Workpackage 2 – Functional Ecosystems

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Rationale:

Adaptive ecosystem-based management approaches require an understanding of ecosystem function, distribution and connections and how these may be altered by changes in food supply, climate and resource exploitation.

Environmental conditions and external factors from field observations and model predictions

Physiological responses from laboratory experiments

WP2 objective:

Develop a new class of predictive modelling tool that integrates externals and ecosystem functioning at management relevant spatial scales

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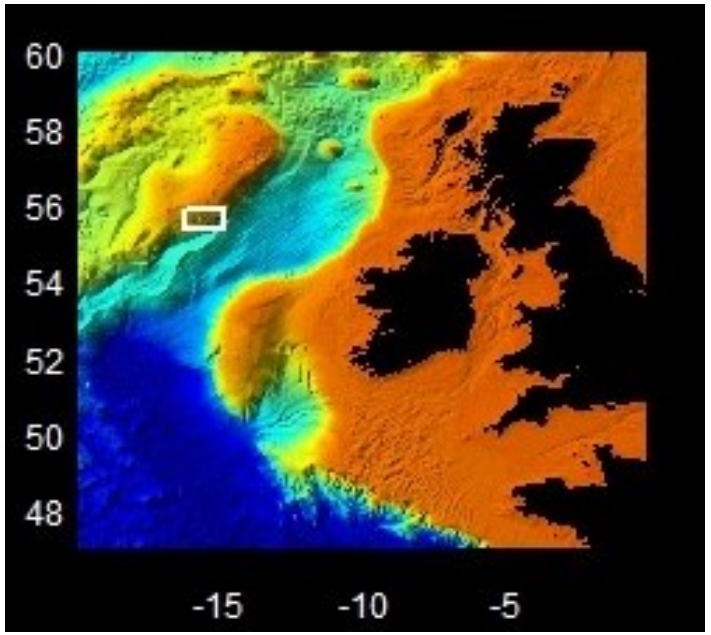
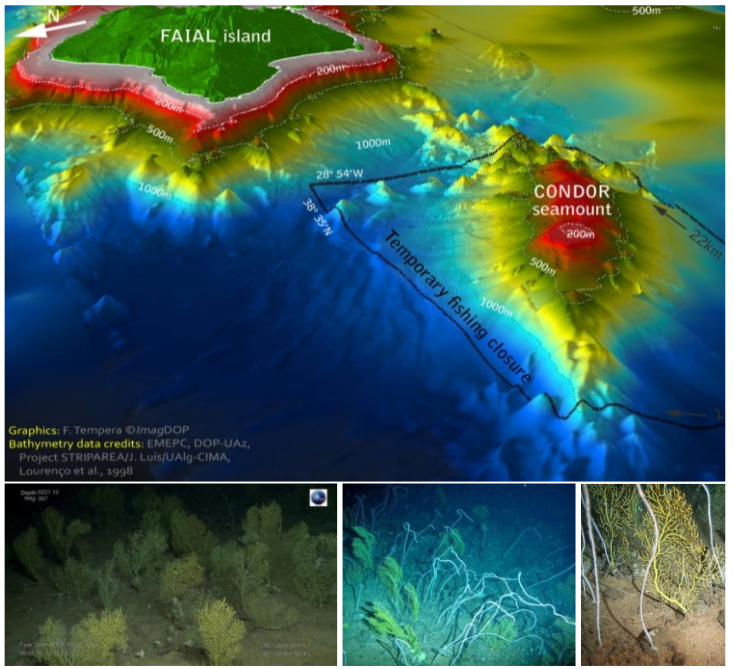
Rockall Bank



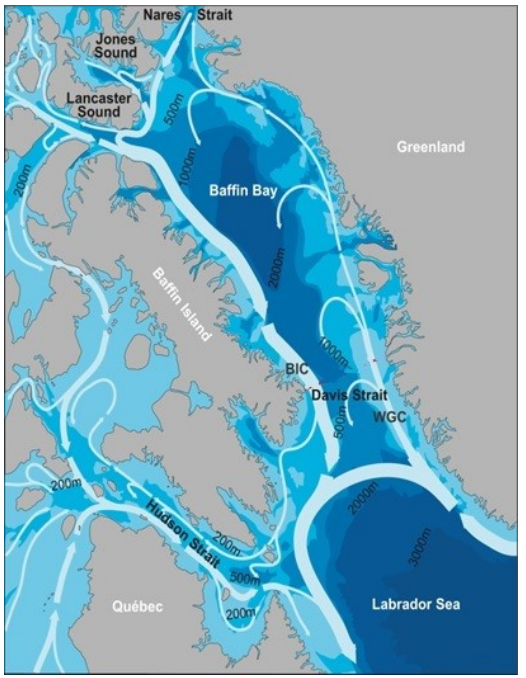
- Large coral mounds
- 600 m deep
- High data availability
- Existing models

