SECTION 3: SEA-TROUT

INPUT 3A: DETERMINING AND DEFINING THE STOCKS OF SEA-TROUT WITHIN THE TWEED SYSTEM AND THEIR LIFE-HISTORIES

Rationale: The most basic information needed on the Sea-trout of the Tweed is their stock structure: Is there just one interbreeding stock of uniform characteristics throughout the whole catchment, or are there stocks differentiated by location and life-history and, if there are, are such differences genetic? If the full range of stocks and run-timings is to be maintained in the Tweed, then it is essential to know the exploitation rate of each stock and how well their spawning requirements are being met. If there are different, geographically based stocks, then the question of how these are related to the Brown trout in their home areas arises: are these too different "stocks"?

***Results from previous Plans*:**

a. *Scale reading of Sea-trout killed at the sample rod fisheries and at the estuary has given basic information on life histories and sizes. Till Sea-trout proved to have a different size-range to that Tweed Sea-trout in general.*

b. *A few September Sea-trout were successfully radio-tagged from 1994-96 which gave their pattern of upstream movement, spawning location and pattern of downstream movement.*

c. *Tagging and recapture of Sea-trout kelts showed that the period spent at sea between return and repeat spawning run can be only 3 to 4 months and that their growth rate at sea could be as much as 15mm per month.*

d. *Collation of all the pre-1990 records of tagged and recaptured Sea-trout has shown that there is a migration route to the south, to East Anglia, the Frisian Islands and the Dutch and Danish coasts. This is a quite different pattern from those of the rivers to the north of the Tweed, whose Sea-trout appear to only come as far south as the Tweed estuary. It appears that there could be two distinct migration routes for Tweed Sea-trout, a shorter, local one and a long distance one to the Waddensee.*

Policies for the next five years:

Policy 3A.1: Devise a large-scale genetics survey for the trout of the Tweed and Eye catchments to extend the work undertaken under the Living North Sea (LNS) programme and make a comprehensive trout genetic map (*Such work could be undertaken as an extension of the genetics work on Salmon presently being undertaken with RAFTS and the FASMOP programme, if other Fishery Trusts have similar interests*). This work would show:-

(i) How many different stocks of trout there are and whether Sea- and Brown trout belong to the same stocks.
(ii) What areas they occupy.
(iii) Whether the number of juvenile sampling sites within each stock's area is adequate to show trends in their numbers.

Policy 3A.2: Continue to investigate the stock structure and life-histories of the Sea-trout of the District and define any geographical or temporal differences

(i) Geographical/temporal patterns in age structure.
(ii) Geographical/temporal patterns in lengths and weights.
(iii) Patterns of marine growth.
(iv) Characteristics of spring, summer and autumn running fish and whether these could be defined as "runs" produced by particular stocks.

b. LNS: Determine the marine feeding grounds and migration routes of Tweed Sea-trout

(i) Carlin tag Sea-trout smolts at the smolt traps. Recaptures at sea will show migration routes and marine feeding grounds.
(ii) **LNS:** Contribute samples for genetic analysis to the LNS Genetics programme. This will characterise Sea-trout populations from around the North Sea, with the aim of allowing any Sea-trout caught at sea to be identified back to its home population. Tweed Sea-trout caught at sea should be recognisable wherever caught when this programme is completed.

c. LNS: Continue smolt trapping to determine sizes, ages and timings of Sea-trout smolt runs

(i) Establish sex-ratio of Sea-trout smolts.

d. LNS: Determine sex-ratio of adult Sea-trout populations

(i) Trap Sea-trout in the Gala fish ladder to establish the sex-ratios of the migratory trout of this tributary. (As this has the largest, trappable, run of Sea-trout, it is the primary source of such data).
(ii) Collect data from the other permanent and temporary traps that have Sea-trout spawning runs.

LNS: Policy 3A.3: Determine the relationships of Tweed Sea-trout to other populations around the North Sea and whether they share historical catch trends

(i) Contribute data on the characteristics (size, age, run timing, sex-ratios, etc.) of Tweed Sea-trout for analysis with similar data from rivers around the North Sea to identify patterns and differences.
(ii) Contribute catch record data of Tweed Sea-trout for analysis with similar data from rivers around the North Sea to allow identification of common trends and the relationship of these to physical phenomena such as sea-temperatures, current patterns, etc.

Policy 3A.4: Determine the fecundities of Sea-trout (The fecundity of a fish is the number of eggs that it carries in relation to its size) [*This would require large samples of fish killed near spawning time. At present, these are not available, so fecundities are measured from whatever fish become available.*]

(i) Find if Sea-trout that could represent different stocks have different fecundities.

