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Report of the Study Group on Climate related Benthic processes in the North Sea (SGCBNS)

1–4 March 2010

Lowestoft, UK

ICES International Council for the Exploration of the Sea

CIEM Conseil International pour l'Exploration de la Mer

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Contents

Executive summary

The Study Group on Climate related Benthic processes in the North Sea (SGCBNS) was initiated by the ICES Benthos Ecology Working Group (BEWG) as a follow up initiative of former North Sea Benthos Surveys (NSBS 1986; NSBP 2000) and is partly based on the outcomes of a eponymous workshop held in 2008 (see WKCBNS report). The aim was to discuss and initiate future research activities concerning benthic ecosystem processes related to changes in the climate regime and to establish a network of benthic long-term series. The meeting took place in Lowestoft, UK, 1–4 March 2010.

Initial discussions were focused on the pros and cons of a reduced spatial coverage (i.e. box or small scale approach) for the study of benthic processes in the North Sea. Examples of representativity of benthic habitats, sampling effort and comparable areas were covered at length. As previously discussed a series of benthic hypotheses in relation to benthic communities and the effects of climate change were identified as key questions at the study group meeting at Wilhelmshaven in 2008 (ToR a). From these initial discussions it was mainly acknowledged of the importance of ecosystem processes which are driven by the hypotheses previously discussed. Further discussions were mainly focused on the key processes, parameters, drivers and methodology to be considered in helping to identify specific benthic processes affected by climate change.

To facilitate the study of relevant key ecosystem processes, it was decided that two case studies on bioturbation would be undertaken (ToR d). The objectives are to evaluate the spatial (North Sea wide) and temporal (intra-annual) variation of the potential for community level and species level bioturbation. A follow-up workshop will be organised in Plymouth in November 2010 to work on case study 1 (inter- annual variation of bioturbation) and case study 2 will be started during next years meeting (2011).

Ecosystem modelling was highlighted as an important tool for understanding benthic processes and the prediction of ecosystem changes (ToR b and e). Nevertheless, benthic components in current ecosystem models are not sufficient. Therefore, the SG will initiate a cooperative approach to test current ecosystem models with existing benthos time-series data. The North Sea will be used as a study region, but the approaches used should be of general importance for the understanding of benthic processes. A closer cooperation between ecosystem modellers and this SG is also planned.

The establishment of a network for long-term benthos data was initiated during the SG meeting (ToR c). The intention of the network is to facilitate joint analyses of marine benthic long term series by collaborative work of scientists and to make existing information (e.g. publications, reports) available. The aim is NOT to collect data. The network will be finally discussed during the meeting of the BEWG.

The Flanders Marine Institute (VLIZ) agreed to contribute in three ways to the SGCBNS. Firstly, by making a link with the European Marine Observation and Data Network (EMODNET). EMODNET will assemble fragmented biological data and information into one portal, which can help the SGCBNS in their search for suitable long-term data. Secondly, VLIZ will develop the website for the Benthos Network. Finally, VLIZ will act as data managers of the planned case studies.

The main recommendations were:

- Support from ICES for the long-term network (e.g. facilitating network interactions and providing data contributions)
- The BEWG to develop the network further via facilitating and disseminating current and future initiatives
- ICES to support intercessional work on the case studies (detailed work provided in the report for case studies 1–5)
- Facilitate the links between SGCBNS and Modelling group (WGPBI), WGBIODIV, BEWG
- ICES to actively feedback research needs and scientific priorities for the next FP7 call
- VLIZ to assist in preparing data for case study 2 and to develop the website for the Benthos Network
- The SG to support an additional workshop in Plymouth for case study 1

1 Opening of the meeting

The chairs of the workshop, Silvana Birchenough and Henning Reiss, opened the session (1 March at 13:00) at the Centre for Environment, Fisheries and Aquaculture (Cefas) (Lowestoft, UK) and welcomed the participants. 8 participants from 4 countries, Belgium, UK, the Netherlands and Germany, were present (Annex 1).

Silvana Birchenough, Jacqueline Eggleton and Julie Bremner were appointed as rapporteurs for the meeting on a daily basis.

2 Adoption of the agenda

The group unanimously adopted the agenda (Annex 2) without any changes.

