Aim 3: Determining the effects of ocean acidification on the overall function of key benthic habitats

Co-ordinated by Prof David M. Paterson, St Andrews University

Aim 3 Tasks

Aim 3 will build on the understanding generated from experimental studies to predict the impacts of OA and warming on the functioning of key benthic habitats. Each task will focus on a specific benthic habitat:

Task 3.1 – Sediment habitats

Task 3.2 – Calcifying biogenic habitats

Task 3.3 – Rocky intertidal habitats

Task 3.1 – Sediment Habitats

Silvana Birchenough, Ruth Parker, Julie Bremner, John Pinnegar, Finlay Scott and Clare Coughlan

H_0: Future high CO_2 scenarios will have no significant impact on the functioning of sediment habitats

Aims of the task:

1. To map baseline fauna and function assessment

2. OA impact meta-analysis & statistical modelling

3. Dynamic ecosystem modelling

Cefas

3.1 Progress so far…

Aim 1: *Mapping baseline fauna & function assessment*

- Ongoing desk-based work: identification of existing data sets (1950-1955, 1986 and 2000) for North Sea species and their physical variables.
- Gathering traits to classify species (biological traits Analysis (BTA) for assessing function change
- Key functions based on key mediated biologically mediated ecosystem processes (bioturbation, bioirrigation, production)
- Key commercial species (Cefas: DAPSTOM database)
- Cefas' workshop to work-out data sets and map fauna and function (13/01/11)
- Linking with other OA colleagues (NERC consortium) for physical data

3.1 Progress so far…

Aim 2: OA impact meta-analysis & statistical modelling
•Interactions with colleagues on model developments (J. Blackford)

Aim 3: Integrated regional modeling
•Requires input from aims 1 and 2

Aim 4: Empirical GIS modelling:
•Requires input from aims 1 and 2

Cefas

Task 3.2 – – Calcifying, biogenic Habitats

Dr Murray J Roberts (Heriot –Watt University) and
Dr Nick Kamenos (Glasgow University) , Dr Seb Hennige

H_0: Future high CO_2 scenarios will have no significant impact on the functioning of cold-water corals

Aims of the task:

1. Field observations of Mingulay Reef and deep Rockall Bank
2. Laboratory studies of changes in maerl habitat structure
3. Laboratory studies of mearl habitat provision

Cefas

3.2 Progress so far…

Aim 1: Field observations of Mingulay Reef and deep Rockall Bank

- Sea-going respirometers (*L. pertusa*) ordered
- Baseline eddy correlation & benthic chamber study (maerl) deployed
- 2011 *L. pertusa* collection cruise linked to pelagic OA consortium cruise

Baseline survey
Prior to
collection:

Loch Sween

3.2 Coralline algae – *Lithothamnion glaciale*

University of Glasgow

- •Baseline survey prior to collection
- • Collected from Loch Sween
- • Incubation at University of Glasgow
- • Assess OA impacts on: Growth, calcification, dead skeleton dissolution, geochemical composition & photosynthetic capacity

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pCO_2	Temperature °C
380 ppm	Ambient
	Ambient +2
750 ppm	Ambient
	Ambient +2
1000 ppm	Ambient
	Ambient +2

