Project information

Project title
Seabird habitat use II
Year
2012/2013
Project leader
Børge Moe, NINA
Participants

Leader:

- **Børge Moe** (NINA)

Participants:

- Norway: Strøm, Welcker, Gabrielsen, Steen, Sagerup, Descamps (NPI), Barrett, Lassen (UIT), Hanssen, Bustnes, Anker-Nilssen, Dalsgaard-Christensen (NINA) Fenstad, Bech, Noreen, Schultner (NTNU), Helberg (UiO)
- France: Gilg (GREA), Chastel, Tartu, Boulinier, Gremillet, Ponchon (CNRS)
- Spain: González Solís (Univ Barcelona),
- Netherlands: Oudman, Biersma, Loonen, Reneerkens (Univ Grooningen)
- Denmark: Fort, Frederiksen, Mosbech, Schmidt, Hansen (Århus Univ)
- UK: Phillips (BAS)
- Russia: Krasnov (IMBI)

Flagship

Fjord and coast, Theme: Physical-biological coupling: Oceanography and habitat use by predators and their prey

Funding Source
Fram Centre, internal funding, Fylkesmannen i Troms/Finnmark
Summary of Results

In this project, we revealed results with strong significance for management and conservation. It has provided important new knowledge about inter-annual as well as inter- and intra-individual variation of migration of seven arctic seabird species (kittiwakes, little auks, arctic skuas, long-tailed skuas, glaucous gulls, lesser black-backed gulls, common eiders) . All the work has been part of large scale collaborations to ensure multi-colony tracking, including field work in 11 different Arctic and sub-Arctic locations, including Svalbard (Kongsfjorden, Grumant, Isfjorden, Bjørnøya), Greenland (Zackenberg, Thule, Kap Hoeg), Russia (Cape Krutik- Murman coast), North Sweden (Ammarnes) and Norway (Røst, Hornøya, Anda, Grindøya, Brensholmen, Horsvær). Hence scientific and financial contributions of partners have been crucial. The funding from the Fram Centre covered expenses in Kongsfjorden and in Troms.

Highlights

1. Identification of marine hotspots is important for effective conservation and management, as detoriating environmental conditions may explain some of the large decrease in numbers of breeding seabirds in the Barents Sea region. Our multi-colony tracking study of kittiwakes from seven colonies in the Barents Sea region showed that post-breeding kittiwakes concentrated in a specific hotspot located in the seasonal ice zone in northwest Barents Sea (Figure 1). In September, this was the only area in the Barents Sea where tracked birds were at high density, and was estimated to hold 1.3 million adult kittiwakes. The hotspot was most important for birds breeding along the Barents Sea, but also attracted birds from colonies at the Norwegian Sea coast, which migrated >1000 km north to reach this area before heading southwest to the wintering grounds.

2. Extensive development of human activities combined with ocean warming are rapidly modifying marine habitats in the Arctic and North Atlantic regions. In order to understand the potential impacts of these changes upon marine biodiversity, there is an urgent need to define species distribution in these remote regions and highlight sensitive hotspots. We tracked one of the most abundant seabirds of the world, the little auk, from four North Atlantic colonies. We provided for the first time a large, meta-population, scale overview of their non-breeding distribution and highlighted several hotspots for this species. We demonstrated that some of these hotspots largely overlap with human activities, notably with oil/gas offshore licenses and shipping traffic (Figure 2). Little auks, which spend the major part of their time on the sea surface, are extremely vulnerable to marine pollutions and our results emphasize the risk that the projected expansion of these activities could have for this species.

3. Among Arctic birds, the Long-tailed Skua has undoubtedly one of the most peculiar ecologies. It is the most northerly breeding bird species, and it functionally links different ecosystems, being strongly dependent on marine resources during the non-breeding season and terrestrial resources in summer. For the first time, we have revealed the complete habitat use by this species during the entire year, demonstrating that they use the entire Atlantic Ocean (Figure 3). Migrating from the colonies in the Arctic in late summer, and spending time in several Atlantic hotspot regions, before wintering in the Southern hemisphere at 10-45°S. This is a strong example of connectivety between the Arctic, and temparate and even tropical marine environments. Hence, viability of such long-distance migrating species, may depend on marine resources located from 0 to to 13.000 km away from the Arctic breeding grounds. This highlights the

importance of global ocean health for Arctic breeding seabirds.

