RIVER SPEY SEA TROUT SCALE PROJECT

Comparison of a present day scale collection with 2 historic collections

Dr A F Walker (Dec 2009)

A project jointly funded by the Spey Research Trust and the Moray Firth Partnership

The MFSTP is supported by Fisheries Trusts, Boards and Angling Associations in the Moray Firth region. Co-sponsored by:

1.0 BACKGROUND

This report describes an analysis of collections of sea trout scales and related data made in the River Spey during 2003 to 2009 which can be compared with results from older collections of scales, nominally made in 1928, 1976, 1984 and 1985 (as reported in Aug 2009). It should be pointed out that the scale collections were made from sea trout taken using different capture methods, by angling, commercial netting and electro-netting for fishery management purposes. This lack of consistency may limit direct comparison of the individual collections to some extent. Each capture method will involve some bias, perhaps in size selection and capture efficiency, in seasonal timing, or place sampled within the river catchment. It is reasonable to assume that sea trout populations deriving as juveniles from different parts of the Spey catchment are biologically structured, in much the same way as salmon. Some areas may hold earlier- or later-running components, for example, as in the Perthshire River Earn (Walker 1990). Ideally, scale sampling needs to cover all fish sizes, age groups and running times. However, this intensity of sampling is not feasible without operating a trap continuously near the river mouth, with all the attendant practical problems. Despite the sampling weaknesses, the accumulated data provide a fair picture of the age structure, migratory performance and marine growth of Spey sea trout over several decades. This information is required to inform scientifically based fishery management decisions.

2.0 SAMPLING

The dataset from 2003-2009 is patchy and opportunistic, comprising 415 sets overall. Therefore, the results from the individual years in this series are shown combined. The collection made in 2009 provided the bulk of the overall sample. Most of the data came from sea trout caught and tagged while Fishery Board staff were electro-netting (especially Avon and Livet) for salmon broodstock. The relatively small number of packets from Spey anglers was disappointing and may indicate poor fishing success, or that sea trout fishing is less popular than it used to be. It may also reflect the difficulty of taking scales and fish measurements from lively sea trout that will be returned under catch and release procedures.

Sampling details from the “historic” datasets are discussed in the August report. They came from sea trout netted near the mouth of the river. The earliest samples, reported by Nall (1928), came from research netting by the Fishery Board for Scotland in 1925/26 and from commercial netting at Tugnet in 1920 and 1927. The samples taken in 1976, 1984 and 1985 were obtained from the Crown Estate sweepnet fishery by the Freshwater Laboratory (now part of Marine Scotland). The commercial nets were intended to catch salmon and thus took few finnock and small adult sea trout due to mesh size selectivity. On the other hand, the early research netting exercise (Sept 1925 and Jan 1926) employed smaller mesh sizes and caught many finnock (0+ sea years), which were then tagged and released.

3.0 RESULTS

3.1 Age at smolting

Every effort was made to ensure that the scale reading procedures and protocols used in the early studies by G. H. Nall were consistently replicated. Examples of scales were read independently by three experienced scale readers and the scale packets are archived in case of review. Table I shows the percentage contribution of smolt ages to the various scale collections. The numbers represent only those fish where complete centres were present in the scales. Commonly, some scales are lost and then replacement scales regrow without the earlier pattern of rings.

Nall's data indicate that almost two-thirds of the sea trout sampled in the 1920s had been three-year-old smolts, whereas the 1976 and 1984 and 1985 samples suggested a change to earlier smoltification, which is confirmed by the 2003-2009 scale collection. A similar change to earlier smoltification has been shown by various studies on salmon. Accelerated development could lead to younger mean age at sexual maturity, shortened lifespan potential and other consequences.

. Table I: Smolt Age Frequency of Spey Sea Trout

	SMOLT AGE (%)					
YEAR	1	2	3	4	5	Nos
1928*	0	29	59	11	1	1690
1976	0	56	38	5	1	428
1984	0	58	37	4	1	271
1985	0	48	45	6	1	84
2003-09	1	57	41	1	0	210

*Nall's full Spey collection is included

3.2 Sea age at maturity and spawning frequency

The 2003-2009 scale collection contained 233 fish with complete scales. Based on "spawning marks," 175 of these were maiden fish (75%) and 58 (25%) were previous-spawners (Table II).

