



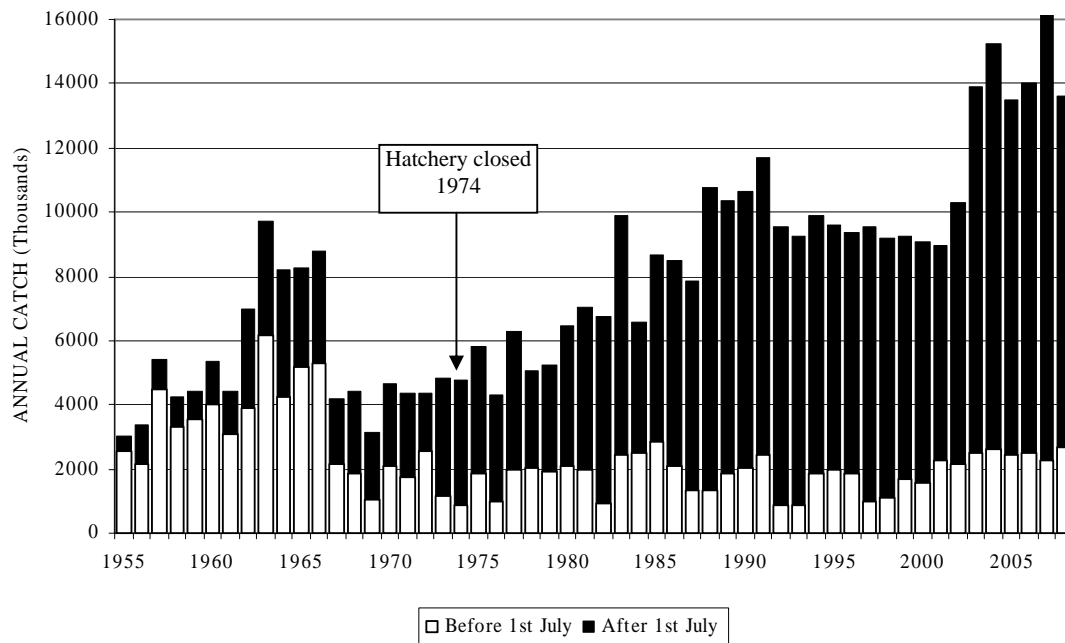
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FREQUENTLY ASKED QUESTIONS ABOUT THE TWEED

1: Hatcheries & Salmon Management on the R. Tweed.

The Salmon hatchery on the Tweed was closed in 1974, at the end of the UDN outbreak that had reduced catches during the years after 1966. The graph below shows how salmon catches on the river recovered after the disease faded out and how the timing of the catches changed from being mainly in the first half of the season (before the 1st July) to being in the second half of the season. This change was a return to the situation before WWI when catches had also been mainly in the Autumn.



There has been no hatchery on the river since because:

- 1 Wild production is far greater than anything that can be produced in hatcheries. Estimates are that around 200 million salmon eggs are deposited naturally each year in the Tweed system, over its wetted area of 17.1 million square metres (6.6 square miles). This is around 15% of all the water open to Salmon in Scotland. On the main river, spawning stretches almost 90 miles, from Coldstream up to the Cor Water and is spread through all the tributaries, down to burns only a couple of metres wide, a huge and varied amount of nursery area.

Typically, around 95% of Salmon fry die within three months of hatching as their numbers are reduced to the level that can be supported by the available food and space. There is no point in stocking in such situations. All too often, though, when hatcheries are considered, no attention is paid to the amount of wild production – but unless hatchery production is a significant proportion of wild production, it is pointless. Hatcheries can only

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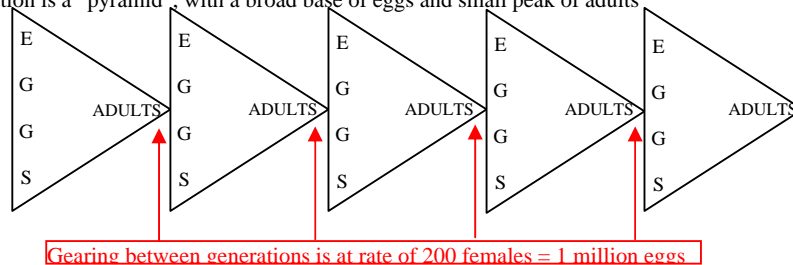


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make a noticeable contribution when wild production is very low indeed, but as wild production can recover very quickly without artificial stocking (see the case history of the Whiteadder in Point 3 below) there is little need for hatcheries even in such situations - unless wild recovery is prevented by problems such as Acid Rain or Salmon farming.