3 Studying benthic processes (ToR a)

The group continued the discussions in relation of sampling strategies, data sets and the most cost-effective manner to direct efforts whilst studying benthic communities across the entire North Sea. At the last workshop conducted at Wilhelmshaven in 2008 there were a series of hypothesis identified as the most prominent questions to concentrate on whilst studying benthic processes in relation to climate change. The group continued to build onto these discussions but also provided a more detailed approach mainly focusing on ecosystem processes affected by climate change on benthic systems. A detailed session containing the main information whilst assessing these key processes is outlined below:

- Main drivers for ecosystem processes,
- Main implications for the organisms (for single or direct issues),
- Secondary effects (at a community level),
- Overall/final effect (reflected on biodiversity, community structure, carbon cycling effects, benthic productivity, etc.)
- Methods and way forward for the SG to answer some of these questions
- Laboratory assessments
- Field methods

A final summary table containing all the information discussed under all of the categories above is illustrated below:

Table 1: Relevant information for studying ecosystem processes for benthic systems in relation to climate change.

Drivers	Processes	Direct effects (single organism)	Secondary effects (community)	Final	Methods/SG Workshops	Methods - lab
Temp	metabolic rates	mortality, respiration, reproduction, behaviour/activity (e.g bioturbation, bioirrigation), feeding, growth, metabolite production, immunity	Intra-/inter- specific competition, trophic interactions, habitat modification (provision/bioturbation), facilitation,	Biodiversity/community structure/ distribution, elemental cycling, climate regulation, benthic productivity	1. Case study to calculate bioturbation potential at species and community level using seasonal data/North Sea Benthos 1986/2000 already collected. Link to nutrient flux	Case study to use growth rings as proxy for bottom temp changes
Salinity	Osmoregulation, calcification	mortality, respiration, reproduction, behaviour/activity (e.g bioturbation, bioirrigation), feeding, growth, metabolite production, immunity			2. Calculate % contribution of bioturbators using North sea spatial data to identify areas sensitive to ecosystem function change	
Food quality/quantity/supply	metabolic rates	mortality, respiration, reproduction, behaviour/activity (e.g bioturbation, bioirrigation), feeding, growth, metabolite production, immunity			3. Calculate benthic productivity using seasonal data used in 1.	
Acidification	metabolic rates, calcification	mortality, respiration, reproduction, behaviour/activity (e.g bioturbation, bioirrigation), feeding, growth, metabolite production, immunity			4. Simulate different extinction scenarios to see how it affects benthic function	
Currents		larval/juvenile dispersal,			5. Trait analysis to determine larvae/adult dispersal potential	
Turbidity	photosynthesis, clogging	Benthic primary production, feeding				

Recommendation: based on the information discussed under ToR a, further case studies have been planned for future SG activities.

4 Case studies (ToR a; ToR d)

Group discussions whilst preparing the summary of key processes (Table 1) were addressed by participants. It was deemed important to concentrate on specific ecosystem processes, which directly affect individual organisms and have repercussions for the overall community/assemblage level. Clear case studies were planned in relation to calculating and assessing bioturbation (over finer scales/temporal variability and effects on vulnerability of benthic systems), production and other key ecosystem processes.

Bioturbation is one of the key ecosystem processes strongly affecting nutrient and carbon flux in the benthic system. Thus, detailed knowledge of the bioturbation potential is essential in validating ecosystem models and improving our understanding of the effects of climate change on the benthos. Case studies 1 and 2 are aimed at studying the temporal and spatial variation of bioturbation by using existing data and will be carried out during the upcoming SG meetings. Three further case studies on ecosystem processes were highlighted, which will be focussed on in the final phase of the SG. The case studies will follow two main approaches: 1. Key processes will be studied on a North Sea wide scale to reveal large scale spatial patterns and 2. A small scale comparison, similar to the box approach, will be carried to gain detailed information on the dynamics of the processes under different environmental regimes.

As the SGCBNS is planning five case studies in which several datasets will be compared and analysed together, Flanders Marine Institute (VLIZ) is willing to take the

lead in the integration exercise, as previously undertaken for the ICES North Sea Benthos Project.

Bringing together several datasets from different sources, all collected for various purposes and under very diverse circumstances, requires harmonization of the data, an essential part of the integration process. Data standardization of the received datasets will be undertaken on three levels: (1) taxonomy, (2) geography and (3) units. The steps included in the data management for such research-oriented databases have been thoroughly discussed in Annex 5 of the previous CBNS report (ICES 2009). For further details on the data management actions which will be undertaken in an integration action, we refer to this report.

4.1 Case study 1 – An assessment of the fine scale temporal variability in coastal sediment bioturbation

Objective: To determine the extent to which a key ecosystem function (bioturbation) varies within and between years. To achieve this we will use a number of temporal reference datasets using macrofauna abundance and biomass, to answer the following four questions.

- Does the potential for community level bioturbation vary over the course of a year?
- If so, which species are most responsible for this observed variation?
- Does the strength and nature of any variation observed in an area depend on the geological location or the sediment characteristics?
- Are observed patterns of intra-annual variation significant and are the conserved from year to year?