3.2 Progress so far…
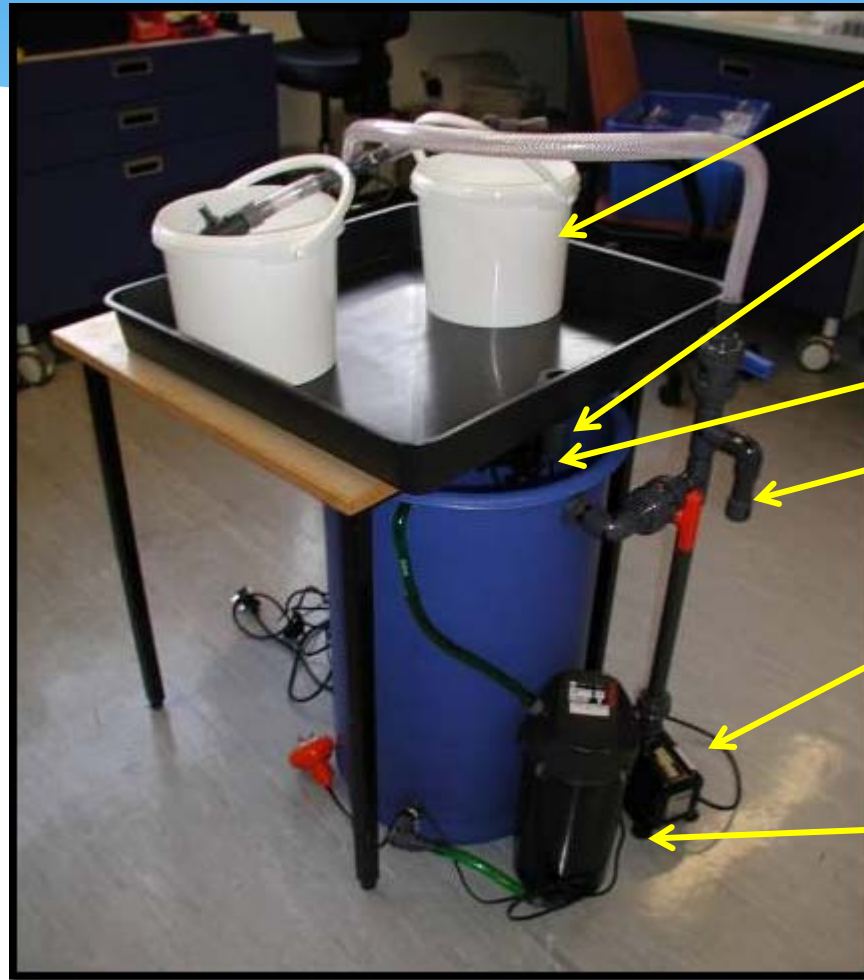
Aim 2. Changes in maerl habitat structure

- To be implemented: Employing new laboratory set-up (HW)

Aim 3. Habitat provision

- To be implemented: Employing new laboratory set-up (HW)

3.2 Prototype Development

- 20 systems in new CT room

- CO_2 mixed with CO_2 free air and three concentrations pumped into CT room

- pCO_2 to be bubbled into each sump

Replicate 'coral tanks' x 4

Heater and Temperature controller

Protein skimmer

Alarm

Pump

Filter

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3.2 Impact of OA on cold-water corals 18 month exposure plan

Parameters to be measured every 3 mo:
- Metabolic rates
- Growth
- Calcification
- Dissolution of dead skeleton

Parameters to be measured daily/weekly:
- TA
- pH
- Nutrients

pCO2	Temp	No. of Systems	No. of nubbins
380 ppm	9°C	4	4 (3 live, 1 dead)
750 ppm	9°C	4	4 (3 live, 1 dead)
380 ppm	12°C	4	4 (3 live, 1 dead)
750 ppm	12°C	4	4 (3 live, 1 dead)
1000 ppm	9°C	4	4 (3 live, 1 dead)

Task 3.3 – Rocky Intertidal Habitats

Dr Nova Mieszkowska (Marine Biological Association)

H_0: Future high CO_2 scenarios will have no significant impact on the functioning of rocky shores

Aims of the task:

1. To develop ecological forecast models capable of predicting the status and functionality of rocky intertidal systems in response to increased temp and decreased seawater pH

2. Formally compare the performance of these models using information theoretic models

3.3 Progress so far…

Aim 1. Ecological forecast models

• MarClim surveys have been completed at long-term sites around the UK in 2010 (Mieszkowska and Burrows) , data is ready for input into te developing models.

Aim 2. Compare the performance of these models

• Input from aim 1 required: Formal comparison of model performance will be achieved using information theoretic methods (AIC-based) using goodness of fit.

•Dialogue and discussions on model design and data input between Nova Mieszkowska (MBA), Mike Burrows (SAMS), Helen Findlay (PML) and Jerry Blackford (PML) have been continuous throughout this first phase.

Benthic systems