 smolts, and mean S1 smolt size. However, a similar study at a commercial hatchery was terminated because of exceptionally high mortality of triploids prior to the start of feeding. Marine grow-out trials in sea cages showed that triploids grew well in seawater, but had reduced survival rates (leading to a 5-15% reduction in yield at harvest) and high rates of jaw abnormalities. Similar results have been reported elsewhere. Although induced triploidy can be used effectively as a management tool to ensure lack of reproduction, there is at present little support of the aquaculture industry to switch to their large-scale use. In light of fundamental biological differences, it is perhaps naive to expect triploids to perform as well as diploids using standard culture methods. Triploids should be treated as a new "species" for aquaculture development, beginning with research to determine their optimum rearing requirements.

Competitive interactions in young Atlantic salmon (*Salmo salar* L.) and brown trout (*Salmo trutta* L.) in lotic environments

Bremset G; Heggenes J

Journal of Freshwater Research (75):127-142

Young Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*) are ecologically similar in most respects. Considerable inter-specific niche similarities, e.g. in feeding, habitat use and behaviour, are indicative of potentially severe inter-specific competition. Trout are generally more aggressive and have a higher freshwater growth than salmon, and at the juvenile stage trout are recognised to be a superior competitor, dominating salmon of similar body size. In order to minimise inter-specific competition, sympatric species can be spatially segregated. On the macro scale, juvenile salmon are predominantly found in the faster-flowing habitats such as riffles and runs, while brown trout tend to favour slower flowing habitats such as pools and flats. On a smaller spatial scale, young salmon are often found at longer distances from the riverbank than young trout, and seem to use the mid-river areas to a greater extent than trout. Moreover, young trout are less attached to the riverbed than similar-aged salmon. This inter-specific difference in habitat use could be the result of competition for profitable feeding positions. On the micro scale, juvenile trout occupy microhabitats with lower water velocities than salmon juveniles. Juveniles of both species are segregated both along the horizontal and the vertical axis, with the younger specimens closest to the riverbank and riverbed. This three-dimensional habitat segregation is probably due to subordinate fish being excluded from the most profitable feeding areas by higher ranked individuals, and are restricted to areas of less profitability in terms of food availability and predation risk.

Estimating carrying capacity and pre-smolt production of Atlantic salmon (*Salmo salar*) and anadromous brown trout (*Salmo trutta*) in west Norwegian rivers

Saegrov H; Urdal K; Hellen B A; Kalas S; Saltveit S J

Nordic Journal of Freshwater Research (75):99-108

Density estimates of pre-smolt Atlantic salmon and brown trout were obtained by electrofishing in late autumn in eleven rivers in western Norway during 1991 to 1999. Total pre-smolt density varied from 4 to 34 pre-smolt 100m⁻², and decreased significantly with the natural logarithm of annual discharge (linear regression, R²=0.84, P<0.001, N=11). Overall mean pre-smolt density and biomass were 15.8 and 282 g 100 m⁻². The results indicate that factors associated with high discharge constrain smolt production in some of these rivers. This may occur particularly during early summer when high water velocity may restrict the area of available habitat within rivers. Atlantic salmon pre-smolts outnumbered brown trout pre-smolts in the warm rivers, while there was a shift towards dominance of brown trout in the coldest rivers. The

pre-smolt-discharge relation may provide a simple method to check if smolt production in a river differs from expected carrying capacity.

