

HERMIONE

Month 24 scientific progress report

Each HERMIONE partner is required to complete a progress report detailing scientific activities and advances during the period **1 October 2010 - 31 March 2011**. Please use this document to outline your activities during this period and return by email to Abigail Pattenden by **18 March 2011** (adcp@noc.soton.ac.uk).

Partner organisation name: UGOT

Partner number: 22

Lead scientist: Tomas Lundälv

1. Scientific progress over the past 6 months (Oct 10 – March 11)

Please give a brief (3 pages max.) account of your institute's progress and contribution to HERMIONE during the last 6 months. Please divide your report according to work package and include details of any deviation from the workplan or delays incurred in your work. If referencing publications, please include a full reference list at the end of this section, including reports etc. Please ensure that you refer to milestones and deliverables when describing your work.

WP 4: The main fieldwork conducted during the period was related to a cruise with the German research vessel Maria S. Merian to the Mauritanian margin during the period October 22 - November 20 (Las Palmas to Mindelo). UGOT contributed an ROV with pilot to this cruise, with the main task of mapping possible CWC-habitats on the Mauritanian margin, as well as to obtain samples for genetics, age-determinations and biodiversity studies. The cruise was highly successful, and it was possible to establish that substantial CWC habitats exist on the Mauritanian margin, and that they have obviously done so over a very long time period, but with variable degrees of development. During the cruise, 12 long ROV-dives were undertaken, at positions ranging over a large part of the Mauretanian Margin, and documentation was obtained in the form of approximately 60 hours of high-definition video, 3000+ high-resolution still photographs, numerous samples and recorded ROV-tracks. The dominating hermatypic coral species was *Lophelia pertusa*, but there was also a substantial occurrence of *Madrepora oculata* as well as solitary scleractinians and gorgonians. These observations now establish the Mauritanian Margin as the southernmost well-documented major occurrence of *Lophelia pertusa* in the eastern Atlantic. Another interesting observation was a surprisingly high overlap of associated species (or at least closely related species) with those observed in Scandinavian CWC-habitats, with the giant mussel *Acesta excavata* as a dominating example. The ROV-observations provided strong evidence for the significance of 3D-structures on the seafloor as favourable fish habitat, since larger structures formed by *Lophelia pertusa* were always associated with exceptionally dense fish populations. Some observations indicated disturbance by benthic trawl fishery, but these observations were still of limited extent. Our observations also indicated, however, that a large international fishing fleet is operating in the area, and this gives cause for concern regarding the future for the sensitive CWC-habitats along the Mauritanian Margin. The actual geographical distribution of valuable CWC-habitats along the Mauretanian Margin should be properly mapped and protected from

bottom-impacting fishing gear - possibly a task to which HERMIONE could contribute.

Much of the fieldwork that was planned in the NE Skagerrak had to be postponed, due to highly irregular weather conditions. An early and very cold start to the winter led to ice conditions that prevented work with our small research vessel *Lophelia* already in early December. Among tasks that had to be postponed were the since long planned installation of a seafloor observatory at Tisler reef in collaboration with Jacobs University, and the regular documentation of a "coral recovery transect" at Tisler reef.

Much work went into finalising a number of manuscripts that are in advanced stages of preparation. Among manuscripts close to submission may be mentioned one on the small-scale genetical structure of *Lophelia* populations in the NE Skagerrak, one on the spawning and early development of larvae in *Lophelia pertusa*, and one on recolonisation experiments with *Lophelia pertusa* in the Koster Fjord. A manuscript on the large-scale genetical structure of *Lophelia* in the East Atlantic is also underway. Hopefully, the material from Mauritania can also be included, but has not yet been available for analysis.

