

Project information

Project title

Is the cocktail effect of environmental contaminants a threat for Arctic fish populations?

Year

2013/2014

Project leader

Anita Evenset, ApN

Participants

Project leader(s)/institutions: Anita Evenset (ae@akvaplan.niva.no), Akvaplan-niva

Project participants/institutions:

- Marianne Frantzen (mf@akvaplan.niva.no), Guttorm Christensen(gc@akvaplan.niva.no), Akvaplan-niva
- Mikael Harju (Mikael.harju@nilu.no), Eldbjørg Heimstad (esh@nilu.no), NILU
- Knut Erik Tollefsen (knut.erik.tollefsen@niva.no), Katarina PetersenNIVA
- Even Jørgensen (even.jorgensen@uit.no), Helge Johnsen, UiT
- Alec Maule (amaule@usgs.gov), Columbia River Research Laboratory
- Matt Vijayan (mvijayan@sciborg.uwaterloo.ca), University of Waterloo

Flagship

Hazardous substances, Theme: The impact of climate change on transport and fate of contaminants in the Arctic

Funding Source

Fram Centre, NRC

Summary of Results

The results from the study show that:

Concentrations of all organohalogen- (OHC) groups, Σ HCHs, HCB, Σ CHLs, mirex, Σ DDTs, and Σ PCBs (all in ww), were significantly higher in both muscle and gonads of charr from Ellasjøen than Laksvatn, except from Σ HCHs in muscle that did not differ between the lakes (Figure 1).

- Contaminant profiles: Muscle and gonad samples from Lake Ellasjøen had a higher proportion of Σ PCBs compared to those from Laksvatn, while the proportion of Σ HCHs, HCB, Σ CHLs, and mirex were higher in muscle and gonad samples from Lake Laksvatn compared to those from Ellasjøen. The proportion of Σ DDTs in muscle and gonads did not differ between the lakes.
- The lipidnormalised levels of HCB, Σ CHLs, mirex, Σ DDTs and Σ PCBs in gonads were approximately 0.4 to 1.1 times the levels in muscle tissue. No significant between-lake differences in the Gonad/Muscle-ratios for any of the compound groups was found (lw)
- EROD-activity was low in all fish. This was probably due to the fact that the cytochrome P450 enzyme system is depressed during maturation.
- Estradiol-17 β (E2), testosterone (T), 17 α , 20 β -P-dihydroxy-4-pregnen-3-one (17 α 20 β -P) were measured in female charr (Laksvatn: n =10, Ellasjøen: n =11), and 11-ketotestosterone (11-KT) was measured in male charr (Laksvatn: n=10, Ellasjøen: n =11). The results showed that there were some differences in steroid profiles between fish from the two lakes (Figure 2). This might indicate that they were in different stages of the reproduction cycle at the time of sampling. This is important information for the planning of the large-scale field experiment that will be performed in 2014.
- Spermcell-activity has been assessed, but the results has not yet been treated.
- Contaminant extracts have been prepared from muscle and gonad-tissues. The extracts (containing the natural contaminant cocktail) will be used in *in vitro* experiments.
- Eggs from mature fish has been prepared for histological assessments. However, the results from these studies are not ready yet.