Identification by scale analysis of farmed Atlantic salmon juveniles in south-western New Brunswick rivers

Stokesbury M J W; Lacroix G L; Price E L; Knox D; Dadswell M J

Transactions of the American Fisheries Society 130 (5) 815-822

A procedure was developed to identify whether the natal origin of juvenile Atlantic salmon *Salmo salar* in the Magaguadavic River, New Brunswick, was farmed or wild. Farmed juveniles enter this river as escapees from commercial hatcheries. The discriminant function was developed using measured scale characteristics for the first year of growth, as determined from samples of farmed and wild juvenile Atlantic salmon of known origin. Eight scale characteristics proved to be significant predictors of origin. In a jack-knife cross-validation, the discriminant function was 90% accurate in predicting the origin of juvenile Atlantic salmon in the Magaguadavic River. The procedure was then applied to juvenile Atlantic salmon of unknown natal origin sampled from the Magaguadavic and neighboring Waweig and Digdequash rivers, which also support salmon hatcheries. Of the juvenile Atlantic salmon sampled in the Magaguadavic River in 1996, 1997, and 1998, 36, 59, and 43%, respectively, were estimated to be of farmed origin. During 1998, an estimated 9% and 42% of juvenile Atlantic salmon sampled from the Digdequash and Waweig rivers, respectively, were of farmed origin. The study indicated that farmed juvenile Atlantic salmon escaped from hatcheries and occupied suitable habitat in all three rivers.

A method for tracking the behaviour of mature and immature salmon parr around nests during spawning

Armstrong J D; Einum S; Fleming I A; Rycroft P

Journal of Fish Biology 59 (4):1023-1032

A remote monitoring system was developed to provide information on the behaviour of mature and immature Atlantic salmon *Salmo salar* parr at nests during the spawning season. An octagonal passive integrated transponder (PIT) detector (0.865 m maximum diameter) designed to surround nests of Atlantic salmon was used to identify individual salmon parr present at 38 spawning events in three circular spawning channels. The range of the detector for PIT tags presented in the optimum orientation was 2.4 cm (range between tags 1.7-3.0 cm). Using a sub-sample of 20 spawnings, the mean efficiency of the detector (number of fish passes registered relative to number of passes observed on video) was 70.5% (range 32-100%). There were no significant effects of time from spawning, total number of registrations, body size or maturity status (mature or immature) on efficiency. However, fish were more likely to be detected entering nests than leaving, as departures were more rapid and higher in the water column. The PIT detector did not affect the numbers of parr at spawnings or between-spawning intervals of females, and allowed for the individual identification of 65 of the 72 parr observed in nests during spawning. In all cases where certain identifications were not possible and the video was of satisfactory quality, this was due to obstruction of the camera view by anadromous fish. The remote monitoring system was thus effective in identifying behavioural differences, and only one of 20 immature parr was ever detected during the period encompassing 10 min before and after spawning compared with 30 or 40 mature parr.

Return migration of Atlantic salmon in the River Tana: Phases of migratory behaviour

Okland F; Erkinaro J; Moen K; Niemela E; Fiske P; McKinley R S; Thorstad E B

Journal of Fish Biology 59 (4):862-874

From a total of 174 multi-sea-winter Atlantic salmon radio-tagged in the Tanafjord (northern Norway, 70°N) during 1992 and 1993, 48 Atlantic salmon were followed from entering the River Tana until spawning. Three phases were identified: (1) migratory, direct or stepwise migration to, or close to the position held at spawning; (2) search, movements both up and down river at or close to the position held at spawning; (3) holding, a period without movements prior to spawning. During the migratory phase, Atlantic salmon migrated directly to near the spawning area, or stopped between one and nine shorter periods during the upstream migration. Number of stops increased with increasing migratory distance in 1993, but no such correlation was found in 1992. The highest migratory speeds were recorded in the lower parts of the river. A distinct change in migratory pattern was found in 67% of the Atlantic salmon near or at the area held at spawning. Most common was a search phase of erratic movements with more than one down-river movement. After the movement terminated, 96% of the Atlantic salmon had a period when no or little movement was recorded until spawning (on average 55 days in 1992 and 51 days in 1993). There was no preference for staying at, up or down river from the spawning area during this holding period. Early ascending Atlantic salmon migrated to spawning areas further from the mouth than the later arriving Atlantic salmon in 1993, but not in 1992. The proportion of time spent on the migratory phase increased, while the proportion of time spent on the holding phase decreased with increasing distance to the spawning area.

