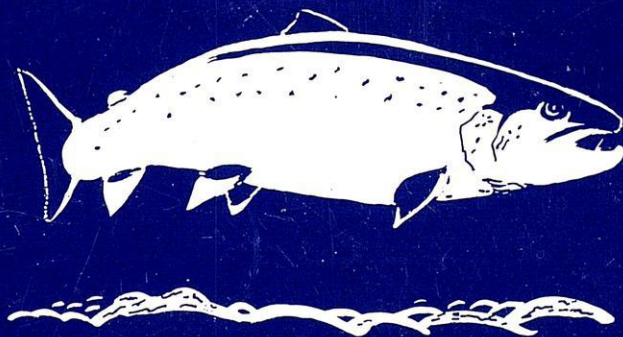




ATLANTIC SALMON TRUST

PROGRESS REPORT

December 1997



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Professor Noel P. Wilkins, (Department of Zoology, National University of Ireland)
John Webb, B.Sc., MSc., (AST Biologist)

Observers:

N. Milner, B.Sc., Ph.D. (Environment Agency)
A representative of the Scottish Office Agriculture, Environment & Fisheries Department
E.C.E. Potter, B.A., M.A. (The Centre for Environment, Fisheries & Aquaculture Science)

INTERNATIONAL CONSERVATION ORGANISATIONS WITH WHICH THE TRUST IS IN CONTACT

France:	Association Internationale de Défense 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

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CHAIRMAN'S INTRODUCTION

A number of notable events have taken place since the last Progress report in June. On the personal front John Mackenzie, our Director for the last thirteen years duly retired on 30th September (a tribute appears elsewhere in this Report) and was succeeded by Jeremy Read, our former Deputy Director, who has moved to Scotland. Tim Hoggarth, who had been recruited earlier in the summer took up his appointment as our new Deputy Director in October. At the Annual General Meeting in London on 3rd December the following were elected to the Council:

Mr. Robert Clerk, OBE
Rear Admiral D.J. Mackenzie, CB
Dr. David Solomon

And, in accordance with our now established procedures, the following members retired, having served six years on the Council:

Mrs. Llin Golding
Mr. Moc Morgan

Dr. Derek Mills also retired but, as he will continue to chair the Honorary Scientific Advisory Panel, will remain an ex-officio member of the Council. Dr. Jack Cunningham, MP also resigned from the Council during the summer consequent upon assuming the appointment of minister of Agriculture, Fisheries & Food in the new Government.

The 5th International Atlantic Salmon Symposium took place in Galway in September. This was a well-organised, well-attended and thought-provoking occasion. A synopsis of the proceedings is contained elsewhere in these pages; I would particularly commend your attention to the powerful and stirring opening address given by Dr. Wilfred Carter, the President Emeritus of the Atlantic Salmon Federation and a Vice-President of this Trust.

We are all aware that stocks of salmon throughout the NE and NW Atlantic have been in decline for some years but there is no longer any doubt that the situation is now extremely serious. Fewer and fewer fish are returning to rivers and there is now an urgent need to undertake comprehensive research at sea to ascertain the causes of the present high mortality. This will be extremely expensive and can only be undertaken on an international basis. The Trust is accordingly working with other organisations to persuade North Atlantic Governments to release the necessary resources and co-operate in undertaking this overdue research. The Trust has already held discussion with the Atlantic Salmon Federation in this regard and a joint document emphasising the international decline in stocks, the issues responsible for the decline and the broad actions needed, is already in preparation. On completion other interested organisations will be invited to support the strategy so that a firm demarche can be made to all North Atlantic Governments.

Meantime, here in the UK every effort must be made to increase spawning escapement stocks, particularly the early running MSW spring component. Much is already being done, especially as regards habitat improvement. But on many river systems rod exploitation is a significant factor in the threat to a sufficient abundance of spawning stock, especially early running

spawning stock. The implementation of measures to reduce the number of fish killed by rods, some of which may well prove to be unpopular, is a matter for river owners and managers but the exercise of that responsibility is becoming increasingly necessary on such systems if salmon stocks are to have any hope of recovery.

In November, the Scottish Office Fisheries Minister, Lord Sewel, in an address at Dryburgh gave the Governments' (initial) response to the Task Force Response. Details are contained elsewhere in this Report. While commending many aspects of it, he emphasised that consideration of its many recommendations would be a matter for the new Scottish Parliament. Although stressing that certain aspects could go ahead on a voluntary basis, any primary legislation would have to await the establishment of the new Parliament.

Given the present state of stocks on most East coast Scottish rivers, the Trust again took up the vexed question of the NE Drift Net fishery with Lord Sewel and received an encouraging assurance that he would "keep a close eye on" and do what he could "to take the issue forward".

Following the Scottish Office announcement of intention to hand responsibility for approving the siting of marine fish farms from the Crown Estate to local authorities, the Trust wrote to Lord Sewel pointing out that supervision and regulation of the operation of these sites also require to be addressed as a matter of equal priority. The Scottish Office subsequently issued a consultation paper on marine fish farm planning arrangements to which the Trust will be responding.

The Minister of Agriculture, Fisheries & Food, Dr. Jack Cunningham, announced in July a review of salmon and freshwater fisheries policy and legislation in England and Wales. The review will take place this year and the Trust will expect to participate in the consultation procedures.

Finally, I should like to record the Trust's gratitude to the Robertson Trust for their further very generous donation to the important DNA project, now in its third year, being undertaken by John Webb.

H.F.O. BEWSHER
Chairman

DIRECTOR'S REMARKS

Writing these, my first notes as Director, I am conscious of the act that I have to follow, and most grateful to John Mackenzie for all his help and advice since I joined the Trust. We welcome Timothy Hoggarth, who joined in September as Deputy Director; he is busy establishing contacts in his prime area of interest in England & Wales.

An active time lies ahead, in the wake of the publication of the various national Salmon Strategies. The Chairman has referred to the work in hand by the Atlantic Salmon Trust and the Atlantic Salmon Federation to distil the elements of a number of initiatives into a coherent strategy for the North Atlantic. While we are looking outward in this way, we must also be considering the implications of devolution. There is added emphasis to our arguments for the early implementation of a delay in the opening of the Northeast drift net season in order to protect early-running stocks.

Although the Scottish Office have rejected the Task Force proposal for an independent overall regulatory body for salmon farming, there are signs of an increasing readiness by the salmon growers to co-operate with fishery interests for the common good. At the time of publication, they have just announced the development of an environmental strategy, which we shall be studying with care before taking our part in consultation.

As one consequence of the Galway Symposium, reported in this issue, a workshop is being organised at Faskally in November to bring together experts in a number of scientific disciplines. They will be examining all the factors that may be responsible for the dramatic increase in salmon mortality at sea.

Among other items in a very full issue, may I draw the attention of readers to the publication of a new colour poster by Robin Ade, depicting the life cycle of the salmon. The reproduction on the centre pages of the Report is but a pale representation of his brilliant work. There are also two generous offers of support for the Trust through sales of fishing maps and a photograph of the original Jock Scott fly, which I commend to your attention.

Finally, the provisional 1998 programme for the Trust's display caravan is:

9-10 May	Chatsworth Angling Fair
20-21 June	Welsh Game Fair, Llandeilo
4-5 July	Scone Fair
24-26 July	CLA Game Fair, Stratfield Saye
31 July- 1 August	Highland Fair, Moy

The Deputy Director and I, as well as the volunteers who we hope will help to man the display, look forward to meeting supporters of the Trust at these events.

J.B.D. Read

JOHN MACKENZIE

On 1st October, John Mackenzie retired as Director of the Atlantic Salmon Trust. The occasion was formally marked by the Council of Management at a lunch at Fishmongers' Hall on Wednesday 3rd December, the day of the Trust's Annual General Meeting, and he was presented with a David Norwich Evolution fly rod and reel in recognition of his long and valued service to the Trust.

John Mackenzie joined the Trust after a distinguished career in the Royal Navy. Entering in 1943, he commanded nine ships in all, ranging from a motor launch on the Rhine to the aircraft carrier Hermes. Promoted Rear Admiral, he was Flag Officer Gibraltar from 1981 until his retirement from the Service in 1983, and was deservedly awarded a CB.

In 1984 he became the Trust's Scottish representative. Appointed Director at the beginning of 1985, he set about moving the office to Scotland, and after a temporary lodging in Killiecrankie, established the present premises at Moulin. From here he developed a wide range of contacts in every field affecting the wild salmon, and acquired an expert knowledge of salmon matters and salmon politics.

Noteworthy among his many achievements have been:

- a strong but independent rapport with those in Government, evidenced by the respect in which he is held by the Scottish Office, MAFF, the Environment Agency and the Fisheries Laboratories.
- a series of successful International Salmon Symposiums, in Biarritz in 1986, in New Brunswick in 1992, and most recently in Galway last September.
- a very close co-operation through the years with all the relevant scientific and biological authorities, coupled with an increase in the Trust's support for research projects.
- the setting up and chairmanship of the West Highland Sea Trout and Salmon Group, which led to the formation of the West Coast Fishery Trusts.

Throughout, he has demonstrated his strong belief in trying to get people to work together. In this he has succeeded admirably, particularly in the delicate task of maintaining constructive dialogue between those with diverse and often conflicting interests.

Over thirteen years, and under three Chairmen, he has been a tower of strength, and has conducted the Trust's affairs in a most effective and efficient manner. He has raised the profile of the Trust, and done it in such a way that the Trust's view on salmon matters is influential and highly regarded.

Fortunately for us all, John has not given up his involvement with salmon. He continues to serve as a member of the Tay Board and a Trustee of the Tay Foundation, as Vice-Chairman of the Association of Scottish District Salmon Fishery Boards, and as Chairman of the Association of West Coast Fishery Trusts. Nor has the Atlantic Salmon Trust lost his services, for he was elected to the Council of Management at the Annual General Meeting. For this continued support, and for all that he has done for the Trust over the years, we are deeply grateful.

THE HONOURABLE EDWARD DAVIES

Like all his family, Edward Davies grew up with a love of fishing, and in a very full life he gave much of his time to its service. He was a member of the Council of Management of the Atlantic Salmon Trust from 1974 to 1993, and was instrumental in setting up the Appeal Committee which put the affairs of the Trust on a sound financial footing. He was a Council Member and Vice President of the Salmon & Trout Association, and a Liveryman of the Fishmongers' Company, and always ready to work to overcome disagreements about the way to approach a problem; his especial talent for getting people to co-operate was never better demonstrated than during the two terms that he spent bringing all angling interests together, as Chairman of the now disbanded National Anglers' Council.

From his arrival at Ingestone, he gave freely of his time and experience in the support of the Wye Salmon Fishery Owners' Association, of which he was a valued Committee member. He will be remembered for his practical knowledge of hatchery management and help in development of a stocking programme, and especially for his strong and well-justified backing for the formation of the Ghillies' Association.

A fisherman to his all too sudden death on 26th October 1997, his friendliness, enthusiasm and mischievous sense of humour are sadly missed. A Service of Thanksgiving for his life was held in Powys in December, at which the Atlantic Salmon Trust was represented by John Hopkinson; a further service in London is to be arranged in the early spring, to give Edward's many friends from further afield the opportunity to remember him.

SWEDISH INTERNATIONAL SALMON SEMINAR

BRANAS/RANSBY, 2 to 4 September

(Derek Mills)

It was a pleasure and a privilege to be invited to attend and speak at the above seminar. The aim of the seminar was to consider methods for conserving and managing the unique stocks of landlocked salmon in Lake Vänern which spawn in the inflowing rivers Klarälven and Gullspång. Particular emphasis was placed on considering the free movement of salmon up these rivers and their biological, cultural and economic importance to the local communities in the past, at the present and in the future.

By way of introduction one should say that Lake Vänern salmon are a landlocked form of the Atlantic salmon as during the ice age the lake became cut off from the sea and consequently the smolts migrating from the rivers spent their "sea life" in the lake. There was a large fishery for Vänern salmon in the middle ages but the numbers of fish declined dramatically with the advent of power development early this century and this situation was exacerbated when, in the 1930's there was no longer a requirement to install fish passes at the dams on the Klarälven. So, by the 1950's, the stocks had been almost eliminated. However, as a result of arrangements for salmon conservation instituted by the Hydro Power Company - Gullspångs Kraft - salmon stocks have increased and now something of the order of 200 tons of salmon and sea trout are taken by the recreational fishery (which includes the use of nets and long lines!) annually. There is also a commercial fishery taking about 32 tons of salmon and sea trout. However, even with these levels of catch, the Gullspång salmon is classified as one of the most valuable salmon stocks in Sweden.

As the seminar was conducted mainly in Swedish and Norwegian, except for my own talks, I had to rely on the personal instantaneous translation into English by a succession of charming Swedish girls. However, the following account of the seminar is based on the careful translation of the speakers' papers by Anne-Catherine Amritzer and Kalle Jansson transcribed from tape by Susanne Pettersson.

The seminar opened with an address by Kaj Larsson from the Department of Agriculture and an advisor on fishery matters. His review of the Swedish salmon conservation scene is summarised under 'Review of Scientific Literature' appearing later in this Progress Report. He thought that salmon fishing should be used economically as an attraction and for sport fishing. Facilities for anglers, however, were essential, such as access, accommodation and restaurants. Future conservation measures should include creation of nursery areas for the fish, removal of barriers to migration, setting up associations for conserving fish and improving the control of fishing. He mentioned the proposition that every angler should pay a fee of 100 Kroner/year (about £10) to a special fund. The money should then be divided between the counties and through them to the Fishing Preservation Societies. However, there was resistance to this proposal from the proprietors, although it had support from the Sportfishing Association, the professional fishermen and the fish farmers. Those opposing the proposition felt, among other things, that it would be impossible to control. Exactly the same criticisms have been levelled at similar proposals to introduce such a scheme in Scotland based on the experience of administering area and national fishing licences in England and Wales.

An interesting point mentioned by Dr. Larsson was the old legislation on timber river transport and the proposed repeal of this legislation as being no longer applicable as the timber is now moved by road. However, surprisingly, there seems to be much opposition to the repeal, as the transport of timber by river has interesting cultural aspects which some local people did not want to see disappear. This issue came up in discussion quite frequently.

Other aspects presented and discussed on the first day were the salmon in an international perspective by Stig Johansson of the Directorate for nature Research, Trondheim; the evolution of salmon in fresh water by Bo Delling of the Natural History Museum in Stockholm and Pirjo Lahtiperä of the Bergen Zoological Museum, and the future of salmon – threats and possibilities by Lars Karlsson of the famous Salmon Research Institute in Älvkarleby. Lars is well known at the North Atlantic Salmon Conservation Organisation, whose meetings he regularly attends.

The second day started with a tour of the upper Klarälven. This is a very large river even this distance from Lake Vänern. The length of the river between Lake Vänern and Höljes dam is something like 115 miles. This area is the most suitable area for spawning should salmon be transported upstream of the dams. Unfortunately, much of the river bed has had most of its large rocks and boulders removed in the past to ease the downstream passage of timber. Consequently, the river bed is too even and there is little turbulence. Grayling and trout are the most abundant fish found in this part of the river. We were left in no doubt that salmon were at one time most abundant in this region from archaeologist Eva Svensson's account of the role of salmon in the local culture many years ago when the main form of salmon capture was spears. A controversial issue between the Swedes and Norwegians in the party was regarding allowing salmon upstream access into Norway by installing a fish pass in the 85.4m high Höljes rockfill dam. After seeing the dam my only comment was "no way"!



“The ancient method of spearing salmon on the Klarälven”

After the tour the conference continued at a roadhouse in the small community of Finnskoga and concentrated on fish passage. An exhaustive account of fish passes was given by Reidar Grande of the Directorate of Nature Conservation Trondheim. It was interesting to hear him say that pool pass efficiency was 80 – 90% while other delegates gave figures ranging from 10% to 50%. This was followed by my account of methods used to ensure the survival and free movement of salmon in Scottish rivers harnessed for hydro power. The delegates were most impressed with the efforts Scottish Hydro-Electric put into ensuring the free movement of salmon and their financial contribution to research in this field.

An afternoon visit to the Nordvärmland Hunting and Fishing Museum at Sysseleback provided the delegates with an idea of the museum staff's dedication to their work. Everyone was appreciative of how well they had organised this seminar. There was a heated debate over coffee on the future of salmon in the upper Klarälven and their being allowed access to Norway by the opening up of the Höljes dam to provide more salmon angling for tourists. There was much historical reference to the past status of salmon in this region. The role of archaeologists played a significant part in the discussion.

The third day's meeting was open to the public and was held in the community hall in the village of Ambjörby. The good attendance included students from the newly-opened Sport Fishing College at Forshaga near Karlstad by lake Vänern. At this college students are trained during their three-year course to work with anglers and maintain fishing waters. Next year the college is planning a new course with the University of Umeå in northern Sweden. A good representation of fishing interests guaranteed a healthy and unrestrained debate even allowing for Swedish good manners.

Robert Carlsson of Gullspångs Kraft described the arrangements for trapping salmon ascending the Klarälven from Lake Vänern at Forshaga. The fish are held until ready for stripping and checked for disease. The young are reared to the smolt stage and then released. At present they are particularly interested in smolt mortality and considering various release methods. Predation by pike and burbot could be serious. Radio telemetric methods were used to track the smolts on their downstream migration to the lake. It was estimated that the mortality rate when passing the power stations was probably less than 50%. Passage through the turbines was less dangerous than going via the old river channel where the smolts can be left stranded. It was thought that there was a 100% survival of fish passing through the Kaplan turbines at these low head power stations. There are eight power stations on the Klarälven.