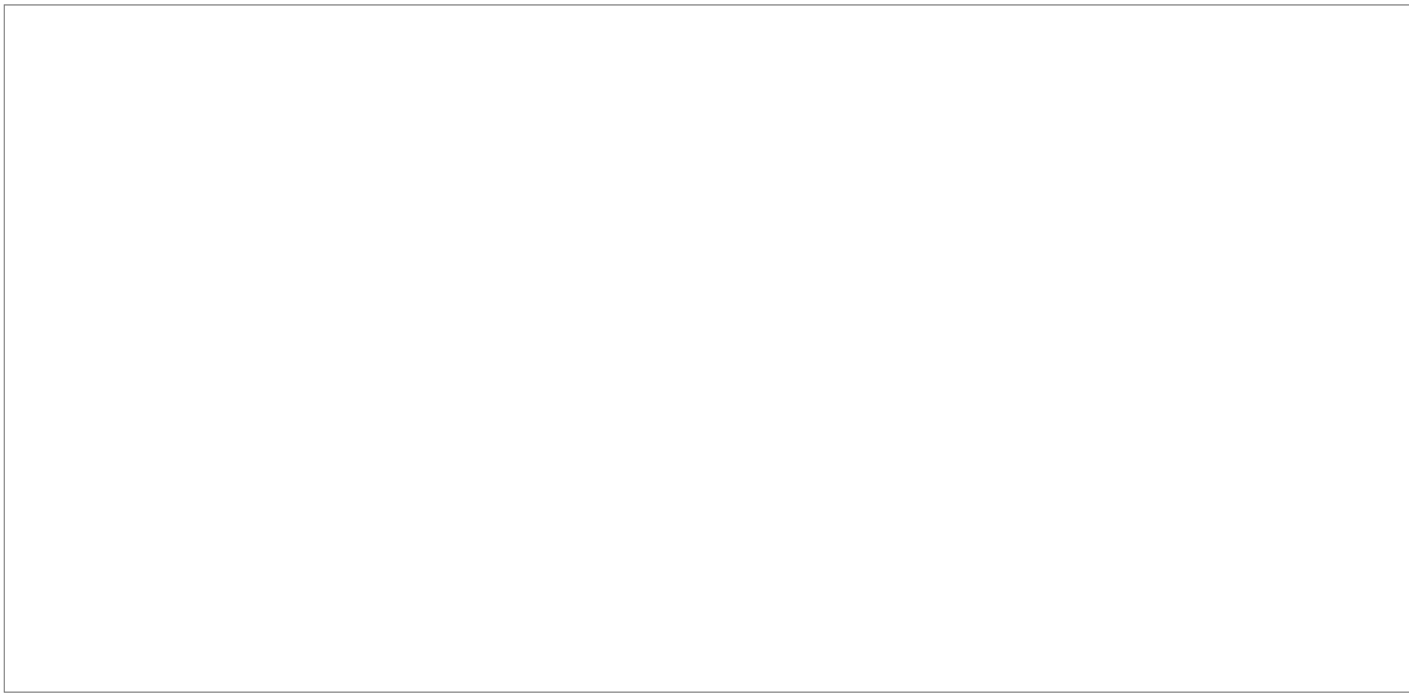

Figure 1. Areas used in 2009 by post-breeding kittiwakes (n=67) from five Barents Sea colonies (stars) tracked using geolocators. The 25, 50 and 75% kernel contours (red, orange, yellow) are shown for the periods 1–10 Sept (a, d), 21–31 Oct (b, e) and 1–30 Nov (c, f). Sea-ice is grey (> 40% sea-iceconcentration).