Approach: So far 16 appropriate data sets have been identified (see Annex 3). Each data set contains estimates of macrofauna abundance and biomass. For each species in each replicate sample we will calculate an index of bioturbation using the methods described in detail by Solan *et al.* (2004). In summary, the index is calculated using equation 1 and uses three biological traits known to influence sediment bioturbation: (i) mean body size (Bi, usually biomass in grams), (ii) extent to which the organism moves through the sediment (Mi), and (iii) method of reworking sediments (Ri).

$$BPi = Bi\ 0.5 \times Mi \times Ri$$

Mi and Ri will be scored on categorical scales that reflect either increasing mobility (Mi) from 1 (living in a fixed tube) to 4 (free movement via burrow system) or increasing sediment turnover (Ri) from 1 (epifauna that bioturbate at the sediment-water interface) to 5 (regenerators that excavate holes, transferring sediment at depth to the surface).

For each species in each replicate sample BPi will be multiplied by its abundance (Ai) to determine the "population-level" bioturbation potential (BPp) of that species in that sample ($BPp = BPi \times Ai$).

BPp values will then be summed across all species in a sample to estimate the "community-level" bioturbation potential for that sample (BPc).

A series of univariate and multivariate and analyses will be applied to determine:

- The magnitude of intra-annual variation in BPc within each of the separate datasets
- The identity of the species who, through changes in their BPp between sampling dates, contribute most to any variation observed in BPc
- The degree to which intra-annual variation in BPc is consistent across habitat types and geographic locations.
- The relative importance of intra- versus inter-annual variability in BPc

Recommendation: To organise a workshop for case study 1 at Plymouth Marine Laboratory during November 2010.

4.2 Case study 2 – Bioturbation potential and vulnerability in the North Sea

Objectives:

- To assess spatial patterns in bioturbation across the North Sea in relation to habitat variability and environmental forcing.
- To investigate potential vulnerability of benthic bioturbation potential to climate change across the North Sea.

Background:

Bioturbation, the biologically-mediated regulation of biogeochemical processes, is one of the most important aspects of ecosystem function in marine soft sediments. The bioturbation potential of individual communities can be estimated using the BPc index of Solan *et al.* (2004). Case study 1 will assess short-term temporal variability in bioturbation at a selection of sites. Case study 2 will expand on this rationale, to examine spatial patterns in bioturbation over the North Sea and assess how these patterns relate to habitat type and environmental forcing.

As BPc is an estimate of overall community bioturbation, it does not provide information on the relative contributions of different bioturbating species. However, the number and range of species contributing to overall bioturbation is important when considering the vulnerability of the function to external forcing (climate change). Assemblages with a higher diversity of bioturbation types (traits) and those with higher richness within each bioturbation trait, might be expected to be less vulnerable to climate change effects than those with few bioturbation types and low within-trait diversity, because they will have increased capacity to 'compensate' for the loss of any particular species.

Questions

- How does bioturbation vary over the North Sea as a whole?
- How does bioturbation vary between and within North Sea habitats?
- How does bioturbation relate to environmental forcing factors across the North Sea (e.g. temperature)?
- How do the relative proportions of species with specific (bioturbation) traits relate to community-level bioturbation across the area?
- How much within-(bioturbation) trait diversity is there in different communities?
- How does within-(bioturbation) trait diversity relate to habitat/environment variability?

Approach

- Compile North Sea benthos datasets
- Compile habitat and environmental variables datasets (e.g. bottom temperature)
- Score species list for bioturbation traits
- Calculate BPc across samples
- Assess spatial patterns in relation to habitat and environmental variation
- Analyse % contribution of each bioturbation type/trait to total BPc
- Analyse within-trait diversity
- Assess spatial variability in trait/BPc patterns in relation to climate variables

Recommendation: VLIZ to help with data preparation (NSBP 2000 data) and additional data sources needed for case study 2 for next SGCBNS meeting

4.3 Case studies 3–5

Three further case studies were identified and regarded as relevant for the objectives of the Study Group. The further development and necessary planning will be part of the future meetings.

