



THE Tweed FOUNDATION

A Tweed Foundation Paper

SECTION 1 : SALMON

INPUT 1.A: DETERMINING AND DEFINING THE STOCKS OF SALMON WITHIN THE TWEED SYSTEM AND THEIR LIFE HISTORIES

Rationale : The most basic information needed on the Salmon of the Tweed is their stock structure : Is there just one interbreeding stock throughout the whole catchment, or are there stocks differentiable by their life-histories and / or genetics - essentially, are there Tweed Salmon or Tweed Salmons ? If the full range of stocks and run-timings is to be maintained in the Tweed, which is what gives the river its 10 month long Salmon fishing season, then it is essential to know the exploitation rate of each stock and how well their spawning requirements are being met.

Results from previous editions : -

- a: *Scale reading showed :*
 - (i) *That early-running Spring Salmon were being caught as far upstream as the Ettrick but only rarely beyond (Appendix A1)*

- b: *Radio-tracking showed :*
 - (i) *That this pattern could also be found by tracking fish from the time of their entry into the estuary to their final spawning destination : Most early running Salmon of the 1994-96 project went to either the Ettrick or the Whiteadder with only small numbers returning to other home areas. Fish of other run timings had different patterns of home areas as shown in Appendix A1*
 - (ii) *Radio-tracking on the Ettrick in 1998 showed that later running fish spawned in the lower part of the river and earlier fish in the upper parts*

- c: *Spawning surveys showed :*
 - (i) *That there were still Spring Salmon in the Upper Tweed, despite none being caught for radio-tracking. One area at the very top of the Tweed in which Salmon spawn at the same time as the Ettrick Spring Salmon has been identified so far.*

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System



THE Tweed FOUNDATION

A Tweed Foundation Paper

- d: Catch Record analysis showed*
- (i) That there can be considerable variation between tributaries in the changes in run timing: Spring Salmon appeared in catches downstream of the Ettrick around 1910 but did not do so upstream of that river till around 1930 (Appendix A1). This is an important finding as it shows that local factors or stocks can affect run-timing, not only large scale marine factors.*

These findings clearly show that there are different stocks of Salmon within the Tweed, with different run-timings. As it is known from research elsewhere that run-timing is an inherited, genetic, behaviour (see Appendix A) and not simply the product of different environments that fish experience either during their freshwater or marine stages, these Tweed stocks have to be considered genetically distinctive.

Policies for the next five years :

Policy 1.A (1) - Confirm and Refine Knowledge of the Salmon Stock Structure of the Tweed

- (a)** The Radio-tracking project of 1994-96 on the whole Tweed showed how Salmon of different run timings went to different tributaries and sectors of the main river and the Ettrick project of 1998 how earlier and later fish were distributed within a single tributary. Since then, the N.E. England Drift nets have been largely bought out, allowing more Summer salmon into the system and these now need to be investigated and their home areas within the catchment defined:
 - (i)* Organise an extensive tracking project in which Salmon tagged at Berwick throughout a year, but concentrating on the "new" Summer Salmon, would be tracked back to their actual spawning sites.
 - (ii)* This would also include a particular effort to track large Autumn Salmon (previous tracking work concentrated on Spring Salmon). In particular, information is needed as to whether there are any particular areas within the catchment that produce these fish as they are becoming less frequent.
 - (iii)* Given the historical changes in run-timing shown in Section 4, the repetition of tracking work more than 10 years after the

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System



THE Tweed FOUNDATION

A Tweed Foundation Paper

original project is also needed to show if the results obtained then are still valid.

- (b) In addition to the tracking work, set up a programme to map the time of Salmon spawning and fry emergence throughout the catchment. This will extend the value of the tracking work on the same subject which will necessarily be limited by the expense and logistics of that sort of work. ***This will be undertaken by the RTC Bailiffs, who will record times of first spawning in defined areas in different parts of the catchment. To begin in Autumn 2005***

- (c) Produce a map of the geographical distribution of nursery areas the different stocks of Tweed Salmon based on tracking and on spawning times which would then be put on the Tweed Fisheries GIS. Such a map would allow information from juvenile surveys to be attributed to particular stocks making them more useful for setting Management Levels.

