Atlantic Salmon Trust

Summer Journal 2008

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WHAT IS THE TRUST?

- Founded in 1967, the Trust is an Atlantic-wide, UK based organisation which champions the wild salmon and sea trout – it does not represent any body, only the fish themselves.
- Works for the conservation and restoration of wild salmon and sea trout stocks to a level which allows sustainable exploitation
- Is an independent, registered Charity, with a small staff, which receives no Government funding

WHAT ARE THE TRUST'S CURRENT ACTIVITIES AND PRIORITIES?

Promoting, taking part in or supporting:

- Research into the survival of salmon at sea
- Restoration of wild salmon and sea trout stocks, especially on the West Coast of Scotland and the Islands
- Reduction of mixed stock nets
- Reduction of the impacts of aquaculture on wild salmon and sea trout
- Reduction of mammal and bird predation
- Improvement of river habitats and water quality

Improvement of the AST's education, information and communications roles.

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WHAT DOES THE TRUST DO?

- Conducts and supports marine and freshwater research
- Gives practical advice on the management of fisheries and rivers
- Gives independent advice to governments, international and national authorities and to commercial enterprises
- Co-ordinates activities with other conservation, environmental, fishery, heritage and wildlife agencies and organisations
- Holds and supports seminars and workshops to investigate specific issues
- Publishes high quality reports and booklets to inform and educate

USEFUL DATES 2008

JULY

4-6 **The Scottish Game Fair, Scone**

25-27 **CLA Game Fair, Blenheim**

AUGUST

1-2 **Highland Field Sports Fair, Moy**

OCTOBER

8 **Board Meeting**

DECEMBER

3 **AGM & Members' Meeting, Fishmongers' Hall**

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EDITORIAL

The Atlantic Salmon Trust's Journal is our main public communication. Over the last few years it has gained a reputation as a major source of information for the informed layman, and what may be loosely described as 'the Atlantic salmon community'. As its new editor, I want to acknowledge the successes of my predecessors, Jeremy Read and Seymour Monro, in getting the Journal to the pre-eminent position it enjoys today. It is the only publication that promotes the wellbeing of wild Atlantic salmon, as opposed to representing the interests that exploit the fish.

The Journal is published twice each year, in time for the summer shows season and just after Christmas. Its purpose is to bring our readers up to date with current research, and to provide them with a notice board of the Trust's activities. Its readership includes politicians, the media, fishery managers, scientists, riparian owners, and anglers. For the future I want to see the Journal appealing to ecologists and the informed public who have an interest in the environment. The Atlantic salmon is a prime indicator species for the health of our rivers and seas, and many people care about how the salmon can show whether we are succeeding in managing the region's fresh and saltwater environments, and the diverse species that depend on them.

It is unprecedented for a single species to command such widespread support. This is in part because of the salmon's status as a 'barometer' species, but it is also because the salmon captures the human imagination in ways that other species do not. Its origins in some of the most beautiful mountain country on earth, its juvenile years in our local rivers and streams, and its extraordinary odyssey as it migrates to the ocean to grow, have inspired people from the beginning of time. The salmon engenders a sense of wonder and wellbeing, but when it is threatened, as it is now in its marine habitat, we feel less secure about ourselves. Above all else, the AST Journal must endorse that aspect of human perception because, without the salmon, our quality of life would be immeasurably diminished.

The AST is a UK-based charity that works across national borders within the Atlantic salmon's range. Increasingly we are participating in international efforts to research the physiology and genetics of the fish itself, and factors affecting its wellbeing. The Summer 2008 Journal focuses on answering the question, "Why is such a high proportion of salmon dying at sea?" To continue this level of activity, the AST depends on the commitment and generosity of its supporters. You can help us in a number of ways. The most obvious is a cash donation or an auction lot. We also appreciate practical help on the AST stand at the GWCT fair at Scone, the Highland game fair at Moy or the CLA game fair at Blenheim Palace. If you can help in any way at all, please contact me at director@atlanticsalmontrust.org. I look forward to meeting you.

Tony Andrews, Executive Director

Please note that articles do not necessarily reflect the Trust's views. Advice and guidance is always available from the Trust's staff.

Contents

JOURNAL DATES

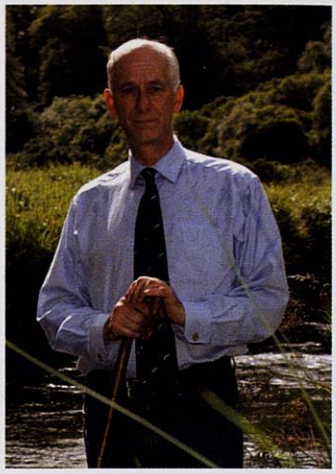
Winter Edition:
Contributions by 1st December
Published late January

Summer Edition:
Contributions by 1st May
Published late June

Photographs:

Front cover: silvering salmon parr before smolting in readiness for its migration to sea, David Hay
Back cover: Where salmon start life: an upland tributary of the River Ericht at spawning time, John Webb
Other photographs:
Andrew Graham-Stewart, John Webb and Tony Andrews

From the Chairman



Robert Clerk

In the last Journal I referred to this being a time to look forward to the challenges of the next ten years and we do so with confidence with our new Executive Director, Tony Andrews, now in post. Following a period of service with the Royal Marines, an honours degree in English from St Andrews University, and subsequently a very successful career with the British Council, Tony has for the last five years been Chief Executive of the Scottish Countryside Alliance. As a keen angler and fishery proprietor we welcome him and whilst he has a hard act to follow in taking over from Seymour Monro we know that he too will work tirelessly in taking the Trust forward in the years ahead.

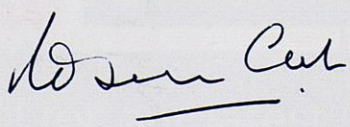
Following several years of preparation, and in particular securing funding, a milestone was reached in May 2007 with the sailing of the first research cruise, part of the international marine salmon research project (SALSEA) co-ordinated by NASCO. Using equipment developed and loaned by the Atlantic Salmon Trust this led to the successful interception of a good sample of post smolts at sea and work is now in hand using DNA analysis to identify the rivers or regions of origin of these fish. The promising start in May 2007 was followed this year by a spectacularly successful survey with the same net and centred on the Shelf Edge Current by both *Celtic Voyager* and the much larger *Celtic Explorer*, during which 356 post-smolts and numerous plankton and water samples were secured for analysis.

The use of new technology to sample juvenile salmon at sea represents a major step forward in scientists' attempts to unravel the mysteries of their fate in the marine environment and in particular our understanding of the reasons behind the fact that the proportion of the smolts that leave our rivers and return as adult fish to spawn is now only about one third of the number that safely made that great journey back to natal rivers 40 years ago. We may not be able to influence the fact that, as seems likely, the driving force behind the loss of salmon at sea now occurring is associated with climate change, but it is vital that we understand the mechanisms that underlie this much increased level of mortality and that where human influence can be exerted every step is taken to ensure that as many salmon and grilse as possible return to their rivers of origin.

Evidence of a steady decline in the physical condition of grilse (and possibly also salmon) returning to spawn is a matter of considerable concern. Whilst some poorly conditioned fish may survive the journey back to fresh water we know nothing of the number that are lost on their return migration and there is no doubt that the spawning success of these undernourished fish is compromised.

The failure of British fishery administrations to play an active part in the sampling of salmon at sea implicit in the international NASCO SALSEA programme and the impending withdrawal of financial support by SNH for sea trout and salmon stock restoration work in Scottish west coast river systems brings sharply into focus the efforts of the Trust and its NGO analogues to fund such efforts. This year the Trust has agreed its highest ever level of expenditure on research projects giving grants to a total value of over £100,000, much of which has been directed towards salmon at sea. To enable us to continue to support research at this or an even greater level we have to redouble our efforts to raise our annual revenue and, wherever possible, restrict our overhead and administration costs.

We are always enormously grateful to those many people and organisations that generously support us but now, more than ever, we look to our many friends for their help in ensuring that the Trust retains its influence and ability to encourage research and promote best possible practice in the management of our threatened salmon and sea trout stocks.



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International and Scotland

Tony Andrews, Executive Director, International and Scotland

International – Salmon at Sea – the SALSEA Project

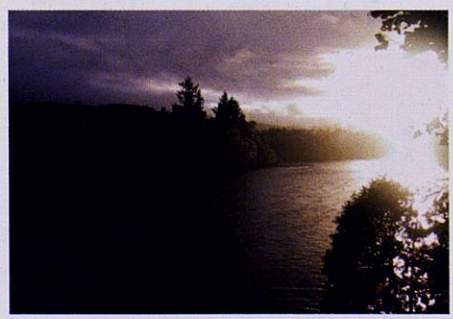
The Atlantic Salmon Trust's participation in the North Atlantic Salmon Conservation Organisation's (NASCO) research into the lives of salmon at sea puts the AST at the cutting edge of salmonid research. There could be no better moment to make that claim than now, as the three-year SALSEA-Merge project gets underway. Its contracted research vessels are at this very moment mapping the detail of the salmon's north Atlantic range.

The sampling of salmon DNA from Scottish eastern and northern rivers for Rivers and Fisheries Trusts (RAFTS), funded by the AST, is providing important new data for fisheries managers, which should enable them to respond quickly to specific threats, thereby ensuring that stocks remain viable. This work is described in Dick Shelton's Research report (pages 12 and 13), and complements the SALSEA project.

The new data should provide implications and applications for people managing salmon stocks, and how they can be exploited sustainably along our coasts and in our rivers. It will also identify areas where pelagic trawlers fishing for other species may inadvertently catch post-smolts and maturing adults. An important issue for salmon conservation organisations is how governments of the Atlantic salmon countries keep pace with this new knowledge. Ideally, their policies should respond to the new science to enable us to manage our salmon stocks sensitively and effectively. In this context the application of the precautionary principle has never been more valid.

International Salmon Conference in Asturias

The report on the SALSEA (salmon at sea) project was a highlight of the 2008 North Atlantic Salmon Organisation's (NASCO) conference in Asturias, Spain. AST provides funding for the post of Jens Christian Holst, the project co-ordinator. This contribution is acknowledged by all parties and NGOs within NASCO, who also recognise the seminal influence of the AST's role in the early stages of the project. The work of Dick Shelton and Jens Christian Holst in testing specialised trawling gear and undertaking the first cruises in the northeast Atlantic, is particularly appreciated. With SALSEA as NASCO's biggest ongoing commitment, the next two years will also focus on habitat (2009) and aquaculture (2010), both of which are priority areas of salmon research and habitat restoration for AST.



Spring 2008: The Tay saw more MSW big salmon than in recent years.

Scottish matters

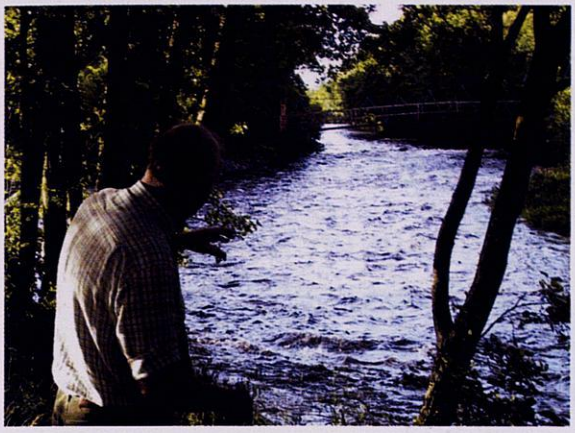
The report by Andrew Graham-Stewart (pages 32) on the early months of 2008 shows an increase in the numbers of multi-sea-winter (MSW) salmon returning to Scotland's rivers, especially the Tay. However, articles in this Journal about thin grilse and red vent syndrome still give cause for concern.

The Scottish Government's 2007 catch statistics confirm Tweed's status as the most prolific rod fishery in the North Atlantic basin (14,500 salmon and grilse). Spring salmon (pre 31st May) catches on the Dee continue to suggest that there is a growing abundance of valuable spring stock components in that river.

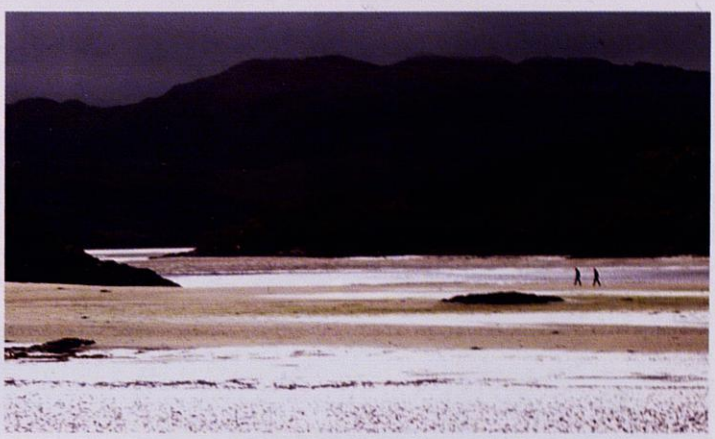
Smaller east coast rivers' catches suffered from low water in the autumn months of 2007, and the rivers of the west coast continue to show fragile MSW populations, although bigger rivers, especially the Lochy, are doing better. Despite rod catches holding up reasonably well, indicators continue to point to high mortality at sea.