Dr. Per Nyberg of the National Board of Fisheries at Örebro, in giving a general account of Vänern salmon and its exploitation, made it clear, that in his opinion any attempts to open up the whole river, including that section in Norway, to salmon fishing was doomed to failure. Among those reason he listed in support of this statement were: lack of significant spawning areas, shortage of suitable places to fish except in the vicinity of power stations, the slow and meandering nature of the lower reaches of the river and the unrealistic plans to install pool passes in all the dams, at Höljes in particular. On this point he calculated that out of every 1000 salmon leaving Vänern only 135 would reach Höljes.

It was obvious from the general discussion afterwards that many present were still not convinced by Per Nyberg's arguments. As I flew over the vast expanse of Lake Vänern on my homeward flight I realised that there were as many landlocked salmon as faced our salmon in the north Atlantic and of whose problems I would be hearing at the forthcoming symposium in Ireland.

**FIFTH INTERNATIONAL ATLANTIC SALMON SYMPOSIUM, GALWAY,
16th-20th September, 1997-11-25
(Derek Mills)**

The Fifth International Atlantic Salmon Symposium, held in Galway from 16th to 20th September, was a great success and upheld the standards of the earlier four symposia held in St. Andrews (Canada) twice, Edinburgh and Biarritz. There was an excellent attendance with over 180 delegates from 10 countries. As with previous symposia, the Atlantic Salmon Federation and the Atlantic Salmon Trust sponsored the event. Significant financial support was given by the Electricity Supply Board. Support for additional elements of the Symposium was kindly provided by the Salmon Research Agency, Central Fisheries Board, Marine Institute, Western Regional Fisheries Board, Ireland West Tourism, Hydroacoustic Technology Inc., CS & M Design Studio, Bill Murphy Design and Berry Print Group.

The Symposium was opened by Dr. Michael Woods, Minister for the Marine and Natural Resources. His scientific background was very apparent from the aspects he covered, namely addressing the decline in global wild salmon catches, economic contribution, policy objectives, strategies, conservation measures, catchment based management, structural and organisational change. He ended by referring to his having established an Inland Fisheries Forum which will include all the relevant interests and will advise him on an ongoing basis on all issues as they impact on fish life and habitats.

The Opening Address was then delivered by Wilfred Carter of the Atlantic Salmon Federation. He gave an emotive plea for immediate action to be taken to safeguard our environment from all the many deleterious effects to which it is exposed and which consequently affects the Atlantic salmon stocks which are fast declining on both sides of the Atlantic.

The theme of the symposium was Managing Wild Atlantic Salmon – New Challenges – New Techniques. The first of the three sessions was on Marine Pressures and included papers on the effect of forage fish harvesting; young salmon at sea and marine habitat influences. As a result of recent Scottish and Norwegian research ship cruises in the Norwegian Sea and north-east Atlantic off Shetland and the Outer Hebrides, Dick Shelton and Jens Holst caught a large number of post-smolts in a pelagic trawl. An examination of these fish provided useful insights into their home water origins and speed of migration. These findings provide a useful piece in the jigsaw puzzle of the salmon's marine existence and help in the understanding of Dave

Reddin's paper on salmon sea survival. This involves exploratory analysis of sea surface temperature data from global weekly composite Multi-Channel Sea Surface Temperature set calculated with University of Miami algorithms applied to the Advanced Very High Resolution Radiometer data collected by the NOAA polar orbiting satellites. In considering Interception Fisheries, Ted Potter neatly avoided the controversial issues of exploitation effects on home water stocks and confined his presentation to a most useful highlighting of factors to be considered in exploitation of stocks such as the socio-economic importance to different communities and the effects of one fishery upon another and how the strategies for the management of fisheries have also been influenced by our increased understanding of the biology of salmon, in particular the recognition that many rivers contain a number of genetically discrete populations which must be independently protected.

This last point was nicely reinforced by Ronald Campbell and John Webb in their paper on Run Timing in the second session on Freshwater Management. They showed that analysis of historical catch data from a number of fisheries suggests long-term changes in abundance of late and early running fish. Over the past 100 years significant changes in the patterns of return have been observed in many larger, more complex river systems. The timing and degree of changes can be shown to vary between populations of different sub-catchments of such complex river systems.

Other subjects that came into the Second Session were habitat management and the impacts of exotic species. On habitat management Martin O'Grady revealed that over the period 1995 to 1999 a total of IR£19m is being spent on Irish game, coarse and sea fisheries to increase tourist angling revenue in Ireland. He described the strategy being adopted and applied to define the status quo in catchments in fishery terms. He provided an inventory of the type of works being undertaken through a useful series of slides. Some of his work sites were visited on one of the post conference tours. A slightly different approach to watershed management, which supplemented Martin's work, was described by John Armstrong who considered the behaviour of juvenile salmon in a stream habitat. From his work it is obvious that instream works are as important as bankside improvements.

The Third Session was concerned with Politics and Salmon Management. Malcolm Windsor adopted a novel approach to International Co-operation on the Conservation of Wild Salmon by looking at it as seen from the viewpoint of a salmon. He reviewed and attempted to quantify all the losses to salmon stocks and how co-operation, whether it be national or international, might play a part in restoring wild stocks. It was hoped that an Irish Minister, Eamon Gilmore, would speak on Conservation and Politics. However, at the last minutes this responsibility was put on the broad shoulders of Noel Wilkins. Noel had been the chairman of the Irish Salmon Review Group and he was very much on the defence of the recommendations his group had put forward in the Irish Salmon Review Group Report. His was not an easy task! Derek Mills experienced calmer waters for considering Education and Communication. He felt that there was no substitute for 'hands-on' experience in education and practical work is essential at all educational levels.

He suggested that anglers could achieve a greater awareness of salmon life history and management through part-time courses as given by such organisations as the Institute of Fisheries Management and should be encouraged to participate in conservation projects. Salmon interpretation and visitor centres are an invaluable source of information and should be

located on most larger salmon river systems. The educational theme was continued by John Anderson in his paper entitled Socio-Economic Issues. Although his description of a five-year government-funded Education and Public Awareness Programme in support of the recreational fisheries in Canada's four Atlantic Provinces was interesting, it was disappointing that the socio-economic issues mentioned by Ted Potter earlier were not pursued. Points that could have been discussed could have included the socio-economic importance of salmon fisheries to the North American Indians and the Greenland Inuit and how these impacted on salmon management plans, and the pros and cons of the value of commercial and recreational fisheries both as a source of employment and the economy of the country. A good lead in here would have been through the remarks of Dr. Woods right at the start when he said: "The traditional commercial salmon fishery has contributed to the livelihoods and economic well being of remote coastal communities in Ireland for over hundreds of years. In the interests therefore of all those who benefit from the Irish salmon resource, our starting point has to be what is good for the species and what is good for salmon conservation. This poses complex challenges for managers and policy makers." I am afraid therefore that this was an important gap in our deliberations. However, one important aspect covered very well was that of Catch and Release. This subject has been studied intensively by Bruce Tufts, a Canadian fish physiologist. He showed from his studies that certain conditions such as extremely soft water, water temperatures elevated above 22°C, or a recent transition from sea water to fresh water may increase the probability of mortality following catch and release.

During the proceedings little time was available for any worthwhile discussion. This was unfortunate as some presentations, such as that of Vaughn Anthony's excellent account of Predator/Prey Interactions had no time for sensible consideration. It was hoped that these weaknesses could be addressed in the General Discussion. However, much of this was taken up by the well-worn and emotive topic of sea-lice and salmon farms. This was disappointing, as the subject has been well-aired recently at other workshops designed to consider the specific problem. Ken Whelan brought things back together in his summing up; he highlighted three points stemming from the Symposium, namely the need to tackle the issue on research at sea; the requirement to co-ordinate international action to ensure that the declining salmon situation did not worsen, and drift netting in Irish waters. Following on this, two actions were generally agreed. (1) A workshop would be held at the end of 1998 to bring together oceanographers, marine biologists and fishery scientists to pool information on the problems at sea and to establish a future line of research. (2) A meeting between the AST and ASF to lay groundwork for a North Atlantic Strategy which can then be taken forward to influence governments. We live in hope. After all, the Resolution at the Edinburgh Symposium led to the formation of NASCO.

The Symposium was followed by a number of tours. These were most popular and, while they didn't always run to time, everyone agreed that they enjoyed the relaxed atmosphere of western Ireland.

ADDRESS BY DR. MICHAEL WOODS TD MINISTER FOR THE MARINE AND NATURAL RESOURCES

I am very pleased to have the opportunity to address this opening session of the Symposium and to welcome all of you to Galway. I would like to extend a particular welcome to our many visitors from overseas. This impressive array of international and Irish fisheries expertise, and the wide-ranging work programme for the next three days, underlines not just the world wide value put on the wild Atlantic salmon but also, the international partnership dimension to the challenges of salmon management and conservation.

This Symposium is a timely opportunity to debate the issues of salmon conservation and management, to review current challenges and threats to habitat and stocks and to explore the way forward to securing the future of this unique and valuable resource.

ADDRESSING THE DECLINE

The international scientific advice and the available data on stocks point to a continuing decline in global wild salmon catches – a decline which has been charted over the last two decades. We in Ireland have serious concerns for the viability of spawning stocks in a number of rivers. There is no room for complacency. The trends world wide and here in Ireland underline the continuing imperative to give major priority to the restoration and enhancement of salmon stocks through effective conservation, management and research strategies.

Ireland, as one of the last strongholds of the wild Atlantic salmon, has a particular contribution to make and role to play in the international effort to secure the future of the resource.

The Irish salmon is a unique national symbol with a very special place in our culture and social history. In addition to its economic importance for local communities, the salmon is an irreplaceable part of our Irish heritage with an intrinsic value that cannot be measured solely in monetary terms.

ECONOMIC CONTRIBUTION

The salmon makes a valuable contribution to the Irish economy. Both sport and commercial salmon fisheries contribute to the local and national economy through the direct and ancillary jobs they support and the other benefits for the communities in which they are based. Salmon angling is a premium product in the national tourism context with the considerable potential for further development and job creation. The traditional commercial salmon fishery has contributed to the livelihoods and economic wellbeing of remote coastal communities in Ireland over hundreds of years. In the interests therefore of all those who benefit from the Irish salmon resource, our starting point has to be what is good for the species and what is good for salmon conservation. This poses complex challenges for managers and policy makers.

POLICY OBJECTIVES

My key policy objective is to secure the future for salmon in its own right and in the economic interests of our rural and coastal communities which it supports. I am working therefore to conserve and enhance salmon stocks in the interests of all legitimate stakeholders in the resource.

I am mindful that international experience and trends in salmon management are driven by the conservation imperative – reflected in the work of NASCO and other international for a and groupings over many years. This is an opportune moment therefore to restate the commitment of successive Irish governments for some time now, to a national policy aimed at maximising on a sustainable basis the value of the wild salmon resource. The basic premise underlying Government policy is that the balance of advantage, on conservation, ecological and economic grounds should lie increasingly with redirecting salmon exploitation from the sea towards the rivers and estuaries.

The policy challenge is to manage the process of transition in an equitable way taking into account the socio economic consequences and the conservation needs.

STRATEGIES

Since taking office some 2 months ago, I have been assessing salmon management strategies in light of overall policy objectives. In that context I have been hearing at first hand, the views of a variety of interests and organisations.

I am convinced that an inclusive approach to salmon management is the way forward – an approach based on consensus where there are neither winners nor losers but one which delivers the benefits for salmon stocks first and foremost. The Salmon Management Task Force achieved a remarkable degree of consensus on the way forward – in a debate which has so often been fraught with controversy and conflict. I intend to build on that consensus and to move forward the strategies which will pay the dividends for the salmon resource itself and for all stakeholders. I would like to set out for you the key components of our strategy.

CONSERVATION MEASURES

I have already begun a review of the conservation measures introduced for the 1997 season. My decisions on the need for additional conservation measures for 1998 will be informed by:

- (1) a comprehensive analysis by our salmon scientists of the state of Irish salmon stocks as well as of the international data;
 - (2) the impact and effectiveness of the conservation measures taken this year
- and
- (3) an assessment of fishing effort, enforcement and compliance levels.

I can say that the initial reports available to me on catches and stocks highlight the need to at least continue with existing conservation measures. The need to press ahead with these measures, which involve pain, but also gain, for all users, is self evident.

CATCHMENT BASED MANAGEMENT

I have already announced my intention to move to a catchment based approach for inland fisheries management, involving and empowering all users and beneficiaries at local community level. To kickstart this process I have, earlier this month, given the go ahead to a number of Pilot Fisheries Catchment Projects at selected locations around the country. This immediate practical initiative will inform and reinforce the development of a national catchment management strategy.

STRUCTURAL AND ORGANISATIONAL CHANGE

A review of fisheries legislation and structures is underway, together with work on a 5 year inland fisheries development plan, which will set the way forward for the management, conservation and development of the salmon, trout and coarse fish resources. My main objective is to deliver the necessary organisational change to ensure that the resources of the fisheries service and all relevant agencies and interests are deployed to best effect.

The Marine Institute will submit, shortly, practical proposals for the introduction of a Total Allowable Catch, a quota system and a tagging regime for salmon. I will consider these recommendations positively with a view to progressing the necessary legislative change, as well as the funding and technical issues inherent in this new management strategy.

FORUM

I have established an Inland Fisheries Forum which will include all the relevant interests. The Forum, which will have its inaugural meeting soon, will advise me on an ongoing basis on all issues as they impact on fish life and habitats.

CONCLUSION

To summarise the key elements of our strategy: a firm commitment to conservation and to tackle systematically the many threats to salmon habitats and stocks. A strategic vision of sustainable fisheries development based on the catchment area management approach. Effective deployment of the very considerable State resources devoted to fisheries research, conservation and management.

I look forward to working with all the interests concerned in a partnership approach to conserving and developing the salmon resource. My congratulations to the organisers, sponsors and participants in this Symposium. I wish you well in your discussions on the key challenges for salmon over the next few days and I look forward to receiving the outcome of your deliberations in due course. We have a common global objective i.e. to secure the future of the wild salmon resource. Shared experiences and shared knowledge will help us all to secure the future of the wild Atlantic salmon.

A GATHERING OF PEOPLE

OPENING ADDRESS AT THE FIFTH INTERNATIONAL ATLANTIC SALMON SYMPOSIUM Galway, Ireland – September 17 1997

(Wilfred M. Carter)

It is a considerable honour for me to be asked to give the opening address at this distinguished gathering of individuals who do so much to promote the conservation and welfare of *Salmo salar*, the King of fish, aptly named the leaper by Pliny the Elder, the Roman naturalist, in the 1st century. There have been many changes in the world we know since Roman times, but one thing that has not changed is the undisguised admiration and fascination we have for one of creation's masterpieces which has stubbornly defied man's unrelenting attempt to drive it into oblivion and extinction. Two thousand years after Pliny's evocative description, *salar* still leaps in many rivers of Europe and North America, although in steadily declining numbers. How much longer can we expect to see these majestic creatures thrusting upstream against the surging current? I believe that depends upon how badly we want to see the salmon runs continue and what each of us is prepared to do to ensure the salmon's survival.

In his literary masterpiece, *A River Runs Through It*, Norman Maclean writes, "In our family, there was no clear line between religion and fly fishing. We lived at the junction of great trout rivers in western Montana, and our father was a Presbyterian minister and a fly fisherman who tied his own flies and taught others. He told us about Christ's disciples being fishermen, and we were left to assume, as my brother and I did, that all first-class fishermen on the Sea of Galilee were fly fishermen and that John, the favourite, was a dry-fly fisherman." As a good Presbyterian and a Scot, Maclean believed that the world was in a hell of a mess because man had fallen from an original state of grace, a condition that might be rectified by more fishing and contemplation. There are many among us who try very hard to follow that good advice, especially the part which advocates more fishing, but we are discovering that fishing and contemplation alone will not help us to undo the greedy and stupid acts that have brought many of the world's precious resources, including *Salmo salar*, perilously close to the edge of disaster.

Fishing, for both trout and salmon, has been almost a religion in my life too. In my early boyhood days growing up on the Gaspé Peninsula, arguably one of Canada's most beautiful areas and home to some magnificent salmon rivers, many of my happiest memories revolve around bare-footed expeditions to favourite fishing holes carrying a home-made, 14-foot bamboo fishing pole over my shoulder and a bologna sandwich in my pocket. My small, happy world always contained fish, and in my youthful visions the chosen people were fishermen, beginning with my father, a passionate angler, and my grandfather, a sometime commercial salmon fisherman, and also a Presbyterian, who firmly believed that God had filled the waters with fish for him to catch, and that frivolous anglers like me and my father were interfering with his more worthy pursuit of his livelihood as a commercial salmon fisherman.