Flow and pH modelling to study the effects of liming in regulated, acid salmon rivers

Bjerknes V; Tjomsland T

Water Air and Soil Pollution 131 (1-4 Part 3):1409-1414

In the regulated river Ekso, Western Norway, liming of the headwater has been introduced as a mitigating action to improve the water quality for Atlantic salmon (*Salmo salar* L.). Supply of lime from a dosing plant situated 5 km above the salmon producing part of the river, aims to raise pH from 5.0 to 6.5 during the smolt period for Atlantic salmon, and to 6.2 for the rest of the year. Hydrological modelling based on the relationship between CaCO_3 and pH is applied for the evaluation of the liming strategy, based on monitoring data from the spring 2000. The water quality demand was satisfied 80% of the time in the upper part of the salmon area, and 40% of the time in the lower part, influenced by power plant discharge. Flood forecasting and overdosing of lime ahead of floods will reduce the effects of acidified and unlimed tributaries. An additional lime doser is recommended to supply the power plant discharge.

Tolerance to acid water among strains and life stages of Atlantic salmon (*Salmo salar* L.)

Rosseland B O; Kroglund F; Staurnes M; Hindar K; Kvellestad A

Water Air and Soil Pollution 130 (1-4 Part 2):899-904

Re-introduction of Atlantic salmon (*Salmo salar* L.) after liming of acidified barren salmon rivers could benefit by choosing acid-tolerant strains. Testing different life history stages from fry to smolts of five salmon strains with different acidification history demonstrated strain-specific variation in tolerance to acid aluminum-rich waters for stages from fry to parr. Contrary to expectation, salmon from non-acidified rivers were more tolerant. Differences in sensitivity were found between life history stages. Within a specific life history stage, size-dependent sensitivity was found; small fish being more sensitive to pH while large fish were more sensitive to aluminum. Pre-smolts showed the same relative tolerance between strains as younger stages. These differences disappeared, however, when the smolt reached full smoltification, probably due to super-sensitivity at this stage. Poor water quality during the last period of smoltification and outmigration can thus mask the genetic potential for tolerance to acidic rivers.

Effects of acidity and aluminum on the physiology and migratory behavior of Atlantic salmon smolts in Maine, USA

Magee J A; Haines T A; Kocik J F; Beland K F; McCormick S D

Water Air and Soil Pollution 130 (1-4 Part 2):881-886

Atlantic salmon, *Salmo salar*, smolts of hatchery origin were held for 5 - 16 days in ambient (pH 6.35, labile Al = $60 \mu\text{g l}^{-1}$), limed (pH 6.72, labile Al = $58.4 \mu\text{g l}^{-1}$), or acidified (pH 5.47, labile Al = $96 \mu\text{g l}^{-1}$) water from the Narraguagus River in Maine, USA. Wild smolts were captured in the same river in rotary traps and held for up to two days in ambient river water. Osmoregulatory ability was assessed by measuring Na⁺/K⁺ ATPase activity, hematocrit, and blood Cl concentration in freshwater, and after 24-hr exposure to seawater. Hatchery smolts exposed to acidic water and wild smolts displayed sub-lethal ionoregulatory stress both in fresh and seawater, with mortalities of wild smolts in seawater. Using ultrasonic telemetry, hatchery-reared ambient and acid-exposed, and wild smolts were tracked as they migrated through freshwater and estuarine sections of the river. The proportion of wild smolts migrating during daylight hours was higher than for hatchery-reared smolts. Wild smolts remained in the freshwater portions of the river longer than either group of hatchery smolts, although survival during migration to seawater was similar for all three treatments. Acid-exposed hatchery-origin and wild Narraguagus River smolts were both under ionoregulatory stress that may have affected their migratory behavior, but not their survival for the time and area in which we tracked them.

