

## **FREQUENTLY ASKED QUESTIONS : 3 Changes in the size of Tweed Salmon**

- 1 There has been a long-term trend towards Autumn Salmon and Grilse becoming smaller, and, possibly, a more recent trend towards Spring Salmon becoming larger.

## **CHANGES IN SIZES OF SPRING SALMON**

- 2 This can be seen from the table below, which shows the most frequent sizes of Spring Salmon caught in the Coldstream area for each decade since 1860. The commonest size recorded has been 8lbs for every decade except for the 1870's and 1880's. The second commonest size has been either 7 or 9 lbs, apart from those same two decades. Until the 1960's, the third commonest size was usually 6 or 7lbs (except for 1900-09) but since then, the third commonest size has been 9lbs (1960's to the 1980's ) and in the two most recent decades, an unprecedented 10lbs. Until the 1990's, the second and third commonest sizes were usually the weights just above and below 8lbs, but since then, both have been above 8lbs.

Frequency of sizes of Spring Salmon caught in the Coldstream area (1 <sup>st</sup> Feb to 30 <sup>th</sup> June)			
Decade	Commonest size	2 <sup>nd</sup> Commonest	3 <sup>rd</sup> Commonest
1860-69	8	9	7
1870-79	8	7	9
1880-89	7	8	6
1890-99	8	7 = 9	
1900-09	8	7	9
1910-19	8	9	7
1920-29	7	8	6
1930-39	8	9	7
1940-49	8	9	7
1950-59	8	7	6
1960-69	8	7	9
1970-79	8	7	9
1980-89	8	7	9
1990-99	8	9	10
2000-06	8	9	10
<i>For 1890-99 numbers of 7 and 9lb fish were equal</i>			

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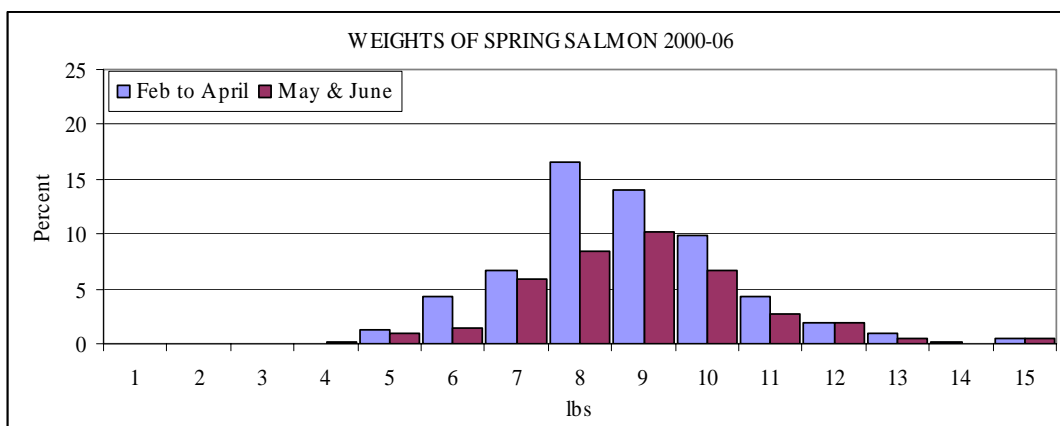
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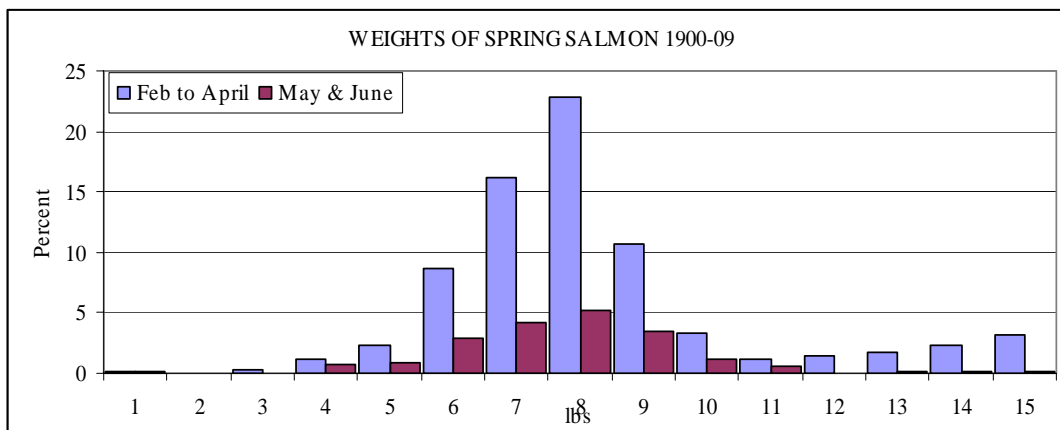
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- 3 Spring Salmon get larger through the season, later entering fish having had more time in the feeding grounds. The increasing size of the fish caught could, therefore, simply be due to more fish being caught later in the Spring than earlier in more recent years. A higher proportion of the Spring catch is indeed being caught later in the season but there are also more larger fish in the early part of the season as shown in the graph below: The blue columns show the sizes of the February to April fish and it can be seen that while 8lbs was the commonest weight, 9 and 10 lbs were the second and third commonest respectively. For the May and June fish (purple columns), 9lbs was the commonest size, with 8 and 10lbs being second and third.



