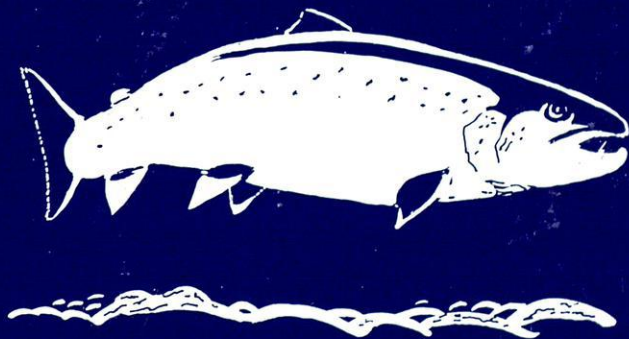




ATLANTIC SALMON TRUST

PROGRESS REPORT

June 1996



The Atlantic Salmon Trust
Moulin, Pitlochry
Perthshire PH16 5JQ
Telephone: Pitlochry (01796) 473439

Patron:

HRH The Prince of Wales

COUNCIL OF MANAGEMENT

President:

The Duke of Wellington

Vice Presidents:

Vice-Admiral Sir Hugh Mackenzie

Mr. David Clarke

Sir Ernest Woodroffe

Dr. Wilfred M. Carter

The Lord Nickson

The Lord Moran

ELECTED MEMBERS

Chairman:

Colonel H.F.O. Bewsher

Vice Chairman:

Major General John Hopkinson

Chairman of HSAP:

Dr. D. H. Mills

Mr. G. Bielby

Lt. Col. R.A. Campbell

Mr. Colin Carnie

Mr. J.R. Carr

Mr. J.A.G. Coates

Mr. J. Cunningham,MP

Mr. D.A.J. Dickson

The Earl of Eglinton & Winton

Mrs. L. Golding, MP

Dr. G. Harris

Mr. M. Larby

Mrs. E. Macdonald Buchanan

Mr. J. McGrigor

Mr. M.D. Martin

Mr. I Mitchell

Mr. Moc Morgan

Mr. E. Mountain

Mrs. Judith Nicol

The Rt. Hon. Sir Cranley Onslow, MP

The Hon. C.A. Pearson

Mr. C. Robinson

Dr. David Solomon

Mr. H. Straker

Mr. C.S.R. Stroyan

Mr. D. Turner

Mr. O. Vigfusson

Mr. A. Wallace

Dr. K. Whelan

Mrs. Margit Worsham

Mr. R. Williamson

OFFICERS OF THE COUNCIL

Director:

Rear Admiral D.J. Mackenzie

Deputy Director/Secretary:

Mr. Jeremy Read

Treasurer:

Mr. Peter Tomlin

INVITED REPRESENTATIVES OF OTHER ORGANISATIONS

ASF (USA)

ASF (CANADA)

AIDSA

RASA

BFSS

ASDSFB

SPEY TRUST

FISHMONGERS

S&TA

Mr. J. F. Cullman 3rd

Mr. L. G. Rolland

Madame S. Tissier

Mr. Richard Buck

(A Representative)

Mr. Robert Clerk

(A Representative)

The Rt. Hon. Viscount Leverhulme

Mr. John Bennett

Mr. T. A. F. Barnes

HONORARY SCIENTIFIC ADVISORY PANEL

D. H. Mills, M.Sc., Ph.D., F.I.F.M., F.L.S. (Institute of Ecology and Resource Management, Edinburgh University) Chairman
W. J. Ayton, B.Sc., M.Sc.
J. Browne, M.Sc. (Department of the Marine, Dublin)
M. M. Halliday, Ph.D. (Joseph Johnston & Sons Ltd.)
G. J. A. Kennedy, B.Sc., D. Phil. (Department of Agriculture for Northern Ireland)
E. D. Le Cren, M.A., M.S., F.I.Biol., F.I.F.M.
J. Solbé, D.Sc., B.Sc., C.Biol., F.I.F.M., M.I.Biol. (Unilever Research)
D. Solomon, B.Sc., Ph.D., M.I.Biol., M.I.F.M.
J. L. Webster, B.Sc., Ph.D., C.Biol., M.I.Biol. (Scottish Salmon Growers Association)
K. Whelan, B.Sc., Ph.D. (Salmon Research Agency of Ireland, Inc.)
Professor Noel P. Wilkins, (Department of Zoology, National University of Ireland)

Observers: M. Aprahamian, B.Sc., Ph.D. (Environment Agency)
A representative from the Scottish Office Agriculture
and Fisheries Department
E. C. E. Potter, B.A., M.A.
(Ministry of Agriculture and Fisheries)

INTERNATIONAL CONSERVATION ORGANISATIONS WITH WHICH THE TRUST IS IN CONTACT

France: Association Internationale de Defense du Saumon Atlantique
Belgium: Belgian Anglers Club
Spain: Asturian Fishing Association of Oviedo
Germany: Lachs- und Meerforellen-Sozietat
U.S.A.: Restoration of Atlantic Salmon in America Inc.
Canada and
U.S.A.: Atlantic Salmon Federation
Ireland: Federation of Irish Salmon & Sea Trout Anglers

Registered Charity No. 252742

INDEX

| | |
|---|-------------|
| Council of Management | Front Cover |
| Honorary Scientific Advisory Panel | 1 |
| Index | 2 |
| Chairman's Foreword | 3 |
| Director's Report | 4 |
| Fifth International Atlantic Salmon Symposium | 5 |
| NASCO Meeting 10-14 June 1996 | 10 |
| Post NASCO Salmon Study Tour, Southwest Sweden | 14 |
| Fish-Eating Birds - Action in Prospect? | 19 |
| Westcountry Rivers Trust | 21 |
| Countryside Stewardship - The Benefits for Salmon | 22 |
| Fisheries Management Plans | 24 |
| "Titbits" | 26,35 |
| Where Have All the Springers Gone? | 27 |
| Water of Life Boosts Salmon Research | 28 |
| AST Biologists Report | 30 |
| Effects of Temperature on the Larval Development of early and late-running Atlantic Salmon | 32 |
| West Coast Fisheries Trust | 34 |
| Scottish Fisheries Protection Agency | 36 |
| Fish Farming | 38 |
| Social, Economic and Management Aspects of Recreational Fisheries | 39 |
| Review of Scientific Literature on Salmon | 42 |

CHAIRMAN'S FOREWORD

Since the last Report a fair degree of progress has been made on a number of important fronts.

In January I met Raymond Robertson, the Scottish Office Fisheries Minister (deputising for the Secretary of State for Scotland who had been called away), and raised four issues with him: (1) our dismay at the NRA's failure to implement the Ministry of Agriculture's recommendation to delay, until 1st May annually, the opening of the NE drift net fishery and our increasing anxiety at the effect on MSW spring fish of this highly damaging fishery; (2) our concern about the increased environmental pollution and sea lice predation that would result from any expansion in salt and fresh water farms; (3) with the absorption of River Purification Boards into the Scottish Environment Protection Agency (SEPA), the need to retain key fishery experience on the SEPA Boards if effective liaison is to be maintained with District Salmon Fishery Boards; and (4) the high value and importance which the Trust attaches to the continuing existence of the Freshwater Fisheries Laboratory at Faskally and the Marine Laboratory at Aberdeen both of which have been included in a review of fishery establishments. Shortly thereafter Tony Baldry, the Fisheries Minister, rejected in robust terms the NRA's arguments for maintaining the status quo on the NE drift net fishery and invited the NRA to reconsider the position with a view to delaying the opening of the season until 1st May annually.

Accompanied by the Vice-Chairman, the Director and the Deputy Director, I next called on Lord de Ramsey, the Chairman of the new Environment Agency, and emphasised the high importance the Trust attaches to the NE drift net issue. We received encouraging assurances that the whole matter would be reconsidered, albeit it was clear that the EA would be reluctant to see it go to a judicial review. We also took the opportunity to stress the need for co-ordination between the NRA's recently published salmon strategy for England and Wales and those being developed in Ireland and in Scotland, the latter under Lord Nickson's chairmanship, if a coherent strategy for the UK as a whole was to emerge.

I also met Lord Lindsay, the Scottish Office Environment Minister, in March to reiterate our concern about the environmental issues surrounding the fish farming industry and the replanting, without any form of prior consultation, of forestry in areas of high acidity. I also took up the importance of proper fishery representation on the SEPA Boards.

Finally, in May I met Professor Bill Turmeau, the Chairman of SEPA, and discussed with him our concerns about the fish farming and forestry industries and the importance we attach to close liaison with District Salmon Fishery Boards.

In all of these meetings, at which a frank exchange of views took place, I was greatly heartened at the degree of understanding and sympathy shown for the Trust's concerns. I was particularly encouraged at the clear recognition of the importance which Government Ministers and the Chairmen of the two Agencies attach to the conservation and enhancement of the Atlantic salmon. In the result, I feel confident that by working together we shall make progress on all the issues raised, albeit it may not in every case be as quickly as some of us would like.

H.F.O. BEWSHER, Chairman

DIRECTOR'S REPORT

In the first half of this year, there has at last been evidence that thought is being given throughout the British Isles to the need for a positive strategy for wild salmon. The Trust has welcomed this, and has pressed all the authorities involved to remember that the development of separate plans in isolation would be fruitless, and that a harmonised approach is essential.

The NRA, just before its duties were taken over by the Environment Agency, published a salmon strategy for England and Wales which set out the basic principles and the timetable for producing action plans for the principal rivers by the year 2000. It stressed a commitment to the conservation of spring fish; I wonder if there will be a more enlightened view on implementing that commitment? I wish Dr. Tony Owen, the new Fisheries Officer of the Agency, good luck in his appointment.

In Ireland, the Minister of the Marine has set up a Task Force under Professor Noel Wilkins to look at the future of salmon fisheries in Ireland and, in Scotland, the Secretary of State has asked Lord Nickson and his Task Force to recommend a "strategy for the management, conservation and sustainable exploitation of stocks into the next century". We await these reports with interest.

Looking further afield, the Fifth International Atlantic Salmon Symposium will be held in Ireland 16-20 September 1997, entitled "Managing Wild Atlantic Salmon - New Challenges, New Techniques". A summary of the programme is in this report. If anyone wishes to express an interest in attending, please let the office know.

The Trust held a very successful conference on spring fish, an account of which is included in this Report.

The fishing auction did very well this year and the final result was -

| | |
|------------------|--------|
| AST | £51132 |
| Tweed Foundation | £5475 |
| Wye Owners | £4278 |

I sent out, with the last Progress Report, raffle tickets and I must say the response has been excellent. We are most grateful to David Norwich for the magnificent gift of the two rods and their case. Tickets are still on sale and the final draw will take place at the Moy Fair on Saturday 4th August. The total, to date, is £1800 and, hopefully, we will sell many more tickets at Scone, The Game Fair and at Moy.

With this report goes a letter to those covenant donors who have not given us anything for some time. I am constantly trying to reduce our expenses by cutting out having to send Progress Reports to those who do not want them.

Finally, good luck and good fishing to you all!

D.J. Mackenzie

PRELIMINARY ANNOUNCEMENT

FIFTH INTERNATIONAL
ATLANTIC SALMON
SYMPOSIUM

MANAGING WILD ATLANTIC SALMON
NEW CHALLENGES - NEW TECHNIQUES

GALWAY, IRELAND

16-20 SEPTEMBER 1997

Organised by

The Atlantic Salmon Federation

and

The Atlantic Salmon Trust

**MANAGING WILD ATLANTIC SALMON
NEW CHALLENGES - NEW TECHNIQUES**

Outline Programme

| | |
|---------------------|--|
| Tues 16th September | Arrival, registration, evening reception |
| Wed 17th | Conference |
| Thurs 18th | Conference and Conference Dinner |
| Fri 19th | a.m. Conference p.m. Tour |
| Sat 20th | Depart |

* * * * *

Proposed Topics & Invited Speakers (*subject to alteration*)

Wednesday 17th September

0900-0930 **Opening Address**
Wilfred M. Carter (Can)

First Session - Marine Pressures

0945 **Effect of forage fish harvesting**
Phil Culzic/Peter Wright (UK)

1030
to Coffee
1100

1100 **Post-smolt by catch**
Lars Hansen (Nor)

1145 **Marine habitat influences**
David Reddin/Brian Whitehouse//Kevin Friedland (Can/US)

1230
to Lunch
1415

1415 **Predator/Prey interactions**
Vaughn Anthony (US)

1500 **Interception fisheries**
Ted Potter (UK)

1545
to
1615

Tea

1615

Aquaculture/wild stocks interactions
Bror Jonsson (Nor)

Thursday 18th September

Second Session - Freshwater Management

0900

Run timing
Ronald Campbell/John Webb (UK)

0945

Optimizing natural production
Martin O'Grady (Irl)

1030
to
1100

Coffee

1100

New approaches to watershed management
Julian Dodson (Can)

1145

Impact of exotic species
Fred Whoriskey (Can)

1230
to
1415

Lunch

Third Session - Politics and Salmon Management

1415

International co-operation
Malcolm Windsor (NASCO)

1500

Conservation and politics
t.b.a.

1545
to
1615

Tea

1615

Education and communication
Derek Mills (UK)

Friday 19th September

Third Session - continued

- 0900 **Catch and Release - pros and cons**
Bruce Tufts (Can)
- 0945 **Socio-economic issues**
John Anderson (Can)
- 1030
to
1100 Coffee
- 1100
to
1130 General discussion
- 1130 **Summary and recommendations**
Ken Whelan (Irl)
- 1200
to
1300 Early Lunch
- 1315 Depart for Tour

Planning Committee

| | |
|----------------|--------|
| John Anderson | ASF |
| Wilfred Carter | ASF |
| Bill Taylor | ASF |
| John Mackenzie | AST |
| Derek Mills | AST |
| Jeremy Read | AST |
| Ken Whelan | SRAIrl |

* * * * *

There will be plenty of space for poster displays and a room for showing videos will be available.

GENERAL INFORMATION

Venue

The symposium will be held in the Corrib Great Southern Hotel in Galway, Ireland.

Accommodation

There are many good hotels and 'bed and breakfast' establishments in the town. A provisional block booking has been made at Corrib Great Southern.

