Norwegian, Finnish and Swedish partners collaborated in 2020–2022 in the Kolarctic CBC ENI project 'CoASal' *Conserving our Atlantic salmon as a sustainable resource for the people in the North; fisheries and conservation in the context of growing threats and a changing environment (KO4178).*

Atlantic salmon has played an important role within northern history and culture for centuries and has long been a symbol of healthy and vital ecosystems. The salmon's fascinating ability to undergo great physiological adaptations to change its habitat from freshwater to seawater, while also undertaking huge migrations across thousands of kilometers from their feeding grounds to the coastal areas while also being able to accurately return to their river of birth makes it almost impossible to not be fascinated by this amazing fish.

Despite implementation of stronger conservation and management measures, international and bilateral agreements to protect both salmon stocks and their habitats, the current situation for wild salmon stocks is alarming, and most likely caused by a range of different factors. This project has addressed the currently alarming situation regarding wild salmon stocks in Northern-Norway and studied some of the likely multiple factors that can be the cause of the observed salmon stocks decline. The project has documented and examined the new salmon sea fishery regulations and studied the effects of growing threats Atlantic salmon populations face today with climate change, growing cage culture industry and emerging diseases.

Throughout the project, local fishers have been of great help, as they have contributed greatly by collecting salmon scales and noting basic information about every salmon they have caught. Thanks to these fishers we have been able to gather a lot of vital information about our Atlantic salmon, and without them the CoASal project would simply not have been possible to implement.

The project follows up and builds upon the unique results from the "Kolarctic salmon (KO197)" project (2011–2013).

CoASal

Key findings

Conserving our Atlantic salmon as a sustainable resource for the people in the north

CoASal
2020 – 2022

Partners and associates:
Norway: County Governor of Troms and Finnmark, Institute of Marine Research and Sør-Varanger Sea salmon fishers Association

Finland: University of Turku, Biodiversity Unit (UTU) and Olli van der Meer Company
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Co-funded by the European Union

Key findings

1 We updated the existing genetic map from 2013.

The updated genetic map shows us that the genetic structure and genetic variation of the salmon stocks are stable over time. We now know more in detail, which salmon stocks are being harvested in different regions at different times during the allowed fishing season; genetic stock identification (GSI) results show that catch composition during the first fishery period (June) were more diverse and consisted of a mix of stocks from a wide geographical area, whereas during the second fishing period (July-early August) more local salmon stocks are present in the coastal catches and consequently harvested on.

2 We observed a drastic decline in Tana salmon stocks in the coastal fishery.

Generally, most of the salmon stocks investigated have stable stock proportions in the coastal catches, between this recent and the previous study (Kolarctic Salmon 2011–2013). However, we observe a drastic decline of Tana salmon stocks contributing to the coastal catches throughout the project area. Moreover, we also observe a decline of North-Western Kola Peninsula salmon stocks (including River Kola) contributing to the coastal catches in the Varangerfjord and Sør-Varanger areas. (Figure a.)

3 We elaborated on possible long-term consequences to salmon stocks due to the rising of temperatures.

Higher river temperatures in summer can cease the salmon migrations into or within the rivers. Juvenile salmon may lose their territorial behavior, stop feeding and become more exposed to predation. Increased water temperatures might also cause disease outbreaks. Earlier ice-breakup in spring may cause mismatch between migration of smolt to the sea and when sea feeding is not optimal.

4 We studied and assessed the risk of the spreading of both parasitic and viral diseases associated with a warming climate and salmon cage culture.

The myxozoan parasite (*T. bryosalmonae*) screening compared to the temporal patterns over 10 years revealed no signs of contemporary spread of the parasite to previously uninfected rivers. However, since the Proliferative Kidney Disease (PKD) caused by *T. bryosalmonae* is temperature-dependent, a warming climate can enhance the spread and severity of the disease. (Figure b)

Wild juveniles have low occurrence of viral infections that are prevalent in salmon farms.

