Project information

Keywords

Organic contaminants, POPs, seabirds, modeling

Project title

Development, evaluation, and application of a bioaccumulation model for organic contaminants in Arctic seabirds

Year

2018

Project leader

Ingjerd S. Krogseth (NILU)

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

The work will focus on the Kongsfjorden area, Svalbard (U33XE; U33XN; 439299; 8764644).

Participants

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Flagship

Hazardous Substances

Funding Source

Fram Centre flagship for Hazardous Substances

Summary of Results

The activities during the initial year have focused on (1) developing and implementing a seabird module in an existing Arctic bioaccumulation model framework, and (2) revising and collecting existing data and information needed for model parameterization and evaluation for the black-legged kittiwake (*Rissa tridactyla*).

1. The existing Arctic ACC-HUMAN model that will be utilized in this project consists of an Arctic marine and terrestrial food web. The model is currently being adapted to Norwegian Arctic ecosystems within the NEM project. In 2018, a new module has been included in the marine food web, representing a generic seabird feeding on zooplankton and fish. The new module was based on an already existing model for a terrestrial goose. Uptake of contaminants to the seabird can occur through air, water, and diet. Elimination of contaminants from the seabird can occur through air, water, egestion, biotransformation, and reproduction. The seabird can feed on three different kinds of zooplankton (copepods, krill, and amphipods) and three different species of fish (herring, capelin, and polar cod). The dietary composition and the lipid content of the bird may vary seasonally. As the model is dynamic (time-variant), contaminant concentrations can be modelled as a function of time, including season and age. Contaminant concentrations can also be modelled as a function of gender, accounting for reproductive loss of contaminants during egg-laying. The bioaccumulation model representing the food web of the seabird has already been evaluated and shown satisfactory performance for polychlorinated biphenyls (PCBs) in Kongsfjorden and the Barents Sea area.
2. To model contaminant flows resulting in exposure in seabirds, detailed parameterization of the seabird and its food web is required. Efforts in 2018 have focused on reviewing available data for parameterization of the generic seabird model for the black-legged kittiwake. This includes information about the seabirds' (i) size, life-span, and biochemical composition, (ii) reproductive behavior including time and frequency of egg laying and clutch size, (iii) air and water uptake and elimination rates, (iv) energy requirements, feeding rates and dietary preferences, and (iv) migration routes. These data will in 2019 be used to parameterize the model which next will be evaluated for PCBs.

Master and PhD-students involved in the project

None yet.

For the Management

As the project is only in its first year, no results have been finalized yet.

Published Results/Planned Publications

A scientific publication in a high-ranked scientific journal is planned for 2020.

Communicated Results

Krogseth, I.S.; Breivik, K.; Wania, F. Development and evaluation of a bioaccumulation model for organic contaminants in European Arctic marine ecosystems. Poster no. 179. DIOXIN 38th International Symposium on Halogenated Persistent Organic Pollutants, 26. – 31. August 2018, Krakow, Poland.

Krogseth, I.S.; Breivik, K.; Wania, F. Development and evaluation of a bioaccumulation model for organic contaminants in European Arctic marine ecosystems. Poster at Framdagen, 22. August 2018, Tromsø, Norway.

Interdisciplinary Cooperation

This project could not have been carried out without the close cooperation between the chemistry and multimedia modeling competence at NILU and the extensive biological, ecological, and toxicological knowledge on Arctic seabirds at Akvaplan-niva, NINA, and NP. These disciplines complement each other and are all vital to enable development, evaluation, and application of the bioaccumulation model for organic contaminants in Arctic seabirds. The model will serve as a very useful framework to integrate and organize the existing knowledge from these disciplines, and to aid address the research questions in the project with a holistic and interdisciplinary approach.

Budget in accordance to results

The activities carried out in 2018 and summarized above could not have been carried out without funding from the Fram Centre. As the project is ongoing, finalization of results are expected in 2019-2020 provided continuation of funding for this project.

Could results from the project be subject for any commercial utilization

No

Conclusions

As the project is only in its first year and no results have been finalized, no conclusions can be made yet.