

River Restoration

The Ghillies Seminar
Friday 17th April 2009

Part-funded by Scottish Government through RAFTS

Speakers and their topics

Dr Shona Marshall (WSFT)	Introduction and area update; introduction to the Biosecurity Plan
Mr Chris Daphne (WSFT)	Habitat surveys and management plans
Mr Alisdair Matheson and Ms Kirsten Thorburn (SEPA)	River engineering – what effects do your actions have?
Dr Bob Kindness (Carron)	River restoration in the Carron
Dr Eric Verspoor (MSSFL)	Genetics – why management should think about the genes

Dr Shona Marshall (WSFT):

All were welcomed to the seminar and a short report on local issues given.

The proposal to develop a Biosecurity Plan for the area during the coming year was discussed and assistance requested. The reason behind the plan was outlined and the need for vigilance highlighted. Anybody knowing the locations of the species mentioned were asked to report them to Shona and eradication could be considered. Similarly, all were reminded about the need to disinfect tackle between water courses.

Mr Chris Daphne (WSFT):

Chris gave an introduction to the methodology used in habitat surveys and the details recorded. He also introduced the habitat requirements for juvenile salmonids and how these are recorded within the SFCC methodology.

Using photos, Chris gave examples of good and bad habitat and detailed the requirements for knowing the whole catchment before undertaking any stocking or restoration works.

Questions and discussion:

The issue of riparian woodland was raised, and it was asked if this was considered a good improvement? *Yes, provided it was mixed woodland and not conifer stands. It is good to have a buffer zone, with fencing to allow it to develop. A mixed riparian zone will provide additional food, shade, cover and bank stability.*

The addition of limestone to lochs in order to improve water quality was raised.

Chris noted that it had been used in England, while Kirsten commented that it was used in Norway but seldom in Scotland. Keith Dunbar commented on the beneficial impacts he had observed by placing scallop shells in a small loch.

The experiment from the Conon, where salmon carcasses were staked out in the burns was noted and the loss of these nutrients as a result of reducing adult numbers was commented on. The historic catches from the Laxford were quoted to show the extent of the decline. Other materials were also raised as potential ‘fertilisers’ including wool, deer and marine fish.

Kirsten pointed out that this would not be acceptable to SEPA. Chris noted that the Conon was an attempt to replicate a natural situation, not fertilisation per se. Shona quoted Alan Joyce and his concerns about the denuding of the highlands as deer and sheep are grazed on the land and then transported from the area, thereby constantly exporting nutrients.

The large numbers of elvers observed in the Laxford 50 – 60 years ago, and their subsequent growth were noted leading to the natural removal of nutrients by this means.

Mr Alisdair Matheson & Ms Kirsten Thorburn (SEPA):

Alisdair gave an introduction to river processes, describing the different aspects such as riparian zone, silt deposits, active erosion/deposition, riffles and slack water. He stated that water carries and moves sediment creating complex river systems.

Rivers will respond to a range of factors, including changes in slope, water, channel boundary (clay, gravel, rock, etc.), sediment supply from upstream and any river engineering.

It was noted that systems are primarily stable, said to be in a dynamic equilibrium, where energy is balanced against sediment supply. This is what dictates the shape of the channel. Alisdair used the analogy of a weigh scale to demonstrate this, with water on one side and sediment on the other.

Thus, if you increase the energy by, for example straightening a channel (increased slope) or increasing the water flow by constraining the river or increasing riparian drainage, then the water will need to carry more sediment. This will increase bank and bed erosion, leading to deposition further downstream. Alternatively, if the flow rate is reduced then there will be a reduction in sediment movement and increased deposition.

Changes in sediment structure will also affect the river, with an increase in sediment size leading to slower flows and increased deposition, while decreasing sediment size will result in an increase in water movement and therefore erosion.

It was noted that STABLE DOES NOT MEAN STATIC.

Alisdair then gave examples of poor engineering, where the river then tries to get back to a stable state. For example, the straightening of a channel will result in the river trying to re-establish the meanders.

Croynes and groynes will create primarily localised effects, although the resulting erosion will deposit material downstream thereby having a knock-on effect.

Embankments will cause more water in the channel rather than the flood plain and will therefore result in bank and bed erosion, with the material also deposited downstream.

It is possible to create very unstable rivers if the engineering works go badly wrong, although this doesn't happen very often. Usually the river will create a new, if different, stable state.

Kirsten talked about the regulatory function of SEPA. She described the Water Framework Directive and the licensing requirements. By detailing the reasons for legislation and the structure of the new Controlled Activities Legislation, she clarified the role of SEPA in river management.

Bob Kindness (River Carron):

Bob detailed the work he has undertaken in the River Carron, describing the catchment and the historic information available.

He has been stocking the Carron since 1995, using a captive broodstock system since 2001. Fish are stocked at all stages from eggs to smolt, dependent on the numbers of eggs produced that year. While most smolts are S2, there are approximately 10 – 20% of S1's.

Sea trout numbers remain variable, although increases have been observed from 2000. Salmon have increased since 2004, and this trend is continuing. The stocking programme seems to correlate to increases in catches.

Smolts are released from ponds, with the timing carefully controlled to ensure that the run is optimum. They are likely to have left the river within a few days. On their return, grilse tend to be taken just below the release point indicating homing on that point of the river.

Some smolts and parr were tagged. These tended to be the S1's – but they showed a consistently higher fecundity than the non-tagged fish. This is possibly as a result of the larger size of S1 smolts.

Some smolts were also treated with the sea lice treatment SLICE. There were no differences in survival between the treated and non-treated fish.