All accommodation enquiries to:

Ireland West Tourism
Reservation Department
Aras Fáilte
Eyre Square
Galway
Ireland

tel: 353 91 563081 / fax 353 91 565201

(enquiries should mention 5th International Atlantic Salmon Symposium)

Secretariat

Ms. Sandra Doyle
Secretariat
5th International Atlantic Salmon Symposium
Central Fisheries Board
Balnagowan, Mobhi Boreen
Glasnevin
Dublin 9
Ireland

Tel: 353 1 8379206

Fax: 353 1 8360060

Fees

It is hoped to keep registration fees in the region of IR£100 to include proceedings.

Post Symposium Tour

This will be for half a day on Friday 19th September.

Travel

Best route - fly to Dublin and either internal flight to Galway airport or train from Dublin.

Firm programme will be sent to those who have expressed an interest in March 1997.

NASCO MEETING 10 - 14 JUNE 1996

(Report by the Deputy Director)

The thirteenth annual meeting of the Council of the North Atlantic Salmon Conservation Organisation took place in Gothenburg, Sweden. It began with an open session, at which Non Government Observers (NGOs) were able to make statements, copies of which were afterwards circulated. These opening statements provide the only opportunity for NGOs to take an active part in the formal business of the meeting, except for participation in Special Sessions. One such session, on "the Atlantic salmon as prey and predator" was held during the week.

On behalf of the Trust, I made three points:

Since the NGOs, which included the Trust, had suggested the topic for the session, it might have been helpful for them to be included in its planning

NASCO should encourage and facilitate active international co-operation in the expensive business of research into the salmon's life at sea

NASCO should urge member states to speed up the translation into national legislation of the 1994 Resolution on measures to reduce the impact of salmon farming on wild stocks.

The two latter points were in fact taken up during later Council discussions.

Although NGOs cannot speak in formal session, there are, of course, opportunities to discuss Council business with members of the delegations representing the Contracting Parties to the NASCO Convention. In the case of the UK, civil servants from the European Commission provide the official representation, but there was a strong Scottish and English presence (Scottish Office, MAFF and Environment Agency) in the team that they had in support.

High Seas Fisheries

A considerable amount of the time of the meeting was taken up by meetings of the three Commissions - North America, West Greenland and the North East Atlantic (the latter primarily concerned with the regulation of the Faroes fishery). NGOs are now allowed to attend the Commission meetings. However, the real work of quota negotiations goes on outside the conference room in meetings of the heads of delegations, to which NGOs are not privy.

The meeting was dominated by difficulties over the Greenland quota. In accordance with an agreement reached in 1993, this should be set on the basis of scientific advice from ICES (the International Council for the Exploration of the Sea). This year, that advice was that there should be no landings in the West Greenland area, nor in the North American area except

within rivers where spawning escapements were assessed as adequate. The Greenland delegation claimed that the stock abundance model used to develop the scientific advice had been changed from that which was in use when they agreed to scientifically-based quotas. They argued that the previous model should have been used, which would have given a quota of 271 tons. Despite informal attempts to effect a compromise by setting a reduced quota, the Greenlanders were adamant. Since NASCO decisions require a consensus, the result was stalemate.

At the time of writing, the EU delegation was trying to set up further negotiations. If this attempt fails, it is probable that Greenland will set its own quota, as has happened before. There is not long for further negotiations, because the season starts at the beginning of August. For the time being, any discussion of compensation payments from NASF, in order to close the fishery once more, is forestalled.

There is as yet no agreement on a scientific basis for the Faroes quota, since spawning targets for North East Atlantic rivers have not yet been developed. There is considerable pressure for this to be accomplished and for a scientific basis for the quota to be introduced, next year if possible. In the interim, ICES recommended a reduction in fishing mortality, and a smaller quota was agreed. This was set at 425 tons, with an announcement by the Faroese that if they were to fish, no more than 360 tons would be taken. In this case, the existing arrangements for compensation payments should stand, and the fishery should remain closed.

Other discussions during the meeting are summarised below.

Salmon Farming

NASCO has been working for some time on measures to reduce the impact of aquaculture on wild salmon stocks. Guidelines have already been developed, and in 1994 a Resolution was adopted with the aim of full implementation by 1998. As the President of NASCO pointed out, progress on implementation has been slow, and will need to be accelerated if the target date is to be met. Salmon aquaculture will be the subject of a special symposium on the scientific and management issues, to be held jointly in Bath by NASCO and ICES from 18 to 22 April 1997.

The subject of transgenic salmon was covered in a paper by the Secretary of NASCO, which drew attention to the potential risk to wild stocks. A resolution designed to control the risks and develop more information was discussed, and it is hoped that this will be adopted by correspondence without waiting until the next formal meeting. A special session will be held on the topic as soon as practicable.

NASCO has set up a liaison group with the international salmon farming industry. It is intended to arrange the first meeting of this group before NASCO meets again, and the Council asked for the subject of transgenic salmon to be discussed, and for the group to make recommendations.

Fishing for Salmon in International Waters

Subsequent to NASCO's invitation to nations who are not party to the NASCO Convention to act to counter fishing for salmon under their flags, or landing catches in their ports, the Polish government has now announced a new law authorising the prohibition of such activity. Work to improve co-ordination of surveillance activity in areas of unauthorised salmon fishing is continuing.

Research

A Resolution has been developed to make provision for notified research fishing in waters outside national jurisdiction. This was virtually agreed at the meeting, except for some wording regulating the non-commercial disposal of research catches, and again the aim is to adopt this Resolution by correspondence as soon as possible. Norway gave a detailed description of research fishing with surface trawls north of the Faroes and off the Hebrides, which had resulted in the capture of significant numbers of post smolts. This research is to continue, and the subject figures prominently in the request from NASCO to ICES for scientific advice.

Among other significant subjects on which advice has been requested were:

the causes of long-term changes in the sea-age composition of salmon stocks

the causes of changes in abundance of salmon with special reference to changes in natural mortality and ocean climate.

The Salmon as Predator and Prey

One forenoon was given over to this special session. Four papers were presented:

Predators of Atlantic Salmon and their impact on salmon stocks - a vigorous statement by Dr. Vaughn Anthony of the damage done by seals and fish-eating birds, and of the need for predator control. This was mainly in a North American context, but took account of European experience.

The public perception of predator control programmes - an entirely Canadian description of some predator control experiments which were not particularly conclusive. From this it was argued, not very convincingly, that large scale predator control programmes were not justified.

The prey of the Atlantic Salmon - a detailed study of the food of salmon its freshwater and marine phases by Dr. Lars Petter Hansen of Norway.

The impact of industrial fisheries on the prey of salmon - a Danish paper which gave some useful information on the scale and catch levels of various species in the North Sea industrial fisheries. Not surprisingly, sandeels predominated. The author sought to argue that the effect of the fishery was to reduce the average size of all fish in the North Sea and therefore increase the quantity of suitable prey for salmon. This was not received very sympathetically.

It was a useful session, although it might have been better structured, and it was a pity that NGOs, who had suggested the subject, were not involved in planning the session. There was no move to develop a plan of action, but NASCO will produce a report summarising the papers and discussion, and addressing management implications. Unfortunately, considerations of public attitude are likely to continue to dominate the issue of predator control.

Catch and Release

A set of proposed NASCO guidelines on Catch and Release was before the Council, but was not discussed in detail. However, it was again agreed that this should be commented on and, if possible, agreed by correspondence.

Fishing in Coastal Waters

At the end of the meeting, the retiring President, Børre Pettersen, expressed his regret that despite the work of NASCO, stocks of salmon had declined. He suggested that most of the threats to salmon were in the hands of the nations who are parties to the Convention, and needed a strong political approach at national level. He drew particular attention to the fact that reduction in interceptory fishing on the high seas quotas had not been reflected in coastal waters, where Ireland and the United Kingdom still permit drift netting. He felt that those who called for reductions in fishing off Greenland the Faroes should match them by reducing their own homewater catch.

Co-ordination among NGOs

It was clear from the Opening Statements that many of the topics raised were of concern to a number of NGOs. With limited time available for speaking, it would have been better to have been able to develop a united front, which could increase the impact of NGOs on NASCO. The need for co-ordination was agreed, and a meeting is proposed in Edinburgh during late November 1996 to prepare for next year's NASCO meeting, which is to be held in Greenland. The aim will be to discuss travel and attendance at this very expensive meeting - it may be possible to economise by joint representation.

The aim will be for NGOs to circulate drafts of their statements well before NASCO meetings, in order to identify and strengthen common issues - this could allow one spokesman to represent all on such issues, but it would not preclude individual statements by NGOs on other issues. It is hoped to arrange a meeting of NGOs before business starts at subsequent NASCO meetings.

POST NASCO SALMON STUDY TOUR - SOUTHWEST SWEDEN

(by Derek Mills)

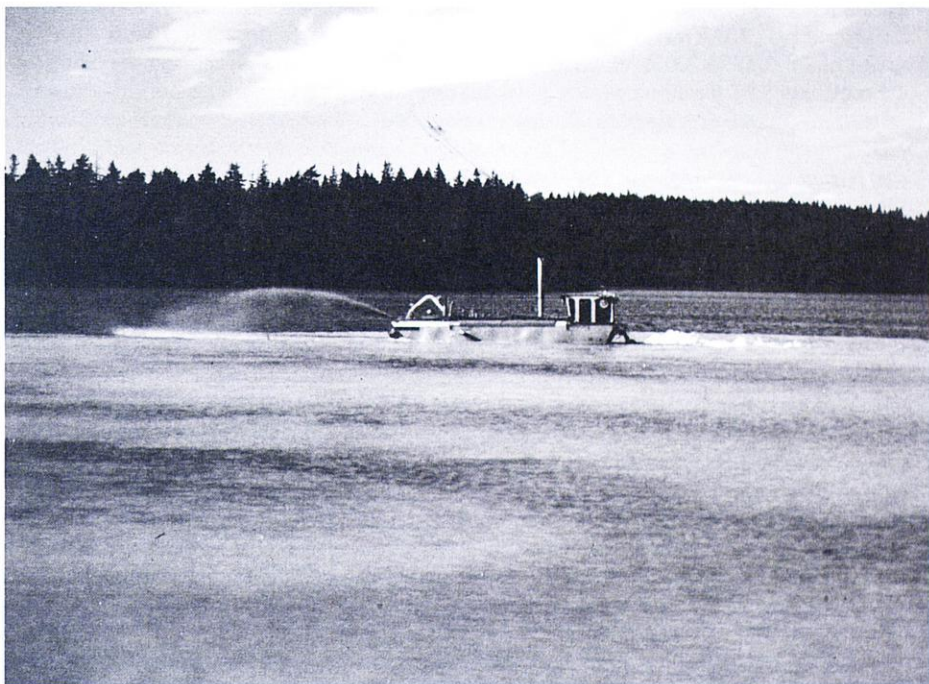
After serious deliberations and cogitations throughout the Annual Meeting of NASCO it was refreshing to join an excellent weekend salmon study tour in the County of Halland in southwest Sweden, organised by Dr. Ingemar Olsson of the Swedish National Board of Fisheries. The programme covered inspections of surface water liming operations, fish facilities at hydro-electric installations and salmon restoration schemes and visits to salmon sport fisheries. The 25 delegates and their wives on the tour represented most countries party to NASCO and consequently there was a useful interchange of views and information.

There are 13 salmon rivers and 32 river systems with sea trout in the County of Halland. Many of these waters have either obstacles on their course and/or are acidified. Their present total annual smolt production is 160,000 from a spawning and nursery area of 177 hectares. This annual production could be increased to 257,000 if the potential spawning area of 233 hectares is achieved. The total 1995 rod catch of salmon in the County of Halland was approximately 750 wild salmon and 1650 salmon of hatchery origin. The best year since 1980 was 1993 with a total catch of just over 4000 fish, and the poorest year was 1989 with a catch of just over 1000. This may have been due to high mortality in the Kattogat as a result of a severe bloom of Chrysomolina resulting from large amounts of nutrients - from salmon farms? There is a commercial stake net fishery operated by about 10 men which takes about 95% of the total salmon catch.

Acidification is caused by the deposition of sulphur and nitrogen. The only solution to the acidification problem is to reduce the emission of acid substances. Although many European countries have agreed upon a sulphur reduction of 70-80% by 2010 relative to 1980, acidification will still be a problem for many decades. In Sweden 14,000 lakes (16%) and 120,000 km (40%) of running waters are acidified and each year 7,500 lakes and 11,000 km of rivers and streams are limed. Since the early 1980's and up to 1994, 675,000 tons of lime have been spread in the lakes in the five counties of southwestern Sweden and over the following five years a further 600,000 tons will be spread. Lakes are normally limed when the pH gets down to between 5.5 and 4.5. In an acidified area the pH in the ground water may be 4.1 and in the stream as low as 3.8.

Liming is carried out by spreading fine-grained (0.0-0.5mm) limestone on lakes using boats and helicopters, on wetlands using helicopters and on rivers and streams using dosers (a tower-like structure which releases a calculated amount of lime into the water). The dosage is between 5-30 grams per cubic metre for lakes and streams and 10-30 tonnes per hectare on wetlands over the area to be limed. The treatment may continue for up to five years until the pH and calcium content of the water increases and the level of aluminium and toxic metals decreases. Liming of surface waters was started in the 1970's and forest liming in the 1990's. While liming will normalise the aquatic system, it does not result in a complete recovery because of an unstable water quality due to acidic episodes which, in a lake, may result in an acid upper water layer.

LIMING OPERATIONS ON LAKE SVANSJÖN



The River Rolfsån drainage area has been intensively studied as it is severely affected by acidification and a number of lakes on its course are limed, including the large Lake Lygnern important for nature conservation and recreation. One of the tributaries of the Rolfsån, the Gärån, is the spawning area for brown trout from this lake and is also habitat for the pearl mussel which has been severely affected by acidification, as has the crayfish elsewhere in the county. We witnessed liming of neighbouring Lake Svansjön and, seeing the type of boat and equipment used, we appreciated how costs mount up.