INPUT 3B: INVENTORY THE QUANTITY AND QUALITY OF NURSERY AREAS OF SEA-TROUT

Rationale: As for Salmon.

Results from previous editions: *As for Salmon.*

Policies for the next five years:

Policy 3B.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 Sea-trout spawning in 1800, 1850, 1900, 1950 and at present will be produced.

b. Continue analysis of long-term catch records and environmental data.

Policy 3B.2: Survey of Sea-trout spawning areas

a. New technologies of aerial river survey offer a much more objective and usable way to survey and analyse habitat data and the development of these will be monitored and, if the opportunity arises, applied to the catchment.

b. Existing aerial survey data for the catchment (taken from general rather than from river-specific surveys) will be analysed to show:

(i) Area of wetted habitat in tributaries to show the extent of spawning that needs to be filled by fish.

c. Where areas of weaker trout juvenile numbers are found during the electro-fishing surveys of Policy 3C.1, these should be investigated according to the Habitat Investigation Protocol (see below) and the reasons for such poorer results identified. If feasible, any problems identified should be removed or mitigated.

LNS: Policy 3B.3: Monitor the effects of obstacles on fish passage and undertake appropriate habitat protection and restoration work in Sea-trout spawning and nursery areas

a. All obstacles in the catchment are now passable by Sea-trout, but possible restriction of access, in particular in dry years, needs to be monitored.

b. While no specific areas where bankside fencing to provide buffer zones around Sea-trout spawning and nursery areas would be of benefit have been identified, the fencing undertaken for the general protection of watercourses will be of value to Sea-trout.

Policy 3B.4: Monitor the physical changes and the juvenile trout 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.

Policy 3B.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 3C: MONITOR THE JUVENILE POPULATIONS OF EACH STOCK OF SEA-TROUT, THE INFLUENCE OF HABITAT CHARACTERISTICS ON THEM AND THE EFFECTS OF PREDATION

Rationale: As for Salmon.

Results from previous editions: *As for Salmon, and in addition:-*

a. *In the first edition of the management plan (1990-95) timed Electro-fishing surveys were made of the fish populations in the smaller burns (dominated by Trout) of the Ettrick, Eden, Till, Teviot and upper Tweed catchments and in the second edition (1995-2000) the Whiteadder, Leader, Leet, Gala and minor tributaries were surveyed in the same way. The survey of the districts smaller burns has thus been completed. In all 460 locations on 350 streams were visited and trout were shown to be the most widespread fish species in both the Tweed and Eye catchments.*

b. *These smaller burn sites are now being re-sampled as part of the TTGI and differences from the baseline survey analysed. As the timed methodology is now being used for Salmon sites as well, the Salmon and the smaller burn trout sampling have been amalgamated.*

Policies for the next five years:

LNS: Policy 3C.1: Monitor the densities of juvenile Trout at sites throughout the medium-sized channels of the catchment and survey any smaller burns required

a. Continue the electro-fishing monitoring of the sites set up previously - the cycle will be:-

SECTORS OF THE CATCHMENT TO BE SAMPLED IN :

2010	**2011**	**2012**	**2013**	**2014**
Till	Whiteadder	Leader	Till	Whiteadder
Teviot	Eye	Gala	Teviot	Eye
Middle Tweed	Leet	Upper Tweed	Middle Tweed	Leet
	Lower Tweed			Lower Tweed

The Ettrick is sampled every year.

b. LNS: Continue to extend the Fry Index sites over the whole catchment – existing coverage is shown in Map 2.1, for Salmon.

(i) Continue to develop the database holding the information from these surveys and linking this with physical, chemical and aerial survey data.

(ii) Analyse this electro-fishing data to show areas of good and poor abundances of juveniles and relate these to the habitat survey data gathered under Policy 3B.2. Where areas have no natural explanation for being poor in juveniles, further investigations under Policy 3B.2 using the Habitat Investigation Protocol are indicated.

(iii) Identify where new sites could extend and improve coverage by the monitoring programme.

c. LNS: Continue the smaller burns electro-fishing surveys: these are repeats of the 1990s baseline samples, with appropriate additional sites. Sites selected so far are shown in Map 4.1 in the Brown trout Section.

d. Maintain an appropriate selection of quantitative electro-fishing sites throughout the catchment to maintain continuity. Liaise with SEPA through the SFCC to establish the role these electro-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 3C.2: **Collect data on the effects of predation on juvenile Trout, and on Sea-trout smolts in particular**

a. Continue to count the numbers of Goosanders and Cormorants in January, April, May and October of each year (as for Salmon).

