SECTION 3: THE FISHES OF THE TWEED AND THE EYE

A.1: Atlantic Salmon
Salmo salar

"*The Salmon grey of Tweed or Spey*
Returning from the sea,
Will to its native stream come back,
Whichever stream it be"
John Younger (in W. Henderson, 1874)

Photo A.1.1: "Pinheads" is the name given to newly emerged Salmon. Only 2cms or so long and almost invisible against the stream bottom, they can be seen in shoals in the quiet water at the very edge of rivers and streams in May. As they gain size and strength, they move out into the faster water to become fully formed "Fry". In just two or three years, the tiny fish shown in this picture could be a metre long and living off the coast of Greenland.

THE TWEED FOUNDATION
Drygrange Steading
Melrose TD6 9DJ
www.tweedfoundation.org.uk

A.1.1: The Life-cycle of the Atlantic Salmon: The Atlantic Salmon is an animal of the North Atlantic zone of Europe and America. On the European side it ranges from the rivers that run into the White Sea from northern Russia and Norway, down to the north coast of Spain, though in the past its southernmost limit was the River Tagus, which runs through Lisbon. On the American side, it lives in one river in Greenland and ranges south to the coast of Maine. Salmon from all rivers on both sides of the Atlantic share the same marine feeding grounds around Greenland, the Faeroes and Iceland except for those of around the Baltic Sea which spend their marine stage there. The life cycle is summarised in Diagram A.1.1.

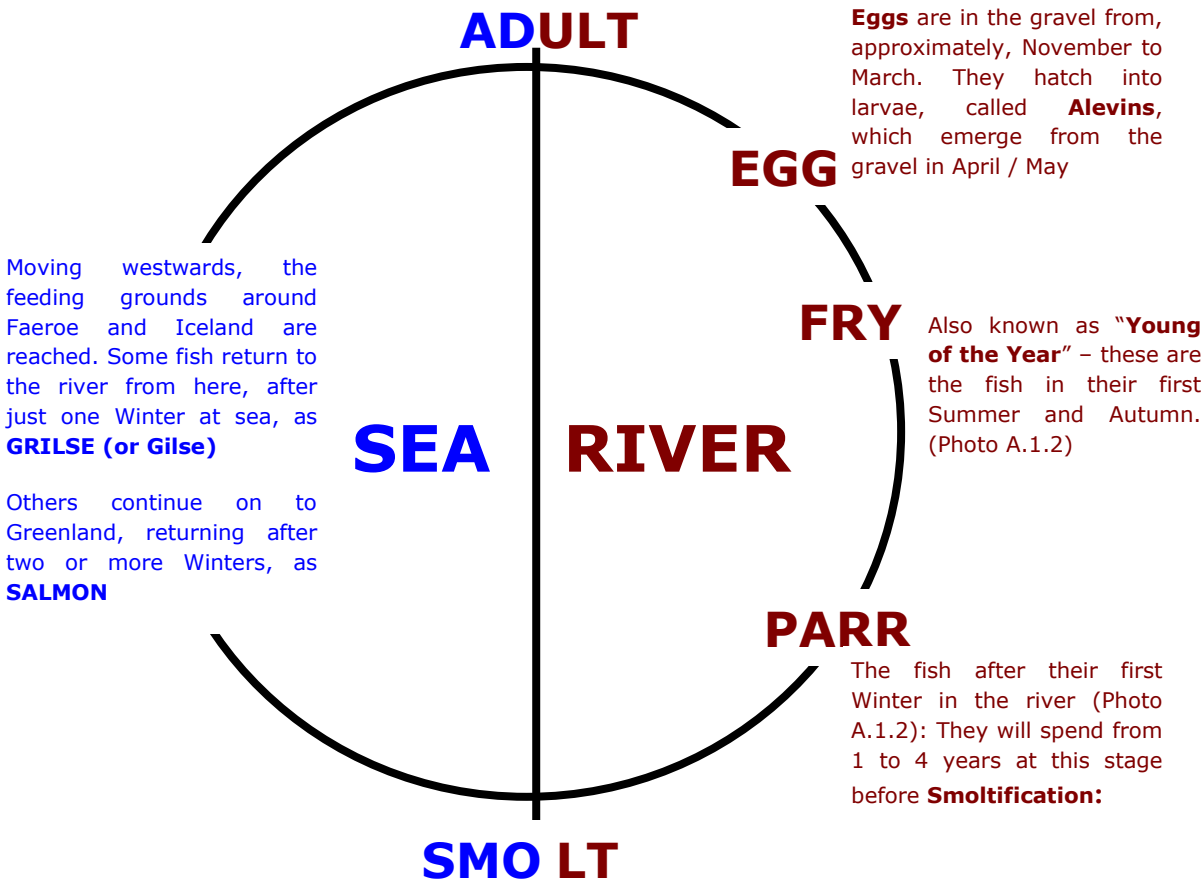


Diagram A.1.1: The life cycle of the Atlantic Salmon

Some numbers on survival from stage to stage can be added to this diagram from research on the North Esk, where there are trapping facilities that catch Smolts on their way out of the river and a fish counter that counts the adults back into it. As Smolts are tagged on the way out, recaptures in fisheries furth of the N. Esk show what numbers of the total of N. Esk fish at sea are being taken in each fishery.