Salmon Conservation

The recent Conservation of Salmon Scotland Conference (CASS) marked the end of the three-year EU funded Life Project. This concentrated on actions to improve salmon habitat in eight Special Area of Conservation (SACs) rivers (Spey, Tay, Tweed, Dee, South Esk, Oykel, Moriston and Moidart). The environment minister, Michael Russell MSP, in his opening address emphasised the importance of managing salmon "in the round", and not treating them simply as a single species with special status. He reminded delegates that salmon are integral to Scottish life, and part of the national psyche, to the extent that in Celtic culture the image of a salmon was a symbol of wisdom. The CASS project has been a success on account of its co-operative funding, working partnerships and practical actions. These range from restocking in severely depleted rivers to



Sea trout time: June on the South Esk.



Sea trout habitat: the tidal lagoon at Kentra, Argyll.

repairing eroding banks, erecting stock fencing, raising awareness of salmon as an environmental barometer, and extending the 'Salmon in the classroom' educational initiative. The minister concluded by acknowledging the position of salmon as "the figurehead for our high environmental standards" and we should be proud of the fact that "Scotland has remained a stronghold for Atlantic Salmon since the last ice age".

CASS conference

A report given to the CASS conference by the Argyll Fisheries Trust raised concern over the level of exploitation by mixed stocks nets, exacerbated by increased levels of inter-breeding with farmed fish escapees. Managers and biologists currently receive very limited baseline information from fish farms. This means that they operate in a data vacuum. It is therefore virtually impossible for them to make rational decisions based on conservation levels, which is the basic measure for achieving sustainability.

Sea trout

We now know from research done by Fisheries Research Services (FRS) at Shieldaig that the inshore feeding habits of sea trout can make them especially vulnerable to the debilitating and potentially fatal effects of sea louse infestation. More than is the case with salmon, the sea trout is our 'domestic' migratory salmonid. Like the salmon, the sea trout goes to sea to grow big and then returns to fresh water to breed. But there the similarities end because trout are polymorphic, 'local' in most cases, and extraordinarily adaptable, and we know very little about them.

An abundance of sea trout?

Not so long ago the great freshwater lochs of the Scottish west coast – among them Shiel, Maree, Na Shealagh, Stack, Eilt etc – were famous for their abundance of sea trout. The number of people in employment in the Poolewe/Gairloch area in the 1960's and up to the mid 1970's, who serviced the high value sea trout angling sector, was between 50 and 60. At least three local hotels, including Mrs Moody's famous Loch Maree Hotel, based their business on sea trout. The same was true of Loch Sheil and Loch Stack. Since the advent of freshwater and sea loch aquaculture installations, sea trout populations in all these places have collapsed, and with them the valuable sea trout angling tourism sector. It is perhaps time to research the question "what would healthy stocks of sea trout in these places contribute to the West Highland economy today?" West coast river and loch proprietors say that sea trout are their main concern, more so than salmon in some cases.

Researching sea trout

Separately from the aquaculture issue, sea trout abundance in the UK has diminished in recent years, and scientists want to know why. There are now research groups in the Moray Firth area, the Celtic sea trout project in the Irish sea, the Sea Trout Group of the Scottish Western Highlands and a group led by Dr Ronald Campbell of the Tweed Foundation researching east coast sea trout. The AST supports the Celtic project and another local one in Orkney (See Research report, pages 12 and 13).

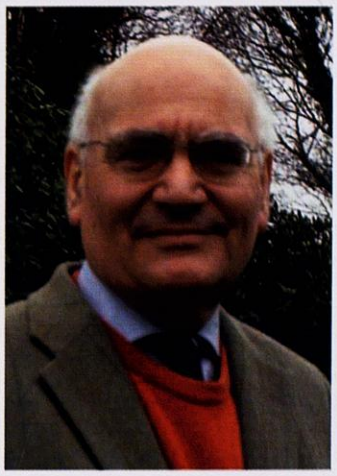
AST sea trout campaign

The AST has always included sea trout in its work, despite making no specific mention of the fish in its title. We now believe it is time to increase our efforts on behalf of these fish. During the autumn we will publish a Blue Book entitled 'Sea Trout Facts' edited by Andy Walker, formerly of FRS. We have also commissioned Robin Ade to design a poster showing the life cycle of sea trout. He will also create car and bumper stickers promoting the AST's sea trout campaign. We will also encourage new research projects, and we hope to hold a workshop for scientists involved in sea trout research at St Andrews University sometime in the next nine months.

The future of Scottish Freshwater Fisheries

The Scone Game Fair on the 4th, 5th and 6th of July will be the venue for Cabinet Secretary for the Environment, Richard Lochhead, to announce the way forward for freshwater fisheries management in Scotland. His announcement marks the end of the first phase of discussions of the Freshwater Fisheries Forum Steering Group in which the AST has participated. We expect Mr Lochhead to say that catchment-based management of all species of fish is the way forward and that Fishery Boards and their associated trusts will be responsible for an inclusive approach. The Scottish Government has already funded RAFTS to the tune of £400,000 to produce fishery implementation plans. With the only source of year-on-year funding coming from salmon and sea trout fishery proprietors, people in the sector hope that he will also indicate how funding all freshwater fisheries will be achieved.

Ireland, England and Wales



Ivor Llewelyn, Deputy Director, Ireland, England and Wales

Future Legislation

The Government has at last produced proposals for new salmon and freshwater fisheries legislation, eight years after the Warren committee reported. In April it published the draft Marine Bill, which contains nearly all the key changes to the law recommended in the Warren report, and it has been confirmed that the Bill will be included in the Government's legislative programme for the coming year. The draft Bill is currently out for consultation and is also undergoing pre-legislative scrutiny in Parliamentary committees; Defra hope that the final Bill will be ready to go before Parliament in November.

The draft Bill proposes two important changes to the Net Limitation Order (NLO) system; changes that the AST has long pressed for. At present, Ministers **have** to hold a public inquiry into a proposal to reduce the number of licences in a fishery if a single existing licence holder objects; this requirement will be removed, so that in future it will be up to Ministers to decide whether to hold an inquiry, as it is with byelaws. Furthermore, under the existing rules it is impossible to make an NLO that will cause someone who is dependent on fishing for their livelihood to lose their licence (and the Courts have given a generous interpretation to the concept of dependence on fishing). This, too, will be removed, and replaced by a new power (but not an obligation) for the Environment Agency to pay compensation to netsmen who are dependent on fishing and who lose their licence as the result of an NLO.

These are the first major changes to the NLO system since it was introduced in 1923, when the priority was to protect the rights of netsmen rather than conserve salmon and sea trout. They will make NLOs a more effective mechanism for reducing levels of exploitation in net fisheries.

The draft Bill gives the Environment Agency new powers to control historic installations, the term it uses to describe fixed nets and other devices that have been fished under a privileged status since the first Salmon Fishery Act in 1861. Although historic installations are subject to rules on close seasons and close times, they are otherwise outside the normal framework of fisheries regulations, which has made it impossible for the Agency to limit levels of exploitation by devices such as the Severn putchers. The draft Bill therefore gives the Agency the power to impose conditions on a licence to use a historic installation. This will enable it to, for example, limit the number of fish that may be taken or set conditions for the design and operation of an installation where this is necessary for conservation purposes. In addition, the Bill makes it clear that EA byelaws do apply to historic installations.

The draft Bill introduces a new concept of 'licensable means of fishing'; it will be an offence to take fish by any other means without specific authorisation from the Environment Agency (it of course remains an offence to use a licensable means of fishing without a licence). This closes a loophole identified in the Warren report. Under existing legislation the list of prohibited instruments is not comprehensive, and if someone uses other methods the only option is to prosecute them for fishing without a licence. It is unclear, however, if this can be used to deal with a method of fishing that cannot be licensed. These provisions remove this problem.

Licensable means of fishing will comprise:

- rod and line
- historic installations
- methods listed in secondary legislation. These will be generally less intensive methods that pose a lower risk to fish stocks; they are likely to include all salmon, sea trout and most eel nets that are currently licensed.

More intensive methods will require specific authorisation by the EA, as will fisheries undertaken for scientific or management purposes that would otherwise be illegal.

Another new power in the draft Bill will enable the Environment Agency to make emergency byelaws. In an emergency standard procedures are too slow to allow the Agency to take effective action. A prolonged drought, for example, can prevent salmon and sea trout entering a river, and make them vulnerable to a net fishery operating in the estuary. In such circumstances, the Warren report recommended that the Agency should be able to introduce emergency byelaws which would have immediate effect. This is provided for in the Bill, with appropriate safeguards. In particular, emergency byelaws will lapse automatically after 12 months unless extended by Ministers, and any extensions will be limited in total to a maximum of 6 months.

There is a number of other changes in the draft Bill. These include:

- a ban on the use of gaffs and tailers;
- enabling the Agency to set maximum as well as minimum sizes in byelaws for fish that may be retained. This will make it easier for the Agency to protect multi-sea-winter salmon and large sea trout;
- abolishing all statutory provisions for close seasons and close times. In future the Agency will have the power to set these using byelaws (there is no intention of abolishing close seasons for salmon and sea trout, although the Agency will have more flexibility to respond to changing run times).
- reforming the rules on introductions of live fish. Detailed new rules will be set out in subordinate legislation; the intention is to establish a comprehensive scheme to control all movements of fish, including to and from fish farms and reduce the risks to biodiversity from unauthorised introductions, of both native and alien species.

The Trust supports all these changes, and we will be working with other fisheries organisations to ensure that the Act that emerges from Parliament meets the needs of salmon and sea trout conservation.

Salmon Stocks in 2007

The report that CEFAS and the Environment Agency produce annually on the state of salmon stocks and fisheries in England and Wales shows:

- the total salmon catch in 2007 was 29,000 fish, of which 18,000 were caught by rods and 11, 000 by nets;
- catches by rods fell by 7% compared to 2006. However, this is probably attributable to poor angling conditions, with low flows in the spring and autumn and floods in the summer. The number of days fished was a little lower than in 2007 (which in turn was 21% lower than in 2006). Overall, the report states that over the last 9 years the annual rod catch has fluctuated between 11,500 and 23,500 fish without any evident trend;
- 54% of all rod caught fish were released;
- rod catches of multi-sea-winter salmon were 15% below the 5-year average, while grilse catches were close to the average, although there were marked regional variations;
- the declared net catch was 20% below the 2006 level, and about half the average for the previous five years. It was at the lowest level recorded, and contrasts with a net catch of 51,000 as recently as 2000.

Stock levels on individual rivers are assessed by the Environment Agency against conservation limits, which define the minimum spawning stock size needed to ensure the conservation of salmon stocks; they therefore set thresholds below which the number of spawning fish should not fall. Compliance with conservation limits is assessed using all available data, including trends in egg deposition. The number of spawners was above the conservation limit on 48% of rivers in 2007. However, the Environment Agency sets a higher management objective, which is that rivers should have a high (more than 95%) probability of meeting their conservation limits in 4 years out of 5. Only 10 rivers met this objective.

IRELAND AND NORTHERN IRELAND

Irish Salmon Stocks in 2007

The figures now available on catches in 2007 confirm the dramatic effect of closing the drift net fishery. The total catch fell from around 121,000 fish in 2006 to some 44,000. The rod catch was 33,000, including 13,000 released, and the net catch only 11,000.

These figures are not easily comparable with those from previous years because of the very significant reduction in fishing effort. The total number of net licences fell from 1535 in 2006 to 435, and because these could only be used in estuaries and rivers which were identified as having an exploitable surplus, and so were open for fishing, only 158 licences were actually used. Similarly, angling was permitted on only 49 of around 150 salmon rivers in Ireland and on 6 of these on a catch and release basis only. All other rivers were closed, either because spawning stocks were estimated to be below conservation levels or, in the case of small rivers, because no reliable data on stock levels were available. Despite these restrictions, the overall rod catch was only 13% below that of the previous year. There can be no doubt that the overall effect of all the measures taken, including increased catch and release in the rivers open to angling, will have been a significant increase in the the number of salmon surviving to spawn in Irish rivers.

For 2008 the number of rivers open for angling is being increased to 74, including 21 where catch and release will be compulsory.

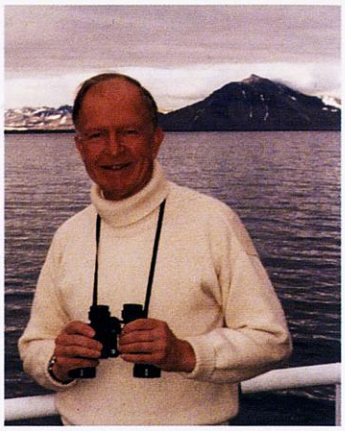
Northern Ireland Salmon Stocks in 2007

The total salmon catch in 2007 was 10,300 fish (this comprises all salmon caught in the Fisheries Conservancy Board (FCB) area and 50% of the fish caught in the cross-border Loughs Agency area).
The provisional rod catch was 4,900 fish, slightly above the 2006 final figure of 4,000. Net catches, at 5400 fish, were 77% below the average for the previous 10 years and 69% below the average for the previous 5 years.

The fall in net catches reflected the reduction in the number of licensed nets in recent years. In particular, as a result of the compulsory buy-out of drift nets in the coastal area seaward of Lough Foyle in 2007, the total number of salmon net licences fell from 162 in 2006 to 34 in 2007.

The impact of the removal of drift nets around the Irish coast was shown by the dramatic reduction in the exploitation rate of wild river Bush 1 SW salmon in Irish homewater fisheries. This was 5.6 in 2007, down from 28.1% in 2006 and from the average for the previous 10 years of 45.3%.