WP6: During spring 2010 collection of data for socioeconomic studies related to the recently established marine national parks in Koster and Hvaler continued, as well as contacts to evaluate the status of a marine SAC Bratten in the open Skagerrak:

- a) Case studies Koster/Hvaler/Bratten (compilation of Deliverable 6.8)
 - Status of cases: National parks in Koster and Ytre Hvaler are under implementation and possible to study. The Bratten area's protection is under way. There is, however, except for earlier informal meetings with stakeholders within the Forum Skagerrak INTERREG-project at present no participation process. The responsibility would be with the National Board of Fisheries, which is under transformation to a new marine & water planning authority. So far there is no integrative spatial planning in the Swedish economic zone. It is questionable whether there will be a process to observe in time for a report in March.
 - Funding from the Swedish EPA for an in depth documentation & evaluation of the Koster-national park process (with focus on Koster, not Hvaler). Research assisted by 3 project assistants. Main methods: semi-structured interviews with 106 involved participants and observation (e.g. of meetings in relation to the evaluation of the national park's new management council, Kosterhavsdelegationen). Complementary methods: document analysis, web analysis.
 - Analysis of data summer/autumn 2010 and winter 2011.
 - 3rd December 2010: Evaluation meeting of 1st year of work for Koster Sea delegation (working groups and plenary, report coming).
 - Economic reporting and report of first results of rough evaluation of interview-study (1st draft) presented to SEPA in December 2010.
- b) Related work on science-policy interface and maritime spatial planning and ecosystem based management (can lead to input for synthesis work within WP 6) by way of employment at Swedish Institute for the Marine Environment
 - Working group of planning-experts adjoined to the Nordic Council's Aquatic

Ecosystem Group AEG:

Planning meeting for a Nordic workshop on how to implement maritime spatial planning and the Ecosystem approach in West-Nordic countries, planned for October 2011 in the Faeroes (meetings in: November 2010, January 2011, March 2011).

- 14. March 2011: Coordination of referral within the Swedish Institute for the Marine Environment on SOU 2010:91 on proposal for Swedish maritime planning system with ecosystem approach in the Swedish exclusive economic zone.

- c) July 2009 - Jan 2012: Participation in INTERREG Baltic Sea programme in project BaltSeaPlan on maritime spatial planning for the Baltic Sea area. Working within BaltSeaPlan's WP 3 with analysis of national maritime policies relevant for maritime spatial planning (national reports March 2010, GAP-analysis of Swedish strategies by October 2010). The project has had 3 international meetings so far: in Germany (summer 2009), Estonia (autumn 2009) and Latvia (spring 2010), Stockholm (November 2010, organised by AM and colleagues).

WP8: Contribution of a large number of photographs, video clips and interviews for books, exhibitions and information material (brochures and web-sites).

2. Scientific objectives for the next 6 months (April – Sept 2011)

Again, please separate by WP where possible.

WP4: (1) Installation of Seafloor Observatory at the Tisler reef in collaboration with Jacobs University. (2) Documentation of “coral recovery transect” at Tisler reef. (3) Recycling of long-term recording instruments (ADCP, Microcat) at Tisler reef in collaboration with NUI GALWAY. (4) Finalisation and submission of several manuscripts (see above). (5) Development of video-mosaicing techniques for monitoring the development at selected sites in coral reef environments in collaboration with Jacobs University.

WP5: Weather permitting, ROV-documentation of cold seep areas in the Skagerrak.

WP6: Analysis of data and publications, complementary field work in Koster/ especially Hvaler if possible (financing, time). Keeping in contact with authorities on development of Bratten. This is no more related to any deliverable, but for personal research interest. Contributions to synthesis work within WP 6 (based on research interests and capacities).

3. Publications, presentations and conferences

Please list below any publications or presentations related to HERMIONE that your team has produced in the last 6 months. You should include details of any conferences or workshops attended as part of HERMIONE research. Any publications include must have cited HERMIONE in the acknowledgments.