On two other river systems visited the total amount of lime spread and the total costs were as follows:

River Fylleån

Total amount of lime spread (1982-96): ca. 27,000 tonnes
Total cost: ca. SEK 13 million. 100% govt. subsidy
Planned liming: 1997-2001: ca. 14,000 tonnes
Total cost: ca. SEK 8 million. 100% govt. subsidy?
Total 1995 rod catch of salmon ca. 20 and sea trout 200

River Nissan

Total amount of lime spread 1984-96: ca. 9,000 tonnes
Total cost: ca. SEK 5 million. 100% govt. subsidy
Planned liming: 1997-2001: ca. 5,500 tonnes
Total cost 1997-2001: ca. SEK 4.3 million. 100% govt. subsidy?
Total 1995 rod catch of salmon ca. 90 and sea trout 400

(SEK 10.189 = £1).

There have been intensive monitoring programmes on these river systems with records being taken of pH, alkalinity, salmon parr and trout densities and rod catches. On the River Högvasån, a tributary of the River Ätran which has been developed for power generation, the salmon population has been well documented at a salmon trap at Nydala Mill, in the form of counts of ascending salmon, since 1954 and for smolts since 1959 with the co-operation of the mill owner. The traps do not count all the fish and the numbers recorded may partly be related to river flow, so they only provide a relative estimate of population size. Supplementary studies using electro-fishing have been undertaken for some time. Catches of ascending salmon prior to liming (between 1954 and 1977) amounted to a few hundred a year and exceeded 500 on only two occasions. Toxic metals in industrial effluent deterred upstream migration for some years during the late 1960's. Catches of ascending salmon increased significantly after liming. The numbers of salmon ascending increased until 1987 when over 1,600 were counted at Nydala. Rod catches also increased. Sea trout did not increase to the same extent as salmon after liming and this was thought to be due to interspecific competition with salmon. It is considered that liming of the River Högvasån system has been profitable in socio-economic terms which, it is said, is quite clear when the liming costs are seen in relation to the recreational value of the salmon and salmon fishing. A word of caution is not out of place as, during the 1990's, there have been occasional decreases in the numbers of fry, smolt and spawners despite increased liming efforts and improved pH and alkalinity. The reason for this decline is unclear. One serious problem may be that ongoing acidification is causing increased leaching of toxic metals to the watercourses, which may be particularly lethal during dry periods when dilution rates are low. While neighbouring rivers, such as the Fylleån, show similar but less drastic trends, young salmon in the Högvasån have higher infections of the parasite Gyrodactylus salaris.

Unfortunately, due to the present poor state of the Swedish economy, the government is cutting back on the liming programme and reducing its annual expenditure from SEK 180m to SEK 90m. This could have serious repercussions on the Swedish salmon resource.

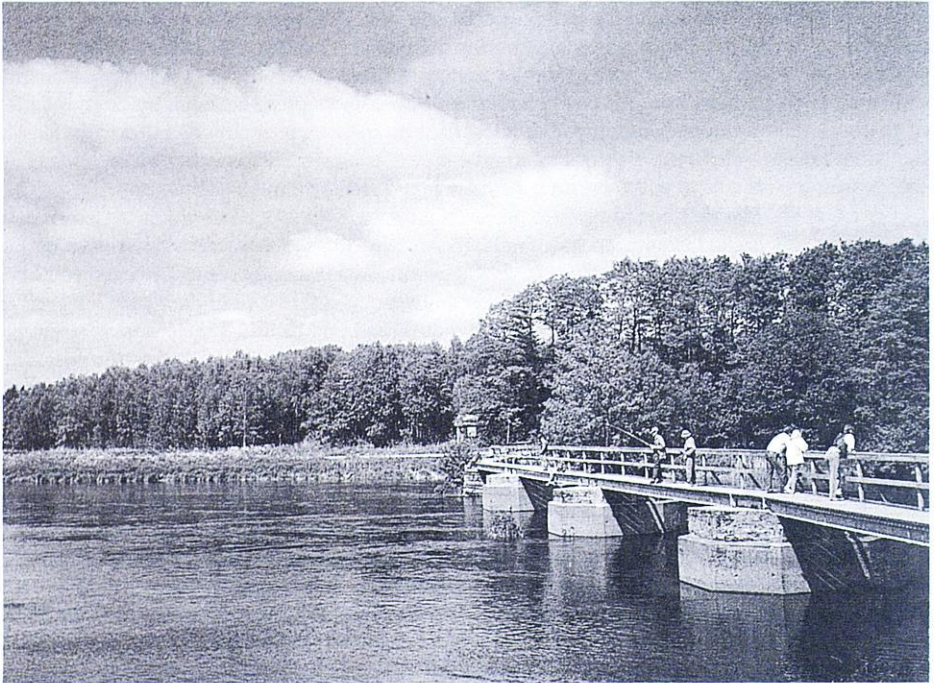
Having seen the water power schemes in northern Sweden in 1960, it was interesting to see the arrangements made for migratory fish on hydro schemes in the southern part of the country. Sydkraft is one of the major power companies in southern Sweden and is responsible for 60 hydro-power stations in this area. Unlike northern Sweden, where there is now no natural spawning in rivers harnessed for power and where the salmon are maintained by large releases of hatchery-reared smolts below the lowermost dam on the system, many hydro installations in the south are provided with fish passes to give access to upstream spawning areas. Many of the passes are of a pool and traverse construction and some are quite old.

However, at the Marbäck hydro-electric power plant on the River Fylleån a newly constructed fishway for salmon and smolts has been built. At the Sperlingsholm power station, also on the River Nissan, there is the oldest fishway in the county, but this has been superseded too by a new fish pass. Installed alongside this is a sloping pipe of a fairly wide diameter designed to enable kelts, and probably smolts, a slightly more gentle descent. The pipe discharges its water close to the lower entrance of the pass which must help ascending fish find the entrance. There is no doubt that some smolts must pass through the Kaplan turbines at this low head station but there appeared to be no information on mortality of smolts descending by this route. Also, further downstream on the Nissan, is the Slottsmöllan power station alongside which is a very successful Denil pass and installed close to it is a gently sloping narrow flume designed to allow the passage of elvers.

An interesting habitat improvement scheme has been undertaken on the Fylleån below the Marbäck power plant. This became necessary due to water diversion to the headpond, so leaving a length of watercourse with rather canal-like features. This stretch of river has now had its original substrate of boulders, stones and gravel replaced, resulting in a good population of aquatic insects and juvenile salmonids.

Probably one of the most famous west coast Swedish salmon rivers is the Lagan. In the distant past there were salmon fishermen with primitive home-made rods who made a living from catching salmon in this prolific river. To compensate for the loss of spawning grounds, when the Lagan was harnessed for power, a salmon hatchery was built at Laholm in the 1930's. After many improvements over the years the hatchery was completely rebuilt and modernised in 1992 at a cost of 25 million Swedish kroner. It produces 120,000 smolts a year from Lagan with a smaller proportion going to neighbouring rivers such as the Nissan and Fylleån. A proportion of the fish are tagged. There is an excellent visitors' centre which shows a most informative video (available in several languages) on the history of the river and the importance of salmon in the local culture over the centuries. It is a popular venue for school outings. I was surprised at the casual way people are allowed to wander around the fish tanks without any provisions for preliminary disinfection of footwear. Had one visited some Icelandic salmon hatcheries one would have had to strip off and shower oneself down before entering the complex! One of Laholm's popular annual festivities is the "Salmon Day" when the local populace fish the river. The most successful angler is appointed Salmon King or, I guess, if the angler is a woman, Salmon Queen.

There was an opportunity to watch salmon anglers on the River Ätran at the "Salmon Bridge" near Falkenburg by the side of which is a fishing lodge where the catch is recorded. It seemed to be a bit of a "rammy" with a large number of anglers sitting on this low concrete structure spanning the width of this wide river spinning with, or simply hanging, prawns in the water.



Although, to be fair, fishing with prawn is a special tradition and some do fly fish if they can find room. However, there is a 2.5km stretch of water available to the public and the lowest section is set aside for fly fishing only. The cost of fishing is very modest indeed. An annual salmon licence, available from tourist offices, is SEK 500 (£50) for adults, and SEK 200 (£20) for adolescents. The corresponding prices for a day permit are SEK 60 (£6) and SEK 30 (£3). The annual rod catch on this stretch in 1994 was just under 400 and in 1995 200. The numbers of salmon running this river are quite considerable and a fish count in the fishladder at Herting, between March and October 1995, was approximately 8000. For those interested in old angling books, one was written by W.M. Wilkinson (the fly named after same) in 1884 entitled "Days in Falkenburg, a Record of Sport in Sweden". Don't expect the sort of catches friend Wilkinson achieved. He didn't have to contend with rapidly fluctuating water levels resulting from power station generation.

For those considering a fishing holiday in Sweden, the annual publication [Top 10 Fishing Sweden](#) is recommended.

Finally, I should like to thank the following for the tremendous amount of trouble and thought they put into ensuring that this tour was such a success: Dr. Ingemar Olsson of the National Board of Fisheries; Dr. Lennart Henrikson of the County Forestry Board; Dr. Ingemar Alenäs of the Municipality of Falkenburg; Mr. Hans Schibli of the County Administrative Board of Halland; Mr. Randolph Stenlund of the Tourist Board of Falkenburg and last, but not least, Ingrid our stalwart coach driver for negotiating some difficult roads.

* * * * *

FISHING-EATING BIRDS - ACTION IN PROSPECT?

(Report by the Deputy Director)

The damage caused by fish-eating birds to stocks of salmon and other fish is nothing new, but readers of the Progress Report will know that the scale of the problem has greatly increased. The numbers of cormorants, in particular, are growing dramatically, and birds have moved far inland from their normal estuary habitat. They are a particular plague in still-water trout and coarse fisheries, but in rivers they can take a heavy toll of wild salmon, particularly during smolt migration. As long ago as 1988, Gersham Kennedy estimated that between 51 and 66% of the wild smolt run on the upper part of the River Bush was being taken by the birds. Last year, examination of regurgitated pellets under a single cormorant roost on the Test revealed a very substantial number of microtags from fish which had been released into the river as part of the rehabilitation programme. As for sawbill ducks, the report of a recent study on the North Esk contained an estimate that the daily intake by goosanders was 10-11 smolts and 48-52 parr per bird - a total predation of between 8000 and 15000 smolts, or between 3 and 16% of annual production.

The birds are protected under the Wildlife and Countryside Act, which reflects their status under the European Wild Bird Directive. Member states of the European Union can permit the taking of protected birds under specific "derogations" to prevent serious damage to crops and fisheries, but very strict control has to be imposed on these derogations. This is why licences to shoot fish-eating birds - granted for the purpose of deterrence, not for culling - are difficult to obtain, and why the conditions under which birds may actually be shot are so restricted.

In England and Wales, the Department of the Environment is responsible for the status of birds, while MAFF has the task of administering the licensing process. To make a case in Europe for being able to act more effectively, hard evidence will be needed, and the two departments have jointly commissioned a three-year research programme. This has an encouragingly wide scope, covering not only the numbers of birds, but the practical question of their feeding behaviour, the damage done, and, most importantly, the efficacy of deterrent methods. Fortunately, bird predation is not just a British problem - there is major pressure in France, Italy and Germany for action to counter large-scale damage by cormorants.

We have been able to take advantage of this. The Atlantic Salmon Trust is a member of the United Kingdom branch of FACE (the Federation of Associations for Country Sports in Europe). From its office in Brussels, FACE is in close touch both with the Commission and the European Parliament, and made us aware that the cormorant problem was to be discussed by the Parliament's fisheries Committee. We made a submission to the Committee, which also heard detailed evidence from German fishery managers. The end result was a proposal from the Committee for a Parliamentary Resolution on the subject. This was adopted by the Parliament in February, thanks in good part to determined lobbying from members of FACE in a number of States. Although slightly watered down in its final version, the Resolution is most valuable. It acknowledges the enormous growth in cormorant populations and the scale of the resultant damage to fish stocks. Significantly, it recognises that current methods of controls under derogation are ineffective, and calls on the Commission to act to restore the ecological balance. *Phalacrocorax sinensis*, the European cormorant, is currently listed in the "super-protected" Annex I of the Bird Directive, and the Resolution calls for this to end, at least temporarily.

Parliamentary Resolutions are not binding on the European Commission, but they can often be the trigger for legislative action. Follow-up work was therefore needed to keep up the momentum. Inspired by the Trust, the President of FACE has written to the Fisheries commissioner, Emma Bonino, to repeat the call for action. The letter asks the Commission to launch an urgent programme to determine and implement measures to reduce the damage done to stocks by fish-eating birds, also including *Phalacrocorax carbo* (the variety predominant in UK), as well as goosanders, mergansers and the grey heron. It recommends that this work should take account of current research, rather than suffering delay in the commissioning of new studies. As an intermediate measure, it proposes that the species concerned should be transferred to the "hunnable" Annex of the Directive. This is not aimed at allowing complete "open season" to shoot the birds, but rather at freeing Governments from the current severe constraints on their ability to allow any control.

Finally the letter asks for the opportunity to meet Commission officials, together with representatives of other interested organisations such as the European Anglers' Alliance, as well as Birdlife International, in order to agree a way ahead. At the time of writing, a reply is still awaited - I hope to be able to describe developments in the next Progress Report.

The first steps have been taken. It may need time to achieve the changes that we are seeking, but this is not only an issue where game and coarse anglers are united. It is encouraging that, in this instance at least, the UK is able to call on support from the rest of Europe.

* * * * *

WESTCOUNTRY RIVERS TRUST

(by Michael Martin, Chairman of the Board of Trustees)

Just a year ago the Trust was a vision, a dream of a group of trustees who felt passionately that our Westcountry Rivers were a priceless heritable asset which was declining in a frightening way. How could we help to ensure that our children and succeeding generations can enjoy, paddle, bathe and fish, with jam jar for minnows and with rod and line for salmon and trout in beautiful clean and safe waters?