- 4 If this graph is compared with a similar one for a hundred years before, the changes in sizes are obvious:



Here, while 8lbs is the commonest size for February to April fish, the second commonest size of fish is 7lbs and the third, 9lbs. It is also apparent that a smaller proportion of the early season catch was taken in May and June compared to a hundred years later.

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- 5 Part of this change is due to the appearance in recent years of more three sea-winter fish, some of which are as small as 10lbs. Until ten years or so ago, the age pattern of Spring Salmon on the Tweed was very simple: up to 12lbs in size, two sea-winters, around 15lbs, repeat spawners back for a second time and 18lbs or more, three sea-winters. The arrival of small three sea-winter fish has complicated this pattern and it can no longer be assumed that a 10-12lb Spring Salmon is a two sea-winter fish. This trend towards smaller three sea-winter fish is widespread and is not just a Tweed phenomenon. However, for the Tweed to have any numbers of three sea-winter fish is new. It may be that some Tweed fish that would normally have returned after two sea-winters are now staying on for another year to gain size – but another year at sea is another year of dangers and a reduced chance of surviving to return to the river.

## CHANGES IN SIZES OF AUTUMN SALMON AND GRILSE

- 6 This is a more complicated picture than for Spring Salmon, which are, effectively, only one age group, two Sea-Winter fish. In Autumn there are both Grilse (one Sea Winter away) and Salmon (two or more Sea Winters, but almost all two). The data shown here is from a Middle Tweed beat with complete records back to the 1880's and unchanged boundaries.