- (d) Continue to micro-tag Salmon Parr sampled under the juveniles monitoring policy (in Section C below)
 - (i) Recaptures in the river will contribute to the understanding of relationships between geographical area of spawning and the type of Salmon produced
 - (ii) Recaptures at sea will give information on where Tweed Salmon are being taken outside the catchment).

- (e) Devise a large scale genetics survey for the Tweed and Eye catchments to find out :
 - (i) How many different stocks of genetically distinctive Salmon there are ?
 - (ii) What areas they occupy ?
 - (iii) Map these areas and relate to the map produced for (c)
 - (iv) Determine whether the number of juvenile electric-fishing sampling sites within each population's area is adequate to show trends in that population.

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System



THE Tweed FOUNDATION

A Tweed Foundation Paper

Policy 1.A (2) Continue collection of Salmon scales from the sample fisheries along the course of the main river and from the larger tributaries: -

- (a)** Analyse these to show :-
 - (i) Geographical pattern and age structures
 - (ii) Lengths and weights of fish for in relation to area, time of year and age

- (b)** Analyse DNA from these scales to show which part of the catchment they came from and therefore which parts of the catchment produce the different types of adult fish (Spring, Summer, Autumn, Salmon, Grilse)

INPUT 1.B : INVENTORY THE QUANTITY AND QUALITY OF NURSERY AREAS OF EACH STOCK OF SALMON

Rationale : Healthy stocks of Salmon can only come from a healthy river environment, which is much more than simply a good chemical quality of water. The physical forms and shapes of streams and rivers are crucial - larger fish need deeper water but young fry need shallower, gentler, areas so the ratio and mix of stream types, of runs, pools and riffles, is vital if every life-cycle stage is to find enough of the conditions best for it. Overgrazing weakens and destroys the bankside turf that separates soils from floodwaters and so accelerates bank erosion making streams become wider and shallower and less suitable for older fish and for young fish during spates and droughts. Overshading by dense trees kills off bankside vegetation and so has the same effect as overgrazing. Even the best quality of habitat is useless to fish if they cannot reach it to spawn in it, and the industrial history of the Tweed has left behind a multitude of barriers to fish migrations. The identification of areas inaccessible to spawning fish and areas of poor physical quality show where remedial actions are needed. Areas that are in good condition need to be secured as such through protection by fencing.

Once remedial actions are taken, their long-term effects and benefits need to be monitored to assess their effectiveness and value.

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System

© All information contained within this paper is Copyright and must not be reproduced without the prior permission of The Tweed Foundation. E&OE



THE Tweed FOUNDATION

A Tweed Foundation Paper

The backlog of problems of habitat degradation and blocking of fish migrations in the District is a "by-product" of the farming, forestry, industrial and road-building methods of the past. but with relatively minor changes to traditional practices further problems will not be created and this must be a major aim of fisheries management. The changes in forestry practice brought about through the "Forests and Waters Guidelines" demonstrate what can be achieved in this way.

Results from previous editions :

- a: There have been systematic foot surveys made of all the watercourses between 2 m and 8 m wide (approx.) throughout the catchment. Lists of obstacles to fish migration were produced as a basis for remedial action and areas where banksides were under stress were identified.*
- b: Since 1990 eight obstacles to fish movement have been completely removed and 27 eased to make fish passage less difficult.*
- c: Since 1992, 115 km of bankside have been fenced, to provide protection to the banksides, allowing vegetation to develop and strengthen banks and provide more cover for fish as well as providing buffer zones between the river and other land uses.*
- d: Where bankside erosion has been particularly severe, some 4 kms of instream works have been built to stabilise banks till natural revegetation, aided by the planting of native trees, can restore the situation. These fenced and planted riverbanks create corridors of semi-natural vegetation along watercourses that connect up existing woods and wetlands to provide a network for many plants and animals to spread and connect up previously isolated populations.*
- e: Six pilot projects to monitor the long-term effect of different types habitat improvements were set up during the period of the first management plan and have been monitored since.*