LIFE CYCLE STAGE	NUMBER	*NOTES*
FEMALE SPAWNERS IN 1978	7,521	
Eggs deposited	29,000,000	
Smolts emigrated	144,000	*from 1980 (1yr old Smolt) to 1984 (5 yrs old Smolts)*
Killed in High Seas fisheries (Greenland, Faeroe)	1,952	
Killed in coastal fisheries outside the N. Esk	16,479	
Returned to the N. Esk	14,300	*from 1981 (as 1.1 Grilse) to 1986 (as 3.3 Salmon)*
Killed in the N. Esk	3,199	*totalled for each year of return*
POTENTIAL SPAWNERS LEFT	11,100	*over the years 1981 to 1986*

Table A.1.1: The fates of Salmon hatched in the North Esk in 1979 (from Shearer, 1992)

Of the 30,779 Salmon that made it back to Scottish coastal waters, 16,479 (53%) got taken by the net fisheries before they could reach the river. This table also shows how the few thousand female spawners of 1978 produced 29 million eggs to start the cycle off. This high "gearing" between generations of Atlantic Salmon is the great safety mechanism of the species: as each female produces thousands of eggs (the bigger the fish, the more eggs) only a relatively few are needed to produced many millions (at 5,000 eggs each on average, only 200 female Salmon can produce a million eggs). From these millions of eggs, many juveniles are lost due to predators, floods, droughts and the limitations imposed by the amount of food and space available for them. In this example survival from egg to smolt is 0.5% but better rates of survival, up to 4%, are known from other work. Once at sea, predators again take a toll, as do fisheries (The Faeroe fishery has now been bought-out and the Greenland one has been very much reduced in the same way). Coastal netting is now much reduced from the 1970's as well.

Photo A.1.2: A salmon Fry, one summer old, and a Salmon parr, one winter and two summers old

Some specific Tweed details can be added to the general outline shown in Diagram A.1.1.

(A) The length of the freshwater stage: How long a Salmon stays in freshwater before smolting and going to sea depends on how fast it grows to the right size. For Tweed Salmon, the typical smolt size is 12cms and in the richer, warmer, parts of the system some can reach this size just one year after hatching and so become "S1's". The great majority, however, take two years to reach this size ("S2's") and a few three years. Fish that had taken four years to smolt are very rare for the Tweed, as shown in Table A.1.2. (The method by which the ages that Salmon smolted at can be read from scales is covered in Database 1, Scales, at the end of this Manual).

S1	S2	S3	S4
22.2%	70.1%	7.5%	0.2%

Data from 6,794 readable scale samples from Rod-caught Salmon, 1991-95

Table A.1.2: The smolt ages of salmon caught at seven major beats along the Tweed 1991-95

That these ages are not fixed is shown by some historical information on the smolt ages of Tweed Salmon. The first comprehensive Salmon scale reading surveys of Tweed fish were made in 1929 and1930 (MacFarlane 1933) and during the 1960's the then D.A.F.S. had a programme of catching and tagging smolts in the estuary of the Tweed during which ages were read from scales. When these historical results are compared with present day ones, a series of changes is apparent.

	S1	S2	S3	S4
Present day	**22.2%**	**70.1%**	**7.5%**	**0.2%**
MacFarlane 1929	5.1%	95.4%	2.5%	0.0%
1930	6.4%	90.9%	2.7%	0.0%
DAFS 1960's	0.0%	39.9%	56.3%	3.8%

It should be noted that each survey was based on different types of samples. The 1929-30 survey used scales from net caught fish and therefore excludes later running fish. The 1960's sample was based on netting smolts in the estuary, from March to June, and should thus reflect the whole population. The 1990's samples are from rod caught fish and should also cover the whole population.

Table A.1.3: Historical data on Tweed smolt ages

The present day results are much more like those of the 1930's than the 1960's, though the proportion of S1's is much higher, but the 1930 survey did not cover later running fish, being based on netting catches, and later fish are more likely to be S1's than earlier fish. It may be therefore that if the 1930 survey had included later fish, the proportion of S1's would have been higher.

The really significant difference, however, is with the 1960's results: 60% of the smolts were leaving at three or four years old, quite different from the situation 30 years before or after. The proportion of smolts emigrating at different ages can differ greatly from year to year but within overall limits that are less changeable and would not, for example, have three year old smolts being 60% one year and 10% the next.

The key question that this change in smolt age poses is whether it could be related to the types of adult fish dominant at the different periods: in the 1920's Spring Salmon were rising to dominance, in the 1960's they were dominant and in the 1990's they had been replaced by Autumn fish as the major component of the adult run (see Sections 4.1 & 4.2). The smolt ages of the 1960's sample shows that the age structure of the Salmon parr in the catchment must have been very different from what it is a present; there would have been many two and even some three year old parr compared to the present day when the great majority are just one year old (one year old parr become two year old smolts, two year old parr, three year old smolts, etc.).

