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SAMARCH 2022 International Forum
Salmon and Sea Trout: Scientific Tools for their Protection
17th – 18th May 2022

Salmon survival and growth rates

Extensive data on salmon survival and growth rates highlight feeding conditions at sea as one of the biggest problems at the May 2022 SAMARCH Conference.

Individual growth rates

Analysis of 9,000 salmon scales of fish obtained from the five rivers across the last fifty years 1970-2020, reveal the individual growth rates of the fish has changed significantly over this period, particularly during the first year at sea, or more particularly during the first summer at sea. Growth during the first months at sea would seem critically important and this has significantly declined during this period, with a particularly marked decline in growth since 2005.

The reduced size of certain stocks of returning salmon has also been highlighted. With the notable effect that smaller salmon also produce fewer eggs. Encouragingly the subsequent feeding periods, such as overwinter feeding to the North of the Faroes, or over summer west of Greenland, appear as far as growth is concerned fairly stable. Which means that if fish can survive through the first summer, they should then have reasonably good potential to survive to feed and grow into maturing salmon.

Changes at sea

Ken Whelan's (Atlantic Salmon Trust) presentation also clearly highlighted potential challenges facing salmon at sea. More particularly, changing conditions during the early marine phase for salmon post smolts could be proving extremely challenging.

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Recent decades have seen a significant decline in the ocean productivity as measured by the food availability for fish, zooplankton levels. The area to the West of Scotland, is the key migration path for young post smolts of many rivers southern populations heading for the Norwegian sea. Zooplankton are a vital link in the food chain between primary production and the higher trophic levels. In this crucial area, zooplankton levels have declined by approximately 50% compared to the 1960's, the last period when many would say that salmon were truly abundant. If crucial zooplankton levels have decreased by 50%, it stands to reason that this impact could well be seen to ripple through the entire marine food web.

Other food sources

Sandeels, are known to be an important food source for salmon, whilst zooplankton, like the Copepod, Calanus finmarchicus are a known to be a key food for sandeel and herring populations. It would stand to reason that a significant impact on key prey for salmon during the early part of their migration, such as sandeels, could impact the growth and survival prospects of migrating juvenile salmon post smolts, unless of course they could find an alternative abundant food source.

Judging by the drastic decline in the northern populations of surface feeding sea birds in the UK, such as kittiwakes and terns, which are highly reliant on sandeels, and of course the drastic decline in salmon populations, it would appear that an abundant highly nutritious alternative food source does not currently seem to be available. Understanding - and where possible - enhancing key forage species will likely be of critical importance in the future.

Fully functioning marine ecosystems are key for a very wide range of species, to ensure the system remains productive, vitally important marine seabed habitats and the corridors upon which migratory species depend must also be protected. Ensuring that industrial pelagic fisheries for herring, mackerel and other species, are also managed with salmon conservation in mind may also prove extremely beneficial.

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Salmon survival post smolts

From the projects five index rivers positive news is emerging about the survival prospects of salmon post smolts. Data suggested the survival rate increases with the size at which the smolts leave the river.

Bigger appears to be better, as mortality is lower for the bigger smolts. Protecting and improving freshwater ecosystems to produce healthy wild smolts should therefore remain a very high priority. The body size of the fish at sea appears to be important, as the probability to mature and return as 1 sea winter/grilse, increases with body size after the first summer at sea. Therefore, a large smolt, feeding well at sea around the British Isles and the Norwegian basin during the first summer at sea, is more likely to survive and quickly return. A smaller sized post smolt, will either simply not survive at all, or it will then spend another year at sea, probably migrating on to West Greenland before returning as a larger multi sea-winter fish, however, longer migrations of course still pose further mortality risks.

A changing ecosystem

Salmon populations are declining across all of the five rivers studied. Indeed, it is consistent with other populations seeing declines in marine survival and changes in the population structure, such as in Scotland and Norway. This reinforces the view that there has been a major change in the ecosystem of the Northeast Atlantic and perhaps particularly the ecosystem of the Norwegian Sea, which is the main feeding area for all our young salmon during their first summer feeding at sea.

It is noteworthy that wider changes in the pelagic ecosystems in the Northeast Atlantic do seem to be taking place. Several species like mackerel and herring are undergoing changes in their distribution and abundance, whilst perhaps also of interest is the return of Atlantic Bluefin Tuna

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to waters around the British Isles. Understanding how salmon fit into the marine ecosystem and how they may adapt to any potential changes is important.

Supporting data

On the river Tweed, Dr. Ronald Campbell has presented historical rod and net catch data showing significant fluctuations in Atlantic salmon populations. Data over the last 150 years, show that populations on the Tweed vary from being dominated by grilse or multi-sea-winter salmon and back again. This Indicates change may be part of wider climatic cycles driven by the Atlantic Multi-decadal Oscillation (AMO), that may now actually favour multi sea-winter salmon over grilse, due to the current patterns of change in the jet stream and the and warming of sea surface temperatures in the Northeast Atlantic.