Case studies

- Case study 3. Calculate benthic productivity using seasonal data used in case study 1.
- Case study 4. Simulate different extinction scenarios using model (suggestion: from Henning Reiss work in preparation) to see how it affects benthic function
- Case study 5. Trait analysis to determine larvae/adult dispersal potential

Recommendation: to further develop the cases studies in the upcoming meeting

5 Network (ToR c)

Aims - targets

The intention of the network is to facilitate joint analyses of marine benthic long term series by collaborative work of scientists and by making existing information (e.g. publications, reports) widely available. Unlike other initiatives, the aim of this network is NOT to collect data. Instead it is meant to bring scientists together to jointly analyse long-term data series to further the understanding of temporal changes in marine ecosystems over larger scales and the effects of climate change. These approaches will facilitate studies of climatic effects on benthic systems over larger scales. Results from single data series will support wider assessments on benthic changes over wider North Sea regions.

Development

The Network started as an initiative developed by the ICES BEWG and was further developed by the SGCBNS. However it is open to all scientists willing to participate.

General idea - concept

Instead of collating data, results will be produced by the data owner, keeping the data sets separate, but joining the overall assessments. This way, also inconsistencies between data sets can be overcome as long as they are considered in the separate analyses and results are formulated accordingly. The point of the network is to circumvent data problems by working together without sharing raw data.

The network will be able to produce results that can only be achieved by complementary analyses – not by repeating work, but by generating overarching insights based on group contributions. Clear and identifiable end products shall be joint publications and workshops. This should be an interesting forum that will provide wider opportunities to work and collaborate among scientists.

Comparison and relations to other projects

Large scale projects that intend to collect, harmonise and manage actual data already exist (e.g. EMODNET, see information in Annex 4) and the initiative presented here does NOT intend to duplicate these efforts.

Large collections of data are valuable tools for the future, but are notoriously difficult to manage. First, the ownership and intellectual rights of the data supplier need to be assured and procedures are needed to avoid unauthorised use of the data. Second, an extensive harmonisation of these data sets is necessary to ensure comparability and data quality before any analyses can begin. Third, the producers of the respective data sets know best the potentials and restrictions of the data as well as any interesting observations.

Although the technical problems can be overcome with some effort - as has been successfully demonstrated in some projects (e.g. MARBEF, NSBP 2000) there is still considerable reluctance from many scientists to give away valuable long term series data. This is an understandable issue since collection, analysis and interpretation of time-series data sets requires time and effort over prior to publish these outcomes in the peer review literature.Sentence doesn't make sense needs rewording

Procedures

Communication will be facilitated by a network web site and associated mailing lists. There will be a main list advertising general news and new studies and specific lists for each study.

Every member can put questions (objectives) forward and suggest required analyses, ask for necessary contributions (data, results & expertise), which then are open for discussion.

The initiative shall tackle specific questions by asking for contributions of specific results from the partners. All contributors will have access to existing contributions when they submit their results. They will then be added to a distribution list to receive all future contributions. Contributions can be data or expertise, offering the opportunity for contributors to justify their inclusion – like a research consortium: What can people bring to this collaborative project?

To allow a productive outcome within adequate time, each study should fix appropriate deadlines for

- discussions of questions, analytic methods & type of output and
- delivery of contributions.

With the specific objective, well defined tasks will be distributed to construct a joint manuscript. All contributors will be co-authors.

After some initial joint analyses an informal meeting may be organised to develop the final publication.

This procedure needs a general element of trust from the collaborators and for each study a specific agreement about the handling of contributions shall be defined by the respective groups.

The Flanders Marine Institute (VLIZ) will be responsible for the development and hosting of a website for the Benthos Network. The web content will be delivered by the Network itself.

This website will provide a short outline of the goals of the Network and participants. Over time, it is hoped that the website will expand and be used as a communication tool for the benthic community. It will list people and institutes involved, and also metadata descriptions of the datasets they have available. Additionally, a discussion forum will be set up on the site and a general email address will be created. A scientific coordinator will run the general organisation for defined time periods, as a general contact person for questions regarding the network. The discussion forum will be monitored and followed up by the scientific coordinator and members of the Benthos Network, as will all the emails sent to the Network through the info mailing address. VLIZ will assist in compiling a data agreement or "declaration of mutual understanding on data sharing". This document will describe the possible data use and availability of contributing datasets within the Network and between the Network and third parties. Additional information on the website can contain links to other relevant initiatives or explain how one can become part of this network.

Status quo

Participants of the BEWG meeting 2009 agreed on developing the collaborative work, which will involve further analyses/results (on published or unpublished records), using standardised analyses. Intercessional work will continue by means of interrogating the long-term datasets with an agreed set of parameters to enable further comparisons. Two initiatives have already been started in BEWG for joint analyses of long term data, which will be further discussed during the BEWG meeting 2010:

- Latitudinal shifts of species
- Regime shifts in benthic communities across the North Sea.

