



### Changes in Atlantic Salmon on Tweed

It is clear to everyone on the River that great changes are taking place in the runs of Atlantic Salmon<sup>1</sup>: recent Autumn catches are declining, Summer catches are generally increasing but with considerable annual variation, and Spring catches are staying much the same. While both Autumn Salmon and Grilse are declining, it is only Summer Salmon that are increasing, Summer Grilse are not. The key points about these changes are: (1) they are also happening on other rivers at this time and, (2) they have happened before.

The two trends are shown in the graphs below, for catches in July and November:

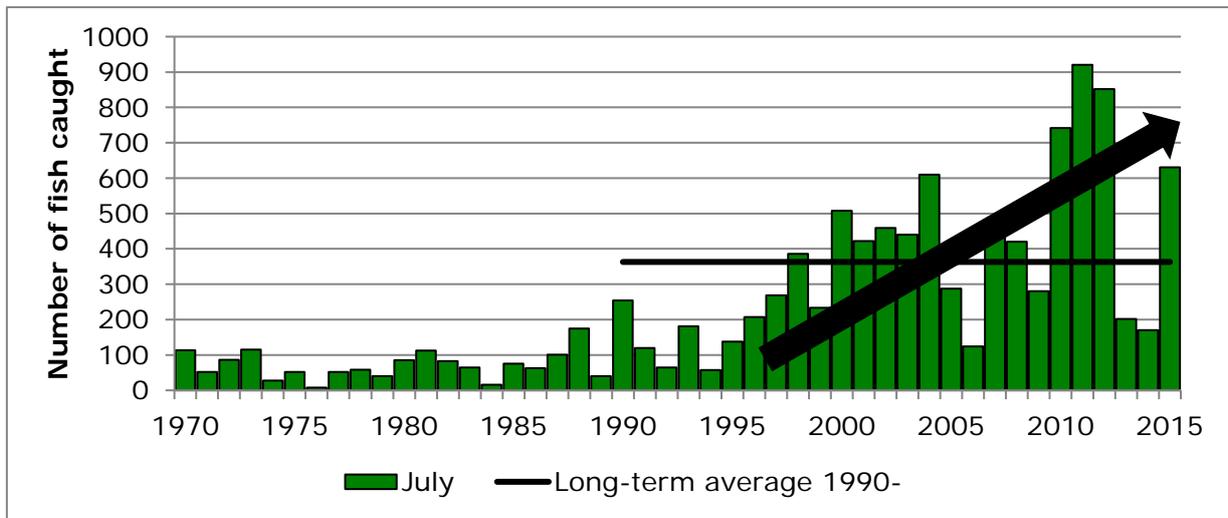


Fig.1: Trends in July Catches 1970 - 2015

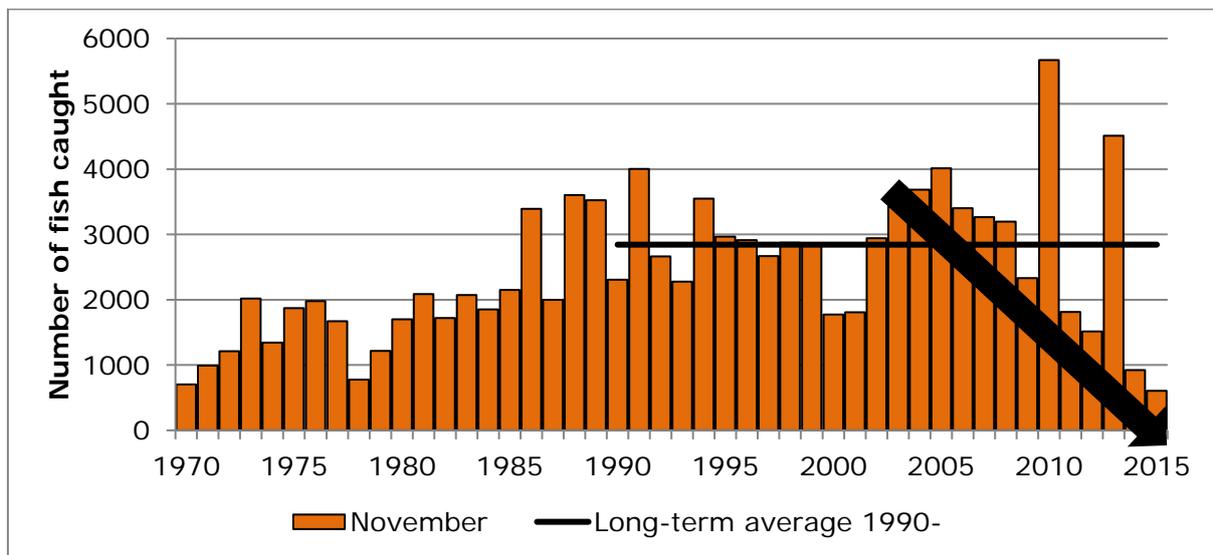


Fig.2: Trends in November Catches 1970 - 2015



While there are annual variations for each month, the upward and downward trends are clear. What are very remarkable are the huge increases in November catches in 2010 and 2013, which were completely against the trend; there is no obvious explanation for these.

Another change that is happening is that the fish caught in Summer are getting bigger, while those caught in Autumn are getting smaller:

	1980s	1990s	2000s	2010s
July & August	6.61	6.08	7.08	8.43
October & November	11.4	10.04	8.82	8.71

Table 1: Average weight (lbs) of fish caught at two Tweed Rod fisheries

The type of fish being caught in the later part of the season, July to November, is also changing, as shown by scale reading. In the period 1995-99, fish of 7-10lbs were mainly Grilse but in the five years 2010-14 fish of 7-10lbs were mainly Salmon. The commonest sizes of Grilse and Salmon are also changing:

**Commonest Grilse sizes:**

- 1995-99: 7lbs
- 2000-04: 6lbs
- 2005-09: 5lbs
- 2010-14: 4lbs

**Commonest Salmon sizes:**

- 1995-99: 16-18lbs
- 2000-04: 14lbs
- 2005-09: 11lbs
- 2010-14: 9-11lbs

Changes like these have been seen before, both on the Tweed and on other rivers, though the Tweed has the longest series of data, catches at the Sandstell netting station dating back to the 1740s:

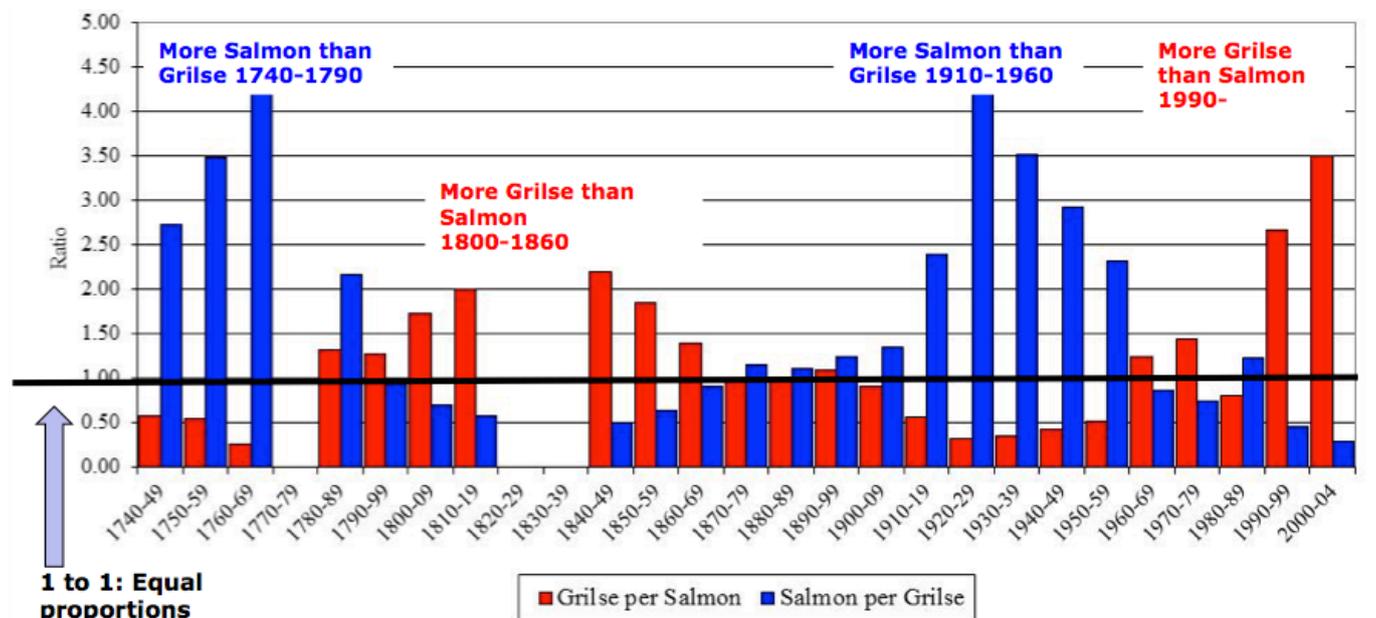


Fig.3: Tweed Estuary Salmon: Grilse ratios in net catches



The pattern is quite clear: since the 1740s there have been two periods when there were more Salmon than Grilse and two when there have been more Grilse than Salmon, but what this diagram also makes clear is that there is no set or stable pattern to Salmon runs or types, change is to be expected and seems to come at intervals of roughly 60 years, the last being in the 1960s suggesting that another change is about due. The netting records end in 2004 but it is clear that since then the proportion of Grilse has been declining from the peak it reached around the year 2000. When Grilse decline, they also become earlier running and smaller, and both these features have been obvious in the catches of the last ten years or so.

The effect of these changes in terms of the numbers of fish caught at the Sandstell nets can be seen in the graph below. The blue line shows the number of fish, Salmon and Grilse, caught from July to September and the orange line, the numbers caught from February to June:

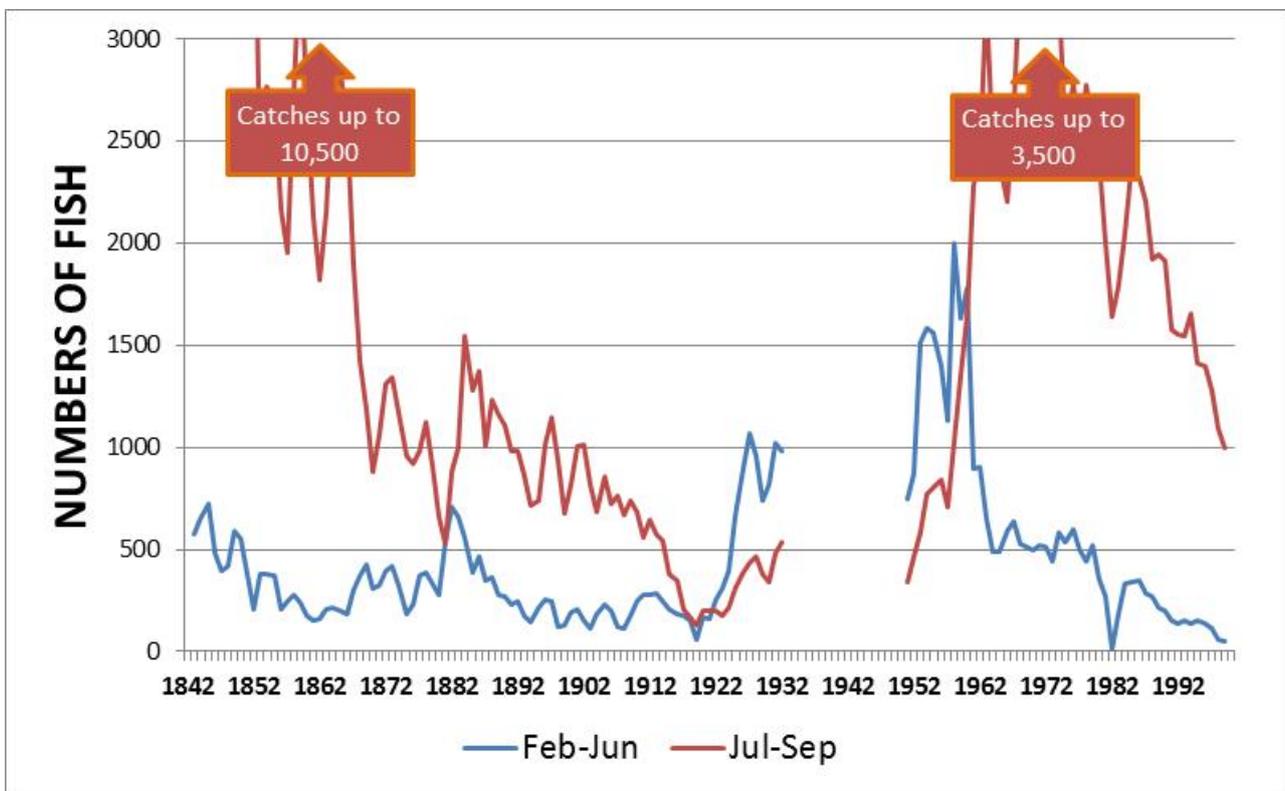


Fig.4: Effects of changes in numbers of fish caught at Sandstell, 1842 - 1992

The cross-over year when earlier catches became larger than later is 1921 and the reverse, when later catches exceeded earlier is 1961. The other point to notice is the difference in scale of numbers being caught. From 1921 to 1961 total season catches, early and late, are 3,000 or so at best (most data from the 1930s & 1940s is, however, missing). The really big catches are made when the later fish are dominant, in the 1850s up to 10,500 in a year and in the 1960s & 1970s, up to 14,000 or so. This is due to the numbers of Grilse, which have a much higher survival rate at sea than Salmon as they only spend one year out, instead of the two or three that Salmon do.

Similar Grilse “highs” and “lows” occurred in other rivers at the same times as in the Tweed, as shown in the graph below that shows the proportion of Grilse in the catches of netting stations on the Spey, Don and Dee and in the sea near the Dee, at Raik from 1840 to 1990 (*this graph is taken from Reference (1) in the list at the end*).