As water temperature largely controls the rate of fish growth and therefore the age at which smolt size is reached this suggests that the growing conditions in the catchment were very different in the 1960's: at present, two year old parr (which will become S3's) are only found in the highest and coldest areas of the tributaries, but plainly, such small areas could not have been responsible for producing the 60% of Tweed smolts that were three years old in the 1960's; much larger areas of the catchment must have been producing such fish at that time. The 1940's, 50's and early 60's were a period of long, cold, winters and the fish would have had shorter annual growing seasons, which would explain the majority taking three years to reach smolting size.

(B) The sizes of Tweed salmon smolts: This is shown in Diagram A.1.2 which gives the lengths of Salmon smolts trapped at Drygrange on the Leader Water in March and April 1999 and 2000, combined with a sample from the Gala Water taken on the 5th May 1997 giving a sample size of 486.

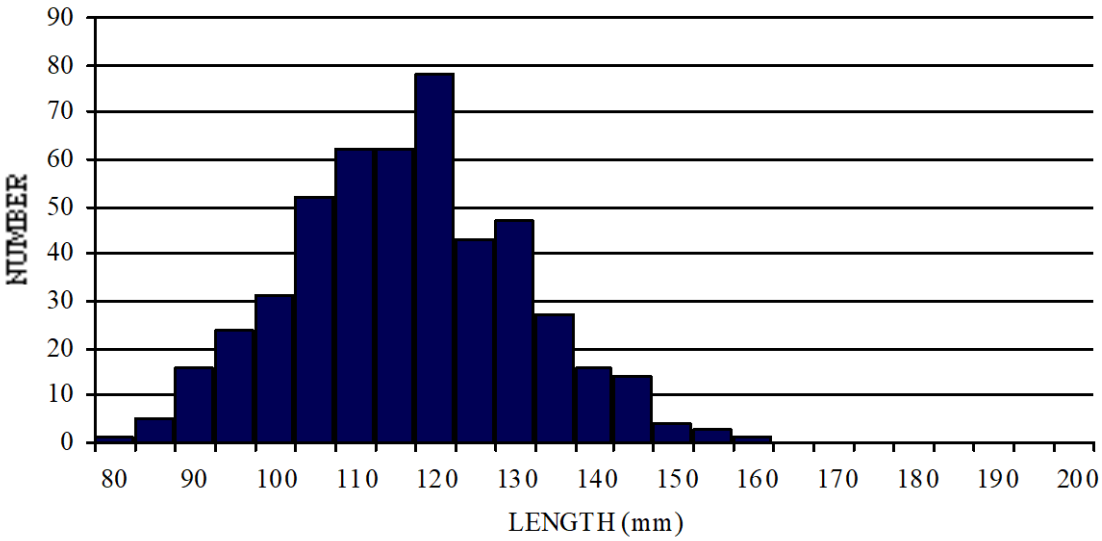


Diagram A.1.2: The sizes of Leader and Gala salmon smolts

As can be seen from this graph, the sizes of Salmon smolts are very much centred around 120-124mm (5”).

(C) The Salmon at sea: Strange as it may seem, it was not until the late 1950’s that the feeding grounds of the Salmon at sea were first properly identified, when it became known that a fishery for them was developing off Greenland: exports of Atlantic Salmon from Greenland rose from 2 metric tonnes in 1957 to 1,400 tonnes in 1964 (Netboy, 1968). Since then, the broad picture of the migration of Salmon at sea has been worked out but detail is sparse and there are still some blanks. Leaving their home rivers on ebb tides, smolts are swept quickly out to sea; east coast smolts can then use currents that help them across the North Sea to a current that runs northwards along the Norwegian coast. Their first summer at sea is spent off Norway as they move out to the seas around the Faeroe Islands. Here, some mature and head back to their rivers as grilse after one winter in the sea, some stay in Faeroese waters for another year and some move further westwards to the seas south and west of Greenland where they meet up with American salmon. In winter, the fish move down to the Irmiger Sea, south of Greenland and then start returning home after this second winter in the sea, returning as “multi-sea-winter”, (MSW) fish, or “Salmon”. A smaller proportion, however, return northwards to Greenland for a third (or more) summer at sea (Shearer, 1992).

At sea, their diet in the Faeroese area is of Amphipod and Euphausid shrimps and Sand-eels, while in the Greenland area, fish and squid generally dominate. Some of the food species consumed show that Salmon must be able to feed at depths down to 300m (Shearer, 1992).

(1) Tweed Salmon at sea: The little information available on this comes from the recapture of Tweed Salmon that had been tagged at some stage in their life cycle: it must always be remembered that such data is as much about where the fisheries that make the recaptures are located as about the places that are visited by the tagged fish. Table A.1.4 summarises all the information available at present.

