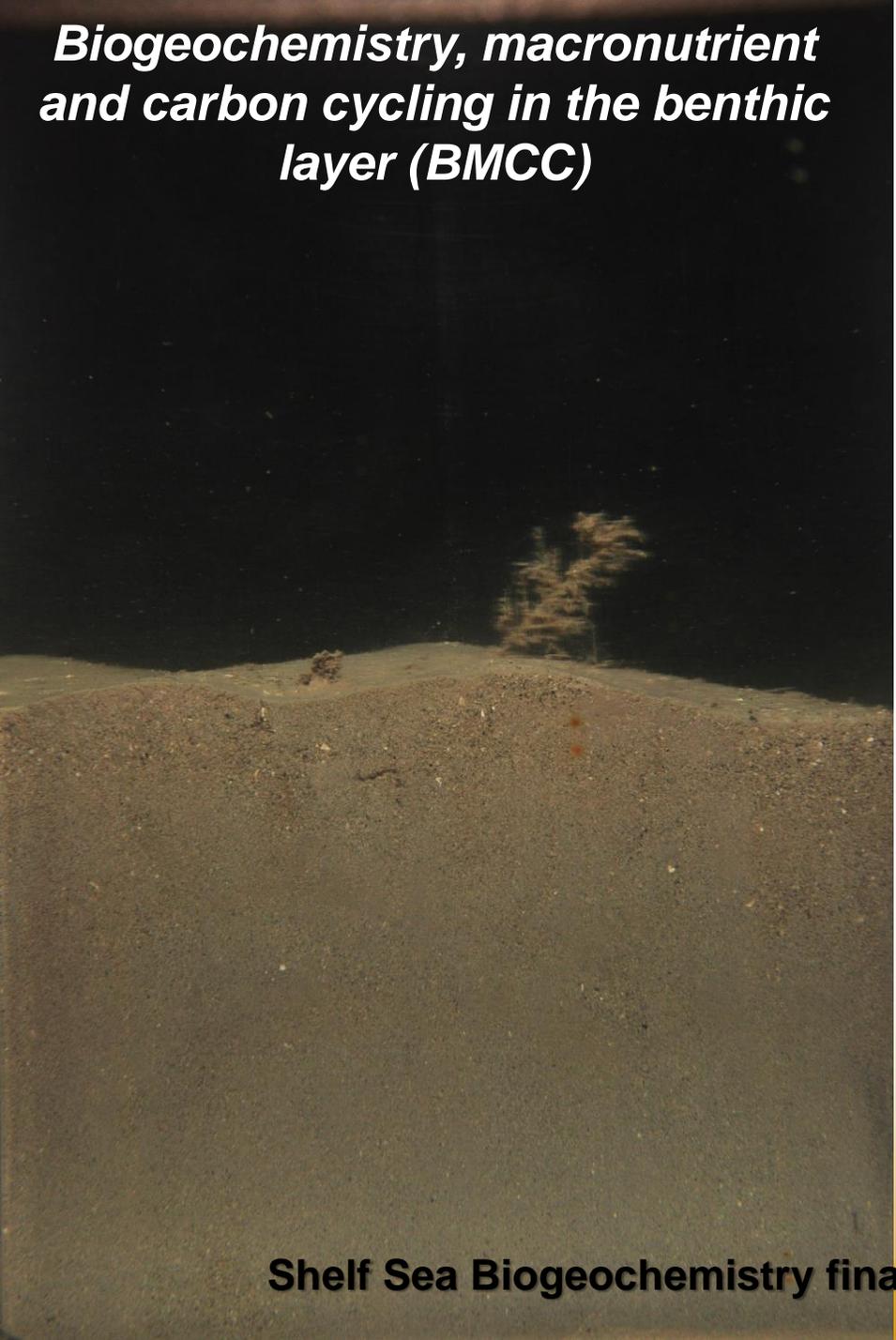


***Biogeochemistry, macronutrient
and carbon cycling in the benthic
layer (BMCC)***



WP2 Overview

Martin Solan

TEAM

Southampton

CEFAS

NOC-S

NOC-L

PML

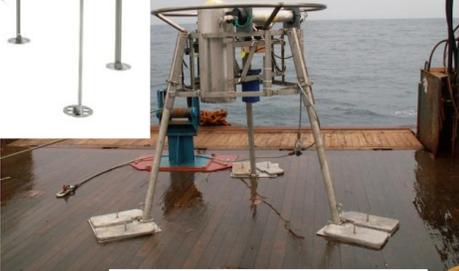