The return of the salmon

Kroglund F; Kaste O; Rosseland B O; Poppe T

Water Air and Soil Pollution 131 (1-4 Part 3):1349-1354

The Atlantic salmon population in the River Otra, southern Norway was lost during the 1960's due to acid rain and industrial and municipal pollution. The industrial and municipal pollution sources were sanitized by 1995. A concurrent reduction in acid deposition has during the last 10 years raised pH from 5.2 to 5.7 and reduced inorganic monomeric Al from 71 to $28 \mu\text{g Al l}^{-1}$ above the industrial area. The water quality improvement resulted in salmon fry again being caught from 1995. Physiological measurements (blood parameters and seawater tolerance) performed on smolts of Atlantic salmon exposed within the river during the spring of 1999 suggests that the smolts were fully smoltified and seawater-tolerant, despite having moderate gill morphological changes and having moderately high gill Al concentrations ($70\text{--}80 \mu\text{g Al g}^{-1}$ dry weight). The smolt quality measured suggests that the river again can support a native salmon population, provided there is no negative change in water quality. Winter episodes and acid tributaries within the watershed can, however, offset the recovery process.

Atlantic salmon and acidification in southern Norway: A disaster in the 20th century, but a hope for the future?

Sandoy S; Langaker R M

Water Air and Soil Pollution 131 (1-4 Part 3):1343-1348

Due to acidification, 18 Norwegian stocks of Atlantic salmon are extinct and an additional 8 are threatened. In the two southern-most counties, salmon is eradicated. Due to the high acid sensitivity, production of salmon was greatly reduced as early as 1920, several decades before acid rain was recognized as an environmental problem. International agreements on reduced atmospheric emissions will reduce acidification effects in Norway substantially during the coming 20 to 50 years. However, the extreme acid sensitivity of salmon makes the destiny of this species in Southern Norway uncertain. Liming is an effective measure to protect and restore fish populations in acidified waters. Liming of acidified salmon rivers has become important in Norway in recent years which in combination with reduced emissions will be an important contribution to protection of the Atlantic salmon species. In this paper we give an overview of the effects of acidification on Norwegian salmon and discuss different aspects of mitigation measures; the expected effect of international agreements on reduced atmospheric emissions, the expected effect of liming on salmon production and the possibilities of re-establishing self-sustaining salmon stocks in limed rivers.

Infectious salmon anaemia virus in wild fish from Scotland

Raynard R S; Murray A G; Gregory A

Diseases of Aquatic Organisms 46 (2):93-100

Following the outbreak of infectious salmon anaemia (ISA) at salmon farms in Scotland, UK, a survey was established to determine the extent of infection in wild fish. All fish tested were free from the clinical symptoms of ISA. Isolations of ISAV were made from 5 sea trout within areas where ISA-affected salmon farms were located. Evidence for ISAV in other sea trout was provided by ISA RT-PCR diagnostic tests. Results from ISA RT-PCR tests reveal evidence for ISAV being present in salmon parr, adult salmon and juvenile brown trout in rivers distant from salmon farms and indicate that, at the time of the survey (1998-1999), ISAV may have been widely distributed. Nucleotide sequence analysis of segments 2 and 8 showed that for most sequences from wild fish there was 100% homology with ISAV isolated from clinically affected farmed fish although evidence is presented which indicates variability in ISAV sequences from wild fish. Modelling the RT-PCR findings indicates that ISAV among salmonid fish was spatially non-random. Brown trout, sea trout and salmon (adult and parr) show a pattern of occasionally large numbers of positive samples against a background of very low numbers.