Viral disease outbreaks in salmon cage culture may lead to increased infection pressure on wild fish populations. There is an increasing public concern of this negatively impacting wild salmonids in Norway. Screening of wild juveniles from the rivers in the study area showed a very low prevalence of viruses that are prevalent in salmon farming.

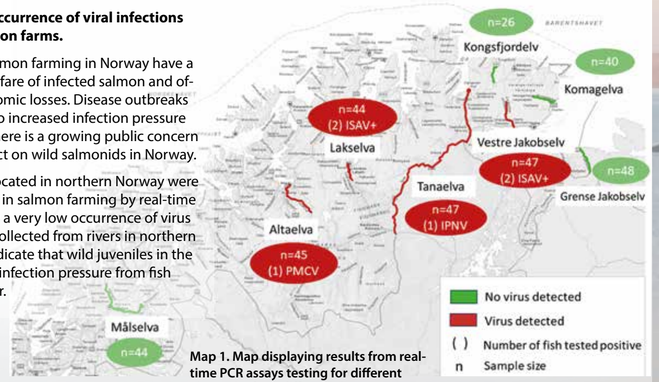
Photo: Eero Niemelä, Eevaliisa Kivilahti, UTU, VNIRO/ PINRO. Print: Painotalo Seiska, 2024

Figure a. Contribution of River Tana salmon stocks to coastal catches in seven fishery areas the years 2008–2021.

Wild juveniles have low occurrence of viral infections that are prevalent in salmon farms.

Viral diseases in Atlantic salmon farming in Norway have a negative impact on the welfare of infected salmon and often cause substantial economic losses. Disease outbreaks in salmon farms may lead to increased infection pressure on wild fish populations. There is a growing public concern of this has a negative impact on wild salmonids in Norway.

Wild juveniles from rivers located in northern Norway were tested for viruses prevalent in salmon farming by real-time PCR assay. The results show a very low occurrence of virus infection in wild juveniles collected from rivers in northern Norway. The results may indicate that wild juveniles in the rivers are exposed to a low infection pressure from fish farming, in this region so far.



Map 1. Map displaying results from real-time PCR assays testing for different viruses in the 8 different rivers.

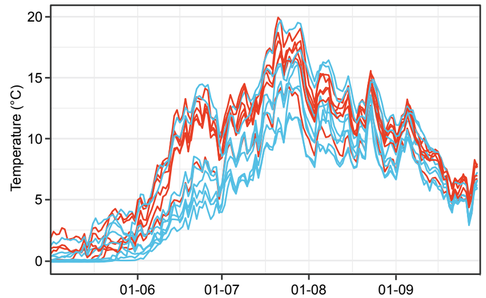


Figure b. Water temperature profiles of fifteen rivers measured from June till October during 2020 growing season. Red and light blue lines indicate rivers where T. bryosalmonae was present and absent, respectively.

Some like it hot but don't mind the cold. The distribution of the myxozoan parasite *T. bryosalmonae* in northernmost Europe. A warming climate can enhance the spread of PKD.

Global climate change is altering the abundance and spread of many aquatic parasites and pathogens. Proliferative kidney disease (PKD) of salmonids caused by the myxozoan parasite *T. bryosalmonae* is one of such emerging disorders, which is expected to increase its impact with the rise of water temperatures. Here, we studied 43 locations spread over 27 rivers in northernmost Norway and Finland to describe the infection frequency and patterns in 1389 salmonid juveniles.

The causative agent of PKD was discovered in 12 out of 27 rivers. This equals to 44% and the prevalence of *T. bryosalmonae* ranged from 4.2% to 55.5% in Atlantic salmon and from 5.8% to 75% in brown trout among infected rivers. In sympatric populations, brown trout was more frequently infected than salmon.

Rivers containing *T. bryosalmonae* measure higher temperatures. Temperature monitoring over two years indicated that the mean water temperature in June was between 2.1 and 3.2° C higher in rivers containing *T. bryosalmonae* compared to parasite-free rivers, confirming the important role of temperature in parasite occurrence (Figure b).