

Project information

Project title

Benthic biodiversity and ecosystem function in Svalbard and North Norway

Year

2013/2014

Project leader

Sabine Cochrane, ApN

Participants

Co-leaders (alphabetical order)

- Sabine Cochrane, Akvaplan-niva (APN)
- Kari E. Ellingsen, Norwegian Institute for Nature Research (NINA)
- Lis Lindal Jørgensen, Institute for Marine Research (IMR – reporting separately)

Collaborators (this 2013 report; see 2012 report for full collaboration list):

WP1

- Emmelie Åstrøm, University of Göteborg (UG)
- Maria Włodarska-Kowalczyk, Institute of Oceanology, Polish Academy of Sciences (IOPAS)
- Paul Renaud (UNIS/APN)
- Lindsay Wilson (APN)
- Ann Helene Tandberg (IMR)

Laboratory/ database/ other staff of Akvaplan-niva (alphabetical: H. Andrade, K. Bluhm, H.P. Mannvik, R. Palerud, V. Remen, K.H. Sperre and R. Velvin).

Note: work in 2013 has focused on processing data from the Norwegian coast and Svalbard, thus a limited number of participants have been involved this year.

Flagship

Fjord and coast, Theme: Structure, function and change in Arctic and boreal fjord ecosystems

Funding Source

Fram Centre

Summary of Results

Highlights

In 2013, our highlights were as follows:

- Completion of a masters thesis using data from fieldwork around Svalbard in 2011 (collaboration with APN, UNIS, IMR and University of Göteborg);
- Processing of all samples taken from Svalbard, 2011 and 2012; biomass analyses completed;
- Extensive dataset compiled of coastal benthos from mainly Troms and Finnmark, in association with local environmental monitoring assignments (implication for regional environmental legislation);
- Offshore dataset compiled from approximately 50 reference stations at similar latitude as the coastal locations;
- Data analysis to determine what characterizes a "typical" benthic community in coastal Norway as compared with offshore locations.

Introduction

Environmental legislation is moving away from site-based surveying, to more holistic approaches, such as the Norwegian Integrated Management plan for the Barents Sea and Lofoten areas. Norway participates in international biodiversity initiatives, such as those led by the OSPAR Regional Seas convention, where the focus is to determine environmental condition, in terms of whether or not "Good Environmental Status" is the case. Benthic fauna in individual Svalbard glacial fjords is relatively well-researched (Włodarska-

Kowalczyk et al. 1998; 2001; 2005; 2012). In Northern Norway, a large number of sea-floor monitoring assignments have been carried out by Akvaplan-niva, and a number of published research studies also exist (e.g. Holte et al., 1996, 2004; Holte and Gulliksen, 1998, Oug, 2000, Oug et al., 2011). However, few, if any, studies have assessed coastal benthos across a wider area. We aim to address this gap.

The main rationale of this project has therefore been to determine what characterizes typical benthic faunal assemblages in both northern Norway and Svalbard. We have previously identified some marked differences in species composition and faunal structure between Svalbard fjords and offshore areas at similar latitudes in the Barents Sea (Włodarska-Kowalczyk et al., 2012). We therefore also compare offshore benthic assemblages with those along the coast, also at approximately similar latitudes.

Methods and study area

The study locations included in this project are shown in Figure 1. The study material comprises 26 stations from Svalbard, 156 stations from coastal Norway and 53 stations offshore.

The Svalbard stations have been sampled using support from the FRAM Centre programme, the coastal stations are extracted from Akvaplan-niva's database (sampling dates range from 1993 to 2013) and the offshore stations are from the baseline sediment survey conducted for the Norwegian petroleum industry (data used with permission from the Norwegian Oil and Gas producer's association – Norsk Olje og Gass). All samples have been taken using a 0.1 m² van Veen grab, in accordance with international guidelines (ISO 16665). Three sample replicates were used from each station. During data selection, we have prioritized sampling years which reflect lowest pressure conditions (e.g. pre-petroleum activities, before population expansion or installation of aquaculture farm, or in case of temporal data sets, we selected the earliest).