Condor Seamount



- Coral gardens
- 200 m deep
- High data availability
- Closed for fishing

Davis Strait



- Sponge grounds
- Background data
- Cruise opportunities

Task 2.1 Identify hydrodynamic controls and organic matter supply - NIOZ (M1-M36): Hydrodynamic models will be developed for each Case Study using ROMS (Regional Ocean Model System) based on seafloor topography and basin-scale boundary conditions of AMOC and N Atlantic gyres (WP1). Hydrodynamics and OM transport will be validated with ADCP deployments.

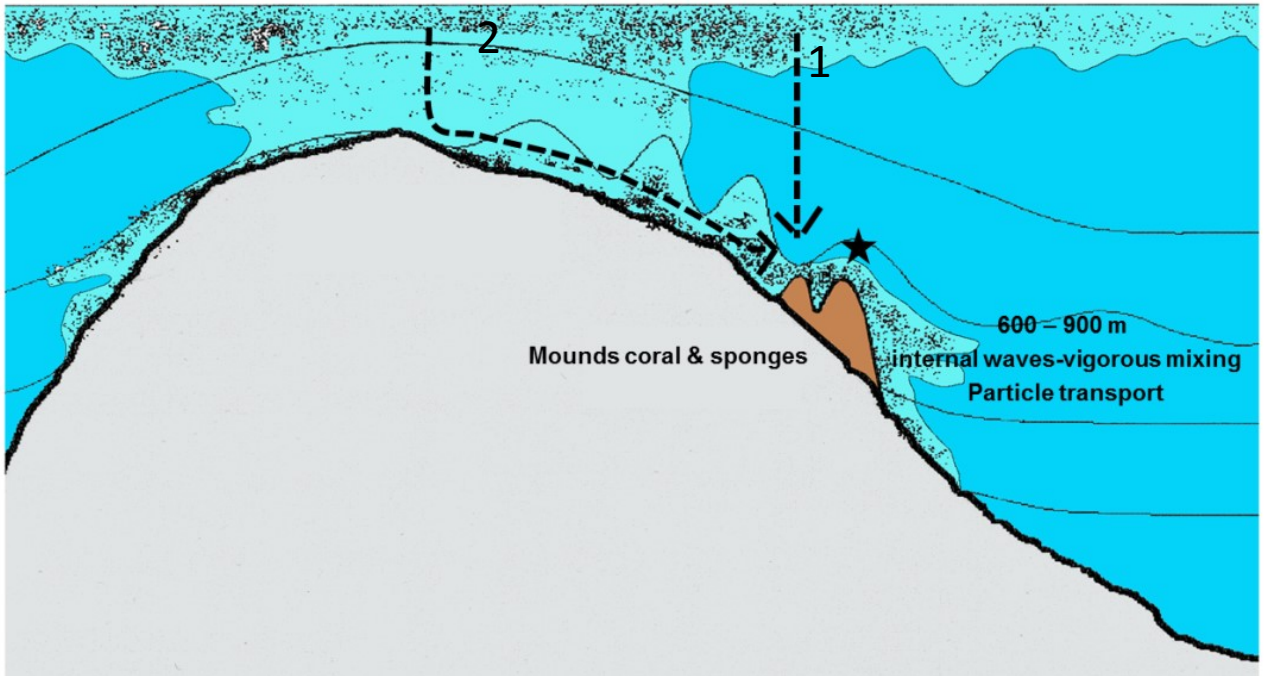
Task 2.2 OM characterisation and mineralisation - ULIV (M1-M38): Fauna and near-seafloor OM characterised and biomarker analyses performed to determine phytodetritus/zooplankton OM contributions. Total community OM mineralisation will be measured using deployments of the EC system to derive ecosystem-scale oxygen fluxes.

Task 2.3 Experimental physiology - UAZO (M1-M36): Assumed relationship between fatty acid composition of food and faunal tissues will be validated feeding with isotopically labelled organic matter (^{13}C and ^{15}N). Assumed differences in food uptake between active (sponge) and passive (coral) filter feeders will be validated using isotopically labelled food. Interactive effects of OM supply and ocean acidification on organism physiology will then be quantified.