Striped bass predation upon Atlantic salmon smolts in Maine

Beland K F; Kocik J F; vandeSande J; Sheehan T F

Northeastern Naturalist 8 (3):267-274

We documented estuarine predation by an immature striped bass (*Morone saxatilis*) upon an Atlantic salmon smolt (*Salmo salar*) that had previously been tagged with an ultrasonic transmitter on the Narraguagus River, Maine. That observation revealed the potential confounding effects that fish predation can have upon a telemetry study if the behavior of predatory fish cannot be distinguished from that of the target species. To investigate this effect, we also tracked the movements of immature striped bass in the same river system. We found that the striped bass alternately moved upstream and downstream of the release site, independent of tidal flows and light conditions, whereas salmon movements were generally passive and in the direction of tidal flows. These differences can be incorporated into our data analysis to better recognize and explain anomalous behavior of tagged smolts. Salmon abundance in Maine rivers has steadily declined since the mid-1980s, whereas Atlantic coast striped bass stocks have been increasing in abundance. Although the potential exists for significant smolt predation by striped bass in any one year, striped bass abundance in eastern Maine rivers is highly variable between years, suggesting that striped bass predation is not the proximate cause of the persistent decline in salmon populations.

Comparative analysis of population structure across environments and geographical scales at major histocompatibility complex and microsatellite loci in Atlantic salmon (*Salmo salar*)

Landry C; Bernatchez L

Molecular Ecology 10 (10):2525-2539

Evidence of selection acting on major histocompatibility complex (MHC) genes has been illustrated with the analysis of their nucleotide sequences and allele frequency distribution. Comparing the patterns of population differentiation at neutral markers and MHC genes in the wild may provide further insights about the relative role of selection and neutrality in shaping their diversity. In this study, we combine both methods to assess the role of selection on a MHC gene in Atlantic salmon. We compare variation at a MHC class II B locus and microsatellites among 14 samples from seven different rivers and seven sub-populations within a single river system covering a variety of habitats and different geographical scales. We show that diversifying selection is acting on the sites involved in antigen presentation and that balancing selection maintains a high level of polymorphism within populations. Despite important differences in habitat type, the comparison of the population structure at MHC and microsatellites on large geographical scales reveals a correlation between patterns of differentiation, indicating that drift and migration have been more important than selection

in shaping population differentiation at the MHC locus. In contrast, strong discrepancies between patterns of population differentiation at the two types of markers provides support for the role of selection in shaping population structure within rivers. Together, these results confirm that natural selection is influencing MHC gene diversity in wild Atlantic salmon although neutral forces may also be important in their evolution.

Lacustrine spatial distribution of landlocked Atlantic salmon populations assessed across generations by multilocus individual assignment and mixed-stock analyses

Potvin C; Bernatchez L

Molecular Ecology 10 (10) :2375-2388

The objective of this study was to assess the spatiotemporal distribution of four landlocked Atlantic salmon (*Salmo salar*) populations during their sympatric feeding phase in lake St-Jean (Quebec, Canada). A total of 1100 fish captured over a period of 25 years was genotyped at six microsatellite loci in order to assess the temporal stability of the relative proportion of each population in different lake sectors using both individual-based assignment and mixed-stock analysis. Estimates of relative proportions obtained from both methods were highly correlated. A non-random spatial distribution of populations was observed for each period and, despite the fact that the overall proportion of each population varied over time, the pattern of differential distribution remained generally stable over time. Furthermore, there were indications that the extent of horizontal spatial overlap among populations was negatively correlated with that of their genetic differentiation at both microsatellites and a major histocompatibility complex locus, and independent of the geographical distance between the rivers of origin. We discuss the hypothesis that the temporal stability of spatial distribution, the lack of an association between spatial partitioning and geographical distance between rivers of origin, and the apparent negative correlation between spatial overlap and genetic differentiation, reflect the outcome of selective pressures driving behavioural differences for spatial niche partitioning among populations.