The development of the Network was further discussed during the SGCBNS meeting in Lowestoft in March 2010. The results of this discussion are summarised in this text, describing a possible setup of the Network initiative. It is meant as a first draft and is open to all comments/discussions. This first draft will be presented to the BEWG-meeting 2010 by A. Schroeder, where it shall be discussed by the group. A subgroup will gather during the meeting to finalise the text for a Network web site. After consent of the BEWG, this text will be forwarded to VLIZ to set up a web site.

Suggested network names

Initial name suggestions for the network were proposed, these are listed below:

- Benthic Long Term Research Network - BeLTeRN
- Benthic Ecology Analysis Network BEAN
- Long term Ecology analysis Network LEAN

- Network of Benthic Long term Analyses NeBeLA
- Benthic Long term Analysis Network BLAN

Links to other initiatives

Similar initiative in the UK: MECN (http://www.mba.ac.uk/mecn/index.htm)

EMODNET European marine observation and data network incl. Metadata (see Annex 4). Examples of working data collection and analysis are given by MarBEF and NSBP.

Recommendation: further development/dissemination of the current network initiatives at the forthcoming ICES BEWG meeting.

6 Modelling approach – box approach (ToR b; ToR d; ToR e)

Johan Van Der Molen (Cefas) presented an overview of the numerical models that are and have been used in Cefas to simulate effects of climate on regional seas around the UK and of effects on the sea bed and benthos. A one-dimensional water column model to simulate the resuspension, deposition and concentrations of multiple grain size fractions has been developed and applied to sites where observations from SmartBuoy are available. A 50 year hind cast has been carried out with a three-dimensional hydrodynamic model to study the inter-annual variability of temperature and salinity, and of stratification in the North Sea. The results showed features that can also be found in observational time series, and in addition indicate that some of the salinity changes originate from the Atlantic Ocean. Another three-dimensional hydrodynamic model showed that climate-change scenario's of global warming increase the strength, spatial extent and duration of stratification in the North Sea. Subsequent studies with a one-dimensional water-column model of biogeochemistry indicated a) a resulting increase in the strength and duration of oxygen depletion events in the bottom mixed layer, b) a slight decreased in pelagic biomass, and c) a slight increase in net primary production. A three-dimensional coupled physical-biogeochemical model was used to trace anthropogenic nutrients from selected groups of rivers through the North Sea, showing substantial transport away from the sources. The benthic biomass in the model showed substantial spatial variations, with high values along the continental coast and south of the Dogger Bank, and low values in the northern North Sea. Finally, some results from a particle-tracking Individual Behaviour Model were presented, used to study potential connectivity of potential Marine Protected Areas in the North Sea.

During the discussion on approaches to study benthic processes in relation climate change (Chapter 3), ecosystem models were highlighted as a necessary tool for a better understanding and for predicting ecosystem changes.

Several ecosystem models exist for the North Sea (see above; Moll and Radach, 2003) providing estimates i.e. of primary production and sedimentation. All models were validated showing strength and weaknesses (Radach and Moll, 2006) in simulating the annual cycle or regional differences in the nutrient and plankton distributions. Most of these ecosystem models like the European Regional Seas Ecosystem Model (ERSEM) or its close relation the Biogeochemical Flux Model (BFM) were initially developed to model the processes in the pelagic system. Benthic functional groups were added at a later stage to improve the overall model performance.

The benthic environment is strongly coupled with the pelagic environment, mainly at the sediment-water interface and the bottom boundary layer. Particulate organic mat-

ter input to the sediment results from the three-dimensional pelagic production, lateral transports and sedimentation within the water column. Three-dimensional biogeochemical models combine the simulation of the hydrodynamic, geochemical and biological system. The state variables for the biological subsystems are not species specific but merge several species in a functional group like phytoplankton, zooplankton and the major benthos groups (epifauna, meiofauna and macrofauna).

It was concluded during the meeting, that the few benthic functional components in the current ecosystem models are not sufficient to improve the process understanding for the benthic system. Therefore, the box-approach mentioned above could be used to study the ecosystem processes and provide the baseline data about e.g. nutrient and carbon cycling in different benthic regimes. However, this has to be accompanied by testing and further development of the benthic component of existing ecosystem models. It was already highlighted during the CBNS workshop in 2008 (ICES 2009) that out of the suit of ecosystem models for the North Sea a combination of diagenetic (Luff and Moll, 2004) and benthos (Allen *et al.*, 2001; Blackford, 1997) models is needed for a accurate description of the benthic system, while the existing pelagic models should serve as forcing tools (Skogen and Moll, 2005).