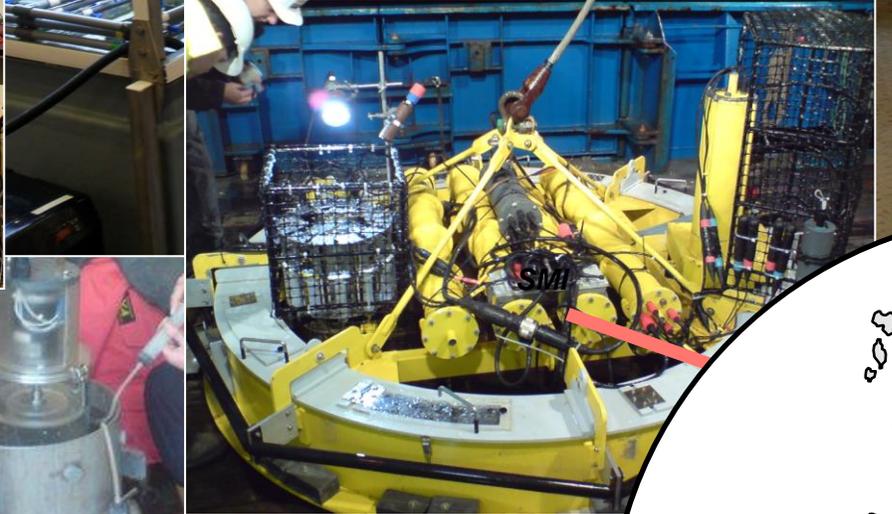
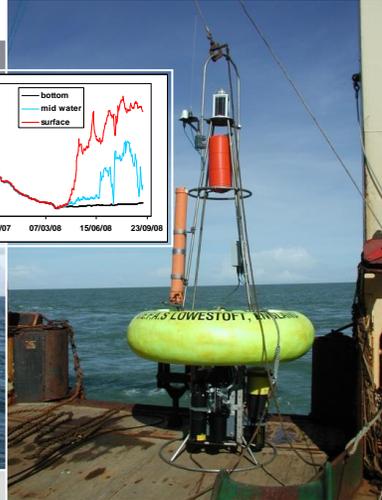
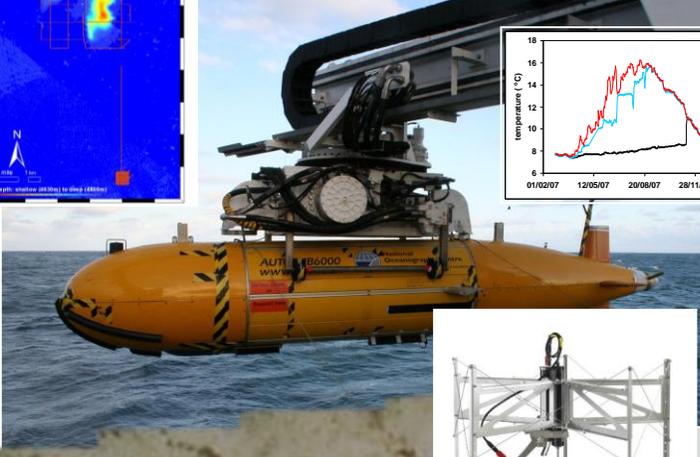
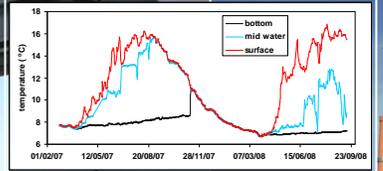
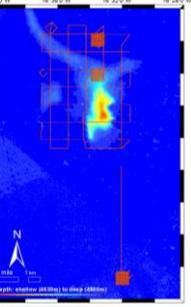
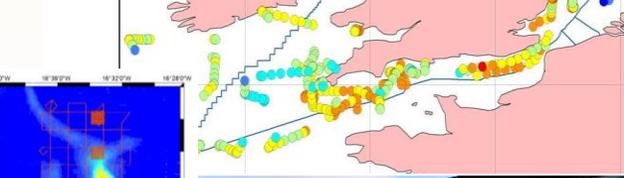
Portsmouth