Research



Dr Richard Shelton, Research Director

Research Priorities

Despite the virtual suspension of high sea fishing for salmon and sharp reductions in coastal and net fisheries in the home waters of the British Isles, the numbers of salmon returning to support fishing in our rivers and to found the next generation are much lower than they were in the 1960s and early 1970s. Accompanying this decline in abundance has been a marked reduction in the proportion of multi-sea-winter fish in our rivers. Changes in the relative representation of fast and slow maturing populations in the returning stocks may play some part in this unwelcome change in the age and size structure of the fish available to us as may environmentally driven increases in the rate at which the salmon are triggered to mature. However, it would seem that the primary reason for the proportional decrease in older sea age fish is increased marine mortality which inevitably impacts hardest on the fish subjected to it longest, namely the multi-sea-winter salmon.
The recently published results of analysing the post-smolt growth patterns of salmon returning to the River Drammen in Norway over the period, 1983-2003, reveal that reductions in rates of growth during the fourth and fifth months at sea were strongly associated with subsequent reductions in the abundance of both one and two sea winter fish. The fourth and fifth months after the young salmon leave the river cover the period when the fish are switching from a diet dominated by planktonic crustaceans to one in which small fish assume increasing importance. It seems likely that shortages of this critical dietary component slowed the growth rate of the salmon at a time when it would normally have been at a maximum. Thus the fish were constrained to remain small for longer and therefore vulnerable to a wider range of potential predators. Exactly what lay behind the shortage of forage fish for the salmon is unclear. It appears to be a symptom of much more broadly based changes in the biodiversity of the north east Atlantic of which the growth and survival dynamics of the salmon are an especially sensitive indicator. That is why it is so important for us to establish the position of salmon in the changing ecosystem of the north Atlantic.

Gaining a working understanding of the lives of salmon at sea and of the factors that affect their survival there are currently the most important research priorities for the Atlantic Salmon Trust. Closely allied with these priorities is the need to compile an inventory of the genetic labels carried by populations representative of our main salmon-producing regions so that fish sampled at sea can be assigned to an area of origin. The Trust is also keen to investigate the scope for reducing losses to predators and to promote the better management of in-river and estuarine habitats so that, at a time of poor marine survival, at least the starting number of sea entrants can be maximised. In this context, we must not forget that the problems created by the intensive culture of Atlantic salmon have not gone away. Despite the recent upturn in the abundance of wild salmon in the west of Scotland, which may be ascribed to the welcome closure of the Irish drift net fishery, numbers are low and the abundance and age structure of many local sea trout populations still reflect the dire effects of infestation by sea lice. Furthermore, the all too frequent releases of large numbers of farmed strain fish, maladapted to life in the wild, from both freshwater and coastal installations continue to be a serious cause for concern. Getting to grips with the problems salmon and sea trout face at sea is an expensive business so it is vital that the increasing numbers of studies being pursued in this area are not being undertaken in ignorance of one another but are fully co-ordinated and applied in a practical manner. That is the purpose of the so-called SALSEA programme (see page 14 in the Journal for an overall description), administered by the North Atlantic Salmon Conservation Organisation, a body which the Atlantic Salmon Trust helped to found. One of the most important aspects of practical co-ordination is linking work at sea to the gathering body of genetic labelling data currently being collected in rivers of origin. In the north east Atlantic area, this task (known as the SALSEA-Merge Programme) is in the capable hands of my former shipmate, Dr. Jens Christian Holst, now on secondment from the Norwegian Institute for Marine Research in Bergen. The full costs of his secondment (£50,000 p.a.for 3 years) are being borne by the Atlantic Salmon Trust.

Brief summary of 2008/09 HSAP approved projects

Stable Isotope Analysis of Salmon Otoliths and Scales – £4,530 p.a. for 3 years

Recent work has shown that the representation of certain stable (non-radioactive) metal isotopes in the hard parts of returning salmon can be used to reconstruct a record of the temperature conditions and feeding opportunities a returning salmon has encountered during its life at sea. This highly original project will be undertaken at the University of St.

Andrews by Miss Nora Hanson under the supervision of Professor Chris Todd.

Genetic Sampling and Analysis of Scottish Salmon Populations – £15,000 in first year
The single greatest gap in the acquisition of genetic labelling data is in material from representative rivers from eastern and northern Scotland. This project is designed to plug that gap and will be administered by Mr. Callum Sinclair, Director of RAFTS and undertaken by RAFTS scientists in collaboration with Dr. Eric Verspoor of the FRS Freshwater Laboratory.

Distribution of Atlantic Salmon in the Strontian River – £1,000
The Strontian River is one of the most severely depleted systems on the west coast of Scotland. This work is designed to assess its current status and in the hope that the recent closure of the Irish drift net fishery and the better management of intensive aquaculture will assist its recovery. The work will be undertaken by the Lochaber Fisheries Trust.

River Exe Salmon Project – £3,000 p.a. for 3 years
The salmon resources of the River Exe are depleted but have the potential for recovery. This work, which will be undertaken by Dr. Dylan Bright and Mr. Toby Russell of the West Country Rivers Trust, will use the latest genetic techniques to investigate the population structure of the salmon stock using the river. This information will be used to guide future management.

Upper Wye and Irfon Liming Project – £1,000
Surface water acidification is a limiting factor for salmon production in these systems. Liming offers respite but it is not clear how effective it is in the longer term. This project, under the management of Mr. Stephen Marsh-Smith, seeks to find out.

Investigation of Smolting Chacteristics in Sea Trout Populations in Orkney – £1,000
This work, which is being undertaken largely at his own expense by Mr. Malcolm Thomson and with practical advice from the Atlantic Salmon Trust's Biologist, Mr. John Webb, is designed to improve understanding of the freshwater basis for the unique coastal fly fishery for sea trout in the Orkney Islands.

Comparisons of the Abundance of Juvenile Salmonids in Fenced, Unfenced, Shaded and Unshaded Sections of Rain-fed Streams – £7,750
This project, the early results of which were reported in last year's joint conference (with the Game Conservancy and Conservation Trust) on the management of salmon and trout habitats, seeks to assess the value of applying a range of management actions to a southern system. The work is being undertaken by Dr. Dylan Roberts of GWCT.

Centre for Salmonid Research, University of Southampton – £1,000
The establishment of this unit was an important practical outcome of last year's salmonid habitat management conference. This small award has been given to help pump prime the practical work of this new Centre in southern England.

Workshop on Hydromorphological Conditions and Links to Ecology – £2,000
The amount and dynamics of flow are critical arbiters of the salmonid producing capacity of rivers. Professor Chris Soulsby of the University of Aberdeen is an authority in this field and will chair this international workshop which the Atlantic Salmon Trust is glad to sponsor.

SALSEA Progress Report

Martin Windsor, Secretary, NASCO

Investigation of Smolting

It is time to bring you up to date with the SALSEA Programme. There is a lot of good news!

First, the funding from the European Commission's Seventh Research Framework Programme for the SALSEA-Merge project has been confirmed. This means that the North-East Atlantic marine surveys in 2008 and 2009 will be funded to the tune of Euro3.5 million. The matching funding brings this total to Euro5.5 million. The twenty partners in the consortium made a huge effort to put the application together and it scored very highly. The project started officially on 1 April 2008 and the first cruise will depart on 16 May from Killybegs in Ireland. It will be followed by cruises from the Faroe Islands and then from Norway. One of our NGOs, the Atlantic Salmon Trust, is funding a scientific coordinator for this complex project He has now been appointed and is Dr Jens Christian Holst from Norway who actually pioneered the trawl gear for catching salmon at sea. He will work from the Institute of Marine Research in Bergen, Norway. The AST has generously committed £50,000 in each of the next three years to this vitally important post.

Second, we have been successful in bringing the private sector on board in the form of the TOTAL Foundation from France. They funded the recent genetics workshop in Paris where geneticists from around the North Atlantic were charged with developing an approach to allow salmon caught at sea to be identified to region or river of origin. Representatives from the TOTAL Foundation visited NASCO Headquarters in January and committed to supporting SALSEA-Merge with Euro100,000 in both 2008 and 2009 which will be used to support the Faroese research cruises. Apart from the valuable contributions from our NGO colleagues this is the first private sector funding that we obtained. The TOTAL Foundation believes that SALSEA fits well with their focus on the marine environment and biodiversity and it is thanks to another of our NGOs, led by Patrick Martin, that we were introduced to TOTAL.

Third, the expanded sampling programme funded by the Board which will improve understanding of the marine life of salmon stocks at West Greenland was in place for the 2007 fishery. The results from this sampling should become available in the coming months.

Fourth, the Canadian government has announced that it will provide 23 days of research vessel time and scientific expertise to conduct marine surveys in the Northwest Atlantic in 2008. The value of this contribution is CAN$0.8 million. The US National Marine Fisheries Service is cooperating in this programme. Canada also contributed Can$50,000 to the Board in 2007.

Fifth, also in Canada, the Atlantic Salmon Federation is expanding its sonic smolt tracking work further into the Atlantic. In 2006 and 2007 receiver arrays were in place across the Strait of Belle Isle and the Federation sees potential for further development of these surveys through the Ocean Tracking Network.

We can all be proud of the fact that NASCO, in creating the Board, established the conditions in which the SALSEA Programme could be developed through international cooperation. This formulation of a large and complex research programme was essential in receiving the support we have received from the private sector, from NGOs and NASCO's Parties. All involved now face a major challenge in delivering a high quality programme which helps all of us to better understand what is happening to salmon at sea and improve the conservation and management of the stocks.

We faced a daunting challenge in creating and funding such an ambitious and innovative research programme but we can all take real pleasure that SALSEA is a reality in 2008.

Many people have been and will be involved in SALSEA and its promotion. However, we all recognise the huge efforts in all of this made by our President Ken Whelan who fittingly has taken over the Chairmanship of the IASRB. Our Mr SALSEA in North America, Bud Bird, has also tirelessly promoted the programme. We are very grateful to them and to all those who have worked very hard to put the programme together. There will be further reports made to the Board and to Council in June.

The natural re-colonisation of a tributary inaccessible

to salmon for 127 years: genetic analysis tells the story.

Anna Finnegan and Jamie Stevens, School of Biosciences, University of Exeter

As numbers of Atlantic salmon continue to decline we are faced with the question: *why?* And, perhaps more important, *what can be done about it?* On the River Tweed in Scotland, the Tweed Foundation and the University of Exeter have recently found that the simplest solutions are perhaps the most effective.

The problem: Decline of the salmon

One of the principal contributing factors to the decline of Atlantic salmon in fresh water is the loss of suitable habitat within rivers due to the installation of barriers to migration, such as dams and weirs. Atlantic salmon spend a large proportion of their life in fresh water; young salmon will spend on average 2-3 years in their home rivers before undertaking long marine migrations to productive feeding grounds; mature adults then make the return migration back to their home waters to reproduce.

Where an obstruction is installed without a fish pass, this effectively renders potential habitat upstream of the obstruction inaccessible to migratory salmon. The inevitable knock-on effect of this to fish returns can be severe. To a greater or lesser degree, this situation is not uncommon for many salmon rivers, including the River Tweed, the second largest river in Scotland.

In 1821 one of the major northern tributaries of the River Tweed, the Gala Water, was closed to migrating fish when the Skinworks weir (known locally as a 'cauld') was installed, reducing available spawning and juvenile habitat by approximately 10% within the catchment. Following the destruction of the weir in the 1948 floods, it was re-built with a fish pass (Figure 1) and the 40km Gala Water was effectively reopened to migrating salmon. Hence, after a period of 127 years, the previously inaccessible tributary has now been re-opened to salmon for 60 years. Contrary to many managerial operations on rivers elsewhere, no known supplementation programmes have taken place; rather, the natural re-colonisation of the river has been encouraged and the Gala Water now supports a healthy salmon run. A collaborative project between the Tweed Foundation and the University of Exeter set out to determine where the re-colonising salmon came from, and if the Gala Water population has reached a stable, self-sustaining state in the 60 years it has been re-opened.

The Science: Population structuring

One fascinating aspect of the life of Atlantic salmon is their ability to home back to the river, and even the tributary, where they themselves were spawned. It is this phenomenon that helps create discrete populations within river catchments. Since these populations do not interbreed to any great degree, each population has evolved a unique genetic identity, or genetic fingerprint. By generating genetic fingerprints for all populations that are likely sources of the re-colonising fish, it is possible to assess the re-colonised population, i.e. the Gala Water, and ask *"from which population does this Gala Water fish most likely originate?"* This process allows us to determine whether the new population was re-colonised from

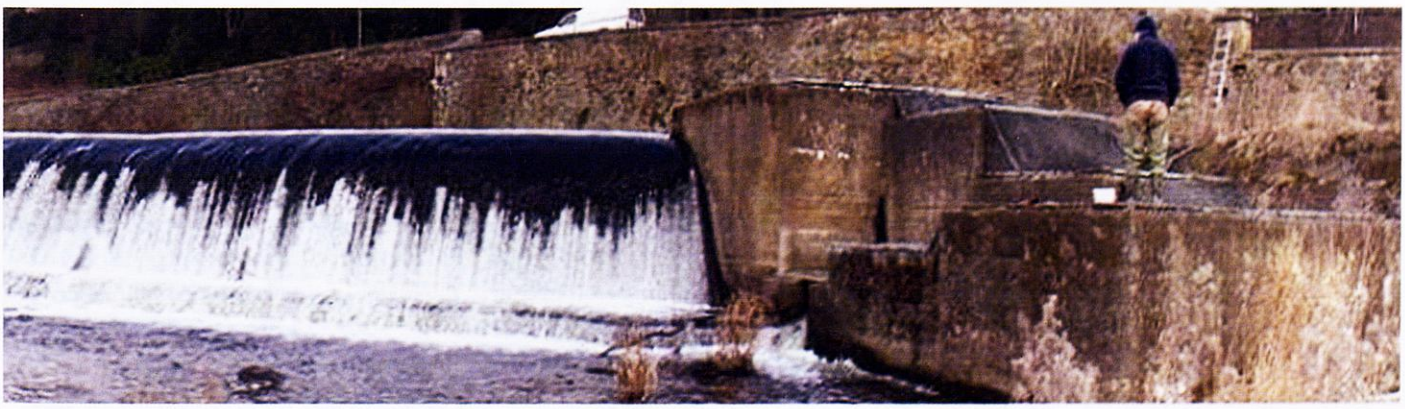


Figure 1. Skinworks Cauld. Built 1821, the Skinworks weir prevented salmon migrating upstream to suitable habitat. In 1948 the fish pass, visible in the right of the picture, was installed allowing upstream access to salmon once again.