Table II: Spawning Mark Frequency of Spey Sea Trout

	Number of Spawning Marks (%)						
YEAR	0	1	2	3	4	5	Total
1926	1337(80.9)	199(12.0)	92(5.6)	19(1.2)	3(0.2)	2(0.1)	1652 (100)
1976	314(71.7)	82(6.2)	27(6.2)	8(1.2)	5(1.1)	2 (0.5)	438 (100)
2003-09	175(75.1)	30(12.9)	16(6.9)	10(4.3)	2(0.9)	-	233 (100)

The maximum number of SMs identified was four (2 fish). Age at maturity is inferred from the onset of spawning marks and it appears that spawning was annual once maturity was reached. Nall (1928) states that 315 of his fish had one or more spawning marks on their scales and, of these fish, 12.7% had matured as finnock (0+ sea winters), 68.6% at 1+ sea winters and 18.7% at 2+ sea winters. So a large majority of the sea trout did not mature until they were in their second year in the sea. The 1976 collection contained 124 fish with one or more spawning marks. Among these, only two fish (1.7%) had matured first as finnock, 119 (96%) had spawned first at 1+ sea winters and three (2.3%) at 2+ sea winters. The 1984 and 1985 collections did not provide age at maturity or spawning frequency information. Only two fish (0.8%) in the 2003-2009 scale collection appeared to have spawned first as finnock, compared with Nall's 12.7%. A total of 231 (99%) of the sea trout represented in the 2003-2009 scale collection, and assumed to be on their first spawning migration, were in their second sea year. In contrast, none of the previous spawners in that series had left spawning until their third year in the sea, compared with 18.7% of Nall's equivalent fish.

A trend towards earlier maturity in terms of sea age may be a consequence of the earlier age of smoltification shown by the results in Table I. Faster juvenile development could result in an increasing proportion of sea trout progeny maturing in fresh water and remaining there as brown trout. The suggested fall in finnock maturation is less easily explained, but may be connected to the drop in numbers of older smolts.

3.3 Total age frequency

Information on total age frequency (freshwater and sea age combined) is provided for 1976 and the 2003-2009 series in Table III. Nall (1928) gave a minimum age of 2+ and a maximum of 8+, but did not provide the full details. The age range in 1976 was 2+ to 9+ and in 2003 - 2009 it was 3+ to 7+, perhaps reflecting the smaller number of fish obtained for that scale collection and also the lack of finnock sampled. Most of the sampling in that series took place in upper/middle tributaries where finnock would be expected to be less common.

There was a sharp decline in sample size after age 4+, i.e. after the average fish reached maturity, having smolted at age 2 and matured in its second sea year (Also note Table IV). Increased levels of mortality can be expected to occur as a consequence of the rigours of spawning migration, spawning and recovery as kelts.

Table III: Total Age Frequency of Spey Sea Trout (%)

	Total Age								
YEARS	2	3	4	5	6	7	8	9	Total
1976	1 (0.2)	185(43.1)	148(34.5)	62(14.5)	19(4.4)	5 (1.2)	5 (1.2)	4(0.9)	429
2003-2009	-	87(41.6)	88(42.1)	22(10.5)	9(4.3)	3(1.4)	-	-	209

* Total age (Freshwater and sea age combined).