The Carron is a catch and release system. Multiple re-captures are examined through the use of tagging with a panjet. This started in 2005 with the following success:

Year	No. tagged	No. re-caught	Multiples
2005	34	3	
2006	79	11	
2007	120	13	1 recaptured 4 times
2008	75	11	5 recaptured 3 times

A lot of the recaptures were taken in the same location. The rate of recapture will depend on the river and therefore this should be repeated in each area.

Interactions with the fish farms are not considered important. Synchronisation of growth and treatment between the 2 farms started in 2004. There have been almost no early returning post-smolts seen during recent years and sampling in 2003 gave 350 sea trout/finnock, of which only 2 had higher than background levels of lice. These were adults and didn't equate to the farms.

Bob detailed the economic considerations of his stocking, and believes that a value has been added to the fishery that exceeds the expenditure.

He has concerns about natural changes in river flow, with spates recorded since the 1970's which would be large enough to wash out eggs and cause the observed declines in catches and juvenile densities. He plans to continue with the stocking policy in order to bypass these spates.

Questions and discussion:

Should fish be put out as unfed fry or retained to smolt?

Feed on a bit unless you have plenty, but smolts are not necessarily the answer. If you have good habitat then plant out early, poor habitat then raise to smolt.

It was noted that stocking as unfed fry on the Shin produced about 3% survival to smolt. *This is about right for the wild (1% from egg to smolt).*

Dr Eric Verspoor (MSSFL):

Eric described what genes are and gave examples showing the complexity of salmonids and the roles that genes play in the life cycle of the species.

In Canada, Atlantic Salmon show similar traits to sea trout in this country, with resident and anadromous strains in the same systems which don't interbreed.

In the River Tay run timing appears to be genetically controlled. In the River Tummel multi-sea winter fish enter the river earlier than grilse. This was similar in the River Almond, although both stages ran later than the Tummel fish. When stocked to the Braan system in controlled circumstances the timings remained the

same, although the differences were reduced. This demonstrated that run timing was genetically controlled, although modified by environment.

A similar pattern was observed in the timing of the smolt runs. This also helps to demonstrate 'homing' behaviour, although it is unclear to what extent the homing is defined – 2 populations, 4, 20?

The Feochan study, Argyll, gave 6 distinct populations in the space of 15 km, with only 6 areas examined. This study was undertaken to look at a bag net fishery in the shared sea loch. It demonstrated that the fishery was mixed, and that the majority of the catch came from the most distant freshwater fishery.

This also demonstrated that DNA can be used to estimate the breeding population within an area and therefore the exploitation rates (number of breeders compared to catch).

Eric introduced the SALSEA Merge project, where genetics are used to determine the different stocks being taken in the high sea fisheries – whether from Spain, France, Britain, etc.

Local adaptations are also apparent, and Eric gave 4 examples.

The experiment in the Burrishoole system, undertaken by Phil McGinity, looked at the survival and return of native Burrishoole fish compared to the non-native Owenmore fish stocked into the Burrishoole. Again, stocking was controlled. Survival to eyed ova was found to be the same, although Owenmore fish did 90 – 95% as well to fry. However, 900 % more Owenmore fish migrated from the tributary by 1+ compared to the native Burrishoole fish. The non-natives continued to perform less well, with a return rate of about 17% that of the native stock.

Gyrodactylus salaris was mentioned, with Baltic salmon being immune to the parasite. However it is the AIDS equivalent in Atlantic salmon, causing greater susceptibility to other infections, poor feeding and growth and ultimately death.

Fish were taken from the Oykel and Shin and stripped, before planting out and rearing in the Oykel, Shin, Loth and a hatchery. Egg survival of both strains was good in the Loth, Shin and hatchery (98%). However Oykel stock planted in the Oykel had a 5-6% mortality, while Shin stock in the Oykel showed 35 – 40% mortality. This is the result of acid flushed in the Oykel and demonstrates that Oykel fish are better adapted to the conditions than Shin fish – the moral being, don't put Shin fish in the Oykel!

Population mixing experiments were undertaken between Canada and Scotland, giving 4 crosses. Differences in egg size were observed, with Canadian females and Scottish males producing smaller eggs, with no difference observed in Scottish females. However, this is likely to be the result of the smaller size of Canadian salmon rather than the crossing itself. No other differences were observed.

However, when the resulting hybrid males were back crossed in a hatchery with Scottish and Canadian females the result was normal survival in the Scottish females but 100% mortality within the Canadian females. This demonstrates that the effects of any action may not be seen until the next generation and it is important to understand the breeding population. Egg development rates can differ between populations therefore mixing can be bad.

The Loch na Thull study was mentioned, with the fact that the population is unique being of interest.

The outcome appeared to be that when undertaking stocking it is important to try and avoid mixing of the population and avoid the Canadian and Shin/Oykel situations.

Also, it is important to identify the bottlenecks and sort these before considering enhancement stocking.

Before stocking:

Know what you want and how to assess it.

Understand the population structures and be sensitive to them.

Understand the underlying factors controlling and limiting abundance – is it possible to get over these?
Establish the sort of interventions that are possible. If you can't surmount the problems then consider changing the objectives.
Make sure that you can prove the success of otherwise of your actions – plan to monitor.

Stocking is more of a Pandora's Box than a Panacea – be careful how you use it.

The book *The Atlantic Salmon, Genetics, Conservation and Management* is a good and helpful guide.

Questions and discussion

The 'success' of the Tyne stocking policy, using mixed stocks was raised as an example of why non-natives are not necessarily bad. *The Environment Agency believes that only 17% of the recovery of the Tyne can be attributed to the stocking policy, the rest was natural. There are plans to look at the genetic composition of the stock and this will answer the question of the success or otherwise of stocking with non-native populations.*