YEAR	PLACE TAGGED	STAGE TAGGED	YEAR	PLACE RECAPTURED
1966	Tweed	Smolt	1967	Greenland
1971	Tweed	Smolt	1972	Greenland coastal fishery
1971	Tweed	Smolt	1973	Greenland coastal fishery
1972	Faeroe	at sea	1973	"in the Tweed"
1972	Greenland	at sea	1973	"in the Tweed"
1972	Meldon Burn	juvenile	1974	Coastal net at Aberdeen
1972	Meldon Burn	juvenile	1974	Coastal net at Montrose
1972	Eddleston B.	juvenile	1974	Found frozen in a Cornish hotel. No
1986	Ettrick	Fry	1989	Irish Drift Nets
1986	Leithen	Fry	1990	Irish Drift Nets
1986	Glensax	Fry	1990	N.E. England Drift Nets
			1990	N.E. England Drift Nets
			1990	N.E. England Drift Nets
1989	Tima & Glensax	1+ Parr	1990	Irish Drift Nets
1989	Tima & Glensax	1+ Parr	1990	Venture Netting Station, R. Tay
1990	Jed & Slitrig	1+ Parr	1991	Irish Drift Nets
1990	Jed & Slitrig	1+ Parr	1991	N.E. England Drift Nets
1990	Jed & Slitrig	1+ Parr	1991	N.E. England Drift Nets
1990	Jed & Slitrig	1+ Parr	1991	N.E. England Drift Nets
2000	Leader Water	Smolt	2001	Montrose nets.

Table A.1.4: Recaptures of Tweed Salmon at sea since the discovery of the marine feeding grounds

The broad pattern of Tweed Salmon movements at sea is illustrated by these recaptures: Faeroe and Greenland are their destinations at sea and their first approach to land on return appears to be off the west of Ireland (Irish drift nets are supposed to operate within 19kms (12 miles) of their coast). There is then a complete gap in the records until the Aberdeenshire coastal nets are reached. If Tweed fish do indeed make landfall in Irish Waters, it might be thought that there would be a pattern of recaptures around the West and North coasts of Scotland where there were, in the 1970's and 1980's, many netting stations. The recaptures from Montrose and the Tay show some fish travel close inshore down the East coast, whilst those from the Northumbrian drift nets south of the Tweed show that others take the route down the middle of the North Sea (Shearer 1992) turning off the Yorkshire coast and heading back northwards and so being intercepted off Northumberland.

(2) Food in Tweed Salmon at sea: Some research from the end of the 19th century (Tosh, 1895) gives a picture of what Tweed Salmon are eating in their final few days at sea before entering the river. The sample was of net-caught fish up to the end of the netting season on the 14th September, and then was of rod-caught fish from Kelso. More than half of the few fish sampled in the earliest part the season had food remains, but this declined rapidly until by June only 13% of stomachs had remains. By the time rod caught fish were being sampled upriver at Kelso, in October and November, no remains were being found at all. Of the identifiable remains, most were of fish or crustaceans:

	Number of Stomachs	Number with food	NUMBER OF STOMACHS CONTAINING : Herring	Sand-eel	Haddock	Whiting	Crustacea	Worms	Percent with food
March	15	9	2				7		60%
April	82	23	6	4	2	1	9	1	28%
May	134	28	14	6	3	1	1	1	21%
June	105	14	9	2				1	13%
July	149	3	2	1					2%
August	120	4	2						3%
September	49	1					1		2%
October	92								0%
November	77								0%
TOTAL	823	82							10%

Table A.1.5: Food in Tweed Salmon at sea

Adult Salmon do not, of course, feed in freshwater but very occasionally, some can be found with food in their stomachs. One case of this is recorded in the Annual Report of the Fishery Board for Scotland for 1925 when a 17lb male Salmon "taken" on the Kale Water on the 22nd December 1925 whose stomach contained eight salmonid parr, seen and identified by W.L. Calderwood, then H.M. Inspector of Salmon Fisheries for Scotland.

(D) The length of the marine stage: Almost all Tweed Salmon return from the sea after either one or two years, only a very few remaining for a third. The number of winters spent at sea gives the sea-age and thus major type of fish:-

Grilse - "One Sea-Winter" fish
Salmon - "Multi Sea-Winter" or "MSW" fish.
Depending on the number of Sea-Winters, they can also be noted as "2SW" or "3SW"

These can be further sub-divided by the season at which the fish leave the sea, as "Spring Salmon", "Summer Salmon", "Autumn Salmon", "Summer Grilse" and "Autumn Grilse". The Tweed has the full range of these types, being a large river, but smaller rivers tend to be very largely Summer Grilse. Database I on Scale-reading, at the end of the Manual, shows how these different types can be recognised from the growth patterns on their scales. The proportions of the sea-age and seasonal types on the Tweed are shown in Tables A.1.6a-c.

1SW	2SW	3SW	4SW
57.6%	42.0%	0.4%	0.02%

Data from 6, 316 readable scale samples from rod-caught Salmon, 1991-95

Table A.1.6a: The sea-ages of Salmon caught at seven rod fisheries along the Tweed 1991-95

That these ages have changed considerably over the last seventy years is shown by comparison with the results from the first comprehensive Salmon scale reading surveys of Tweed fish made in 1929 and1930 (MacFarlane 1933): One-sea-winter fish were uncommon then, the catches were dominated by multi-sea-winter Salmon. By the 1930's, Spring Salmon had come to dominate the catches but until 1915 or so, the Tweed had been mainly an Autumn fishery. There are no scale readings from this period, but size analysis shows that the catches were mainly of MSW fish and that Autumn Grilse were actually uncommon (Section 4.2) making it very different from the present Autumn phase which is dominated by grilse.

