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UNDERSTANDING DEEP ATLANTIC ECOSYSTEMS

FATE of cold-water coral reefs - identifying drivers of ecosystem change : project overview and synergies with ATLAS

ATLAS 2nd General Assembly

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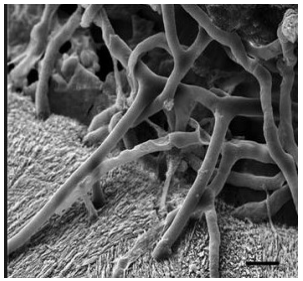
‘FATE’ of cold-water coral (CWC) reefs – identifying drivers of ecosystem change

Enhance knowledge on effects of increased pCO2, increased temperature and food availability on the functioning of CWC ecosystems by studying intra- and inter-annual variability in environmental conditions on the rates of biological and physiological processes of key species associated to CWC

Lophelia pertusa

Mycale lingua

Acesta excavata



Bioeroders

Why?

- All earlier cold water coral OA studies are single species studies (*Lophelia pertusa*)
- Conducted in artificial environments (stable physical environment & unnatural food source and supply)
- Natural variability in env. conditions unknown
- Range of natural variability in biological and physiological response parameters are unknown

Where?

- Field measurements - WP1 & 2

WP1: Biological, geochemical and physical constrains for arctic and boreal CWC ecosystems

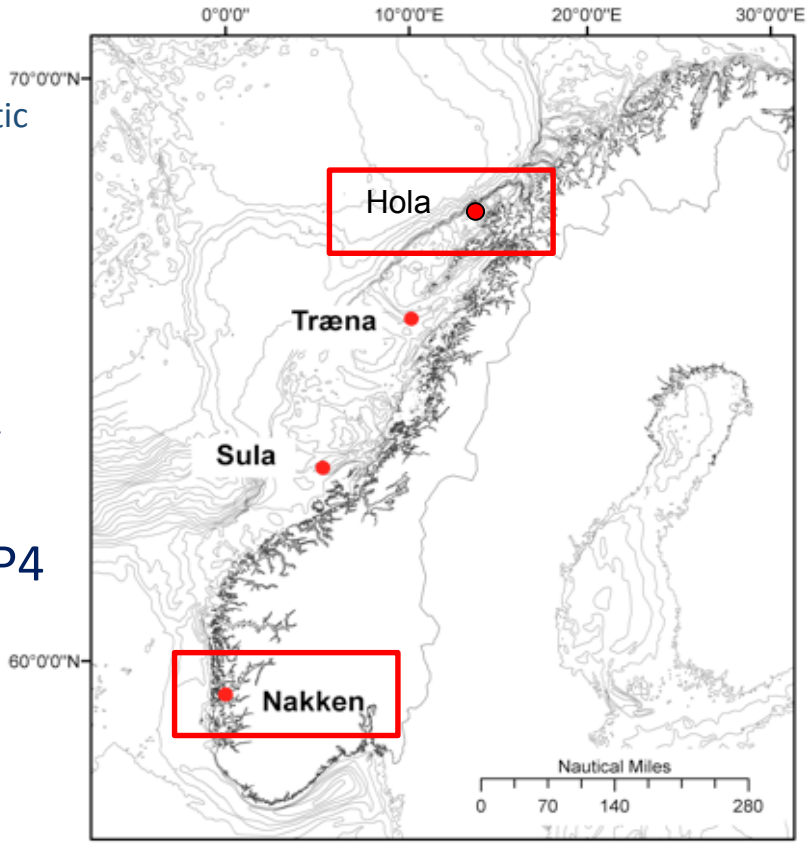
WP2: Spatial and temporal variability in the biology and physiology of CWC fauna

- Laboratory investigations – WP3

WP3: Effects of OA & warming on CWC reef biology, physiology & biogeochemical cycling

- Individual and ecosystem modeling – WP4

WP4: Modelling changes on carbon flow in CWC ecosystems as a result of OA



WP 2 - Assess seasonal and annual variability in the biology and physiology of CWC reef fauna at two CWC sites

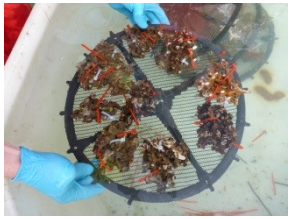
Link biology and physiology of the reef fauna to environmental conditions