In the days of my boyhood, when I was more prone to dangle a gob of fat and juicy worms in front of a hungry trout than try to tempt it with a fancy artificial fly, there was no apparent shortage of trout or salmon frolicking in the pools I loved to frequent. Many of you, I am sure, can recall similar experiences in your youth, when you had no difficulty finding a fat salmon, a couple of trout or a brace of game birds for the pot. The historical literature is filled with references to the great abundance of salmon and other wildlife that filled the rivers, lakes and forests in Europe, the UK and North America to overflowing. There were so many salmon in the rivers and such abundant game in the forests in those days that no one in their wildest imagination ever thought that the supply could disappear.

Recently, when glancing through some historical records of salmon abundance in Lake Ontario, Canada, from which the salmon have been gone since about 1900, I came across the following report by J.R. Diamond, a respected Canadian fisheries scientist. "Roger Conant, a farmer who settle on land on which the city of Oshawa is now located, gives us a picture of how plentiful salmon were when he reported that when he tried to paddle his canoe across the creek at Port Oshawa in 1805, the salmon partly raised his boat out of the water and were so close together that it was difficult for him to get his paddle below the surface". Another story which helps us to picture the abundance of salmon, also reported by Diamond, is about a farmer who, one afternoon when he was watering his horses, saw so many salmon swimming up a small creek that he was able to capture fifty-six with a pitchfork.

There are no indigenous salmon runs in the rivers draining into Lake Ontario today, as there are none in the Rhine, Seine, most rivers of Southern Europe as well as most rivers in New England and some in Canada. Even countries like Scotland, Norway, Ireland, England and Wales have seen dramatic declines in salmon populations, in particular those early spring runs of fat, sculptured fish so sought after by anglers and commercial fishermen alike.

To put things in perspective, in April 1996, The International Council for Exploration of the Sea (ICES), reported that it was evident from both the indicators of stock status and extremely low quota levels that the North American stocks of Atlantic salmon were in a tenuous condition, and that low abundance levels were being observed despite nearly complete closure of mixed and single stock fisheries. The ICES report went on to note the continuing trend of below target spawning escapements and low marine survival rates in the North Atlantic, and indicated that the situation was equally bad with respect to European stocks, with the fish that form the majority of the catch in the Faroes showing an overall downward trend over the previous 15 years despite measures taken to reduce exploitation.

Recent figures published by the United Nations Food and Agriculture Organisation (FAO) reveal that fisheries in 13 out of 17 of the world's major fishing regions are either depleted or in serious decline. The US National Academy of Sciences added to this gloomy picture late in 1995 by reporting that human actions have caused drastic reductions in many of the preferred species of edible fish, and that changes induced in the composition and abundance of marine animals and plants were serious enough to endanger the functioning of marine ecosystems.

No better example of fish depletion in the sea exists than the sad tale of the northern cod of Newfoundland in Canada. The abundance of cod in the time of John Cabot, the explorer who came to Labrador in 1497, was one of the wonders of the world. Fishermen could drop a net anywhere on the Banks and immediately drag it in overflowing with cod. The cod fishery was the mainstay of Newfoundland fishermen for hundreds of years. Indeed, it was the only source of annual income in many coastal villages. The fishery was closed in July 1992, after 350 uninterrupted years of harvesting and thousands of proud and independent people have had to endure the agony and despair of lost jobs, lost homes and lost hope, while surviving on government social assistance and welfare handouts. *"Even the gulls have left, it got too g... d... hard for them to make a living."* Said Jack Troake, welfare collecting captain of the commercial fishing boat *Lone Fisher*. A modest cod fishery has now been re-opened, but the area where northern cod are found remains closed, and may be permanently crippled.

I could go on and illustrate the tragedy with other examples of valuable fish resources brought to the edge of extinction, but I think the point has been made. The world IS in a hell of a mess, and the Atlantic salmon are in the thick of it. How did it happen and how are we going to get out of it?

There are responsible people today who will claim that the decline in fish populations is all due to cyclical phenomena, and that fish stocks will rebound when the pendulum swings the other way. I am not one of them. Others maintain that the salmon's problems can be linked directly to environmental factors, global warming and ocean temperature changes. Still others point the finger at seal predation and abusive industrial fishing for capelin and sand lance, the salmon's principal food supply in the sea, and many others claim that nets in the sea and along the salmon's migratory path are the villain. All of them are partly right, so if these perceived causes of the salmon's decline could be corrected the salmon's problems would be solved, right? Not so, and therein lies the real problem.

I would be among the first to applaud the good work of people in different countries who continue to toil and to address those issues vigorously, like Orri Vigfusson in Iceland. They are my heroes, but a single issue focus will not, in my view, be enough to reverse the decline in Atlantic salmon populations. Take netting in the sea, for example. We all agree that it is gross mismanagement to harvest mixed salmon stocks in the sea, and that sensible management dictates that the runs be cropped only after they have separated into discrete populations and are entering their rivers of origin. To do otherwise is to risk the entire salmon population of some rivers where they are hanging on my the slimmest thread.

The Atlantic Salmon Federation and the Salmon Conservation Trust of Scotland were the first conservation bodies to successfully cause the removal of interceptory nets, in Scotland and Canada.

Canada, to its credit, has invested more than \$71 million in retirement of commercial salmon fishing licenses over the past 20 years; less than 300 of more than 10,000 remain. More recently, the North Atlantic Salmon Fund has negotiated moratoria at the Faroe islands and Greenland. In the last decade thousands of nets that were ensnaring salmon have been removed, to the great credit of those organisations and to the people who led the charge. However, despite improved runs to some river systems, there has been no dramatic resurgence of salmon populations in the sea, as we would have expected. On the contrary,

ICES has forecast the pre-fishery abundance of North American salmon at West Greenland in 1997 at 197,000, while the spawning requirement of all North American rivers is 201,000, a deficit of 4000 before any fishery occurs. If removing the nets hasn't solved the problem, what else do we need to do?

In our understandable zeal to identify the culprit responsible for the sorry state of affairs of the salmon and to rectify the problem, I believe that we are missing the principal point. There is no single villain which, if eliminated would result in a resurgence of populations of Atlantic salmon to historical levels. With the greatest respect, I believe that a focus on single issue solutions is not wrong, it is simply not enough.

Recovery and a secure future for Atlantic salmon will not occur, in my opinion, until we address the central issue that was identified by the US National Academy of Sciences in 1995, to which I referred earlier: "that human actions have caused drastic reductions in many of the preferred species of fish, and that changes induced in composition and abundance of marine animals and plants are extensive enough to endanger the functioning of marine ecosystems."

What we need to realise is that the environment that sustains all living things has been under siege by civilisation for most of this century, and that serious damage has been done to entire ecosystems, limiting their ability to maintain sustained natural reproduction. Not long ago we believed that the ability of animals to reproduce was so great, and their numbers so enormous, that it was impossible to destroy the entire species of any animal. Even some professional fisheries managers made the same mistake. Politicians and bureaucrats made little effort to understand the damage that was being done by gross over-harvesting while at the same time condoning and promoting activities that severely limited the normal reproductive ability of the natural system. In simple terms, we have been catching too many fish while allowing the habitat necessary for their reproduction to be diminished and destroyed.

While Atlantic salmon were being relentlessly pursued by nets in the sea and along the coastline of their migratory routes, and poachers and predators stalked the riverbanks, dams with inefficient or non-functioning fishways blocked access to spawning areas. Forestry mismanagement allowed entire tributaries to be converted into sluiceways for sawlogs, scouring the bottom and destroying natural habitat for juvenile salmon. Housing developments, parking lots and erosion from careless road construction straightened and filled in thousands of metres of pristine salmon rearing area. Run-off from chemical pesticides and agricultural fertilisers poisoned the water, and sewage from some communities continued to spill into the rivers. In simple fact, we have, for a long time, been guilty of reaping a salmon harvest while raping the natural habitat that produces the annual crop. There are numerous examples of salmon rivers and salmon stocks that have been ruined by destruction of their habitat, not by Greenland fishermen, pollution, seals or global warming, the favourite villains.

There is no acceptable substitute for a healthy natural system that is producing maximum numbers of wild salmon juveniles, under the caring stewardship of people who live close to the resource. When we begin to repair and restore the habitat essential to provide spawning, shelter and food for salmon, and when our rivers are sending hundreds of thousands, even millions, more juvenile salmon to sea each year, then I believe that there will be hope for the survival of Atlantic salmon. Healing the salmon's natural habitat is something we can do, something we know how to do, something we should do and it is something that people

throughout the salmon world can become personally involved in, if there is leadership and dedication to inspire and encourage them.

People and governments working separately, sometimes in adversarial positions, have failed to halt the Atlantic salmon's decline. People and governments working together, in a spirit of true co-operation can, I am convinced, succeed.

I am suggesting that if we seriously want to prevent the continuing decline and eventual disappearance of Atlantic salmon we need a new partnership among people, conservation groups and government, and a recognition that urgent co-operative action is required.

The partnership will require leadership by governments, because that is where authority and responsibility for salmon management resides in most countries, and it will require dedication and hard work by people who care.

I am issuing a challenge today for government bodies and concerned people to forge those partnerships and take a giant step forward for salmon conservation, not unlike the amazing co-operative spirit, leadership and determination that enabled man to land on the moon in July 1969. That's the true magnitude of the challenge ahead.

I am challenging government agencies to accept the offer of co-operation and support of people who care about the survival of salmon, and who want to help. I am challenging my own country, Canada, to move quickly to develop an administrative and legislative framework within which watershed-based management partnerships can function, and to provide more support for research, especially into the causes of salmon mortality at sea, and then help us to heal the wounds. I am challenging governments in all the salmon producing and harvesting nations of the North Atlantic to take urgent precautionary measures to ensure salmon conservation at home and in international areas.

In certain parts of North America there has been a long-standing tradition of a gathering of people for a common purpose, called a BEE. Often, there are BEES to help people in trouble; the best and most frequent examples are barn or house-raising BEES to help a neighbour to replace a barn or a home destroyed by fire. The entire community or neighbourhood turns out to work and help in various ways to replace something precious that would have been extremely difficult, even impossible, to achieve in any other way.

I am suggesting that we need the same kind of people involvement to restore our environment, to repair the damage we have done to ecosystems and to rehabilitate our Atlantic salmon runs. I am talking about people like you, who understand that recovery of Atlantic salmon stocks to sustainable levels is both possible and desirable, and who are prepared to assume a large degree of responsibility and authority for Atlantic salmon management.

We will be entering a new millennium in a scant fifteen months. I believe that the greatest challenge of the 21st Century will be to halt the siege against the world's environment and to repair the damage that has already been done. Only then can there be a sustained recovery of renewable resources that will benefit people everywhere.

Our small part is to restore the Atlantic salmon's habitat. In doing that we will be making a major contribution to the challenge facing the 21st Century, and we won't have to face a future without Atlantic salmon, or without a host of other things that can't survive in a world that is indifferent to the fate of the environment.

If we can meet that challenge, then we can talk proudly about a bright new future for *Salmo salar*, the King of Fishes.

CLOSING REMARKS

by Colonel H.F.O. Bewsher

Preamble:

I have it on good authority from the Greek scholars on my staff that the word "Symposium" is derived from the Greek word meaning a "drinking party". This is the first of these International "drinking parties" I have had the privilege of attending. Like all of you, I have found it riveting - the papers presented have been interesting, informative and, especially, thought provoking. I must congratulate all the many speakers for the clarity and comprehensiveness of their presentations - without exception they have been quite first class.

What has impressed me most over the last three days has been the quite exceptional level of knowledge and understanding which all of you here in your different fields possess. It is quite remarkable and most impressive.

But as the Symposium has gone on I have kept asking myself "why are we here and what is our purpose?" Have we come because we know it is a good party, have we come to see old friends, have we come to air our developing knowledge and parade our own views, have we come to exchange views with one another and bring ourselves more up-to-date with what each other is doing?

The answer is "yes" in part to all of them. But the over-riding and principal reason we are here is our concern for the future of the Atlantic salmon.

For all our improved knowledge and understanding, the reality is that stocks of Atlantic salmon continue to decline in both the NE and NW Atlantic. That is the stark reality - and faced with that reality, we all of us have to resolve to do something - something more effective - to help halt the decline. And the measures employed will of course be different for different river systems.

Pressures:

We know the salmon is under pressure in three main geographical areas:

the North Atlantic Ocean and the North Sea
Coastal waters
and inland in rivers and lochs

We know more and more now about the salmon's behaviour in coastal waters and in inland freshwaters and, until we know more about what is happening at sea, we must redouble our efforts and take firm action to help the salmon in coastal and freshwaters which may help them resist the pressures they encounter at sea.

We all of us recognise there is a crucial need to undertake research at sea - as Nathaniel Reed so eloquently put it yesterday -

“What the hell is going on out there in the pond”.

All of us share that sentiment, Nathaniel. Research at sea will be hideously expensive and, to be effective, it will have to be co-ordinated efficiently by the North Atlantic countries. Piecemeal efforts, while useful, will be of limited value. Governments must be persuaded to free up the necessary resources - and that won't be easy. It is clear to all of us present that if we are to take effective action to halt the decline and save the salmon, there has to be much closer co-ordination between the three main players - the scientists/biologists, the Government and the managers - all must have the determination and will to halt the decline.

The scientists and biologists have a key role to play. They carry out the research and provide the data. I would like to suggest to all you high-powered and experienced scientists and biologists that your role - in future - should not simply end with providing the data. In business parlance, I believe the time has come - indeed it may be long past - for you to take a much more pro-active stance and take an altogether higher profile in helping, encouraging, at times compelling, management to take decisions and implement measures which may not always be popular but will be necessary.

You understandably speak your own language but, as Judith Nicol put it so well last night, to get management to take and implement the necessary decisions, you are going to have to explain your findings in terms which are easily understandable to the layman - and, above all, give them practical on the ground help. Unless you do this, and perhaps sometimes forcefully, much of management will continue in the same old way and draw back from decisions which they know will not always commend themselves to those who exploit the resource.

There is a popular misconception about managers - managers are not always “do'ers” and leaders. But leaders are invariably “do'ers” and more often than not effective managers. There is no doubt that we need more leaders and we certainly need to improve the calibre and the determination of management in some places.

Then we come to Government. The Government sets the policy and the strategy within which management has to implement its decisions. Here again the scientists/biologists have a crucial

role to play as the Government's principal advisers. You have to make it clear to Government - again in layman's terms - what the problems are and especially what needs to be done to resolve them. The reality of life in the late 20th century is that Governments do not have a high reputation as managers - it requires constant persistent determination on all our parts if we are to persuade Government to determine the right strategy and to free up resources to implement it.

Exploitation:

I want to turn now to exploitation. There is, and will remain, continuing argument about the level of exploitation in commercial fisheries - especially mixed stock fisheries. We all of us know that there is no longer any justification for the continuation of drift net fisheries in English and Irish coastal waters. As Judith Nicol said so firmly, their existence is no longer acceptable - and, without wishing to rub salt into one or two wounds, every one of you here knows it. A way must be found to remove these fisheries and found soon. But it must be done in a fair and equitable way. That said, it may take a little longer than we would like but that must not weaken our resolve to see them ended.

The level of exploitation in rod and line fisheries must also come under the spotlight. There is increasing evidence of the need for reduction - in some cases, a very substantial reduction - in many river systems. This nettle must be grasped just as firmly if we are to save and increase the spawning stocks. These of course will be management decisions, fully supported by a much more pro-active input from the scientists and biologists.

I don't want to sound gloomy but I have a gut feeling that in some river systems conservation measures and the current level of rod exploitation may no longer be compatible. Ken Whelan's viewgraph of the Burrishoole Fishery encapsulates this very aspect. We may have to face the fact that tough, possibly even draconian measures, may be necessary if we are to save and enhance the spawning stock until such time as there is a sufficient abundance to permit an acceptable level of rod exploitation to resume.

Wilfred Carter in his challenging and inspiring address said "we can no longer regard the resource as inexhaustible". Nor can we. The late King George VI (whose commission I hold) put it so well when he stated:

"the wild life of today is not ours to dispose of as we please; we each and every one of us hold it in trust for those who come after".

If we are to fulfil that responsibility we must co-operate much more fully, we must co-ordinate our activities more carefully and share our research and, above all, we must be determined and persistent in the actions we take. Two years ago I said at the Atlantic salmon conference at Battleby in Perthshire: "We can no longer afford to plug our individual vested interests - we must all co-operate and work together however diverse our different standpoints. United we shall make progress; divided we shall almost certainly fail - and we shall have failed not just the salmon but future generations."

May I again thank you all for a most interesting, greatly enjoyable and happy conference. In wishing you God speed may I do so in the words of the old Gaelic valediction (which I daresay is known to some of you over here)

May the road rise with you
May the wind always be at your back
May the sun shine warm upon your face
And the rain fall soft upon your fields
And until we meet again
May God keep you in the hollow of his hand.

THE SCOTTISH SALMON STRATEGY - THE SCOTTISH OFFICE RESPONSE

This was given by Lord Sewel on 10 November, in a speech at a Tweed Foundation conference at Dryburgh. He began by describing the background of a continued decline in Scottish catches, reflected around the whole North Atlantic. No single cause could be identified, and it would be simplistic to blame fish farming for the whole problem. There was a need for more research, possibly in collaboration with other countries.

He commended the Task Force Report as well-considered and constructive, and pointed out the legitimate interest in Scottish salmon that will be taken by the Scottish Parliament, without the constraint of shortage of time experienced at Westminster.