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ

Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277

email: info@tweedfoundation.org.uk

Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System



THE Tweed FOUNDATION

A Tweed Foundation Paper

- f: Leaflets on habitat improvements and on river works have been produced.*
- g: Links with Farmers and Foresters have been established and information on how land uses can impact on waters and fish has now been widely disseminated throughout the District*
- h: All available long term catch data has been collected and computerised as part of the Catch Records Project 2001-04.*

Policies for the next five years :

Policy 1.B (1) : Collect and Analyse Historical Data on the Environment of the Fisheries District

(a) Collect and map the locations of man-made barriers past and present and quantify the areas of spawning blocked or restricted by them. If possible, maps of the area open to Salmon spawning in 1800, 1850, 1900, 1950 and at present will be produced.

Policy 1B (2) : Survey of Salmon Spawning Areas

- (a)** Although the foot surveys of the nursery areas were completed in the second Management Plan period, analysis of the information obtained did not keep pace with the surveys themselves, owing to the bulk of data collected. The advent of the G.I.S. Data Management System makes the handling and analysis of such large data sets and the gathering of relevant inputs from other sources (such as geological and physical maps) much more practicable. Analysis of the data will aim to show :
- (i)* Geographical relationships with recorded habitat quality - the effect of gradient, geology etc.
 - (ii)* Cultural relationships with recorded habitat quality - the effect of fencing, commercial forestry, land-use etc.
 - (iii)* Quantification of recorded habitat quality and its mapping.
 - (iv)* A query system will be developed to allow this habitat survey data to be easily available and analysable

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System



THE *Tweed* FOUNDATION

A Tweed Foundation Paper

- (b) The foot surveys were of the medium sized channels, leaving the larger channels, the habitat of the Autumn Salmon unsurveyed. Different methods are needed for such large channels and remote sensing from the air appears to offer the best solution and this will be investigated.

Policy 1B (3) - Monitor the effects of obstacles on fish passage and undertake appropriate habitat protection and restoration work for each salmon stock.

- (a) Most obstacles in Spring and Summer Salmon areas have now been eased : These have been in small and medium sized channels
- (b) Most habitat restoration in areas of importance for Spring Salmon has either been completed or is being planned
- (c) Bankside fencing to provide buffer zones to protect watercourses in areas of Spring Salmon production has been largely completed in the Ettrick catchment: Such areas in other sub-catchments should be similarly protected.

Policy 1B (4) : Monitor the physical changes and the juvenile salmon populations where habitat protection or restoration has been undertaken

- (a) Continue to monitor the long-term changes at the Habitat Pilot Projects set up during the period of the first Management Plan to evaluate the techniques used.
- (b) Continue the monitoring programme of sites in areas of habitat rehabilitation and analyse the results.
- (c) Set up and maintain a database of protection and restoration sites : To include pre-works photographs and data, rationales, plans, costs and contracts for the restoration work, post-works photographs and continuing monitoring data

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System



THE *Tweed* FOUNDATION

A Tweed Foundation Paper

Policy 1B (5) : Ensure the access and habitat problems of the past do not recur

- (a) Collect information from the UK and abroad on best practice in Farming, Forestry and Road-building in relation to waters and fish populations.
- (b) Disseminate this information amongst local land-users and provide practical advice on its implementation.

INPUT 1.C: MONITOR THE JUVENILE POPULATIONS OF EACH STOCK OF SALMON : THE INFLUENCE OF HABITAT CHARACTERISTICS ON THEM AND THE EFFECTS OF PREDATION

Rationale : Monitoring the abundances of juvenile Salmon in the different parts of the catchment shows how well the spawning areas are being filled with young. If numbers of spawners of a stock were to fall to the extent that it reduced the densities of juveniles at its monitoring sites, this would become apparent several years before the resulting adults were due to return, and catch regulations to reduce exploitation on them could be prepared in advance. Knowledge of how well the catchment is stocked with juveniles will also show if any fall in adult numbers is due to actual lack of juveniles or to some other reason

Poorer numbers in particular areas also serve to show where there are access problems or where habitat restoration may be required. Knowledge of how different habitat types affect the abundances of juveniles that can live in them is necessary if habitats that are capable of improvement are to be distinguished from those that are not.

