

Project information

Project title

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

Year

2013/2014

Project leader

Jan O. Bustnes, NINA

Participants

- Leader: Jan Ove Bustnes, NINA
- Participant: : Geir Wing Gabrielsen, NPI
- Participant: Børge Moe, NINA
- Participant: Bård Jørgen Bårdsen, NINA
- Participant: Sveinn Are Hanssen, NINA
- Participant: Dorte Herzke, NILU
- Participant: Kjetil Sagerup, APN
- Participant: Jacques Godfroid, NVH
- Participant: Olivier Chastel, Chizé, France

Flagship

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

Funding Source

Fram Centre

Summary of Results

This project involves NINA, NILU and UiT along with numerous international collaborators. The main objective of this project is to understand variations in different environmental contaminants in populations of high trophic raptors; both marine and terrestrial species. Special focus is on how environmental contaminants may function in concert with other natural and anthropogenic stressors; i.e. a multi-stress perspective. Of special interest is how climate change will influence the accumulation and effects of POPs in such species. In 2013, we have analyzed and published data, in addition to collecting data on sea eagles as a part of a long-term monitoring of effects. Several effect parameters are measured over several years; oxidative stress, immunology and blood parameters, and how these parameters are affected by pollutant levels. Blood samples and ecological data have been collected from 15 sea eagle chicks in the summer of 2013. One MSc student is currently working on this project.

In 2013 focus has been on understanding accumulation of POPs in top predators of different ecosystems in northern Norway; woodland, mountain ecosystems and marine ecosystems. The results show species and ecosystem specific accumulation of POPs (Eulaers et al. 2013). In addition, special focus has been on unraveling the factors that influence the accumulation of both lipid-soluble OCs and PFOS in raptor nestlings. This is particularly relevant in connection with monitoring long-term trends of POPs. A central question has been whether chicks accumulate POPs during the growth phase or, whether it is dominated by maternal transfer. The analyses showed that most POPs tend to increase over the growth phase, especially PFOS. In addition, for lipid-soluble POPs there was a strong relationship to diet. This suggests that plasma of raptor chicks quite well reflect local contamination and are thus suitable for monitoring projects (Bustnes et al. 2013a).

Parasites are natural stressors that may have multiple negative effects on their host as they usurp energy and nutrients and may lead to costly immune responses that may also cause oxidative stress (meaning more oxidants than anti-oxidants). Raptor nestlings may be more sensitive to infectious organisms because of their rapid growth and partly immature immune system. Therefore, we studied the effects of relieving the chicks from parasites. In the raptor project we conducted treated chicks against ectoparasites led to a reduction in circulating immunoglobulin plasma levels. The results are published in Hanssen et al. (2013).

A central topic has been to document how different POPs accumulate in wildlife depending on climate variations and feeding conditions. In a study of tawny owls (Bustnes et al. submitted) it has been shown that accumulation of different PFASs such as PFOS and PFCAs in eggs of the tawny owl are related to both atmospheric processes and the feeding. It seems for example that climate may have different impacts on the PFOS and PFCAs.

In addition, a methodological study (Bustnes et al. in MS) shows that eggs abandoned in tawny owl nests are suitable for monitoring POPs in a terrestrial raptor; important information with regard to monitoring. Finally, temporal trends (1986-2005) for a large number of elements found in tawny owl feathers have been published in Bustnes et al. (2013b). Interesting results include increasing Rubidium levels and decreasing Boron levels over the time period.

Published Results/Planned Publications

1. Bustnes, J.O., Bårdsen, B.- J., Herzke, D., Johnsen, T.V., Hanssen, S.A., Eulaers, I., Ballesteros, M., Covaci, A., Jaspers, V.L.B., Eens, M., Sonne, C., Halley, D.J., Moum, T., Erikstad, K.E. & Ims, R.A. 2013a. Plasma concentrations of organohalogenated pollutants in predatory bird nestlings: associations to growth rate and dietary tracers. *Environmental Toxicology & Chemistry* 32: 2520-2527.
2. Bustnes, J. O., Bårdsen, B.J., Bangjord, G., Lierhagen, S. & Yoccoz, N. 2013b. Temporal trends (1986-2005) of essential and non-

essential elements in a terrestrial raptor in northern Europe. *Science of the Total Environment* 458-460: 101-106.

3. Eulaers, I., Jaspers, V.L.B., Bustnes, J.O., Covaci, A., Halley, D.J., Johnsen, T.V., Halley, D.J., Moum, T., Ims, R.A., Hanssen, S.A., Erikstad, K.E., Herzke, D., Sonne, C., Ballesteros, M., Pinxten, R., & Eens, M. Intra- and inter-specific ecology drives differences in bioaccumulation of persistent organic pollutants in subarctic nestling predatory birds. *Environment International* 57-58: 25-33.

4. 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. In press. Anti-parasite treatments reduce humoral immunity and impact oxidative stress status in raptor nestlings. *Ecology and Evolution*.

Submitted

5. Gómez-Ramírez, P., Shore, R.F., van den Brink, N.W., van Hattum, B., Bustnes, J.O., Duke, G., Fritsch, C., García-Fernández, A.J., Helander, B.O., Jaspers, V., Krone, O., Martínez-López, E., Mateo, R., Movalli, P., & Sonne, C. The first inventory of existing raptor contaminant monitoring activities in Europe.

6. Bustnes, J. O., Bangjord, G., Herzke, D., Ahrens, L. & Yoccoz, N. Climate and feeding conditions as predictors of perfluorinated compound (PFCs) concentrations in eggs of a terrestrial raptor.

Manuscripts

7. Bustnes, J. O., Bangjord, G. & Yoccoz, N. Intra-clutch variation in concentrations of organochlorines and brominated flame retardants in eggs of a terrestrial raptor.

Communicated Results

A NRK documentary (Ut i Naturen) about the white-tailed eagle is based on research conducted within the Flagship project RAPTOR. It will probably be sent in 2014.

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

Conclusions

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.