It was suggested to further develop this initiative as one major activity within the SGCBNS. Cooperation with the planned 'network of long-term benthos data' (chapter 3) could serve as a starting point to test the performance of existing ecosystem models on long-term benthos data in different areas. It was concluded to follow this line and to discuss this initiative with the relevant expert groups in ICES (e.g. Working Group on Modelling of Physical/Biological Interactions (WGPBI)) and ecosystem modellers outside ICES. Due to the wide range of available data and ecosystem models, the North Sea will be used as a study region, but the approaches used should be of general importance for the understanding of benthic processes.

Recommendation: Link with other groups (modelling; e.g. WGCBI) and experts to facilitate collaborative research on benthic components of ecosystem models.

Further reading on this related topic:

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7 Other business (ToR f; ToR g)

The potential contributions to the high priority topics of ICES Science Plan (ToR f) were briefly discussed in plenary. The document (SSGEF_workplan) was completed

at the end of the meeting and subsequently sent to all participants for approval. The final table was sent on 16 March to Pierre Petitgas.

Possible contributions for the 2010 SSGEF session during the ASC were also discussed (ToR g). Given the early stage of the Study Group and the available theme sessions it was concluded that SGCBNS will not contribute to the following topics: Individual, population and community level growth, feeding and reproduction; the quality of habitats and the threats to them; Indicators of ecosystem health.

The contribution to the ICES Position Paper on Climate Change (Chapter 8: The Benthos and Climate Change) was discussed and further developed within a sub-group. Deadlines for the revision of the chapter were set and all revised contributions were subsequently sent to Steven Degraer (chair of the BEWG). The final draft manuscript to the ICES SCICOM for review is scheduled for 15 September 2010.

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Annex 1: List of Participants

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Annex 2: Agenda

Study Group on Climate related Benthic Processes in the North Sea (SGCBNS)

1–4 March 2010, Lowestoft, UK

Monday, 1 March 2010

09:00 – 12:00 Arrival and set-up

13:00 – 17:00

- Opening and introduction of all participants
- Adoption of agenda
- Appointment of rapporteurs
- Introduction to the meeting (H. Reiss)
- Plenary discussion about studying benthic processes i.e. by applying a box approach outlined during the Workshop Climate related Benthic Processes in the North Sea (WKCBNS)
- Slot for presentations of participants

Tuesday, 2 March 2010

9:00 – 11:00

- Plenary discussion about studying benthic processes i.a. by applying a box approach (ToR a)
- Identify Sub-Groups to address selected approaches and case studies (e.g.):
  - Further development of selected approaches for studying climate change effects on benthic processes (ToR a)
  - Identifying possible case studies (ToR d)
  - Using NSBP 2000 benthos data to address climate change related hypothesis (ToR d)

11:00 – 13:00

- Working in sub-groups or plenum

13:00 – 14:00 Lunch

14:00 -17:00

- Working in sub-groups or plenum
- Plenary review of sub-group activities
- Slot for presentations of participants

Wednesday, 3 March 2010

9:00 – 10:30

- Final discussion about studying and identifying further activities to set up the initiative

10:30 – 13:00

- Presentation of Ecosystem Modelling (J. van der Molen; see section 6)

- Discussion of using ecosystem models for studying benthic processes

13:00 – 14:00 Lunch

14:00 – 17:00

- Presentation of the EMODNet Project (L. Vandepitte; see Annex 4)
- Initiating and planning network of long-term benthos series (ToR e)
- Discussing the possible contribution of VLIZ to the network

Thursday, 4 March 2010

9:00-13:00

- Final discussion and development of an integrated strategy for CBNS
- Explore collaborative work with other ICES Expert Groups (ToR e)
- Discussion of the regional focus of the SG based on the outcome of the sub-group activities

13:00 – 14:00 Lunch

14:00 – 16:00

- Finalizing work plan for the SG for developing research proposal (ToR b)
- Close of meeting

SGCBNS terms of reference

a) Review and consider a reduced spatial coverage (i.e. small-scale approach) for studying benthic processes outlined as during the Working group Climate related Benthic Processes in the North Sea (WKCBNS);

b) Develop a work plan within the time frame of the Study Group for developing a comprehensive research proposal;

c) Initiate a benthos long-term series network in support of comparative studies on climate effects on the benthos across areas;

d) Initiate intercessional work by using case studies to explore wider patterns across benthic assemblages;

e) Explore collaborative opportunities with other ICES Expert Groups, for maximising the use of data sets;

f) Report by 15 March on potential contributions to the high priority topics of ICES Science Plan by completing the document named "SSGEF_workplan.doc" on the Share Point site. Consider your current expertise and rank the contributions by High, Low or Medium importance;

g) Prepare contributions for the 2010 SSGEF session during the ASC on the topic areas of the Science Plan which cover: Individual, population and community level growth, feeding and reproduction; The quality of habitats and the threats to them; Indicators of ecosystem health.