He stressed the need for the maximum attention to be paid to habitat, and paid tribute to the role of proprietors and Fishery Boards in this respect. He referred to the development of good practice to avoid damage to rivers and fish passage from agricultural and road construction work, holding up the "culvert card" - with whose production the Atlantic Salmon Trust was involved - as an example.

His comments on certain specific recommendations of the Task Force Report were as follows:

- Extinction of unexercised netting rights. More consideration of this proposal was needed, because of their historic legal status.
- Interceptory fishing at sea. He confirmed support for the work of the North Atlantic Salmon Conservation Organisation in relation to the high seas fisheries, and said that the Government would do all it could in discussions about the Irish drift net fishery. Drift netting in Scottish waters would continue to be banned. Although the English North East Coast fishery was continuing to decline, he accepted that for many this did not go far enough. He confirmed that the matter would be considered in the forthcoming review of salmon and freshwater fishing policy in England & Wales.

- Predation He described this as an emotive area, but said that the management of seal populations was a legitimate area of debate. Depending on firmer evidence, he would be open to persuasion on how to proceed.
- Catch and release. He welcomed this as a measure of restraint by proprietors and boards, and endorsed the development of training in how to handle fish.
- Co-ordinator for monitoring and research programmes. He hailed the funding of the post by the Fishmongers' Company, and committed his Department to support the Fishery Data Co-ordination Centre, which is being established. He hoped that all Boards would participate in due course.
- District Fishery Board Structure. There would be no creation of mandatory Fishery Areas, but he encouraged appropriate voluntary association between Boards, and confirmed that current legislation could provide for this. He did not rule out the possibility of some form of mandatory approach might be necessary if gaps in coverage occurred.
- Special Areas of Conservation. Consultation on the management of riverine SACs would begin shortly, but he did not accept that Salmon Fishery Boards should have the lead responsibility, although the interests of proprietors must be taken into account
- Regulation of Salmon Farming. The Government did not favour the creation of a single regulatory authority, and proposed to entrust the handling of local planning issues to local authorities. Consultation on this would begin shortly, and central planning guidance would be needed. He stressed the need for close liaison between local authorities and local communities, environmentalist bodies including those with an interest in wild stocks, and potential developers, and the important role for the Scottish Environmental Protection Agency. He welcomed the work commissioned by the Crown Estate Commissioners and the Scottish Salmon Growers' Association on the subject of environmental assessments.
- Consolidation of current legislation. He agreed that this was much needed, and announced the intention to take a consolidated Act through the "fast track" procedures in Parliament in 1998/99.
- Border rivers. He confirmed that Tweed would remain under Scottish jurisdiction, with English interests protected through Westminster. A consultation exercise would be carried out to determine if Scottish jurisdiction for the Border Esk would be acceptable. In the Solway Firth, the provisional approach would be the establishment of a fixed boundary, and this proposal would also be the subject of consultation.

NORTH ATLANTIC SALMON FUND (UK)

(By the Secretary)

The June 1997 Report described how negotiations were still in progress for renewal of the agreement not to fish the Greenland commercial salmon quota. Regrettably, despite a two week delay in the opening of the season to allow extra time for discussion, the Greenland Fishermen's Association failed to agree the NASF proposals. However, this is only seen as a temporary set-back. The action met with considerable local opposition, and one of the strongest protests at this failure came from the Speaker of the Greenland Parliament. He is now the Prime Minister, and Orri Vigfússon has appealed to him for mediation in the interests of a new agreement in 1998. This is a most promising development. Looking to the Faroes, the basic agreement not to fish remains in effect, and Orri is working to obtain a more economical long-term structure for the compensation costs.

Despite the late launch of the 1997 appeal, because of uncertainty over the Greenland situation, a total of £95,000 was transmitted by NASF(UK) to Orri Vigfússon's International Fund before 31 August. In addition, the Atlantic Salmon Conservation Trust (Scotland), which had benefited from an auction held at Christie's in the spring, donated £50,000 direct to the International Fund.

From the start, UK contributions have been paid each year to Orri Vigfússon in respect of expenditure incurred by his International Fund in the previous year. In 1997, no compensation payments were made to Greenland, and costs for the development of alternative fisheries were less than in previous years because much of the work had already been undertaken. The UK appeal for 1998 is therefore now being launched at the considerably lower level of £70,000.

This is a modest figure, but the aim is to help keep Orri Vigfússon's work going towards eventual success. In the meantime, the NASF(UK) Committee is again appealing to owners of fishings, to anglers and to all those who care about the wild salmon to continue the support that has been so readily forthcoming up to now. At a time when runs of multi-sea-winter salmon, and especially springers, are still in decline, it is vital to take all possible measures to reduce the number of fish that are lost or taken at sea. Closure of the high seas commercial fisheries is a significant element of these measures.

NEWS FROM THE WEST

(Andrew Wallace)

The 1997 season was generally an extremely poor one. Salmon/grilse stocks were patchy with only a few rivers holding their own. None were helped by the low water conditions experienced throughout much of the summer. Many rivers, however, also suffered from the 'no show' of grilse that has been a feature of this season all over Scotland and which must surely point to marine survival problems.

Once again, most West Coast rivers had very small runs of sea trout with the exclusion of some of the Hebrides where stocks are in better shape. Some of the Northern rivers also had runs worth fishing for, but the once great systems such as Loch Maree, the Carron, Ailort, Moidart, Morar, Shiel again had pitiful runs of fish this year, as in others, and suffered from the, by now, familiar problem of substantial numbers of lice-infested post smolt returns in May and June, most of which we believe died.

There has been a tendency for people to confuse the general declines of salmon and sea trout stocks, which all Scotland has been suffering from in recent years, with the almost complete collapse of stocks on this part of the West Coast. Fisheries that once caught one, two or even three thousand sea trout are now catching ten, twenty or thirty – in some cases none. Lest there be any doubt – regardless of cause – most North West Coast systems are suffering from a complete different problem from those in other parts of the country. Readers will also be interested to hear of very good runs of sea trout in the Solway rivers this year. The collapse of sea trout stocks to a non-viable level (economically and biologically speaking) is emphatically a North West problem.

For the Trusts, the 1997 survey season is now over, with water temperatures dropping away in October prohibiting the effective use of electro-fishing gear. The Galloway Trust (WGFT) has maintained its regular survey work over this year and continues to do some extremely interesting work in the field of continuous monitoring of acidification, habitat enhancement and smolt tagging. The Trust's excellent 1997 Progress report has now been published which gives a detailed account of the Trust's work this year. For copies contact: 01671 403011.

The new West Coast Trusts, having now completed their first survey season, are analysing what will almost certainly prove to be some revealing data on juvenile populations. The picture is inevitably looking as if it will be a mixed one with juvenile stocks of both species ranging from the very poor to the very good. Trusts have also identified areas with missing age classes, suggesting either that certain spawning areas are in some years not successfully used by adult fish (either because of obstruction or lack of fish) or that certain age classes have suffered severe mortality at a critical stage (possibly as a result of acid events).

The Trusts have all identified obstructions in their systems, such as stock fences, grids and poorly designed road culverts. Over the next few months efforts will be made to alleviate these problems. The Trusts are also shortly to embark on a spot sampling acid monitoring programme over this winter to identify areas that might be sensitive to acidification. This work will be considerably enhanced by the fisheries data co-ordination project that is being developed with the Conon Board, Spey Research Trust and Tay and Tweed Foundations. A

further project to evaluate the revenue and jobs relating to the fisheries in the Trust areas is being developed and will hopefully be conducted next year.

On the fish farming front, there appears to be a gradual shift within the government agencies and within the industry towards an acknowledgement that fish farming, and particularly sea-lice, are a highly significant cause of sea trout stock declines.

Earlier this year the Trusts trapped and tagged good numbers of post-smolts to record lice numbers. Samples were also taken to support the genetics work being conducted by Chris Todd at St. Andrew's University. The Trusts are also working up trapping/counter projects in each of their areas to complement the Scottish Office Agriculture, Environment and Fisheries Department's facility at Shieldaig. Through such projects we hope to achieve a better understanding of stock structures, marine survival and to develop quantitative evidence to support the theory that sea-lice are causing severe mortality in smolts.

The industry, with the Crown Estate, is currently engaged in setting up environmental assessment protocols for the industry and are consulting with the AST, the Association of West Coast Fishery Trusts and the individual Trusts on issues relating to concerns about wild fish. The industry is also looking at regional lice management strategies and how they might better control lice populations through single bay management, better fallowing and the adherence to the principle of avoiding mixed year classes in any one area. There is considerable dialogue with the Trusts over these issues and we are confident that the industry is slowly being persuaded to recognise wild fisheries issues in their management procedures.

In spite of poor returns of fish this year there appears to be a feeling that useful work is being done by the Trusts at practical and scientific levels. There are many more years of work ahead, but there can be little doubt that this rational, carefully thought out and organised approach is already paying dividends in terms of enhanced recognition.

If the hopes, fears and frustrations that we all have about the desperate state of this resource on the West can be articulated rationally and with authority through the Trusts – therein lies the prospect of a solution to a problem that many of us, involved in this work, believe can be solved.

If you would like to be kept regularly informed about the development of the Trust initiative please contact: Andrew Wallace on 0131 337 2243 (fax: 337 4945).

ATLANTIC SALMON

Salmon at sea

Salmon feed in many parts of the North Atlantic Ocean. Those from British rivers which spend a single winter at sea (grise) may go no farther than the Færoes, but multi-sea-winter salmon commonly go as far afield as Greenland and the Norwegian Sea. They feed on a diet of crustaceans and fatty fish such as lantern fish, sandeel post-larvae, capelin and herring. Salmon tend to double in weight each year, averaging about 6 lb after one year and sometimes eventually reaching over 40 lb.

Under 10% of smolts usually survive to return to their home rivers. Salmon numbers are strongly affected by ocean conditions, and by the availability of prey, of which some species are taken commercially. Threats at sea include many predators such as cormorants, sharks, seals, dolphins and killer whales, as well as commercial fisheries, including those targeted at other species.

Smolt

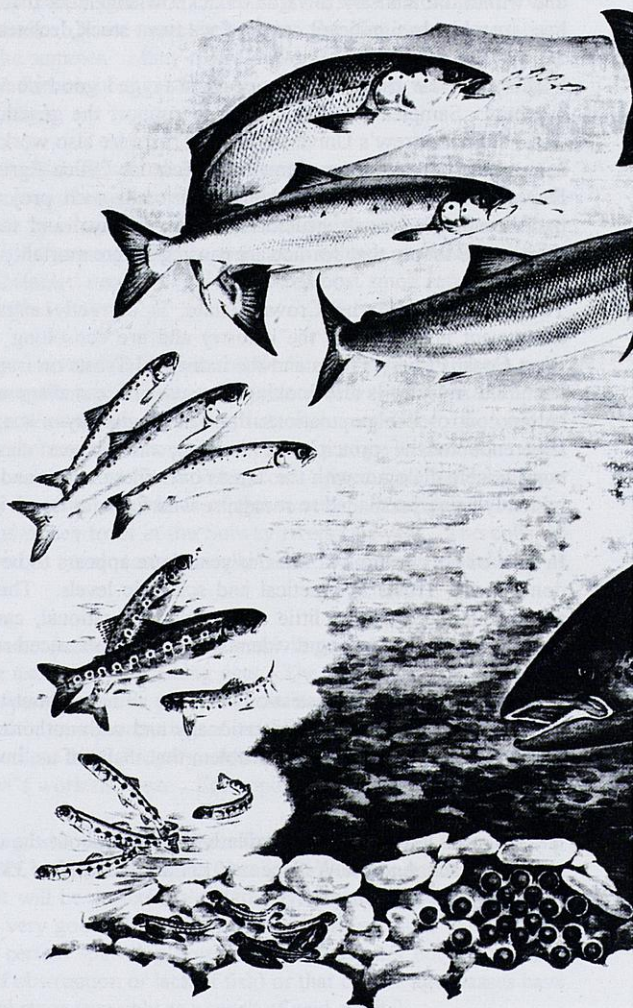
Each Spring the largest parr become silvery smolts and start to drift downstream at night towards the sea. In the South this is usually after one year; most Scottish smolts, with a shorter summer growing season, are 2-3 years old. They tend to travel in shoals, becoming vulnerable to predation especially at estuary 'bottlenecks' where the threat is often accompanied by the risk of water pollution. They travel near the surface, and head out to sea on their way to the main ocean feeding grounds.

Parr

Once they have grown above fingerling size, the prettily marked young salmon are known as parr. Most live in fast, shallow riffles; although about half may perish each year, mainly due to predation, continuing territorial pressure tends to keep the well-stocked salmon stream fully utilised. The main threat apart from pollution is from summer droughts which can severely reduce available water, oxygen and food. Effects of droughts and floods are increased by hill drainage schemes, especially in commercial forests; faster water runoff can lead to erosion, siltation and (on some soils) acidification of rivers and tributaries.

Fry

On emergence from the gravel fry begin feeding on invertebrates drifting down with the current. Their numbers typically exceed the carrying capacity of the stream and the following weeks usually see the highest mortality rate of the whole lifecycle. Over 90% of fry normally die in competition with one another over the limited number of potential feeding territories.



Alevins

These are newly hatched salmon with attached yolk sacs. Born in early Spring, alevins remain safe under the gravel for a few weeks until the food in their yolk sacs has been used up; the tiny fish then emerge from the gravel as free-swimming fry about an inch long.

Eggs

A 10 lb hen salmon lays about 7,000 eggs in a gravel nest called a redd, and total egg production is normally in excess of the number needed to stock the rivers. Buried deep in the gravel, they suffer little predation and hatching rates may exceed 90% in clean gravel. The main threat is from severe floods which can wash eggs away or silt up the egg pockets in the redd.

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Written & illustrated by Robin Ade

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SALMON LIFECYCLE



Returning adults

At the onset of maturity salmon begin the journey home, apparently finding their way across the ocean with the help of celestial cues and the earth's electromagnetic field. Most return as grise, with the proportion of big, multi sea winter fish varying in different parts of their range and over different periods of time. On reaching coastal waters salmon can locate their home rivers by smell. In dry weather they remain near the estuaries, some falling prey to nets or to groups of seals, but when the rivers rise after rain they enter them immediately. Adult salmon do not feed in the river and the main freshwater threat, rod fishing, is relatively inefficient. Depleted runs of salmon, especially Spring runs, can however be damaged by angling. Springers are relatively easily caught and may spend up to a year in the river, living on fat reserves which comprise about 30% of body weight.

Breeding pair

After a few weeks in fresh or estuarine water salmon lose their silver coats and begin to develop a colourful breeding dress, the males also acquiring a hooked lower jaw (kype). Spawning usually takes place between October and January in the same stretch of water where the salmon themselves were born. The hen digs a series of nests (redds), laying eggs which are simultaneously fertilised by an adult male, and often by precocious parr as well.

In fresh water few predators apart from man are able to catch adult salmon. Otters can do so but they prefer eels and tend to take salmon mainly around spawning time. Most waters do in fact have enough breeding fish, even in bad years, to fully stock the rivers - the main limitation on salmon numbers is the state of the rivers themselves, virtually all of which have been degraded to some degree by human activity.

Conservation and Enhancement

Conservation measures today are aimed at repairing or enhancing the streams and rivers on which salmon production relies, and are now being broadened to include diverse interests which affect the rivers. In Scotland, Fishery Trusts are now being set up to manage the habitat regeneration and conservation.

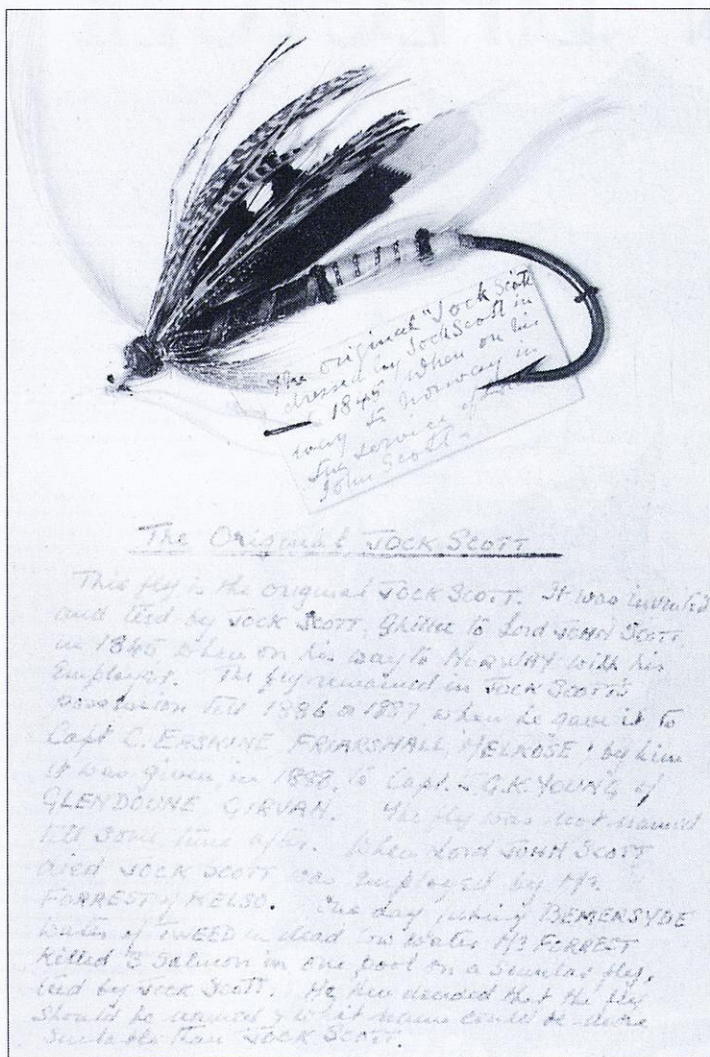
Traditional management methods are being modified by new scientific findings. Artificial propagation is expensive and has been found to be relatively ineffective, except in special situations where salmon are absent or close to extinction. Fishery regulation remains vital, but is complicated by the fact that it is often concerned with

dividing the catch rather than conserving stocks; today the emphasis is on recreational fishing, which produces most revenue for rural communities and river owners. Since the development of salmon farming the commercial value of wild fish for human consumption has declined.