(i) 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 (as for Salmon).

b. LNS: Acoustic tag Sea-trout smolts in the Yarrow and Gala and track down to the sea:

(i) Determine success rate in reaching the sea, taking account of any handling/tagging mortality.

(ii) Determine causes of losses where possible and if there are particular parts of the main river in which losses are greater than in others.

(iii) Relate smolt movements and losses to the pattern of distribution of fish-eating birds on the main river during tracking.

(iv) Record types and levels of predator damage on Sea-trout smolts at traps.

INPUT 3D: ANALYSE THE CATCH COMPOSITION AND TRENDS OF EACH STOCK OF SEA-TROUT

Rationale: Analysis of catches for their composition shows which stocks (and areas of the catchment) are producing the fish that support the fisheries - and also what level of exploitation is being suffered by each stock. Knowledge of trends and cycles allows annual catches to be judged in a wider context.

***Results from previous editions**:*

a. *Scale reading has shown the age structure and life-histories of the Sea-trout caught in the rod fisheries. Of fish sampled at the nets, 79% were returning for the first time, 18% for the second and 1.5% for further times (Appendix A2).*

b. *Analysis of long-term net catches of Sea-trout has shown that the run timing has remained centred in the middle of the year, but with more September fish in the later 19th century and more May and June fish in more recent times (Appendix D).*

c. *RTC Assessment Records of Sea-trout rod catches have been collated and computerised (Appendix D).*

d. *All available long series of Sea-trout catch records at individual fisheries were collected and computerised as part of the Catch Records Project 2001-04. These give sizes (weights) of fish and so provide more details than the RTC records.*

Policies for the next five years:

Policy 3D.1: Determination of long-term trends and changes

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

Policy 3D.2: Monitor catch composition

a. Continue collection of Sea-trout 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 3D.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 at 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.

b. Continue the accumulation of data for modelling the Sea-trout stock(s) of the District and the collection of examples from elsewhere.

INPUT 3E: ESTIMATE THE EXPLOITATION RATE OF EACH STOCK OF SEA-TROUT

Rationale for this work: As for Salmon.

Results from previous editions:

a. *Tagging Sea-trout in the estuary each September to find the number later caught by anglers has shown that the exploitation rate by the rod fisheries of these later fish is very low, only 2% or so (Appendix E1), if the recaptures of tagged fish are being fully reported. Of the 500 Sea-trout tagged, the 6 angling recaptures have been distributed between the different sectors of the river as follows :-*

Lower River	*0*
Middle River	*3*
Upper River	*3*
Tributaries	*0 angled, but 2 found dead (one as a kelt the other as an Otter kill)*

This pattern of recaptures seems unrealistic and could indicate that tagged fish on the lower river are not being reported. If this was the case, then it would follow that the Sea-trout catches for the river generally were being under-reported.

Policies for the next five years:

Policy 3E.1: Tag Sea-trout on the lower river/estuary to find their angling exploitation rates

a. Continue the assessment of the rod exploitation rate of autumn Sea-trout 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 Sea-trout stocks.

LNS: Policy 3E.2: Acoustic tag Sea-trout on the lower river/estuary and track them upstream

a. Tag net or rod caught fish on the lower river/estuary.

b. Track the tagged fish upstream to determine non-angler mortality. The ordinary tagging shows the proportion killed by anglers, but cannot show what proportion die in the river due to other causes (predation, poaching, disease, etc.). During this tracking, data can also be collected on:-

(i) The speed of movement upstream of Sea-trout and how this relates to water conditions.
(ii) How their movements relate to the pattern of catches as shown on the FishTweed website.
(iii) How quickly the fish pass obstacles/find and use fish-ladders.

LNS: Policy 3E.3: Determine extent and locations of coastal fisheries for Sea-trout around the North Sea

a. Take samples for genetic analysis from coastal fisheries and from fish merchants (e.g. at Eyemouth) to identify origins of the Sea-trout being caught by fisheries in this area and contribute to the LNS programme to identify the sources of Sea-trout caught at coastal fisheries around the North Sea. This should, in turn, show where Tweed Sea-trout are being caught further of the Tweed.

INPUT 3F: COUNT AND MODEL ADULT SEA-TROUT POPULATIONS

Rationale: As for Salmon.