NOTE: The reproductive strategy of Salmon is to produce very large numbers of eggs: a 70cms / 8 lb female spawns around 5,000 eggs so the Tweed's record annual rod catch of Salmon of 16,000 could be produced by just four average-sized females! Unlike birds and mammals, a lot of "parents" are not needed to produce a lot of young. A shortage of eggs or fry (since hatching success is very high, around 80-90%), is therefore the *least* likely problem to affect salmon. Each Salmon generation is a "pyramid", with a broad base of eggs and small peak of adults



It is worth noting that while anglers only see the small, adult "tip" of this pyramid, fishery managers also see the broad base of eggs and fry, which can lead to very different perceptions of the strength of salmon populations.

If egg / fry numbers are reduced for any reason, survival of the fry is better with the reduced competition and this compensates for the reduction. This is called "density-dependent mortality" and is the mechanism by which Salmon can compensate for any shortfall in eggs because fewer eggs = higher survival rate of fry. Salmon populations have to get very low before this safety mechanism will fail to keep juvenile numbers up.

- 2 There is no evidence that economically affordable levels of Smolt stocking can produce enough extra fish to make a noticeable increase in the catches of a large river. This was pointed out as long ago as 1904, by Sir Herbert Maxwell, in his book "British Freshwater Fish" when he wrote "River proprietors are spending more and more upon artificial salmon hatcheries, in the belief that therein exist the means of replenishing exhausted rivers; but it is obvious to those who have watched most closely the operations of Nature that, in order to have any effect, artificial hatching must be carried out on a very considerable scale. Until one has watched the smolts descending to the sea in any ordinarily prolific river, no conception can be had of the profusion of Nature's provision for the maintenance of the species". The same consideration applies now:

- To give a 10% increase in Tweed's catches would mean 1400 extra Salmon would have to be caught
- Which would need 17,500 extra fish back to the river at a catch rate of 8% (this is the actual recapture rate of fish tagged in September in the lower Tweed. For later fish, it will be smaller, for earlier it will be greater. This is comparable with data from other rivers. The general Rule-of-Thumb is that anglers catch 1 in 10 to 1 in 12 of the salmon in a river (8% to 10%) – but this can be up to 40% for Spring Salmon.
- At a 1% return rate for hatchery smolts this would mean 1,750,000 smolts to be put in the river each year. (Wild smolts have a return rate of around 8%, but hatchery smolts, being domesticated animals, do not do so well in the wild and have typical return rates of around 1%. Note that return rates in Iceland are somewhat better, as the fish do not have the long migration north that ours do)
- At 80p per smolt (which is cheap), this would cost £1,400,000 per year. Even if hatchery smolts had the same return rate as wild, it would still cost £175,000 every year.
- There would also be the problem of where such hatchery reared fish that were not killed by anglers would breed in the river. Modern genetics research has shown that cross breeding of wild stocks, even from nearby river systems, produces hybrids that survive less well than pure-bred fish.

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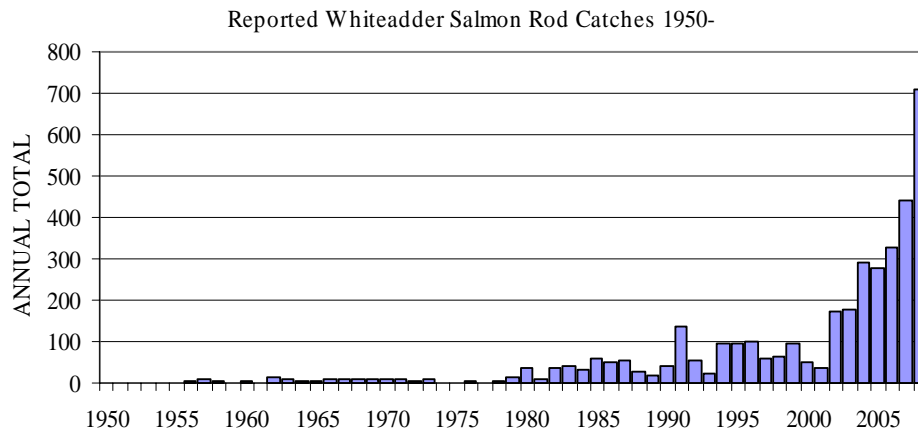
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- 3 Experience with the natural recolonisation of tributaries when re-opened to Salmon has shown that empty space in nursery areas is rapidly filled. The Gala Water was blocked from 1821 to 1949 and is now one of the best stocked nursery areas in the catchment; The Leader Water was blocked from the 1840's to 1959 and now has the highest densities of Salmon fry found anywhere in the Tweed catchment. The Whiteadder was fully opened up only in the 1990's, so the recolonisation has been tracked through electric-fishing surveys:

1988	7 sites, average Salmon Parr density of	1.3 per 100 m ²	(at 2 sites out of 7)
1996	same 7 sites, average Salmon Parr density of	15.9 per 100 m ²	(at 6 sites out of 7)
2000	same 7 sites, average Salmon Parr density of	65.0 per 100 m ²	(at 7 sites out of 7)

(one of these sites then became unusable. Later samplings have shown continued good levels of juvenile Salmon in the Whiteadder. The Blackadder was opened up later and is still recolonising)