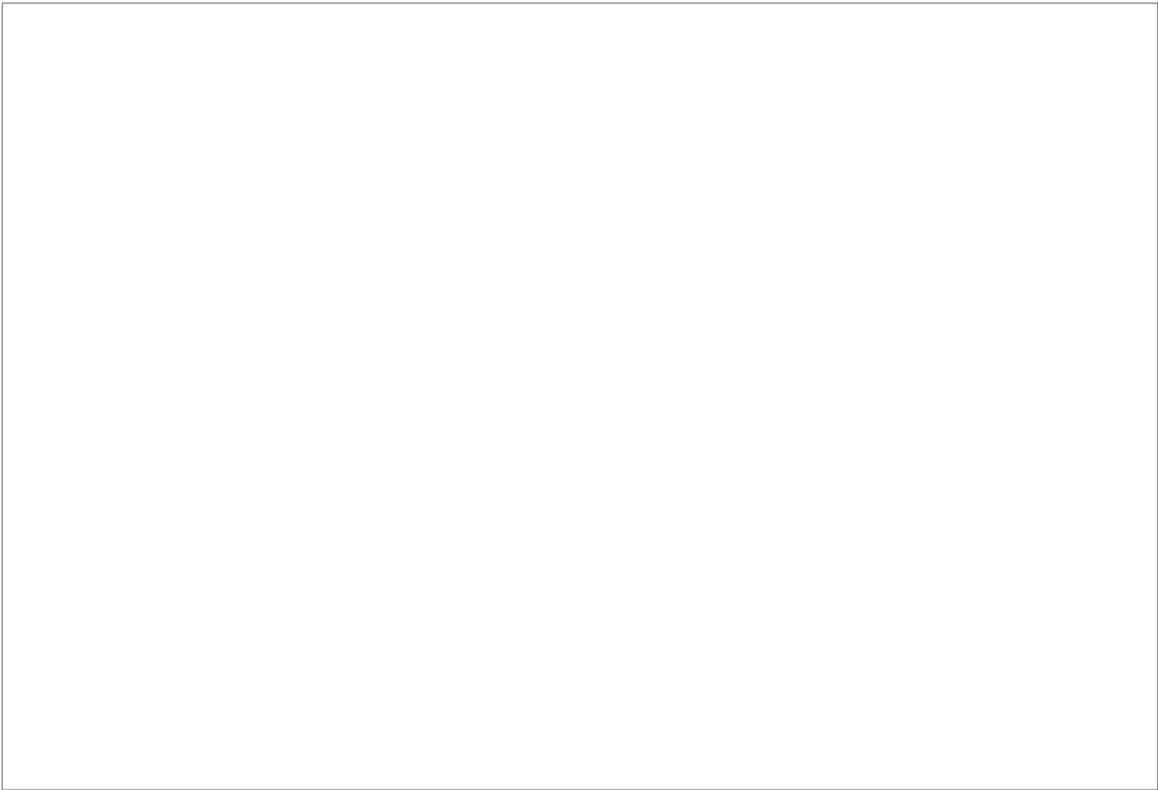


Figure 1. Sampling locations: upper left: Svalbard, upper right: northern Norway, lower: offshore SW Barents Sea).



Figure 2. Non-metric multi-dimensional scaling plot showing similarity between polychaete species distributions at sampling stations located at various distances from the glacier at Billefjorden, Svalbard (Åström, 2013).



Figure 3. Biomass and taxon composition of selected sampling stations analysed from Billefjorden, Svalbard, in relation to station location.