Bangor

SMI

(Hull)

(Aberdeen)

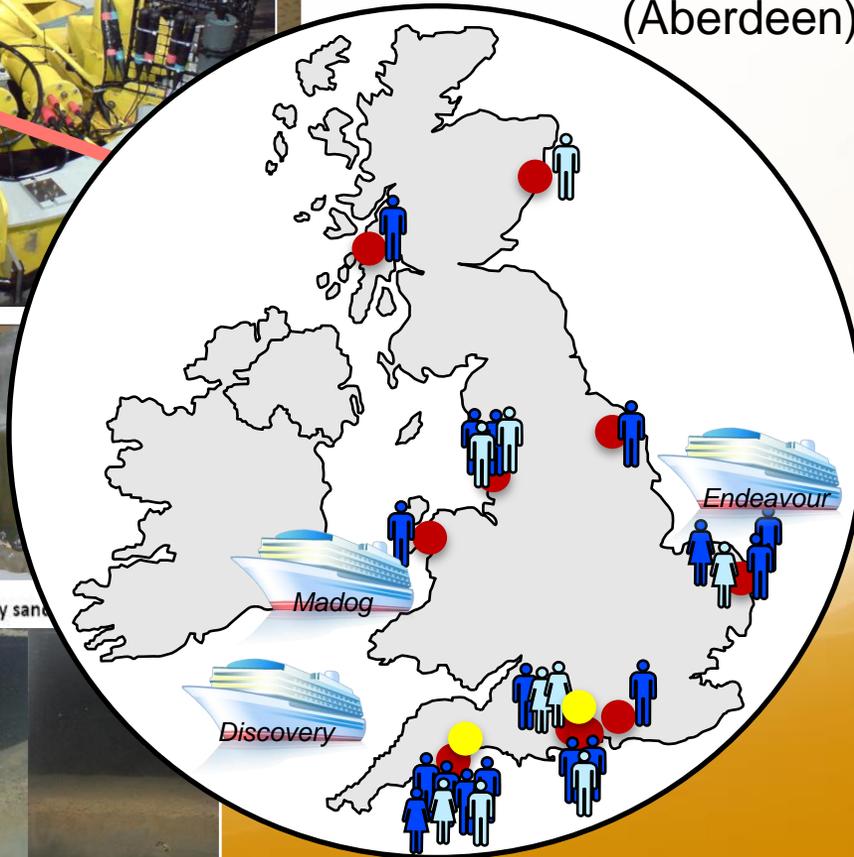
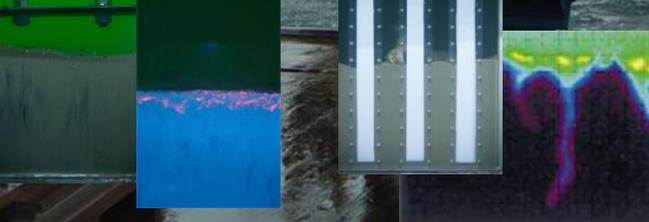