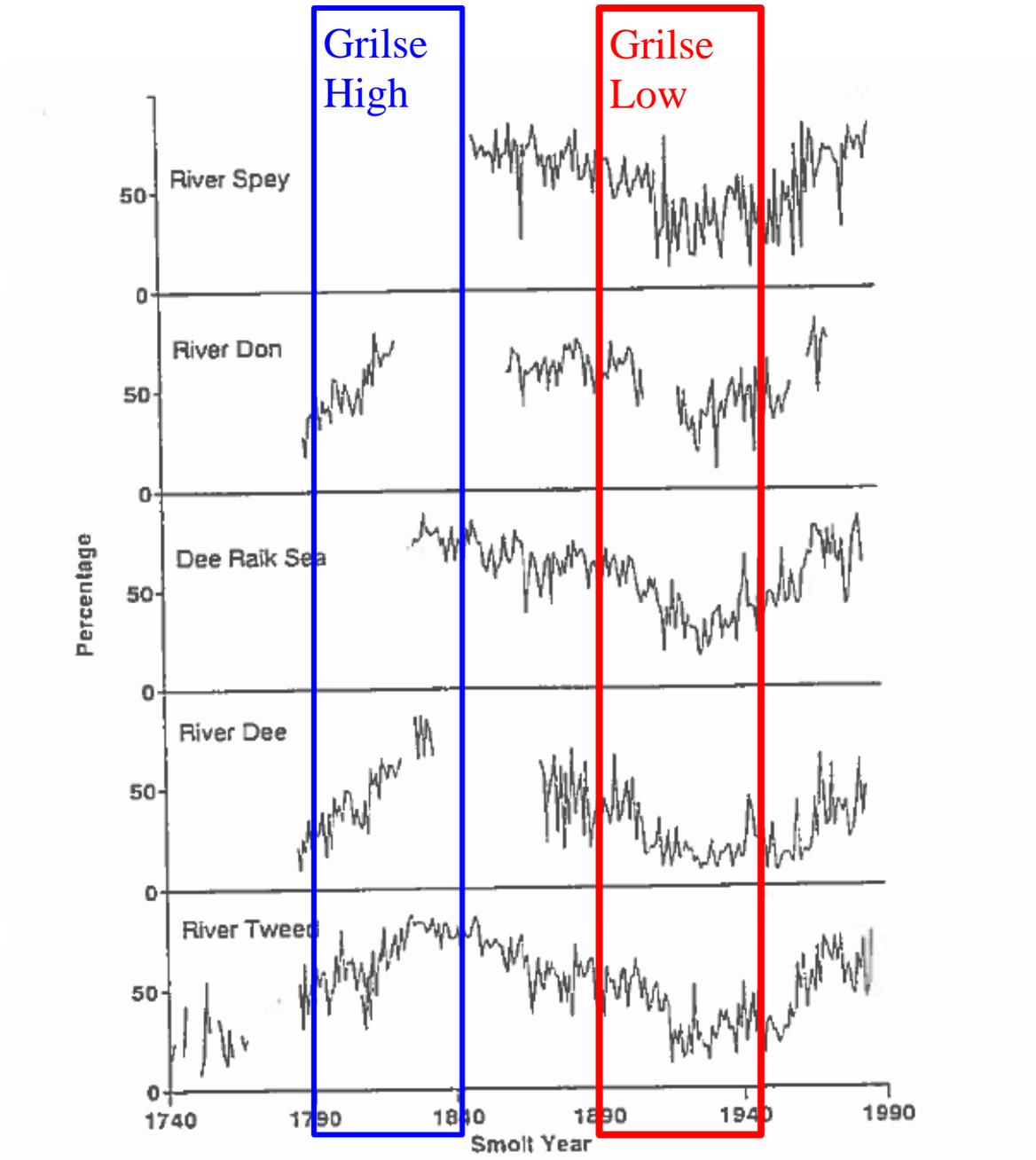


Fig.5: The proportion of Grilse in the catches of netting stations on the Spey, Don and Dee and in the sea near the Dee, at Raik 1840 to 1990

The fact that all these East coast fisheries have their Grilse “highs” and “lows” together shows that the changes are not due to anything in the rivers themselves, but must come from some changes in the sea where the fish from all the rivers mix and mingle and experience the same conditions.