Publications:

- Hannes Wagner, Autun Purser, Laurenz Thomsen, Carlos Jesus, Tomas Lundälv, in press. Particulate organic matter fluxes and hydrodynamics at the Tisler cold water coral reef. *Journal of Marine Systems* (HERMES acknowledged).
- Tomas Lundälv and team, 2010. Fascinating new insights into Mauritanian cold-water coral habitats. *HERMIONE Newsletter, Issue 5*.
- Morf Andrea, Dagard, Ulrika, Eriksson, Jenny, and Godhe, Anders. 2010 (13th December): Vägen till Kosterhavets nationalpark (1st draft for comments from stakeholders). Vägen till Kosterhavet nationalpark – deltagande och dess betydelse; dokumentation av en pilotprocess i marin förvaltning; underlagsrapport till Naturvårdsverket efter översiktlig utvärdering av det insamlade materialet (The Road To Koster Sea National Park and the Role of Participation: documentation of a pilot process in marine management – Documentation report to the Swedish EPA after a first analysis of the material). Gothenburg University, School of Global Studies, Gothenburg. 122 p.
- Morf Andrea. 2010. Kosterhavets Nationalpark: På väg mot nya förvaltningsformer för havet (Koster Sea National Park: Under Way Towards New Forms of Maritime Management). *HAVET 2010*. Swedish Institute of the Marine Environment and Swedish Environmental Protection Agency, Gothenburg and Stockholm. Pp. 96-99.

Presentations:

- Tomas Lundälv. Presentation of results from the coral recovery transect at Tisler reef at a workshop in AWI, Bremerhaven, October 11, 2010.
- Morf, Andrea. 2009. *Kosterhavets nationalpark – ett exempel på nya förvaltningsformer*. Presented to Swedish Environmental Ministry, Swedish Institute for the Marine Environment, Oct. 13th 2009, at Ågrenska Villan in Gothenburg.

4. Media contact/public outreach

Please list below any HERMIONE-related media coverage you have been involved with (including date and details of newspaper, radio station, etc.)

- Contribution of video footage and photographs from coral environments to a permanent exhibition at the Gothenburg Aquarium, opened in December 2010.
- Contribution of a large number of photographs and know-how to various information brochures, books and web-sites informing about the Marine National Parks of “Kosterhavet” and “Yttre Hvaler”.
- Contribution of 5 underwater photographs to an article about coral reefs in the youth magazine “KamratPosten” (KP3/February 2011).

5. Staff working on the project

Please list below the people currently working on the HERMIONE project at your institute. You should indicate whether they are permanent or temporary members of staff, or post-doc researchers. For gender monitoring purposes (a FP7 requirement), please indicate male/female.

Staff name	Position	Perm/Temp	Male/Female
Tomas Lundalv	Researcher	Perm	Male
Lisbeth Jonsson	Postdoc	Temp	Female
Carl André	Assoc. Professor	Perm	Male
Lars Hagstrom/Annci Niklasson	Administrative staff	Perm	Male and Female
Mats Lindegarth	Assoc. Professor	Perm.	Male
Kerstin Johannesson	Professor	Perm	Female
Andrea Morf	Researcher	Perm	Female

6. Students working on the project

Please list below any students currently working on HERMIONE at your institute (regardless of whether they are funded by the project or not). Please include a brief description of their work (PhD title, etc) and at what level they are working (PhD, MSc, undergraduate project, etc), and indicate **male/female**

Student name	Level (PhD, MSc etc)	Supervisor	Research topic	Male/Female
Mikael Dahl	PhD-student	C. André/T. Lundalv	Coral genetics	Male
Genoveva Gonzales Mirelis	PhD-student	M.Lindegarth/T.Lundalv	Predictive habitat mapping	Female
Susanna Stromberg	PhD-student	K. Johannesson/T. Lundalv	Coral recruitment/recovery	Female
Ulrika Dagård	MSc	Andrea Morf	The Koster Board	Female
Jenny Eriksson	MSc	Andrea Morf	Maritime planning	Female
Anders Godhe	MSc	Andrea Morf	Maritime planning	Male

7. Person-effort per workpackage

IMPORTANT: Please enter the person-month effort contributed by your organisation to each WP in the table below for the period 1 October 2010 – 31 March 2011. Please note that under FP7 rules, you are obliged to keep records to support these figures (e.g., timesheets).

Person months	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	Total
Funded				4.75				0.25			5
Non-funded				6		6		0.25			12.25

8. Cruise list

Please list any cruises that your institution was involved with during the last 6 months, and the WP to which the cruise related.