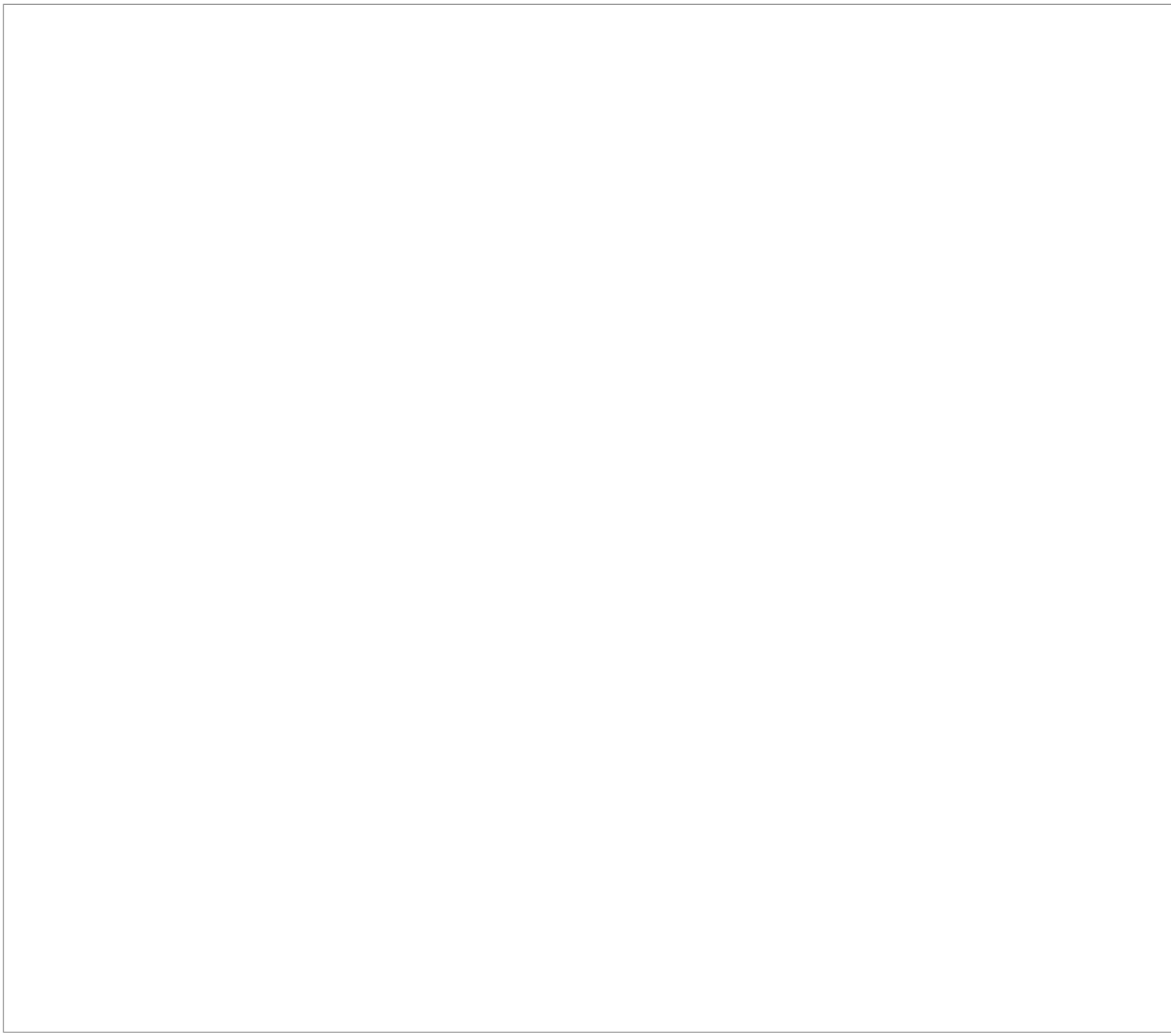

Figure 2. Overlap between the non-breeding distribution of tracked little auks and the development of future human activities in the Arctic (oil/gas activities and shipping routes). Little auk hotspots are defined by kernel 50% density contours in autumn (15 September/15 August – blue kernels), winter (December and January – red kernels) and spring (April – brown kernels). Black areas represent oil/gas exploration licensed blocks.