The Tweed Fisheries District is home to significant populations of fish eating birds - Goosander, Grey Heron and to a lesser extent, Cormorant. The first is of much the greatest significance as it feeds purely on fish and is found throughout the system (Hérons eat significant amounts of Frogs, ducklings, rodents and insects as well as fish and cannot reach out beyond the banks to where Smolts move and Cormorants are mainly found in or near the estuary) The Goosander is also a gregarious rather than a solitary feeder

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System

© All information contained within this paper is Copyright and must not be reproduced without the prior permission of The Tweed Foundation. E&OE



THE *Tweed* FOUNDATION

A Tweed Foundation Paper

which means that considerable flocks of Goosanders can form where they find fish available. As Smolts are the "end-product" of up to three years of freshwater life, any loss to predation is irrecoverable and must result in fewer adult Salmon returning to the river.

Results from previous editions :

- a: In the first edition of the management plan (1990-95), sites in medium-sized channels (dominated by Salmon) that would be electric-fished regularly to monitor the fish densities in them were set up in the Ettrick, Till, Teviot and upper Tweed catchments, and in the second edition (1995-2000) the same was done for the Whiteadder, Leader, Gala and some minor tributaries. The first repetition of the monitoring cycle started in 1999 when the Teviot and Till sites were re-sampled.*
- b: The information from these samplings (Appendix C)) has helped determine the management levels required for Salmon stocks*
- c: Access problems for spawning Salmon have been shown up by the results from some sites as have areas where habitat restoration work would be beneficial*
- d: Analysis of the stomachs of Goosanders provided by the TF and RTC to the Institute of Terrestrial Ecology (and now published as part of Marquiss, Carss, Armstrong and Gardiner 1998) has provided estimates of Smolt consumption which, when combined with counts of made of these birds during the Smolt season, has made possible the estimation of the economic damage to the local economy caused by their predation.*

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System

© All information contained within this paper is Copyright and must not be reproduced without the prior permission of The Tweed Foundation. E&OE



THE Tweed FOUNDATION

A Tweed Foundation Paper

Policies for the next five years :

Policy 1.C(1) : Monitor the Densities of Juvenile Salmon at Key Sites throughout the Medium-sized Channels of the Catchment

- (a) Continue the electric-fishing monitoring of the sites set up previously - the cycle will be: -

SECTORS OF THE CATCHMENT TO BE SAMPLED IN :

2005	2006	2007	2008	2009
Ettrick	Upper Tweed	Middle Tweed	Ettrick	Upper Tweed
Whiteadder	Gala	Teviot	Whiteadder	Gala
Eye	Leader	Eden & Leet	Eye	Leader
		Till		
		Total number of sites		
<u>51</u>	<u>58</u>	<u>58</u>	<u>51</u>	<u>58</u>
(Further sites may be added if found necessary)				

In setting up this sampling rotation, care had to be taken to avoid following the same generational cycle of Salmon. The Ettrick and Whiteadder are dominated by five year old Multi-Sea-Winter Salmon so if sampling was every five years, it would be the same line of Salmon being sampled each time. To avoid this, the sampling periodicity for these sectors has to be any period other than five years. The other sectors are dominated by four year old Grilse and their sampling periodicity therefore has to be three or five years. Combining these two different periodicities to give a schedule that covers each sector at a reasonable frequency produces the three-year pattern shown above.

