Project information

Keywords

Atlantic salmon sea growth Barents Sea

Project title

Salmon at sea in a changing world: Linking growth, sea-age at maturity and survival with changes in marine physical and biological conditions.

Year

2016

Project leader

Martin-A. Svenning

Geographical localization of the research project in decimal degrees (max 5 per project, ex. 70,662°N and 23,707°E)

67-71o N and 13-52oE

Participants

NINA: Martin-A. Svenning, Morten Falkegård, Per Fauchald.

UIT: Nigel Yoccoz

Natural Resources Institute Finland (LUKE): Jaakko Erkinaro, Eero Niemelä

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Fisheries and Oceans, Canada (DFO): Brian Dempson

University of Waterloo, Canada (UW): Mike Power

Flagship

Fjord and Coast

Funding Source

Norwegian Research Council

Fjord and Coast

NINA

Summary of Results

The main objectives was to identify potential geographic and stock-specific patterns of marine growth from different Barents Sea salmon stocks, including Tana salmon, collected along the coast of northern Norway, in the sea-fishery (2011-2012). Further, scale data for Tana salmon, was analyzed in conjunction with physical and biological marine data sets from the Barents Sea.

Based on a genetic baseline developed from 185 separate rivers in North Norway and Russia, we have identified the home river of ca 16 000 wild Atlantic salmon caught in the mixed-stock coastal salmon fishery in North-Norway, we tried to group or cluster the different stocks of salmon based on back-calculated growth increments during their first summer at sea.

Since calendar year and sea age showed interactions with the growth increments in different stocks, the regression analysis used in clustering included catches (2011 and 2012) of 1 and 2 sea winter salmon only. Calendar year, when the growth of first sea year happened, had different effect on the growth increment among different stocks. Also sea age had an interaction with stocks. Because 1SW salmon are mainly males and 2SW salmon mainly females, males and females were also separated and the opposite sex was used for evaluating the clustering.

When including only the five “largest” stocks, we found that salmon from these rivers/regions 1) seem to grow consistently different in sea among years, and 2) that sea growth also seem to increase along a west-east gradient of home rivers (**Figure 1**). When including all stocks with at least 50 fish in each studied group, including several stocks from Tana (1SW, males etc.), we found huge variations in adjusted growth increment both during the first year in sea and the after the two first years in sea (Figure 2), both for 1SW males (first year) and 2SW females (first two years). We also found significantly differences in sea growth between Tana salmon originating from different tributaries in the Tana River (**Figure 2**).

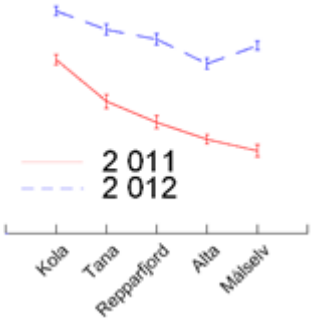

Figure 1 Back-calculated growth during the first summer in sea for 1SW males, for the five largest “assigned” stocks in the coastal fishery in 2011 and 2012.

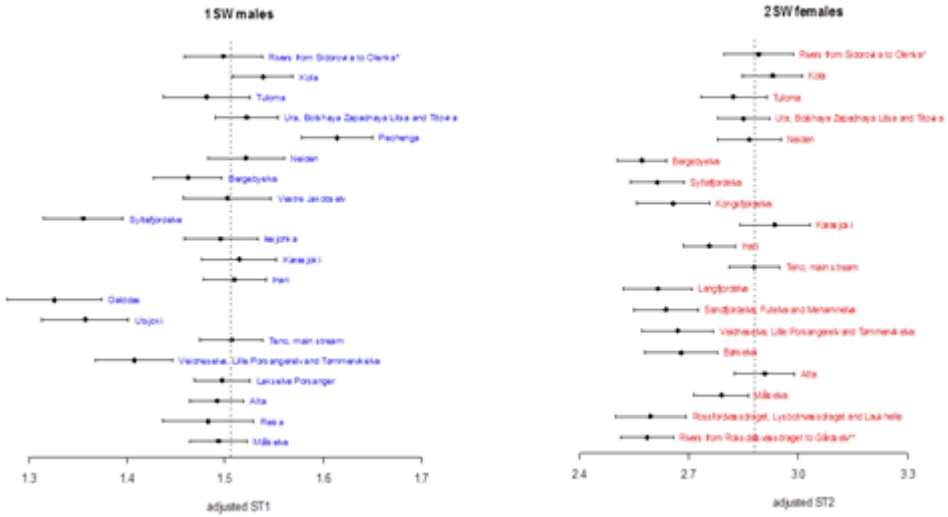

Figure 2 Adjusted mean growth increment 1) during the first year in sea for 1SW males (left), and 2) during the two first years in sea for 2SW females (right). The analysis are adjusted for growth year, gear type and time of catch (spring, summer or autumn).