	1SW	2SW	3SW	4SW
MacFarlane 1929	6.8%	88.0%	5.2%	0.00%
1930	13.1%	78.7%	8.1%	0.08%

The data from 1929 & 1930 is from netted fish only and as the netting season ends on the 14th September, later running fish were not sampled. These would have contained a high proportion of Grilse, so the 1SW percentages shown here must be underestimates and the multi-sea-winter proportions must be overestimates

Table A.1.6b: Historical data on Tweed sea ages

	2SW	3 SW*		1SW
Spring Salmon	1430 (26.5%)	19 (0.30%)		
Summer Salmon	436 (6.9%)	3 (0.05%)	**Summer Grilse**	1675 (26.5%)
Autumn Salmon	784 (12.4%)	4 (0.06%)	**Autumn Grilse**	1964 (31.1%)

* *Includes repeat spawners*

Table A.1.6c: The seasonal types of Salmon caught at seven rod fisheries along the Tweed, 1991-95

There are no Spring Grilse because this type does not exist: such a fish would be one that came back to its river with no growth beyond that of its first winter in the sea. Overall, the proportions of Grilse and Salmon caught in the rod fisheries from 1991-95 were 42.8% Salmon and 57.2% Grilse.

(E) The ages of Tweed Salmon: If the time spent in the river is added to the time in the sea, the total ages of Salmon is given. A fish that spends one winter in the river before smolting and four in the sea before returning has lived five winters since hatching, and a fish that spent four winters in the river and just one in the sea, would be the same. Although belonging to the same basic year class, as they both hatched in the same spring, they would belong to different smolt year classes as they left the river in different years. To give total age, the winter spent in the gravel as an egg also has to be added in, so a fish that lived two winters in the river and two in the sea is actually five winters old. Salmon ages are generally noted as a combination of River and Sea ages, e.g. a "1.2" is a fish that left the river after one winter as a juvenile and returned after two winters at sea; a "3.1" is a fish that left the river after three winters and returned after one winter at sea, and so on. As Table A.1.7 shows, the permutations of river and sea winters is actually quite restricted in the Tweed population.

	SEA WINTERS				
RIVER WINTERS	**1**	**2**	**3**	**4**	*Totals*
1	**789**	**533**	**2**	**0**	*1324*
2	**2541**	**1839**	**21**	**1**	*4402*
3	**247**	**226**	**3**	**0**	*476*
4	**7**	**5**	**0**	**0**	*12*
Totals	*3584*	*2603*	*26*	*1*	*6214*
In Percentage terms:	**1**	**2**	**3**	**4**	
1	*12.70*	*8.60*	*0.03*	*0.00*	
2	*40.90*	*29.60*	*0.34*	*0.02*	
3	*4.00*	*3.60*	*0.05*	*0.00*	
4	*0.11*	*0.08*	*0.00*	*0.00*	

Table A.1.7: The permutations of River and Sea ages in Tweed Salmon 1991-95 and the numbers in each category

There is a heavy concentration of just two types, 2.1's and 2.2's which together make up 70.5% of the catch: one of the management aims (Section 7) for the Tweed is therefore to safeguard existing diversity and, if possible, increase the range of River and Sea ages found within the population. The total ages of the fish, adding in the winter spent as an egg in the gravel, gives the results shown in Table A.1.8.

TOTAL AGE	**3**	**4**	**5**	**6**	**7**
% of Sample	12.7%	49.5%	33.6%	4.1%	0.1%

Data from 6213 readable samples from rod caught Salmon 1991-95

Table A.1.8: The total ages of Tweed Salmon

From this it can be seen that 83.1% of Tweed Salmon are either four or five years old, showing that the fishery is essentially exploiting just two egg year classes – and as almost all the Salmon spent two winters at sea, only two smolt year classes, one for Grilse and another for 2SW Salmon.

(F) The spawning season of Tweed Salmon: The earlier that Salmon run, the earlier they spawn (Webb & McLay, 1996), so mapping the areas where early spawning occurs is one way of working out where Spring Salmon stocks are located within a catchment. In the Tweed catchment, the Spring Salmon of the Ettrick start spawning at the end of October, peaking in the first week of November. Just over the hill from them, there is a small area of early spawning fish in the Cor Water at the very top of the Tweed, where a small population of Upper Tweed Spring Salmon survives (Appendix A1). By contrast, some very late running fish spawn in February. Photo A.1.3 shows a very fresh Salmon that was killed by an otter at Maxton on the middle Tweed that was full of spawn and would have spawned in February. A Salmon was seen over a new redd on the 29th of

February 1992 on the Leader at Drygrange (R. Campbell, *personal observation*: If it had not been a Leap Year, it would have been the 1st of March.) There are also reports of spawning in April on the Upper Tweed.