Principal scientist/organisation	Cruise ID and location	Ship name	WP to which work related	Dates
Hildegard Westphal/Univ. Bremen	MSM16/3, Mauritania	Maria S. Merian	4	Oct18-Nov20, 2010



Carbon cycling at the Tisler Reef, Kosterfjord

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 School of Environmental Science, University of Liverpool, UK. ¹National University of Ireland, Galway, Eire. ²John Moores University, Liverpool, UK. ³Sven Lovén Centre for Marine Science, Sweden. ⁴Florida International University, USA.

Theme 4: Ecosystem distribution and interconnection

1. Introduction

- Tisler Reef, situated near 59°N 11°E, in a channel connecting the Kosterfjord with the northern Skagerrak is a convenient location to study a cold water coral (CWC) community.
- Elevated respiration rates determined “on reef” of 27-67 mmol O₂ day⁻¹ (White et al., submitted), consistent with ecosystem modeling studies (van Oevelen et al., 2009)

2. Hypotheses

- CWCs are a sink for particulate organic carbon (POC) through sedimentation/trapping, but a source of dissolved organic carbon (DOC) via heterotrophic alteration of POC and CWC exudate.
- Respiration of DOC released by the CWC via the microbial loop, leads to elevated respiration rates at the reef.

3. Methodology

To test our hypotheses we carried measured DOC, POC, dissolved oxygen, DIC and alkalinity on and off the Tisler reef on 3rd September, 2010. We used excitation-emission matrix (EEM) fluorescence spectroscopy with parallel factor analysis (PARFAC) to determine potential sources of fluorescent dissolved organic matter (DOM; Jaffé *et al.*, 2008). Samples were collected through the water column using a CTD, focussing on water just above the reef (115 – 131 m) and ~ 20 m above the reef, as well as surface, chlorophyll maximum and at the thermocline.

4. Results

- Water column structure shows stratification, with fresh (warm) water at surface (Fig 2 a, b).
- Surface waters well oxygenated (super saturated, with minimum at ~10 m (Fig. 2c). No obvious on- vs. off-reef trends.

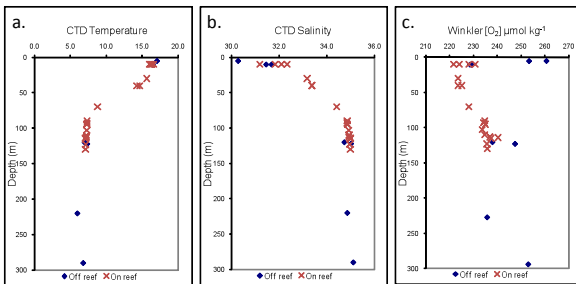


Figure 2 – Depth plots for a. temperature, b. salinity and c. oxygen concentration (determined using the Winkler method) in the Kosterfjord on and off the Tisler Reef

- Apparent oxygen utilisation (AOU)¹ increases with depth on and off-reef.
- DOC shows no real depth trend on or off-reef (Fig 3b)
- AOU tends to increase vs. DOC concentration off reef (not including surface, super saturated samples), but is tightly clustered on reef.

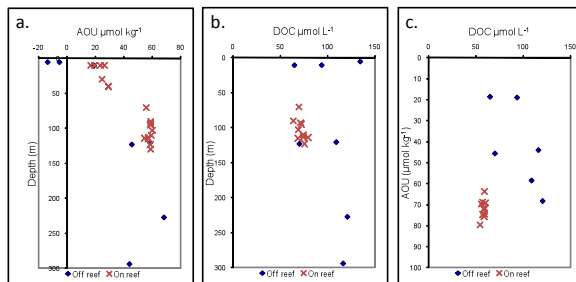


Figure 3 – Depth plots for a. AOU, b. DOC, c. shows DOC vs AOU.

¹ Apparent oxygen utilisation (AOU) = [O₂]^s - [O₂]^{actual} where [O₂]^s is the theoretical saturation concentration of oxygen for a sample of given S & T, and [O₂]^{actual} is its actual concentration

References.