Based on growth increments in Tana salmon scales (selecting samples only from the Tana main stem), we found 1) a positive correlation between summer sea growth of both 1- and 2SW fish and temperature (Kola section), and 2) an indication of the same positive correlation between sea growth in 2SW salmon and the abundance of capelin in the Barents Sea.

Highlights:

- Sea growth seem to vary significantly among Barents Sea salmon stocks
- Sea growth seem to increase along a southeast to northeast gradient
- Sea growth in Tana salmon seem to be positively correlated to water temperature and capelin abundance in the Barents Sea.

Master and PhD-students involved in the project

No master students involved this year.

For the Management

We produced extensive genetic baseline data involving 36 sampling locations and 33 microsatellite markers, and identified 28 hierarchically structured and genetically distinct population segments in Tana River (see Vähä et al. 2016). The strong genetic structuring among populations, together with a powerful marker system, allowed for accurate stock identification of individuals and enabled assessment of stock compositions contributing to the mixed-stock fisheries in the river. Thus, the biological knowledge gained from this study is essential for explaining the impact of the selective fishery on the Tana salmon. Our results also imply that the salmon stocks originating from the different tributaries in Tana, must be treated separately.

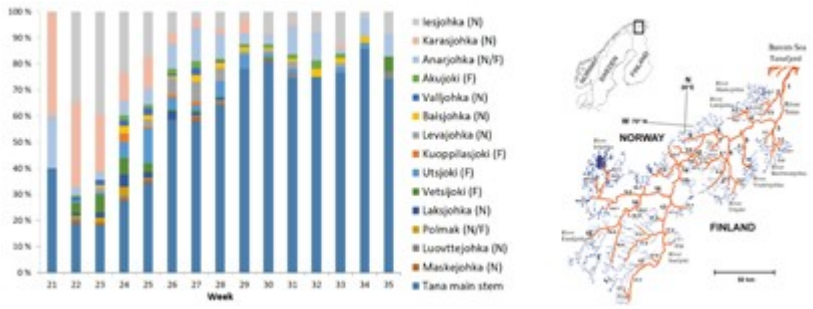

Figure 3 Estimated contribution of the salmon from different Tana tributary stocks in catches in the lowermost part of the Tana river.

Published Results/Planned Publications

Vähä et al. 2016. Genetic stock identification of Atlantic salmon and its evaluation in a large population complex. Canadian Journal of Fish and Aquatic Sciences, doi.org/10.1139/cjfas-2015-0606.

Submission of articles in 2017 to ICES Journal of Marine Science, with working titles:

Stock-specific patterns of marine growth of Atlantic salmon from Barents Sea rivers; indications of spatial stock-specific feeding areas

Variation in growth patterns in Tana mixed-stock salmon; influence of oceanic conditions and prey fish abunance in the Barents Sea

Communicated Results

A workshop will be held in Oslo in week 48 (2016).

Poster at Fram-dagen (November 2016).

Oral presentation, Fjord and Coast flagship meeting, Sommerøy, Nov. 2016

Lectures (2016) at the County Governor in Finnmark, the Tana Sea salmon fishery association and the Troms Sea salmon fishery association.

Interdisciplinary Cooperation

Ecology, genetics

Budget in accordance to results

This application to the Fjord and Coast flagship (FCF) is partly based on a project founded by the Norwegian Research Council (SALMAZE; 2015-2017). The funding from NRC, however, was reduced by 18.1 %, and the funding from Fjord and Coast has been essential to continue and fulfill the Salmaze project.

Could results from the project be subject for any commercial utilization

No

Conclusions

Background:

The base of this project is that we have identified the home river of more than 15 000 Atlantic salmon caught in the mixed-stock coastal salmon fishery in North-Norway. Thus, we can estimate the amount of the different Atlantic salmon river stocks contributing to the sea salmon fishery, and start developing a temporal and spatial stock-migration model for the largest salmon stocks in the Barents Sea. By using these results we may also estimate the pre fishery abundance for the most important salmon rivers, and calculate the exploitation rate between the coastal and river fishery.

Based on the latest genetic analyses (see Vähä et al. 2016) we may now estimate the historical exploitation rate of the ca 25 tributary stocks in Tana, and used this information in a future sustainable management of Tana salmon.

2016-results

The results in 2016 show that sea growth seem to vary significantly among Barents Sea salmon stocks, and sea growth may be correlated to the geographical location of their home rivers. One interpretation is that this may indicate differences in migratory behaviour, i.e. use of different feeding areas at sea, and/or that teh different salmon stocks feed on different prey. Since stable isotope analysis (SIA) has become an important tool for assessing fish diet, we aim to enhance our knowledge about salmon responses to changing conditions at sea, focusing on the long-term (40 years) time series from the large Tana river system, by comparing the long-term SIA record ($\delta^{13}C$ and $\delta^{15}N$) in Tana salmon with long-term monitoring data from the Barents Sea. Thus, this is the main goal in our new application to Fjord & Coast for 2017.