Project information

Project title

Habitat and dietary specific accumulation of methylmercury in Arctic charr (Salvelinus alpinus)

Year

2017

Project leader

Hans Fredrik Veiteberg Braaten, NIVA

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

Ellasjøen, Svalbard: 74° 30’ N, 19° 00’ E. Storvannet (Finnmark): 70° 39′ N, 23° 42′ E.

Participants

Guttorm Christensen (Akvaplan-niva)

Kate Hawley (NIVA)

Audun Rikardsen (UiT)

Anders Ruus (NIVA)

Carolyn Rosten (NINA)

Flagship

Hazardous Substances

Funding Source

The project was funded 400 kNOK from the Fram Centre in 2017, and we have applied for the same amount in 2018. The project has no other sources of funding.

Summary of Results

The toxic and bioaccumulative species methylmercury (MeHg) biomagnifies in the aquatic food web. The mercury (Hg) toxicity in humans is primarily linked to fish consumption, as a result of high Hg concentrations in fish at the top of the food chain. However, little is known about the bioaccumulation of MeHg according to the trophic pathways of the top consumer. The Arctic charr (*Salvelinus alpinus*) is the northernmost freshwater and anadromous fish and the top consumer of Arctic aquatic food webs, with differences in life-history and diet often reported and considered adaptive for inhabiting Arctic regions. In this study we will identify and investigate fundamental differences in bioaccumulation of MeHg in two populations of Arctic charr; from Storvannet in Finnmark and from Ellasjøen, Bear Island. The project had its first year in 2017, where field sampling and preliminary analysis of data were conducted. The data analysis will continue in 2018, and we will over the next 12 months compare MeHg bioaccumulation between anadromous (marine feeding) and non-anadromous (fresh-water feeding) charr in Storvannet, and littoral versus pelagic bioaccumulation of MeHg in Ellasjøen. These contrasts will allow us to evaluate the effect of trophic pathways on MeHg accumulation as well as the comparisons of a heavily anthropogenic influenced system (Storvannet) and the isolated, but Hg contaminated site of Ellasjøen. Results will be of particular importance for the Fram Centre flagship as fish Hg levels in Arctic regions are documented to be 10-12 times higher than during pre-industrial times.

Main milestones achieved in 2017:

- -Field work planned and accomplished Ellasjøen, Bear Island, August 2017
- -Field work planned and accomplished Storvannet, Finnmark, September 2017
- -Morphometric data documented for between 50 and 75 fish from each lake

(Photographs of each individual fish will be investigated in December 2017)

- - All water samples (general chemistry, Hg and MeHg) analysed in 2017

Although Ellasjøen is an isolated lake in the high Arctic, concentrations of Hg in the lake and MeHg in the lake outlet were higher than what we observed in Storvannet. The measurements also show that Ellasjøen is richer in nutrients (both nitrogen and phosphorous) compared to Storvannet.

Master and PhD-students involved in the project

None so far, but a MSc student is planned for 2018.

For the Management

Arctic charr are an important cultural resource for the inhabitants and visitors to many Arctic locations. Yet human consumption of larger, top-predator charr should be limited due to bioaccumulation effects, and has been shown in large charr from Ellasjøen, which contain high levels of PCBs and Hg.

The Arctic charr has a circumpolar distribution and populations of charr serve as an important model to investigate adaptation to extreme environments, a crucial need under current changing climatic conditions. The project will provide important information about population structuring of Arctic charr that may alter as a result of climate change which is relevant to management decisions regarding sustainable harvesting of charr. This study will also contribute with new scientific knowledge that will be published in international articles and receive international attention.

Additionally, Hg is of special interest in the Arctic since there seems to be a general increasing trend of concentrations in fish and wildlife. The Arctic Monitoring and Assessment Programme (AMAP) have Hg as one of the prioritised topics for future monitoring of the Arctic, and the Arctic Contaminants Action Plan (ACAP) includes Hg as one of their four *Expert Groups*.

Arctic areas of the world are generally considered to be pristine and not influenced by local sources of contamination. Despite this, concentrations of MeHg have been documented to be high and increasing in aquatic food chains many places in the Arctic. The effect of MeHg in fish on human health is well documented, while the mechanisms and parameters leading to differences in high top consumer Hg concentrations are less understood. This project will be an important project documenting important mechanisms on the topic.

Published Results/Planned Publications

We expect to publish our results in 2018.

Communicated Results

The project only published results very late in 2017 (due to timing of field work), and results communication will be a priority in 2018.

Interdisciplinary Cooperation

The project link contaminant transport, bioaccumulation and biomagnification with ecological and climatic effects, and involve a close collaboration between chemists, ecologists, biologists and biogeochemists.

Budget in accordance to results

The results from 2017 is in accordance with the budget. Most of the fish analyses and data interpretation will be accomplished in 2018.

Could results from the project be subject for any commercial utilization

No

Conclusions

It is too early to draw any major conclusions from the project as the final results will not be ready until 2018. However, the field work accomplished in 2017 was very successful and all data planned for was collected, which means that we have the necessary information to investigate our main hypothesis in 2018: *i)* concentrations of Hg (as MeHg) in non-anadromous Arctic charr are greater than in anadromous Arctic charr, due to the reduced MeHg concentrations typically found in the marine food webs; *ii)* concentrations of Hg (as MeHg) in littoral feeding Arctic charr are higher than sympatric pelagic feeding Arctic charr, following the increased availability of MeHg in the littoral food web; and *iii)* concentrations of MeHg will be relatively similar in the two aquatic food webs although one is located in an industrialised area and one in the remote Arctic region, due to the input of long-range transported Hg with birds to Ellasjøen.