- (b) Analysis of the information obtained has not kept pace with monitoring cycles, owing to the bulk of data collected, but the advent of the G.I.S. Data Management System makes the handling and analysis of such large data sets and the gathering of relevant inputs from other sources (such as geological and physical maps) much more practicable. Analysis of the data will aim to show :
- (i) Geographical (including altitudinal, geological and locational) variation in abundances of Salmon juveniles throughout the District

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
 Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
 email: info@tweedfoundation.org.uk
 Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System



THE Tweed FOUNDATION

A Tweed Foundation Paper

- (ii) Local effects of the width, depth, substrate and cover on the numbers and ages of fish present at sample sites
 - (iii) The combinations of factors that give good juvenile Salmon numbers and those that give poor numbers.
 - (iv) An assessment of whether samples that produced poor numbers were being affected by natural or artificial problems and the definition of the latter.
 - (v) Listing of any problem areas discovered for appropriate remedial action.
 - (vi) Identification of where new monitoring sites could extend and improve coverage by the monitoring programme.
- (c) Particular attention should be paid to results from sites upstream of fish passes as the efficiency of these can change over time due to erosion downstream or under the entrance and this could be reflected in juvenile numbers upstream.
- (d) Liaise with SEPA through the SFCC to establish the role these electric-fishing sites could play in the biological monitoring dimension of the forthcoming Water Framework Directive. The implementation of the Water Framework Directive has been identified as a Key Issue in the "Rivers and Burns" section of the Local Biodiversity Action Plan.

Policy 1.C : (2) : Collect Data on the Effects of Predation on Juvenile Salmon, and on Smolts in particular

- (a) Continue to count the numbers of Goosanders and Cormorants in January, April, May and September of each year. ***Counts are organised by the RTC Superintendent and carried out with the RTC bailiffs.***
- (i) Use the information from these counts and from published analyses of the diet of Goosanders and Cormorants on the Tweed to make annual assessments of the total impact of their predation on the Smolt run

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System

© All information contained within this paper is Copyright and must not be reproduced without the prior permission of The Tweed Foundation. E&OE



THE *Tweed* FOUNDATION

A Tweed Foundation Paper

- (ii) Analyse the results of the counts to show any geographical pattern to the distribution of Goosanders along the river. If any locations are found where the birds are regularly clustered these could be "choke-points" where smolts are particularly vulnerable and special measures to protect such sites could be taken.

INPUT 1.D: ANALYSE THE CATCH COMPOSITION AND TRENDS OF EACH STOCK OF SALMON

Rationale : Analysis of catches for their composition shows which stocks (and areas of the catchment) are producing the fish that support the fisheries. Knowledge of trends and cycles in catches allows annual figures to be judged in a wider context. The "breadth" of support for catches depends on their composition : Catches that depend on only one age class of fish are more vulnerable to fluctuations due to environmental effects on single spawning or smolting years than those that exploit two or more age groups of fish and this is important information if the significance of fluctuations in catch totals is to be properly assessed.

Results from previous editions :

- a: Scale reading has shown :*
- (i) The age structure of the Salmon caught in the rod fisheries. Up to 85% of the Spring Salmon can be the same age (2.2, five years old) though the ages Autumn catches are more diverse*
 - (ii) The relative contributions of the different seasonal types to the catches*
- b: Analysis of Salmon rod catch records has shown :-*
- (i) There have been considerable shifts in the timing of the main Salmon rod catches over the last 150 years from Autumn (2nd half of the Season) to Spring (1st half) and back to the Autumn (Section 4). This shows that before the "decline of the Spring Salmon" there was a very considerable "rise of the Spring*

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System

© All information contained within this paper is Copyright and must not be reproduced without the prior permission of The Tweed Foundation. E&OE



THE Tweed FOUNDATION

A Tweed Foundation Paper

Salmon" so the situation is much more complex than generally realised and it is better to think in terms of "change" rather than "decline", especially as there is some evidence that there was a previous period of mainly Spring catches around the end of the 18th century.