Field experiments on stranding in juvenile Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*) during rapid flow decreases caused by hydropeaking

Saltveit S J; Halleraker J H; Arnekleiv J V; Harby A

Regulated Rivers Research & Management 17 (4-5):609-622

Field experiments showed that sudden reductions in river flow may cause high mortality of juvenile salmonids through stranding. A 75m² enclosure in the drawdown zone of a regulated river was stocked with a known number of wild 0+ and/or 1+ wild Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*). The number stranded was estimated by counting the surviving fish collected in a bag as they left the enclosure. In general, a far higher incidence of fish stranding was found during winter conditions (<4.5°C) compared with the higher temperatures during late summer and early autumn. This is probably mainly because of lower fish activity during the cold season and a substrate seeking behaviour especially during daytime. Stranding was lower at night, probably because of a predominant night active behaviour. Hatchery salmon behaved oppositely to wild fish, and studies based on cultivated fish may give wrong conclusions as to the consequences of hydropeaking. Searching for fish in the substrate underestimated the consequences of sudden flow reductions, as fish were difficult to find. Stranding is not equal to mortality, as fish were found to survive for several hours in the substrate after de-watering. Long shut-down procedures of the turbines during daytime decreased stranding of Atlantic salmon (7-9 cm) drastically under spring conditions. Temperature, season and light conditions have the most pronounced effect on stranding of juvenile salmonids. It is possible to reduce stranding by taking into account these ecological considerations during hydropeaking operations.

The influence of male parr body size and mate competition on fertilization success and effective population size in Atlantic salmon

Jones M W; Hutchings J A

Heredity 86 (6):675-684

Alternative mating strategies in male Atlantic salmon, *Salmo salar*, are characterized by variability in body size and mate competition. Controlling breeding numbers of larger, older anadromous males, we examined whether body size of mature male parr influenced fertilization success and whether such an association was affected by mate competition among parr. Variation at three to four hypervariable microsatellite loci was used to determine individual paternity of 53-60 offspring from two or three nests from each experimental treatment. Although individual and total parr reproductive success differed significantly among nests within treatments, there was no relationship between parr size and individual reproductive success at any level of competition when anadromous males were involved. However, in a single treatment having no anadromous male, the influence of body size on parr fertilization success was highly significant. Combining data from all treatments, parr body size was an important predictor of the probability of an individual being involved in spawning. We found a negative relationship between total parr reproductive success and intensity of anadromous male competition. To our knowledge, the present study is the first to estimate the effective number of males from individual fertilization success

in fish. Our estimates of N_e should not be taken as absolute and may have a downward bias because we did not sample all nests and we used a proxy for lifetime reproductive success. They do, however, illustrate how mature male parr can greatly increase the effective number of males when the latter is estimated from anadromous individuals alone. Although reproductive success by mature male parr increases the effective number of males, this increase seems likely to be most pronounced in natural populations when the number of anadromous males is low.

Seasonal variation in density of juvenile Atlantic salmon in fluvial shoreline habitats of a large sub-arctic river

Niemela E; Julkunen M; Erkinaro J; Mäkinen T S

Journal of Fish Biology 59 (3):555-568

The densities of Atlantic salmon fry (0+ years) and parr (1+ years and older) in shoreline habitats of the large River Teno watercourse and its tributary, the River Utsjoki, generally fluctuated considerably, showing an increase from early summer towards late August and a subsequent decline towards autumn. The seasonal pattern of variation in density was more distinct for parr than for fry. In the period between late July and early September, parr density followed a sinusoidal curve, being highest in late August and lowest in early August and in September. Fry density had a weaker seasonal profile than parr, being highest in late August and in early September. Frequency distributions of the parr age groups (1+, 2+ and \geq 3+ years) were mainly independent of the sampling month.

