

EuroBASIN
Plymouth
22-24 May 2012

WP2

WP2 Objectives

- 1. Perform laboratory experiments to establish the relationship between plankton community composition, size structure and aggregate formation, sinking rate and stability under idealised conditions.
- 2. Perform a mesocosm experiment to determine the influence of plankton community composition, size structure and grazing pressure on aggregate formation, sinking rate and stability
- 3. Perform observations at sea on the link between plankton community composition and size structure, grazing and aggregate formation, sinking and decomposition and organic carbon export.
- 4. Perform surveys at the broad scale of the biological sequestration of carbon dioxide in the Nordic seas and high latitude North Atlantic
- 5. Develop and apply new algorithms for particle export and decomposition based on experimental work above and on literature information available from WP1.
- 6. To implement these new algorithms in 1D models and assess their skill in representing particle flux via a comparison of model output with a defined validation dataset assembled in WP1.
- 7. Synthesise these previous activities in order to estimate, in conjunction with WP8, the economic value of the contemporary biological carbon pump and how this value may change as ocean functioning changes in response to an evolving climate and a changed exploitation of top predator species.

T1.3.1

Consolidate historical data on rates of particulate matter downward flux, decomposition and aggregation; transfer efficiencies. Sources: data archives and literature [supports T2.1 and T2.4]

Responsible: NOC

Start: Month 4; End Month 16

- Almost 6000 measurements of export flux from across Atlantic
- Component/associated fluxes (POC, PIC, BSi, CaCO₃) where available
- Matching environmental data (T, S, NO₃, PO₄, SiO₃, O₂) extracted from World Ocean Atlas
- Full documentation
- Inconsistencies in how BSi flux reported, Pesant notified
- Extra staff allocated and completion expected end June 2012

T2.1.1

Experimental work in the laboratory at Brest.

Responsible: CNRS

Participant: NOC

Start: Month 1; End Month 24

- 2 main experiments conducted
 - The role of microzooplankton in POM aggregation, sinking, solubilization & remineralization and the simultaneous influence of the presence of suspended calcite minerals on the rates.
 - The different influences of small, suspended particles of calcium carbonate (coccoliths) and of large, dense, fast sinking particles of calcium carbonate (foraminiferan tests) on the aggregation and sinking of POM.
- Joint support from Region Bretagne, and CalMarO (a FP7 Marie Curie Training Network)
- 3 papers in preparation (for Biogeosciences and GBC)
- Posters at ocean acidification summer school, Iceland, 08/2011 and AGU 12/2011
- Work contributed to a PhD (Southampton) and a Masters thesis (Groningen)
- Final checks prior submission to PANGAEA

T2.1.2

Experimental work in mesocosms in Norway

Responsible: CNRS

Participants: Uni, DTU-AQUA.

Start: Month 1; End Month 24

- Bergen mesocosms
- SOPRAN mesocosm experiment April-June 2011
- To study the pelagic ecosystem response to increasing ocean acidification with focus on trophic coupling and carbon and energy transfer
- Carbon dioxide system measurements
- Data has been worked up and delivered to the central experiment database
- Needs secondary QC
- Paper in preparation

T2.1.2

Experimental work in mesocosms in Norway

Responsible: CNRS

Participants: Uni, DTU-AQUA.

Start: Month 1; End Month 24

- Trondheim mesocosms
- On schedule to run end July-end August 2012
- Funding secured for T&S at Sletvik Field station (€40K)
- 14-15 participants
 - Brest, NOC, DTU-Aqua, Bremen, & Hamburg (BASIN)
 - Munich, Kiel, and Lille (non-BASIN)
- Experimental design set, "side experiments" planned, mesocosm bags being built, supplies and consumables ordered.
- Working out the final details of the logistics (buying plane tickets, organizing growing up the phytoplankton and zooplankton inocula) prior to the start of the experiment.
- Possible special issue: prep 2012-2013, pub 2013-2014

T2.2

Experimental work at sea

Responsible: NOC

Participants: DTU-AQUA, Uni Research

Start: Month 12; End Month 36

- FS Meteor Convection cruise 2012
- Quantification and analysis of export using snow-catcher
- Analysis of changes in surface phytoplankton community structure
- Aggregate degradation by dominant zooplankton (*Microsetella norvegica*) as a function of aggregate type, concentration and size.
- Individual day / night carbon budget for *Calanus finmarchicus* (respiration, egg production, egestion, ingestion),
- Measured carbon dioxide system, oxygen, O₂/Ar and pH
- Will provide air-gas exchange for study area, separate the biological and solubility pumps, estimates of net community production..
- Work will contribute to 2 PhD (Southampton) theses