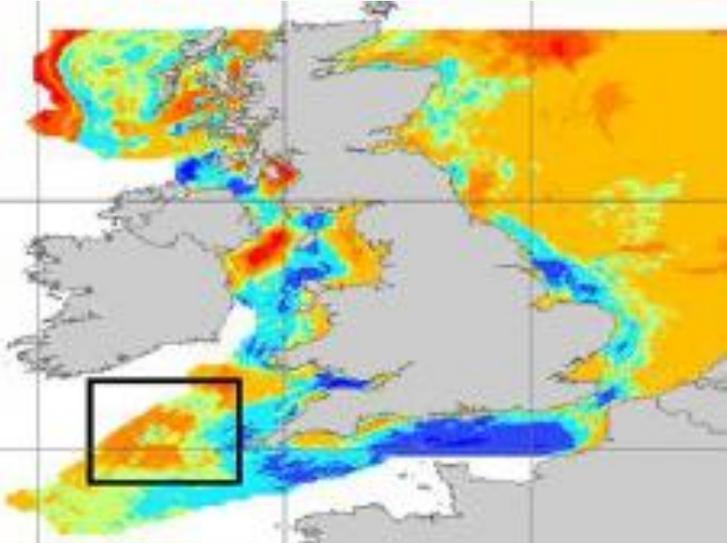
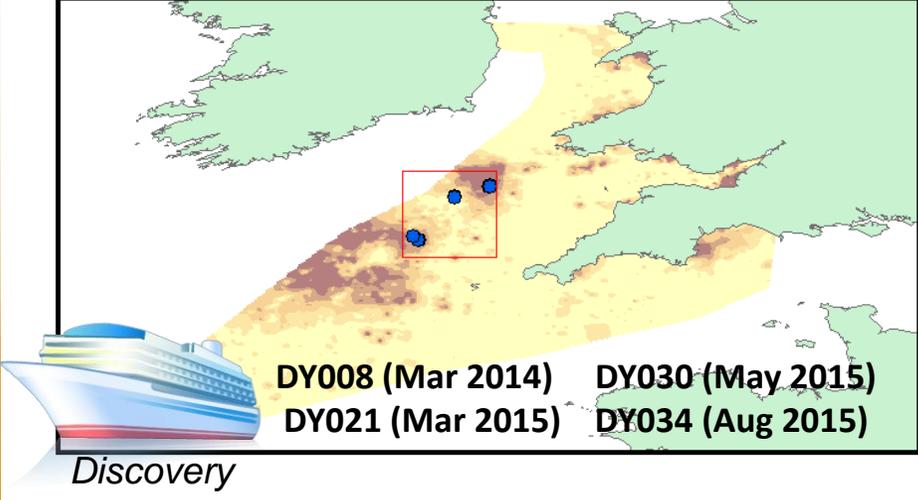