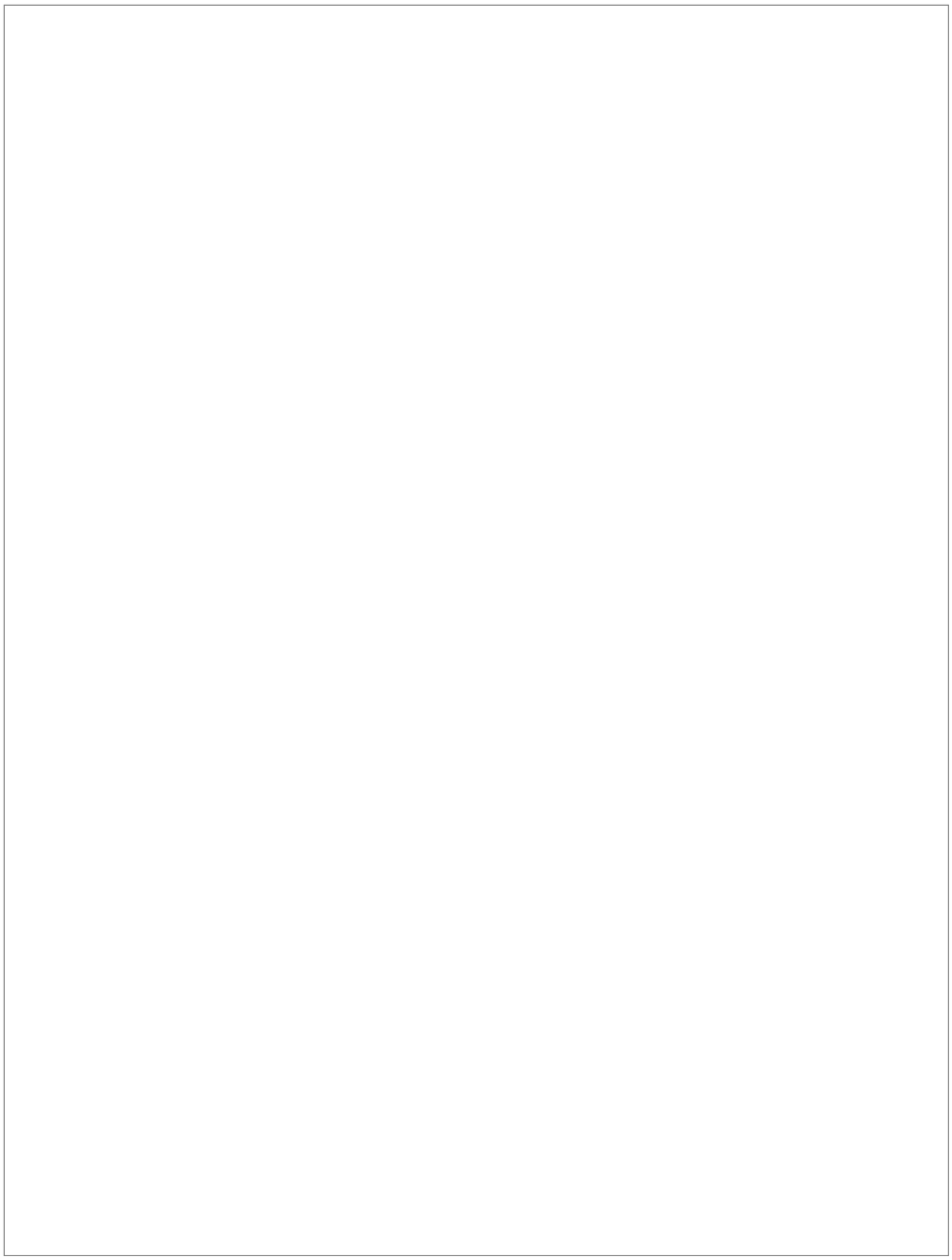

Figure 3. Flyways used by eight adult Long-tailed Skuas between their breeding grounds in Greenland and Svalbard (red stars) and their wintering ground: (a-b) two male and (c) one female from Greenland, (d-f) three males and (g-h) two females from Svalbard. Autumn movements (August-November) are in green, winter movements (December-March) in red and spring movements (April-June) in yellow. Dashed lines represent interpolations (linear or parallel to the continents) for periods (equinox) when latitude could not be estimated. Black lines: same interpolations close to breeding grounds due to permanent daylight. The last panel (i) presents all raw positions (two per 24h) obtained for these eight birds over one year.