Conservation at sea relies largely on

agreements at international level. Drift netting, which takes salmon of different river origins indiscriminately, has been banned by most North Atlantic countries, but commercial fisheries for prey species have remained poorly regulated. The health of future salmon stocks rests on wise management of both saltwater and freshwater environments.

THE ORIGINAL "JOCK SCOTT"



A new photograph - only the third in its history - has been taken of the original fly, which was tied by Mr Jock Scott in 1845, during a voyage from Scotland to Norway, as a distraction from the effects of rough weather. Having been fished with great success, the fly was kept as a pattern by his employer, Lord John Scott. It was subsequently given to Captain Erskine of Friarshall, Melrose, who presented it in 1888 to his friend Mr Young, grandfather of Major Young, the present owner. The colour photograph shows the framed fly life size.

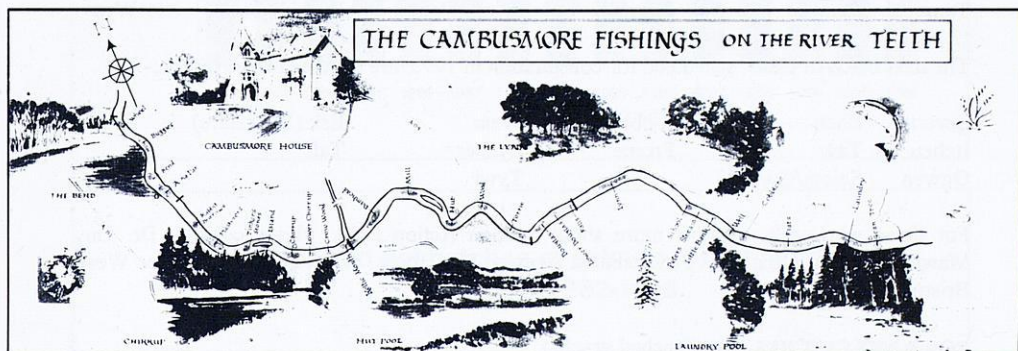
The label was attached by the previous owner; below it is a brief history of the fly written by Major Young's father.

Each copy of a limited edition of one thousand, hand printed and double mounted at a size of eight by ten inches, will be numbered, signed and dated by the Danish photographer, Pia Enghild. Copies will be available at £25.00, plus £2.60 postage and packing (£3.60 outwith the EU). **For each print sold, the Atlantic Salmon Trust will receive a donation of £3.00.** Prints may be ordered from:

Griffinvest Ltd, 2E Balgray Court, Glasgow G12 0SD
Telephone: 0141 400 0840 Facsimile: 0141 400 0841

Cheques should be made payable to "Griffinvest Limited". Delivery will take place within ten days.

CAMBUSMORE FISHINGS



Earlier this year, Cambusmore Estate commissioned an annotated map of their fishings on the River Teith from the artist and fisherman Peter Yates. Due to popular demand they have produced a limited edition of 400 prints, signed and numbered by the artist, which are for sale at £25.00 each (including postage and packing). **Half of the profits are to be donated to the Atlantic Salmon Trust.** Copies may be obtained from:

Dr Paula Baillie-Hamilton	Telephone: 01877 331445
Auchleshie	Facsimile: 01877 331408
Callander	E-mail : mikebh@sol.co.uk
Perthshire FK17 8LS	

Peter Yates is willing to receive commissions on a similar basis from owners of other fishings. He may be contacted on 01877 331262.

ENVIRONMENT AGENCY (ENGLAND & WALES)

SALMON ACTION PLANS

In 1996, the Environment Agency, on its creation, adopted a Strategy for the Management of Salmon in England & Wales which had been developed by its predecessor, the National Rivers Authority. The strategy has four key objectives, i.e. to:-

- * optimise the recruitment of salmon to home water fisheries;
- * maintain/improve the fitness and diversity of salmon stocks;
- * optimise the economic value from sustainably exploiting stocks;
- * meet the necessary costs of managing salmon stocks.

The implementation of the strategy relies on the development of local Salmon Action Plans by the year 2000 for all the 60 principal salmon rivers. The first batch of plans went out for consultation with interested parties during 1997. The rivers covered were:-

Eden	Coquet	Torridge	Mawddach	Leven & Crake	Test
Tamar	Teifi	Lune	Avon (Hants)	Welsh Dee	Wye

The next batch of plans, scheduled for consultation in 1998, are expected to cover the:-

Severn	Ehen	Ribble	Wear	Esk (Yorkshire)
Itchen	Taw	Frome	Lynher	Taff
Ogwen	Seiont/Gwyrfai		Tywi	

For those who wish to know more about Salmon Action Plans, please contact: Dr. Guy Mawle (Fisheries Officer) at Environment Agency, Rio House, Waterside Drive, Aztec West, Bristol BS32 4UD.

ROD & NET CATCHES (see attached graphs)

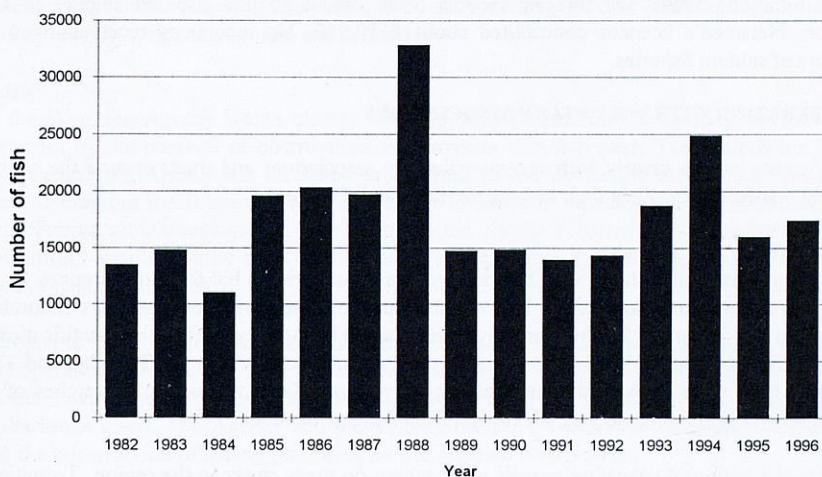
As usual the Agency collected catch statistics for the previous year. For the rods, the catch in 1996 showed a slight improvement on 1995, increasing by 9 per cent, to 17,444 salmon. About 20 per cent of these were released.

For the nets, the declared catch dropped by over 50 per cent to 32,680 salmon, due mainly to a big reduction in the catch reported from the North East coast fishery. This fishery is being phased out and has seen a 37 per cent reduction in the number of licences issued to netsmen since 1992.

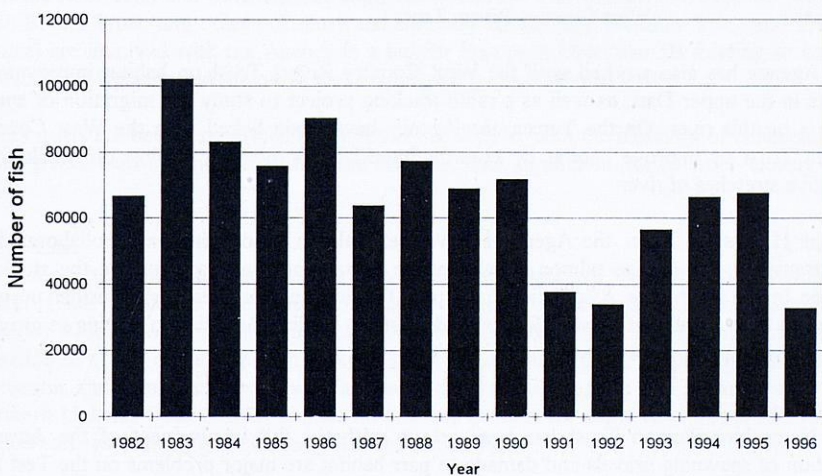
Initial indications are that catches in 1997 by both rods and nets were poor, especially the early run, though there were some exceptions.

For more information on declared catches, please contact: Steve Gledhill at Environment Agency, Rio House, Waterside Drive, Aztec West, Bristol BS32 4UD.

Reported rod catches of salmon for England and Wales, 1982-1996



Reported net catches of salmon for England and Wales, 1982-1996



FUNDING OF AGENCY WORK ON SALMON FISHERIES

The Agency's work on salmon fisheries is funded mainly by Grant-in-Aid from Government and licence income from anglers and netmen. In 1997/8, the Ministry of Agriculture, Fisheries & Food maintained the level of Grant-in-Aid at £7.4 million (another slight fall in real terms, given inflation), whilst the forecast income from salmon anglers also fell slightly to £1.1 million. Netmen's licences contributed about £150,000. No income is received from the owners of salmon fisheries.

COOPERATION WITH VOLUNTARY ASSOCIATIONS

The Agency works closely with various voluntary associations and trusts around the country to help resolve problems in their respective rivers and fisheries.

South West

The Agency has collaborated with riparian owners in preparing a bid for lottery money to pay for a fish counter on Beam weir to help quantify runs into the River Torridge more accurately. Linked to this initiative, 5 volunteers have been trained by Agency staff in the identification of salmon and sea trout redds to help monitor the spawning patterns on the Torridge and Taw. Projects have been set up with the West Country Rivers Trust to fence off stretches of the Torridge and Waldon protecting the habitat from damage by stock.

Increased siltation of spawning gravels is a concern on many rivers in the region. To mitigate this, Agency staff have worked with local associations on cleaning spawning gravels, e.g.

Fowey	Liskeard anglers and netmen
Axe	Axe Vale Rivers Assn & Axe Flyfishers Assn
Dart	Dart Fisheries Assn, including netmen
Frome	Local fisheries groups
Teign	With riparian owners
Tamar	West Country Rivers Trust

The Agency has also worked with the West Country Rivers Trust on habitat improvement works in the upper Dart, as well as a radio-tracking project to study the migration of spring salmon on this river. On the Tamar, the Agency have again linked with the West Country Rivers Trust to improve habitat by contributing £16,000 towards fencing off stock from sensitive stretches of river.

On the Hampshire Avon, the Agency and Wessex Salmon Association have collaborated to tag, transport and release salmon caught by the estuary nets, and so increase the stock of salmon in the river. The Association have paid the netmen for these fish. Further upriver, there has been collaboration with Salisbury & District Angling Association putting in groynes to improve spawning gravels.

Southern

The Hampshire Salmon Trust has been set up with the full involvement of the Agency. Siltation of spawning gravels and damage to parr habitat are major problems on the Test and

Itchen. Initial projects with the Trust include creation of rearing channels for salmon parr after eggs are hatched in streamside incubators.

Working with riparian owners and local fishing interests, 7,300 m² of spawning and parr habitat has been restored on the Test, with a further 6,250 m² on the Itchen. The Agency continues to loan out pumping equipment to de-silt spawning gravels: there has again been a good uptake from riparian owners and keepers.

Welsh

On the Wye, the Agency works closely with the Wye Foundation on opening up spawning tributaries by the removal of obstructions or provision of a fish pass. The Foundation has a hatchery and the Agency has identified those areas of the catchment most likely to benefit from stocking out fry. It has also worked with the Foundation on assessing how successful and cost-effective such stockings are. The collaboration should become even more fruitful if an application, worked on by both organisations, for European 5B funding of riverine habitat improvements is successful.

A project to install a hydro-acoustic fish counter on the Teifi has come to fruition as the result of cooperation between the Teifi Fishermen's Federation, the Countryside Council for Wales and the Environment Agency. The counter is being validated in this, its first year, and the results look good. The Agency and the Teifi Fishermen's Federation have also cooperated over the construction of fishing platforms for the disabled on the river.

North West

The Eden Rivers Trust has just appointed staff in its first operational year. Early collaboration with the Agency on projects to fence out stock to protect habitat indicate the type of work the Trust intends to concentrate on. Grant-funding is being sought.

The Agency has also been working with the Derwent Owners Association on excluding stock from the river bank and other habitat improvement work. This association together with the Eden Rivers Trust, and other voluntary and statutory bodies (e.g. National Trust and English Nature) are involved with the Agency in a bid for European Objective 5B funding to benefit the Northern Uplands and the rivers that drain it, led by the National Park.

Rivers trusts are being established on the Lune and Ribble, with the intention of enhancing the whole riverine environment including the fisheries. The Agency hopes to work closely with them.

North East

About a quarter of a million pounds has been raised from Objective 5B funding for work in the valley of the Yorkshire Esk. The Environment Agency collaborated with the Esk Valley Fisheries Association and others in making the bid. The Agency's contribution includes the provision of a fish counter to help improve stock management. Other projects include habitat protection and improvement as well as restocking to help restore the salmon run. The Northern Uplands Objective 5B bid should also see benefits for some catchments on the east of the Pennines, including the Coquet, Aln and North Tyne.

Thames

The last year has seen a successful joint bid by the Agency and the Thames Salmon Trust for 50 per cent funding by the Millennium Commission of a programme costing £1.3 million to build 17 fish passes on the Kennet by the year 2000. Construction has started on the first three passes.

THE SCIENTIFIC ANGLE

(Dr. Sally Northcott, The Freshwater Fisheries Laboratory, Faskally)

It is always a source of some amusement when staff from The Freshwater Fisheries Laboratory are seen sampling fish with rod and line! However, many of my colleagues are skilled anglers and this particular ability has never been in greater demand since the Laboratory began investigating parasitic lice, both marine and freshwater. In the sea, *Lepeophtheirus salmonis* is of concern because it occurs in large numbers on wild sea trout in the West Highlands (Northcott & Walker 1996). In freshwater, the first outbreak in Scotland of the louse, *Argulus foliaceus*, occurred at a rainbow trout fishery in Lowland Perthshire in 1994. The event recurred in 1995 and in both years it resulted in the closure of the fishery. Another species of freshwater louse, *Argulus coregoni*, was found in the rivers, Earn and Tay, adjacent to the rainbow trout fishery and in a reservoir. Although some brown trout stocked in the reservoir were heavily infested, a more serious outbreak appears to have occurred this year (Northcott & Walker 1995; Northcott *et al* 1997).

Both sea lice and freshwater lice are parasites that live on the skin of their host fish and they are called ectoparasites. Although the young stages of *L. salmonis* are attached to the skin by a filament, older stages and freshwater lice are mobile creatures. Freshwater lice, *Argulus* spp., are particularly active and free-swim to a greater extent than *L. salmonis* partly because they leave their host to lay eggs on inanimate substrates unlike sea lice which have attached egg strings. The mobility of both freshwater and sea lice presents a problem when scientists need to obtain an accurate measure of the level of infection of their hosts. These data provide, for example, the basis for assessing whether infestations are likely to cause mortality or for investigating a difference in infestation level between sites. Some methods of sampling fish will be more prone to dislodging lice than others although the host species, the nature of the location and the cost of sampling are also important considerations.

In 1995, rainbow trout were sampled intensively at the put-and-take fishery in Lowland Perthshire. Angling with bait and netting with monofilament gill nets were used in this small (c. 3 ha) and shallow (<2m) loch. The results showed a significant difference in the level of infestation depending on the method used (Figure 1). The mean abundance (number of lice per fish sampled) for angled rainbow trout was 44 (± 40) lice whilst that of gill-netted fish, captured concurrently, was 15 (± 36) lice; a significant difference ($P < 0.001$) (Northcott & Walker 1995). It is likely that lice were dislodged because fish struggling in the net, rubbed themselves against it and because much handling was required to remove fish from the gill nets. Some fish will also die in the nets and lice rapidly abandon these fish. The sampling methods were unlikely to be selecting different subpopulations with differential levels of infestation, because typically they were used in a confined part of the loch where the rainbow trout were shoaling. There may be suspicion that heavily infested, damaged, fish would be unlikely to take bait but the data do not support this suggestion. Indeed, severely lesioned

rainbow trout, infested with several hundred lice, were captured (Northcott & Walker 1995). In 1997, angling was deemed the preferred method for obtaining counts of *A. coregoni* on brown trout at the reservoir fishery (Northcott *et al* 1997). In mid-June, there was an average of 168 (± 141) lice on a sample of 14 brown trout and the fish had severe lesions which had become secondarily infected (Northcott *et al* 1997). In rivers and estuaries on the west coast of Scotland, many sea trout, heavily infested with sea lice, have been captured by angling. Gill nets have also been used but the accuracy of the lice counts from these fish is questionable in the light of the results from sampling *Argulus* spp. On the other hand, if the sampling requirement is to obtain a small number of lice from many fish, for example, to investigate their genetic characteristics, then gill netting may be the best method. The procedure is relatively inexpensive because it generally requires only two people to set the net, usually from a boat. In a tidal environment, a net set by wading out on a rising tide and left to fish over the high tide, can be retrieved when the water level drops again. More innovative methods that avoid using a boat include casting a line across a pond and pulling the net across (A.E. Thorne pers. comm.) or using a float tube and fins (A.F. Walker, pers. comm.). Nevertheless, the quality of the data on ectoparasite infestation levels from gill-netted fish is questionable.