What is not known is how much of this recent change and the decline in salmonid populations may also be due to human induced climate change. Rapid recent warming and changing weather patterns may affect wider natural patterns and the more favourable returns of multi sea-winter salmon, particularly for their subsequent spawning success and survival.

Dr. Campbell notes that you cannot fight the AMO, but perhaps human induced changes should be a different matter. Climate change is posing significant pressures on the survival of salmon in freshwater, which should be fought. Salmon require cool, clean well oxygenated water, obviously more periods of steady rain, not less, particularly during key migration periods for fish moving both up and downstream would be very helpful, if this is not apparent then other solutions will be important.

It may well be some time before the populations based on improving numbers of multi sea winter salmon can naturally rebuild, certainly in the shorter term they will certainly require significantly increased protection to return them to levels with healthy abundant spawning stocks. This pattern of change of moving from being grilse dominated to seeing an increase in the proportion of larger multi sea winter fish, is also evident on the Tamar index river. More

salmon successfully returning as larger multi-sea winter fish can certainly help boost egg production on rivers.

Work carried out by the University of Exeter, with the genetic typing of fish has also revealed that an increasing proportion of these multi sea winter salmon on the Tamar also happen to be female. Taken together these are emerging positive trends in protecting and improving the overall strength of salmon populations on our rivers.

Restoring freshwater ecosystems

At present one of the best options to offset any decline in survival at sea is to take significant action to restore freshwater ecosystems to maximise the number of healthy wild smolts produced. This should of course go hand in hand with protecting the migratory corridors for fish, from source to sea and particularly through estuaries and the near shore zone where mortality may also be taking place.

The SAMARCH project is turning its attention to the coastal transitional zone, building on the new understanding of salmonid behaviour with management advice being developed to help protect our vulnerable fish stocks through harbour, estuarine and coastal waters from the most significant marine stressors.

Wider actions to improve freshwater ecosystems, include improving water quality and quantity and ensuring habitat connectivity by removing barriers to allow good access to and from spawning grounds. This is essential and of course can be linked with wider land use change and habitat restoration most of which has already been clearly laid out clearly in the Salmon Five Point Approach, a combination of actions which would certainly help to ensure an increased output of strong healthy wild smolts.

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SAMARCH: action for sea-trout

As part of the project, a genetic database for sea-trout has been established through a collaboration between the University of Exeter, INRAE and Agrocampus Ouest in Rennes.

Data-led evidence

The database is built on a baseline of nearly 3,000 brown trout samples. These samples were collected from all the main rivers on the south coast of England and the Northern Coast of France. A wider baseline of samples from regions outside of the study area were also included. Consolidate, this data has allowed genetic typing of samples from 103 different rivers.

For accurate and robust results, groups of rivers that share genetic characteristics are grouped together. To make eleven reporting regions including fish from rivers in Devon and Cornwall, the rivers of Dorset and Hampshire Basin, rivers of Southeast England, Brittany, Normandy and further afield including rivers of Northeast England and Ireland.

The database will allow any fish caught at sea around the Channel to be genetically assessed and accurately assigned back to its region of origin. The database has been tested with the first assignments of samples from sea-trout caught at sea by project researchers from the Game and Wildlife Conservation Trust. Brought together this is enabling the unique identification of the region of origin for each individual fish. Sea-trout caught at sea by any recreational or commercial fishermen can now be analysed to ascertain their actual region of origin.

Evidence-led solutions

The data captured will allow questions about sea-trout declines to be answered.

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For example, are larger sea trout >40cm caught by nets off the Dorset coast, just from the local area. Well perhaps not really. Several originated from rivers in Devon and Cornwall, fish that had probably migrated more locally across county boundaries following rich feeding opportunities along the coast, as indeed had the largest proportion of fish caught which had headed along the coast from the other direction, from the Hampshire Basin rivers.

More surprising was the few migrants from significantly further afield. Firstly, fish from France, assigning to the Normandy rivers. Despite political and viral restrictions, we would seem to have a French exchange without any requirement for health checks or passports!

What is perhaps more surprising is the few fish that had made the migration all the way down from the Northeast for a feeding sojourn along the south coast, a migration of over 800 kilometres.

What is rapidly becoming clear is that sea-trout feeding at sea are, depending upon an individual's life cycle, potentially covering significant distances, and anyone catching them off the South coast of England could actually be exploiting fish from a very diverse and mixed stock of fish, certainly not just from the nearest local rivers. This fact certainly makes managing them more complex as understanding the exploitation on any single stock is vital when undertaking fisheries management.

Further analysis is required to confirm wider details of each individual's life cycle, this information will be gleaned from the scales, which can confirm the age, growth rates and time spent feeding at sea and whether the fish had spawned previously.

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