The catches on the Whiteadder have also increased as it has been recolonised:



This recovery has been entirely natural, produced by the removal / easing of obstacles, there was no artificial stocking at all. Interestingly, the natural recovery has been as a Spring Salmon population, yet if there had been artificial stocking, Spring fish stock would not have been chosen as the Whiteadder is not a typical site for such a stock

- 4 The history of the Whiteadder (and other opened-up areas) shows what will happen to any empty or under-populated nursery area within the Tweed catchment – they will be rapidly colonised and brought to full production without any artificial stocking. If any areas are found in which this does not happen, it would show that there is some basic problem (water or habitat quality etc.) that prevents full production. The correct management action in such

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situations is to deal with the basic problem rather than to try and cover up the situation by stocking into such unsuitable areas.

- 5 Ensuring that the catchment is fully open to spawning fish so the area of juvenile production is maximized is a much cheaper and more effective option than stocking. Money spent on easing / removing an obstacle is spent only once – hatcheries have to be paid for every year.

Note: Unless salmon hatcheries are using eggs bought in from elsewhere, they are maintained by taking eggs *out* of the river. The assumption is that by being kept safe in hatcheries, more young are produced from the same number of eggs. However, this is based on the assumption that traditional hatchery rearing produces fish of the same quality and ability as natural rearing, which is now known not to be the case. The longer fish are kept safe in a hatchery, the less suited they are for life in the wild, both in terms of physical shape and condition and in behaviour. The apparent increase in survival from eggs reared in traditional hatcheries is not therefore what it seems, as the survival of hatchery-reared fish in the wild is so much poorer than that of wild reared fish. This is why modern hatchery practice aims to keep fish in captivity for as short a period as possible before stocking them out to minimise these adverse effects of hatchery rearing on them.

- 6 Only a small proportion of the Salmon running the river in Autumn is actually caught by anglers. Recaptures by anglers of fish tagged in the lower Tweed were around 3% from 1997-2001, increasing to 6% from 2002-2006. This means that more than 90 out of every 100 Autumn fish entering the river are *not* caught by anglers! Trying to increase catches by increasing the number of fish entering the river by artificial stocking is pointless in such a situation – a much more effective way of increasing catches would be for anglers to improve their skills and knowledge and so catch a higher proportion of the fish that are already there.

- If anglers could catch 12% of the fish coming into the river instead of 6%, it would double the Autumn catch to around 19,000 fish.

- Though this would mean catching 12 out of every hundred rather than 6 out of every hundred, it would still leave more than 80 fish out of every hundred entering the river free to spawn.

- 7 If there is a problem that is reducing fish stocks (over-fishing; poor habitat; restricted access; estuary pollution) then these cannot be solved by stocking. Stocking treats only the symptoms (lack of fish) not the underlying cause(s). In fact, stocking makes things worse because it uses up money that could otherwise be used to solve the real, underlying causes of problems. On the Tweed, we spend our money on:

(1) the actual causes of problems, not on just treating symptoms.

(2) finding out how the salmon populations of the catchment “work” in terms of numbers of adults and juveniles; distribution and quality of nursery areas; ages; run-timings etc. at this time of good catches, so if something does go wrong in future, it will be apparent where the problem is

(3) Protecting the habitat of juveniles and making sure access to all parts of the catchment is open.

- 8 Salmon hatcheries have been around since the 1840’s, but until electric-fishing became possible in the 1960’s, no-one actually had any idea of what the numbers of juvenile salmon in the wild were. It is very difficult to see fry and parr in the wild, and it was just assumed that nursery areas were empty and needed stocking. Once electric-fishing started, however, it was found that wild production could be on an enormous scale and most rivers and streams were full of juveniles. The 19th century belief in the incapability of salmon to reproduce in

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the wild and the consequent need for artificial stocking has, however, persisted. If hatcheries worked in the real world as well as they “work” in the letters pages of angling magazines, the world would have been swamped with Salmon for the last 150 years!

- 9 Hatcheries and stocking have a long history in Scotland and elsewhere, and there is now a great deal of experience in their use (and mis-use). The best summary of this is probably given in the foreword to the Fisheries Research Services *Scottish Fisheries Information Pamphlet No. 22, 2003*, where it says: “*Advice on stocking is contradictory. Proponents raise expectations of large additional catches if stocked fish survive. Critics emphasise the heavy costs set against the modest, if any, gains shown from past stocking initiatives, as well as potential threats to health and genetic integrity of existing fish. What is clear is that stocking should only be considered as one of a number of courses of possible action*” [This pamphlet is available online: No. 22 “Salmon and Sea-trout. To Stock or Not” and should be read by anyone interested in the topic]
- 10 The juvenile salmon populations of the Tweed and their habitat have been extensively surveyed for nearly 20 years now and are well known. Nothing has been found to suggest that stocking would be useful part of management here – and the circumstances in which stocking can be of use are now well defined in the scientific literature in a number of guides such as the one quoted in Point 9.

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