T2.2

Experimental work at sea

Responsible: NOC

Participants: DTU-AQUA, Uni Research

Start: Month 12; End Month 36

- PAP cruise 2013
- Specific dates available in June
- Planning meeting in WP2 breakout
- Currently interest/involvement:
 - DTU-Aqua, Brest (BASIN)
 - CalTech, MIT (US BASIN)
- Heavily supported by NERC OSMOSIS programme
 - Gliders, 9 moorings, Met Buoy

T 2.3.

Time series analysis of the biological carbon pump at high latitudes

Responsible: Uni Research

Start: Month 3; End Month 36

- Using CARINA data (available at CDIAC: http://cdiac.ornl.gov/oceans/CARINA/Carina_inv.html) to calculate C & N dynamics related to biological production.
- Working on an assessment of stoichiometry of community production for North Atlantic/Nordic Seas.
 - Calculate C, N, P deficits for Nordic Seas basins, North Atlantic, and Southern Ocean
 - Evaluate the seasonal and interannual variability within regional mixed layers
 - Compare results with model outputs
- Performing a model analysis of North Atlantic and Arctic biogeochemical feedbacks (comparing Bergen Climate Model and regional SINMOD model of changes to the surface CO₂ system until 2100)
- 2 papers in preparation

T2.4.

Algorithm Advancement. Retrospective Analyses and development of new particle flux parameterizations

Responsible: IMS-METU

Participants: NOC, UNI, DTU-AQUA

Start: Month 1; End Month 42

- The evaluation of existing model algorithms of the models in WP6 complete
 - PISCES, MEDUSA, ERSEM
- Distinctive algorithms representing key processes were selected.
- The implementation of these algorithms in 1D model has begun.
- The dataset that will arrive in June will be used to test the algorithms
- Planning ‘experimental’ stage where model forced with timeseries data.
 - take either phyto/zoo or primary production from data and apply the algorithms to be tested.
- The work done for Task 2.4 will form the core of a PhD thesis (IMS)

Deliverables

- **D2.1) Report on WP2 meeting at Kick off meeting on algorithms (Task 2.4) and data needs (WP1): [June 2011; Martin]**
- **D2.2) Report describing preliminary algorithms and initial results of mesocosm experiment: [Oct 2012; De La Rocha & Martin]**
- D2.3) Mesocosm data delivery to WP1: [June 2013; De La Rocha]
- **D2.4) Report detailing cruise results and how results affect the initial algorithms: [Dec 2012; Bellerby & Poulton]**
- D2.5) Cruise campaigns data delivery to WP1: [June 2013; Coordinator]
- D2.6) Report on revised algorithms based on cruise and mesocosm data: [Nov 2013; Martin]
- D2.7) COMPARISON Revised algorithms and potential future implementation described: [June 2014; Martin]
- D2.8) Cruise campaigns data delivery to WP1: [June 2014; Lampitt]
- D2.9) Final report: scientific papers; progress in field of particle aggregation and consumption, made in grant [Nov 2014; Martin, De La Rocha et al.]

Deliverables

- **D2.1) Report on WP2 meeting at Kick off meeting on algorithms (Task 2.4) and data needs (WP1): [June 2011; Martin]**
- Delayed by cross-wires. Delivery imminent.

Deliverables

- **D2.2) Report describing preliminary algorithms and initial results of mesocosm experiment: [Oct 2012; De La Rocha & Martin]**
- Mesocosms only finish at end of August.
- End of year more realistic.

Deliverables

- **D2.4) Report detailing cruise results and how results affect the initial algorithms: [Dec 2012; Bellerby & Poulton]**
- Convection cruise only recently complete.
- Would be in much better position to report after PAP cruise which will strongly complement first data set.

US link

- **NSF grant: Atmospheric Forcing and the North Atlantic Spring Bloom**
- Raffaele Ferrari and Glenn Flierl (MIT), Andrew Thompson (CalTech)
- Project linked to EuroBASIN and UK NERC OSMOSIS programme
- To study trigger for spring bloom
- Fieldwork focussed on PAP site
- PAP 2013 cruise in support of joint work