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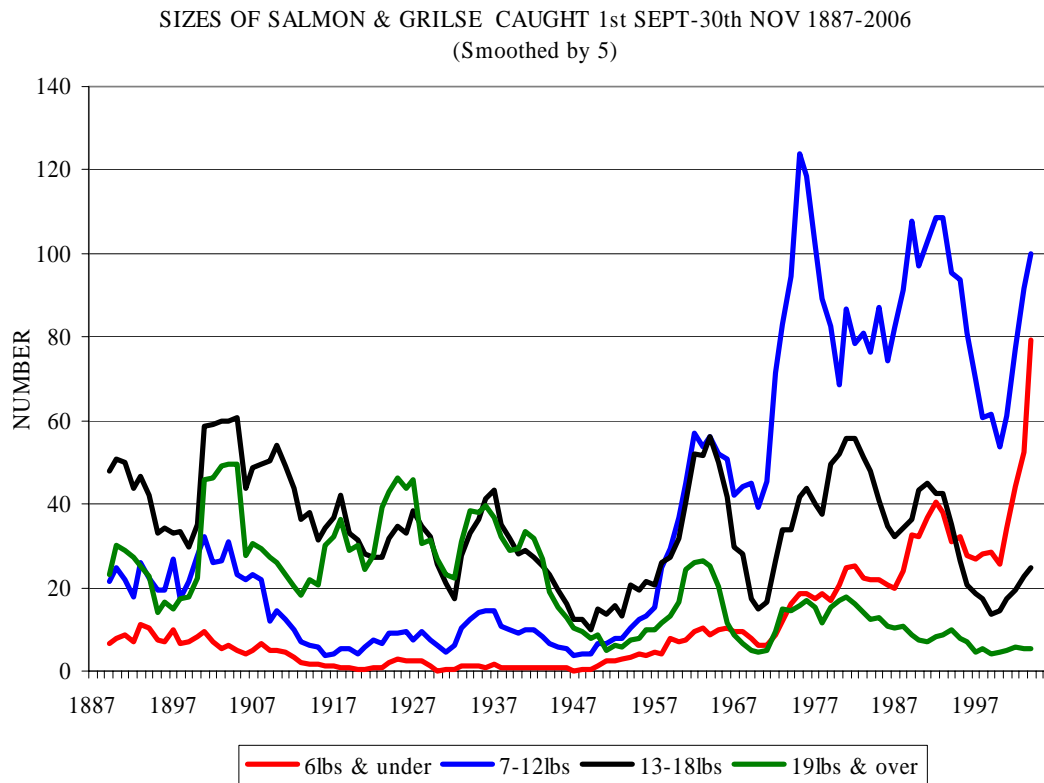
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- 7 The changes in size of Autumn fish (taken as 1<sup>st</sup> September to 30<sup>th</sup> November) at this beat are summarised in the graph below:



- The **green** line shows the numbers of fish of 19lbs and over, which have declined over this period from 20 to 40 per year on average to just a handful in more recent times.
- The **black** line shows the numbers of 13-18lbs fish caught, which, with ups and downs, have remained broadly similar over the period
- The **blue** line shows the numbers of 7-12lb fish caught, which has increased enormously since the 1940's.
- The **red** line shows the numbers of fish of 6lbs and under, which from being almost absent from the catches before the 1950's, are now the second commonest size of fish caught in the these three Autumn months.

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- 8 It is very obvious from this graph that there was a major change in the type of fish caught before and after the 1940s. Before then, most fish caught in Autumn were larger, multi-sea-winter fish (MSW – fish that spend two or more years at sea, Salmon). Since then, most fish caught have been one-sea-winter (1SW – fish that spend only one winter away at sea, Grilse). A shorter period growing out at sea obviously means smaller fish – but it also means more fish. This is because a shorter period at sea means fewer risks are encountered and therefore a higher chance of survival. There is a “trade-off” for salmon in the “choice” of how long they spend at sea. If they spend a longer time, they become larger: females have more eggs and males have more chance of winning fights on the spawning grounds and gaining mates – but the chances of survival at sea are lower. If fish spend a shorter time at sea, they lose the advantages of size, but gain higher chances of survival. The which strategy is better depends on the environmental conditions in the sea and since the 1940’s these have obviously favoured the “quick and small” strategy over the “slow and large”.
- 9 This change from MSW to 1SW is one of the two major changes that have taken place within the Salmon of the Tweed over the last century, the other being the change from Autumn dominance to Spring and back again. Both these changes can be seen in the catch records of a group of Upper Tweed fisheries, shown in Section 16 below.
- 10 What cannot be assessed from these records is the “Catch per Unit Effort” (CPUE), the number of hours fished per fish caught. Angling effort has greatly increased with the greater commercialization of salmon fishing which began in the 1960’s. This means that though the numbers of 13-18lb fish caught in the 1980’s are much the same as the numbers caught in the 1880’s, there will have been more fishing effort made to catch them.
- 11 What is clear however, is that the trend towards smaller fish in the Autumn is long-term and well-established and is not a recent change. Before the 1940’s, 7-12lb fish were the 3<sup>rd</sup> commonest size category caught. Since the 1960’s, they have been the commonest. Fish of 6lbs and under hardly featured in the catches before the 1940’s but in the 1990’s, they become the second commonest size class caught.
- 12 The contrast between the two halves of the season for this Middle Tweed fishery is shown in the graph below. While the average weight of fish in the second half (gray line) has fallen from 16-18lbs a century ago to 8-10lbs at present, the average size in the first half of the season (black line) has hardly changed at all.

