

Project information

Keywords

Ocean acidification; climate change; warming; epigenetics; resilience; adaptation

Project title

Capacity for adaptation in arctic invertebrates to multiple OA drivers (pCO₂, salinity and temperature)

Year

2019

Project leader

Howard Browman

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

60,1216 N 5,44916 E

Participants

Project leader: Howard Browman (IMR)

Participants: Howard Browman (IMR), Haakon Hop (NPI), David Fields (Bigelow Labs, USA), Steve Shema (Grotti, Iceland), Neel Aluru (Woods Hole Oceanographic Institute, USA).

Flagship

Ocean Acidification

Funding Source

Fram = 800 000-

HI = 865 000-

Summary of Results

In 2018, we conducted a pilot experiment with Cladocerans (*Evadne* sp.) and a copepod (*Acartia tonsa*) in short-term (3-4 days) experiments to assess whether an epigenetic response could be observed. The experiments were conducted at 12 and 16 °C and at 500 and 1000 pCO₂. In addition, the metabolic rates of *Penilia avirostris* were measured across a temperature range of 8-16 °C. These experiments have been analysed and three manuscripts are in preparation.

After several months of trials, we succeeded in culturing the marine Cladoceran, *Penilia avirostris*, through several generations. The generation time at 16 °C is 6-7 days.

A multigeneration study on the effect of temperature and CO₂ (12 and 16 °C and at 500 and 1000 pCO₂) on gene expression and epigenetic response in *Penilia avirostris* will be conducted in fall 2019-spring 2020.

Master and PhD-students involved in the project

Not applicable.

For the Management

Marine copepods appear to be resilient to ocean acidification and, within limits, to warming.

Future outcomes of the work will hopefully contribute to estimating the capacity of marine copepods to adapt to climate change.

Published Results/Planned Publications

Aluru, N, D.M. Fields, C. Thompson, S. Shema, A.B. Skiftesvik & H.I. Browman. Gene expression and epigenetic response of the marine Cladoceran, *Evadne nordmanni*, to elevated temperature and pH. In preparation.

Aluru, N, D.M. Fields, C. Thompson, S. Shema, A.B. Skiftesvik & H.I. Browman. Gene expression and epigenetic response of the marine copepod, *Acartia tonsa*, to elevated temperature and pH. In preparation.

Fields, D.M. S. Shema, C. Thompson & H.I. Browman. Temperature responses in the metabolic rate of a marine Cladoceran, *Evadne nordmanni*. In preparation.

Fields, D.M., A.B. Skiftesvik, S. Shema & H.I. Browman. Temperature effects on metabolic rate of *Calanus* spp. In preparation.

Fields, D.M., A.B. Skiftesvik, S. Shema & H.I. Browman. Effect of ocean acidification on the grazing rates of *Calanus* spp. feeding on lithed and delithed coccolithophores. In preparation.

Thompson, C., D.M. Fields, R.M. Bjelland, V. Bina San Chan, C.M.F. Durif, A. Mount, J.A. Runge, S.D. Shema, A.B. Skiftesvik & H.I. BROWMAN. 2019. The planktonic stages of the salmon louse (*Lepeophtheirus salmonis*) are tolerant of end-of-century pCO₂ concentrations. *PeerJ*. 7:e7810. Doi: 10.7717/peerj.7810.

Runge, J.A., D.M. Fields, C. Thompson, C.M.F. Durif, S. Shema, R.M. Bjelland, A.B. Skiftesvik and H.I. Browman. Interaction between temperature and pH on growth and respiration of the planktonic copepod, *Calanus finmarchicus*. In preparation for *Limnology and Oceanography*.

Communicated Results

Not applicable.

Interdisciplinary Cooperation

David Fields - Bigelow Laboratory for Ocean Sciences, USA

Neel Aluru – Woods Hole Oceanographic Institute, USA

Grotti (Steven Shema) – Iceland

These collaborations are essential for the success of the project as they allow the combination of molecular, bioinformatics, behavioural and physiological approaches to be applied to address the hypotheses.

Budget in accordance to results

The project could not be conducted without Fram Centre funding, which is almost 50% of the total and finances the collaborators.

Could results from the project be subject for any commercial utilization

No

Conclusions

a) Indicate future research and/or perspectives which the project results have led to – As described above.

b) List and describe new methods or techniques that have been developed during the project or that the project has revealed a need for – Not applicable.