Nutrient-dependent recovery of Atlantic salmon streams from a catastrophic flood

Weng Z; Mookerji N; Mazumder A

Canadian Journal of Fisheries and Aquatic Sciences 58 (8):1672-1682

The impact of a major flood and recovery of the stream communities under contrasting nutrient conditions were studied in two second-order streams of Sainte-Marguerite River, Quebec. A massive flood during the summer of 1996 caused extensive displacement of the stream substratum and severe reductions in the abundance of all biota: periphyton, benthic invertebrates, juvenile Atlantic salmon (*Salmo salar*), and brook trout (*Salvelinus fontinalis*) (especially in the 0+ age-class). In the post-flood recovery phase, nutrient-enriched sections recovered significantly more rapidly than the non-enriched sections. After 1 month, periphyton biomass in the enriched sections had increased to five times that of the pre-flood levels, and after 2 months, the invertebrate communities had recovered to pre-flood levels. Fish densities and growth rates also returned to normal levels more rapidly in the enriched sections. Our results suggest that nutrient-rich systems are more resilient to massive disturbances, and so nutrient enrichment may represent a viable tool for restoring nutrient-limited systems.

Effects of developmental stage at stocking on growth and survival of Atlantic salmon fry

Letcher B H; Terrick T D

North American Journal of Fisheries Management 21 (1):102-110

Stocked fry are the primary source of fish for the restoration effort for Connecticut River Atlantic salmon *Salmo salar*, yet it is unknown whether there is a developmental stage at stocking that yields optimal growth and survival or whether good growth and survival can be achieved across a wide range of fry developmental stages. To evaluate the effects of developmental stage on growth and survival, we stocked otolith-marked (thermal-banding patterns) fry from four (1996) or three (1997) developmental stages (thermally delayed, nominal, thermally accelerated-fed, and thermally accelerated-unfed) into three rivers in the spring and sampled the age-0 fish in the fall. There was no difference in 1996 among delayed, nominal, or accelerated-fed developmental stage treatments in the final size or population estimate. Few fish from the accelerated-unfed treatment were recovered. Results from a laboratory starvation study suggested that fish from the accelerated-unfed treatment would die from starvation in about 4 d after release. In 1997, accelerated-fed fish were recaptured at a slightly higher rate than were fish from the delayed or nominal treatment, but final sizes did not differ among treatments. Despite differences in population estimates and sizes among rivers, there was no interaction between treatment and river in either study year, indicating that treatment effects were consistent among rivers. Our results suggest that fry from a fairly wide range of developmental stages will survive equally well and will grow to similar sizes by fall unless the fish have been accelerated without feeding.

Sensitivity of Atlantic salmon eggs to mechanical shock during the first six hours after fertilization

Krise W F

North American Journal of Aquaculture 63 (1):34-37

Eggs from six domestic adult Atlantic salmon *Salmo salar* and six sea-run kelts (wild adults held over for a second spawning season) were tested at 0.5 to 6 h after fertilization for sensitivity to mechanical shock produced by dropping eggs from measured heights. Estimates of drop height and force causing 10% (lethal tolerance, LT90) and 25% (LT75) mortality were used to project egg sensitivity to handling while collecting, disinfecting, and transporting eggs to incubation facilities. Differences in LT90 and LT75 drop height or force were not significant among sample times up to 6 h post-fertilization. The LT90 estimates of drop heights and force were 23.5-26.9 cm and 5,200-6,000 ergs for domestic eggs and

17.5-38.5 cm or 3,500-7,700 ergs for kelt eggs. The LT75 estimates of drop height and force were 46.1-60.3 cm and 10,200-13,400 ergs for domestic stock eggs and 43.7-65.1 cm and 8,800-13,100 ergs for kelt eggs. Variability in egg shock sensitivity among individual females was high and similar to differences in 24-h mortality observed in eggs transported for incubation. Our results show that a single dropping of eggs from a height of 17.5-38.5 cm could cause 10% egg mortality before eggs are incubated.

Biological characteristics of adult Atlantic salmon (*Salmo salar*) in the Buctouche River, New Brunswick, 1992 to 2001

Atkinson G

Canadian Data Report of Fisheries and Aquatic Sciences (1076):1-16