The target fish species also affects the methods available, for example, small perspex box traps proved efficient for catching sticklebacks in the rainbow trout fishery (Northcott & Walker, 1995). For salmonids, angling, gill netting and sweep netting are effective in freshwater lochs and electro-fishing is also available in the shallows of a loch side and in flowing waters. In salt water, it is not possible to use electro-fishing but the other methods are available and various forms of trap, from commercial nets to experimental live trapping devices, can also be used to intercept migrating fish. Long-lining was used effectively to sample salmon at sea for sea lice in a study that also showed gill-netting to be less effective (Nagasawa 1985). A long-line, used in three reservoirs in east Scotland captured few fish although this was the only method that provided a sample of perch (Northcott *et al* 1997). To maintain accurate louse counts in any of these environments, the method must avoid the fish struggling against a net or knocking into the sides of a container which will remove lice. It is more difficult to catch salmonids in their saltwater habitat than fresh water because it is less confined but for accurate sea louse counts, it is important to do so because these lice do not survive in fresh water.

Consideration of the location to be sampled often severely limits the options available. For example, sweep-netting has been used to enclose small shoals (30-50 fish) of sea trout post-smolts and although they become crowded in the net when it is pulled ashore, fish with heavy infestations of the attached juvenile stages have been retrieved (Northcott & Walker 1996). This method cannot be used where there is i) no shore for the net to be hauled on to, ii) extensive aquatic plantlife that makes the net too heavy to pull in, iii) a beach with boulders that catch on the net allowing fish to escape underneath it. Sweep netting also requires a minimum of four people and a boat and thus is an expensive method to use.

Angling has some notable advantages over all other methods available for sampling fish for ectoparasites. Once hooked, the fish is brought in quickly and placed immediately in a polythene bag, without any handling. It is dispatched and the hook removed while the angler holds the fish in the bag so that any lice dislodged by this process can be attributed to that fish (Northcott & Walker 1995; Northcott *et al* 1997). Angling can be carried out in lochs, rivers, estuaries, sea lochs and even the open sea. Different angling methods can be used to target different species of fish. It does not necessarily require a boat and can be carried out safely

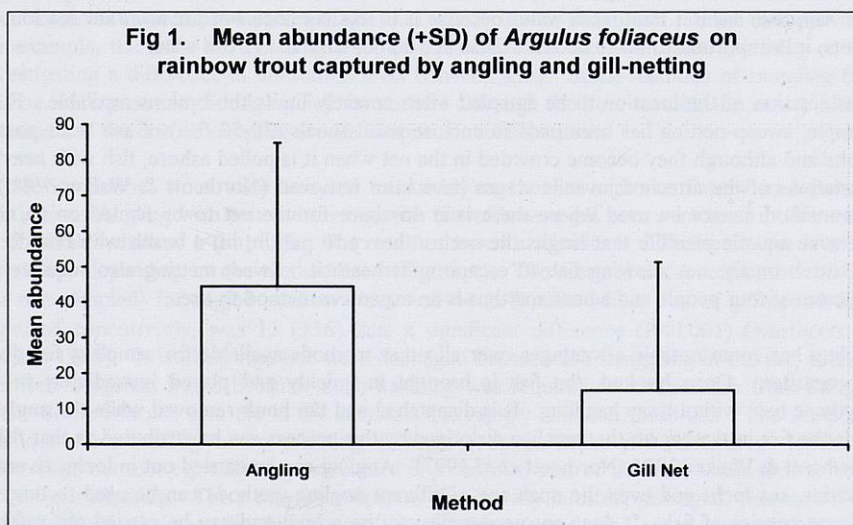
alone. Angling is highly cost-effective, even with the finest tackle in use, when compared with the additional manpower required for methods such as sweep netting or the cost of replacement gill nets which are readily damaged. It is also enormously pleasurable! In fact, it is undoubtedly the best method for obtaining accurate counts of ectoparasites on fish and thus it is important when designing sampling protocols to consider seriously the scientific angle.

Acknowledgements

The author wishes to thank her colleagues, in particular, Andy Walker, Alastair Thorne and Steve Keay for their angling expertise in the studies noted above. Thanks also to Christopher West for my first cast.

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KEEPING TABS ON THE TAGS

The Freshwater Fisheries Laboratory Tagging Register

(by Alisdair I.M. MacDonald)

For many years, the use of tagging and marking to follow the fate of fish, and the populations of which they are a part, has been one of the most potent weapons in the fishery manager's arsenal. Even the simplest of tags have the potential to provide information on patterns of movement, growth, interception and exploitation. Modern advances in the technology of tagging such as radio and Passive Integrated Transponder (PIT) Tags enable biologists to follow the movement patterns of adult and juvenile fish in fresh water in great detail. Even in the sea, where the output of radio tags is attenuated too rapidly for the technique to be practicable, acoustic tags permit the tracking of larger post-smolts and adults.

All current tagging methods have their *pros* and *cons*. Simple external marks such as Carlin and Floy tags are easy to apply and are readily seen by fishermen. They are also readily seen by predators, are more likely to drop out than internal tags and may act as foci for infection. Internally-applied tags (micro tags, PIT tags and some radio and acoustic tags) are more expensive in terms both of application and detection. Internal tags have the great advantage that they interfere less with the normal behaviour of the fish. In independent trials they have been found to out perform external tags in terms of fish survival. The problem lies in securing adequate levels of return. This either involves expensive screening exercises mounted at monitored sites, the use of bankside (radio tags) or vessel-mounted (acoustic tags) receivers or the use of subsidiary marks which fishermen will recognise. Often the most common external mark is the removal of the adipose dorsal fin. Although removal of this fin may theoretically have a slight effect on peak swimming performance, its removal appears to have little effect in practical terms. Nowadays however it is vital to restrict this form of marking only to those fish which are carrying an internal tag or are marked in some other way such as by pan-jet or other fin clip.

Whatever the method used, the key to success for all tagging exercises is getting the tags back as quickly and efficiently as possible. Given the modern advances referred to above, and the welcome appointment of more regionally-based biologists by District Salmon Fishery Boards, Foundations and Research Trusts, co-ordinating tag returns in Scotland is a more complex and important task than ever.

A central tagging register has been operating at the Freshwater Fisheries Laboratory (FFL) since 1960. This service helps to identify tags and enables reported recaptures to be forwarded to the appropriate tagging agency. International and inter-agency co-operation on tagging is important for the speedy reporting of tags caught abroad. A list of all known Scottish tags is added to the ICES (International Council for the Exploration of the Seas) Atlantic Salmon Marking Database, which is then distributed to the various nations participating in tagging programmes. This procedure, along with contacts and agreements with international tagging agencies, allows Scottish tag recaptures from abroad to be returned to the Laboratory for processing and distribution with the minimum of delay. Another advantage of having a central register is to assist in preventing duplication and interference between tagging programmes. To make this service workable, a record of all the tags and marks used for research/management purposes is required.

The following is an example of the type of information required by the tag register:

Marking agency, species, age at marking, life stage (parr, smolt etc), whether the fish is hatchery-reared or wild, the stock origin, type of tag or mark, number marked, tag codes or serial numbers, other identifying marks or finclips, release date, place of release and any relevant comments.

Anybody interested in fisheries science or management who is involved in or considering a tagging exercise in Scotland is asked to get in touch with me at the Freshwater Fisheries laboratory. I will register any information you give and then be able to pass on any details of relevant recaptures that may be reported to the Laboratory. Please note that the register deals with all freshwater species and not just Atlantic salmon. I will also be able to advise on any tagging enquiries that you may have or pass you on to someone else who may be of help.

May I also pay tribute to the many fishermen, ghillies, proprietors and members of the public who have made and continue to make such a strong contribution to fishery science by their prompt reporting of tagged or marked fish.

I can be contacted as follows:

Alisdair MacDonald, Freshwater Fisheries Laboratory, Faskally, Pitlochry, PH16 5LB
Tel: 01796 472060; Fax: 01796 473523; E-mail: MacDonaldAIM@ffl.marlab.ac.uk

CATCHMENT AFFORESTATION AND JUVENILE SALMONID POPULATIONS IN GALLOWAY

(by Chris Pühr, University of Durham, reproduced with kind permission from
the Progress Report of the West Galloway Fisheries Trust, July 1997)

Many scientists now agree that inappropriate coniferous catchment afforestation exacerbates surface water acidification in acid sensitive areas and that this can in turn increase mortality amongst juvenile salmonids. WGFT has long argued that this may be a major problem facing salmonid fisheries in Galloway, which is one of the most heavily afforested areas in the United Kingdom. Unfortunately, there are some scientists in the forestry industry who strongly disagree with this hypothesis and this disagreement has severely hampered the development of regional forest management strategies that are more sensitive to freshwater ecosystems.

There is an urgent and continuing need to carry out more research on the relationships between catchment afforestation, water chemistry and juvenile salmonid populations to clarify exactly what role catchment afforestation plays in determining fishery status in Galloway. Between 1993 and 1996 Durham University Geography department and WGFT have collaborated in a research project to address this need. The Scottish Environment Protection Agency (SEPA) West Region, previously Solway River Purification Board (SRPB), who agreed to carry out part of the required water chemistry analyses, were also involved in the project.

High flow water chemistry data and fish data were collected at over 90 sites in streams spread throughout Galloway. These data were analysed in relation to catchment afforestation and other physical catchment characteristics (mean altitude, mean slope and area) to determine whether catchment afforestation is a potential cause of surface water acidification and low salmonid densities in Galloway. Some preliminary findings of the research project were summarised in last year's Progress Report. The project has now ended, and available data have been fully analysed.

The three main research findings are as follows:

1. **Catchment afforestation and surface water chemistry**

Catchment afforestation with conifers increases the concentrations of acidic cations (hydrogen and aluminium) and acidic anions (sulphate) when stream discharge is high. Sulphate is an acidic anion primarily derived from fossil fuel combustion, and it is thus suggested that conifer forests increase surface water acidity by filtering acid pollutants from the atmosphere. Concentrations of cations derived from the sea, in particular sodium, also increase with increasing catchment afforestation. It is possible that this further exacerbates surface water acidification. The chemical sensitivity of stream waters to afforestation varies with bedrock geology, being greatest for streams draining granitic rocks followed by those draining Ordovician rocks. Streams draining Silurian rocks appear to be least sensitive to catchment afforestation due to their increased buffering capacity.

2. **Catchment afforestation and juvenile salmonid populations**

Catchment afforestation with conifers decreases the density of juvenile salmonids in freshwater streams and also decreases the likelihood of finding a stream populated with juvenile salmonids. These effects are particularly marked for streams draining granitic and Ordovician rocks. Catchment afforestation does not appear to have any significant influence on juvenile salmonid populations in streams draining Silurian rocks. On granitic and Ordovician rocks, juvenile salmonid density decreased when catchment afforestation reaches medium levels; no stream with a heavily afforested catchment was found to contain salmonids. This suggests that salmonid populations become increasingly vulnerable as catchment afforestation increases.

3. **Surface water chemistry and juvenile salmonid populations**

Increased surface water acidity decreases the density of juvenile salmonid populations in freshwater streams and also decreases the likelihood of finding a stream populated with juvenile salmonids. The likelihood of finding a stream without juvenile salmonids increases sharply once mean pH levels drop below 4.5, calcium concentrations drop below 3mg/l, and labile aluminium concentrations increase above 100 µg/l. Given that a conifer forests increase surface water acidity and that juvenile salmonids are sensitive to such increases, it is suggested that the main reason why afforestation is associated with sparse juvenile salmonid populations is because afforestation results in levels of water acidity that are lethal to juvenile salmonids.

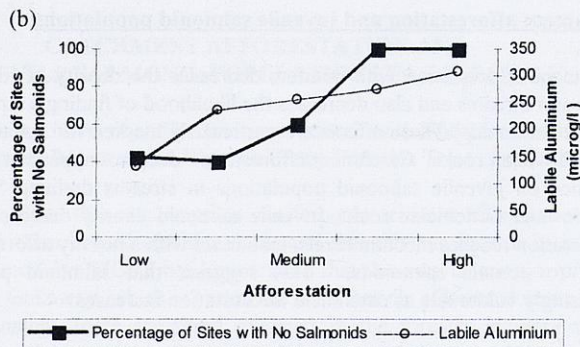
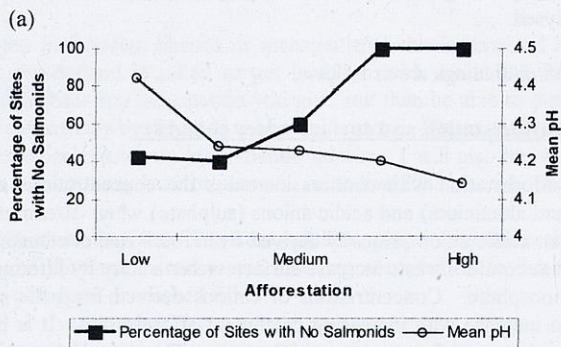


Figure 1: Percentage of sites where salmonids were found to be absent in plotted in relation to afforestation and (a) mean water pH and (b) labile aluminium concentrations, sites with granite catchments only.

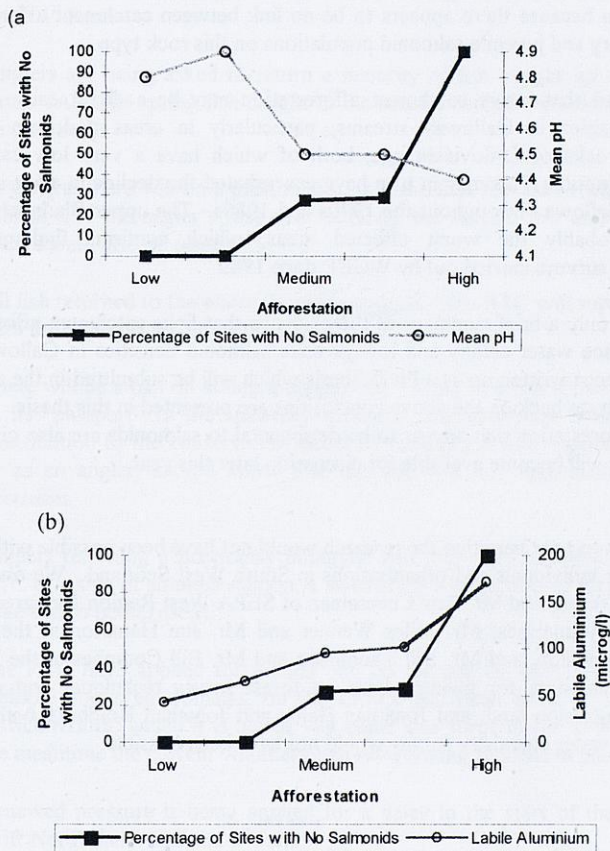


Figure 2: Percentage of sites where salmonids were found to be absent in plotted in relation to afforestation and (a) mean water pH and (b) labile aluminium concentrations, sites with Ordovician rock catchments only.

The results are clearly summarised in Figures 1 and 2, which show salmonid population status in relation to catchment afforestation, pH and labile aluminium concentrations. Low pH values and elevated labile aluminium concentrations are extremely toxic to juvenile salmonids. The Figures show that for streams draining granitic and Ordovician rocks, decreases in pH and increases in labile aluminium concentrations due to increased catchment afforestation are associated with a decline in salmonid populations. Results for streams draining Silurian rocks are not shown because there appears to be no link between catchment afforestation, surface water chemistry and juvenile salmonid populations on this rock type.

It is concluded that heavy catchment afforestation may be a direct cause of low juvenile salmonid densities in Galloway streams, particularly in areas underlain by granite and sedimentary rocks of Ordovician age, both of which have a very low capacity to buffer external acid inputs. This may in turn have exacerbated the decline in adult salmonid catches observed in Galloway throughout the 1970s and 1980s. The upper Bladnoch, Cree, Dee and Fleet are probably the worst affected areas, which confirms findings from routine electrofishing surveys carried out by WGFT since 1989.

The above is only a brief summary of the evidence that links catchment afforestation to high levels of surface water acidity and low juvenile salmonid densities in Galloway. The entire research has been written up as a Ph.D. thesis which will be submitted in the near future. Full statistical analyses backing the above conclusions are presented in this thesis. Precise levels of catchment afforestation that appear to be detrimental to salmonids are also given. It is hoped that the thesis will become available for discussion later this year.