- (ii) These changes are reflected in the overall rod catch figures of the last 50 years as shown in the RTC Assessment records (Section 4) in which it can be seen that the most recent change from 50% and more of the catch being taken in the first half of the season to it be taken in the second half of the season was 1968*
- (iii) The differences between the stocks of the Etrick and the Upper Tweed found at present (Appendix A1 can be traced back through the 20th century in the catch records from immediately upstream and downstream of the confluence of the Etrick with the Tweed.*
- (iv) There was a five year cycle in the numbers of Spring Salmon caught which appears to have been set off by a catastrophic flood in the Etrick at the end of October 1977 (Section 4)) highlighting the vulnerability of the Etrick Spring Salmon stock, limited as it is in area of production and age of maturity, to adverse natural factors - and therefore to man-made impacts such as over-fishing as well.*
- (v) The age classes being exploited by the rod fisheries through the season*

c: All known long series of net and rod catch records were collected and computerised during the Catch Records project of 2001-04

Policies for the next five years :

Policy 1.D (1) - Determination of Long-term Changes and Cycles

- (a)** Continue analyses of catch and environmental data to show any long term trends or cycles.

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System

© All information contained within this paper is Copyright and must not be reproduced without the prior permission of The Tweed Foundation. E&OE



THE Tweed FOUNDATION

A Tweed Foundation Paper

Policy 1.D (2) - Monitor Catch Composition

- (a)** Continue collection of Salmon scales from the sample fisheries along the course of the main river and from the larger tributaries:-
 - (i)* Analyse these so show the different stocks and age classes of fish being caught. This shows how dependent catches are on particular ages of fish and how success or failure of particular spawning or Smolt years can be reflected in the catches of the resultant adults.

Policy 1.D (3) - Monitoring and Analysis of Catch Trends

- (a)** Continue to analyse the rod and net catch records for trends and changes and improve catch recording detail if possible:
 - (i)* Improve the quality of rod catch records by recording the amount of fishing effort at least a sample of fisheries - the same total of fish caught with a little effort indicates a very different situation than if caught with a lot of effort. This improvement is of particular importance for the monitoring of Autumn Salmon and Grilse as these fish spawn largely in the main channel and at the bottom of the tributaries, they are unlikely to be monitorable by fish counters in the foreseeable future. Rod catch records with effort data therefore offer the only practicable way at present of monitoring this stock.
 - (ii)* In particular, monitor the Spring catches for any further signs of the five year cycle in poor catches found previously
- (b)** Continue the accumulation of data for modelling the Salmon stock of the District and the collection of examples from elsewhere.

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System

© All information contained within this paper is Copyright and must not be reproduced without the prior permission of The Tweed Foundation. E&OE



THE Tweed FOUNDATION

A Tweed Foundation Paper

INPUT 1.E : ESTIMATE THE EXPLOITATION RATE OF EACH STOCK OF SALMON

Rationale : If spawning targets are to be established, it is necessary to know where the adults of a stock are being killed or are dying and how many are being lost in these ways. If more breeding fish are needed for the spawning areas, then reduction of these losses is the best way to provide them. Early running stocks are generally more heavily exploited than later stocks because they are in a river for more of the fishing season. Later running stocks, may, in fact be only very lightly exploited and if this can be shown, then it can indicate increased scope for fisheries just as high exploitation rates of early running fish can mean that their exploitation should be reduced.

Results from previous editions :

- a: Tagging Salmon in the estuary each September to find out how many were later caught by anglers has shown that the exploitation rate by the rod fisheries of these Autumn fish is very low, only 5% or so (Appendix E)*

Policies for the next five years :

Policy 1.E (1) : Monitoring of Angling Exploitation Rates of Salmon

- (a) Continue the assessment of the rod exploitation rate of Autumn salmon through tagging and recapture. This is based on the use of a netting station after the netting season ends.
- (b) If possible, extend this to the Spring and Summer stocks as well : This would require the use of a station during the netting season. There are, at present, no estimates for the exploitation rate of Tweed Spring and Summer Salmon stocks but these are very important for the setting of Management Levels. In other rivers, the angling exploitation rates of earlier running stocks are known to be much higher than those of later fish.