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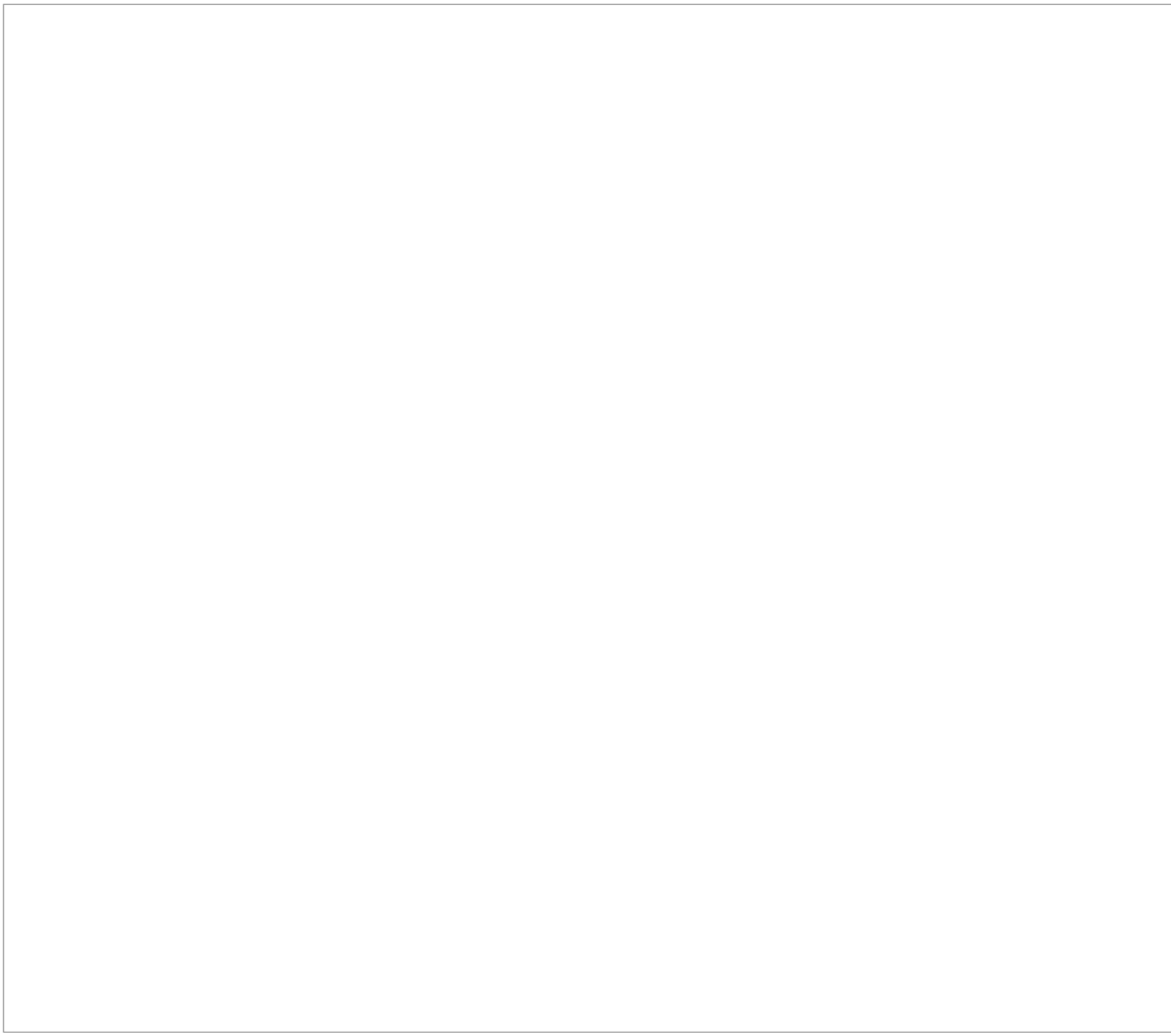