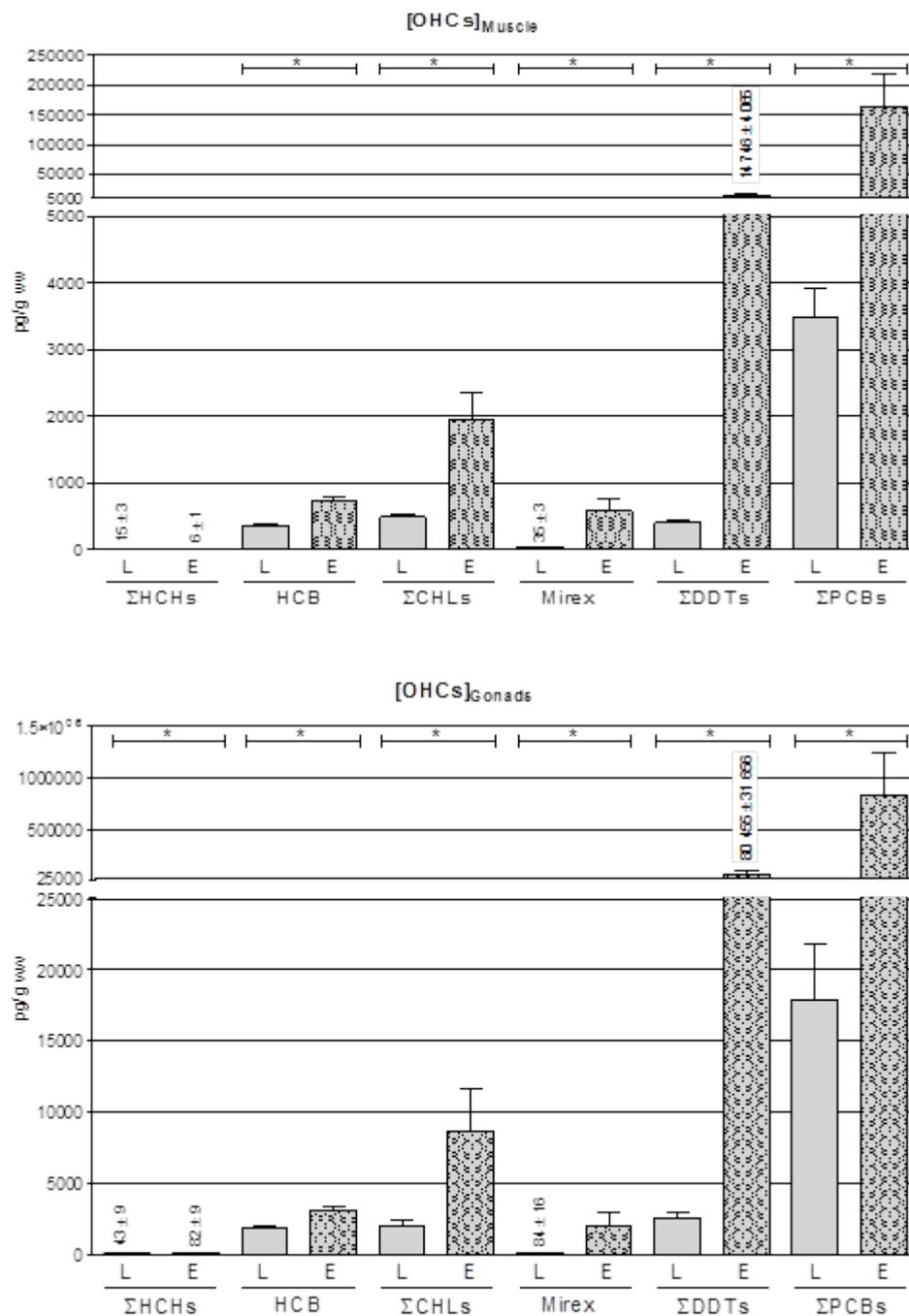


Figure 1: Mean concentrations±SEM (pg/g ww) of OHCs in **A)** muscle and **B)** gonads of Arctic charr (*Salvelinus alpinus*) sampled in Lake Laksvatn (Muscle: $n=7$, Gonads: $n=4$) and Lake Ellasjøen (Muscle: $n=8$, Gonads: $n=4$) at Bjørnøya (Svalbard, Norway) in September 2012. Asterisk (*) indicates significant differences between the lakes (ANOVA: $p<0.05$).

For the Management

In order to regulate the use of chemicals it is important to acquire more knowledge about how the environmental suite of chemicals that Arctic animals are exposed to work together. Today regulatory actions are generally based on effects of one chemical alone, and very little is known about the effects of contaminant cocktails. New knowledge about cocktail effects will be useful to the management in the work with international conventions that aim at phasing out chemicals with harmful effects (alone or in synergy with other compounds).

Published Results/Planned Publications

- Evenset, A., M. Frantzen, G.N. Christensen 2013. Contaminant cocktails – a threath for Arctic fish populations? Fram Forum 2013.

A number of publications in peer-reviewed hournals are planned as part of a the NRC study and the Fram Centre funding.

Publications in prep:

- Bytingsvik et al. Organohalogenated compounds (OHCs) in muscle and gonads from Arctic Charr (*Salvelinus alpinus*) from Bjørnøya, Svalbard (Norway).
- Bytingsvik et al. Effects of Organohalogenated compounds (OHCs) on selected reproductive traits in Arctic Charr (*Salvelinus alpinus*) from Bjørnøya, Svalbard (Norway).

Communicated Results

Workshop presentations:

- The Bjørnøya study. Cocktail workshop Fram Centre, 2013. Evenset, Frantzen, Jørgensen, Christensen, Bytingsvik, Maule, Vijayan 2013.
- Is the cocktail effect of environmental contaminants a threat for Arctic fish populations? Flagship meeting.

Interdisciplinary Cooperation

The project involves ecologists, chemists and ecotoxicologists. By combining knowledge from these three research disiplines we believe that we will be able to get a good overview of both chemical and biological processes that may cause negative effects in fish.

Budget in accordance to results

The funding from the Fram Centre was essential to perform a pilot project which ked to the finansing of the main project from the Norwegian Research Council. As the budget allocated from the NRC was lower that applied for, the Fram Centre fundingin 2013 allowed us to carry out project activities in accordance with the original plan. In addition, the funding allowed us to include some extra biomarker analyses that will strengthen the total putcome of the project.

Could results from the project be subject for any commercial utilization

No