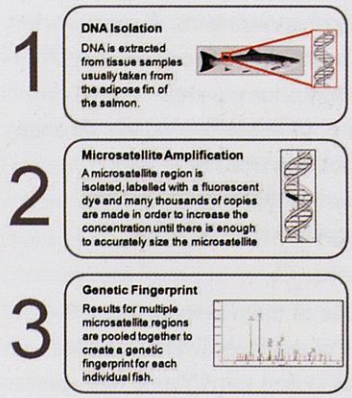
one or multiple populations. Furthermore, by assessing the Gala Water population over time we can assess the stability of the population.

The Methods: Genetic fingerprinting

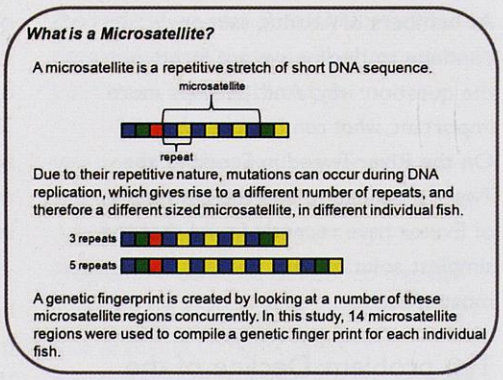
Consequently, genetic fingerprinting techniques, akin to those used in forensic sciences (see Box 1 and Box 2), were used to generate genetic profiles for the main tributaries of the Tweed catchment, alongside samples taken from the Gala Water in 1997, 2001 and 2003 (Figure 2). Individual Gala fish were then "assigned" to one of the main Tweed tributaries based on the relationships between their genetic fingerprints, *i.e.* a Gala salmon with a similar genetic fingerprint to the Ettrick population would be "assigned" to the Ettrick population, implying that this is where the fish, or its parents, are most likely to have originated.

The Findings: Nearest neighbours initiate re-colonisation

Based on these "assignment" methods, the Gala Water appears to have been largely re-colonised by individuals straying from the most proximate neighbouring tributaries of the Caddon, Ettrick, Middle Tweed and Leader Water, with the most distant tributaries contributing the smallest amounts (Figure 3). However, in a sister project to this being undertaken at Exeter, relationships between populations from across the Tweed catchment are being explored using the same genetic fingerprinting techniques as used in this study. Preliminary findings from this sister



Box 1. Genetic fingerprinting explained



Box 2. What is a microsatellite

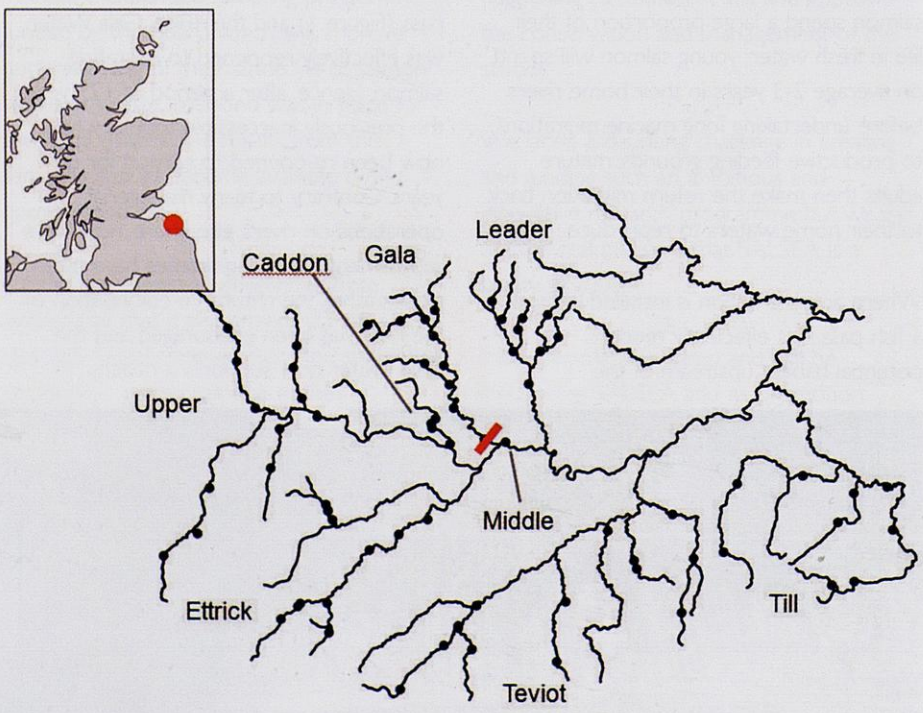


Figure 2. Tributaries of the River Tweed, Scotland. Sampling locations indicated by black circles; Skinworks Cauld indicated by red line.

project reveal that, in spite of the dendritic nature of the Tweed catchment, populations in different tributaries have relatively similar genetic profiles and are quite closely related. Hence, due to the apparently low level of natural genetic diversification within the Tweed catchment, it has proven difficult to discriminate reliably between populations in different tributaries of the catchment; against this backdrop, the discriminating power of the assignment analyses reported here have almost certainly been decreased. Nevertheless, this intuitive finding – linking re-colonisation to individuals straying from the most proximate neighbouring tributaries – is consistent with studies conducted in Finland, which assessed the re-colonisation of a whole river system and noted that, in the first instance, it was individuals straying from the nearest river that were initially involved in the re-colonisation process.

The Findings: Gala population is stable

Of perhaps greater importance though, using this genetic analysis, the Gala population was found to be stable over time. Significantly, there was little variation in the assignment of Gala fish in the three different years. Furthermore, when a genetic fingerprint for the whole Gala population was created, this was found to be significantly different from all of the other main tributaries, but no significant difference was observed within the Gala between the three years. This indicates that the Gala population may have reached a stable state over the 60 years since it has been re-opened, through entirely natural processes.

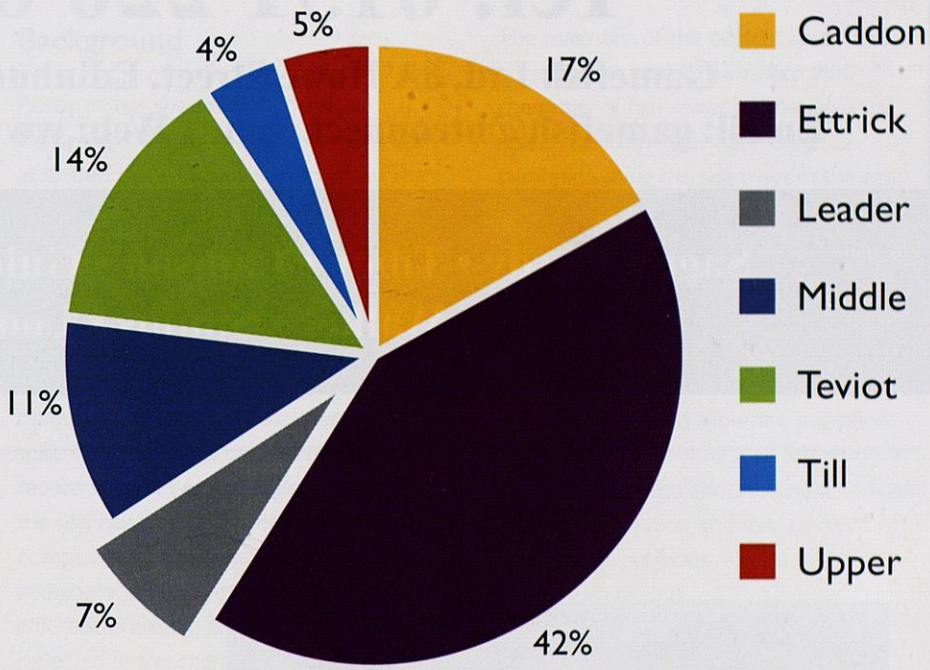


Figure 3. Assignment of Gala salmon to other Tweed tributaries.

Conclusions: Nature prevails

In an impatient world where the quick fix solution is almost always favoured over natural, but slower, restoration, the regeneration of the Gala Water delivers an important message: *nature will prevail if allowed to do so*. From across the world of fisheries biology, there is mounting evidence indicating the dangers of artificial stocking and supplementation programmes, even when locally sourced broodstock are used. Often these costly programmes run for decades, with variable success, which can rarely, if ever, be unequivocally attributed to the stocking or supplementation regimes employed. Yet here we have a situation where the enigmatic salmon has done what it does best: exploited a beautiful clear upland river, without the help, and in spite of the hindrance, offered by man.

Whilst levels of confidence in our preliminary findings remain to be enhanced by further research, particularly in relation to the source of the re-colonising fish and the relative amounts contributed from each neighbouring tributary due to the close genetic relationships between populations in the catchment, the established stability of the current Gala population is encouraging. Potentially, this may signify that the Gala population has reached a self-sustaining state, whereby maintenance of the salmon population in the Gala Water is no longer dependent on individuals straying from neighbouring populations. The relatively short time-frame over which this has occurred (less than 60 years), should act to encourage the use of this cost-effective management strategy in similar cases encountered on other rivers in the future.

Tracing the Geographical Origin of Sea Trout using Scale Chemistry

Alice Ramsay, Dr Ian McCarthy and Prof. Roger Hughes, Bangor University; Dr Nigel Milner, APEM Ltd.; Ian Davidson, Environment Agency

Understanding the origins, distribution and movements of salmonid fishes, such as salmon and sea trout in marine and freshwater environments is essential for effective conservation and management. At present, our knowledge of salmonid movement patterns is very limited and some key questions still need to be answered. For instance, where do they go to in the sea once they have migrated as smolts from the rivers in which they were spawned (natal rivers)? Do stocks from different catchments share the same feeding grounds at sea? Within a river catchment, which tributaries are important for producing smolts? Can we identify the tributaries of origin for adult sea trout returning to their natal river to spawn?

There is a number of techniques for tracking the movements of fish. These include physical tagging and tag recovery in fisheries or traps, and telemetric tracking. More recently, genetic methods have also become available. All of these methods have their place, but tend to be time consuming and expensive.

The AST is part funding a PhD project trialling techniques for tracing the origins and movements of sea trout based on chemical elements naturally present in their scales (so called chemical 'tags'). This method may reveal the geographical origins of individual fish. If this technique proves successful, it could provide a low cost method for identifying sea trout stocks and river of natal origin and for collecting information on sea trout movements in marine and freshwater habitats. The following article provides an outline of progress with the project so far.

Background

Research has shown that chemical elements in the aquatic environment are absorbed by fish scales as they grow. The outer edge of the scale represents the most recently deposited scale material, while the centre corresponds to material deposited in the earlier stages of development. The central area of the scale therefore corresponds to the scale material formed in the natal river. As the scale grows, it can provide a chronological record of the chemical elements to which the fish has been exposed. The chemical composition of the water in different geographical locations varies and, if the differences are big enough, these can be reflected in the chemistry of fish scales, which can be analysed in very fine detail across a scale.

The technique has been successfully used to identify different fish stocks and to reveal movement patterns of fish in marine habitats. A limited amount of work has also been carried out on salmonid scale chemistry in freshwater habitats. Scale chemistry has proven successful in distinguishing farmed from wild Atlantic salmon and also in tracking migration patterns of salmonids between marine and freshwater environments. It has even been possible to differentiate between juvenile salmonids caught in different tributaries within a river. While this technique is still in its infancy, the use of scale chemistry as a natural tag has many potential applications in salmonid ecology and offers a useful tool for improving the conservation and management of salmonid populations.

The main aim of the current research project, is to establish whether the chemistry of fish scales can be used to reveal the freshwater natal origin of salmonids, using the sea trout in the Irish Sea as a model. The Irish Sea presents a relatively contained system, which may be an important feeding ground for sea trout migrating from surrounding river catchments. Identifying the region or catchment of origin for salmonids caught in the Irish Sea would allow the migration patterns and inter-mixing of fish stocks at sea to be assessed and this could be useful in the conservation and management of salmonid populations.

The geographical resolution to which the natal origin of sea trout can be identified through scale chemistry analysis in the UK and Ireland is being examined through two projects carried out at different geographical scales.

Project 1

The first project aims to identify whether the natal origins of sea trout populations in the Irish Sea can be distinguished to the regional or river catchment level. With the help of the Environment Agency, Fisheries and Rivers Trusts, Fisheries Boards (Ireland), the Department of Agriculture Fisheries and Forestry (Isle of Man), river bailiffs and anglers, scale samples have been collected from sea trout smolts and adults in their natal river catchments. Scale samples have been obtained from rivers draining the coastal regions surrounding the Irish Sea - the Firth of Clyde, the Solway Firth, northwest England, Wales, the Isle of Man and east of Ireland (Figures 1 and 2).

River catchments in each of these regions provide important spawning grounds for sea trout.

Scale samples are routinely removed for scale ageing work, with minimal harm caused to the fish. Only a small number of scales are required for chemical analysis and these are removed from the side of the fish, just above the lateral line and slightly behind the dorsal fin (Figure 3).