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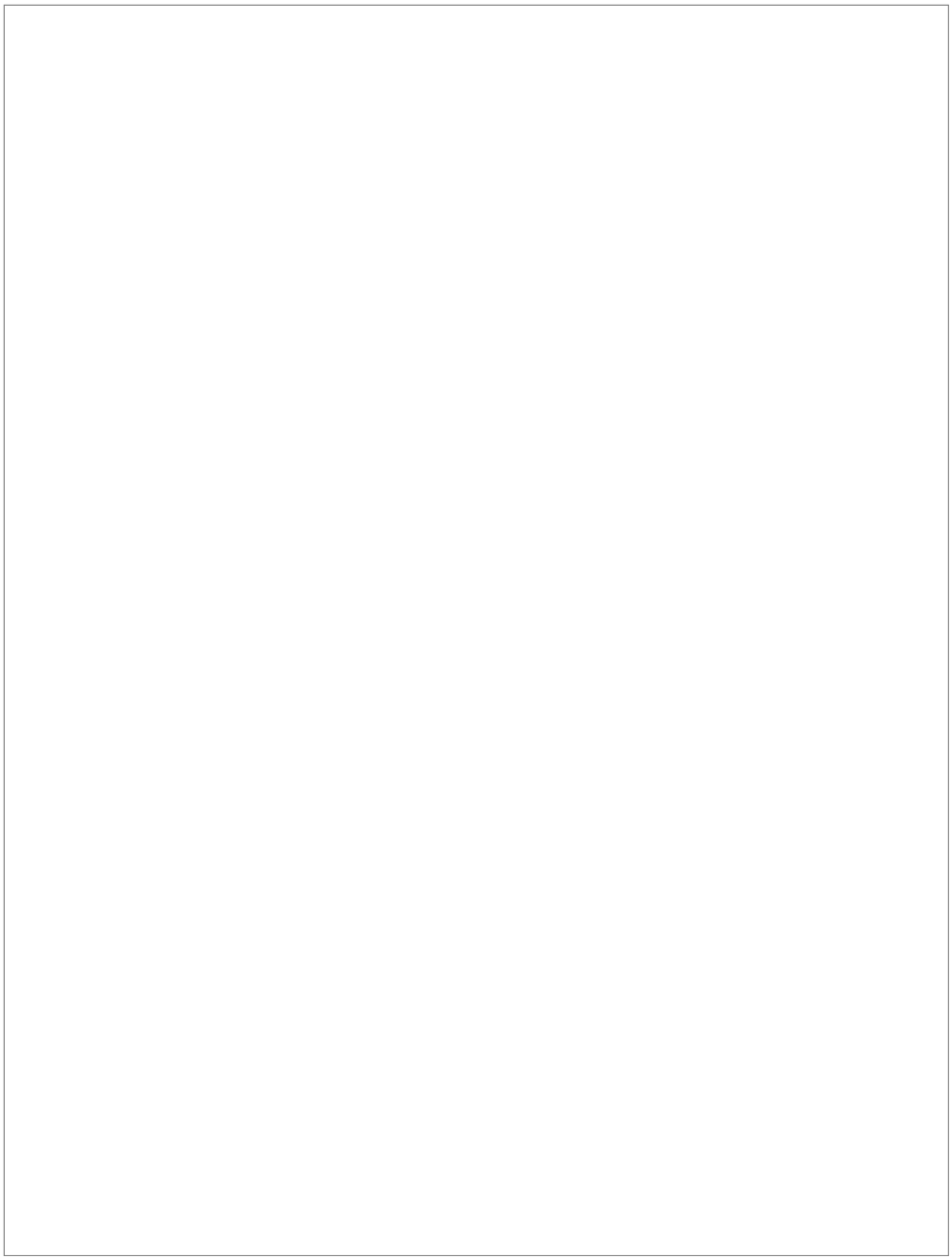

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Published Results/Planned Publications

Published manuscript:

1. Frederiksen, M., Moe, B., Daunt, F., Phillips, RA., Barrett RT., Bogdanova, M., Boulinier, T., Chardine, JW., Chastel et al. (2012) Multi-colony tracking reveals the non-breeding distribution of a pelagic seabird on an ocean basin scale. *Diversity and Distributions* 18: 530-542.