Task 2.4 Development of integrative models - NIOZ (M3-M40): Tasks 2.1-2.3 outputs will be integrated into new coupled hydrodynamic-biogeochemical-physiological models that predict near-bed OM, biogeochemical impacts and biomass of sensitive marine ecosystems at regional management scales.

ATLAS cruise to Rockall Bank (24-April to 12-May):

1. **Quantify carbon and nutrient cycling to determine organic matter utilization of the reef community**
2. **Determine benthic-pelagic coupling to identify food supply mechanism(s)**

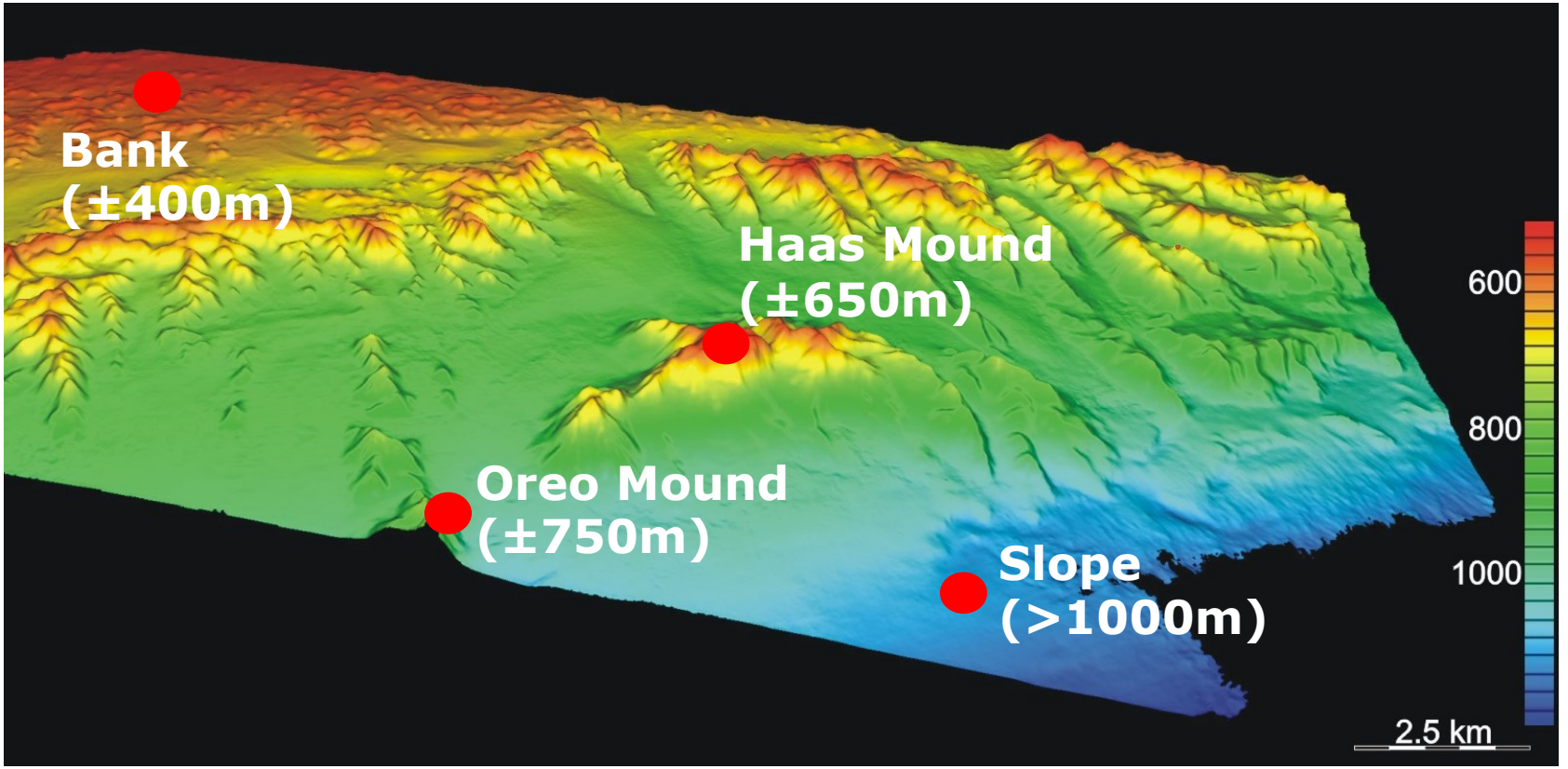


<u>Two hypotheses for food supply at Rockall bank</u>:

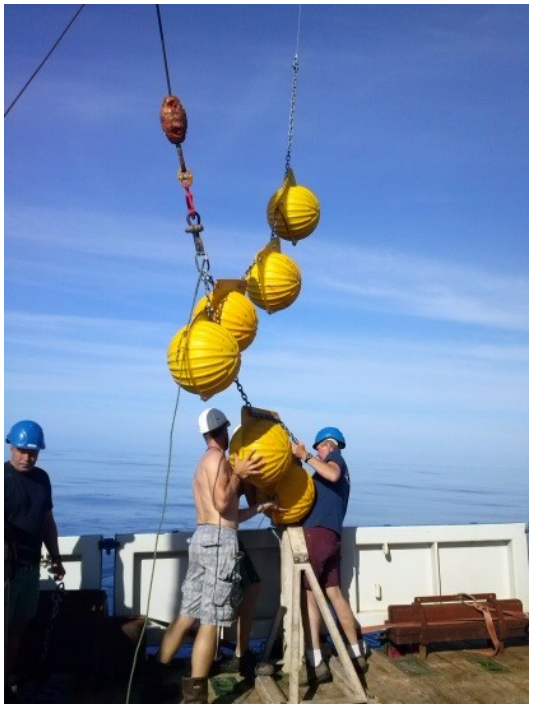
1. Episodic downwelling of surface-derived organic matter

2. Production on shallow Rockall Bank and subsequent cross-slope transport

Cruise activities:



Cruise activities:



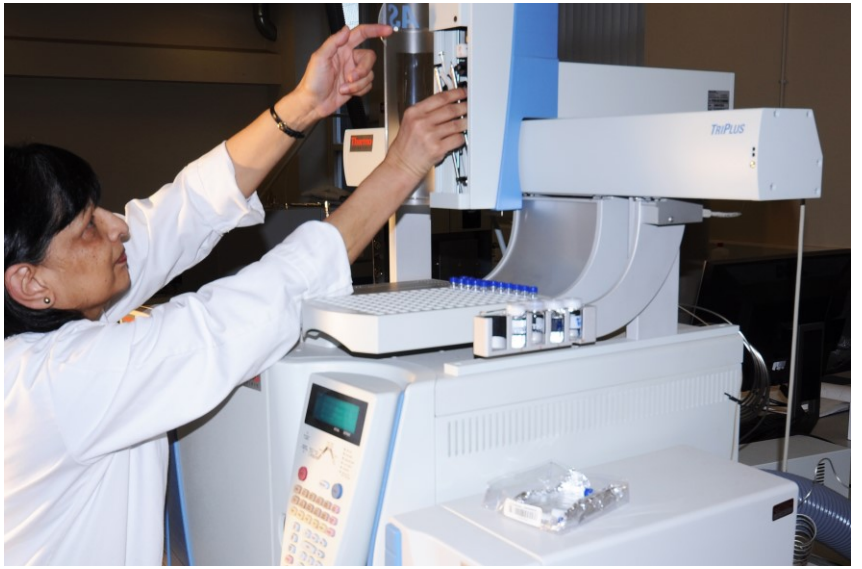
1-year mooring deployment on shallow bank and Orea Mound (sediment trap, ADCPs, fluoresence sensor)

Short-term thermistor string mooring at Haas Mound

Cruise activities:

SAPs deployed as close to sea floor as possible

IR-GCMS analysis

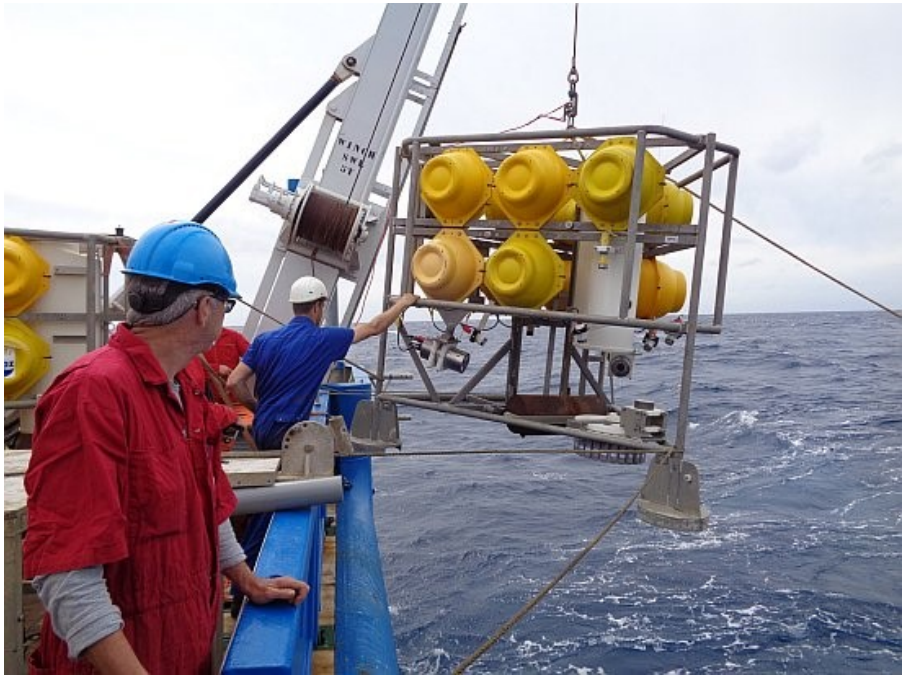


Cruise activities:

ROV Genesis:

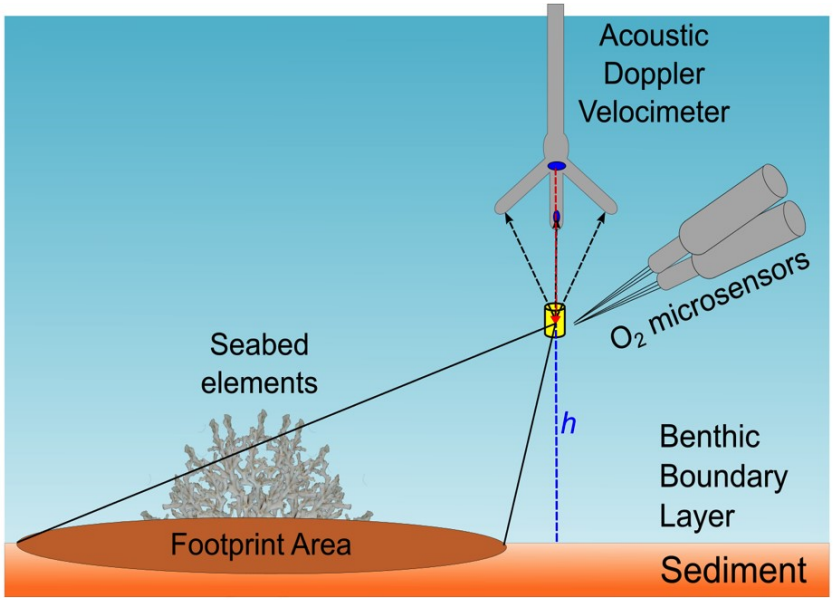
1) Seafloor mapping
2) Fauna sampling for analysis and onboard experimentation
3) Measurement of oxygen dynamics *within* the reef framework

Cruise activities:



Repeated 1-day deployments of ALBEX lander:

1) oxygen fluxes with Eddy covariance
2) nutrient / DOM concentration gradient above the reef