At that time we had no money, no infrastructure, no credibility. Huge strides have been made in the last year. Firstly we appointed our Director, Arlin Rickard, a westcountryman whose knowledge and interest in the countryside and natural history is combined with enormous energy and the capacity to enthuse others; Stuart Gardiner, the Secretary of the South West Rivers Association, has given his expertise in computers and business administration unstintingly so our office is efficient and has the ability to deal with our diverse constituency and projects. He is the Chairman of our Management Committee. Alan Hawken, a professional company secretary for one of the West's largest companies, looks after all the secretarial and regulatory requirements of the Charity Commissioners and prepares our accounts for audit. Ian Cook has bravely taken on responsibility for the organisation of our most vital fundraising activity. Through a generous sponsorship we have been able to employ Simon Evans as Scientific Officer. Simon is a graduate of Southampton University with an Honours Degree in Environmental Science. His specialist knowledge, youth and enthusiasm, not to speak of his encyclopaedic knowledge of fisheries in the West, is of great assistance to the Director.

Our main thrust throughout these first months however, has been our successful application for substantial funds from the European Union under section 5b for our Tamar 2000 Project.

The Tamar divides, or rather unites, Devon and Cornwall and is a river in great need of environmental improvement. Such improvement undertaken in partnership will concentrate on the wetland sources of the Tamar and its tributaries and vital bankside corridors. In order for these funds to be spent to maximum effect total co-operation, understanding and enthusiasm of landowners and the farmers will need to be achieved. Success which will take some years to bring about, will restore the river for its natural inhabitants from the humblest micro-organism to the noblest salmon and in its train bring not only delight to thousands but also employment and economic wellbeing. This major project will be our first ship of the line in the management of Westcountry river restoration - others will follow. The grant also gives the Trust a great boost of confidence and a sure foundation for the future. The very complicated application to the European Union has been the work of many hands led by Arlin Rickard whose dedication to the project is worthy of the highest praise.

After the first meeting of the Trustees last year the Chairman, Michael Martin, commented that with four young men such as Arlin, Stuart, Alan and Ian, the Trust could not possibly fail to succeed. This forecast looks on course - with the help of our supporters we shall go forward.

COUNTRYSIDE STEWARDSHIP - THE BENEFITS FOR SALMON

(by Jeremy Read)

Atlantic Salmon Trust supporters may already know that the Countryside Stewardship scheme in England is now being run by MAFF. It is a clear advantage that there is now only one organisation responsible for both Countryside Stewardship and Set-aside, and moreover, one that has an interest in fisheries. The Ministry is actively seeking applications for grants under the scheme, and the Trust has received a copy of a pack which is now available, setting out details of the scheme and how to apply for a grant. The Trust welcomes this initiative, and feels that all its supporters, and not only riparian owners, will wish to be aware of its potential.

Three Objectives of the scheme are of particular interest in the context of improvement of fisheries.

The "Waterside Land" option can be used in a number of ways to improve habitat alongside rivers and streams. It can be used for the restoration and management of waterside vegetation, which will provide shade and increased supplies of vertebrates for fish. It can be used in stopping fertiliser and pesticide use, thus removing danger from run-off. It can also be used, where necessary, to protect banks from erosion by livestock, which will obviously help to improve and maintain water quality and depth.

The "Field Margins on Arable Land" option can also be used to create wildlife habitats along rivers and streams by creating buffer strips and, again, restoring and managing waterside vegetation. This option could prove particularly useful in areas of the country where intensive arable farming extending to the bankside has reduced vegetation and increased soil erosion, to the detriment of spawning and nursery streams.

The "Uplands" option can also help with measures taken to protect upland streams from damage by livestock, which could protect salmon and trout spawning areas.

The pack contains a series of booklets explaining the scheme and its objectives and rules, and covering the management actions that are eligible for grants (together with the relevant payment rates). As well as application forms, a sample application is included to ease the burden of form-filling. Copies of the pack may be obtained from MAFF regional service centres - a list of addresses is at the end of this article. The closing date for applications this year is 30 April, but it may not be too soon to be thinking about applications for next year.

A similar scheme for Wales, entitled "Tir Cymen", is being administered by the Countryside Council for Wales. The address for enquiries is: Plas Penrhos, Ffordd Penrhos, Bangor, Gwynedd LL57 2LQ. It is understood that proposals for a Scottish Scheme, to be run by the Scottish Office Agriculture, Environment and Fisheries Department, and called the "Countryside Premium Scheme", are the subject of consultation. The Trust will report when more information is available.

MAFF REGIONAL SERVICE CENTRES

Northern (Cumbria, Lancashire, Northumberland, Tyne and Wear)
MAFF
Eden Bridge House
Lowther Street
Carlisle CA3 8DX
Telephone: 01228 23400

North East (Cleveland, Durham, Humberside, North Yorkshire, South Yorkshire, West Yorkshire)
MAFF
Government Buildings
Crosby Road
Northallerton DL6 1AD
Telephone: 01609 773751

North Mercia (Cheshire, Greater Manchester, Merseyside, Shropshire, Staffordshire)
MAFF
Berkeley Towers
Crewe
Cheshire CW2 6PT
Telephone: 01270 69211

South Mercia (County of the West Midlands, Gloucestershire, Hereford and Worcester, Warwickshire)
MAFF
Government Buildings
Block C
Whittington Road
Worcester WR5 2LQ
Telephone: 01905 763355

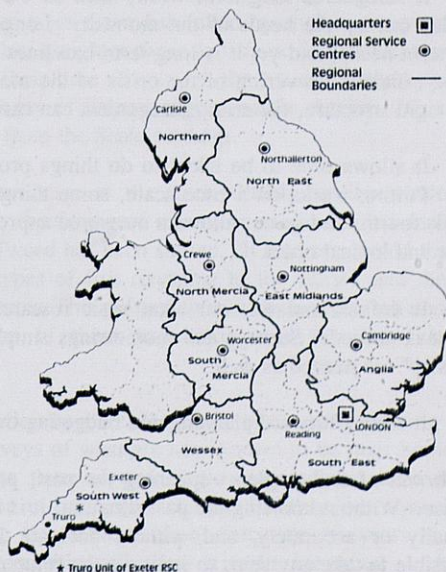
East Midlands (Lincolnshire, Derbyshire, Leicestershire, Northamptonshire, Nottinghamshire)
MAFF
Block 7
Chalfont Drive
Nottingham NG8 3SN
Telephone: 01159 291191

Anglia (Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk, Suffolk)
MAFF
Block B
Government Buildings
Brooklands Avenue
Cambridge CB2 2DR
Telephone: 01223 462727

South East (Berkshire, Buckinghamshire, Greater London, Hampshire, Isle of Wight, Kent, Oxfordshire, Surrey, East Sussex, West Sussex)
MAFF
Block A
Government Offices
Coley Park
Reading RG1 6DT
Telephone: 01734 581222

Wessex (Avon, Dorset, Somerset, Wiltshire)
MAFF
Block III
Government Buildings
Burghill Road
Westbury on Trym
Bristol BS10 6NJ
Telephone: 01179 591000

South West (Devon, Cornwall and the Isles of Scilly)
MAFF
Pyder House
Pyder Street
Truro
Cornwall TR1 2XD
Telephone: 01872 265400



Produced by the Ministry of Agriculture, Fisheries and Food

© Crown copyright 1996. PB 2505E.

Printed on an environmentally friendly **ECO-CHECK®** ***** paper

FISHERIES MANAGEMENT PLANS : Some personal thoughts and experiences

(by Ronald Campbell)

The first edition of the Fisheries Management plan for the Tweed having ended in 1995 and having just completed its successor for 1996-2000, the definition, format and basic purpose of such plans have been making me do some thinking.

The *definition* I came up with in formulating the second edition is that a fisheries management plan is:

"The co-ordination of data collection and analyses with fundamental research into relevant topics to devise management actions that will beneficially affect the future state of fish stocks"

The basic *purpose* of such plans is to set out the programme of what needs to be done on a river for the fish and over what time scale and it is vital that this is done because:-

- 1) It gives clear objectives to the organisation pursuing the plan and a time-frame in which to achieve these
- 2) It safeguards long-term work, such as the sampling of monitoring sites, from being crowded out by the needs of the moment. Long-term work is always under pressure from short-term needs, and yet it is long-term baselines that makes for good fisheries management, not the efficient answering of the crisis of the moment in the office or the river. Without a fairly rigid structure, fisheries management can easily turn into "event-led chaos".
- 3) It allows time to be taken to do things properly instead of trying to do everything at once. Putting works on a time scale, some things to be done in the first year, some in the second, fourth, and so on, allows a measured approach to be taken and things to be put in their proper and logical order.
- 4) It defines and sets out what basic research into the life-histories and stocks of fish present is needed. Surveys and monitorings simply tell the "what", but often the "how" and the "why" are needed as well.
- 5) It allows forward planning and budgeting over the period of the plan.

The *format* of such a plan - spanning the past, present and future - arises naturally from its purpose. Without knowing the past situation, it is impossible to judge present conditions either rationally or accurately, and without accurate knowledge of the present situation, it is impossible to take any steps to improve the future. As an illustration of this, the work on the "Spring Salmon" of the Tweed can be taken as a case history:-

THE PAST: Most basically, what is the historical background to the present condition of early-season fish on the Tweed? Records for the whole Tweed show that the river was dominated by late-returning fish for most of the last century, with a change to Spring dominance occurring over a very short period around 1915. That lasted till around 1970, when another rapid change to Autumn dominance took place. From one fragment of information on net catches in the 1740's, however, it appears then that most of the fish were expected to be caught by the end of April each year. Over 250 years therefore, there has been a change from Spring to Autumn to Spring and back to the present, Autumn, situation. This then, is the background that the present state of this run has to be judged against. There does not appear to be any rigid proportion of the stock that always comes back in the early part of the season, but a fluctuating level - maybe cyclical, maybe not, but certainly very changeable.

THE PRESENT: Surveys of the present state of such fish are also a basic requirement, but before that could be done, some basic research was indicated, to define what a "Spring Salmon" on the Tweed actually is and where they come from in the catchment.

Measurements and Scale-reading from seven sample rod fisheries has shown that the great majority of Salmon caught before the 1st of July on the Tweed at present are 2.2's (two year old Smolts returning after two years at sea) and that they are almost all between 60 and 79 cms in length. This also showed that such fish were almost never caught in the fishery above the entry of the river Ettrick, though the fishery below catches many such fish, leading to the conclusion that these fish went up that tributary but not into the upper Tweed.

As this work depended on the scale samples taken from fish killed by anglers, its conclusions could have been biased by the times and places anglers chose to fish, so independent evidence was sought from radio-tracking fish from their time of entry to the estuary to their spawning destination - and this showed that the majority of Salmon tagged before the 1st of June went into the Ettrick, confirming the conclusion from the Scale-reading.

This, however, seems to go against the evidence of the catch-records for the whole river, which pointed to there being no rigidity in the timing of return, so more detailed analysis of the catch records of the Ettrick and upper Tweed has been started. It also seems odd that there should be such strong differences in the types of fish returning to the Ettrick and the upper Tweed - two neighbouring upland, catchments. This pointed to more basic research needing to be done, on the genetics of the Salmon of these two areas, and this has now been commissioned.

THE FUTURE: In terms of trying to beneficially affect the future of the early-running fish of the Tweed, habitat quantity and quality surveys of what are now known to be their home areas have shown what scope for enhancements there is and improvements have been started. Having found the early-fish to be restricted in both age-class and location, extra monitoring sites and effort are being put into tracking the status of these fish over the years to come. Should any problem arise, then the data available will allow it to be identified much more easily.

The role of monitoring - of juvenile densities; of types of fish in the river at what times of year and their respective frequencies in the catches (through Scale-reading); of catch effort and totals; of fish-counter totals and of many other features - is absolutely crucial. Without long baselines of comparable data stretching over the years, it is simply not possible to know what is happening. Salmon stocks are as dynamic as the rivers they live in and only continuous, good-quality monitoring can distinguish natural highs and lows from the effects of any new problem, either freshwater or marine. Change is not the same as decay, but without a good knowledge of the state of a Salmon stock over many years, the two cannot be distinguished and are very often confused. Perhaps the most basic role of all for a fisheries Management Plan is make sure that such monitoring is carried out continuously over the years, however pressing the imperative demands of the day or the week.

* * * * *

"TITBIT"

Dramatic loss of chinook brings closure on outer coast

The fisheries department is closing all commercial and sport fisheries for chinook salmon along British Columbia's outer coastline this summer because of an unprecedented collapse of stocks. The department blamed the collapse on El Nino warm water currents a few years ago. The currents drew in hundreds of millions of mackerel that devoured most of the juvenile chinook living in Barkley Sound, west of Port Alberni, and elsewhere along Vancouver Island's west coast between 1992 and 1994.

Brian Riddell, the department's senior chinook biologist, said ocean survival rates were cut by more than 90% and the chinook in some rivers are close to the brink of extinction.

'We have never seen a reduction in survival of this magnitude,' said Paul Sprout, operations branch director for the department. 'We are down to tens of females in the spawning population on some rivers.' The prognosis is only slightly better for three rivers where the department maintains hatcheries. Predictions are for only minor improvement in 1997.

And the federal government can go ahead with its plan to reduce the West Coast commercial salmon fleet, a judge ruled recently. Justice John Cowan of the BC Supreme Court rejected a bid by the BC government for an injunction to stop the federal plan.

* * * * *

WHERE HAVE ALL THE SPRINGERS GONE?

(by Jeremy Read)

The historic meeting room of the Linnean Society of London was filled to capacity by salmon fishery owners and managers, anglers and scientists on Friday 26 January. A conference on the Enhancement of Spring Salmon, organised by the Atlantic Salmon Trust, followed a half-day workshop attended by experts currently studying the factors affecting the abundance, survival and reinstatement of early-running salmon stocks. Speakers drawn from all over the United Kingdom, from the Republic of Ireland and from Canada, examined the evident decline in the abundance of early-running salmon of all sea age groups which has been observed throughout their North Atlantic range, and debated what could and should be done.

The subjects ranged from studies of sea temperature provided by satellite observation, through recent work on the genetic make-up of individual "families" of salmon, to the analysis of catch data going back two hundred years. The common theme that emerged was straightforward. It is clear that early-running wild salmon have recently suffered a much higher mortality at sea than other stock components, probably because of changes in ocean temperature and salinity patterns, which affect feeding and therefore survival at sea and the development sequence which governs the age at which salmon are ready to spawn. These changes may well run in cycles, and we can do nothing directly about them. However, the great risk is that the numbers of returning early-running fish may drop to a level at which not enough fish spawn to maintain this special stock. Therefore we must do all we can, by reducing fishing pressure on spring salmon at sea and in rivers - there was endorsement of the work of the North Atlantic Salmon Fund in closing the high seas salmon fisheries - and we must give returning fish and their progeny the best spawning and nursery opportunities by improving river habitat. This will help to ensure that the stock survives and is ready to recover when sea conditions are more favourable.