It is important to note here that the research would not have been possible without the support of many other individuals and organisations in South West Scotland. We owe special thanks to Dr. David Tervet and Mr. Roy Cheeseman of SEPA West Region for agreeing to carry out water chemistry analyses; Mr. Miles Wenner and Mr. Jim Hamilton at the Castle Douglas Forestry Commission, and Mr. Bill Thompson and Mr. Bill Coombes at the Newton Stewart Forestry Commission, for giving advice on forest survey techniques and giving access to Forestry Commission land; and Jonathan Haley and Jonathan Bradburn without whose help the high flow water chemistry survey would not have been possible.

FIVE YEAR SPRING SALMON CONSERVATION PROGRAMME (River Tweed Commissioners)

There are growing international concerns about declining stocks of spring salmon. A review of all the information currently available on Tweed's early running fish has revealed that for the first 7 months of the season the Tweed fishery below Ettrick mouth is based primarily on Ettrick fish – produced by just 10% of the catchment – and that the majority of these early running fish come from a single year class. This combination of factors makes the fishery particularly vulnerable at a time when spring stocks are relatively weak throughout the North Atlantic.

On the basis of the information now available, the RTC believes there is a need to take a concerted, precautionary approach to managing the spring fishery, and particularly the Ettrick component, and is therefore recommending the following package of conservation measures be implemented with effect from the start of the 1998 season.

- Tweed netmen are being asked to return, and tag, all salmon and grilse caught up to 1st June.
- Anglers are being asked to return a majority of fish caught up to the end of June. (All stale spring fish caught in the second half of the season should also be returned).
- In general there will be a presumption that the first fish taken will be returned (unless it is the angler's first ever salmon); the second fish may be kept; the third should also be returned).
- All fish returned to the water should be tagged. The RTC will supply each beat with the appropriate tagging equipment.
- There will be a ban on killing a tagged fish. A tag in a fish should be regarded as its "passport" to the spawning grounds. i.e. Everyone who has made a contribution to the conservation effort by returning a fish, whether at the nets or as an angler, should know that this fish will not subsequently be killed upstream.
- Anglers returning a previously untagged fish may claim a "reward" from the RTC of a side of smoked salmon, a sweatshirt, a collection of flies etc. (details have still to be finalised).
- The RTC have applied for a legal ban on the use of worms and lures with multiple hooks eg. Rapalas, on the Ettrick and main stem of Tweed below Ettrick mouth, which it is hoped will come into force in the 1998 season. In the meantime the current voluntary ban on worming remains in place.
- Renewed pressure is being applied for a delay in the start of the North East Drift Net Fishery until the 1st June.
- An experimental programme of reconditioning Ettrick "spring" kelts has just started, in collaboration with the Scottish Office. Ettrick kelts are being collected this autumn. They will be "reconditioned" and brought to maturity again next autumn, with the aim by the end of 5 years of producing an additional 1/2 million eggs each year to supplement the Ettrick stocks. The Tweed Foundation is investigating the potential of seeding the upper Tweed and other parts of the catchment with the progeny from early running Ettrick stock.

- The Foundation hopes to run a further radio tracking project in 1998, targeted on Ettrick fish, to provide further information on spawning destinations. The Habitat Enhancement work remains a priority – aimed at improving the natural production and survival of juvenile fish.

(Please note: this is an abbreviated summary. For further information please contact the RTC or the relevant Beat owners, who may apply their own additional rules.)

AST BIOLOGIST'S REPORT

(John Webb, Marine Laboratory, Aberdeen)

DNA fingerprinting studies

Research projects at the Baddoch burn are progressing well and as planned (for a detailed description, see June 1997 AST Progress Report).

Sampling of all the migrating parr and fry at the smolt trap is continuing. Currently, particular effort is being focused on securing samples from the autumn run of mature and immature salmon parr which began leaving the burn in early September. All parr of 1+ and 2+ years old are being counted, measured and scale sampled and the date of migration noted. Adipose fins, removed at tagging are being kept for DNA analysis. Scale reading and DNA analysis of these samples together with those gathered in the spring of this year will begin later in the winter.

Laboratory analysis of samples of tissue obtained from the 0-group fry dispersal study begun in 1994 has now been completed. Preliminary analysis of the data suggests that there are differences in the survival and performance of different families of fry competing for the same areas of natural rearing habitat. In addition, the results suggest that there may be some quite dramatic effects of redd dispersal on fry distribution among competing families sharing common stream areas. Further results of this work will be published in the June 1998 Progress Report.

Meetings and publications

In September, I attended the Fifth AST/ASF Atlantic Salmon Symposium in Galway, at which a paper entitled 'Patterns of run timing in adult Atlantic salmon (*Salmon salar* L.,) returning to Scottish rivers --some new perspectives and management implications' was presented by my co-author, Dr. Ronald Campbell of The Tweed Foundation. (see report by Dr. Derek Mills in this Progress Report). A final draft of the paper is nearing completion and will be submitted for publication shortly.

Later in the month I also attended the Annual Science Conference of the International Council for the Exploration of the Sea (ICES) in Baltimore, USA as an observer for the AST. A separate report follows.

A paper entitled 'Escaped farmed salmon in Scotland: temporal and spatial trends in their frequency and occurrence' that was presented at the ICES/NASCO Symposium in Bath earlier this year has been accepted for publication. The full proceedings of the symposium will be published in the spring of next year.

ICES ANNUAL SCIENCE CONFERENCE; BALTIMORE, USA

(John Webb)

At the end of September I attended the 1997 ICES Annual Science Conference in Baltimore, Maryland, USA in the capacity of an observer for the AST.

Of particular interest was a special theme session entitled 'Diadromous fish extinction: threats on local and global scales'. The five main sessions of the meeting saw the presentation of 21 papers by speakers from the USA, Canada, Europe, Scandinavia, Poland and Russia on a wide range on many aspects of fish population abundance and extinction. These included presentations on subjects as diverse as the disappearance of salmon and their spawning grounds from the Drawa and Plociczna rivers in Poland and the factors that affect the abundance of salmon in the Tuloma river on the Kola peninsula to the effects of the exotic Eel swimbladder parasite *Anguillicola crassus* and competition between rainbow trout and brown trout in European rivers. Other papers focused on a wide range of different aspects of ecology and life history, artificial propagation, stock structure and genetics.

One particular relevance to experiments in the Baddoch burn was a paper that described the use of the latest DNA techniques (micro-satellites) as a method of large scale marking of stocked salmon in the Connecticut River; a large system on the eastern seaboard of the USA. Atlantic salmon were extirpated from the Connecticut River about 20 years ago following the construction of 32 dams which blocked access to spawning grounds. In essence, the project consists of a very much larger version of the project that is currently being conducted on the Baddoch burn (see above). However, in this study, a greater part of the Connecticut River will be stocked with screened family groups of eggs/parr and their fortunes followed to their return as adults. A program to restore Atlantic salmon to the Connecticut River has seen many millions of dollars being spent on hatcheries. However, despite this massive capital input the system's annual adult run is currently estimated to be less than 500 fish! During the past ten years, a total of 2432 salmon have returned. The largest adult count was in 1981, with a total of 529 fish. In 1997,

9 million fry have been planted into 29,000 km² of the river. Consequently, the whole project is based on a very small number of founding sea-run adults and a small captive broodstock population.

Closer to home, two papers presented at another theme session entitled, 'Aquaculture and Genetics' focused on tagging work that has been undertaken on the salmon high seas feeding grounds near the Faroe Islands. In 1980/81 to 1990/91 and from 1991/92 to 1995/96 salmon captured by long lining in the area were sampled for scales. The physical characters of each

fish were also noted. Analysis revealed that in the 1989/90 fishing season, approximately 40% of the fish sampled were of farmed origin. However, among the samples gathered more recently, these levels have declined to about 20%.

As part of the same research programme, some of the wild fish caught were also tagged and released. Their return to their home rivers was then subsequently monitored via the use of home river surveys. Fish bearing the tags used at Faroes were later recaptured in fisheries in nine different countries. Most were recaptured in Norway (54%). However, other recaptures were reported in Scotland, Ireland, Russia, England, Denmark, Sweden and Spain. Four tags were reported from eastern Canada; three from the River Miramichi and nearby Kouchibouguac River. This is the first time that wild Canadian salmon have been captured and tagged in NE Atlantic waters – a significant observation. Indeed, the timing of tagging and subsequent recapture among this group suggested that fish destined for Canadian rivers are capable of crossing the north Atlantic in at least 5 months. The speaker emphasised the great importance of this kind of data for the purposes of estimating true level of stocks of **wild** salmon present in this key fishery area and their future management.

As mentioned in Dr. Derek Mills' report on last year's conference (see December 1996 Progress report) this year's conference was to be the last meeting of the Anadromous and Catadromous Fish (ANACAT) Committee. In future, salmon related issues within ICES will be dealt with by a living resources committee and a resource management group. The ANACAT and the Working Group on North Atlantic Salmon will therefore be subsumed into these much larger groupings. Hopefully these changes will not be to the detriment of the salmon.

More detailed accounts of some of the papers presented at the conference are given by Dr. Derek Mills in his Review of current Scientific Literature, which follows.

REVIEW OF SCIENTIFIC LITERATURE ON SALMON

(by Derek Mills)

1. Parr

Spatial strategies of wild Atlantic salmon parr: exploration and settlement in unfamiliar areas. J.D. Armstrong, V.A. Braithwaite and F.A. Huntingford. *Journal of Animal Ecology*, 1997, 66, 203-11.

Aspects of the processes involved in the colonisation of vacant areas by stream-resident parr were measured under near natural conditions. Considerable variation was observed between the activity of different individual salmon. It would appear that, for territorial animals such as salmon parr, certain members of the population will settle in new territories after very little exploration of their new environment. The propensity to explore was independent of habitat type, but was directly proportional to the size of the fish.

2. Smolts

Short-term exposure to acid water impairs osmoregulation, seawater tolerance and subsequent marine survival of smolts of Atlantic salmon (*Salmo salar* L.). M. Staurnes, L.P. Hansen, K. Fugellie and O. Haraldstad. Canadian Journal of Fisheries and Aquatic Sciences 53, 8, 1996, 1695-1704.

Smolts from several stocks of Atlantic salmon were released in the estuaries of, and 5km upstream in, an acid river and a neighbouring limed river in southern Norway. There was good agreement between recapture rates of released smolts and physiological effects and mortality of fish retained over the same period in floating cages at the different release sites. Of the smolts released upstream in the acid river, scarcely any were recaptured as adults. The smolts retained in the cages of this river suffered severe osmoregulatory failure and high mortality within a few hours. Gill Na^+ , K^+ -ATPase activities were significantly reduced. Exposure for a few hours to the acid river impaired the seawater tolerance of the fish. The results suggest that simple physiological challenge tests of smolts after exposure to the water in which they are to be released may be a useful tool for predicting survival after release, and may help decide when and where smolts should be released.

Smolt age and sea age distributions of Atlantic salmon (*Salmo salar* L.) in the sea north of the Faroe Islands during 1991 to 1995. H.A. Jacobsen, R.A. Lund and L.P. Hansen. International Council for the Exploration of the Sea CM 1997/BB:08.

Smolt age and sea distributions of Atlantic salmon were estimated from material sampled in the sea north of the Faroe Islands during four consecutive fishing seasons. Both smolt age and sea age were significantly lower in the autumn part of the fishing season (November to December) than in the winter part of the season (January to March). Smolt age varied between 1-4 years with a mean of 2.5 in the autumn samples and a mean of 2.7 in the winter samples. Sea age varied between 1-3 years and mean sea age was 1.9 years in the autumn samples and 2.2 years in the winter samples. The significantly lower smolt age and sea age of salmon caught in the autumn suggest that a large proportion of the salmon caught in the Faroes area during this period originate from southern European countries, where salmon are younger than in the northern part of the distribution area. Recaptures in the Faroese fishery of salmon tagged as smolt in different countries support these findings.

Records of post-smolt Atlantic salmon, *Salmo salar* L., in the Faroe-Shetland Channel in June 1996. R.G.J. Shelton, W.R. Turrell, A. MacDonald, I.S. McLaren and N.T. Nicoll. Fisheries Research 31 (1997) 159-162.

This is the report of the capture of 167 post-smolt salmon caught in five trawl hauls during June 1996 in the surface water of the Faroes-Shetland Channel. A combination of age structure and tag-return data suggests a relatively southern origin for most of the fish. The large numbers of fish caught in two hauls and the results of analysing the tag returns suggest that post-smolt salmon form schools in the open sea. All tagged fish were of hatchery origin, suggesting that hatchery-reared fish have ocean migrations similar to wild fish, at least for part of their life at sea. Hydrographic observations obtained before and during the trawls suggest

that the fish were concentrated within a persistent narrow northward flowing slope current located along the northwest European continental shelf edge.

3. Adults

The incidence of reared Atlantic salmon (*Salmo salar* L.) of fish farm origin at West Greenland. L.P. Hansen, D.G. Reddin and R.A. Lund. ICES Journal of Marine Science, 54, 152-155, 1997.

The proportion of escaped farmed Atlantic salmon in the commercial fishery at West Greenland was estimated using samples of fish caught with drift-nets in the commercial fishery in 1991 and 1992. Identification of reared fish was carried out using scale analysis. Despite the fact that large numbers of salmon escape from fish farms around the north Atlantic, the proportion of farmed fish in this fishery was low, 1.1% in 1991 and 1.4% in 1992, and much lower than in the area of the Faroes fishery in the east Atlantic. The low number of fish farm escapees at Greenland is surprising since large numbers of farmed salmon are produced in countries from which most of the wild salmon that occur at West Greenland originate.

Origin and migration of wild and escaped farmed Atlantic salmon, *Salmo salar* L., tagged and released north of the Faroe Islands. L.P. Hansen and J.A. Jacobsen. International Council for the Exploration of the Sea CM 1997/AA:05.

A total of 5,448 Atlantic salmon (3,811 wild and 1,637 farm escapees) were caught by long-lines, individually tagged and released back into the sea in Faroese waters between November 1992 and March 1995. In total 106 fish (87 wild and 19 farmed) have been reported recaptured. The recapture rate of wild salmon (2.3%) are significantly higher than of farmed salmon (1.2%). Tagged wild salmon were reported from large areas in the north Atlantic, both from marine fisheries and in freshwater. No tagged fish were reported from Faroes nor from West Greenland. Tags of wild fish were reported from home waters in nine countries, the majority in Norway, but in significant numbers also from Scotland. Tags were also recovered in Russia, Ireland, Sweden, Denmark, England, Iceland and Spain. Furthermore, four tags of wild fish were reported from Canada, three from the River Miramichi and one in a river close to the Miramichi, all in the same year when they were tagged. This shows that adult Atlantic salmon can cross the north Atlantic ocean in at least 5 months. Of the farmed fish recovered, 18 were reported from Norway and one from the west coast of Sweden. It is suggested that the majority of farmed salmon in Faroese waters originate from Norwegian salmon farms.

Migratory pattern of homing Atlantic salmon (*Salmo salar* L.) in coastal waters W-Iceland, recorded by data storage tags. J. Sturlaugsson and K. Thorisson. International Council for the Exploration of the Sea C.M. 1997/CC:09.

A migration study on homing of Atlantic salmon was carried out in West Iceland waters. External data storage tags were used to record pressure (depth), temperature and conductivity (salinity) during the migration. Comparison with temperature data from satellites showed that

most of the salmon migrated quite close to the coast. The data storage tags' salinity measurements showed that some individuals migrated into estuaries and even into rivers on their way to their home waters. The depth records showed that the salmon migrated mostly in the uppermost few metres. The salmon often showed diurnal rhythm in vertical movements, staying deeper at night. The salmon were closest to the surface during noon and the majority of the deepest dives were related to sunset and sunrise. The usual pattern of migration through deeper layers were a series of rapid dives. Usually the dives were just a few metres, but occasional dives were taken down through the thermocline at 20-40m depth, and even down to 110 metres.

4. Kelt reconditioning

Stocking experiments using progeny of freshwater-reconditioned Atlantic salmon, *Salmo salar* L. I.J.J. Moffet, G.J.A. Kennedy and W.W. Crozier. Fisheries Management and Ecology, 1997, 4, 385-390.

The progeny of salmon kelts reconditioned in fresh water for one and two years were stocked in the spring as swim-up fry into good salmonid habitat in 1993 and 1994. Survival to the first summer was compared with that of control groups. There was no significant difference between the average number of reconditioned kelt and control fry caught per five-minute semiquantitative electric fishing for the two years. Transformation of semiquantitative electric fishing results showed that average survival rates were about 24% and 30% for reconditioned kelt progeny and their controls, respectively, in 1993, and about 34% for both groups in 1994.

5. Enhancement

Evaluation of an alternate strategy to enhance salmon populations: cage rearing wild Atlantic salmon smolts from Conne River, Newfoundland. J.B. Dempson, V.A. Pepper, G. Furey, M. Bloom, T. Nicholls and G. Hoskins. International Council for the Exploration of the Sea, CM 1997/P:03.