Jaffé, R. *et al.* 2008. Spatial and temporal variations in DOM composition in ecosystems: The importance of long-term monitoring of optical properties. *Journal of Geophysical Research* **113**, G04032.
 van Oevelen, D. *et al.* 2009 The cold-water coral community as a hot spot for carbon cycling on continental margins: A food-web analysis from Rockall Bank (northeast Atlantic). *Limnol. Oceanogr.* **54**, 1829-1844.
 White M. *et al.* Are cold-water coral ecosystems hotspots for carbon cycling? Submitted to *Marine Ecology Progress Series*.
 Yamashita Y. *et al.* 2010 Fluorescence characteristics of dissolved organic matter in the deep waters of the Okhotsk Sea and the northwestern North Pacific Ocean. *Deep-sea Research Part II: Topical Studies in Oceanography* **57**, 1478-1485

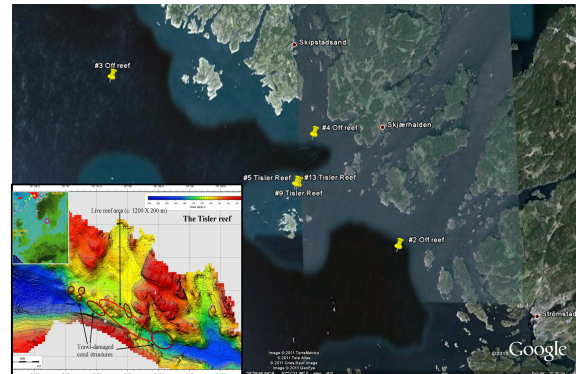


Figure 1 – Google map showing sampling locations off reef and the location of the Tisler Reef. The insert shows the general location of the Tisler reef in the northern Skagerrak with a higher resolution bathymetry map showing the extent of the live (solid) and associated rubble (dashed line).

- EEM-PARFAC analysis identifies four principal components of fluorescent DOM in waters of the study area (see also Yamashita *et al.*, 2010):
 - C1 – ubiquitous humic-like component - (λ_{ex} 255 nm, λ_{em} 468 nm).
 - C2 – protein-like component (tryptophan) - (λ_{ex} 275 nm, λ_{em} 338 nm).
 - C3 – protein-like component (tyrosine) - (λ_{ex} <240 nm, λ_{em} 328 nm).
 - C4 – microbial humic-like component – (λ_{ex} 245 nm, λ_{em} 394 nm).

- Consistent with mixed source of DOM (major autochthonous and minor allochthonous). C3 dominates (refractory protein).
- C2 contribution (labile protein) is minor, but most variable, especially marked on-reef (Fig. 4a), e.g. vs C4 (refractory microbial component; Fig. 4b).
- No significant relationship between AOU and fluorescence intensity (data not shown).

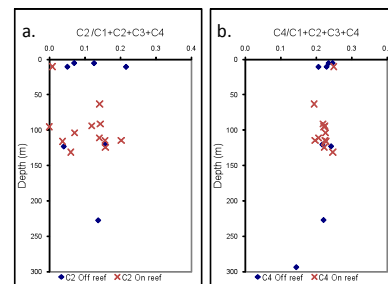


Figure 4 – Depth plots for a. Contribution of C2 to total fluorescence, b. Contribution of C4 to total fluorescence.

5. Discussion/Conclusions

- Water column characteristics typical of fjordic setting.
- Relationship between DOC and AOU implies production and accumulation of DOC with increasing oxygen consumption off reef (POC respiration).
- Tight clustering of (high) AOUs and [DOC] above the reef implies coupling between DOC production and its respiration i.e. no accumulation. Possible reef effect *via* enhanced microbial loop?
- Labile fluorescent DOM highly variable around the reef – a minor component and variability may reflect instantaneous production and/or consumption.
- Hypothesis 1 – not proven, but some evidence to support Hypothesis 2.

6. Acknowledgments

We are grateful to the Master and crew of the *Nereus* for assistance at sea, to EC FP7 HERMIONE project (grant No 226354) and ASSEMBLE Transnational Access Call 2.
 We thank Dr. Claire Mahaffey for useful discussions.