Manuscript awaiting editor decision after minor revision:

2. J.O. Bustnes, B. Moe, M. Helberg, & R.A. Phillips (2012) Rapid long-distance migration in Norwegian Lesser Black-backed Gulls along the eastern flyway. *IBIS* (in revision)

Submitted manuscript:

3. B. Moe, H. Strøm, O. Chastel, A. Ponchon, T. Anker-Nilssen5, R.T. Barrett, S. Christensen-Dalsgaard, C. Clément-Chastel, M. Frederiksen, J. González-Solís, A. Goutte, D. Grémillet, Y.U. Krasnov, R.A. Phillips, H. Steen2, T. Boulinier (2012) Post-breeding hotspot in the cold: Multi-colony tracking of kittiwakes in the Barents Sea. *Biology Letters* (submitted)

Manuscripts ready for submission:

4. O. Gilg, B. Moe, S.A. Hanssen, N.M. Schmidt, B. Sittler, J. Hansen, J. Reneerkens, B. Sabard, O. Chastel, R.A. Phillips, T. Oudman, E. Biersma, A.A. Fenstad, J. Lang & L. Bollache (2012) Trans-equatorial migration routes, stopover sites and wintering areas of a high-Arctic avian predator: the Long-tailed Skua (*Stercorarius longicaudus*). *Diversity and Distributions*

5. J. Fort, B. Moe, H. Strøm, D. Grémillet, J. Welcker, J. Schultner, K. Jerstad, R.A. Phillips, A. Mosbech (2012) Global change threats to little auk meta-population wintering hotspots in the north Atlantic. *Proceedings of Royal Society Lond B*

Paper 1 was also listed in the report for 2011, since it was published online in 2011. Paper 2 is close to acceptance, since it is resubmitted after minor revision. Paper 3 has been submitted to Biology Letters. It was rejected and will be submitted to another journal. Paper 4 will be submitted very soon, most likely targeting Diversity and Distributions first. Paper 5 will also be submitted very soon, most likely to Proceeding of Royal Society Lond B.

Copies of all papers/manuscripts are attached to this report.

The published paper (1) will also be sent to Jo Aarseth.

Communicated Results

Press:

Forskning.no, http://www.forskning.no/artikler/2012/februar/312667

Framsenteret.no, http://www.framsenteret.no/naa-vet-de-hvor-krykkjene-lever-paa-vinteren.5017974-141503.html

NINA.NO, NPOLAR.NO, UIT.NO

International conferences:

- International Research School in Applied Ecology (Evenstad 13-17 August 2012)Presentation: Use of geolocators in studies of seabird spatial ecology (B Moe)

Interdisciplinary Cooperation

The project has benefitted from cooperation between researchers from different disciplines. The listed papers mainly belong to the following disciplines: Distributions/diversity, migration, spatial ecology and climate change biology.

Co-workers involved in this project will also use the data provided here in the fields of ecophysiology and ecotoxicology. The data will also be used by collaborators focusing on seabird spatial ecology, demography and oceanography.

Budget in accordance to results

The funding from the Fram Centre has played a major role for financing fieldwork, equipment, tracking analyses and for writing papers, and has thus given us the opportunity to have a leading role in this large-scale cooperation. The project also benefitted from external funding as well as a substantial use of own research hours (egenforskning). This project is a huge cooperation, involving many researchers and costly field work and analytical work. Its large-scale success has depended on external funding for the field activities of project partners (e.g. extensive field operations in Greenland and other Norwegian colonies).

Could results from the project be subject for any commercial utilization

No

If Yes

No, but the results may have major implications for management and industry (e.g. oil industry, fisheries, shipping)

Conclusions

a) The project has established a strong basis for further work. We have a 3-year perspective and will further develop the project to focus on climate effects on migratory strategies and habitat use in arctic seabirds. The project has provided a unique basis for assessing inter-annual as well as inter- and intra-individual variation habitat use, since we now have obtained several years of data from the same individuals and population, in a wide collaborative network.

This project has also been relevant for developing an application (SEATRACK) to the Ministry of the Environment (MD) about large-scale tracking studies of seabirds in Norway, Russia, UK and Iceland. This application is made in collaboration between NPI and NINA.

b) The development of small-sized electronic tags has been a prerequisite for the project. However, there is a constant need for further decreasing the size, increasing the battery life and increasing the precision of the electronic tracking tags.