Fauna Landers

- Biological sampling of fauna (FA, reproductive output, growth, calcification rates)
- On-board incubations (respiration & feeding)

Bioerosion pyramids

- Bioerosion rates
- Accretion rates
- Reef calcium carbonate budgets



Identify main driving forces controlling **allocation of resources** in the three model fauna and what factors regulate rates of carbonate accretion and degradation under **present** and **future** scenarios

WP3: Effects of OA & warming on CWC reef biology, physiology & biogeochemical cycling

- duration: 1 year experiment
- multifactorial approach of ocean acidification and warming effects
- assessment of community responses taking into account natural variability & seasonality

400 µatm	1000 µatm	1000 µatm + 3°C
h m l	h m l	h m l
h m l	h m l	h m l
h m l	h m l	h m l
h m l	h m l	h m l
h m l	h m l	h m l

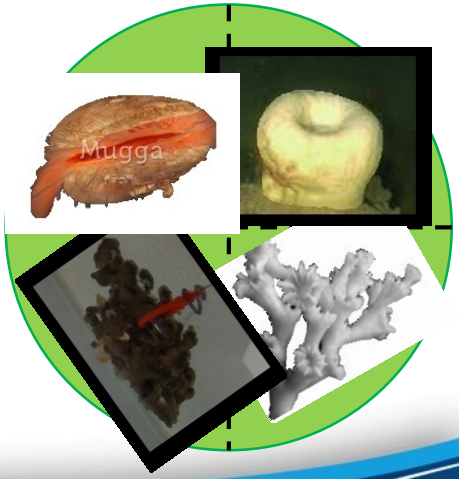
9 treatments
- 5 replicates

h = high food (extra food added using dosing pumps)

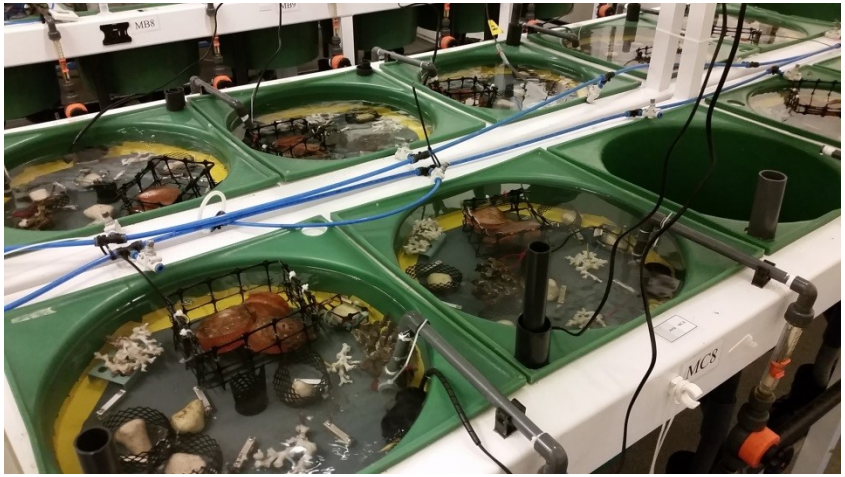
m = medium food (unfiltered deep water, ambient food)

l = low food (filtered deep water)

assessment of physiological parameters of corals (*L. pertusa*) and associated bivalves (*Acesta excavata*), and sponges (*Geodia barretti*), as well as bioerosion rates of dead coral framework



WP3: Effects of OA & warming on CWC reef biology, physiology & biogeochemical cycling



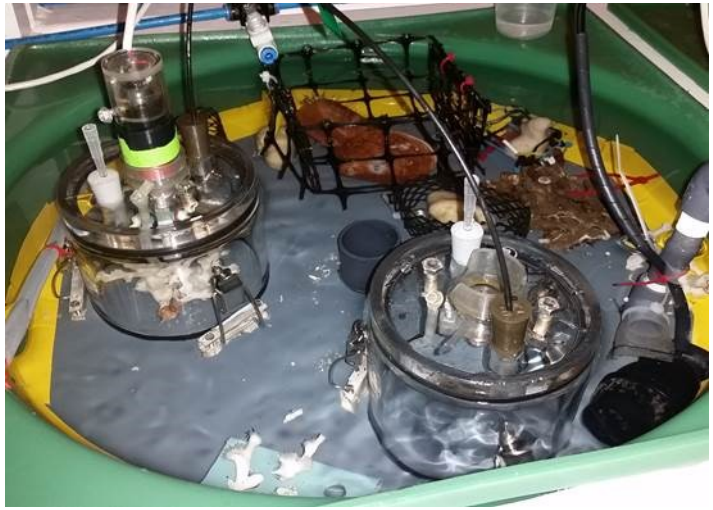
Response variables

- growth rates (buoyant weight)
- bioerosion rates (buoyant weight)
- respiration rates (optodes),

