

Project information

Project title

Multi-stress relationships in seabird populations: interactions between natural stressors and environmental contaminants

Year

2012/2013

Project leader

Jan O. Bustnes, NINA

Participants

Leader

- Jan Ove Bustnes, NINA

Participant

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- Børge Moe, NINA
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Flagship

Hazardous substances, Theme: Animal health and ecosystem

Funding Source

Fram Centre

Summary of Results

Seabirds are among the species most vulnerable to bio-magnifying environmental contaminants, and the main objective of this project is to understand variations in different environmental contaminants in northern seabird populations. Special focus is on how environmental contaminants may function in concert with other natural and anthropogenic stressors; i.e. a multi-stress perspective.

At present, the project studies different seabird species both at Svalbard and on the Norwegian mainland. Prime species of interest is the common eider, the kittiwake, the glaucous gull and the great skua. These species represent different food chains (benthic, pelagic and more scavenging). In 2012 new data have been collected for kittiwake, eiders and glaucous gulls from Kongsfjorden at Svalbard.

In 2012 we have analyzed data on eiders, and showed that there is a strong climate component in the levels of POPs (persistent organic pollutants) in the blood of breeding eiders. Notably, eiders inhabiting cold high arctic climates have to metabolize more lipids during incubation fast, and therefore experience a much more rapid buildup of lipids-soluble POPs in the blood than eider breeding in more benign environments such as northern Norway. These results have been published in Bustnes et al. (2012).

For kittiwakes data have been collected from a Kongsfjord study colony in 2012, for the 6th year in a row. In 2012 one paper has been published showing that stress hormones in kittiwakes are negatively related to PCB in spring (Nordstad et al. 2012). Moreover, one paper has been submitted showing that mercury is involved in disrupting the ability to modulate the reproductive effort in kittiwakes (Tartu et al. submitted). In addition, all blood samples from kittiwakes collected between 2007 and 2011 (5 years) have now been operationalized and are being subject to data analysis. This analysis focuses on the environmental and biological factors that influence the concentrations of POPs in live kittiwakes, and thus the potential effects of POPs.

For glaucous gulls, data on the migrations and POPs have been collected in Kongsfjorden. In addition, a survival analysis has been carried out for glaucous gulls from Bjørnøya showing that pollution have a potentially dramatic population effect.

For the great skua, the Flagship money has enabled continuous work using data from the NFR funded SKUA project. The main results in 2012 has been the demonstration that birds at Bjørnøya are the most polluted great skuas in the whole of northeastern Atlantic; POP levels being as much as 10 times higher than skuas in North Sea (Bourgeon et al. 2012). It has also been shown that perfluorinated compounds (PFCs) in skuas are relatively low compared to glaucous gulls at Bjørnøya (Leat et al. 2013a). Another finding is that wintering areas may be of great importance for levels of POPs in breeding skuas, both with regard to levels and compositions (Leat et al. 2013b). In addition, wintering areas of the mothers also seems to be important for POPs concentrations and compositions in growing chicks even as late as 20 days after hatching (Bourgeon et al. in revision). Finally, the great skua seems to be a species in which POPs are strongly involved in multi-stress relationships; i.e. in stressed populations there are strong impacts of even low POP levels in stressed populations (Bustnes et al. in prep.). These analyses will continue in 2013.

Published Results/Planned Publications

1. Nordstad, T., Moe, B., Bustnes, J.O., Gabrielsen, G.W., Bech, C., Chastel, O. & Herzke, D. 2012. Relationships between POPs and baseline corticosterone levels in black-legged kittiwakes (*Rissa tridactyla*) across their breeding cycle. *Environmental Pollution* 164: 219-226.
2. Bourgeon, S., Leat, E.H.K., Strøm, H., Furness, R.W., Magnúsdóttir, E., Fisk, A.T., Ellis, S., Petersen, Æ., Ólafsdóttir, K., Borgå, K., Hanssen, S.A., Gabrielsen, G.W. & Bustnes, J.O. 2012. Individual variation in biomarkers of health: influence of persistent organic pollutants in great skuas (*Stercorarius skua*) breeding along a geographic gradient. *Environmental Research* 118: 31-39.
3. Bustnes, J. O., Moe, B., Herzke, D., Hanssen, S. A., Nordstad, T., Fenstad, A., Borgå, K. & Gabrielsen, G. W. 2012. Temporal dynamics of circulating persistent organic pollutant in a fasting seabird under different environmental conditions. *Environmental Science & Technology* 46: 10287–10294
4. Leat, E.H.K., Bourgeon, S., Eze, J., Muir, D., Bustnes, J.O., Furness, R.W. & Borgå, K. 2013a. Perfluoroalkyl substances (PFASs) in eggs and plasma of an avian top predator, great skua *Stercorarius skua*, in the North Atlantic. *Environmental Toxicology and Chemistry* in press.
5. Leat, E.H.K., Bourgeon, S., Magnúsdóttir, E., Gabrielsen, G.W., Grecian, J., Hanssen, S.A., Ólafsdóttir, K., Petersen, Æ., Phillips, R.A., Strøm, H., Ellis, S., Fisk, A.T., Borgå, K., Bustnes, J.O. & Furness, R.W. 2013b. Wintering area influences persistent organic pollutant levels in a breeding migratory seabird. *Marine Ecology Progress Series* in press.

In revision:

6. Bourgeon, S., Leat, E.H.K., Furness, R.W., Borgå, K., Hanssen, S.A., & Bustnes, J.O. Dietary versus maternal sources of organochlorines in top predator seabird chicks: an experimental approach. *Environmental Science & Technology*
7. Sonne, C., Rigét, F.F., Leat, E.H.K., Bourgeon, S., Borgå, K., Strøm, H., Hanssen, S.A., Gabrielsen, G.W., Petersen, A., Ólafsdóttir, K., Magnúsdóttir, E., Bustnes, J.O., Furness, R.W. & Kjelgaard-Hansen, M. Organohalogen contaminants and blood plasma clinical-chemical parameters in three colonies of North Atlantic Great skua (*Stercorarius skua*). *Ecotoxicology and Environmental Safety*

Submitted:

8. Tartu, S., Goutte, A., Angelier, F., Moe, B., Clément-chastel, C. Bech, C., Gabrielsen, G.W., Bustnes, J.O., Bustanmante, P. & Chastel, O. To breed or not to breed: endocrine response to mercury contamination by an arctic seabird.

In preparation

9. Bustnes, J.O., Bourgeon, S., Leat, E.H.K., Strøm, H., Magnúsdóttir, E., Fisk, A.T., Ellis, S., Petersen, Æ., Ólafsdóttir, K., Borgå, K., Hanssen, S.A., Gabrielsen, G.W. & Furness, R.W. Impacts of environmental contaminants and natural stress in different populations of a top predator seabird: an experimental study.

Communicated Results

Bustnes J.O. *Exposure of persistent organic pollutants in avian top predators in a changing northern climate*. SETAC 6th world congress, 20-24 may 2012, Berlin, Germany.

Interdisciplinary Cooperation

Ecology, physiology, chemistry

Budget in accordance to results

It has been essential for continuing the research on seabirds in Svalbard, 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

1. Understanding variation and impacts of POPs in the vulnerable ecosystems of the north is a long-term endeavor. In this respect this project is important because it allows us to have a long horizon on our research. The project is now starting to generate new results, both with regard to trends and effects of POPs that is novel to ecotoxicology.
2. No new methods have been developed