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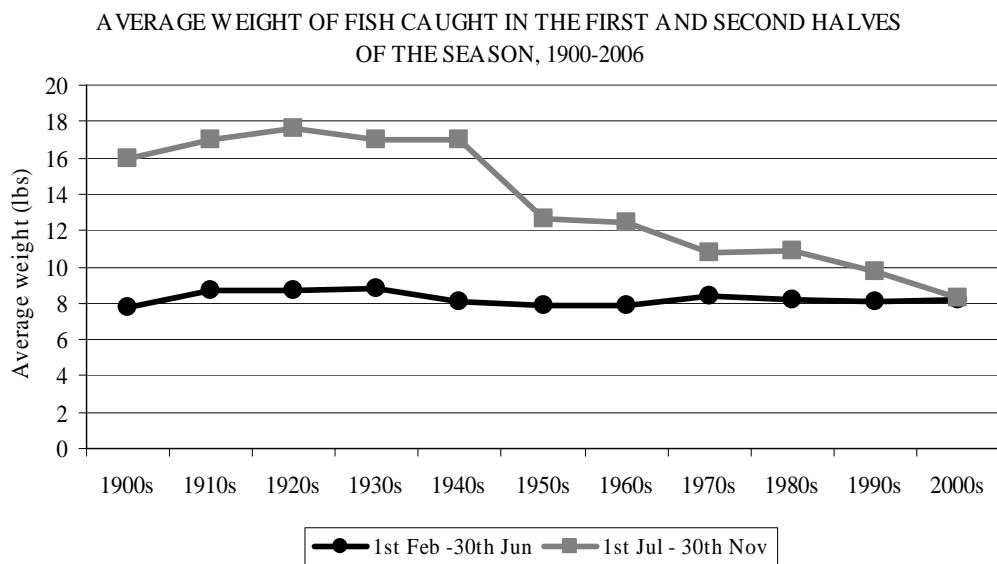
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In the 2000s, for the first time, the average weights in the two halves of the season became the same, at 8lbs.

- 13 This decline in the average size of fish in the latter half of the season is not, however, due only to a decline in individual fish size. While numbers of fish of 19lbs and over have fallen greatly, there are almost as many 13-18lb fish being caught now as 100 years or so ago. The catches of small fish, however, have greatly increased and the decline in average size is partly due to this great increase in their numbers (see the graph under Point 7 for an example of this). In the 1900s, the average annual catch was around 130 a year on this beat; in the 2000s, it was around 250, almost double – but the increase has been entirely of smaller fish (Grilse), reducing the average weight.
- 14 In the last few years, some very small salmon indeed have been caught, fish of around one pound in weight. These have been very rare in the past – one set of Lower Tweed records recorded just 8 fish of this size from 1855 to 1972 and the Middle Tweed records referred to above recorded just 5 from 1887 to 1959, none from 1960 to 1989 but 4 from 1990 to 2006.
- 15 These very small fish raise some obvious questions. Firstly, are they “pure” salmon i.e. not hybrids, but salmon with a trout somewhere in their ancestry? Hybridisation between salmon and trout is much commoner on the Tweed than elsewhere and if hybrids are fertile and “back-cross” with salmon, trout genes can cross the species barrier and enter the salmon population.