This Policy is the basis of the Exploitation Rate Project which will start in 2005

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ

Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277

email: info@tweedfoundation.org.uk

Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System



THE *Tweed* FOUNDATION

A Tweed Foundation Paper

INPUT 1.F: COUNT ADULT SALMON POPULATIONS

Rationale : The most basic need of a stock is that enough fish should escape all the pressures on them to spawn and fully seed their nursery areas for the next generation and this is best known if the fish of each can actually be counted. This needs fish counters to actually tally the fish - and has to be done on a stock-by-stock basis- i.e. each distinct stock needs a counter to record the numbers making it back to their nursery areas so that finally. As well as giving a result for the number of fish passing upstream of it, results from a counter also give checks on a wider range of data : e.g.the totals of a fish counter counting Spring or Summer fish up a tributary should mirror the catches of those fish in the main channel, if these are related to stock size.

Results from previous editions :

- (a) A fish counter was installed in the fish ladder of the Murray Cauld on the Ettrick, near Selkirk, in 1997 and counts of adult fish going upstream to spawn are now available from 1998 onwards (Appendix F) As this counter measures the length of each fish it counts, samples of fish were trapped in most months of 1998 and their lengths and species identified. This data allowed the counter totals to be split into species - Salmon or Sea-trout - by their length in any month.*
- (b) A first estimate of the spawning escapement needed by Salmon of the Ettrick was made and annual counts have been assessed against this since*
- (c) As a result of this information, a Management Level 3 approach was recommended to the RTC to safeguard the Ettrick Spring Salmon*
- (d) Intensive juvenile surveys of the Fry resulting from each counted run of adults since 1998 have been made on the Ettrick. Results are given in Appendix F. Data series are too short as yet, but in time this will serve as a check on whether the estimated number of spawning Salmon needed is appropriate*

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System

© All information contained within this paper is Copyright and must not be reproduced without the prior permission of The Tweed Foundation. E&OE



THE Tweed FOUNDATION

A Tweed Foundation Paper

Policies for the next five years :

Policy 1.F (1) : Continue counts at the Ettrick fish counter and install other counters where possible

- (a) Now that photographs and videos of the fish passing through the Ettrick fish pass are available, more accurate division between Salmon and Sea-trout is possible. Past counts will need to be re-calculated using this new information.
- (b) **Install a fish counter in the fish ladder on the Gala Water.**

Funding for this has been obtained from the Life In UK Rivers Project and should go ahead in 2005

- (c) **Plan for further counters on Tweed tributaries**
 - (i) Gather information on fish counter models, with particular regard to those that could be used on existing caulds and other in-river structures: There are a number of these in the lower reaches of Tweed tributaries that it might be possible to adapt to carry counters.
 - (ii) Where possible sites match with counter models available, conduct feasibility studies

Policy 1.F (2) : Monitor the attainment of the spawning escapement target set for Ettrick Spring Salmon and develop the model of the whole Ettrick population

- (a) Using the fish counts at the Ettrick fish counter :
 - (i) Refine the estimates of the number of spawning adults needed through analysis of the habitat mapping and juvenile survey work
 - (ii) Continue the annual Fry Index surveys of the Ettrick and Yarrow to provide information on the levels of juveniles being produced by the numbers of adults counted. *(NOTE : It would be very useful if such Fry Index surveys could be carried out*

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System



THE *Tweed* FOUNDATION

A Tweed Foundation Paper

over the whole catchment as it would allow comparison to be made between the Ettrick and other areas. It would also be useful generally in mapping the key spawning areas of the catchment and showing variability)

- (b) Continue to develop the population model for Ettrick Salmon: This is based on the counter data that shows how many Salmon survive all the pressures on them to escape to spawn and estimates of how many are killed in the rod and net fisheries, both inside and outside the Tweed catchment. The contribution of "Catch and Release" fish to the spawning stock is also estimated. Results are given in Appendix F1. This modelling shows where pressure is falling on the population, where management action can be best be directed to support it and whether the how effective the current Management Level is.

Policy 1.F (3) : If a fish counter is installed on the Gala, establish its Spawning Targets

- (a) Define the nature of the Salmon stocks - Spring, Summer or Autumn
- (b) Map the habitat to provide an estimate of carrying capacity for juveniles and therefore of the number of spawning adults required
- (c) Start annual Fry Index surveys to provide data on juvenile numbers that can be related to numbers of spawning adults.