Background on Eddy covariance method

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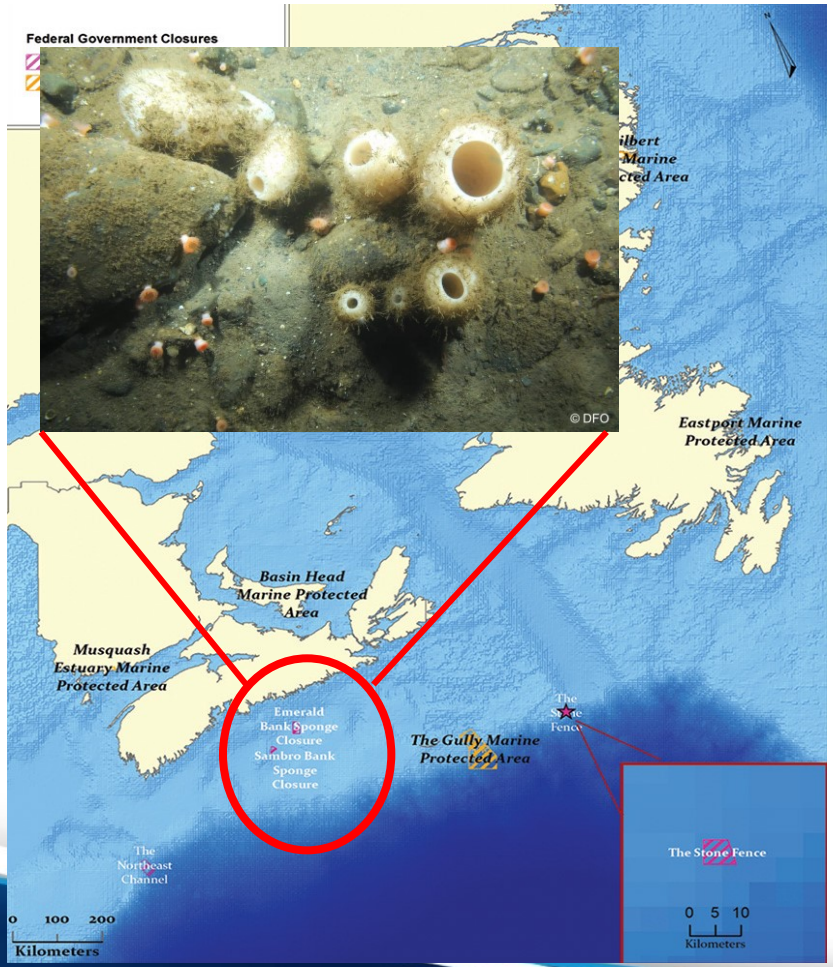
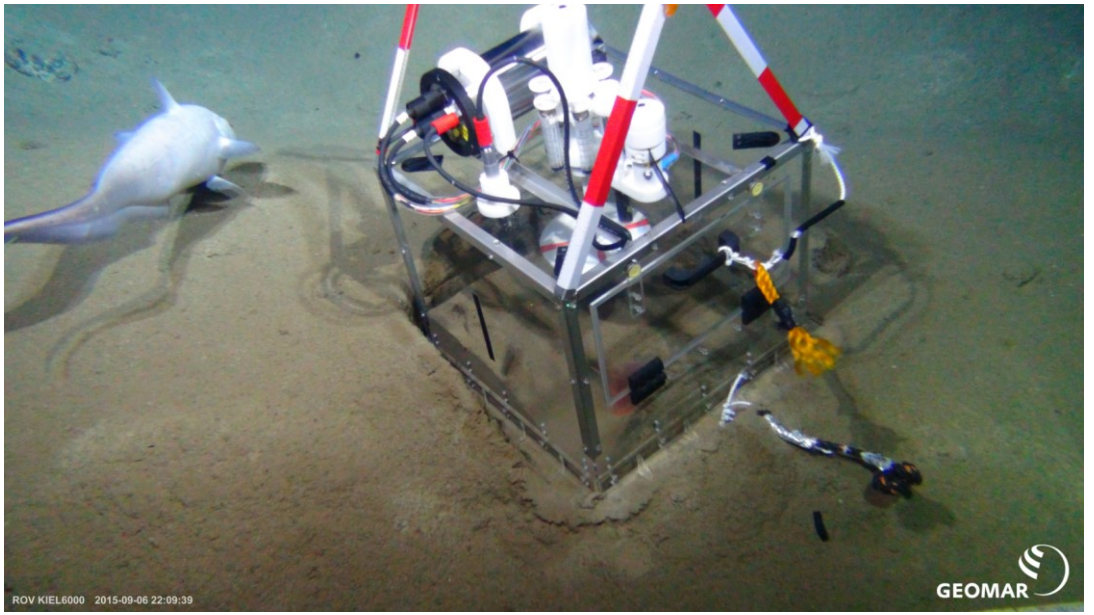
1-week SponGES and ATLAS cruise with RV Hudson (July 2017) to Vazella grounds (glass sponges) off the coast of Halifax (PI Ellen Kenchington)





ROV Ropos will be used to place incubation chambers on the seafloor to measure in situ oxygen and nutrient fluxes

NIOZ

Physiological response of *Lophelia pertusa and Madrepora oculata* under Mediterranean and Atlantic water conditions

Núria Viladrich, Juancho Movilla, Maria Rakka, Cristina Gutiérrez, Alberto Aparicio, Covadonga Orejas, Andrea Gori