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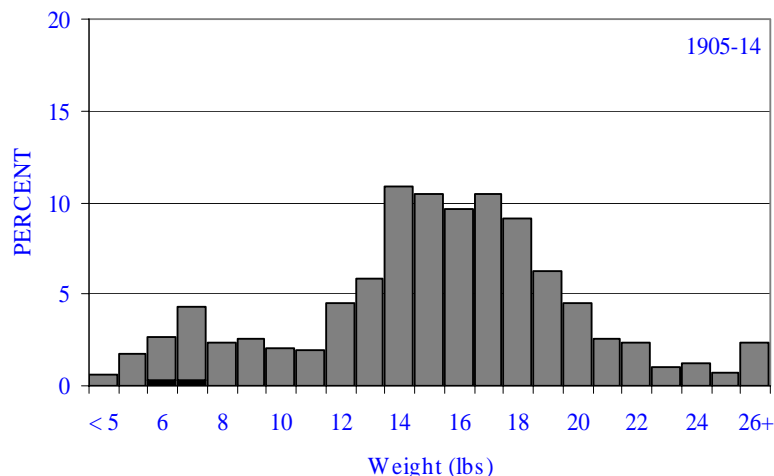
This has certainly happened in the other direction with the trout of the Tweed, around 20% of which have salmon genes in them. Some of the very small salmon caught recently will be genetically tested to show if this is the case. The other question is whether such very small fish make the typical salmon migration to the North Atlantic or not. There are populations of salmon, such as the Inner Fundy of Nova Scotia, that do not, simply feeding along nearby coasts before returning to their home rivers. The chemical composition of the scales of some of these very small Tweed salmon are being tested at present to see what parts of the sea they have been living in.

16 Changes in the Salmon population of the Tweed over the last century, as illustrated by the catch records of a group of Upper Tweed fisheries:

In these graphs, the columns represent the percentage of the annual catch contributed by fish of different weights, from 5lbs or less to 26lbs or more.

The black part of a column shows the proportion of the fish of that weight caught in the first half of the season (1<sup>st</sup> Feb to 30<sup>th</sup> June) and the gray, the proportion of the fish caught in the second half of the season (1<sup>st</sup> July to 30<sup>th</sup> Nov).

- a) 1905-14 (672 fish recorded): This is the first decade for which records are available and these show that almost all the fish were caught in the second half of the season (gray) and that the great majority were 12lbs or more in weight, most being between 14 and 18lbs. The catches therefore were dominated by larger, MSW, Autumn, Salmon. Grilse (10lbs and under) are only a small part of the annual catch.



