

Project information

Keywords

Birds of prey, pollution, elements, sea eagle, tawny owl

Project title

Effects of pollutants and other stress factors on northern raptors: RAPTOR

Year

2016

Project leader

Jan Ove Bustnes

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

69.94N 18.57E, 69.39N 14.97E, 63.25N 10.23E

Participants

Participant: Nigel Yoccoz, UiT

Participant: Dorte Herzke, NILU

Participant: Bård Jørgen Bårdsen, NINA

Participant: Igor Eulaers, University of Århus

Participant: Adrian Covaci, University of Antwerpen

Participant: Sophie Bourgeon, UiT

Participant: Christian Sonne, University of Århus

Participant: Pilar Gomez Ramírez, University of Murcia

Flagship

Hazardous Substances

Funding Source

Flagship and NRC

Summary of Results

1. Accumulation of fluorinated compounds in terrestrial top predators is influenced by environmental conditions such as climate and feeding conditions.
2. Fluorinated compounds are associated to increased levels of stress hormones in white-tailed eagle nestlings.

Bird species at the top of the food chain are vulnerable to bio-accumulating contaminants such as persistent organic pollutants (POPs) and toxic elements such as mercury. Hence, birds of prey are valuable sentinels for research on the impacts of biomagnifying contaminants in nature. However, wildlife face a multitude of natural and other anthropogenic stressors and this has been suggested to have far reaching impacts on the health of individuals and populations. Nevertheless, a major challenge is to document such effects in nature and be able to link natural and anthropogenic stress.

The RAPTOR project is a continuation of NFR and Flagship projects, which have received Flagship funding over several years including 2016. The project has also cooperated with the NFR project NewRaptor (2014-2016) led by Veerle Jaspers, NTNU.

In 2015, the RAPTOR project enabled us to write an application to NRF (the MARINFORSK Program) to study the ecological consequences of POPs in sea eagles: Ecological consequences of environmentally persistent pollutants in a marine sentinel species: A multi-stressor approach (EcoStress). EcoStress is a natural continuation of the sea eagle work in Tromsø, and expands the research internationally. This

project was funded (2016-2018).

In addition, the funding to the RAPTOR project by the Fram Centre, enabled us to write an application to NRF in 2016 (the Miljøforsk Program): ***Environmental stress processes: the role of anthropogenic pollution in a rapidly changing environment (EnviStress)***. This project focus on tawny owl and if funded this project will be coordinated with the RAPTOR project.

In 2016, data collection on white-tailed eagles, as a part of a long-term monitoring of concentrations and effects, has continued. Blood samples and ecological data have been collected from 35 eagle chicks in Troms and Steigen. Effect parameters are measured over several years, such as oxidative stress, immunology and blood parameters. In addition, we have been involved in collecting data on goshawk in Troms for the NewRaptor project.

In particular, we are now in the process of accepting an MSc student on the impact of POPs on telomeres in white-tailed eagles from different regions, including the Baltic Sea. In 2017, we also aim at analyzing data POPs in plasma white-tailed eagle chicks for all years between 2008 and 2016 and produce a paper on the 10-year trend of POPs in eaglets in Troms.

Moreover, data collection on tawny owl has continued in the Trondheim region increasing the data series to 31. These data are the fundament in the EnviStress NFR application that will study stress process related to contaminants. Tail feathers from tawny owl females have been collected and analyzed for elements between 1986 and 2005. The element analyzes of feathers for the period between 2006 and 2016 have now been started and will be supported by funds from the FRAM RAPTOR project (~ 420 feathers).

Recently, focus has been on understanding accumulation of POPs in top predators of different ecosystems. In particularly the project has analyzed data on the impacts of environmental factors such as climate and feeding conditions on the accumulation of PFASs in eggs of tawny owls. The analysis showed that a significant part of the variation can be explained by these (Bustnes et al. 2015). A similar analysis is being started for elements, such as mercury, measured in feathers. We will work on testing the hypothesis that **mercury accumulation in terrestrial raptors increase with increasing trophic levels where the birds feed**. In addition we will include the environmental conditions in this analysis.

The sea eagle studies has in 2016 produced a scientific paper showing that eaglets with high concentrations of various OCs are suffering higher oxidative stress than low contaminated eaglets (Sletten et al. 2016). Moreover, in another paper that will soon be submitted, showing positive relationships between PFAS and biomarkers of liver damage, suggestive of health risk (Gómez-Ramírez et al. in ms.). In addition, a paper discussing the use of corticosterone in nestling birds of prey body feathers suitable to quantify the impact of environmental stressors is being finished (Eulaers et al. in ms.). Finally, a paper on the health parameters of raptor chicks has

been conditionally accepted for publication (Hanssen et al.)

Master and PhD-students involved in the project

3 masterstudents are involved in analysing data from the project.

For the Management

Environmental contaminants have been of concern for management for many decades, and this project adds knowledge to how such pollutants can have adverse effects even as concentrations are declining.

Published Results/Planned Publications

Publications from RAPTOR in 2016

Sletten, S., Bourgeon, S., Bårdsen, B.J., Criscuolo, F., Massemin, S., Johnsen, T.V., Bustnes, J.O. 2016. Organohalogenated contaminants in white-tailed eagle (*Haliaeetus albicilla*) nestlings: an assessment of relationships to immunoglobulin levels, telomeres and oxidative stress. *Science of the Total Environment* 539: 337-349.

Conditionally accepted:

Hanssen, S.A., Bustnes, J.O., Snug, L., Bourgeon, S., Johnsen, T.V., Ballesteros M., Sonne, C., Herzke, D., Eulaers, I., Jaspers, V., Covaci, A., Eens, M., Halley, D.J., Moum, T., Ims, R.A. & Erikstad, K.E. The costs of parasitism: Anti-parasite treatments affect biomarkers of health in raptor nestlings. *Canadian Journal of Zoology*.

Manuscripts to be submitted

Gómez-Ramírez, P., Bustnes, J.O., Johnsen, T., Herzke, D., Eggen, G.S., García-Fernández, A.J., Jaspers, V.L.B. Influence of perfluoroalkyl and polyfluoroalkyl substances and mercury on the stress response and health parameters in birds of prey nestlings from northern Norway.

Eulaers I, Bustnes JO, Bourgeon S, Covaci A, Dahl EL, Johnsen TV, Lepoint G, Leynen N, Nygård T, Sletten S, Jaspers VLB, Eens M. Is corticosterone in nestling birds of prey body feathers suitable to quantify the impact of environmental stressors?

Communicated Results

In April 2016 (24-25) a workshop on effects of POPs and multistress was held in Tromsø with 11 participants as part of the EcoStress/Raptor projects.

Based on data from the project a popular article to popular journal Ottar, Tromsø Museum, has been published in 2016:

Johnsen, T. & Bustnes, J.O. 2016. Havørn i Nord-Norge. Ottar 309 (1): 25-29.

Interdisciplinary Cooperation

Ecology, physiology, chemistry

Budget in accordance to results

It has been essential for continuing the research on raptors, which is especially important for the continuity of the multi-stress perspective.

Could results from the project be subject for any commercial utilization

No

If Yes

No

Conclusions

- a. The project has increased our understanding of variation and accumulation of POPs and different elements in northern food chains, both terrestrial and marine. This will be important in future work on unraveling the potential effects of different contaminants in northern ecosystems.