Photo A.1.3: A very fresh Salmon (scales were very loose) full of ripe spawn that was killed by an otter at Maxton: The newspaper shows the date to be the 1st of February, 1998. This type of fish must spawn very soon after leaving the sea

The very earliest spawners each year will be the earliest Spring Salmon, and some of these enter the Tweed in late autumn. They cannot be detected from their scale patterns, only from the state of their gonads (ovaries, milt sacs) as shown in Photo A.1.4 which shows a fish caught in November 2003 that would not have spawned until the following October.

Photo A.1.4: A 14lb Spring Salmon that entered the river in November 2003. The state of its ovaries shows that it would not have spawned until Autumn 2004. It had spent two winters out at sea

(G) Repeat spawning: Unlike Pacific Salmon, Atlantic Salmon can survive spawning, and in some small rivers where the adult fish spend little time in fresh water, up to a third of the spawning population can be repeat spawners. On a large river like the Tweed, however, spawning is a much longer and more strenuous affair and the number of second spawners is very low. Out of 6,192 rod-caught Salmon taken from 1991 to 1995 whose scale growth as adults were fully readable, only 16 had spawned previously (0.26%). Historically, the

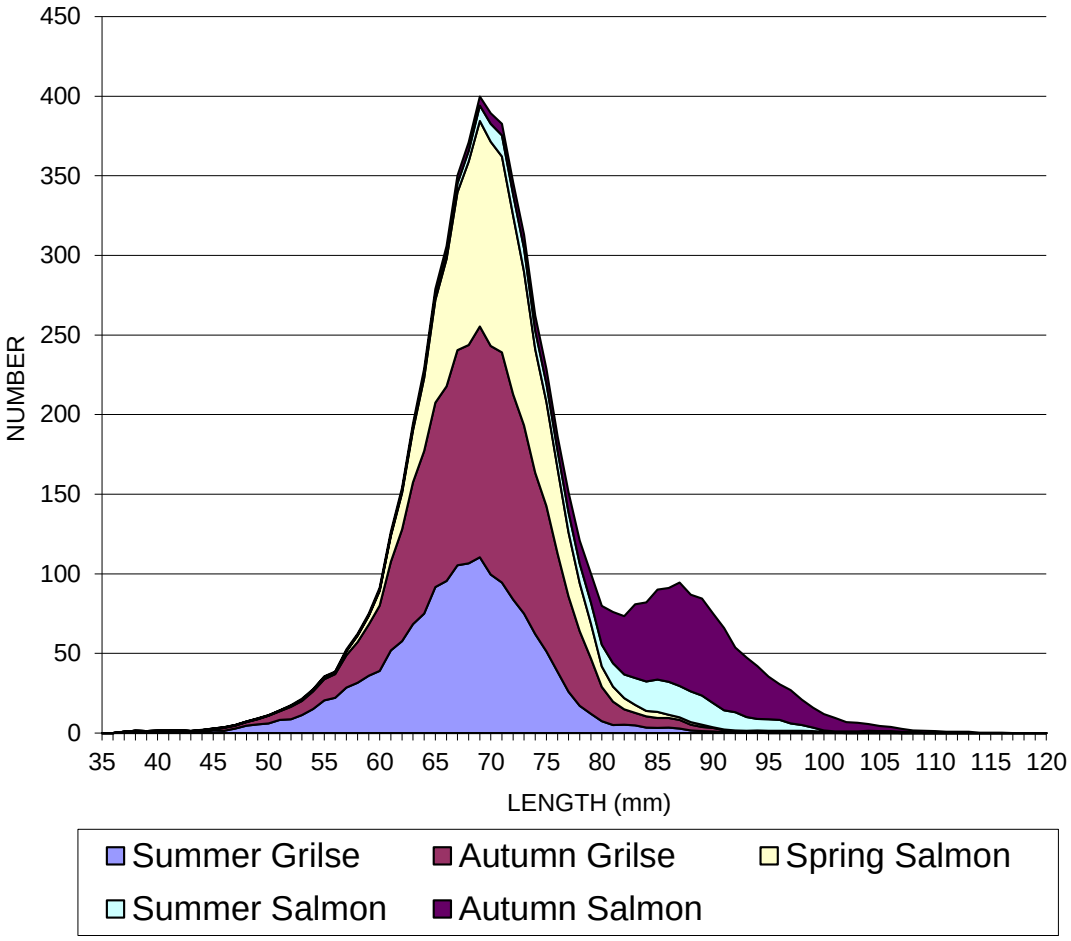
proportion was not high: a survey of netted Salmon in 1929 found 58 repeat spawners in a sample of 2,293 fish (2.5%) and a 1930 sample found 61 in a sample of 2,532 (2.4%) (MacFarlane 1933a and b). Database I on Scale-reading gives an account of how repeat spawners can be recognised from their scales.

