

Project information

Project title

Giants of the ocean – affected by anthropogenic pollutants?

Year

2018

Project leader

Heli Routti

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

77-80°N and 12-18°E

Participants

Mikael Harju/NILU; Jenny Bytingsvik, Kjetil Sagerup/Akvaplan-Niva; Anders Goksøyr/UiB; Christian Lydersen, Kit M. Kovacs, Geir W. Gabrielsen, Sabrina Tartu, Katharina Luhmann/NPI; Cristina Panti, Cristina Fossi/Univ. of Siena, Italy; Martin Hansen/University of Aarhus

Flagship

Hazardous Substances

Funding Source

Funding sources	2017	2018
Own funding NPI	652200	294399
NFR (ICE-whales K.Kovacs)	121325	168790
FRAM	500000	600000

Summary of Results

We have completed our sampling material with 3 blue whales in summer 2018, so now we have samples in total from 30 whales. The samples were collected as a part of the ICE-whales project (K.M. Kovacs and C. Lydersen).

We have analyzed levels organophosphorous flame retardants, current-used and legacy brominated flame retardants, PCBs and organochlorine pesticides in the blubber samples collected in 2014-17 (n=27). Current used brominated compounds were not analysed in 2017 whales as they were not detected in the 2014-2016 samples. Sex determination and stable isotope analyses have also been done in these 27 individuals. Manuscript will be submitted in 2018. The manuscript submission has been delayed due to challenges of getting toxaphene data for some samples. Also, sending of the whale samples for molecular sexing was delayed due to the problems with CITES permits, so we got the data only in summer 2018.

We have also analysed phthalates (plastic additives) in 10 whale samples. Additionally, Akvaplan in collaboration with NILU is getting ready with contaminant analyses on humpback- and killer whales.

We have established a luciferase reporter gene assay for fin/blue whale thyroid hormone receptor, glucocorticoid receptor and peroxisome proliferator-activated receptor gamma (all identical in fin and blue whales) and tested how the compounds with highest concentrations (PCBs and organochlorine pesticides) and their mixtures activate the receptors. Antagonistic effects have also been tested on the thyroid hormone receptor. Statistical analyses are done and manuscript is under preparation.

The sequencing of individual genes of blue whale has been challenging due to low quality of mRNA extracted from the biopsies. Therefore, we have sequenced the whole genome of blue whale at the Genomics Core Facility (GCF) at the University of Bergen. The genome data will be further used for comparison of genomes in blue whales sampled from different parts of the North Atlantic as well as compare current genomes to historical genomes (pre whaling).

Master and PhD-students involved in the project

Katharina Luhmann (University of Landau, Germany) got her MSc-degree in February 2018 on activation of thyroid hormone receptors. A new MSc-student, Karoline Viberg UiB, is working on activation of aryl hydrocarbon receptor in whales.

For the Management

Will be given later.

Published Results/Planned Publications

We are currently working on two manuscripts, one on levels of legacy pollutants in blue and fin whales and another one on in vitro activation of nuclear receptors. Both publications are planned to be submitted in 2018. Based on the data that we have acquired by now, we also plan to write 1-2 publications of emerging compounds in whales, and on which combines contaminant data from different whale species.

Communicated Results

The research has been presented in following conferences in Japan and Svalbard:

Luhmann K, Lille-Langøy R, Øygaarden L, Kovacs KM, Lydersen C, Goksøyr A, Routti H. Activation of the thyroid receptor of fin and blue whales by environmental pollutants. 7th Norwegian Environmental Toxicology Symposium (NETS), Svalbard, Norway. 14-16.3.2018. Talk.

Lille-Langøy R, Øygaarden L, Luhmann K, Kovacs KM, Lydersen C, Goksøyr A, Routti H. Effects of environmental pollutants on the activity of transcription factors in blue and fin whales in vitro. 19th International symposium on Pollutant Responses in Marine Organisms. Matsuyama, Japan 30.6-3.7.2017. Poster.

The project has been shortly presented by Anders Goksøyr and Heli Routti at eleven faculty seminars held at North-American or European universities/ research institutes in 2017-2018.

1. Ocean Sciences Centre, Memorial University, St. John's, Newfoundland, Canada (AG)
2. McMaster University, Hamilton, Ontario (AG)
3. Woods Hole Oceanographic Institution, USA (AG)
4. Stony Brook University New York, Long Island Seminar, Dept. of Marine and Oceanographic Sciences (AG)
5. University of Minnesota, Minneapolis-St. Paul, School of Biological Sciences
6. US EPA, Duluth, MN (AG)
7. UC Berkeley, Department of Integrative Biology (AG)
8. UC Riverside, Department of Environmental Science (AG)
9. University of Siena, Italy (HR)
10. University of Quebec in Montreal (HR)
11. University of Laval, Quebec (HR)

Interdisciplinary Cooperation

This project absolutely benefits of the inter-disciplinary cooperation. We combine information from analytical chemistry, ecology and molecular biology.

Budget in accordance to results

Fram Centre 2018 funding has covered a bit more than a half of the salary of Katharina Luhmann (NPI), pollutant analyses in 2018 samples and quantification of chlorinated paraffins in all samples (NILU), cost of field sampling/analyses of humpback whales (Akvaplan) and cost of receptor activation work (UiB). The remaining salary costs of K.Luhmann have been covered NFR funding (K. Kovacs) and by NPI internal funding, which has also covered salary for HR (NPI) and Katharina Luhmann's participation to NETS

Fram Centre has covered 56% of the costs in 2018.

Could results from the project be subject for any commercial utilization

No

Conclusions

a) Indicate future research and/or perspectives which the project results have led to

We will continue the project according to the plan with slight modifications.

b) List and describe new methods or techniques that have been developed during the project or that the project has revealed a need for

So far, we have developed methods to study in vitro activation of three different nuclear receptors from blue/fin whales. NILU has also developed a method for phthalate analyses. These methods are valuable tools to assess emerging compounds and endocrine disruptive potential of pollutants in whales.