Annex 3: Case Study 1 – data sets

#	Geographical location	Station	Habitat	Depth	Length of time series	Sampling frequency	Reps per sampling date	Data Holder(s)
1	Plymouth	Jennycliff	Sandy mud	10m	July 2008 – May 2010	Every 2 months	5	PML (Somerfield / Widdicombe)
2	Plymouth	Cawsand	Fine sand	10m	July 2008 – May 2010	Every 2 months	5	PML (Somerfield / Widdicombe)
3	Plymouth	Rame Mud	Mud	50m	July 2008 – May 2010	Every 2 months	5	PML (Somerfield / Widdicombe)
4	Plymouth	L4	Muddy sand	50m	July 2008 – May 2010	Every 2 months	5	PML (Somerfield / Widdicombe)
5	Plymouth	Eddystone	Shell gravel	50m	July 2008 – May 2010	Every 2 months	5	PML (Somerfield / Widdicombe)
6	North Sea	Dogger Bank	Coarse sandy mixed	50	2007	Feb, Apr, May, Sept, Oct	4	Cefas (Birchenough)
7	North Sea	Oyster ground	Muddy sands	50	2007	Feb, Apr, May, Sept, Oct	4	Cefas (Birchenough)
8	North Sea	Sean gas field	Muddy sands	50	2007	Feb, Apr, May, Sept, Oct	4	Cefas (Birchenough)
9	North Sea	German Bight	Muddy sand	37m	2000 – 2002	Monthly	5	Senckenberg (Reiss)
10	North Sea	Oyster Ground	Muddy sand	41m	2000 – 2002	Monthly	5	Senckenberg (Reiss)
11	North Sea	Dogger Bank	Fine sand	30m	2000 – 2002	Monthly	5	Senckenberg (Reiss)
12	German Bight	H1	Mud	23	1969 - 1985	nearly Monthly	5	AWI (Schroeder)
13	German Bight	P12	Muddy sand	36	1969 - 1984	Every 1-2 Months	5	AWI (Schroeder)
14	German Bight	FSd	Fine sand	26	1969 - 1984	Every 1-2 Months	5	AWI (Schroeder)
15	Galway Bay	Leverets (polluted)	TBC	9m	Dec 1996 – Nov 1997	Monthly	TBC	Aberdeen (Solan)
16	Galway Bay	Margaretta (clean)	TBC	22m	Dec 1996 – Nov 1997	Monthly	TBC	Aberdeen (Solan)

Annex 4: European Marine Observation and Data Network (EMODNET)

Leen Vandepitte

Data on oceans and seas are available from many sources but assembling them for particular applications takes considerable effort and there is no overall policy for keeping them for posterity. An objective of the EU's new maritime policy is to integrate existing, but fragmented initiatives in order to facilitate access to primary data for public authorities, maritime services, related industries and researchers. The Commission has therefore undertaken to set up a European Marine Observation and Data Network to open up opportunities for marine researchers and private companies, improve the efficiency of activities such as marine observation, management of marine resources and marine research in European laboratories.

The 'proof of concept' of EMODNET is currently being tested through 5 preparatory actions: "Five portals for a number of maritime basins, providing access to marine data of a standard format and known quality and identify gaps in coverage and identify the main challenges". Pilot projects are being set up for biological, chemical, hydrological and geological data and for habitat mapping. The Biological Portal, coordinated by the Flanders Marine Institute (VLIZ), will provide access to biological marine data of a standard format and known quality and identify gaps in the geographical and temporal coverage. This portal will be based on an existing system called EurOBIS (www.eurobis.org) – the European node of the Ocean Biogeographic Information System (OBIS). Both systems will be interlinked and all data made available to EMODNET will also be visible and searchable through EurOBIS.

The biological lot of EMODNET focuses on the following geographical regions: North Sea (including Kattegat and English Channel), Bay of Biscay and the Iberian coast but will not limit its efforts to this. Different species groups are taken into consideration: benthos (macro- and meiobenthos), plankton (zoo- and phytoplankton), birds, mammals, reptiles, macro-algae and plants. All datasets containing information on the defined species groups and collected in the given geographical scope will be documented within the EMODNET data portal (http://bio.emodnet.eu/), where several search options are provided. The SGCBNS can make use of this Biological data portal in their search for long-term biological datasets suited for the planned and future case studies. Datasets identified within the SGCBNS can be documented (=metadata descriptions) within EMODNET, so the European research community is aware of their existence, where they are located and who can be contacted. In due time, data available within the Benthos Network can be made widely available through EurOBIS (e.g. presence data) and EMODNET. The EMODNET Biological Portal gives the possibility to make raw data, aggregated data and data products available. Data products are derived products of the actual raw data. They can include maps with aggregated data (e.g. on a grid scale) or they can be presence maps or maps representing biodiversity indices.