Most of the identifiable repeat spawners in the 1991-95 sample were Spring Salmon: ordinary 2SW Tweed Spring Salmon have an average length and weight of 71.25cms and 8.00lbs; repeat spawning Spring Salmon average 79.7cms and 12.5lbs while the very few 3SW Spring Salmon average 82.25cms and 13.9lbs, so even though the repeat spawners are also 3SW fish, they are smaller than the "straight" 3SW fish, presumably due to the energy lost during spawning. However, it could be that many repeat spawners on Tweed are difficult to recognise: if they are very late running fish, as shown in Photo A.1.3, which come into the river very ripe, and spawn almost immediately and then return immediately to the sea, such a short period in fresh water might leave little trace on the scales.

It would appear that a much higher proportion of Salmon manage to return to the sea after spawning that are able to make the full repeat journey to the North Atlantic and back. Of the 64 Salmon radio-tracked to spawning from 1994 to 1996, 12 (19%, almost 1 in 5), were tracked back to the estuary afterwards.

Photo A.1.5: The difficulties of the long journey upstream to spawn mean that few Tweed Salmon survive to spawn a second time

(H) The sizes of Tweed Salmon: Fish that leave the feeding grounds earlier in a year than later, whatever their sea-age, return to the river at a generally smaller size than those of the same sea-age that return later and therefore have had some extra months of feeding: early returning 1SW fish are smaller on average than later returning Grilse, Spring Salmon are generally smaller than Autumn. The overall sizes of rod-caught Tweed Salmon are shown in Diagram A.1.3 and the average lengths for the different types are given in Table A.1.9.



Sample: Lengths of 6,689 Rod-caught Salmon, 1991-95, with scales that could be read to type

Diagram A.1.3: The lengths of rod caught Salmon at seven sample fisheries along the Tweed 1991-95

There are two peaks in this length frequency, at 69 cm (27") and 87cm (34"), which do not correspond to the two major sea-age groups. The higher peak is made up of Summer *and* Autumn Grilse *and* Spring Salmon, and the lower peak of Summer and Autumn Salmon. The actual average sizes of the different types are:

Summer Grilse	Autumn Grilse	Spring Salmon	Summer Salmon	Autumn Salmon
68.1 cms	69.7 cms	71.3 cms	83.0 cms	88.0 cms
26.5"	*27"*	*27.5"*	*32.5"*	*34"*
7.4 lbs	7.9lbs	8.0 lbs	13.7lbs	16.4lbs
		Sample sizes		
Lengths: 1613	*1926*	*1429*	*423*	*768*
Weights: 1675	*1964*	*1423*	*436*	*785*

The lengths of the Salmon types are for two Sea-Winter fish, there are too few three Sea-Winter fish in the sample for averages to be calculated

Table A.1.9: The sizes of the different types of Rod-caught Tweed Salmon 1991-95

(1) Large Tweed Salmon: The largest Tweed Salmon ever caught appears to have been one described by the then Earl of Home, in Yarrell (1841) "*My uncle, my father's elder brother, caught a salmon with a rod which weighed sixty-nine pounds and three quarters*". The largest rod-caught Salmon of more recent times is a male of 57lbs 8oz (26.1kg), and 135cms (53") in length caught at Floors on the 27th October, 1886 (Calderwood, 1909). It was only weighed the day after it was caught and could have been over 60lbs when fresh (Grimble,

1913). A 60lb male Salmon was found partially spawned, diseased and dead at Mertoun in December 1907 and scale reading showed it to have spawned twice previously, once as a rilse in 1903 and again in 1905 before returning to spawn for a third and last time in 1907 (Calderwood, 1909). In all it was a nine year old fish: one winter in the gravel as an egg, three in the river before smolting and five as an adult at sea. This is not a life-cycle pattern seen in Tweed Salmon today. Second time spawners are very rare and none have been found since 1992 that have missed out seasons between returns. Whilst the vast majority of Tweed Salmon spawn only once, a small proportion survive to spawn a second time and a very, very, few, a third. A modern example of Salmon returning to spawn for a third time was a fish of 30lbs caught at Birgham Dub on the 17th of February 1995, which had been a two year old smolt and had returned at its second Sea-Winter to spawn for a first time, at its third Sea-Winter for a second spawning and was caught in its fourth Sea-Winter returning for third time. Not all very large Salmon are repeat spawners: a 55lb fish caught at The Lees on the 7th November 1913 was a 2.4+, so had been at sea for four winters before returning for the first time. A remarkable "double" for large Salmon was made by a Miss Trotter, Charterhall: she caught a 46lb salmon at Sprouston on the 27th October 1909 and another 46lb Salmon also at Sprouston on the 26th October, 1910 (Fishery Board for Scotland, Annual Reports for 1909 & 1910). The decline in very large Salmon has been a long term one, as shown by the number of fish over 30lbs per 1000 caught in some Lower Tweed fisheries from the 1860's to the 1990's:-