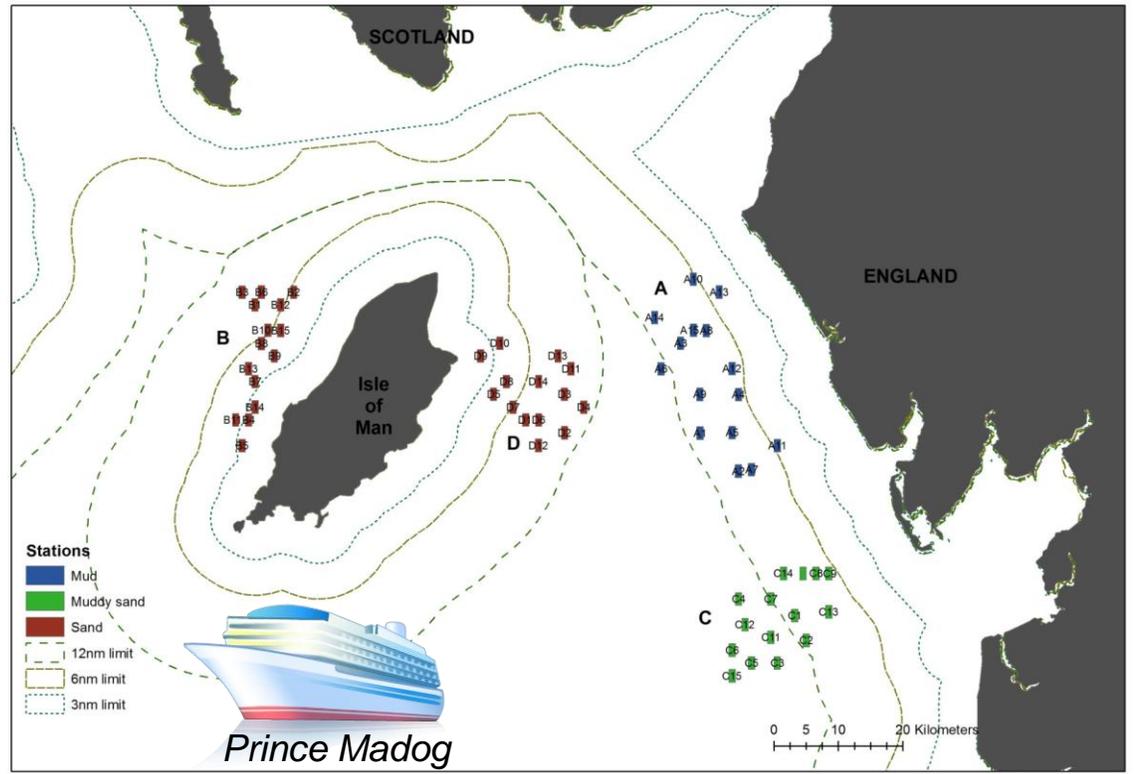
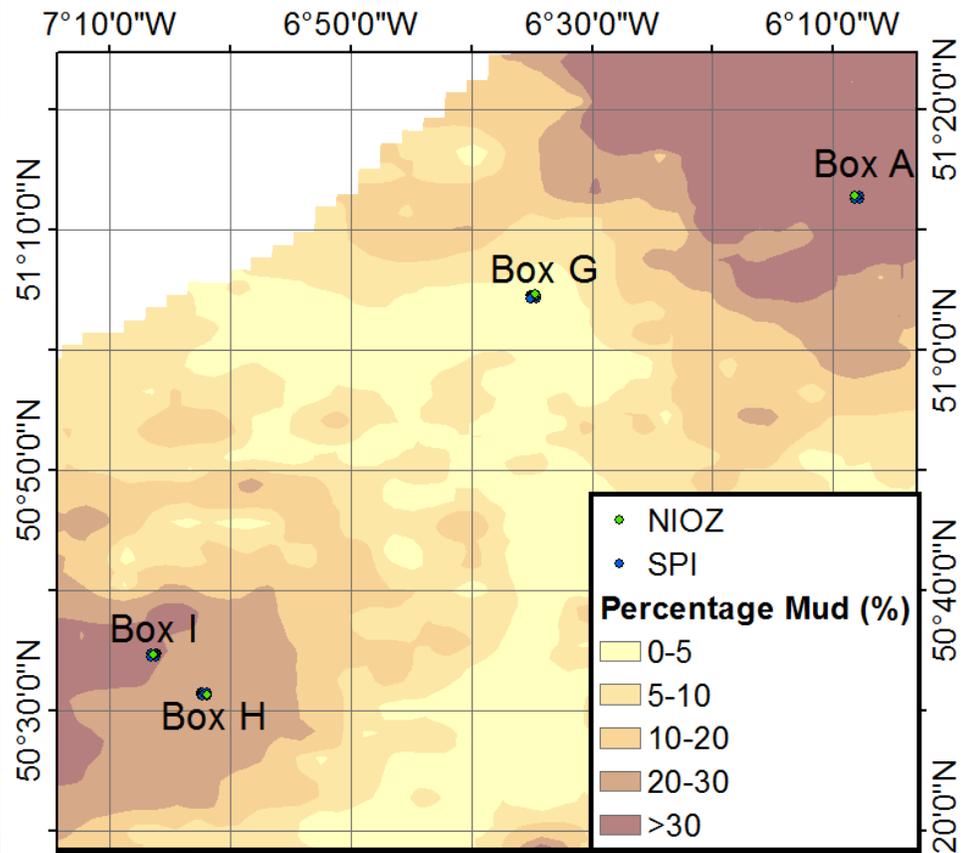
(Sandy, no fines)

