Project information

Keywords
Ocean acidification

Project title
Natural Analogues of an Arctic in Rapid Transition (AnalogueART); The effect of natural temporal and spatial variations in multiple OA drivers (PCO2, salinity and temperature) on the physiology and skeletal properties of benthic and planktonic organisms.

Year
2019

Project leader
Sam Rastrick (IMR), Haakon Hop (NPI)

Geographical localization of the research project in decimal degrees (max 5 per project, ex. 70,662°N and 23,707°E)
Kongsfjorden, Norway 78,928°N and 11,922°E, Austevoll, Norway 60,085°N and 5.622°E, Bangor, UK 53.229°N and 4.13°W

Participants

Agneta Fransson (NPI), Melissa Chierici (IMR), Piotr Kuklinski (IOPAS), Allison Bailey (NPI), Nina M. Whiteley (Bangor University) James Brown (Bangor University), Harada (JAMSTEC)

Flagship
Ocean Acidification

Funding Source

Fram Centre + IMR + NPI

Summary of Results

Further lab analysis of data collected in 2018 has shown in the field, it appears that mechanisms other than Na^+/K^+-ATPase activity are used to maintain haemolymph osmolality in low salinity populations of *G. setosus*, such as organic osmolytes. This appeared to have energetic implications at the cellular level but not at the whole animal level, possibly suggesting changes in efficiency of ATP production upstream of the Electron Transport System. However, other factors that were not controlled for may have obscured potential differences.

In the laboratory, Na^+/K^+-ATPase activity increased after acclimation to low salinity in all populations. This was associated with a reduction in energy budgets at the cellular level, suggesting implications for growth, reproduction and survival. Moreover, this also corresponded to an increase in oxygen uptake rates, but only in individuals from the Mitrahalvøya population. The lack of response in the Blomstrandhalvøya and Kongsvegen populations may have been due to more efficient mitochondrial respiration or trade-offs with other energetically demanding processes. This suggests that they have adjusted to the lower salinities and are physiologically different form the population living in full strength seawater. In all populations, elevated pCO_2 caused an increase in haemolymph osmolality, which may be related to an attempt to buffer haemolymph H^+. In addition to this, there was suppression of oxygen uptake rates, potentially indicating long term implications on growth, reproduction and survival. In conclusion, the ability to cope with salinity in *G. setosus* differs among the different populations at the whole-animal level, and that elevated pCO_2 has little effect (for detailed results see appendix A.

Successfully completed field work in Kongsfjorden collecting metabolic rate, 4 populations of amphipods naturally inhabiting different salinities from 23.6 to 30.9. Two populations (*G. setosus* and) were transported to Austevoll and incubated at 5 different salinities across pCO2 treatments (400 μatm and 1000 μatm) for 4 weeks to test acclamatory capacity. Data will be analysed by Christmas and the paper is planned to be submitted 2020.

For the Management

When the data is analysed it will ultimately help managers understand what physiological characteristics may determine the “winners” and “losers” of OA and related stressors in northern waters.

Published Results/Planned Publications

Published 2018:

Samuel S. P. Rastrick, Helen Graham, Kumiko Azetsu-Scott, Piero Calosi, Melissa Chierici, Agneta Fransson, Haakon Hop, Jason Hall-Spencer, Marco Milazzo, Peter Thor,

and Tina Kutti (2018). Using natural analogues to investigate the effects of climate change and ocean acidification on Northern ecosystems. ICES Journal of Marine Science; doi:10.1093/icesjms/fsy128

Planned publications for 2020

James Brown, Nia M. Whiteley, Allison M. Bailey, Helen Graham, Haakon Hop and Samuel. P.S. Rastrick, Contrasting responses to salinity but not future ocean acidification in Arctic populations of *Gammarus setosus.*

Rastrick et.al. Guides of best practise for natural analogue research

Communicated Results

Workshop at the EMBeR open science meeting in Brest which should lead to a publication "Rastrick et.al. Guides of best practise for natural analogue research"

Further developed the ESSAS AnalogueART WG

Interdisciplinary Cooperation

This will develop as the data is analysed and is planned to be used by other disciplines within the flagship. This project has also sheared data with ocean chemists in WP1 of the flagship

Budget in accordance to results

This project was only possible due to the flagship funding with some time and drift supported by internal IMR funding.

Could results from the project be subject for any commercial utilization

No

Conclusions

Experiments were successfully completed as Data from the experiments and associated lab work will be completed by the end of 2019. This work has helped develop the CEA method and promoted the use of natural analogues in climate change research.