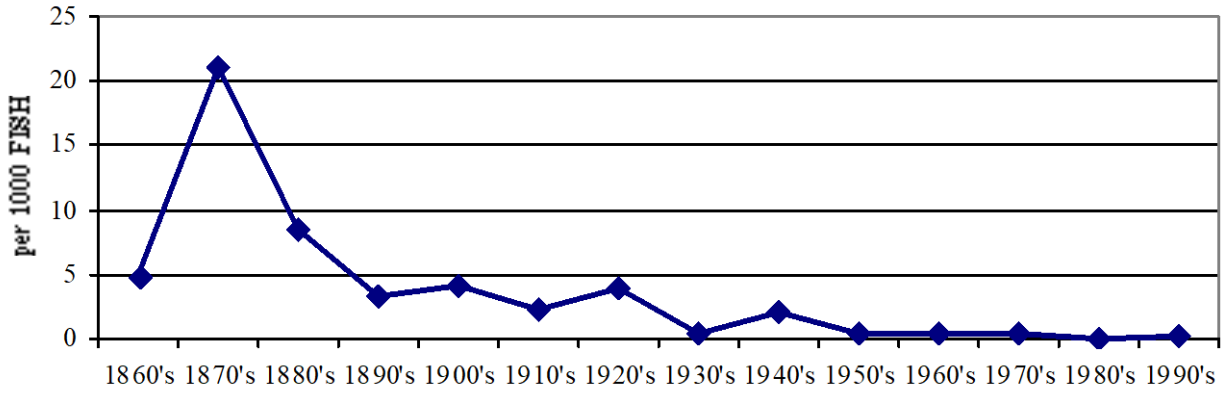


Diagram A.1.4

Two years in the 1870's were responsible for the high peak in that decade. Seven fish over 30lbs were caught in 1872 and 26 (5% of the annual catch on that particular beat) in 1873, with just 16 fish of this size caught in the other eight years of the decade. After this peak, about five such fish per 1,000 caught was the usual proportion from the 1890's to the 1920's, then less than one from the 1930's onwards. At present, only two or three fish over 30 lbs are taken on the whole river in a year, and in some seasons, none at all. Part of the reason for the decline must be the switch from autumn to spring, as almost all these very large fish were caught in October or November, although the decline had set in by the 1890's, 20-30 years before the full switch from autumn to spring phase. Certainly, there has been no reappearance of these very large fish with the switch back to autumn dominance that took place in the 1960's.

There are also a number of stories of very large Salmon that cannot be authenticated: a 67lb salmon was said to have been poached from the Haystoun water at Peebles (year unspecified) with a silver tag on its fin from Spain. Despite the Bailiffs offering a £5 reward for this tag, it was never handed in (Grant, 1948) and the fish remains mythical. There is much better evidence of an exceptional Salmon from Bemersyde in 1883, where a very large fish was played for an hour on the 29th November and brought to the net, but only its head could fit in and after three unsuccessful attempts it escaped. It was later heard that "*a noted poacher called Patterson*" and three others had taken a Salmon reported as weighing 64 lbs out of Bemersyde the following night. At the other end of the scale, a Salmon of 1 lb 8 oz (41cms, 16" in length) was caught on the Junction beat on the 1st of September 2001: it was a Grilse, a Salmon that had been at sea for one year.

(I) The timing of the return to the Tweed: The relative proportions of the different seasonal types of Tweed Salmon were given in Table A.1.6c. At present, most of the Salmon caught are of the autumn types (43.6%) with summer types making up 33.5% and spring, 27.1%, but this was not always the case and "run-timing" has actually changed more than once in recorded history and this is dealt with in Section 4.2.

(J) Different stocks of Tweed Salmon: That Salmon return to their home streams has been known, somehow or other, for a very long time. When King James VI returned to Scotland in 1617 for the only time after becoming king of England in 1603, he compared himself to a Salmon returning to its home. The implications of such homing behaviour has not, however, been generally realised: that a Salmon is more likely to breed with a relative in some degree than with a completely unrelated fish, and that such inbreeding is very likely to develop local adaptations. The Salmon that return to their home areas to breed are those that survived in these areas and so the differences that let them survive are conserved and re-enforced by this local inbreeding. Modern genetics work has shown that the Salmon even of single river systems are made up of many genetically distinguishable populations, each of which, it can be assumed, is adapted to its own particular part of the river. An account of the information available so far on this for the Tweed is given in Appendix A1.

(K) The importance of Salmon to the local economy and culture: The Salmon must have been of very great importance to the people living along the banks of the Tweed and its tributaries from the earliest times. A huge supply of protein coming upriver and most easily available just before the onset of winter at spawning time must have greatly aided survival. Kelts would have been part of the food supply just as much as fresh fish, as they were till the mid 19th Century. The earliest human record made of any fish species in the Tweed catchment is almost certainly the Salmon carved on the standing stone near Roberton on the banks of the Borthwick Water, a tributary of the Teviot Water that joins it just upstream of Hawick, shown in Photo A.1.7. This is one of the few Pictish symbol stones in the south of Scotland and is a Class I stone, reckoned to date from the 7th to 8th centuries (Jackson 1984). The adoption of the Salmon to be the Arms of the Royal Burgh of Peebles shows the continuing local significance of the species, even in the uplands. The netting industry at Berwick was a mainstay of the economy there for centuries, employing up to 300 people (see Section 4.1), and the Salmon today is still the icon of the Tweed and the eastern Borders.

Photo A.1.7: The Pictish Symbol Stone at Roberton, on the banks of the Borthwick Water, the earliest record of Tweed Salmon