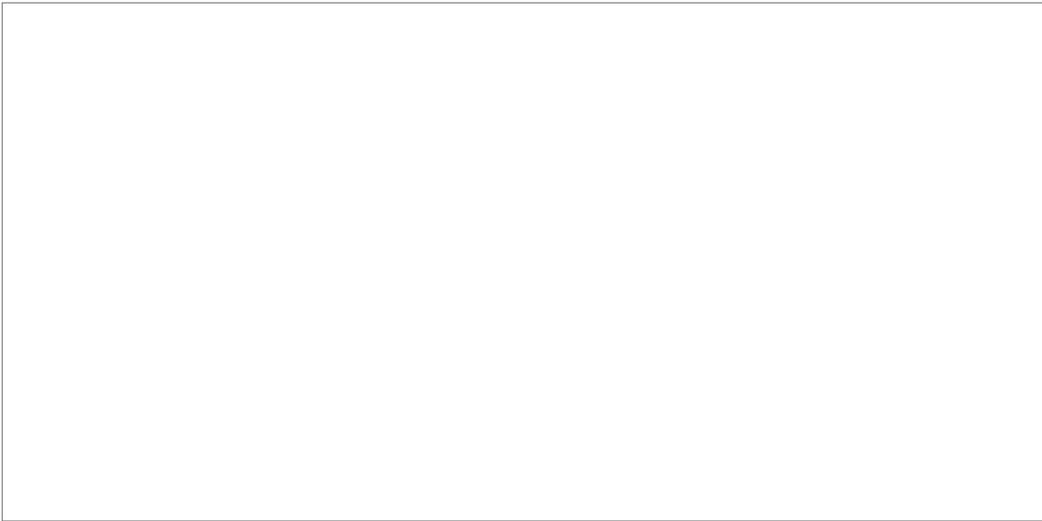


Figure 4. Plot of number of taxa against depth for the coastal stations in northern Norway.

For the Management

Our current findings are of use to environmental management in the following ways:

- Coastal and offshore benthic biodiversity show different characteristics, and will need different threshold values for assessing environmental status;
- Species occurrences along the north Norwegian coast show a high natural variability, and care needs to be taken during pollution monitoring, to make sure that natural variation is taken into account when defining reference conditions;
- Offshore benthic biodiversity in northern waters is characterized by a low species dominance, and a high species richness. This has consequences for offshore sediment monitoring because the "top ten" dominants are likely to vary from year to year for natural reasons, and such changes need to be taken into account and not confused with change due to industrial impacts;
- Future work within this project aims to include a study of the recovery of impacted sediments in selected harbor areas (if approval is granted from the harbor authorities involved) – see point 12 below. This will be of obvious value for local environmental managers, and also has a potential for public outreach.

Published Results/Planned Publications

Åström, E. 2013. Soft bottom communities in the Arctic- benthic fauna in Svalbard. Masters Thesis. Department of Biological and Environmental Sciences, University of Gothenburg. (Pdf file accompanies this report.)

Communicated Results

Nothing formal this year other than the MSc thesis presented above. We plan outreach activities next year.

Interdisciplinary Cooperation

This year, we have had a dedicated focus on benthic macrofauna. However, the Svalbard component of the project is strongly linked to activities within UNIS and IMR, where we collaborate with other disciplines such as stable isotope

Activities in 2014 will move the current results into this wider and cross-disciplinary collaboration.

Budget in accordance to results

The FRAM-centre funding has allowed us to collect and process samples from Svalbard, during sampling missions conducted in collaboration with UNIS. The funding also has allowed us to use time to compile and analyse existing data, which is available without direct costs, but would not have been possible to study without this additional funding.

If Yes

No direct commercial use, although the study will promote FRAM centre and the participating institutes within environmental monitoring. This is of particular value to Akvaplan-niva, as a private research and consultancy institute.

Conclusions

Future research will focus on moving from local-scale to regional-scale assessment of benthic biodiversity. The project uses traditional methods, but in 2014 we will start incorporating some broader approaches, such as functional group assessments (Cochrane et al., 2012) and the linkages between epi- and macrobenthic organisms (i.e. the large visible organisms living on or attached to the sediment surface and those buried within it; see Jørgensen et al., 2011).

Within Akvaplan-niva's available data sets are a number of temporal studies of northern Norwegian harbor areas, where legislative measures have been implemented, to improve the quality of the seabed in affected areas (Tromsø, Harstad and Narvik). We intend to continue our joint work to apply the tools used in this project to compare and contrast the responses of benthic biodiversity to management measures to reduce human impacts on the marine environment.

As mentioned above, future work in 2014 will link to more innovative methods for food web analyses. In addition to collaboration with UNIS and IMR, we will join forces with the University of Tromsø, to incorporate our results into ongoing work on modeling of energy flow pathways in coastal ecosystems.