New knowledge of the characteristics of spring fish may help achieve carefully managed hatchery breeding, but it was agreed that this should be a last resort, and will only preserve the stock, rather than improving it. There is no simple way to increase numbers. One enlightening fact is that very few multi sea winter male fish survive to spawn in the headwaters of rivers, and for those forward-looking anglers who follow the growing trend of releasing spring fish, the males are probably more important for maintaining the genetic line than females. Since it is hard to tell male from female this long before spawning - indeed both sexes have a small "kype" at this stage - the moral is that if you support catch-and-release as one of the spring fish conservation measures, then do not try to differentiate between male and female.

* * * * *

WATER OF LIFE BOOSTS SALMON RESEARCH

A £20,000 project including a two-year research study into the possible impact of the whisky distilling industry on salmon and trout rivers has been launched at Cragganmore Distillery on Speyside.

Funding for the Atlantic Salmon Trust, a charity devoted to the well-being of the wild Atlantic salmon, has been made available through the Water of Life environmental programme of United Distillers and parent company Guinness plc.

Over the next two years, scientists from the Spey District Fishery Board, in conjunction with the Trust, will be making a detailed study of the lifecycle of fish both upstream and downstream of local distilleries.

At every distillery, large quantities of water are used for cooling, to be returned to the river system unchanged except for a modest rise in temperature. The maximum temperature and the actual rise in temperature of the water are subject to strict controls from regulatory bodies.

"We know from earlier research that the effect of this warmer water is to encourage faster growth rates among juvenile fish," explains biologist Bob Laughton. "What the Water of Life project has set out to discover is the effect this might have on the entire lifecycle of the salmon and trout in the river.

"A possibility is that the young salmon parr which grow more quickly, migrate to sea earlier than they would otherwise do," he adds. "Our investigation of what is happening here will no doubt have implications for river management elsewhere in the country."

During the project, the research team will be catching and returning young fish at several sites on rivers in the area to establish the age structure, the growth rates, the size of the population and its density. The salmon will be tagged later in the year to enable the scientists to follow the development of the fish in the future.

"Even though the whisky industry has used water from some of Scotland's best-known rivers for hundreds of years, we have commissioned this research to improve our understanding of the wider effects of our activities," says Mike Gunn, Manager of Cragganmore Distillery. "As a responsible company, we need continually to be able to demonstrate that our environmental record is one of which we can be proud."

Cragganmore produces one of the whiskies in the high profile Classic Malts range of United Distillers. Its parent company, Guinness plc, established the Water of Life initiative in 1995 to fund water-related environmental schemes, linked to its sites around the world. To date, the £1 million scheme has assisted over 30 projects in 19 different countries, including five projects in Scotland.

The scheme takes its name from the phrase 'uisge beatha' - the Gaelic phrase for 'water of life' - from which the word whisky is derived.



The Cragganmore Water of Life project is launched on the famous Junction Pool on the Ballindalloch Castle beat of the River Spey. (From left to right): Mike Gunn, Manager of Cragganmore Distillery and John Webb, Atlantic Salmon Trust; with Bob Laughton and John Bray, the biologists undertaking the research.

AST BIOLOGIST'S REPORT

(John Webb, Marine Laboratory, Aberdeen)

Atlantic Salmon population management: maximising progeny numbers from natural and artificial spawning

Lifetime fitness studies on spring salmon

In a collaborative study between the AST, SOAEFD and Stirling University, using the latest DNA fingerprinting techniques, this research project aims to follow the fortunes of a number of different families of spring running salmon from the egg, through their juvenile lives to smolting and on to their return as adults at spawning. The research is being carried out on a spawning stream on the upper reaches of the Aberdeenshire Dee and will focus on monitoring the performance of different genetically 'typed' family groups of fish derived from three consecutive year classes of eggs.

The project began in the spring of 1995 when 20 different 'genetically typed' families of eggs were stocked throughout the study stream. In the following autumn of the same year, all of the adult spawners that returned to the study tributary were also retained and stripped. In the same way as in 1994/95, the resulting fertilised eggs were incubated in single family groups to the 'eyed' stage in a simple basket system situated in the native stream. During the winter, small samples of adipose fin tissue taken from each member of the broodstock group were genetically screened in the laboratory using DNA fingerprinting. From this analysis, a final group of 10 families of eggs were selected for stocking into the experimental area of rearing habitat situated upstream of the smolt trap. The selected eggs were stocked out in early April at the same locations as the 20 family groups placed out last spring - but at exactly half the density. Genetic fingerprinting screening of the adipose fin tissue that is routinely clipped from the resulting smolts will allow us to identify the fortunes of members of all 30 families stocked in the stream over the past two years. This will mean that we will be able to look closely at the key variables of egg deposition affecting growth and survival in freshwater.

'Local' egg relocation

Natural spawning is rarely evenly distributed throughout the available habitat. Often, the most 'suitable' spawning habitat is utilised in preference to the more marginal areas in the same watercourse year after year. The phenomenon may be particularly evident when female spawner numbers are relatively low or when spawning activity coincides with periods of unusually high or low flow - often resulting in the uneven or 'patchy' distribution of spawning activity within streams.

Falling spawner numbers may therefore lead to localised deficiencies in egg deposition. This in turn may lead to the underutilisation of some areas of the available juvenile rearing habitat. As a part of a new pilot project, I have been investigating various management options to ensure that **naturally spawned** eggs and fry are distributed as widely as possible in nursery

streams. One aspect of this work has been to evaluate a new tool developed in Sweden to place eggs directly into stream gravels. Eyed eggs have been excavated from redds in areas where spawning activity was most concentrated and have been redistributed in unused areas using the new machine.

The principal aim of this work is to attempt to redistribute eggs over a wider area of the available rearing habitat and thereby help to reduce the effects of density dependant mortality during the early stages of free swimming life and increase overall juvenile production. Electrofishing surveys will be carried out in the experimentally stocked areas later in the summer to determine the levels of egg to fry survival attained using this technique. A full report on this work will be published in the next AST Progress Report later this year.

Catch and Release - spring and early summer salmon in the Aberdeenshire Dee

Following the success of last year's pilot radio-tracking study on the Dee (see December 1995 Progress Report) a further study is being undertaken this year. Since early March, twenty two spring salmon caught and released by anglers fishing the Dee at Kincardine, Borrowston, Carlogie, Balogie, Upper Crathes and Sluie have been radio-tagged. To date (May 30th), one of the radio-tagged fish has been recaptured by an angler fishing at Invery. The remaining 21 fish are scattered between Crathes near Banchory and Braemar. Monitoring of each fish's progress will be continued during the summer.

Meetings and Presentations

In February I took part in a Dee 'ghillie training day' jointly organised with the Dee Salmon Fishing Improvement Association, AST and SOAEFD (FFL, Faskally) at the Invercannie conference centre, near Banchory. The main purpose of the day-course was to explain the background to catch and release, and give guidance and training to ghillies in the main techniques of tackle selection, live fish handling and Floytagging.

In early April I gave a presentation to the annual District Fishery Board Superintendent's meeting at Pitlochry on catch and release of spring salmon. On the following day, in the presence of the Scottish Fisheries Minister, Raymond Robertson MP and SOAEFD officials I gave another presentation on the broad theme of catch and release of spring salmon to the annual general meeting of the Association of District Fishery Boards at Battleby, near Perth. Later that month, I was invited to speak to the AGM of the River Taw Fisheries Association in North Devon. The subject of my presentation was fish counters and the data they generate, stock structure within rivers and catch and release.

In mid-May I attended a workshop on GIS Techniques and Salmonid Habitats at the NERC Institute of Terrestrial Ecology near Banchory, Aberdeenshire.

* * * * *

THE EFFECTS OF TEMPERATURE ON THE LARVAL DEVELOPMENT OF EARLY AND LATE-RUNNING ATLANTIC SALMON

(Anne McLay and Gideon Pringle, SOAEFD Freshwater Fisheries Laboratory)

Atlantic salmon spawn in the autumn and winter months, and their eggs hatch and fry emerge from the river bed gravel redds the following spring. Salmon embryos and alevins are almost entirely dependent on yolk reserves to fuel their development and growth. The amount of yolk however, is finite and fry emergence and the successful transition to feeding within the stream are recognised as a critical period of the salmon's life cycle. It is well known that increasing water temperature accelerates the rate of development of both embryos and alevins. Temperature has also been shown to affect the efficiency with which yolk is converted to fish body tissue. In general, fry size increases with decreasing incubation temperatures and larger eggs produce larger fry.

The results of several studies on salmonids, including Atlantic salmon, suggest earlier or larger emerging fry have greater potential for survival and growth. The earliest fry to emerge have been shown to have an advantage in competition for feeding sites. Larger size confers resistance to starvation and more flexibility for making the transition to independent feeding. Larger fry are also more successful in obtaining and defending profitable feeding territories and less likely to suffer mortalities through predation or disease. In seasonally variable climates like the UK's both the condition of fry and the timing of hatch and emergence are likely to be critical to survival on a site specific basis.

Responses to temperature represent a mechanism whereby the rate of development can be adjusted in relation to year to year variation in climatic conditions. However, because of the tendency of salmon to home to their natal streams to spawn, it is also possible that, over time, populations have evolved characteristics which make them particularly well suited to local conditions. Water temperature regimes, in particular, show considerable variation both between and within rivers. Given the importance of early phases of the life cycle to year class strength, the existence of genetic adaptation in relation to incubation temperature deserves further investigation.

With support from the Atlantic Salmon Trust we conducted a hatchery-based experiment to compare the effects of incubation temperature on the larval development of salmon from the Baddoch and Sheeoch Burns. The Baddoch and Sheeoch are upper and lower spawning tributaries of the Aberdeenshire Dee which contribute to spring and later running components of the Dee Stock, respectively. Spawning in the Baddoch occurs four to six weeks earlier than in the Sheeoch and, because of altitude, Baddoch eggs and alevins typically experience water temperatures some 2 to 3°C lower than the Sheeoch during the incubation period.

For the experiment eggs and milt were obtained from adult fish intercepted at SOAEFD's fish trap on the Baddoch and from fish captured by electro-fishing in the Sheeoch Burn. Groups of 200 eggs, from 10 different families from each spawning population, were incubated in the hatchery at three constant temperatures 2, 6 and 10°C to hatch, and throughout the yolk-sac

phase. For each group, at each temperature, the time and duration of hatch were monitored and samples of alevins were obtained at hatch and at various stages throughout yolk utilisation. Egg size was determined for each family from samples taken after fertilisation and water hardening.

As anticipated, the time to hatch decreased with increasing temperature in all experimental groups. At 10°C Baddoch eggs hatched between 43 and 49 days after fertilisation as compared with 83 to 95 days at 6°C and 176 at 2°C. There was some evidence that Sheeoch eggs started to hatch earlier at both 6°C (81 days) and 10°C (41 days) but against the background of family variation, differences between the populations were relatively minor. Only at 2°C was the time to hatch found to differ significantly: the average number of days to 50% hatch was determined as 177 for Baddoch and 170 days for Sheeoch families.

Incubation temperature also affected body weight and percent body weight at hatch, both decreasing with increasing temperature. Significant variation between families was evident in both Baddoch and the Sheeoch fish and much of this variation could be related to egg size. There was also evidence that populations responded differently to temperature. For example, average body weight of alevins from the Baddoch family groups incubated at 2°C was higher than in equivalent Sheeoch groups, whereas at 10°C the reverse was found with the body weight of Sheeoch families being greater than the Baddoch. In Baddoch alevins the dry weight of yolk present at hatch increased with increasing temperature whereas it remained very similar at all temperatures in Sheeoch groups. When family variation and egg size were taken into account it was possible to show that progeny of Baddoch and Sheeoch fish responded differently to the different incubation temperatures. It was also found that families with smaller eggs took less time to use up their yolk and that larger eggs produced larger fry.

Notwithstanding the effects of temperature, Baddoch alevins were often heavier than Sheeoch alevins and had greater yolk reserves. This may be related to differences in egg size. In this experiment, eggs from Baddoch fish were generally of higher average weight than those from Sheeoch fish although the differences were not statistically significant. The eggs had, however, been obtained from a relatively small number of females. In the North Esk work on the relationship between adult and egg size, conducted on much larger numbers of fish, has shown that early running salmon which spawn in the upper reaches of the North Esk produce fewer but larger eggs per unit body length than late running salmon, which spawn lower in the river system. It has been suggested that differences in egg size are an important adaptation which confer greater food reserves on fish larvae likely to be limited by food availability, temperature and the length of the growing season.

This experiment provides some evidence of differences between the progeny of spring and later running Atlantic salmon in the Aberdeenshire Dee, specifically that the young fish originating from the two tributaries differ in their responses to incubation temperature. Differences observed were subtle and relate mainly to alevin size. However, it is important to remember that even tiny size differences may have a substantial effect on later growth and survival. Also in combination with genetic adaptation in relation to spawning date and egg size, they may contribute substantially to the fitness of indigenous populations. The existence of genetic adaptation is an important consideration in the enhancement of spring salmon populations, in

relation to introductions of non-native fish and in the transplantation of fish within river systems.

* * * * *

WEST COAST FISHERIES TRUST

The West Highland Sea Trout & Salmon Group (WHSTSG) was set up in 1994 to address the particular and serious problems - environmental and economic - affecting Scotland's West Coast freshwater fisheries.

In response to recommendations from the WHSTSG's Action Plan - published in April 1995 - five new regional Fisheries Trusts have been established using, as a precedent, the highly successful West Galloway Fisheries Trust which has helped pioneer this imaginative and innovative approach to regional fisheries management.

