Project information

Project title

Anadromous Arctic charr (Salvelinus alpinus) in Northern-Norway and Svalbard – migration, habitat use, adaption and effects of climate change.

Year

2013/2014

Project leader

Guttorm N. Christensen, ApN

Participants

- Project leader: Guttorm N. Christensen, Akvaplan-niva, gc@akvaplan.niva.no
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- WP 2 leader: Geir Bornø, Norwegian Veterinary Institute (VI), geir.borno@vetinst.no
- WP 3 leader: Carolyn Rosten, NIVA, carolyn.rosten@niva.no
- Project participants: Kate Hawley (NIVA), Mark Powell (NIVA), Hilde Sindre (VI), Marta Alarcon (VI), Tor Alte Mo (VI), Kathleen G. O'Malley (Oregon State University), Audun Rikardsen (University of Tromsø and NINA), Martyn Lucas (Durham University)

Flagship

Fjord and coast, Theme: Physical-biological coupling: Oceanography and habitat use by predators and their prey

Funding Source

Fram Centre, The County of Finnmark, Statoil, NRC

Summary of Results

WP 1: *Behaviour of anadromous Arctic charr in marine and freshwater environment*. This WP was not funded by Fram Centre in 2013 since we have succeeded in external funding. The results has so far been used in an assessment report in the Hammerfest area. The results clearly indicated that there the anadromous Arctic char only migrate a few kilometre away from the river outlet. The fish stays mainly in the surface area (0 – 2) meters and close to the shoreline. 2013 was the final season for data collection and the data for three years in the marine system and three years in the lakes are now being processed. The goal is to have two publication out during spring 2014.

WP 2: *Parasite and virus load of anadromous Arctic charr* and *sea trout.*

In 2012 anadromous Arctic char and sea trout were collected at three different sites (Balsfjord, Malangen and Kvænangen) during three different periods June, early July and late July. 26 anadromous Arctic char and 14 sea trout was dissected. The results from 2012 was presented at the European Association of Fish Pathologist conference in Finland in April, 2013. The title of the presentation was "Pathogens in anadromous Arctic charr (*Salvelinus alpinus*) and sea trout (*Salmo trutta)* in north Norwegian fjords" by M. Alarcón[2]*, G.N. Christensen[1], H. Hansen[2], C. Agustí[2], H. Sindre[2] and G. Bornø [2](1) Akvaplan-Niva, Tromsø, Norway . 2) Norwegian Veterinary Institute, Harstad and Oslo, Norway).

Selected summary of the results: Molecular analysis did not detect any viruses. *Parvicapsula pseudobranchicola* occurred in 94% Arctic charr and 50% sea trout. *P. pseudobranchicola* is known to cause mortality on farmed Atlantic salmon in Northern Norway and may thus have a negative impact also on Arctic charr and Sea trout. Large amount of helminths were observed in the gastrointestinal tract and the abdominal cavity. Quantification and sequencing of the helminths is currently being performed.

Histology : • Severe inflammation in the lamina propria of the **intestine** was detected in fish with large amount of parasites (Fig. 1A). • **Gills and pseudobranch** showed mild to moderate degree of inflammation and presence of different type of parasites in/on the gills: *Trichodina* sp, *Cryptocotyle* sp. (Fig. 1C) and an unidentified monogenean (Monoopisthocotylea, morphologycally similar to *Gyrodactyloides Bychowsky*) (Fig. 1B).

WP 3: *Adaptation of Arctic charr, to the extreme polar environment through the study of population biology, physiology and genetics (CharrAdapt).* This is a new WP in the Arctic charr work. We will use a combination of on-site testing and sample collection of Svalbard Arctic charr populations to investigate their adaptation to the extreme polar environment. This work package is a support and extension to CharrAdapt which is supportet by NRC POLRES programme (reference ES504441).

The objectives in his study are:

- To study the adaptation of Arctic charr, to the extreme polar environment in terms of population biology, physiology and genetics through a collaboration with Norway and the US.
- To investigate the hypothesis that anadromy is an adaptation by Arctic charr to the extreme Arctic and individuals exhibiting an anadromous life history strategy are genetically and physiologically adapted to do so.
- To use CharrAdapt as a framework upon which further research applications can be based.
- To build a strong collaboration between Norwegian and US project partners as a basis for the current and future projects.

In 2013 we collected material and carried out field experiments at Svalbard (Linnèvatn). A total of 30 anadromous charr and 30 stationary charr were sampled. The collected material is now being processed.

Figure 1. Histological sections: A. Cestode in intestine. B. Monogenean on gills. C. Cryptocotyle sp. in gills.