(muddy, bioturbation, aRPD 2-6cms)

(muddy sand, aRPD 2-4cms)

(deep, muddy sand)





Biogeochemical cycling of sediment
N, P, Si and C [M1]

SSB stocks and flows } microbial and faunal structure
temporal and spatial variability
quality and quantity of organic material
impact of trawling, tidal currents or storms

C & N within detrital and biological pools
burial of organic and inorganic C
model long-term C storage under different scenarios

Role of sediments in C storage [M2]

infaunal contributions to C and nutrient dynamics
cohesive and non-cohesive / natural and anthropogenically disturbed (trawling)
Role of macrofauna and impacts of natural and anthropogenic disturbance [M3]

exchange of nutrients and C across the sediment-water interface
near-bed processes and temporal variability in sediment-water column exchange
Effects of alternative hydrodynamic and environmental futures

Impacts of sediment resuspension and near-bed current flow [T4]

Observations – Experiments - Modelling

Shelf Sea Biogeochemistry

N, P, Si and C cycling
Short to long term C storage



Effects of environmental, seasonal and stochastic events on rates, processes, controls

Role of natural and anthropogenic disturbance
Microbial-macrofaunal coupling

Climate change

- 4 Celtic Sea cruises
- 2 Irish Sea cruises

- 50 milestones
- 11 deliverables

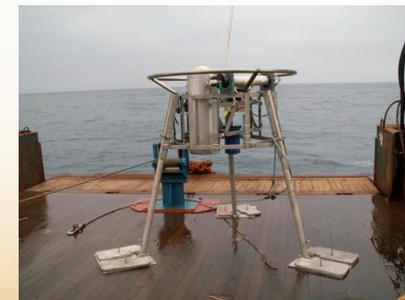
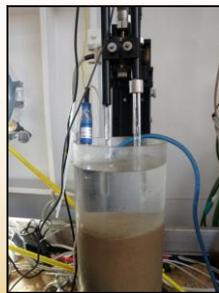
- > 100 datasets published
- Publications
- Outreach programme

+ PhD candidates + 2 supplemental bids (climate & microbial) + several workshops (UK & Canada) + placements

Biogeochemical cycling of sediment
N, P, Si and C [M1]

**SSB stocks
and flows** } microbial and faunal structure
temporal and spatial variability
quality and quantity of organic material
impact of trawling, tidal currents or storms

- Spatio-temporal patterns of fresh organic matter remineralization, benthic bacterial biomass and bacterial respiration - Dan Mayor et al.
- Benthic nitrogen cycling and variation in structure, diversity and abundance of microbial communities - Vas Kitidis et al.

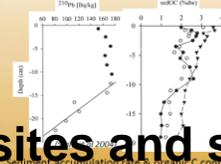
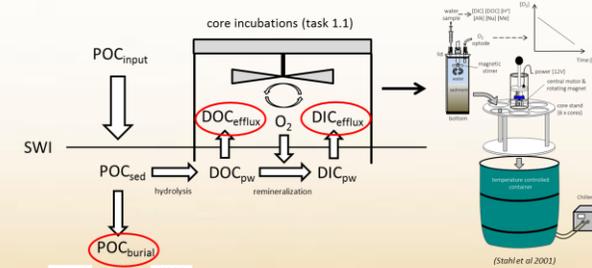
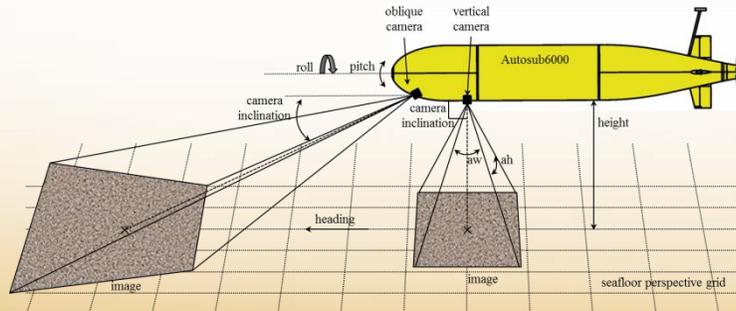
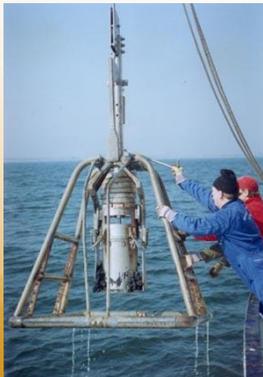