The Trusts cover the following areas by District Fishery Boards:

| | |
|-------------------------------------|---------------------|
| Western Isles Fisheries Trusts | - Outer Hebrides |
| West Sutherland Fisheries Trust | - Hope - Kirkaig |
| Wester Ross Fisheries Trust | - Kannaird - Carron |
| Lochaber & District Fisheries Trust | - Morar - Leven/Coe |
| Awe Fisheries Trust | - Awe catchment |

These organisations have now all been registered as charities, and have been designed as partnerships, consisting of a broad base of predominantly local freshwater fisheries interests, including variously: angling clubs, proprietors, fish-farmers, LEC's, Scottish Natural Heritage, council representatives, local businesses etc.

The five new Trusts have spent the last few months putting in place 3 years of core-funding to ensure that the Trusts will have the necessary time to settle down and gather some momentum. With this funding largely secured the intention is now to employ a Trust biologist/manager in each area.

This person will conduct ongoing research into, and work towards identifying, the in-river and coastal problems which have caused such severe freshwater stock declines on the West Coast. These declines, as well as having important economic implications, are also seen as being indicative of broader environmental problems, concern for which, is shared by environmental organisations with whom the Trusts hope to co-ordinate their work, such as Scottish Natural Heritage and the Freshwater Fisheries Laboratory at Faskally.

Concurrent with the scientific work of each Trust will be an ongoing programme of communication and education with local schools, angling clubs, communities and industries (eg. forestry, agriculture and fish-farming) in an attempt to increase awareness of wild fisheries problems.

It is intended that much of the work of the Trust will be applied in nature, supported, by rigorous scientific research with an emphasis placed on anticipating problems as well as solving them.

Of the five posts, three have now been filled and will be starting work in the near future. It is anticipated that the Wester Ross and Western Isles Trusts will follow shortly and that by September of 1996, all five Trusts will be up and running.

The West Highland Sea Trout & Salmon Group recently decided to dissolve and will now be replaced by the Association of West Coast Fisheries Trusts (AWCFT), an informal and low-profile organisation consisting of the chairmen of each Trust, the chairman of the Galloway Trust (whose experience will be invaluable), an independent chairman - John Mackenzie of the Atlantic Salmon Trust - and a development officer.

The role of this organisation, for the time being, will be to: continue its support of the new Trusts; develop the Trust initiative in areas on the West as yet not covered by a Trust; raise funds; ensure good communication between the Trusts; and liaise with other organisation's relevant to the Trust's interests.

Whilst nobody underestimates the difficulties ahead for the Trusts, the emergence of these organisations must be seen as a positive step towards addressing the extremely serious situation that West Coast freshwater fisheries now find themselves in. This is just the start of an effort to tackle these problems by attempting to provide credible, rigorous and authoritative science and management to an area which has been in need of it for many years.

* * * * *

TITBIT

Sea Lice

As all of you will know, sea lice have been blamed for the demise of sea trout and they are the curse of the salmon farming industry.

It is pleasing to be able to report that, after protracted negotiations, the Scottish Environment Protection Agency is preparing to grant discharge consent for the use of two new treatments which should lead to a significant improvement in the control of sea lice.

* * * * *

SCOTTISH FISHERIES PROTECTION AGENCY

(P.E. du Vivier, Chief Executive)

The Scottish Fisheries Protection Agency was established in 1991 as a Next Steps executive agency within the Scottish Office Agriculture Environment & Fisheries Department. The Agency is headed by a Chief Executive who is answerable to the Secretary of State for Scotland for its operation and performance.

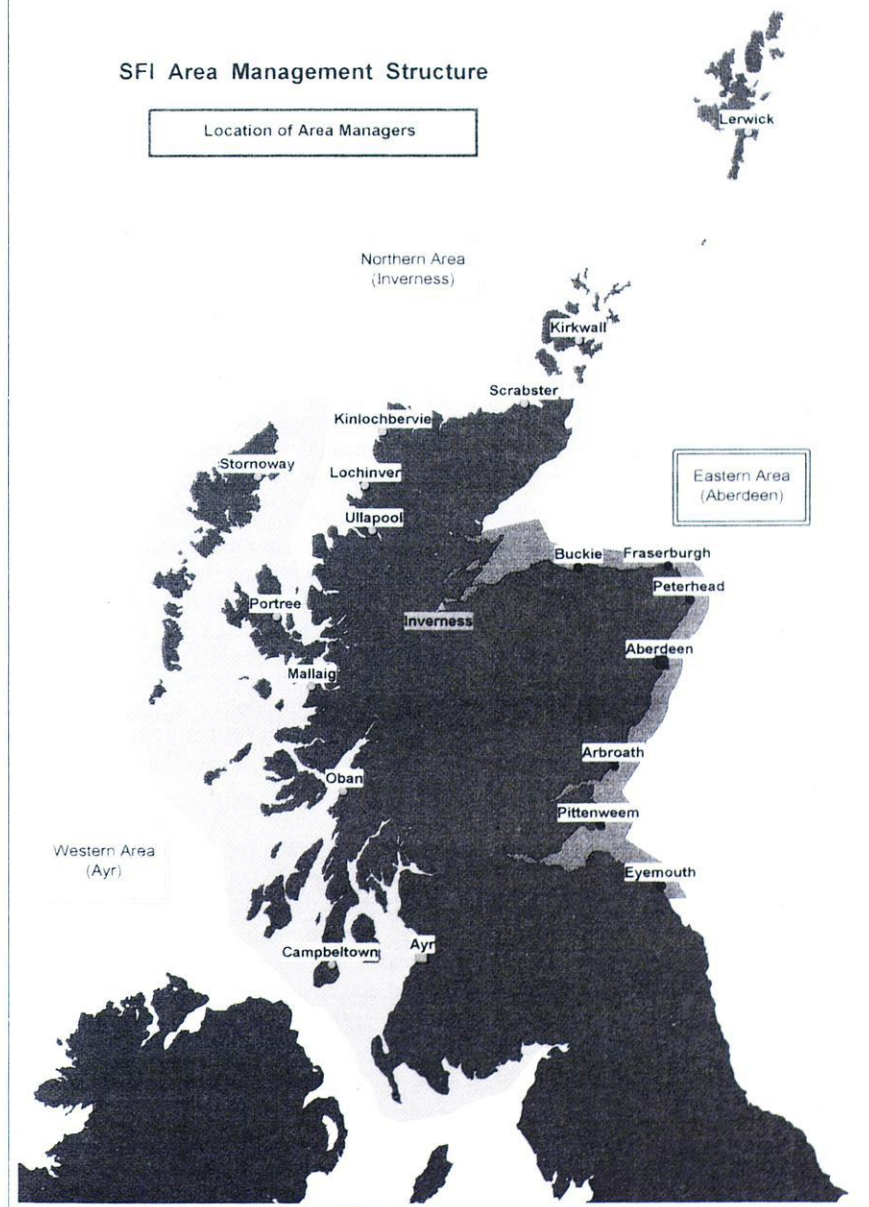
The key role of the Agency is to deter and detect illegal fishing activity in Scottish waters through aerial and marine surveillance and the inspection and monitoring of fishing vessels in ports throughout Scotland. The Agency operates 2 aircraft, 4 offshore Fishery Protection vessels, which patrol the fishing grounds of the North Sea and to the West of Scotland out to the 200 mile fishery limit, and 3 smaller vessels used mainly for patrolling inshore waters. In addition the Agency's Sea Fisheries Inspectorate operates from 19 coastal offices at the main fishing ports in Scotland (see map opposite). The Agency also has a contract with the Royal Navy to provide additional offshore surveillance via its Fishery Protection Squadron.

Although the major function of the Agency is to enforce regulations geared towards commercial sea fishing activity, it also attaches a high priority to the prevention of illegal salmon fishing in Scottish waters. During the period from May to October substantial resources are devoted towards this effort and the inshore FPVs carry out patrols specifically to deter and detect such illegal activity. These include patrols on the median line between Scotland and the Republic of Ireland where a considerable number of contraventions have been detected in the past.

During the past few years the Agency has established a good relationship with the Association of Scottish District Salmon Fishery Boards and this has led to a greater level of co-operation between bailiffs and SFPA officers. Occasional helicopter patrols are provided by the Agency at the request of District Fishery Boards and our shore based staff work closely with bailiffs during these operations. In addition our inshore FPBs will respond to ad hoc requests for assistance from bailiffs or others subject to other operational priorities. Our offshore FPVs also keep a sharp lookout for illegal nets when transiting coastal waters and estuaries. Through both independent action and combined operations with local bailiffs, Agency personnel seized 79 illegal salmon gill nets during 1995 compared with 51 during the 1994 season.

The Agency intends to maintain its existing level of co-operation with salmon bailiffs and district boards but also welcomes the intelligence and advice offered by those who have an interest in and concern about the conservation of salmon stocks whilst perhaps not holding official office. In this regard the Agency's staff at coastal fishery offices would be pleased to hear from those with information which can be followed up so that any illegal activity is pursued as effectively as possible whenever and wherever necessary. Initial contact with regard to the Agency's work on salmon enforcement should be made through the Operations Room at the Agency's Headquarters in Pentland House, Edinburgh (Telephone 0131 244 6074).

SFI Area Management Structure



FISH FARMING

For interest the following has been extracted from the SOAEFD Annual Production Survey, 1995.

Weight of salmon (tonnes) harvested annually in 1985-1995

| Year | Tonnes | Year | Tonnes |
|------|--------|------|----------------------|
| 1985 | 6,921 | 1991 | 40,593 |
| 1986 | 10,337 | 1992 | 36,101 |
| 1987 | 12,721 | 1993 | 48,691 |
| 1988 | 17,951 | 1994 | 64,066 |
| 1989 | 28,553 | 1995 | 70,060 |
| 1990 | 32,351 | 1996 | 80,300(<i>est</i>) |

The weight of salmon harvested in 1995 was 70,060 tonnes, the greatest ever recorded in Scotland and an increase of 4,995 tonnes (9%) compared with 1994. Since 1985 annual production has increased steadily except in 1992 when there was a drop in production due to heavy mortalities attributed to furunculosis, a systemic infection caused by the bacterium *Aeromonas salmonicida*.

Conclusions

The industry continues to grow in terms of production of salmon, staff employed and smolts put to sea. The two most notable features of this years results were the increased survival of the 1993 year class of smolts to 90% and the 24% increase in smolts put to sea. Disease, the most common cause of poor survival in the past, has in general either been absent on many sites or under control. Due to industry and insurers experience, losses due to storm damage also continue to decrease.

Smolt survival has increased by approximately 10% per year for the last 3 years and has accounted for the fairly dramatic increase in production from 36,000 tonnes in 1993 to 70,000 tonnes last year with much the same annual smolt input over the intervening period. Feed improvements have also contributed to improved weights at harvest and therefore to the increased tonnages. It is clear that further increases in tonnage on a comparable scale are unlikely to come from further increases in survival and advances in food technology hence it has been recognised that to retain the industry's share of the continuing and increasing consumer demand for salmon more production will only come from further smolt inputs. It is estimated that, arising from the increased input of smolts in 1995, production will exceed 80,000 tonnes in 1996.

* * * * *

**SOCIAL, ECONOMIC and MANAGEMENT ASPECTS
of RECREATIONAL FISHERIES
(EIFAC Symposium at Dublin, June 1996)**

(a report from Robert Williamson)

A Symposium on the social, economic and management aspects of recreational fisheries preceded the 1996 biennial meeting of the European Inland Fisheries Advisory Commission (EIFAC) at Dublin in June. (EIFAC is an agency of the Food and Agriculture Organisation of the UN). The Symposium was the outcome of a resolution made at an EIFAC Consultation on management strategies for European inland fisheries and aquaculture held in Rome in 1994. The stated objectives of the Symposium were: to consolidate the findings of that Consultation; to identify the factors which influence the use and development of recreational fisheries; to develop strategic guidelines for the management of such fisheries; and to formulate a code of good practice for those participating in recreational fishing.

The Symposium took place over four days, at the end of which it recommended that EIFAC should:

- improve data collection systems, with more precise definitions of the types of recreational fishing so as to provide comparable basic data;
- make a Europe-wide survey of recreational fisheries in the year 2000;
- develop methods for applying socio-economic values to recreational fisheries;
- establish a Working Party on Communication and Education to improve understanding and communication between managers, scientists, fishermen and other groups (and the Working Party should provide information and promote education targeted to different user groups to reduce conflict in multiple-use situations); and
- make progress with the production of the Code of Good Practice for Recreational Fishing (recommended at the Rome meeting, 1994);

and that the appropriate agencies in the member countries should:

- adopt an integrated, sustainable, long-term approach to aquatic resource management, ensuring full consultation between the various interest groups;
- seek to have the true value of the aquatic ecosystem (including the social value) taken into account in the decision-making process on projects related to environmental management; and
- monitor the availability and quality of recreational fisheries and, where necessary, should review their management strategies.

These recommendations arose from discussion of points raised by over 30 papers which were grouped in 5 separate sessions under the headings: Current status and trends; Interactions with outside influences; Interactions with other user groups; Socio-economic and legal aspects; and Criteria for management. As sometimes happens in such symposia, the contributions did not all fit well into the framework, nor did they sufficiently cover all the set topics - the organisers

being limited to what had been offered. (It was interesting to note that there was to have been a paper by Dr. Marquis, reviewing the problems of fish-eating birds, but neither he or his co-workers were there, the paper had not been submitted and nothing on the subject had been put in its place).

There was a substantial representation from Scandinavia (nearly a third of all the delegates came from Sweden and Finland) and from the UK and Ireland (which contributed a further fifth). Otherwise there was a fairly even Europe-wide representation: from Estonia to Italy and Spain to Slovakia. There were also observers and useful contributions from North America.

The most lively discussion centred on a paper presented by Dr. Berg on animal welfare and angling in Baden-Wurttemberg (Germany). He described how a Code of Practice had been developed to reduce conflict between anglers and animal welfare interests. The code was prepared, and eventually agreed, in consultation between the fisheries organisations, the fisheries administration and an official working group on animal welfare. Because of the way it was developed, the Law Courts in Baden-Wurttemberg now rely on the code for guidance in considering cases under the animal welfare legislation. In some ways the code has been judged a success; there is less conflict - or at least less cases come to court. However its terms would alarm many fishermen in the UK (a member of the Irish delegation to the Symposium used less restrained language). Under the code: fish should only be caught in places where there was not an undue risk of losing them, or at places or times when the majority of the fish caught were takeable (ie of legal size and in season); competitive fishing is not accepted, nor fishing events where fish of catchable size are stocked prior to the event; and every fish caught that is in season and within any legal size limits must be anaesthetised and killed immediately after catching.