***Results from previous editions*:**

a. *Counts of Trout have been made at the Ettrick fish counter since 1998 and have been re-analysed using the better information on the sizes of Salmon and Trout available with the video system installed in 2005. This showed that there were more large Sea-trout (over 80cms) and small Salmon (under 50cms) than had been previously realised. With the video system however, around 70% of fish going through the Ettrick counter are now directly identifiable as Salmon or Trout.*

b. *Counts of Trout have also been made since 2007 at the Gala Water fish counter, though the dirtier water conditions there during spates mean that only around 30% of fish can be directly identified as Trout or Salmon. Identification of the majority has therefore to be by extrapolation from those directly identifiable.*

c. *Upstream/downstream traps have been set up on two larger burns of the upper Tweed at one of which counts of spawning adult Sea-trout going upstream in the autumn are made (the other trap has a Brown trout population).*

d. *Other, smaller traps have shown that on smaller burns, the great majority of eggs are deposited by female Sea-trout and fertilised largely by male Brown trout, which shows considerable overlap between the Sea and Brown trout of the system.*

e. *The distinctiveness of the Till Sea-trout and the local importance of the fisheries based on it gives it particular importance. A standard electro-fishing site was therefore set up in 1999 on an upper tributary of the College Burn to monitor the over-summering adults found there (Appendix A2). A second site, further downstream on the main burn, has since found to be required as well, as it was found that repeat-spawning fish enter the College later and do not reach the upper site by the time that it is generally sampled.*

Policies for the next five years:

Policy 3F.1: Continue the counts of adult trout at the Ettrick and Gala fish counters

a. Analyse the sizes of the trout counted and compare between the two tributaries to show up any differences.

Policy 3F.2: Plan for further counters on Tweed tributaries

a. 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.

b. Where possible sites match with counter models available, conduct feasibility studies.

Policy 3F.3: Establish spawning escapement targets for the Sea-trout of the Upper Tweed index tributary.

a. Model this population by:-

(i) Counting the numbers of Sea-trout (identified through scale reading) running upstream to spawn each year and relating them to environmental conditions (water levels and temperature).

(ii) Counting the numbers of Sea-trout smolts that move downstream each year.

(iii) Survey of the burns upstream of the traps to estimate carrying capacity.

WORK CALENDAR FOR SECTION 3:

		Month											
Policy	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3A.1	Genetics												
3A.2	(a) Scales collection	A	F	F	F	F	F	F	F	F	F	F	A
	(b) Marine routes			F	F	F	F				F	F	F
	(c) Smolt trapping			F	F	F	F						
	(d) Adult trapping										F	F	
	(e) Till Whitling									F			
3A.3	North Sea	-	-	-	-	-	-	-	-	-	-	-	-
3A.4	Fecundities									F	F	F	F
3B.1	Historical habitat	-	-	-	-	-	-	-	-	-	-	-	-
3B.2	Spawning area							F	F	F	A	A	A
3B.3	Obstacles & Restor.			O	O	O	F/I	F/I	F/I	F	A	A	AS
3B.4	Restoration monitor.			O	O	F	F	F	F				
3B.5	Best practice	-	-	-	-	-	-	-	-	-	-	-	-

3C.1	Juvenile surveys							O	F	F	A		
3C.2	(a) Bird counts	F			F	F				F	A		
	(b) Smolt tracking		O	F	F	F	F	A	A				
3D.1	Historic Angling recs	-	-	-	-	-	-	-	-	-	-	-	-
3D.2	Catch composition	A	F/A	F/A	F/A	F/A	F/A	F/A	F/A	F/A	F/A	F/A	A
	Catch trends	-	-	-	-	-	-	-	-	-	-	-	-
3E.1	Exploitation rate	A				O	F	F	F	F			A
	Adult tracking	O/A	F	F	F	F	F	F	F	F	F	F	O/A
3E.2	Coastal fisheries	A	A			F	F	F	F	F			
3F.1	Fish counters	F/A	F	F	F	F	F	F	F	F	F	F	F/A
	Upper Tweed Trap	A	A	F	F	F	F				F	F	A

KEY	Not yet undertaken	
	At any time	-
	Organising	O
	Fieldwork	F
	Analysis & reporting	A
	Instream works	I

BASIC RESEARCH NEEDS IDENTIFIED FOR SEA-TROUT

For Input 3A: A comprehensive genetics survey of the Trout of the Tweed**:** to work out how many populations there might be and whether these are distinguished by particular life-histories.

For Input 3C: Monitoring juveniles of large channels. As for Salmon, though large channels are not thought to be as important as Trout spawning areas.

For Input 3E: A tag that anglers could safely and efficiently put on fish that had been caught and released.

For Input 3F: A comprehensive survey of the fisheries that take Tweed Sea-trout at sea (now part of the Living North Sea programme).