The ability to use scale chemistry to identify the natal origins of fish depends on there being sufficient differences in water and corresponding scale chemistries between natal locations. A preliminary study was conducted on scales of four sea trout from each of three catchments bordering the Irish Sea: the River Avoca (Ireland), the Border Esk (on the border between Scotland and England), and the River Taff (South Wales). Chemical analysis of the central (juvenile growth) area of the scales was carried out at the Natural Environment Research Council research laboratory at Kingston University (Figure 4). Statistical analysis of data for seven chemical elements: Lithium,

Figure 1. Sea trout and brown trout caught in the River Ceiriog, a tributary of the River Dee.

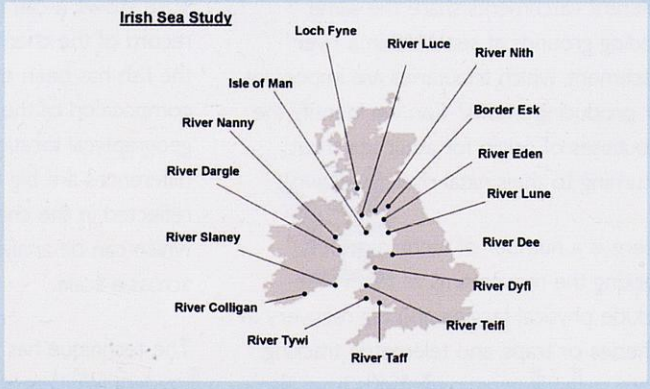


Figure 2. Location of river catchments from which adult sea trout scale samples have been collected.

Figure 3. Scale removal from a juvenile trout caught in the River Meloch, a tributary of the River Dee.

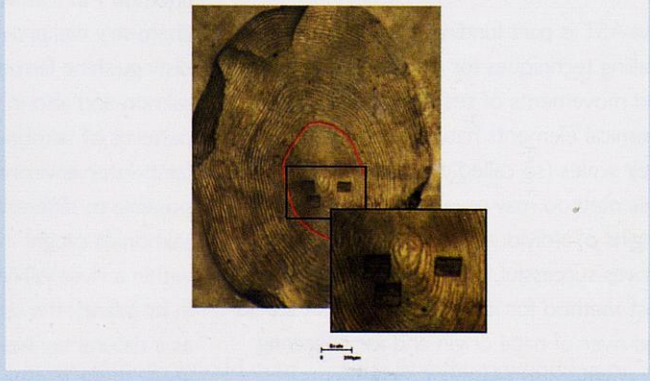


Figure 4. A scale from an adult sea trout from the River Taff catchment, South Wales. The area circled in red shows the scale material formed during juvenile growth in freshwater. The inset image shows the three sections of the scale removed for chemical analysis.

Magnesium, Aluminium, Manganese, Iron, Copper and Zinc, showed that scales from each of these three catchments had significantly different chemistries. The fish from these catchments could be correctly classified to their catchment of origin, based on the chemistry of their scales.

Although the preliminary study was based on a small number of scales, the results are promising. The remaining scale samples collected from over 300 sea trout from sixteen catchments draining into the Irish Sea (Figure 2) will need to be analysed to explore the robustness of this technique for identifying sea trout to a catchment or regional level.

Project 2

The second project will use the chemistry of scale samples to examine whether the natal origin of trout within a catchment in the UK can be determined. Scale chemistry has proven successful in describing the natal origin of fish in large-scale freshwater catchments in the United States. These studies have been conducted in watersheds that are much larger (i.e. >15,000 km2) than those found in the UK and Ireland (the average migratory salmonid catchment size in England & Wales is approximately 440 km2). Our research will complement work recently carried out on Atlantic salmon scale chemistry in Scotland.

The two locations selected for this study were the Rivers Dee and Conwy in North Wales. The Dee is the fourth largest salmonid catchment in England and Wales (approximately 1800 km2) with an annual run estimate of 10,000 adult sea trout (for the period 1991-2005), but is only lightly exploited with an average annual reported rod catch of 242 fish (1996-2006). The Conwy is a much smaller catchment (approximately 380 km2), but is a productive sea trout river with an average annual reported rod catch of 434 fish (1996-2006).

An initial examination of data provided by the Environment Agency and the British Geological Survey suggest that there is sufficient variation in geology and water chemistry within the Conwy and Dee catchments for differences in the scale chemistry of fish from different tributaries to be present. Scale samples have been collected from trout from widely spaced survey sites in each catchment. The scale samples were removed from individuals caught during electrofishing surveys between June and October 2007.

If these studies are successful, the methods employed could be applied to a UK-wide survey. Scale collection for analysis could easily be incorporated into a wider monitoring scheme within the existing framework of smolt and adult traps. If natal origin can be determined for areas within a catchment, it would provide a low cost method of gathering information on the relative contribution of these areas to smolt output. **If the catchment of origin can be determined from adult scale chemistry, this may have a particularly useful application for tracing the migratory patterns of salmonids caught in the marine environment and could provide insight into the inter-mixing of stocks at sea.**

Acknowledgements

Funding for the research has kindly been provided by the Atlantic Salmon Trust (AST) and the Natural Environment Research Council (NERC). Alice Ramsay's PhD research is supported by NERC and the Environment Agency (EA) as part of a NERC CASE PhD Studentship. We are also grateful to Dr Kym Jarvis and Ben Disch at Kingston University, for their technical advice. We would like to thank all individuals who have provided advice for the project to date and assisted in sourcing the scales required for the analysis. These have included staff from the Environment Agency, Fisheries and Rivers Trusts, Fisheries Boards (Ireland), the Department of Agriculture Fisheries and Forestry (Isle of Man), river bailiffs, anglers and landowners. We are also grateful to Andy Marriott and Dr Peter Walker, from Bangor University, who assisted with fieldwork.

Floods, hail and traps:

a night of counting salmon smolts at the East Stoke Salmon Research Facility

Dr Anton Ibbotson, Centre for Ecology and Hydrology (Wallingford)

It's the end of April as I write this, immediately after the first significant rain this month. Two of us are about to spend a night working in the East Stoke fluvarium counting and trapping Atlantic salmon smolts. The river is rising quickly and we are here in anticipation of a wall of salmon smolts riding the coming flood to the estuary of the River Frome in Dorset.

As I sit here in the failing light of the late evening, my thoughts turn to the years of work by a small but dedicated team of fishery scientists that have culminated in this night and its expectant catch. Studying fish populations in a river is an incremental process. As my PhD supervisor once put it 'It's like having a blindfold on and being presented with an elephant. Then you are allowed to touch a bit of it and then another until you can guess what it is'. When I look back over the years it's taken a long time to build and develop the facilities that we now have for monitoring salmon on this small chalk river system.

For many years the Centre for Ecology and Hydrology (CEH) and its predecessors counted adult salmonid fish as they returned to the River Frome. This work provided valuable data on timing of migration in respect to flows and temperatures together with exploitation rates and an annual count of salmonid fish. Indeed this counter provides some of the best evidence for the distinct reduction in population size that occurred in the early 1990s in English south coast rivers. However when that decline came it was recognised that the adult counter on its own could not provide any information on its cause. Was it lower freshwater smolt production or increased marine mortality? **We didn't know, we had only been feeling one part of the elephant.**

Back in the fluvarium, its dark now, I'm expecting the fish to start passing through the automatic smolt counters. I look at the counter on one of the tubes, it reads 8 and as I lift my eyes to the video recorder I just glimpse the silver shape of a smolt drifting downstream in the glass sided channel. It was nearly 10 years ago that the first prototype automatic smolt counter was trialled on the Frome. Its aim was to produce a 'hands-off' estimate of the numbers of smolts migrating from the river. Why 'hands-off'? Because there was a growing body of evidence that suggested that smolts were more delicate than the parr stages, probably due to the stresses of undergoing such a massive physiological change. The technology for diverting and counting smolts with acoustic bubble screens and resistivity counters was there, but 3 prototypes later, we were still unable to produce an accurate estimate of the number of smolts leaving the river in every year. The problems ranged from, breakage of the smolt counter side walls, inundation during floods, the positioning of the counter in the river, to the optimum size of the counting tubes themselves. Some of these problems were of a technical nature and these were quickly resolved, but the greatest problems of all were flood events. And unfortunately this is when most of the smolts choose to migrate. This meant that

Rotary Screw Trap being operated on the River Frome

we needed to add another level to our monitoring if we were to achieve our aim of accuracy in our estimates.

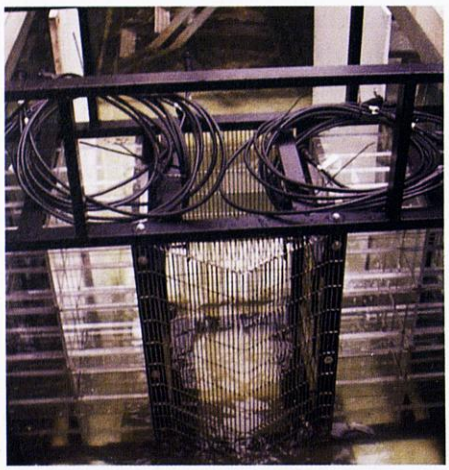
Sometimes I'm asked 'What do you mean by accurate. My answer has been that we should strive to estimate the population at key life-stages to within 10% of its true size. After all, inaccurate measures of population size have a direct effect on the accuracy of mortality estimates. **It's not possible to distinguish real changes in adult return rates when estimation error is larger** than the annual changes in the return rates themselves.

Time is passing, now its midnight, half-way through the night. Two of us stagger through the dark with head torches to the holding box at the back of the rotary screw trap. With the water rising the numbers of fish in the trap have steadily increased each half-hour emptying. Its started to hail now and the small icy particles bounce noisily off the hood of my coat. Peering through the now-coloured water we can see 10-15 torpedo shapes sitting in the trap. Carefully, we net them out and bring them back to the fluvarium in a holding bin. Each fish is checked to see if it contains a passive integrated transponder (PIT) tag. One does and we record its number, DC00380AD4 from the hand held reader. After returning the fish to the water, I have some time left before we are due to empty the trap again, so I walk down the steps of the fluvarium again and check the logs on the automatic PIT tag reader that sits behind the smolt counter. There it is, DC00380AD4, now I know it would have been detected passing downstream on the way out to sea even without the trap. Tomorrow, I'll check the PIT tag reader downstream to make sure it's been detected there as well.

In all we now have 7 separate PIT tag readers positioned in the River Frome catchment. Three are placed on the Tadnoll Brook, a tributary which lost its salmon population in the late 1980's. Here we are able to monitor the population we re-introduced in 2006 and assess the efficacy of rearing eggs in incubation boxes to produce fry for re-introduction to tributaries that have lost salmon populations.

The remainder of the PIT tag readers are associated with the smolt counters and the adult counter. They are positioned so that they give full river coverage at East Stoke. That means that a salmon carrying a PIT tag has to pass a PIT tag reader when leaving the river as a smolt and when returning as an adult. The installation of this apparatus has been the most recent development and has enabled us to produce the accurate estimates of population size at various life-stages that we have been so keen to achieve. At the start, we did not know how many fish we would need to PIT tag to obtain accurate estimates, so in 2002 we tagged a mere 2000 salmon parr throughout the Frome catchment. We tagged them in autumn as they seemed more robust during the parr stage and the effects of tagging at this stage seemed to be so small that it was undetectable. For three years we maintained the tagging effort at about the same level. The smolt and adult returns, recaptures and detections from these initial tagging events showed us that we had vastly underestimated the number of fish that needed to be tagged each year, if we were to achieve our goal. Statistically, we need to tag around 11,000 fish each year to generate sufficient detections of fish moving in and out of the river to provide accurate smolt counts. And that is exactly what we have done since 2005. It takes four weeks work, seven long days each week, for our small team made up of CEH and CEFAS staff.

Now the fish migrating down the river can be counted in the smolt counter. The PIT tag detector in the back of this detects PIT tagged fish and enables us estimate the proportion of salmon tagged in the river; then using the tag detections on all the PIT tag readers we can make an accurate estimate of the number of smolts passing East Stoke on the way to the sea. Of course that is not the end, we also detect the adults when they return to the river to spawn. The individually numbered tags allow us to look back at our records to get a history of each returning fish as well as those that do not return. Its rather like sending Julie, Jack, Jennifer, Boris to sea and when only Jack and Jennifer come back we can begin to ask why. **These individual records allow us to learn so much more quickly than if we simply had bulk counts** of fish. It's a very satisfying feeling to see a



Individual tubes of the automatic smolt counter being placed in situ.

fish that was tagged at 10 cm long in 2002 return to the river to spawn in 2007, presumably after a journey that has taken it far north of the British Isles into arctic waters.

As the night wears on the numbers of fish migrating have increased, but now as morning approaches the numbers start to decline again. I note a PIT tagged fish DC003764AC in one emptying of the trap. I have a bit more time now so I quickly leap down the stairs to my portable computer. Here I have a database with every fish we have tagged listed. It gives information on where and when it was tagged as well as its size. I quickly type the number in and find it came from the Cerne another tributary of the Frome. This fish was tagged in a site which is monitored by one of my PhD students. She is trying to gain an understanding of how different family groups of salmon parr make use of the river habitats. She will be pleased we have detected another one of her fish migrating out to sea.