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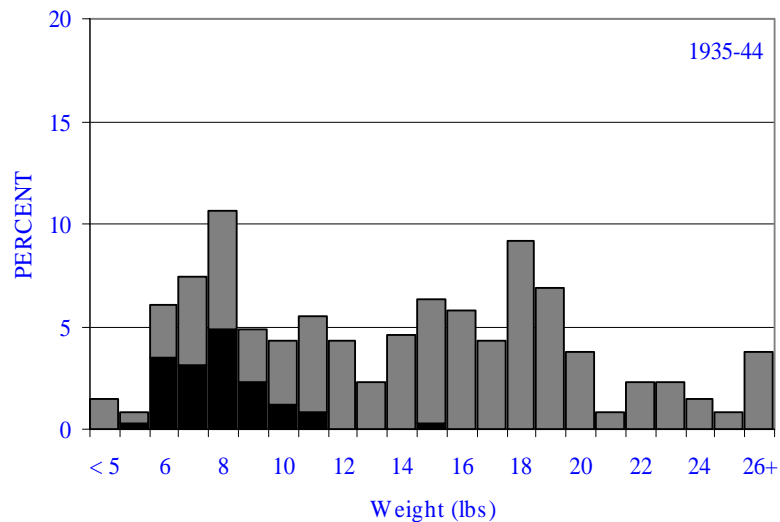
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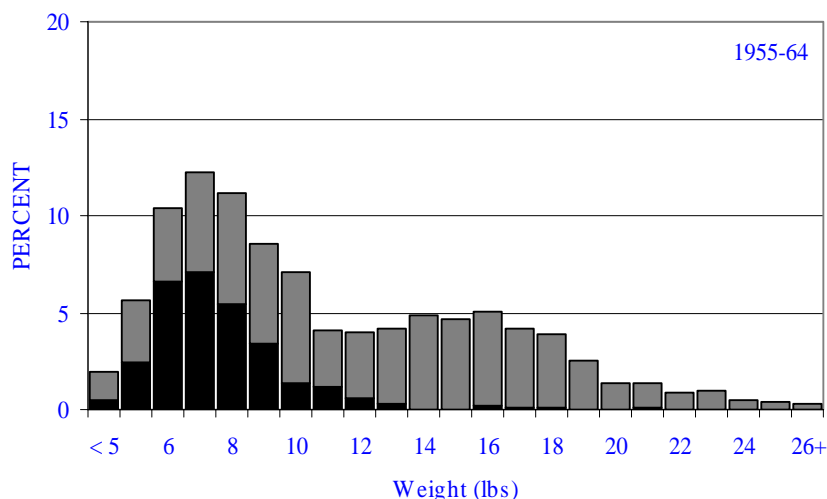
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- b) 1935-44 (348 fish): Two decades later, the picture has changed. Fish caught in the first half of the season (black) are now a minor, but obvious, part of the annual catch. Autumn Grilse (gray, under 10lbs) have also increased their contribution to the catch and larger fish (14lbs +) are now a lesser proportion.



- c) 1955-64 (1067 fish): Two decades further on and the picture has changed again. First half catches are a significant proportion of the annual total and larger fish have declined further in importance.



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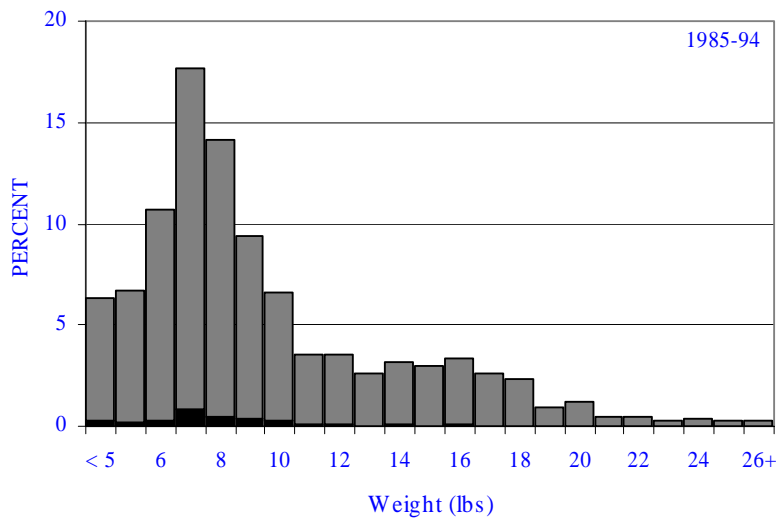
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- d) 1985-94 (1622 fish - the most recent data of this series): Thirty years on, the picture has changed again. First half of the season catches have disappeared almost completely and fishing is now dominated by smaller, second half catches (Grilse). Larger, Autumn fish (Salmon) have become only a minor component. The contrast with the records for 1905-14 is very obvious, showing a change from MSW domination in Autumn to 1SW domination and an overall decline in the average size of fish caught.



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