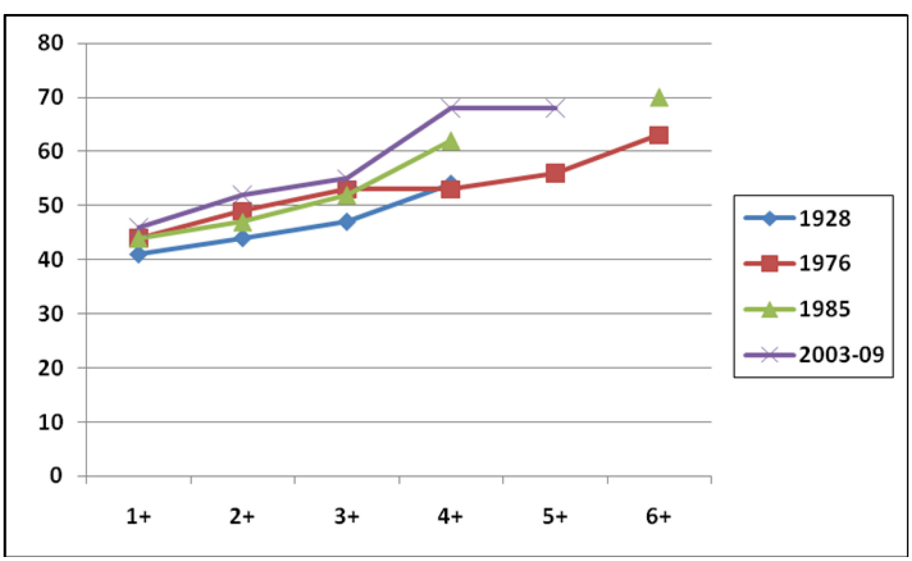
3.3 Marine Growth

The growth performance and body size attained by the sea trout at sea is information of key importance in monitoring their population status. Their overall abundance would be equally important to know, but we have no direct means of assessing this and have to rely very largely upon reported catches. In recent years, these have been disappointing, in the Spey and elsewhere, leading to concern about the overall state of sea trout stocks. Mean length at sea age (sea winters) provides an indication of marine growth, although the growth of individual fish tends to be quite variable and means are less reliable where the numbers sampled are small. Table IV shows mean length at sea ages calculated from the 1928, 1976, 1985 and 2003-2009 scale collections, with the sample numbers shown in brackets. Confidence limits for the means are available from all but Nall's series, but are not provided here. Figure 1 represents marine growth by plotting the series means and these form reasonably smooth curves, except where there were inadequate numbers. From these curves, it appears that the marine growth of Spey sea trout has been at least as good in recent years as in the 1920s, or it may have improved. On the other hand, the sample numbers per sea year indicate an earlier onset of steep decline in annual survival in the later collections compared with that reported in 1926. This may be explained by a shift towards earlier age at maturity in the later decades.

Table IV: Mean Length (mm) at Sea Age (winters) of Spey Sea Trout

	Mean Length (cm) at Sea Age (nos in brackets)						
YEAR	1+	2+	3+	4+	5+	6+	Total Fish
1928	41 (215)	44 (203)	47 (164)	54 (20)	-	-	602
1976	44 (310)	49 (82)	53 (27)	53 (7)	56 (7)	63 (2)	435
1985	44 (72)	47 (8)	52 (1)	62 (3)	-	70 (1)	85
2003-2009	46 (155)	52 (27)	55 (14)	68 (9)	68 (2)	-	207

Fig. 1 Plotted Mean Length (cm) at Sea Age (winters) of Spey Sea Trout



4.0 DISCUSSION

Analysis of scale collections from Spey sea trout made since the 1920s until recent years indicates a trend towards faster juvenile development leading to younger average age at smolt migration, also better overall growth at sea, earlier onset of sexual maturity and possibly shortened lifespan. The evidence for shorter lifespan is fairly weak, as it depends on always limited numbers of larger/older fish.

A reduction in mean smolt age of sea trout could be due to climatic warming and prolonged growing seasons, environmental enrichment through increasing agriculture, forestry and urbanisation, or even better food availability through reduced fish population densities. It is reasonable to envisage related changes in brown trout stocks going on at the same time, although there may be no means of detecting such changes at present. Accelerated juvenile development and earlier maturity of trout overall could result in proportionately more brown trout and fewer going to sea.

It is also an important finding, in view of concerns within recent years about low catches of sea trout and possible marine feeding influences, that Spey sea trout are maintaining their growth at sea. The scale reading evidence from the Spey contrasts with investigations in the River Ewe System (Loch Maree and Clair/Coulin catchment) in Wester Ross, where sea trout have shown a dramatic decline in body size and age span and in egg deposition levels since the late 1980s (Walker, 1994 and Butler & Walker 2004). Over that period, there has been a widespread collapse of sea trout in West Highland river systems, with no signs of a sustained recovery. Although East Coast sea trout stocks are causing some concern, they are apparently not in a state of collapse, as shown by better catches made in 2009. However, there is no room for complacency and not enough is known about the factors which control annual sea trout abundance. Catches are not always a good indicator of stock strength, since they rely so much upon fishing conditions and fishing effort. In view of this lack of basic knowledge, the more precautionary approach now being taken towards sea trout management is timely and appropriate.

REFERENCES

Butler, J.R.A. and Walker, A.F. 2006. Characteristics of the sea trout stock *Salmo trutta* L stock collapse in the River Ewe (Wester Ross, Scotland), in 1988 – 2001).

Nall G. H. 1928. Sea Trout of the River Spey. Fisheries, Scotland, Salmon Fish., 1928, X. H.M. Stationery Office, Edinburgh.

Nall G. H. 1930. The Life of the Sea Trout. Seeley Service, London, 355 pp.

Walker, A.F. 1990. Sea trout and brown trout of the River Tay System. In: The Sea Trout in Scotland (Picken, M.J. and Shearer, W.M., Eds). The Dunstaffnage Marine Laboratory, Oban, Scotland, pp. 5-12.

Walker, A.F. 1994. Fecundity in relation to variation in life history of *Salmo trutta* L. in Scotland. PhD Thesis, University of Aberdeen, 150 pp.