At last, dawn is beginning to break. It's now 5.30 and the two of us are staring into the empty holding box of the rotary screw trap. The fish have stopped running, even though the flood rages on. They seem to be following the normal pattern of avoiding migration at dawn and dusk periods, even though the water is very coloured. I look back at the trap and wonder if it will catch enough tagged salmon parr for this particular experiment we are running with CEFAS to work. CEH and CEFAS have a very fruitful collaboration on the River Frome. Readers may wonder why we are using a trap when I have emphasised the importance of our 'hands-off' system for counting smolts. The answer is that this is an excellent example of the type of experiment that can be run in the Frome with all its infra-structure. Ordinarily, we do not need to run the trap as we can estimate smolt abundance without it, but the infra-structure in the river is perfectly suited to run an almost inexhaustible number of studies and experiments on a natural, wild salmon population. In this particular case we are trying to assess the effect that trapping smolts has on their survival to adult stage. With the PIT tag detectors giving complete coverage of the river we can compare the numbers of PIT tagged and trapped fish returning to the river, with the numbers of PIT tagged and untrapped fish, giving an accurate estimate of the effects of running 'hands-on' smolt counting systems.

What of the salmon themselves? Well I'm pleased to report that over the last 3 years the activities of re-introduction to tributaries that have lost populations and the instigation of a gravel washing programme have resulted in a significant increase in the numbers of parr found in the river during the autumn from 66000 (95% CL 60000-73000) in 2005 to 105000 (95% CL 98000-114000) in 2006. This has led directly to an increase in the numbers of 1 year old smolts in 2007 at 13,900 in comparison to 9400 in 2006. It looks as though 2008 will produce a similar number of smolts to 2007. Of course, 3 years of counts on their own do not provide many answers, but since all our fish are individually tagged, we can tell where each smolt comes from, which were from re-introductions, whether more are coming from gravel washed sites, are some river sites or tributaries producing more smolts than others, what are the characteristics of these sites, what are the environmental effects on the production of precocious parr, do these contribute to the adult population, how will the installation of a major adult fish pass affect the population, how does smolt size and the time of migration affect return rates and age at return from the sea, what general effects of climate change should we expect. **The potential for conducting studies in the Frome seems to be inexhaustable**, but now I'm being relieved by the day shift and the answers to these questions will wait for another article. I'm going home for breakfast.

Red Vent Syndrome (RVS) in Wild Atlantic Salmon:

An update on research and monitoring in Scotland

P. Noguera, D.W. Bruno, C.C. Pert (FRS Marine Laboratory, Aberdeen) and J. Webb (Atlantic Salmon Trust)

Background

Reports of wild Atlantic salmon, *Salmo salar*, returning to Scottish rivers with inflamed, swollen bleeding vents were received in early June 2007. By the end of July over 50 rivers had reported similar observations, with the condition apparently restricted to adult male and female one sea-winter fish (i.e. grilse) and particularly prevalent among 'fresh run' fish. A smaller number of two sea-winter salmon and one case of sea trout *S. trutta*, were also reported but not farmed salmon. Apart from the affected vents, all fish appeared to be in good physical condition.

Soon after receiving the initial reports, staff of the Aquaculture and Aquatic Animal Health (AAAH) programme at Fisheries Research Services (FRS) in Aberdeen, initiated an investigation to establish the cause and extent of the problem. Samples were taken from fish returning to the coast at river entry, rod-caught fish that were donated by anglers and fish approaching full maturity from routine health screening of wild brood stock.

External signs

Affected fish showed different degrees of skin damage around the vent, from mild swelling and reddening to severe protrusion, scale loss, erosion and haemorrhage. The following series of photographs show the different severity levels and the progression of the condition observed on fresh run salmon following return to the coast and river entry (July-August).

Mildly affected fish might show a generalized reddening around the vent and/or a number of small red spots (petechial haemorrhage) with little swelling of the area. Figure 1.

Moderately affected fish show an advanced stage of the 'mild' lesion and additionally exhibited loss of integrity of the skin, seen as breaches of the epidermal layer and scale loss. Figure 2.

Severely affected fish show a pronounced swelling with protrusion of the vent and bleeding under gentle pressure. A severe erosion of the skin can be observed in an area of ~2-3cm in diameter. Figure 3.

Observations at different times from a few weeks after fish entered fresh water and throughout the late winter months, showed different stages of recovery.

Local reddening around the vent of a fully mature female salmon prior to spawning.

Figure 1.

Figure 2.

Figure 3.

Note developing scar tissue and some localized scale loss, but no erosion or deep swelling are evident. Figure 4.

After 6-8 months in fresh water, the vent area of a spawned female fish (i.e. a kelt) is raised and slightly protruding, but no reddening is evident and full recovery of the skin can be observed. Figure 5.

Investigation into the cause

All of the fish examined in 2007 showed a good general health status. Fish with signs of RVS were classified according to the criteria detailed above and selected tissue samples were taken and screened for known fish pathogens. The results from a suite of bacteriological, virological and molecular tests were all negative. Moreover, all internal organs and tissues other than the vent, were in a normal healthy condition. However, round worms were found in the body cavity and particularly in the vent region. The round worm (nematode) parasite was identified as a larval stage of the nematode *Anisakis simplex* complex. Figure 6.

Anisakis larvae were consistently found in the vent area of all the fish examined. They were present in high numbers, burrowed in the dermal, sub-dermal and muscle tissues. Histological assessment showed epidermal erosion, scale loss, moderate dermatitis and some cases of parasite encapsulation. Haemorrhage and an inflammatory response dominated by granular cells were also observed. The numbers of parasites in a piece of vent tissue approximately 2.5 cm^3 could be as high as 100 individuals. This very high number of

Figure 4.

Figure 5.

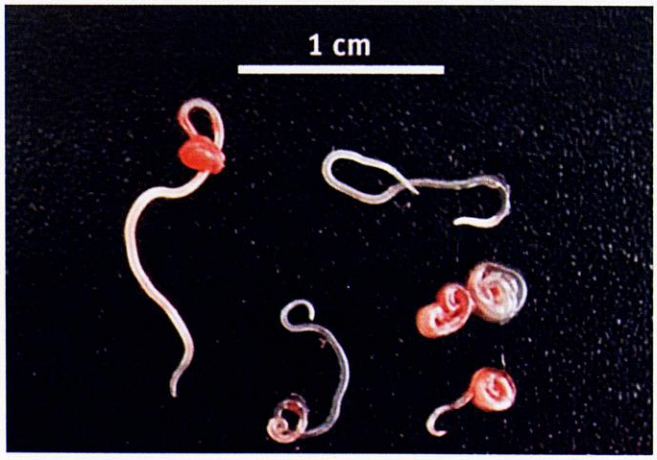


Figure 6.

The image above shows a stained histological section of approximately 4.5cm of a vent. Note the dark red areas which belong to sectioned parasites, mostly transversally and some longitudinally. As parasites are coiled, only a small portion is obvious in a 3 micron section.

larvae found within a discrete region and the associated reaction of the fish tissues, was correlated with the externally observed swollen, inflamed vents.

The size of the parasite allows it to be observed with the naked eye. It is usually coiled – resembling a watch spring that measures a few millimetres in diameter but is up to 20mm long when uncoiled. They are normally seen encapsulated in a protective coat around the wall or external surfaces of the gut, pyloric caeca, liver and fat tissue in the body cavity, where a mild to moderate adhesion reaction can also be observed.

Ongoing and future investigations

The monitoring will continue during 2008 and the main effort will focus on estimating the prevalence of the condition, that is, the assessment of the proportion of fish that are affected among both seasonal and sea age components. Assessments are being undertaken at a range of selected sites with the assistance of the Association of Salmon Fishery Boards, fishery owners and biologists. In addition, some laboratory based work is also ongoing involving the identification of the parasite at the sub-species level.

Discussion

Anisakis simplex is a commonly occurring parasite found in virtually all commercially important fish species in the east North Atlantic. The impact of the parasite is not fully known, but as a chronic infection, *Anisakis* does not result in mass mortality among their hosts. The life cycle of the parasite is quite complex and involves marine mammals (different whale species and possibly seals) as definitive final host, planktonic crustaceans (mostly krill) as an intermediate host, and fish as transport hosts. Details of the life cycle are shown in Figure 7. Therefore fish act as "accumulators", transporting the parasite from the intermediate host to the definitive host. Though the final natural host of *Anisakis* is a marine mammal, the parasite may also affect humans who become infected from eating raw fish (for example sushi) or fish that is under-cooked. For more information please refer to: http://www.food.gov.uk/multimedia/pdfs/guidsalmonanisakis.pdf.

Though there are clear differences between tissue location of Anisakids species and their host as well as between host species, in most affected fish, the parasites tend to be found more widely in the viscera than in the musculature. This means that the region of the vent as a target tissue for the parasite represents a novel location, so far only described for wild Atlantic salmon.

Anisakis spp. life cycle in the North Atlantic

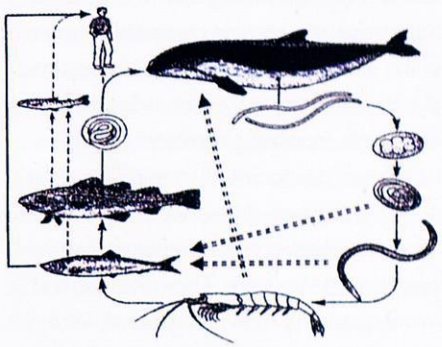


Figure 7.

(after Buchmann, Bresciani & Beyerholm 2001, modified by Levsen 2007)

Conclusions

The cause of the red vent syndrome was directly attributed to the presence of *Anisakis* in the vent region and no additional infection or cause was established. The reason for the concentration of larvae in a discrete region such as the vent remains unknown and will require further investigation.

However, due to the consistent finding of the parasites in the vent of all analysed affected fish, there are reasons to believe the vent is unlikely to constitute an "accidental location".

During 2007 there was no evidence to suggest that the RVS had either led to mortality or prevented salmon from spawning successfully. Consequently, there is no basis to recommend that fish showing signs of RVS be removed or killed.

Thin Grilse – the tip of an iceberg

P. J. Bacon, S. C. F. Palmer, J. C. MacLean, G. W. Smith, and B. D. Whyte

Hooking a wild Atlantic salmon is a very special event, and everyone who does so hopes that the ensuing contest will result in the landing of a fish in prime condition. But over the last few years, in Scotland and elsewhere, increasing numbers of anglers have been disappointed to end up with a poor, thin, scraggy grilse. Reports of these exceptionally thin grilse circulated, and caused some concern. They also sparked many questions. How exceptional were these fish? What might have caused it?

Measurements tell. Fortunately, staff of the Scottish Government's Fisheries Research Service's Freshwater Laboratory, based at Montrose, have been taking regular body size measurements from samples of salmon since the early 1960s. With help and cooperation from the net and coble fisheries at the North Esk, Spey, Dee, Tay and Tweed, and the Strathy Fixed Engine, they were able to obtain crucial data. The information includes date of capture, fork length, whole weight, a visual estimation of sex and a scale sample from which the sea-age of each fish can be unequivocally determined. The fishing method is important, for the net capture ensures that the fish are newly returned, and thus that their 'condition' reflects the state at which they arrived back from the sea, rather than one they had declined to after having starved themselves in fresh water for weeks or months before being caught by rod. The scale sample is also vital, for, as with visual determination of sex, visual discrimination between grilse and multi-sea-winter salmon is far from reliable.

As with people, an index of *thinness*, or *fatness*, can be obtained from the ratio of the body weight divided by the body length. Small weights and long lengths indicate thinness, and large weights and short lengths fatness. However, as a decrease in the ratio can be obtained either by increasing length alone or decreasing weight alone, it is prudent to examine the length and weight values as well as the condition index.

Hooking a wild Atlantic salmon is a very special event, and everyone who does so hopes that the ensuing contest will result in the landing of a fish in prime condition.

FRS Freshwater Laboratory has over 150,000 records available for analysis, with almost half of them coming from the North Esk. But they must be interpreted with care, for the following reason. As salmon grow fairly continuously whilst at sea, both grilse and multi-sea-winter fish that arrive later in the season are, on average, larger than fish from the same sea-age group that arrived earlier in the season. Accordingly, as our data are a sample from a commercial catch, and not a representative proportion of fish taken throughout the season, we might find spurious variations in fish sizes between years just depending on how many fish were caught in which months in different years. But we can adjust for this potential error by accounting for the regular changes in fish sizes that follow the date of the year on which they are caught. Once this correction is made, we can discern the annual differences in sizes largely free from bias.

What do we find? Between 1963 and 2005 the typical length of the yearly groups of grilse has ranged between 54cm and 63cm. But it has not changed randomly. On average there was a gradual decline, from 60cm in 1965 to a value 4.5cm shorter 45 years later. In contrast, the typical lengths of annual groups of two-sea-winter fish varied less, between 74 and 78cm, and increased by a trivial 0.5cm over the same 45 year period. Analogous results are found for the average annual weights. Grilse weights decreased slightly over a 45 year period, but weights of two-sea-winter fish showed a tiny increase.

Over the same period, the thinness, or condition, varied rather more widely from year to year. Two-sea-winter salmon show less annual variation in condition than do grilse, and their condition has, on average, tended to increase slightly over time between 1965 and 2000. At first sight the results for grilse look quite alarming, as the annual condition values show a rather dramatic decreasing trend from 1995 to 2006. However, when compared to the full

45 year run of data, only the very last four years (2003-6) show grilse conditions lower than any in the previous forty years. But those four very extreme years in a row is too many to be a chance event – something different has indeed happened in recent years.

Are the changes in recent years perhaps due to just a very few fish being quite exceptionally skinny? No, the exceptionally skinny fish reported by fishermen are just the tip of an iceberg. In those last four years there have been fewer fat grilse, and fewer grilse in good and fair condition, as well as more thin grilse and many more very thin grilse.