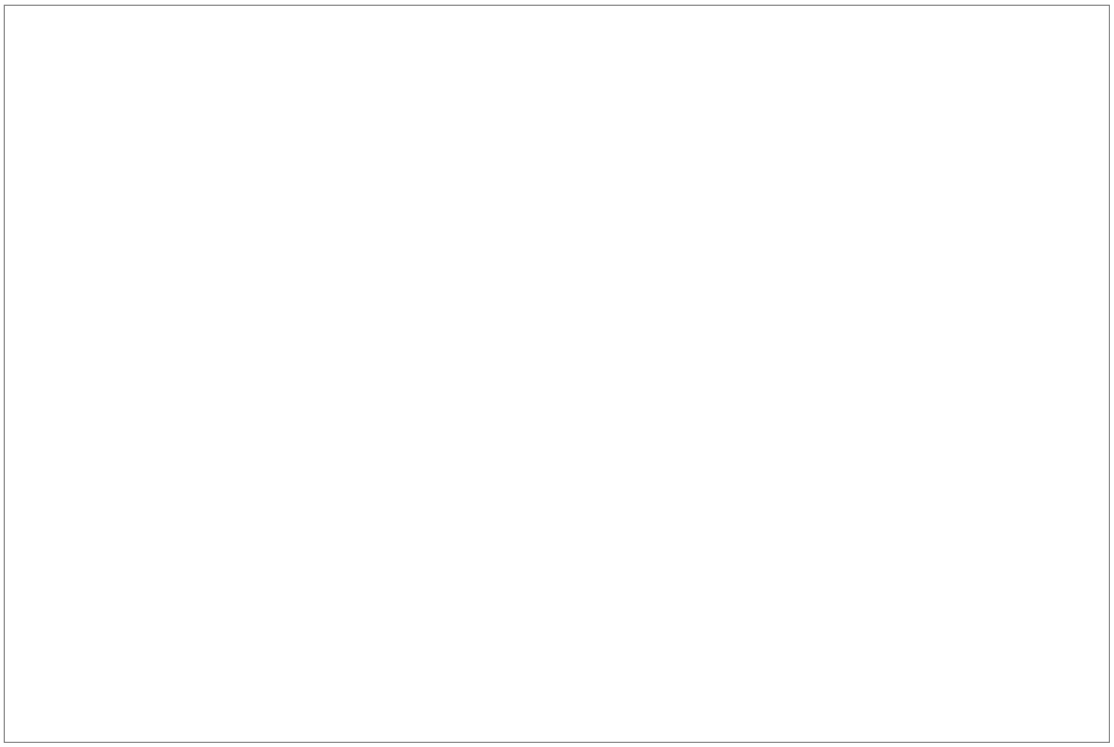

Photo: Sampling anadromous Arctic charr in Linnèvatn, Svalbard. Photo: Guttorm Christensen, Akvaplan-niva.

For the Management

The results from WP 1 and WP 2 give important and new information for the management on local level (municipality), regional level (County of Finnmark) and National level.

Published Results/Planned Publications

- WP 2: Poster presentation at European Association of Fish Pathologist conference in Finland in April, 2013. The title of the presentation was "Pathogens in anadromous Arctic charr (*Salvelinus alpinus*) and sea trout (*Salmo trutta)* in north Norwegian fjords" by M. Alarcón[2]*, G.N. Christensen[1], H. Hansen[2], C. Agustí[2], H. Sindre[2] and G. Bornø [2](1) Akvaplan-Niva, Tromsø, Norway . 2) Norwegian Veterinary Institute, Harstad and Oslo, Norway).

- WP 1. Planned two publications during spring 2013.
- WP 2 One draft manuscript based on the material from 2012 (poster).
- WP 3: Several publications on genetics, parasites and adaption of Arctic charr.

Communicated Results

- **Workshop in Hammerfest, June 2013**
- **Workshop in Trondheim, May 2013**
- **Presentation given to The County of Finnmark, April 2013**
- **4 projects meetings during 2013**

Interdisciplinary Cooperation

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Budget in accordance to results

The funding for 2013 made it possible to present the data from WP 2 at a scientific conference in Finland in April.

To be able to combine sampling for the CharrAdapt project for NRC (WP 3) and new material from Svalbard for WP 2 (diagnostics of ecto-, endoparasites and viruses in anadromous Arctic char).

The funding from the Fram Centre made it possible to trigger funding from industrial partners in the Hammerfest area. Data from WP 1 will be published in spring 2014.

Could results from the project be subject for any commercial utilization

No

Conclusions

1. WP 1: This project will give important knowledge to understand why the population in Storvatn has changed dramatically during recent years but also information that can be used to better understand the general decline in anadromous Arctic char populations in Northern Norway. The result will be of importance for future management of Anadromous Arctic charr.
2. It will be important to repeat the same type of study in other river and fjord systems. The project group started a new project in Kirkenes area in 2013. In this project we are going to work with anadromous Arctic charr, sea trout and salmon from 3 – 4 different rivers in the National salmon fjord Bøkfjorden (Nasjonale laksefjorden Bøkfjorden og Neidenfjorden). The experience and results from the Storvatn, Hammerfest project will be used. Financial support from the Fram Center will be of importance for the new project.
3. The research activity in the Storvatn project has resulted in an increased engagement and awareness among politicians, management and local people about the valuable lake system they have in the middle of their own city, Hammerfest.

Human activity related aquaculture in coastal areas are increasing in Northern Norway. The results from WP 2 where fish are collected from areas with little impact from aquaculture will be of importance as reference for future work. In 2013 we also collected samples from Svalbard that will be a good reference material to the samples from Northern-Norway. The results will be of importance for how management will deal with aquaculture versus wild anadromous species like Arctic charr and sea trout in the future.

In WP 1 we use acoustic tags which is a well know method. However in close cooperation with the producers we are testing new aspects of this method. This is one of the first times such a detailed study of the behavior of anadromous Arctic char in freshwater has been carried out.

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