Wild Atlantic salmon smolts from Conne River, Newfoundland, were captured during their downstream migration in May, 1995. From an estimated total run of 62,750 smolts, 5,000 (8%) were transferred over a thirteen day period to an estuarine aquaculture rearing site 23km away. Survival was monitored throughout the experiment with the greatest mortality occurring in July, approximately six to eight weeks following transfer. Overall survival of smolts to one-sea-winter salmon was 18.5%, over four times higher than the average survival of wild salmon monitored at monthly intervals until November, 1995, with additional sampling in the spring and early summer of 1996. In general, the food conversion ratio was poor which resulted in one-sea-winter survivors from the cage rearing experiment being significantly smaller than wild salmon that returned to Conne River. Survivors were split into two groups and released directly into the Bay d'Espoir estuarine fiord; one group was released in June at a site approximately 7km from the mouth of Conne river. The second group was retained at the aquaculture site and released in July. Less than 50% of the surviving fish were later accounted

for in local Bay d'Espoir rivers. Approximately 80% returned to Conne River with 20% straying to other streams.

There are a number of advantages in using aquacultured wild smolts as an alternative enhancement strategy to assist in rebuilding natural salmon populations. First, the same genetic strain of salmon is utilised. In addition, nature has already contributed to the selection process. Past enhancement strategies that stocked salmon fry into a river system required four years following stocking before any adult production materialised. In contrast, adult salmon were produced in just one year in this experiment.

6. Conservation

Previous and current status of Swedish salmon populations: threats and their mitigation. O. Karlstrom and L. Karlsson. International Council for the Exploration of the Sea CM 1997/P:14.

In Sweden there were originally approximately 40 salmon rivers with wild, self sustaining populations in the Baltic. Original wild salmon populations exist today in 14 rivers, but native populations, unaffected by stocking of hatchery-reared fish are found in only three rivers. Along the Swedish west coast there were originally approximately 15-20 wild salmon rivers. Wild salmon populations still occur in about 15 river systems, but there are only four rivers that have been confirmed to contain an original North Atlantic native salmon population. There were three landlocked salmon populations in Lake Vanern and two of them still exist. The extinction of wild salmon populations can be ascribed largely to the combined effects of dams for hydro power, destruction of habitat, acidification, water pollution, overfishing and, possibly, M74 and other fish diseases.

In the Baltic today the main threats to wild salmon populations are overfishing and, recently, the effects of M74 syndrome. This disease has in recent years caused mortalities in newly-hatched alevins in the range of 50-90%. The most serious threat to the west coast Atlantic salmon is acidification.

Regulation of the fishery is the most important measure that can be carried out to preserve the remaining Baltic salmon populations. Habitat restoration increases and helps to ensure the survival of populations. To restore populations in rivers where salmon were lost introductions from neighbouring rivers are carried out. In Swedish west coast rivers liming is the most important measure. In the Swedish Baltic rivers fish are collected from almost all wild salmon rivers. The resulting gene bank provides some insurance that unique genotypes can be preserved.

THE ATLANTIC SALMON TRUST LIMITED

TRUSTEES' ANNUAL REPORT

PART 1: OBJECTIVES AND FINANCIAL REVIEW

The Trustees are pleased to present their Annual Report and the audited Financial Statements for the year ended 30 June 1997.

1. OBJECTIVES AND FUNDING

- (i) The principal objective of the Atlantic Salmon Trust is to protect and enhance the stocks of salmon in the United Kingdom for the benefit of the community. To achieve this objective, it draws the attention of the appropriate authorities to the particular dangers and problems facing the salmon; it offers advice to Government Ministers and their departments and to the European Union; it finances scientific and biological research, arranges workshops and international conferences and publishes booklets on matters of general and scientific interest about salmon, for the mutual benefit of salmon managers, scientists, biologists and anglers.
- (ii) To raise the requisite funds needed to meet its objectives, the Trust is entirely dependent on donations, and wherever possible, on sponsorship or comparable financial support to finance the costs of scientific studies and the related salmon conservation activities which it continuously undertakes. During the year ended 30 June 1997, the Trust received further financial contributions from various organisations towards the costs of its principal scientific research studies into the maximisation of progeny numbers from natural spawning, an important DNA project on which John Webb, the Trust's scientist, has been actively involved for more than two years. This particular project is referred to in greater detail later on in this Report but the Trustees wish to express their gratitude to the sponsors and contributors concerned. Meanwhile, The Robertson Trust has generously donated an additional £25,000 for a further year from autumn 1997 to ensure the continuation of this extremely important project.
- (iii) The costs of managing the Trust's varied activities are mainly funded by investment income and by covenanted, pledged and general donations. As a registered charity, the Trust is entitled to reclaim the tax effectively included in both its covenanted and dividend income; covenanted donations are therefore encouraged, as the tax recoverable over the minimum four year covenanted period is an important factor in the Trust's total income resources. However, the tax recovery on dividend income for registered charities is to be gradually phased out after 5 April 1999 and probably replaced by an alternative tax regime specifically related to the charity sector. It is therefore hoped that the impact of the dividend tax credit reduction and its eventual abolition will not have a materially detrimental effect on the Trust's income from this source over the longer term. Apart from covenanted donations, general donations of £250 or more also attract a tax recovery if made under the Inland Revenue Gift Aid Scheme and the Trust also benefited from this particular tax relief during the year.
- (iv) A particularly important financial objective of the Trust is to plan for investment income to be maintained at a level sufficient to meet the costs of managing the Trust's activities, both current and future. It is not, however, always possible to ensure that expenditures on major ongoing scientific projects are exactly matched by incoming resources generated within the same financial year in which the project expenditures are incurred. In such circumstances, the policy agreed by the Council of Management is that it would be prudent and realistic to finance any temporary shortfall from capital, so as to avoid any undue delay or restriction to ongoing

projects. The utilisation of capital resources in this way has not been necessary for several years and is not, it is emphasised, a long term option under any circumstances.

2. REVIEW OF OPERATIONAL ACTIVITIES DURING THE YEAR

- (i) The operating surplus for the year ended 30 June 1997 amounted to £78,818 (1996: £11,385), an increase of £67,433, due primarily to a legacy of £65,000 received from the Estate of Malcolm Charles Knight deceased. The legacy received during the year represented an interim distribution by the executors and further distributions totalling £85,000 have been received in the current financial year ending 30 June 1998. This generous legacy has made a substantial contribution to the Trust's financial resources and has been temporarily placed in the Trust's investment deposit account with Coutts & Co., in conjunction with the investment managers. It is the Trustees' intention to invest the legacy on a longer term basis on the London Stock Exchange when market conditions are considered appropriate, so as to optimise investment income and long term capital growth. It is not the Trustees' intention to appropriate the legacy directly towards either scientific research or administration expenditures but to regard it as part of the permanent capital of the Trust.
- (ii) In an overall review of the Trust's principal income resources during the year ended 30 June 1997, the following have been particularly significant:

Investment income

Investment income from shares, securities and bank deposits increased by £5,227 during the year at £65,473 (1996: £60,246). As a result of the special dividend received during the previous year from the National Grid flotation, income from equities fell slightly, offset by an increase in income from fixed interest securities and bank deposits. On the basis that interest rates are maintained at current levels during the financial year ending 30 June 1998, it is anticipated that total investment income for that year should further improve over the 1997 level. As mentioned earlier in this Report, the optimisation of investment income year on year is extremely important, as it represents the primary source of income from which the Trust's direct charitable expenditures are met.

Covenanted donations

Income from covenanted donations also increased by £2,025 at £18,793 (1996: £16,768). New covenants mainly arise from the Trust's presence at the Game Fairs and Country Fairs and from the bi-annual issue of the Progress Report. Covenantors are also contacted on a regular basis when their covenants expire and many renew their covenanted donations. The Trustees especially thank those covenantors for their continued generosity often over a period of many years.

Postal fishing auction

The postal fishing auction continues to attract great support and raised £36,240 (1996: £35,711). The Trustees gratefully acknowledge the continuing interest in this important activity and the generosity of donors of fishing rights. They also wish to record their appreciation of the untiring efforts of the Director and his secretary Jenny Sample at the Pitlochry Office, without which this significant contribution to the Trust's finances could not be achieved.

Raffle of fishing rods

The December 1996 Progress Report mentioned that David Norwich, rodmaker, generously donated two rods in a leather case for the Trust to raffle. The raffle

proceeds amounted to £3,089 and have been included in the Financial Statements for the year ended 30 June 1997.

3. SCIENTIFIC RESEARCH PROJECTS; OTHER ORGANISATIONS

- (i) The gross expenditures on scientific research projects sponsored or financed by other organisations during the year totalled £49,969 (1996: £70,882). The majority of these projects were administered by the Scottish Office Agriculture Environment and Fisheries Department (SOAEFD), in conjunction with the Freshwater Fisheries Laboratory at Faskally, with the Trust employing the project personnel and handling the payroll, for which it levies a 5% administration charge to cover the payroll management costs. Third party financial contributions held by the Trust on their behalf on 1 July 1996 amounted to £34,912, with further contributions of £40,056 received during the year ended 30 June 1997, i.e. a total funding of £74,968. After deducting the scientific research expenditures of £49,969 incurred during the year, the third party contributions carried forward at 30 June 1997 amounted to £24,999, as indicated by Note 4 to the Financial Statements.
- (ii) As mentioned earlier in this Report, an extremely important long-term project carried over from previous financial years was John Webb's study of the maximisation of progeny numbers from natural spawning. This five year DNA project will continue during the year ending 30 June 1998 and beyond. In the year to 30 June 1997, the project was financed by sponsorship grants from The Robertson Trust and The Dulverton Trust, received during the previous financial year. Further grants totalling £12,331 were received during the year from the European Union and the Dee Salmon Fishing Improvement Association. These contributions have been carried forward at 30 June 1997 towards the costs of financing the project during the year ending 30 June 1998, in addition to the further generous contribution of £25,000 received from The Robertson Trust to fund the third year of the project.
- (iii) A further important long-term project continued from the previous financial year was the Shieldaig sea trout electrofishing and habitat survey. During the year ended 30 June 1997, the project was financed by the Highland Council, Highlands and Islands Enterprise and by a grant from the Scottish Office Rural Challenge Fund, totalling £17,168.

4. SCIENTIFIC RESEARCH PROJECTS FINANCED BY THE TRUST

The Trust has itself financed a number of scientific projects during the year, as recommended by the Honorary Scientific Advisory Panel (HSAP). These are detailed in Note 4(ii) to the Financial Statements and totalled £21,123 for the year (1996: £17,903). The entire cost of these projects was met from current year income, with no utilisation of capital funds. The Trust will again support several projects during the year ending 30 June 1998, details of which are shown in Note 20 to the Financial Statements.

5. OPERATIONAL RESULTS

- (i) As already mentioned in heading 2(i) of this Report, the various income producing activities during the year ended 30 June 1997 and the legacy from the Estate of Malcolm Charles Knight deceased, less the conservation and administration expenditures incurred, resulted in an overall surplus of £78,818. Without the legacy, the operational surplus would have amounted to £13,316 (1996: £11,385), a very satisfactory outcome given that scientific research expenditures continue to be financed by the Trust at an ever increasing level. The additional funds generated by the operational surplus will continue to be applied towards direct charitable expenditures, in accordance with the principal salmon conservation and enhancement objective of the Trust.

- (ii) There were no fundamental changes in the Trust's investment portfolio during the year, although the ratio of liquid cash resources to equities and loan stocks was increased as a hedge against the somewhat volatile nature of the stock market. The cash resources were also considerably enhanced by the legacy of £65,000, resulting in a balance on the Coutts investment deposit account at 30 June 1997 of £117,821 (1996: £38,462). Since 30 June 1997, part of these liquid funds have been invested in equities but the Trustees intend to maintain the remaining cash deposits at a reasonably high level until the time-scale for further investments in shares and securities is considered appropriate. The Finance Committee has continued to have regular meetings with the Trust's investment managers during the year to ensure that equities, government and corporate stocks and cash deposits are maintained at a satisfactory ratio commensurate with current stock market conditions. Realised net gains on disposals of investments during the year amounted to £10,438 (1996: £2,541), adopting the market value accounting basis recommended by the Charities Commission for England and Wales under the new Statement of Recommended Practice (SORP) reporting requirements for registered charities. On an historical cost basis, the net realised gains on disposals of investments during the year amounted to £38,068 (1996: £59,661). The comparative figures for 1996 shown in the 1997 accounts have been adjusted to reflect this revised market value basis of accounting.
- (iii) The market value of the investment portfolio (excluding the investment deposit account) on 30 June 1997 was £1,055,678, an increase of £112,627 over the previous year. As has been stated in previous Progress Reports, the market value of an investment portfolio at any particular date does not necessarily indicate a longer term trend and it is therefore the Trust's policy to transfer both realised and unrealised net gains to a special Investment Reserve account, as part of the permanent capital of the Trust, ie. not available for operational purposes. The Investment Reserve, together with the Property Valuation Reserve (the "Scottish Headquarters") totalled £502,722 at 30 June 1997, as indicated by Note 14 to the Financial Statements.

6. STAFF

The Trustees wish to express their gratitude to the Director, John Mackenzie and to the Deputy Director, Jeremy Read, for their untiring efforts in the continuing struggle for salmon conservation. Their professional knowledge and approach to the many problems and their efficient liaison with other organisations in furthering the Trust's objectives are largely responsible for the high reputation that the Trust continues to enjoy. John Mackenzie retired as Director on 30 September 1997 and was succeeded by Jeremy Read. A tribute to John Mackenzie's Directorship over the past 13 years is acknowledged elsewhere in this Progress Report and the Trustees wish him a long and happy retirement. Colonel Tim Hoggarth was appointed Deputy Director on 1 October 1997 in succession to Jeremy Read and will continue to be responsible for the Trust's operations in England and Wales.

7. LEGAL AND ADMINISTRATIVE INFORMATION

The new Statement of Recommended Practice (SORP), issued by the Charity Commissioners for England and Wales in October 1995, with the approval of the Accounting Standards Board, requires certain legal and other administrative information to be given by Trustees of registered charities, as part of their Annual Report. This information is given in Part II of this Report, together with an Appendix listing the names of the Trustees and is intended to form part of the overall Trustee's Annual Report in conjunction with Part I. The Trustees' Annual Report will therefore replace the Chairman's Report, as previously incorporated into successive December Progress Reports issued by the Trust.

3 December 1997

THE ATLANTIC SALMON TRUST LIMITED

SUMMARY FINANCIAL STATEMENTS: YEAR ENDED 30 JUNE 1997

STATEMENT OF FINANCIAL ACTIVITIES

<u>INCOMING RESOURCES</u>	<u>1997</u>	<u>1996</u>
Investment income	65,473	60,246
Donations	44,567	39,480
Fishmongers Company: contribution towards Treasurer's remuneration	6,000	6,000
Legacy	65,000	2,000
Postal Fishing Auction	36,240	35,711
Raffle of donated fishing rods	3,089	-
Miscellaneous income	<u>2,663</u>	<u>2,433</u>
<u>Total incoming resources</u>	<u>£223,032</u>	<u>£145,870</u>
<u>RESOURCES EXPENDED</u>		
Direct charitable expenditures on promotion of salmon conservation	107,975	100,714
Donations and grants to other organisations	1,693	525
Publicity expenditures	7,219	8,188
Management and administration of the charity	<u>27,327</u>	<u>25,058</u>
<u>Total resources expended</u>	<u>£144,214</u>	<u>£134,485</u>
Net incoming resources before transfers	78,818	11,385
Net gains on investment assets	<u>126,026</u>	<u>48,055</u>
Transfers to Reserves	<u>(126,026)</u>	<u>(48,055)</u>
Net movement in Funds during the year	78,818	11,385
Fund balance brought forward at 1 July 1996	<u>636,910</u>	<u>625,525</u>
<u>Fund balance carried forward at 30 June 1997</u>	<u>£715,728</u>	<u>£636,910</u>

BALANCE SHEET

FIXED ASSETS

Tangible fixed assets	62,921	65,844
Investment assets	<u>1,173,499</u>	<u>981,513</u>
Total fixed assets	1,236,420	1,047,357
Net current assets	<u>7,029</u>	<u>1,161</u>

TOTAL ASSETS

£1,243,449 **£1,048,518**

CAPITAL AND RESERVES

Accumulated Fund	715,728	636,910
Reserves	<u>502,722</u>	<u>376,696</u>
Total Capital and Reserves	1,218,450	1,013,606
<u>DEFERRED SCIENTIFIC PROJECT CONTRIBUTIONS</u>	<u>24,999</u>	<u>34,912</u>

TOTAL CAPITAL EMPLOYED

£1,243,449 **£1,048,518**

ATLANTIC SALMON TRUST PUBLICATIONS

Atlantic Salmon: Planning for the Future (Proceedings of the 3 rd 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
Atlantic Salmon Facts	by Derek Mills and Gerald Hadoke	f.o.c.
The Atlantic Salmon in Spain	by C.G. de Leaniz, A.D. Hawkins, D. Hay and J.J. Martinez	2.50
Salmon in Norway	by L. Hansen and G. Bielby	2.00
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 Derek 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 4 th International Atlantic Salmon Symposium, St. Andrews, New Brunswick, June 1992)	edited by Derek Mills	30.00
Surveying and Tracking Salmon in the Sea	by E.C.E. Potter and A. Moore	3.00
Problems with Sea Trout and Salmon in the Western Highlands	edited by R.G.J. Shelton	3.00
Automatic Salmon Counting Technologies - 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
Enhancement of Spring Salmon (Proceedings of a one day Conference held in the Rooms of the Linnean Society of London, 26 January 1996)	edited by Derek Mills	12.00
Water Quality for Salmon and Trout (second, revised edition)	by John Solbé	3.50