What are the implications? Apart from the reduced worth of the fish to anglers, the reduced body reserves might well mean fewer eggs, fewer smolts and fewer adults to fish for in future. Indeed, an analysis of fat content of Strathy adults, undertaken by Professor Chris Todd from St Andrews University, suggests that body reserves available for egg formation by grilse have declined even more dramatically than their 'condition' index has.

So what might be causing it? As lengths and overall weights have changed little, but condition on return from the sea has changed more, and more suddenly, it is likely that the grilse have either failed to put on weight in their last months at sea, or have needed to use up food reserves, accumulated for spawning, prior to reaching the rivers. It is also interesting that the two-sea-winter fish, which are thought to feed in different parts of the ocean from grilse, have not been similarly affected.

Nowadays, '*climate change*' is commonly blamed for many things, and sea temperatures have undoubtedly increased whilst the grilse condition has declined. But then UK house prices have also increased over the same period. But few of us would expect house prices to drop if we could increase the condition of grilse returning from the ocean. If the ocean conditions were strongly responsible for the change in grilse condition, then a strong correlation should remain between oceanic variables and grilse condition even when their general trends over time have been discounted. But we would not expect any correlation to remain if the same calculation was done with UK house prices! When the necessary sums for grilse and ocean conditions are done over the whole 45 year period, the remaining relationships with ocean conditions, although still present, are weak. So the data support the view that changing oceanic conditions may have contributed to the thin-grilse phenomenon, but provide only weak evidence that it might be a major cause. More rigorous tests could be undertaken if we knew when the grilse were in which parts of the northern oceans, and if we had relevant biological and oceanic data for the past 45 years, instead of a much shorter period. But until that fundamental knowledge becomes available, our powers of inference are severely hampered.

More rigorous tests could be undertaken if we knew when the grilse were in which parts of the northern oceans, and if we had relevant biological and oceanic data for the past 45 years, instead of a much shorter period.

What of the future? The most reliable predictions are those which are made immediately after an event has occurred! As the basic causes of thin-grilse are uncertain, we must continue to monitor events. The large samples of relevant and representative size and condition data, available only from the net fisheries, provide one key strand of the information sources on which we rely for the informed management of salmon.

Spring fishing report (2008) – Scotland

Andrew Graham-Stewart, PR Consultant and AST Member

In terms of overall catch numbers, it has been a fair spring – at least by recent standards. Catches on most rivers represented a considerable improvement on 2007's poor returns and were more in line with ten year averages. Nowadays there is little productive fishing in the early weeks; indeed salmon running in January are extremely scarce and February fish are few and far between except on a handful of rivers. A lot of high water hampered angling for much of March. Catches responded to more favourable conditions in April and the start of May. Many of the smaller rivers became almost unfishable later in May due to the impact of three consecutive weeks without rain.

Tweed reported that its spring runs were more dispersed than usual – to the benefit of beats above Kelso cauld. On Tay the bitterly cold weather during the first fortnight of April contributed to some lower beats recording their best April in years. On the Dee, following a reasonable February and a poor March, April was up on the five year average and the spring total to the end of May looked likely to exceed 2,000. On the Spey catches were significantly up on 2007 with beats between Delfur and Ballindalloch faring best.

On the northern rivers wintry conditions stretching well into April held fish back downstream of temperature barriers until much later than has been the norm for several years. Accordingly the lower beats of some rivers with such barriers fished very well – notably the Oykel and Findhorn in late April and early May. Overall most Highland rivers had a reasonable spring – at least until the May drought reduced flows to very low summer levels.

Spring 2008 will long be remembered for the resurgence in numbers of 3SW salmon. Indeed the relative abundance of large springers of 16lb or more has been a marked feature of catches across much of Scotland. Nowhere has their return been more evident than on the Tay. In the first four months of the season the river produced many more fish between 16lb and 33lb than has been the case for at least 20 years. Up until the end of April over 225 fish in this class (including six over 30lb) were caught – representing approximately 25 per cent of the total catch. In recent years typically just 5 per cent of the spring catch would be in this category. A very high proportion (some 90%) of these salmon was released in line with the Tay Board's new conservation code.

What is the reason for the sudden increase in numbers of 3SW salmon? To a certain extent this is conjecture, but there is little doubt that the smolts that went to sea in the spring of 2005 had problems finding adequate food. Those that returned (after one winter at sea) as grilse in 2006 were often very under-nourished – indeed that summer was notable for the poor-conditioned thin (almost eel-like) grilse. The run of 2SW spring salmon in 2007 was one of the worst in recent years. It seems reasonable to surmise that a fair number of the fish, which would normally have returned as 2SW salmon in 2007, elected to stay at sea for an additional year – perhaps to compensate for a shortage of food.

Ghillie Ernie Duff about to release a 27lb springer caught at Stobhall on the Tay. Picture – Ann Cunningham

Paddlers on the River Spey: guidance for anglers

Spey Fishery Board

The River Spey, as well as being one of the world's finest salmon fishing rivers, is also popular with other water sports users, including canoeists and rafters.

In 2003 the Land Reform (Scotland) Act gave recreational access rights to the general public to most land and water within Scotland. This right applies to recreational, commercial and educational activity, including walking, cycling, horse-riding and canoeing. In 2005 the Land Reform Act confirmed the right of reasonable and responsible pedestrian access (including walkers, cyclists, horses) over land (except curtilage and cropped field) and to non-motorised craft over water.

Guidance on responsible behaviour for both recreational users and land managers is contained within the Scottish Outdoor Access Code, a copy of which is available online at www.outdooraccess-scotland.com

Furthermore, the Scottish Canoe Association has produced detailed guidance under the "Paddler's Access Code" (available from www.canoescotland.com), about which the majority of canoeists and rafters are aware. Paddler guidance, specific to the Spey, is available online at www.speyguide.co.uk

Anglers on the River Spey are quite likely to see canoeists and rafters when they are fishing, approaching anglers from upstream. The Spey Fishery Board continues to work with the Scottish Canoe Association to try to ensure that both anglers and paddlers experience as little disruption as possible to their sport. To facilitate this the Board and the Association have issued the following guidelines., the key to harmony on the river is mutual respect as well as courtesy between all river users.

Guidelines for anglers and canoeists on the Spey

Canoeists:

- The leader of the paddling group will endeavour to ensure that anglers are aware of their presence, either by shouting or blowing a whistle that can be heard above the water noise.
- Once contact has been established, the leader will request the angler's preferred line of passage for the paddling group.
- The paddlers will wish to cause minimum noise and disturbance to the angler and will move in the direction indicated, water depth and obstructions permitting. Where the angler is standing on the bank, the direction indicated to the paddlers may include going towards the opposite bank, towards the angler and even under the rod. If the angler is wading, canoeists will be happy, where possible, to pass behind the angler i.e. between the angler and the bank.
- Paddler group leaders will endeavour to have their group pass in fairly close formation, allowing for a reasonable, safe distance between each boat, thus minimising the time taken to pass.
- If an angler is playing a fish, paddlers normally wait upstream until the fish is landed or until there is an indication from the angler or ghillie that it is safe to pass in the angler's preferred direction.
- In the event of an inadvertent capsize, paddlers will do their utmost to affect efficient rescue and refloat the upturned canoe as soon as possible. Anglers will know that the River Spey is fast-flowing and its currents can catch out even the most experienced paddlers!
- Once past the angler, the paddler group will quietly continue on their way downstream. Paddlers will not "loiter" unnecessarily or "play" in a pool where someone is fishing.

Anglers are requested to:

- Acknowledge that they are aware of the presence of the paddlers.
- Carefully consider which line is most practical for both angler and paddler.
- Give clear direction as to the preferred route the craft should take.
- Refrain from casting whilst boats pass by (although it is not always necessary to take in line).
- Only resume fishing once the boats have completely passed the angler.

Scalereadings

Announcement

Fisheries Minister Jonathan Shaw recently anounced the appointment of Ivor Llewelyn as chairman of the Environment Agency's Southern Regional Fisheries, Ecology and Recreation Advisory Committee. RFERACss advise the Agency on how it carries out its inland fisheries duties and responsibilities, also offering advice on navigation, recreation and the conservation aspects of these functions.

Rivers & Fisheries Trusts of Scotland (RAFTS) and The Atlantic Salmon Trust working together

In May, the Atlantic Salmon Trust announced its biggest ever single award of funding for a freshwater project to the Rivers and Fisheries Trusts of Scotland (RAFTS). This was a significant step forward in the relationship between these two organisations. This funding, involving all 20 members of the RAFTS network which now cover over 80% of Scotland, will be used to support a national programme of locally based genetic sampling of Scottish salmon. The project has, at its heart, a desire to better understand the genetics of Scotland's Atlantic salmon populations and links closely with the AST/NASCO sponsored Salsea Merge project.

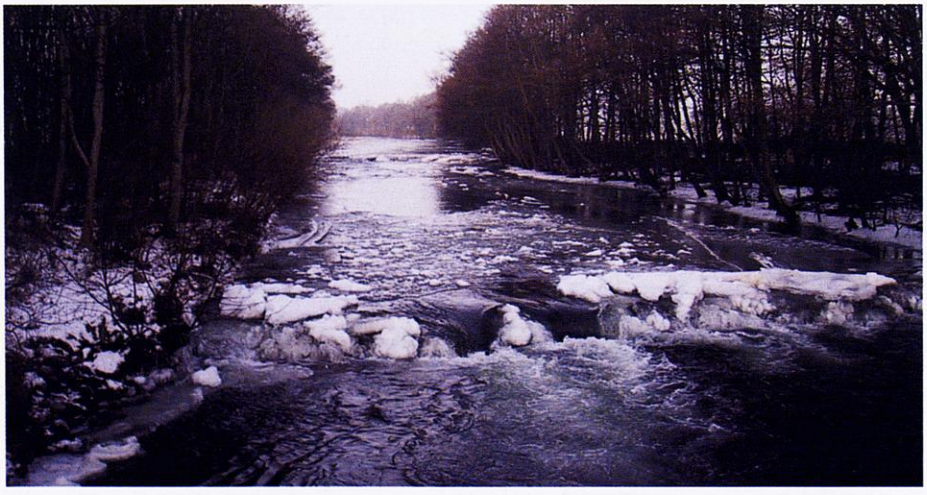
The network of Scottish Fisheries Trusts and Boards now employs about 40 full time fishery biologists and managers. In recognition of the importance of this network and the range of work it undertakes, the Scottish Government has awarded RAFTS £400k for each of the next three years to support the production and implementation of fishery management plans in all RAFTS member areas. The Trusts, working in particular with boards, but with a range of others, have never been better placed to be an influential and effective force in dealing with many important aspects of catchment management.

The AST has recognised the importance of this network for delivering some of the strategic objectives of the Atlantic Salmon Trust in freshwater whilst concentrating much of its effort on the issue of the salmon's life at sea, an area in much need of attention and in which Boards and Trusts have no real ability to conduct meaningful work. This natural division of labours makes sense to both organisations and ensures best use of limited resources.

However, it is clear that both organisations could probably benefit from further thought about how they might work more closely together. This recent award is an excellent example of how the Fisheries Trust network can co-operate and help deliver for AST. In the course of undertaking genetic sampling and analysis to inform local management it is logical for the Trusts to extend the impact of that work by collaborating, via the AST, with an international project of the size and importance of SALSEA. RAFTS and its members are also keen to work with the AST to extend this collaborative approach into other areas of our work at a national and strategic level. Co-operation in areas such as development of policy, co-ordination of research, developing and maintaining international links, fund-raising and communications are all areas ripe for further discussion.

With both organisations being registered charities, sharing many similar objectives and with both having recently been through a period of considerable growth and evolution, there has never been a better time to start discussions about how we can work more closely together to secure the future of the Atlantic salmon and the environment it inhabits.

Andrew Wallace – Managing Director, Association of Salmon Fishery Boards and Rivers and Fisheries Trusts of Scotland, Callum Sinclair – Director, Rivers and Fisheries Trusts of Scotland



Castle Stream, South Esk, winter 07/08.

The Tay at Dunkeld.

The Tay at Dunkeld.

Atlantic Salmon Trust Publications

Salmon Stocks: A Genetic Perspective
N.P. Wilkins

Salmonid Enhancement in North America
D.J. Solomon

Salmon in Iceland
Thor Gudjonsson and D. Mills

Atlantic Salmon Facts
D. Mills and G. Hadoke

The Atlantic Salmon in Spain
C.G. de Leaniz, A.D. Hawkins, D. Hay and J.J. Martinez

Salmon in Norway
L. Hansen and G. Bielby

The Automatic Counter – a Tool for the Management of Salmon Fisheries
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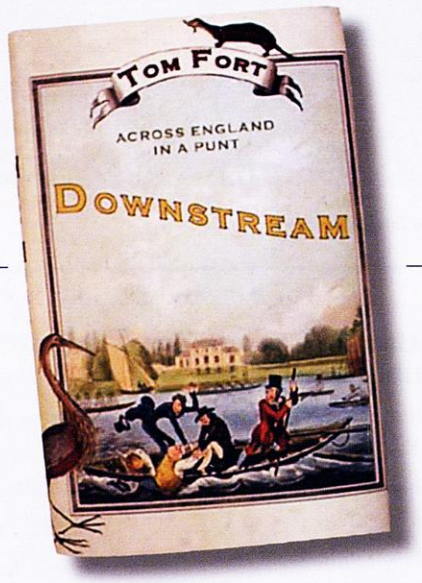
Book Review



Downstream

Across England in a punt

326pp. Century £14.99
ISBN 9781 84605 1692

The school masters of yesteryear could be an eccentric lot. One of mine often assured his pupils that, "There is only one class distinction boys, between those people who are clean and those who are dirty". Despite years of seagoing, my personal experience is far too narrow to know whether the ancient pedagogue was right or wrong. What I do know is that his classification can certainly be applied to England's rivers. Like people, they are born clean, and a lucky few stay clean for the whole of their existence from source to sea. Many do not, especially if they have the misfortune to pass through an industrial or intensively farmed landscape. Clean or dirty, such is the fascination that flowing water holds for most of us that I doubt if any river has been completely unloved for long. So hard-wired seems to be this fascination, in which attraction seems to hold hands with a sort of numinous dread, that it is tempting to speculate with the distinguished Oxford zoologist, the late Sir Alister Hardy, that the later stages of mankind's evolution included a semi-aquatic stage, a time when the forces of natural selection divested our distant ancestors of most of their body hair and replaced its insulating properties with sub-cutaneous fat. Hardy was a marine biologist and mused that this critical change took place along the beaches of a tropical shore. Perhaps it did, but what we now know of our fossil history hints that, if there were an aquatic phase, it is more likely to have been spent along the banks of an African river where the attraction to ready supplies of drinking water and fish would have been mixed with the fear of crocodiles and hippopotami.