Aim

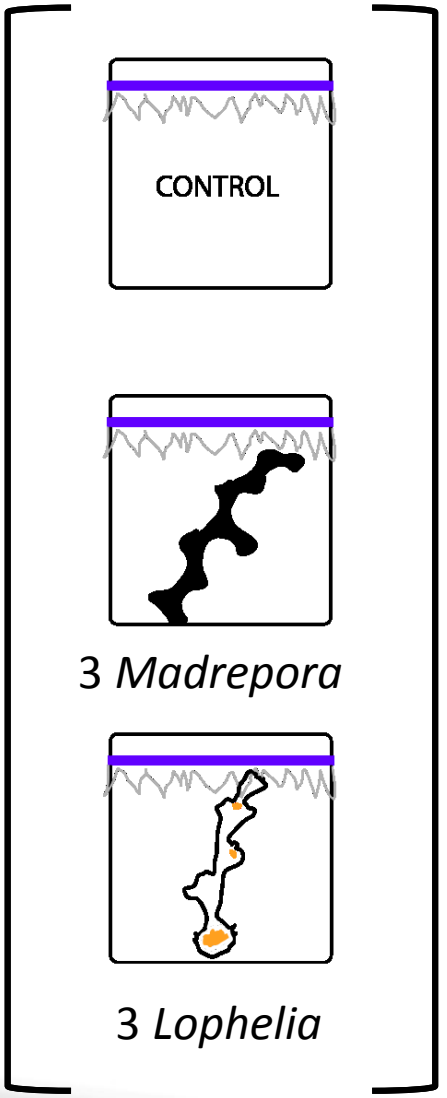
Assess how *Madrepora oculata* and *Lophelia pertusa* behave under the influence of two water bodies with different physico-chemical conditions, the Mediterranean (warmer, saltier and more alkaline) and the Atlantic water (lower temperature, salinity and alkalinity)