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System

© All information contained within this paper is Copyright and must not be reproduced without the prior permission of The Tweed Foundation. E&OE



THE *Tweed* FOUNDATION

A Tweed Foundation Paper

BASIC RESEARCH NEEDS IDENTIFIED FOR SALMON :

For Input 1.A

(1) A comprehensive mapping of the genetically distinctive salmon population of the Tweed is urgently required. Once the home areas of such stocks are known, genetic analysis of scales from adult fish caught at different times of the season would show which part of the catchment and therefore to which population the different runs of adult fish belonged. This would allow juvenile and adult stock assessments to be connected.

For Input 1.B

(1) Aerial surveys of the Ettrick and Gala. This would allow good estimates to be made of the amount of juvenile habitat to be stocked by spawning salmon and therefore better estimates of the number of spawning fish needed to check against the numbers being actually recorded by the Ettrick and Gala counters.

For Input 1.C1

(1) A comprehensive mapping of the genetically distinctive salmon population of the Tweed is urgently required. Once the home areas of such stocks are known, genetic analysis of scales from adult fish caught at different times of the season would show which part of the catchment and therefore to which population the different runs of adult fish belonged. This should allow electric-fishing data on juveniles in different parts of the catchment to be categorised as the young of Spring, Summer or Autumn fish and trends for the different runs to be assessed for both juvenile and adult stages.

(2) Monitoring juveniles of large channels. It should be noted that all the electric-fishing sites monitored as part of this policy are in small to medium sized channels - the furthest downstream monitoring site on the Tweed itself is two kilometres downstream of Tweedsmuir, on the Ettrick it is at Fauldshope and on the Teviot, just upstream of Hawick. The standard techniques for quantitative electric-fishing are basically unsuitable for very wide channels - but such main channels can form 60% to 70% of the total area open to spawning Salmon in a catchment. On the Tweed, Salmon spawn as far downstream as Coldstream and juveniles can be found throughout the middle and lower river. The lack of coverage of this huge area of main channel is a serious weakness in the monitoring programme, particularly as

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ

Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277

email: info@tweedfoundation.org.uk

Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System



THE *Tweed* FOUNDATION

A Tweed Foundation Paper

this is the area of a particular stock, the Autumn Salmon and it has become obvious that some method of sampling has to be devised for this type of channel. The matter is being considered at present by the SFCC and trial sampling will be carried out during this edition of the Management Plan (The SFCC is investigating such sampling techniques – the Assistant Biologist is on the Working Group)

(3) Checking the significance of results from both quantitative and Index electric-fishing. This could be carried out upstream of a trap so that the numbers of spawning adults producing the Fry and Parr sampled would be known. At present, this would only be possible in a trout spawning burn like Stanhope but as female trout carry many fewer eggs than Salmon, there is more likely to be significant variation in egg deposition to produce variation in numbers of juveniles sampled.

For Input 1.D.1

(1) With more and more catch-and-release, the consistency of catch records over the years has something of a question over it – how many fish are now caught more than once? This needs a very easy to use tag that anglers can put on fish they release, that does not require them to put holes in fish. Some sort of “Velcro” band to put round the wrist of the tail would be the simplest thing to do (and tags like these appear to be used for the necks of swans and geese). A six-month life-span (or even less, for the Autumn) would be all that was needed.

For Input 1E

(1) An effective way of catching Salmon and Sea-trout in the estuary for tagging.

THE TWEED FISH CONSERVANCY CENTRE, DRYGRANGE STEADING, MELROSE, ROXBURGHSHIRE TD6 9DJ
Tel: EARLSTON (01896) 848271 Fax: EARLSTON (01896) 848277
email: info@tweedfoundation.org.uk
Charity No. SC011055

A charitable trust established by the River Tweed Commission to promote the development of fish stocks in the Tweed River System

© All information contained within this paper is Copyright and must not be reproduced without the prior permission of The Tweed Foundation. E&OE