It is not for us in the UK to judge the soundness or suitability of these criteria for fisheries in Baden-Wurttemberg, but clearly they would not be considered appropriate in many fisheries here; most obviously, in the coarse fisheries of England where it is all catch-and-release - and often all put-and-take too - but also in those Scottish salmon and trout fisheries that have recently adopted full catch-and-release. The idea of having to anaesthetise each fish before killing it will also seem bizarre to many who think of death as the ultimate anaesthetic (and who believe that fish can be dispatched quickly).

In another paper from Germany, it was explained that: all adult anglers must pass an examination before being allowed to fish (and in some States anglers must previously have taken a formal course of instruction); juveniles cannot fish unless accompanied by a fully qualified adult; and adolescents may only fish unaccompanied if they have passed the examination. Again, all this might suit in Germany, but it is far from the current concept of recreational fishing in Scotland (or Norway and many other countries). Dr. Lukowicz, who presented this paper, argued that other countries should consider adopting the German practices because he thought that the European Union might make a Directive on the subject: some others argued that it was more important to stress the variety of circumstances and attitudes across Europe and that, for recreational fishing, national (and even regional) differences were important and valuable and should be maintained.

There were two interesting papers on economic valuation and the human dimension of recreational fisheries based on work and experience in USA and Norway, and one on valuation in the UK clearly presented by Meg Postle (a consultant economist with the Environment Agency). These were a very necessary ingredient given the strong biological bias in representation at the Symposium. There is significant emphasis on valuation now in England and Wales because, so far as I understand it, the Environment Agency has a statutory duty to make cost benefit analyses in relation to water resource projects.

Apart from the topic sessions, it was intended that the Symposium would consider a draft for an EIFAC Code of Good Practice for Recreational Fishing. However, one of the conclusions in the topic session on Criteria for Management was that the appropriate criteria depend on the nature of the resource and perceptions of what constitutes satisfactory fishing; and that these vary so much across Europe, that it would only be possible for EIFAC to specify criteria in the most general terms. It was concluded that the same would apply to any Code of Practice on recreational fishing and the expected draft was not presented. However, it seems that EIFAC is committed to producing some sort of Code of Practice on the subject (because of a resolution passed in 1994), so it was agreed that the matter should be further progressed in one of EIFAC's working groups (Dr. Hickley, the UK's EIFAC Correspondent, is much involved in this so we may hope that the UK's position and interests will be well heard). Preparation of even a quite general Code may be complicated by EIFAC's current definition of recreational fishing which seems to include all subsistence fishing even if it is not for sport or enjoyment.

Participation in this Symposium reinforced my view that it is important for the UK, and the different fisheries jurisdiction within the UK, to have a voice at such events. Otherwise recommendations may be adopted which are inimical to our preferred policies or practices. That would be unfortunate because, although they may merely be recommendations, they may gradually become more mandatory (the traffic tends to be one-way) and, before the potential dangers are fully appreciated, the juggernaut may be on its way.

Another point which I took from the Symposium was that, in the UK, we should be more aware of the increasing tendency in parts of continental Europe to act against any fishery where there is not an acceptable use for the fish caught (use as food is considered acceptable, return alive to the water is not). I hope that we can defend what we do in salmon fisheries in Scotland and elsewhere in the UK but we must be prepared to do just that and, in so doing, it may be as important to be able to justify the philosophy and morality as well as the practice (techniques of handling fish etc). The terms in which policies and actions are described may therefore be as important as what is actually done on the bankside: it may not be appropriate to excommunicate the priest.

I am most grateful to the Atlantic Salmon Trust for giving me the opportunity to represent them at the Symposium. I was also the only delegate from Scotland and occasionally had to explain the distinctive Scottish regime. A report on the Symposium will be published by EIFAC in due course.

* * * * *

REVIEW OF SCIENTIFIC LITERATURE ON SALMON

(by Dr. Derek Mills, Institute of Ecology and Resource Management,
University of Edinburgh)

1. Juvenile Salmon

Relative production of Atlantic salmon from fluvial and lacustrine habitats estimated from analyses of scale characteristics. J.B. Dempson, M.F. O'Connell & M. Shears. Journal of Fish Biology, 1996, 48, 329-341.

Empirical and back-calculated growth of Atlantic salmon parr were compared between fish reared in fluvial (river) and lacustrine (lake) habitats of Conne River, Newfoundland. Length at age was significantly higher for lacustrine parr. Various classification and maximum likelihood estimators indicated that 75% or more of the fish used lakes for rearing. Lacustrine use is another aspect of the inherent variability and plasticity of Atlantic salmon life history traits. As most Newfoundland river systems include lakes, estimates of regional spawning targets and potential smolt production will need to take habitat into account.

2. Smolts

The migratory behaviour of wild Atlantic salmon (Salmon salar) smolts in the estuary of the River Conwy, North Wales. A. Moore, E.C.E. Potter, N.J. Milner & S. Bambar. Canadian Journal of Fisheries & Aquatic Science, 1995, 52:1923-1935.

Thirty-two smolts, tagged with miniature acoustic transmitters, were tracked in the River Conwy. Migration in fresh water was predominantly nocturnal, although there was a seasonal change in this pattern with later run fish moving during both the day and night. Smolts tagged earlier in the study spent significantly longer in the river before migrating into coastal waters than fish tagged later in the study. The movement of smolts through the estuary was indicative of a nocturnal selective ebb tide transport pattern of migration. All of the smolts migrated seawards on an ebb tide close to the surface and within the fastest moving section of the water column. Smolt migration in the lower part of the estuary was indicative of active directed swimming and there was no apparent period of acclimation required when moving from fresh to salt water.

3. Post-smolts

Marine post-smolt growth and age at maturity of Atlantic salmon. K.D. Friedland & R.E. Haas. Journal of Fish Biology, 1996, 48, 1-15.

The annual variation in sea-age of maturation for a hatchery dependent stock of salmon was compared to variation in post-smolt growth as evidenced by scale circuli spacing patterns. The proportion of returns of 1-sea-winter and 2SW salmon and the fraction of the smolt year class

or cohort that matured as 1SW fish were compared to seasonal growth indices determined from circuli spacing on the scales of smolt survivors returning as 1SW and 2SW spawners. Using image processing techniques, inter-circuli distances were taken from the scales of 2244 recaptured fish. Spacing data for the first year at sea were collected and then expressed as seasonal growth indices for the spring period, when post-smolts first enter the ocean; the summer, when growth appears maximal; and winter, when growth appears to be at a minimum. In general, circuli spacings were wider for 1SW than 2SW returns of the same smolt cohort. The 1SW fraction was significantly and positively correlated with late summer growth, suggesting that growth during this season is pivotal in determining the proportion of a smolt class that matures early.

4. Kelts

Freshwater reconditioning and ranching of Atlantic salmon, Salmo salar L., kelts: growth and reproductive performance. I.J.J. Moffet, G.J.A. Kennedy & W.W. Crozier. Fisheries Management & Ecology, 1996, 3, (1):35-44.

Artificial reconditioning of Atlantic salmon in fresh water over two successive years produced kelt survival rates of 28% and 55% in years one and two, respectively. Eye damage and failure to identify non-feeders were important factors contributing to high mortalities. Average fecundities of kelts reconditioned for the first (1220 ova kg⁻¹) and second (1093 ova kg⁻¹) year were lower than obtained from virgin control fish (1590 and 1728 ova kg⁻¹) respectively. Average survival to swim-up for progeny of first (64.5%) and second year (71.4%) reconditioned fish were similar to survival of virgin control fish progeny (72.3% and 68.9%) respectively. Ranched kelts showed better growth parameters than for freshwater reconditioning but had lower average fecundities (1310 ova kg⁻¹ compared with 1820 ova kg⁻¹) and lower average progeny survival to swim-up (60.8% compared with 88.6%) than their control group.

5. Adults

Historical changes in age structure of Atlantic salmon, Salmo salar L., in the River Eo, northern Spain. F. Brana, R. Garrido & A.G. Nicieza. Fisheries Management & Ecology, 1995, 2, (4):279-287.

Variations in the age structure and number of salmon running into the River Eo were assessed from angling records from 1949-1991. Over the whole period, there was no evidence for a decline in the total salmon run, but the last few years revealed significant changes in both the number and age structure of fish caught. The catches consisted mainly of MSW salmon and this did not change from the 1950s to the 1980s as the proportion of grilse remained unchanged. However, since 1980, there has been a marked decline in both the proportion of 3-sea-winter (versus 2-sea-winter fish) and the frequency of previous spawners among the MSW fish.

6. Predation

Predation of Atlantic salmon, Salmo salar L., smolts and parr by red-breasted mergansers, Mergus serrator L., on two Scottish rivers. M.J. Feltham. Fisheries Management & Ecology, 1995, 2 (4):289-298.

Current models estimating the impact of red-breasted mergansers on salmon fisheries in Scotland fail to take account of any annual variation in the proportion of the diet that is smolts. During the 1987-1990 smolt runs, the annual variation in the diet of mergansers was estimated from the stomach contents of birds shot on two Scottish rivers. The proportion of salmon in the diet was greatest early in the smolt run (76-91% by weight), and contained proportionally more smolts than later in the run, when coarse fish were more prominent. There was little annual variation in the proportion of the diet that was juvenile salmon. However, the proportion of these fish that were smolts, was twice as great in some years than in others and this appeared to be independent of estimated annual smolt production in the rivers.

7. Index Rivers

Index rivers; a key to managing anadromous fish. M. Chadwick. Reviews in Fish Biology and Fisheries. 1995, 5, (1):38-51.

A network of rivers provides information for the management of anadromous fish stocks in the Gulf of St. Lawrence. Index rivers are sites where regular observations are made of fish abundance and characteristics. This information is used particularly for Atlantic salmon to estimate stock abundance, to evaluate spawning requirements and to forecast returns. The need for timely and unbiased indicators of stock abundance is increasing. A network of index rivers would fulfil this need.

8. Genetics

Polymorphic microsatellite loci from Atlantic salmon (Salmo salar): genetic differentiation of North American and European populations. S.K. McConnell, P. O'Reilly, L. Hamilton, J.M. Wright & P. Bentzen. Canadian Journal of Fisheries & Aquatic Science. 1995, 52:1863-1872.

There was a clear discrimination between Canadian and European fish based on unique alleles present at two loci. These Atlantic salmon primers also amplify presumably homologous loci in nine other salmonid species. The polymorphic microsatellites loci reported in this paper demonstrate great potential as genetic markers in population, breeding and evolutionary studies.

A minisatellite DNA marker for discriminating between European and North American Atlantic salmon (Salmo salar). J.B. Taggart, E. Verspoor, P.T. Galvin, P. Moran & A. Ferguson. Canadian Journal of Fisheries and Aquatic Science, 1995, 52:2305-2311.

A highly discriminatory and practical nuclear DNA genetic marker that can distinguish between Atlantic salmon of European and North American origin is described. Screening of 2847 European and 247 North American salmon from much of its geographic range for variability at a minisatellite locus revealed the continental stocks to be almost fixed for two different-sized, easily discernible alleles. The results suggest that little, if any, natural gene flow occurs between the two continental groups of Atlantic salmon.

9. Fish Passes

The behaviour of returning adult Atlantic salmon (Salmo salar L.) at a Borland lift fish pass as determined by radio telemetry. G.W. Smith, A.D.F. Johnstone & W.M. Shearer. 1996. Scottish Office Agriculture, Environment and Fisheries Department. Fisheries Research Services Report No. 7/96.

In July 1995 ten returning adult salmon were radio tagged 1 km downstream of Kilmorack dam on the River Beaully to investigate the movements of salmon through the Borland pass.

Nine fish were detected immediately below the dam between 5 and 57 days after tagging and four of these were tracked through the pass between one and 19 days after being first detected immediately below the dam. All were subsequently detected upstream of Kilmorack dam.

Individual visits of salmon to the area immediately below the dam were generally short-lived, 76.5% lasting for less than 15 minutes. There appears to be considerable scope for improving the effectiveness with which fish are stimulated to move into the lower chamber of the pass. In only 8% of times when tagged fish moved up to the vicinity of the dam did they subsequently move into the lower chamber. However, 80% of visits to the upper chamber resulted in tagged fish moving out of the pass.

10. Pollution

Influence of fluoride on aluminium toxicity to Atlantic salmon (Salmo salar). S.J. Hamilton T.A. Haines. Canadian Journal of Fisheries & Aquatic Science. 1995. 51:2432-2444.

Atlantic salmon (Salmo salar) alevins were exposed to various aluminum (0-4700 $\mu\text{g/L}$) and four fluoride (0-500 $\mu\text{g/L}$) concentrations at two pH values (5.5 and 6.5) for 4- and 30-d periods. In the 4-d tests, aluminum with fluoride was less toxic at pH 6.5 than at pH 5.5, whereas without fluoride, pH had no effect. In the 30-d test, mortality in all treatments was 17-21% at pH 5.5 but only 3-7% at pH 6.5. Fish length and weight after 30-d were reduced in all fluoride-aluminum treatments at pH 5.5, but only in the 200- $\mu\text{g/L}$ aluminum without fluoride treatment at pH 6.5. At pH 5.5 and 6.5 without aluminum, histomorphological

examinations revealed no abnormalities in gill tissue. However, in aluminum exposure with no fluoride, gill filaments and secondary lamellae were swollen and thickened. Addition of fluoride at pH 6.5 alleviated some gill damage. At pH 5.5 and 200 $\mu\text{g/L}$ aluminum, addition of 100 $\mu\text{g/L}$ fluoride reduced swelling of gill lamellae, but 200 $\mu\text{g/L}$ fluoride did not reduce swelling. Low fluoride concentrations ($< 100 \mu\text{g/L}$) may reduce gill morphological damage in fish exposed to aluminum in acidic waters, whereas high fluoride concentrations ($> 100 \mu\text{g/L}$) may not reduce aluminum-induced effects.

