

Project information

Project title

Dynamic interactions between large zooplankton (amphipods and krill) and seals: impacts of climate change (ZOOSEAL)

Year

2011/2012

Project leader

Tore Haug, IMR

Participants

- IMR: Tore Haug (project leader), Anne Kirstine Frie, Tor Arne Øigård, Ulf Lindstrøm, Padmini Dalpadado
- NP: Stig Falk-Petersen (co-leader), Haakon Hop, Øystein Varpe
- Apn: Michael Greenacre
- UNIS: Ole Jørgen Lønne, Jørgen Berge
- AWI: Uli Bathmann, Agnelina Kraft (PhD student)
- NVH/SAV: Jacques Godfroid

Flagship

Arctic Ocean

Funding Source

IMR: NOK 703 000 AWI/NP: NOK 100 000 NVH/SAV: NOK 50 000

Summary of Results

Activities that have characterized the first project year: a) Sampling of data from harp seals during the commercial hunt in the southeastern Barents Sea in May; b) Sampling of data on pelagic amphipods (*Themisto libellula*) during the IMR ecosystem survey around Svalbard in August/September; c) Organizing, analyzing and reporting relevant historical data from the IMR time series of harp seals in the northeast Atlantic; d) Work with *Brucella* infections.

Historical and new (2011) data on harp seal body condition suggests significant variations, with a general increase from 1992 until 2001 and later decreasing towards the lowest body condition in 2011. The decrease coincides with a sudden drop in pup production. Using available abundance estimates (biomasses) of krill, capelin, polar cod and cod the previous year as predictors suggests significant relationships between harp seal body conditions and the abundance levels of prey species. The condition of adult seals increased linearly with increasing krill biomass.

Diet studies, based on historical (1996, 1997 and 2004-2006) IMR data on contents from feces and gastrointestinal tract, suggest that the summer prey use of harp seals vary significantly both in time (year and season) and space. Also, harp seal prey use appears to be size dependent; small harp seals exploit krill significantly more intensively than larger individuals which appeared to eat more fish. Krill was by far the most important prey item for the seals (63%) followed by polar cod (16%) and other fish species (10%) in terms of biomass. Resource mapping, conducted concurrently with harp seal sampling, allowed analyses of prey preferences. Krill dominated as prey in all areas and years. There were considerable variations in the selection of prey (krill included) by the seals which may indicate that they exhibit threshold foraging behavior to their prey.

Fatty acids were studied in harp seal blubber and potential prey species collected simultaneously in the northwestern part of the Barents Sea in May-June 2006. The fatty acid composition differed substantially between potential prey species, and between the prey and the blubber. Nevertheless, the fatty acid composition of the prey species, as identified from stomach/intestine contents, were more similar to that in the blubber than the fatty acid composition of the prey not found in the stomach/intestines. The weak predator-prey relationship, with respect to fatty acid composition in the inner blubber and the prey, suggested that the fatty acid composition in the inner layer was mainly predetermined by the metabolism rather than the fatty acid composition of the diet.

Brucella spp. have been isolated and serologically indicated in a wide range of marine mammal species from most parts of the world. Pathology (reproductive failure) is reported in marine mammals and the possible implications of a *B. pinnipedialis* infection for seal, especially the Northeast Atlantic population needs to be assessed.

Activities that have characterized the first project year: a) Sampling of data from harp seals during the commercial hunt in the southeastern Barents Sea in May; b) Sampling of data on pelagic amphipods (*Themisto libellula*) during the IMR ecosystem survey around Svalbard in August/September; c) Organizing, analyzing and reporting relevant historical data from the IMR time series of harp seals in the northeast Atlantic; d) Work with *Brucella* infections.

Historical and new (2011) data on harp seal body condition suggests significant variations, with a general increase from 1992 until 2001 and later decreasing towards the lowest body condition in 2011. The decrease coincides with a sudden drop in pup production. Using available abundance estimates (biomasses) of krill, capelin, polar cod and cod the previous year as predictors suggests significant relationships between harp seal body conditions and the abundance levels of prey species. The condition of adult seals increased linearly with increasing krill biomass.

Diet studies, based on historical (1996, 1997 and 2004-2006) IMR data on contents from feces and gastrointestinal tract, suggest that the summer prey use of harp seals vary significantly both in time (year and season) and space. Also, harp seal prey use appears to be size dependent; small harp seals exploit krill significantly more intensively than larger individuals which appeared to eat more fish. Krill was by far the most important prey item for the seals (63%) followed by polar cod (16%) and other fish species (10%) in terms of biomass. Resource mapping, conducted concurrently with harp seal sampling, allowed analyses of prey preferences. Krill dominated as prey in all areas and years. There were considerable variations in the selection of prey (krill included) by the seals which may indicate that they exhibit threshold foraging behavior to their prey.