- ***What are the biogeochemical dynamics across different sediment types?
What are the important modulating processes: sediment characteristics,
pelagic input, physical advection, microbes, macrofauna?***

Role of sediments in C storage [M2]

C & N within detrital and biological pools
 burial of organic and inorganic C
 model long-term C storage under different scenarios

- Respiration and burial – *Dan Mayor et al.*
- Oxygen and pH dynamics *Silke Kroeger et al*
- Microbial, meio- and macro-benthic standing stocks and community composition *Steve Widdicombe et al*
- Megafauna and scaling-up in situ seafloor standing stock observations *Brian Bett et al*
- Use of 1D models to explore organic carbon cycling *John Aldridge & Yuri Artioli*
- ERSEM model comparisons with SSB observations: benthic oxygen dynamics (WP4, WP2 & WP1) - *John Aldridge et al.*



$$POC_{input} = POC_{burial} + DOC_{efflux} + DIC_{efflux}$$

$$\frac{POC_{burial}}{POC_{input}} \times 100 = \text{burial efficiency}$$

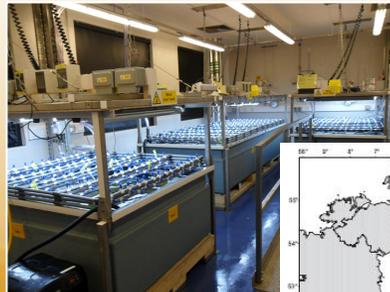
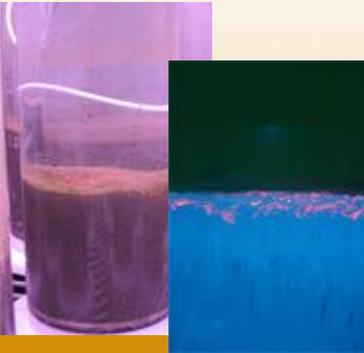
What are the pools of C in sediment at contrasting sites and seasons and what are the relative importance of these over annual to multi-decadal timescales?

Role of macrofauna and impacts of natural and anthropogenic disturbance [M3]

infaunal contributions to C and nutrient dynamics

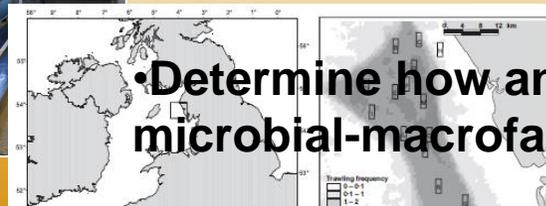
cohesive and non-cohesive / natural and anthropogenically disturbed (trawling)

- Impacts of warming and climate change on macrofaunal community composition and biogeochemical cycling - *Jasmin Godbold et al.*
- The significance of functional traits for biogeochemical properties in different sediment habitats - *Clement Garcia et al*
- Responses of benthic community activity and biogeochemical cycling to seasonal changes and fishing intensity - *Rachel Hale et al*
- Community mediation on shelf-sea benthic nitrogen cycling following bottom trawling and organic enrichment - *Jan Hiddink et al*



•Role of microbial-macrofaunal coupling in affecting biogeochemical processes

•Determine how anthropogenic drivers affect microbial-macrofaunal coupling



Impacts of sediment resuspension and near-bed current flow [T4]

exchange of nutrients and C across the sediment-water interface
near-bed processes and temporal variability in sediment-water column exchange
Effects of alternative hydrodynamic and environmental futures

- Biogeochemical cycling of permeable sediments in a shelf sea environment:
Celtic Sea, a seasonal study - *Gary Fones et al*
- Physical drivers of spatial variability in shelf sediments *Megan Williams et al*
(presented by - *Charlie Thompson*)
- Physical controls of resuspension in the Celtic Sea: implications for resuspension
frequency - *Charlie Thompson et al*
- Regional upscaling of resuspension effects on benthic-pelagic fluxes - *John Aldridge et al*

