

Project information

Keywords

Arctic Ocean acidification, fjords, pteropods

Project title

Pteropod shell thickness and composition in different regimes - OApteropods

Year

2016

Project leader

Agneta Fransson (NPI) and Melissa Chierici (IMR)

Geographical localization of the research project in decimal degrees (max 5 per project, ex. 70,662°N and 23,707°E)

81N 19E, 83N 19E, NyÅlesund, 79N 15W, 79N 5W,

Participants

Collaborators:

Naomi Harada and Katsunori Kimoto (JAMSTEC)

Flagship

Ocean Acidification

Funding Source

Same funding as OAstate WP1

Rely on existing infrastructure such as research vessels and laboratories, instrumentation and in-kind sources.

The funding from Fram Centre provided support to all of the activities with an additional in-kind funding from the IMR strategic initiative SI_ARCTIC and support from the NPI Lance Fram Strait cruises. Kongsfjorden study took place during the MOSJ expedition in July.

Summary of Results

- Collection of pteropod *Limacina helicina* from numerous places in the Fram Strait (September), North of Svalbard (September) and Kongsfjorden (July) (total of 200 samples including juveniles) and the Barents Sea (230 pteropods in collaboration with incentive forum and pteropod project)

- We found large abundance in area North of Svalbard especially of juvenile pteropods (*L. helicina*). Pteropod are mainly small (juvenile stages) and their shells are fragile. However, adults were found in NE Greenland waters and in some places north of Svalbard and reached in some cases up to 10 mm in size.
- We found that the *L. helicina* was more abundant and less patchy than previous experience. This is probably mainly due to methodology improvements.
- Kongsfjorden carbonate chemistry shows aragonite saturation (Ω) of 1.5, which is close to the 1.4 level when damage on the shells has been observed in other regions (California and Antarctica)
- Increased freshening due to glacial melt water have the potential to lower the Ω to detrimental levels in Kongsfjorden.
- Encouraging results from Micro X-ray Tomography (MXCT) scan analyses of aragonite shells of the pteropod *L. helicina* (in collaboration with JAMSTEC, Japan) will be compared to carbonate chemistry gradients.

The results obtained are used for the planning of future field studies and will be at least partly included into a PhD-study, and other researchers at IMR, NPI, and UiT. The data collected during this project (from natural sites) will be compared to previously collected pteropods in this

project and also with other pteropod data sets from the world ocean. This comparison has a great potential to assess the possible scenarios under stronger impact of ocean chemistry changes on planktonic calcifiers.

Master and PhD-students involved in the project

Siri Ofstad, PhD student, UiT as collaborator

For the Management

- Competence and expertise for pteropod studies and ocean acidification have rapidly advanced at the Fram Centre. Contribute with knowledge transfer to other science fields.
- Sampling of shelled pteropods in polar waters along large chemical and physical gradients reveals that polar waters are suitable to use as natural analogues for ocean acidification effects on the ecosystem.
- Increased knowledge on the seasonal variability of pteropod abundance and life cycle and distribution in the water column in different water regimes (temperature, salinity, calcite saturation) which provides insight to the extent of ocean acidification effects on calcifiers.
- Active part in giving advice on biological effect indicators in several meetings and workshops.

Published Results/Planned Publications

Peer-reviewed publications

Fransson A., M. Chierici, H. Findlay, H. Hop, S. Kristiansen, A. Wold. Seasonal of change ocean acidification state in Kongsfjorden, with implications for calcifying organisms. *Polar Biol.* , 1-17, DOI:10.1007/s00300-016-1955-5 special issue on Kongsfjorden.

Manno, C., et al, A. Fransson, M. Chierici. Shelled pteropod in peril: assessing vulnerability in a High CO₂ ocean, in review, *Earth Science Review*.

Related publications in 2016

Iglikowska, A., Bełdowski, J., Chełchowski, M. Chierici, M., Kędra, M., Przytarska, J., Sowa, A., and P. Kukliński., Chemical composition of two mineralogically contrasting Arctic bivalves' shells and their relationships to environmental variables, accepted, Marine Pollution Bulletin, MPB-D-16-00973R1

Charrieau, L.M., H.L.Filipsson., K. Ljung., M. Chierici., K. L. Knudsen & E. Kritzberg., The effects of multiple stressors on the distribution of coastal benthic foraminifera: a case study from the Skagerrak-Baltic Sea region, submitted to Limnology and Oceanography (LO-16-0464).

Public report

Fransson A., P. Thor, A. Bailey, M. Chierici (2016) Ocean acidification in Kongsfjorden, Fram Forum, 2016

Planned publications/in preparation:

Data obtained within the project has a potential to be included into at least 2 publications on ocean acidification effects on pteropods.

Conferences/workshops 2016:

FRAM Day, 10 Nov 2016 (poster presentations)

OA flagship meetings, Sept/Oct. 2016, NPI, IMR, NIVA, Akvaplan-Niva, UiT, NINA, NORUT.

Advice

“Biological effect indicators for OA - pteropods”, October 2016, Skype meeting with Miljødirektoratet

Communicated Results

Conferences/workshops 2016

Chierici., M., A. Fransson, H. Hop., A. Wold., H. Findlay., 2016. Seasonal variability of OA state and implications for calcifiers in Kongsfjorden, oral presentation 4th Ocean in a high CO₂-world, 2-7th of May 2016, Hobart, AUS oral presentation

Assmy, P., A. Fransson., M. Chierici., A. Wold., H. Hop., et al., Phytoplankton spring bloom beneath heavily snow-covered arctic sea ice during the N-ICE2015. 2016. Abstract accepted in Session CR5.4/OS1.24 Marginal ice zone processes, EGU2016-17254

Meetings regularly with all members from UiT, HI and NPI.

FRAM Day (poster presentation)

Open section meeting presentation on Kongsjorden and pteropods (A. Fransson), NPI, Tromsø

Oct. 2016

Interdisciplinary Cooperation

Collaboration with OAstate and OAdrivers and incentive project (Tine Rasmussen and Kasia Zamelyszak)

The project has had great benefit of the large collaboration between the natural science disciplines. In particular, inter-disciplinary cooperation between marine geologist/paleo oceanographers and chemical, biological and physical oceanographers offers a wide range of knowledge and contribution to the project. Only positive aspects.

Collaboration on the thickness and density of aragonite shells with Japanese scientists at JAMSTEC as well as with American expert in pteropod research is rewarding.

Budget in accordance to results

The project funding is shared with WP1 and has a very low budget which only partly covers the field work. The project relies on infrastructure and funding from other projects such as in-ind SI_ARCTIC (IMR), MOSJ (NPI) and Fram Strait (NPI). It supports the costs associated with Arctic field work using research vessels and equipment, and extensive water and pteropod sample collection.

Could results from the project be subject for any commercial utilization

No

Conclusions

- a. Need for more investigation of seasonal variability of carbonate chemistry and planktonic calcifiers (pteropods and planktonic foraminifera) life cycle and special distribution in the arctic waters (e.g. adult, juvenile).
- b. The project lead to modification/improvement of pteropod sample treatment after recovery. Due to severe fragility of the shells (not observed before), more gentle procedures had to applied. In addition, the buffer used for maintaining shell in good state of preservation while storing the sampled had to be adjusted to the fragility of the shells.

Continue with the method development using new techniques for shell density and shell thickness

and relation to CaCO₃ saturation state.