As above, when Grilse become fewer they also run earlier and are smaller which is demonstrated in the diagram below which shows the percentage of the total Grilse catch caught in the months of the netting season from June to September. The proportion caught in July is shown in green and it can be seen that during the



Spring Salmon period, 1920s to 1960s, when Grilse numbers were low, most were caught in July, with only 20% or so in August and September.

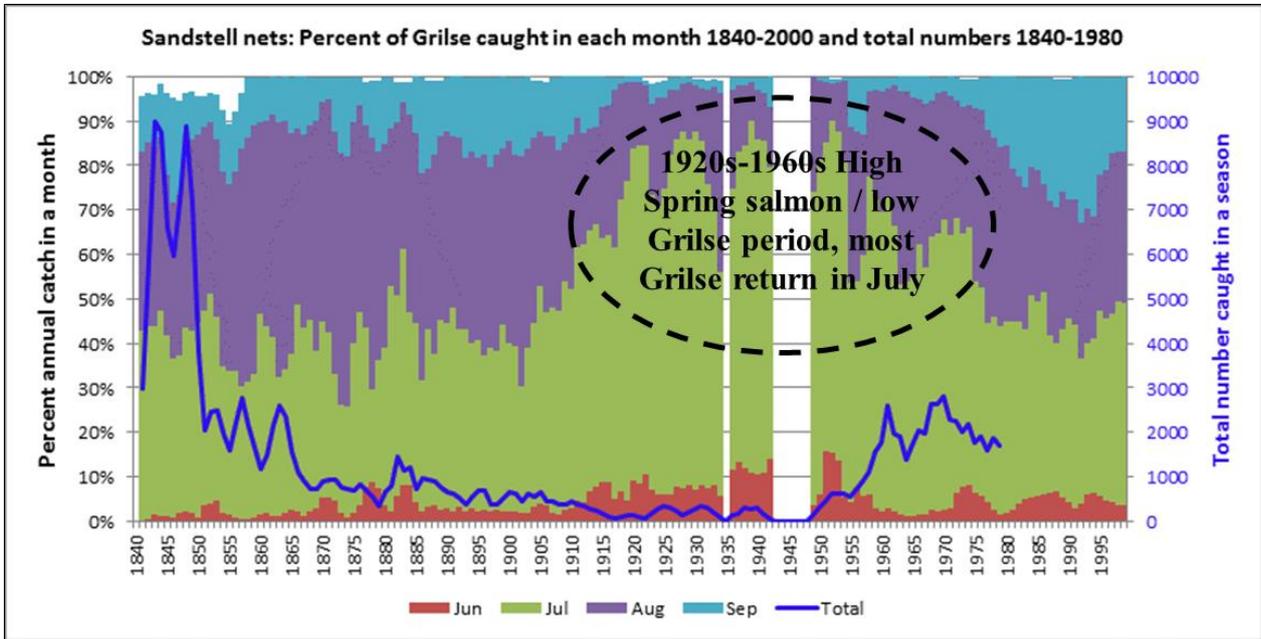


Fig.6: Sandstell nets: Percentage of Grilse caught in each month 1840 - 2000 and total numbers 1840 - 1980