The love of rivers is certainly well-developed in Tom Fort, a feeling so profound and many faceted that he can find no single word to describe it, but in his Preface he tells us,

The river lover sees more than fresh water on the move. There is an awareness of past, present and future – that the water was somewhere else the day before and will be (in) a different somewhere else the next day; that it connects places and people across space and time; that it is both of itself, self-contained, and integral to its landscape. There is a curiosity about its story, how it was seen, how it impinged on lives, how it was used, which armies halted on its banks, which poets strolled through its meadows, which traders put their trust in it to take them where their business was.

Tom Fort's story is of a summer's journey by squelching foot, paddled punt and creaking bicycle down the Trent, England's third largest but one of its least known big rivers. The connecting thread is the tale of the river itself, how its sources combine to form first the dribbling, infant streams that power tumbling rapids that threaten the fragile punt until, among gravel barges and in sight of the earth moving behemoths of the *Environment Agency*, the Trent pours its silty flow into the majestic Humber with its tearing six knot tides. The story of the river that bubbles up throughout the narrative is told with the quiet authority of one who really knows how eddies and vortices form, of the hidden flow beneath the bed, of why pools and riffles succeed one another in the upper reaches and how meanders form (and why they are so-called) in the lower ones. Not surprisingly for one who so revered the writing of the late, J. W. Martin, the splendidly pseudonymed *Trent Otter*, that he named his punt after him, he also knows about water weeds, nymphs and fishes. How good it was to hear of the capture of a splendid barbel from the discreetly secured punt and from under the very noses of those who fain would deny such heart-in-the mouth thrills to all but their privileged selves! How heartening also to know how well the river is recovering from its grossly polluted past. Similar well-referenced scholarship lies behind Tom Fort's lively accounts of the turbulent history of this part of middle England, told as he passes the sites of desperate battles, great houses and industrial endeavour. Erudition with a light touch, cleverly interwoven with stories of pints downed (rather a lot of them), clean sheets and greasy breakfasts appreciated and characters met; what fun it all is and how impressive is the learning that lies behind it.

Dick Shelton

An abridged version of this review appeared in a recent edition of The Times Literary Supplement.

Financial and Fundraising Review

An exceptional year in every way, with record levels of fundraising and expenditure on research and restoration projects – with more to come!

Neil McKerrow, Deputy Director (Finance)

OUR CASE FOR SUPPORT

Record funding and direct support initiatives were achieved in 2007-08, but it is the intention to increase our project funding, so we need to continue to raise funds to aid the restoration of healthy, sustainable stocks of wild salmon and sea trout!

1. **The Atlantic Salmon Trust is the only charitable body exclusively devoted to research and restoration of wild salmon and sea trout stocks on a national and international basis.**
2. **The Atlantic Salmon Trust** liaises with, supports, and provides advice on an independent, scientific and practical basis to governments, national authorities, wildlife and environmental organisations, as well as still-water and river proprietors, managers and biologists.
3. **The Atlantic Salmon Trust** funds numerous research projects in the UK and Ireland, and in international marine waters. It participates in international initiatives and research.
4. **More funding** is desperately needed now to support worthwhile marine and freshwater projects. These are reviewed by the Trust's Honorary Scientific Advisory Panel, whose expertise is widely acknowledged.
5. **NASCO has launched** its long-awaited international SALSEA-MERGE marine research project, a multi-million, EU backed, international marine investigation into salmon mortality and movements at sea. The Trust is acting as the lead British NGO for this project, and has committed to funding the post of the International Scientific Research Co-ordinator for SALSEA-MERGE, Dr Jens Christian Holst of Norway for the three year duration of this significant International Project.

THE YEAR 2007-08 IN REVIEW

In summary –

The 40th Anniversary Year of the Trust was a landmark year in terms of fundraising activities, and the level of direct financial support for restoration and conservation works reached a new high.

Expenditure covered a wide range of scientific research projects, which have been fully covered elsewhere in this and previous editions of the Journal, symposia and international conference, and a maiden contribution to the post of International Scientific Research Co-ordinator for SALSEA-MERGE.

And in more detail –

Our Income

As reported at the Half Year, despite the disappointing cancellation of the CLA Game Fair at Harewood House, income continued to move ahead to record levels. This was achieved on the back of the highly successful Fundraising Dinner and Auction held at Fishmongers' Hall in November, which realised over £106,000 in gross proceeds. Other supporters, including the Kenmore Hotel, dedicated their fundraising efforts for the benefit of the Trust in its 40th Year, so that total funds raised increased by 55%. The level of residual donations fell back slightly, perhaps not unsurprisingly, in the light of complementary activities described above.

The Annual Fishing Auction generated a record level of funds after costs – a satisfactory achievement given the ever increasing availability of fishing opportunities by way of an auction process! The electronic component was further extended, enabling us to reach new bidders for the considerable array of quality fishing opportunities. These sources of income – Auction, Donations, and the Fundraising Dinner accounted for 85% of the Trust's Income, excluding the exceptional item detailed below.

Investment Income was slightly reduced, due to falling interest rates during the year, and income from sales showed a modest decline, due primarily to cancellation of the CLA Game Fair.

Finally, the Trust benefited from a non-recurring profit following sale of the former Trust offices at Moulin, which delivered an exceptional profit of £129,000, having achieved a sale price of £167,500. An exceptional climax to a truly exceptional year!

Our Expenditure

Operating expenditure rose by 17%, the principal component being the impact of office rental on the new Trust offices in Perth. Fundraising costs also increased substantially, reflecting the cost of the special Dinner and Fundraising event in London. Expenditure on general conservation activities increased by 14%.

Costs of governance increased following a legal health check on the Articles and governing instruments of the Trust, ahead of successful registration with OSCR. Journal costs were satisfactorily reduced, on account of continued contributions from a select group of advertisers; other costs were well controlled.

Direct Expenditures on scientific projects increased by 18% to just under £100,000 – a new record for the Trust! This included £40,000 granted by the Honorary Scientific Advisory Panel to a variety of projects which have already been described elsewhere, £27,000 for the work of the Trust Biologist towards West Coast restoration of salmon and sea trout stocks, and £7,000 towards the SALSEA symposium held in Edinburgh in partnership with NASCO, and the International Conference at Southampton University on Salmonid Habitat Management, held in partnership with the Game and Wildlife Conservation Trust. Most significantly, an initial contribution of £25,000 was made to SALSEA-MERGE and the post of

International Scientific Research Co-ordinator, to coincide with the Project launch.

Finally, the Trust brought to a successful conclusion the co-operative SALGEN research project with the publication of Eric Verspoer's landmark work on salmon genetics, the Ferox Trout project – both in partnership with FRS Faskally, and actively participated in the continuing activities of West Coast restoration works in partnership with Scottish Natural Heritage.

Due primarily to the one-off surplus on property disposal, the Trust ended the year with a healthy surplus with which to bolster its reserves. This will allow the Trust to continue to commit increased funds for worthwhile projects with confidence for the future.

The new Financial Year

The New Year has again begun in dynamic style, with over £100,000 already committed to works in support of wild salmon and sea trout activities – another record! Over £50,000 has been committed to a dozen projects following review of the annual applications by the Trust's Honorary Scientific Advisory Panel in April. Recipients include the Centre for Salmonid Research, University of Southampton, the Upper Wye and Irfon Liming Project, Lochaber Fisheries Trust for Strontian River research, continued research into Orkney sea trout populations, Stable Isotope Analysis of salmon Otoliths and scales, River Exe salmon project, Aberdeen University Workshop on Hydromorphological Condition, RAFTS genetic analysis of Scottish salmon populations, Institute of Fisheries Management, and St Andrews University for continued research into returning Grilse condition. An important commitment was made to support the continued sampling of returning fish to the north of Scotland rivers, to ensure continuity of records built up by the Strathy Point netting station, now closed. A commitment of £10,000 was made, though it is possible that sampling may now take place at an alternative site.

Finally, as reported above, support for SALSEA-MERGE and West Coast restoration works take the Trust's direct commitments above £100,000.

Bearing these commitments in mind, and in the light of other worthwhile projects which the Trust would like to support, it is more important than ever that we continue to build our support base of regular givers and levels of giving to ensure that everything possible can be done to promote and sustain the health of wild salmon and sea trout stocks in our rivers.

YOUR SUPPORT – PLEASE!

You can help us by making a Gift Aid Donation, no matter how small. Some examples of current costs and projects are given below:

£15,000 – cost of a privately hired research vessel in North Atlantic for one day

£10,000 – major research project on salmon genetics or predator/ wild fish interaction

£5,000 – research project on river restoration or fish farming impact on water system

£1000 – practical advice or training by the Trust's Field Research Biologist over 2/3 days

£300 – one day's practical advice on river bank management

AS A SUPPORTER

You can help us in one of a variety of ways:

Make a Donation by Gift Aid

The form is on the facing page.
The Trust can reclaim Income Tax. Higher Rate Tax Payers can obtain the benefit of additional relief.

Donations can be made by single donation or by Banker's Order.

Make a gift of shares to the Trust

You can claim Income Tax relief on their value, and will be exempt from any Capital Gains Tax charges.

Sponsor the Trust or a specific project

Many of these are covered in the 'Research' section.

For fuller details of projects please call Tony Andrews, Dick Shelton or Neil McKerrow.

Make a legacy to the Trust

Bequests to charities
Giving a Legacy – Your Will could express a donation in various ways, eg. The gift of a specific sum of money, a gift of specific assets (such as shares), or a gift of all or a specific part of the balance of your estate once all other legacies (eg. to the family) are taken account of. This is known as the 'residue'.

Bequests to charities are deducted from the total value of the estate before the calculation of any inheritance tax therefore reducing the total inheritance tax payable.

If you would like to leave a legacy to AST by changing your Will please consult your legal and financial advisors.

Some families invite friends to leave the Trust donations in memory.

If you would like to leave a legacy to the Atlantic Salmon Trust please contact our Financial Director, Neil McKerrow, who will be very pleased to advise further.

Being a Supporter will secure you a copy of the Journal which is produced twice a year, as well as access to publications and research findings. Above all, you can be sure in the knowledge that you are assisting a most worthwhile cause.

PLEASE DONATE – AND ENCOURAGE OTHERS TO DO SO!!

Leaflets and other publications can be supplied for fishing huts and beats!!

Gift Aid Declaration and Banker's Order Form

If you would like to support the Atlantic Salmon Trust, you can help us by making a cash donation or setting up a Banker's Order. Please complete the Gift Aid Declaration and parts A or B

THE ATLANTIC SALMON TRUST – GIFT AID DECLARATION

PLEASE COMPLETE IN BLOCK CAPITALS, EXCEPT FOR SIGNATURES

Title Forename(s) Surname

Address

Post Code e-mail

I would like the Atlantic Salmon Trust (Registered Charity Nos 252742 and SCO37902) to treat as a Gift Aid Donation this and all donations I make from the date of this declaration until I notify the Trust otherwise.

Signature Date

EXPLANATORY NOTES:

- You must be a taxpayer to make a valid Gift. The total of income tax and capital gains tax payable by you in each year must be at least equal to the tax recoverable on all your Gifts.
- For every £1 donated under Gift Aid, the Atlantic Salmon Trust can recover a further 28p.
- Higher rate tax relief can be claimed by you on Gift Aid Donations.
- A Declaration can be cancelled at any time by notifying us. It must cease if you no longer pay tax.

A. Cash donation. I enclose a cheque in the sum of £ made payable to the Atlantic Salmon Trust

B. To make a series of donations, which will be of great help in allowing the Trust to budget for work in future years, please complete the Banker's Order below.

BANKER'S ORDER

To The Manager Bank Plc Sort Code

Branch Address

Post Code

Please pay to BANK of SCOTLAND, 76 Atholl Road, Pitlochry PH16 5BW (80-09-41) for the credit of

THE ATLANTIC SALMON TRUST LIMITED (Account No 00890858) the sum of £ _____ (_____ pounds)

on the _____ day of _____ 20____ and a like amount on the same day each month/quarter/half year/year

(delete as appropriate) (a) until I give you notice in writing OR (b) for a total period of ____ years.

Account to be debited A/c No Account name

Signed Date

Full Name A/c No

Address

Post Code

PLEASE RETURN THIS COMPLETE DOCUMENT TO THE ATLANTIC SALMON TRUST, 3/12 KING JAMES VI CENTRE, FRIARTON ROAD, PERTH PH2 8DG.

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