- genetics (gene expression analysis)
- reproduction,
- lipid content and fatty acids

Incubation set-up

- Respiration measurements
- TOC, nutrients, bacteria sampling



Preliminary results:

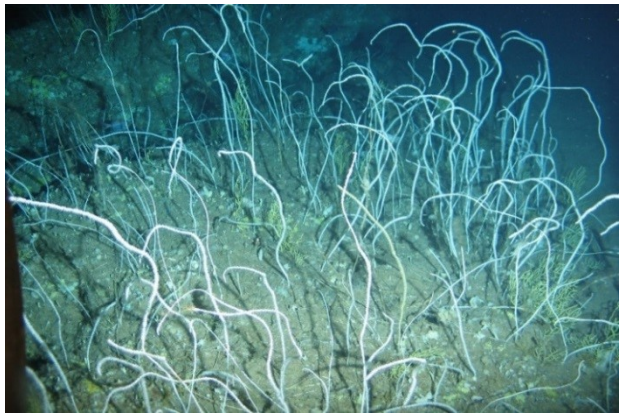
- No apparent change in the physiology of Lophelia pertusa;
- High death rate of *Acesta excavata* in the high pCO2 treatments, some mortality of *Geodia barretii*

Common work topics between FATE and ATLAS

1) Feeding experiments with corals and sponges (isotopic labelled pre-cultured bacteria, algae and zooplankton)

2) Experiments on the interactive effects of OA & warming & food regimes on coral and sponge physiology

FATE



ATLAS

Synergies between both projects

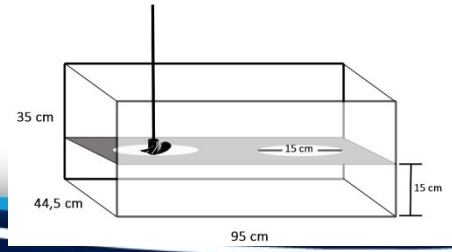
Scientists working on both projects:
Dick van Oevelen (feeding experiments, modelling)
Marina Carreiro-Silva (coral physiology experiments)

PhD Students:
Maria Rakka (Uazores) – food selectivity experiments (isotopically labelled food sources) and experiments on OA & temperature & food regimes

Azores - Gorgonian *Dentomuricea meteor*, black coral *Antipathella wollastoni*
Norway – Gorgonian *Primnoa resedaeformis*

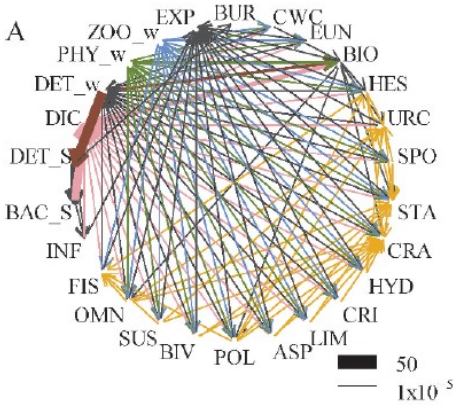
Stephanie Leiffmann (UEdinburgh) – food competition experiments between different species under altered flow speed regimes and food concentrations, and in present and predicted future conditions

Azores - Gorgonian *Dentomuricea meteor*, black coral *Antipathella wollastoni*
Norway – scleractinian *Lophelia pertusa*, sponge *Geodia barretii*



Synergies between both projects

The objective of this collaboration is to **broaden the scope of the results obtained by both projects** by **modelling** the **projected impacts of global climate change** in two of the most important deep-sea habitat types in NE Atlantic, **cold-water coral reefs** and **coral gardens**, contributing to a better marine spatial planning of these habitats at the regional and ocean basin scales (**WP2, WP3, WP6**).



van Oevelen et al (2009)

Thank You!

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Image credit: BGS