Fatty acids were studied in harp seal blubber and potential prey species collected simultaneously in the northwestern part of the Barents Sea in May-June 2006. The fatty acid composition differed substantially between potential prey species, and between the prey and the blubber. Nevertheless, the fatty acid composition of the prey species, as identified from stomach/intestine contents, were more similar to that in the blubber than the fatty acid composition of the prey not found in the stomach/intestines. The weak predator-prey relationship, with respect to fatty acid composition in the inner blubber and the prey, suggested that the fatty acid composition in the inner layer was

mainly predetermined by the metabolism rather than the fatty acid composition of the diet.

Brucella spp. have been isolated and serologically indicated in a wide range of marine mammal species from most parts of the world. Pathology (reproductive failure) is reported in marine mammals and the possible implications of a *B. pinnipedialis* infection for seal, especially the Northeast Atlantic population needs to be assessed.

Published Results/Planned Publications

Grahl-Nielsen, O., Haug, T., Lindstrøm, U. & Nilssen, K.T.. 2011. Fatty acids in harp seal blubber do not necessarily reflect their diet. *Mar. Ecol. Prog. Ser.* 426: 263-273.

Øigård, T.A., Lindstrøm, U., Haug, T. & Nilssen, K.T.. 2011. Variations in body condition of Barents Sea harp seals during April May in 1992-2011. Joint ICES/NAFO Working Group on Harp and Hooded Seals, St.Andrews, Scotland, UK, 15-19 August 2011. WP SEA 196. 21 pp.

Nymo I., Tryland M., Godfroid J. 2011. A review of *Brucella* infection in marine mammals, with special emphasis on *Brucella pinnipedialis* in hooded seal (*Cystophora cristata*). *Veterinary Research* 2011, 42:93. doi:10.1186/1297-9716-42-93.

Lindstrøm, U., Nilssen, K.T., Pettersen, L.M.S. & Haug, T. 2011. Harp seals foraging behavior during summer in the northern Barents Sea; use and selection of prey. *Polar Biol.*: in submission.

Lindstrøm, U., Nilssen, K.T., Pettersen, L.M.S. & Haug, T. 2011. Harp seals foraging behavior during summer in the northern Barents Sea; use and selection of prey. *Polar Biol.*: in submission.

Communicated Results

Results communicated in:

- IMR/PINRO Annual Scientist Meeting, Murmansk, Russia, March 2011
- NAMMCO Scientific Committee, Gjøgv, The Faroes, May 2011
- Joint ICES/NAFO Working Group on Harp and Hooded Seals, St.Andrews, Scotland, UK, August 2011
- Wildlife Diseases Association 60th Annual International Conference, Quebec City, Canada, August 2011.
- Fiskeriforhandlingsrådet, Fiskeri- og Kystdepartementet, Oslo, October 2011
- Joint Norwegian Russian Fisheries Commission, Kaliningrad, Russia, October 2011
- Forskerutvalg om Sjøpattedyr, Oslo, Norway, October 2011

Results communicated in:

Interdisciplinary Cooperation

The project includes biologists and veterinarians, representing various fields including sea mammals, fish, zooplankton general ecology and microbiology (infectious diseases).

Budget in accordance to results

In 2011, the project received no funding from the Fram Centre, only internal funding from the participating institutions.

Could results from the project be subject for any commercial utilization

No

If Yes

No, not very likely. However, it is worth noting that *B. pinnipedialis* has a zoonotic potential and thus this poses the question of the control of hooded seal meat.

Conclusions

a) This is a project supposed to proceed over several years, with different sub-issues being addressed each year along the line. The main questions asked implies that the following issues will be addressed:

1. What are the dominant patterns of seasonality in the life cycle of large zooplankton form (in particular krill and *Themisto*), including depth distribution, size and energy reserves?
2. How does the abundance of the large zooplankton forms vary over time?
3. What is the past and current role and importance of zooplankton as food for harp seals?
4. What are the possible dietary consequences of variations in plankton availability and quality on harp seal feeding grounds during the intensive feeding period of the seals?
5. What are the possible population effects on harp seals from variations in zooplankton availability and quality.
6. Possible effects of *Brucella* infections on harp seal life history (prevalence, isolation and the role of food as a reservoir for the infection).

b) The project address biological, ecological and veterinary biology questions using traditional methodology