Methods

Treatments

Atlantic water
7ºC

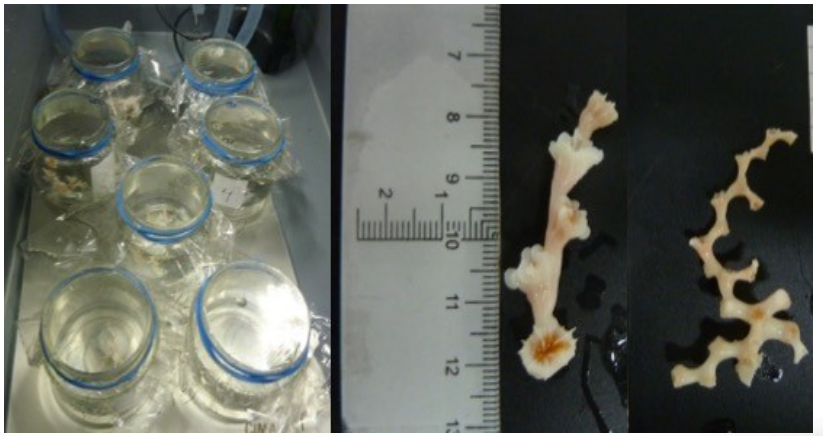
Mediterranean water
11ºC



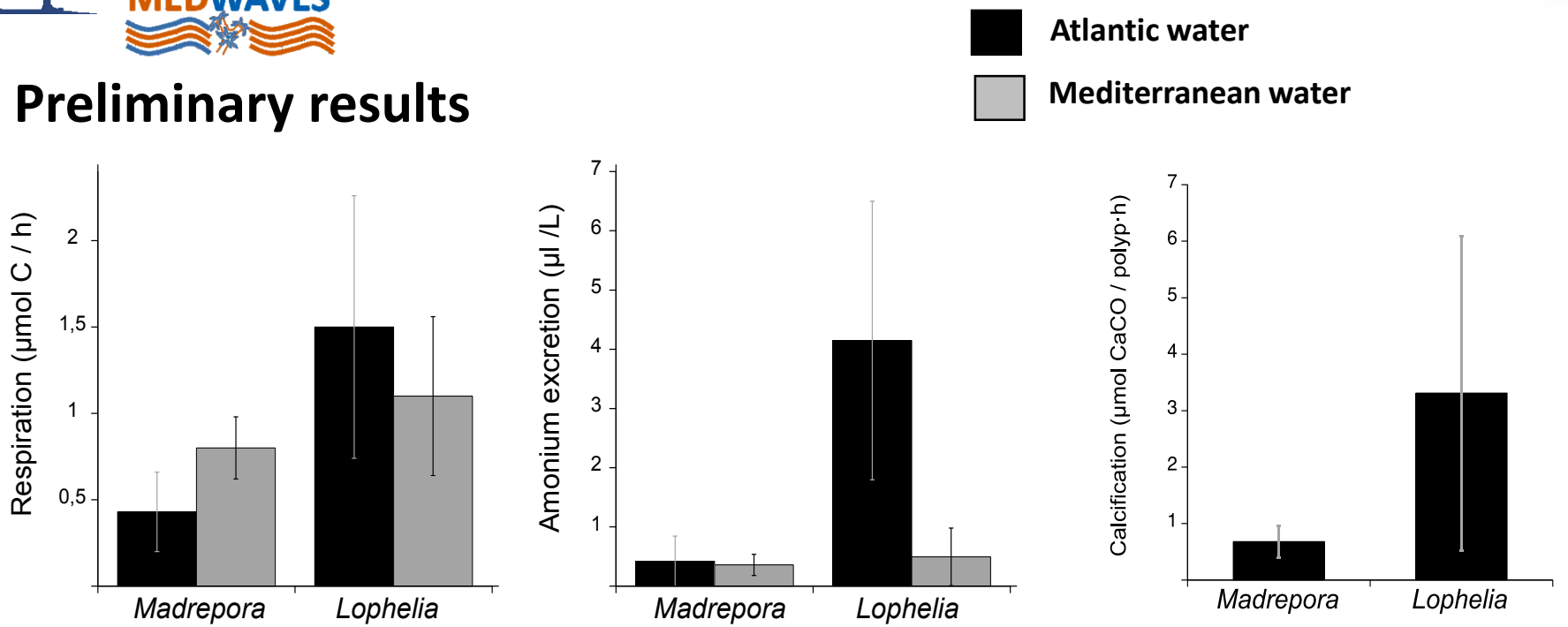
Parameters analyzed

At T_{0h} y T_{6h}:

- **O_2 concentration**
- **NH_4 concentration**
- **Total alcalinity**



Preliminary results



- In general, *L. pertusa* presents higher respiration and calcification rates than *M. oculata*
- The physiological response does not show any significant difference under the influence of the two water bodies
- The results obtained for ammonium excretion by *L. pertusa* show high values that will have to be double checked

Number	Description	Month	Lead
D2.1 ✓	Compilation of existing physiological data on CWC response to different conditions of food supply and oceanographic change scenarios	M8	IEO
D2.2	Detailed analyses of uptake of different food sources into the tissue of key habitat-forming species from isotope experiments	M24	
D2.3	Report on in situ hydrodynamics, abiotic variables, and suspended particles near the seafloor and sedimenting particles from bottom traps. Fluorescence and backscatter data reported as proxies for phytodetritus and zooplankton	M30	NIOZ
D2.4	Experimental data on the physiological response of different D2.5 types of benthic communities under predicted environmental changes including ocean acidification, temperature and food supply	M33	IEO
D2.5	Biogeochemical characterisation (lipid and amino acid composition) of the OM and faunal at the different study sites	M33	ULIV
D2.6	Community respiration rates based in situ O2 consumption rates as a function of location, season, C supply and community characteristics	M36	USD
D2.7	Quantitative assessment of near-seafloor flow dynamics and physical drivers of food availability based on high-resolution hydrodynamic modelling to verify use of VIKING20 in SDMs to proxy food supply	M38	AU
D2.8	Integrative and coupled model based on hydrodynamics, D2.8 biogeochemistry and physiology for the prediction of biomass and biogeochemical dynamics, projections under future oceanic conditions and marine spatial planning	M40	NIOZ

Schedule for WP2 session:

11.55-12.05	Marina Carreiro-Silva (IMAR-UAC)	FATE of cold-water coral reefs- identifying drivers of ecosystem change: project overview and synergies with ATLAS
12.05-12.15	Maria Rakka (IMAR-UAC)	Feeding biology of habitat forming CWC: preferences and assimilation efficiencies of selected food sources
12.15-12.25	Ingunn Nilssen (Statoil)	The Lofoten-Vesterålen Ocean observatory: Understanding behavioural response of benthic organisms from long-term multi-sensor data
12.25-12.35	Christian Mohn (AU)	WP2 Case Study Area Modelling: Concepts and Status. Closure + announcement of breakouts

Thank You!

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