That Grilse get smaller, when fewer, can be shown for both the previous two Grilse “lows”, the 1850s and the 1920s – 1930s:

a) 1850s:

Av. Weight of Grilse caught, 14th Aug -14th Sept, Raik Nets, R. Dee		
Season	Number	Av. Lbs
1855	1,109	6.1
1856	1,046	6.2
1857	614	4.3
1858	881	3.9
1859	146	3.8

Table 2: Average weight of Grilse caught 14th August - 14th September in the Raik Nets, River Dee

b) 1920s-1930s:

During the “depression” in the 1920s and 1930s, the average was down to 4.1 to 4.3lbs. But as the numbers have again improved, so have the average weights. Between 1958 and 1961 it varied from 4.3 to 4.7lbs: from 1962 to 1965 it has been 5.0 to 5.4lbs [Reference (3)].



A similar reduction has, of course, been seen on the Tweed in recent years – as shown previously, the commonest Grilse size has declined from 7lbs in the late 1990s, to 4lbs at present.

### The Causes Of These Changes

The main theory is that it is the temperature of the northern Atlantic that drives these changes: when it is warmer, above 2°C, the fish can go further north and so stay longer at sea, and so Salmon outnumber Grilse [Refs (4) & (5)]. Warmer temperatures also make the feeding in the Grilse feeding areas, (which are more to the East and Southerly in the Atlantic) poorer, compared to the feeding in the Salmon areas, (which are more to the West and the North), so the size and condition of the Grilse also decline. [Reference (4)]

### The Future

Going by what has happened in the past when a Grilse-dominated period has changed to a Salmon-dominated period, it can be expected that Grilse will become smaller and run earlier and that total catches will be less, as it is Grilse that always give the really large numbers of fish. Whether it will be Spring Salmon or Summer Salmon that come to dominate, remains to be seen – it does not look as if it will be Autumn Salmon. Tony George, who has analysed and written most about these large scale changes, made this prediction back in 1990: -

*The history of the Scottish salmon fishery over a long period of time shows that whenever a salmon period declines and a grilse period comes in there are for a period of years strong joint runs of both salmon and grilse in many large rivers (e.g. 1812-17; 1881-84; 1957-66), **but when a grilse period declines and a salmon period comes in there is always a significant, albeit variable, gap in years before the salmon becomes established** (e.g. 1780-92; 1850-5; 1897-1920). During such periods, the fishery as a whole is at a low ebb. [Reference (4)]*

These large scale changes in the Salmon population are the natural and inevitable response of the fish to changing environmental conditions. It is not a question of **if** they occur, but **when**, and when they do occur they have to be recognised and accepted for what they are. They are not the sort of short term, local, issue that can be solved by any sort of management and to try and do so, with hatcheries or any other “quick-fix” solutions is a waste of effort and resources.

<sup>1</sup> Atlantic Salmon spawn and the juveniles grow up in freshwater. They then go to sea, where food is more plentiful than in freshwater, returning to freshwater after either one or more winters rivers to spawn. Those that return after one winter are known as “Grilse”; those that return after two or more winters at sea are known as “Salmon”. Thus the name “Salmon” can mean either the generic fish or be the term to describe those that spend more than one winter at sea.

### References:

- (1) **Summers, D. W., 1995:** Long-term changes in the sea-age at maturity and seasonal time of return of Salmon, *Salmo salar* L., to Scottish rivers. *Fisheries Management and Ecology*, 2, pp 147-156
- (2) **George, A., 1985:** The Grilse Return – Migration and its Variations. *The Salmon Net* XVIII, pp 52-55
- (3) **Menzies, W.J.M. & G.G.J. Smart, 1966:** Salmon runs in Scotland. *The Salmon Net*, vol II pp 49-54
- (4) **George, A., 1990:** Climate and Scottish Salmon – A Summary. *The Salmon Net* XXII pp38-42
- (5) **Martin J.H.A. & K.A. Mitchell, 1985:** Influence of Sea Temperature upon the Numbers of Grilse and Multi-Sea-Winter Atlantic Salmon (*Salmo salar*) Caught in the Vicinity of the River Dee (Aberdeenshire). *Canadian J. Fisheries & Aquatic Sciences*, 42 pp 1513-21