11. Sea trout

The performance of sea trout, Salmo trutta L., stocks from the Burrishoole system, western Ireland, 1970-1994. W.R. Poole, K.F. Whelan, M.G. Dillane, D.J. Cooke & M.M. Mathews. Fisheries Management & Ecology, 1996, 3, (1):73-92.

Since 1975, with partial recoveries in 1979 and 1984-86, the numbers of finnock and adult sea trout in the Burrishoole system have declined. The population decreased sharply from 1987, and collapsed in 1989 and 1990. Finnock were virtually absent in 1989 and one-year maidens equally so in 1990. Sea trout smolt recruitments from 1992 to 1994 were the lowest recorded since 1970. Marine survival of smolts, to total return to fresh water, historically ranged from 19 to 66%. Survival dropped to 1.8% in 1989. Observed changes in the sea trout population structure and the collapse in marine survival suggest that the current west of Ireland sea trout problem is based in the marine habitat.

* * * * *

DEED OF COVENANT
TO THE ATLANTIC SALMON TRUST LIMITED
(Registered Charity No. 252742)

I promise to pay you for years, or during my lifetime, if shorter, such a sum as after deduction of income tax at the basic rate amounts to £..... each month/quarter/half year/year from the date shown below.

Signed and delivered

Date

Full Name (BLOCK CAPITALS)

Address (BLOCK CAPITALS)

..... Post Code

Witnessed by:

Signed

Full Name

Address

..... Post Code

THE ATLANTIC SALMON TRUST LIMITED
BANKER'S ORDER

Subscriber's To Bank plc
Bank

Branch Address

.....

..... Post Code

Please pay to BANK of SCOTLAND, 76 Atholl Road, Pitlochry PH16 5BW (80-09-41) for the credit of THE ATLANTIC SALMON TRUST LIMITED, account No. 00890858 the sum of £ (..... pounds) on the (i) day of 19... and a like amount on the same day each (ii) month/quarter/half year/year for a total period of (iii) years. Total number of payments

Signed Date 19...

Name (BLOCK CAPITALS) A/C No.

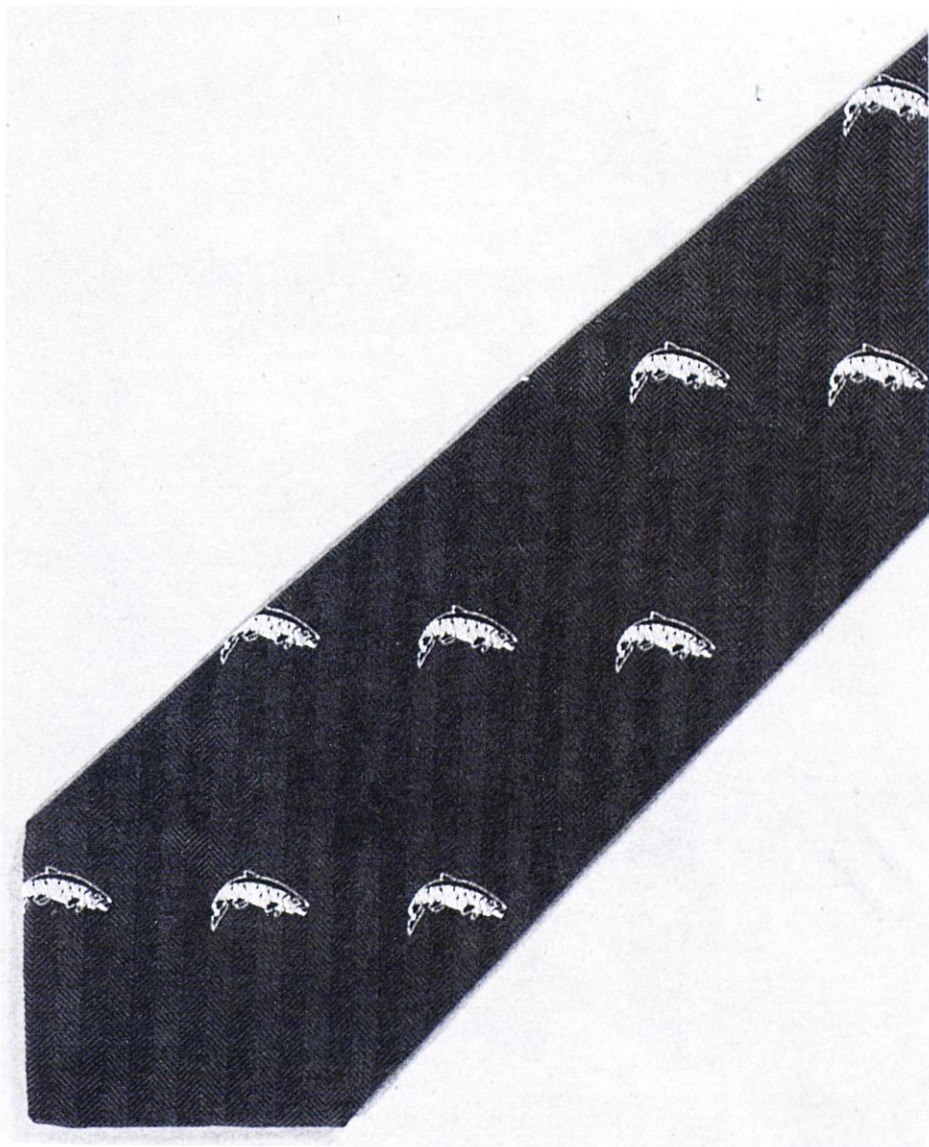
Address (BLOCK CAPITALS)

..... Post Code

-
- (i) This date must be the same as or later than the date on which the covenant is signed.
 - (ii) Please delete as appropriate.
 - (iii) Insert number of years (minimum four years).

PLEASE RETURN THIS DOCUMENT TO THE ATLANTIC SALMON TRUST, MOULIN, PITLOCHRY,
PERTSHIRE PH16 5JQ

ATLANTIC SALMON TRUST TIES



Available in blue and dark blue polyester @ £7.50
and dark blue silk @ £10.00

SALMON *a fisherman's guide* RECOGNITION

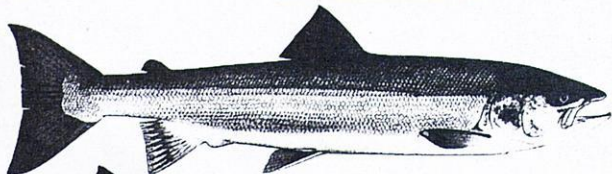
FRESH RUN SALMON

Recognised by the pristine condition and bright silver flanks. Fish straight from salt water have loose, easily detached scales and many carry sea lice which drop off within a few days. Hen salmon (illustrated) have a tiny kype on the lower jaw but unlike cocks they retain normal head proportions while in the river. Fresh run salmon make the best eating.



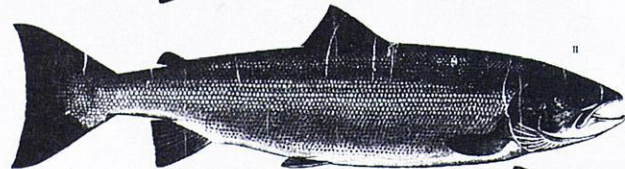
KELT

Kelts are salmon which have spawned. Usually identified by the thin shape, distended vent and presence of "gill maggots" on the red gill filaments, they are often encountered by anglers in spring when they regain a silvery appearance and can be mistaken for fresh run Springers. Kelts must be returned unharmed to the water.



MATURING COCK & HEN

I. Cock. Recognised by the enlarged jaws, cocks often become coloured soon after leaving salt water. This one will have spent a few weeks in fresh or brackish water; some are more reddish, others less so but all will have the partially developed kype. At this stage cocks are still good to eat.



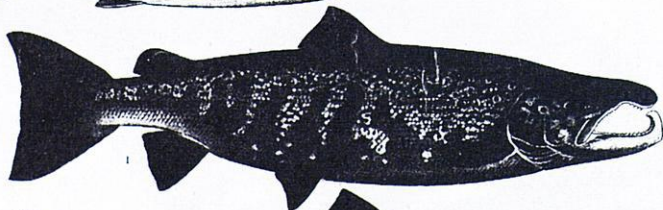
II. Hen. These are usually less coloured than cocks of similar river age and they never have enlarged jaws. This one will have spent a few weeks in river or estuary - note the coloured head and lack of true silver flanks. Hens should not be killed on the basis of colour alone - autumn fish are closest to spawning regardless of colour. For conservation purposes hens are the most important.

COCK & HEN IN BREEDING DRESS

I. Cock. The combination of "tarsus" colours is typical although shades vary - the fully developed kype, used in fighting rivals, is the most consistent indicator of maturity. Conditions can be gauged by viewing from above (fig. 1) - if the back is still thick a fish is in better condition (and more likely to be edible) than a thin "kype" which, unless it is a first salmon, is better returned.



II. Hen. This is a summer fish - Springers are often darker by spawning time while late entrants may still be silver flanked. Fully mature hens have soft, swollen bellies and spawning is imminent if they also have protruding vents.



ROBIN ADE-89



SALMON & SEA TROUT

Salmon (I) can be distinguished from large Sea Trout (II) by a more streamlined shape, conical tail, dimmer red sides, upper jaw reaching no further than tip of eye, few if any black spots below lateral line, 10 to 15 usually 11-13 scales counted obliquely forward from adipose fin to lateral line - most have 13-14.

GRILSE & SALMON

Grilse are one sex mature salmon, which comprise most of the annual rod catch, are often indistinguishable from multi sea water salmon except by scale reading. They are smaller on average (2-3lb. in May, 5-7lb. in July) but grow running rivers in September often attain 8-10lb. and in October 12-15lb. Salmon usually weigh over 8lb. Most are 25W fish, those returning on spring average 8-10lb., in summer 12-14lb., in summer 16-18lb. Salmon tend to double in weight during each full growing period (May - Oct) spent at sea.

SALMON & TROUT PARR

Salmon Parr (I) are normally distinguished from young Brown/Sea Trout (II) by the more streamlined shape, deeply forked tail, longer pectoral fin, lack of orange on adipose fin, smaller mouth, sharp snout, only 1-4 spots on gill cover (later, one large spot), well defined gape marks.



ATLANTIC SALMON TRUST PUBLICATIONS

| | | |
|--|---|----------------|
| Atlantic Salmon: Planning for the Future (Proceedings of the 3rd International Atlantic Salmon Symposium, Biarritz, 1986) | edited by D. Mills and D. Piggins | £ 45.00 |
| The Biology of the Sea Trout (Summary of a Symposium held at Plas Menai, 24-26 October, 1984) | by E.D. Le Cren | 1.50 |
| Salmon Stocks: A Genetic Perspective | by N.P. Wilkins | 1.50 |
| Report of a Workshop on Salmon Stock Enhancement | by E.D. Le Cren | 1.50 |
| Salmonid Enhancement in North America | by D.J. Solomon | 2.00 |
| Salmon in Iceland | by Thor Gudjonsson and Derek Mills | 1.00 |
| A Report on a Visit to the Faroes | by Derek Mills and Noel Smart | 1.00 |
| Problems and Solutions in the Management of Open Seas Fisheries for Atlantic Salmon | by Derek Mills | 1.00 |
| Atlantic Salmon Facts | by Derek Mills and Gerald Hadoke | 0.50 |
| The Atlantic Salmon in Spain | by C.G. de Leaniz, Tony Hawkins, David Hay and J.J. Martinez | 2.50 |
| Salmon in Norway | by L. Hansen and G. Bielby | 2.00 |
| Water Quality for Salmon and Trout | by John Solbé | 2.50 |
| The Automatic Counter - A Tool for the Management of Salmon Fisheries (Report of a Workshop held at Montrose, 15-16 September, 1987) | by A. Holden | 1.50 |
| A Review of Irish Salmon and Salmon Fisheries | by K. Vickers | 1.50 |
| Water Schemes - Safeguarding of Fisheries (Report of Lancaster Workshop) | by J. Gregory | 2.50 |
| Genetics and the Management of the Atlantic Salmon | by T. Cross | 2.50 |

| | | |
|--|-----------------------------------|-------|
| Fish Movement in Relation to Freshwater Flow and Quality | by N.J. Milner | 2.50 |
| Acidification of Freshwaters: The Threat and its Mitigation | by R. North | 3.00 |
| Strategies for the Rehabilitation of Salmon Rivers (Proceedings of a Joint Conference held at the Linnean Society in November 1990) | by D. Mills | 5.00 |
| Salmon Fisheries in Scotland | by R. Williamson | 3.00 |
| The Measurement and Evaluation of the Exploitation of Atlantic Salmon | by D.J. Solomon and E.C.E. Potter | 3.00 |
| Salmon in the Sea and New Enhancement Strategies (Proceedings of the 4th International Atlantic Salmon Symposium, St. Andrews, New Brunswick, June 1992) | edited by D. H. Mills | 30.00 |
| Surveying and Tracking Salmon in the Sea | by E.C.E. Potter and A. Moore | 3.00 |
| Problems with Sea Trout & Salmon in the Western Highlands | edited by R.G.J. Shelton | 3.00 |
| Automatic Salmon Counting Techniques - A Contemporary Review | by G.A. Fewings | 3.50 |
| Salmon in the Dee Catchment: The Scientific Basis for Management (Proceedings of a one day meeting held at Glen Tanar House, 13 October 1994) | by A. Youngson | 3.50 |
| Spring Salmon | by A. Youngson | 3.00 |

FILMS AND VIDEO CASSETTES AVAILABLE FOR HIRE

| | |
|------------------------------------|---------------|
| "Will There Be a Salmon Tomorrow" | - 16 mm film |
| "Salar's Last Leap" | - 16 mm film |
| "The Salmon People" | - Video (VHS) |
| "Irish Salmon Harvest" | - Video (VHS) |
| "Managing Ireland's Salmon" | - Video (VHS) |
| "Salmon Tracking in the River Dee" | - Video (VHS) |
| "Salmon Kelt Reconditioning" | - Video (VHS) |

Films and videos may be obtained from the Trust for private showing by Clubs, Fishery Managers, etc. A donation to AST funds is required in return.