More information on EMODNET can be found at:

http://ec.europa.eu/maritimeaffairs/pdf/roadmap_emodnet_en.pdf

and

http://ec.europa.eu/maritimeaffairs/emodnet_en.html

Annex 5: SGCBNS draft Terms of Reference for the next meeting

The **Study Group on Climate Related Benthic Processes in the North Sea** (SGCBNS), chaired by Silvana Birchenough, UK, and Henning Reiss, Germany, will meet at ICES HQ, Copenhagen, Denmark, May (to be announced) 2011 to:

a) Review the outcome of the workshop on case study 1 in Plymouth and finalize the first manuscript

b) Calculation of benthic biomass for the North Sea as suggested by WGSAM (digitalized map of average benthos production and biomass

c) Start with the compilation and analyses of the data for case study 2

d) Identify required data for case studies 3-5 and develop a work plan for the analyses

e) Develop a work plan within the timeframe of the Study Group for the testing of ecosystem models by using benthos data;

f) Reviewing the progress of the network of long-term benthos series and discuss the further development of the network

SGCBNS will report by 15 June 2011 (via SSGEF) for the attention of the SCICOM, ACOM and BEWG.

Supporting Information

Priority	The work of this Study Group (SG hereafter) will be in accordance to the recent ICES Science Plan in support of an Ecosystem Approach. Evidence-based science to advance our current knowledge with the facilitation of interdisciplinary research for assessing climate change processes for marine benthos and the integration of surveys to harmonise practices will be a valuable strategy to develop this work.
Scientific justification	Current public and scientific concerns on the climate-driven changes within marine ecosystems has stimulated much interest in how climate change might affect benthic organisms. Currently there is a lack of understanding in how benthic communities respond to climatic variation. The fact that marine benthic ecosystems are relatively complex and ecological processes, such as trophic and non-trophic interactions, benthic-pelagic coupling and species interaction, are only partly understood, emphasizes the need for enhanced research of climate influences on benthic communities and processes. Based on the work done in the BEWG and the SGNSBP on the assessment of effects of changes in hydrodynamics and sea temperature and changes of the distribution of benthic communities, respectively, this SG will address relevant open questions of climate related processes in benthic systems. The Study Group "Climate related Benthic processes in the North Sea" [CBNS] will outline and inititate relevant interdisciplinary research and strategies by using case studies to address hypotheses relevant for climate effects on benthic systems. Furthermore, the SG aims to use benthic data for improving the performance of ecosystem models and therefore, their ability to predict changes in the benthos due to climate effect.
Resource requirements	ICES support and facilitation of venues for hosting the meeting in February 2010. Specific resource requirements are for members to prepare for and participate during the meetings.

Participants:	These would include a wide range of scientists, whose disciplines could contribute to the topics developed in this SG (e.g. benthic ecology, fish ecology and ecological modelling). Additional participation will be sought from ICES countries and by scientists both from disciplines and scientific circles not normally represented at ICES when necessary. It has to be clear that - because of its high data availability - the North Sea is here selected as a case-study area, rather than the research focus, which is the impact of climate change to the benthos. Hence, any expert in this field of research – also from non-North Sea bordering countries might contribute to the SG.
Secretariat facilities	This group is likely to have demand on the computing resources of the Secretariat, but no additional software/hardware is anticipated beyond that which is currently available (i.e. SharePoint site, ICES data base information).
Financial	
Linkages to advisory committees	ACOM
Linkages to other committees or groups	A close working link with e.g. Benthos Ecology Working Group (BEWG), Steering Group On Climate Change (SGCC), Working Group on Modelling of Physical/Biological Interactions (WGPBI), ICES Regional Ecosystem Group for the North Sea (REGNS) and ICES Working Group on Zooplankton Ecology (WGZE).
Linkages to other organizations	ICES will seek wider participation for this group including contact with relevant academic and intergovernmental organisations for this SG.

Annex 6: Recommendations

RECOMMENDATION	FOR FOLLOW UP BY
1. Support from ICES for the long-term network (e.g. facilitating network interactions and providing data contributions).	ICES Secretariate
2. The BEWG to develop the network further via facilitating and disseminating current and future initiatives.	BEWG Chairs
3. ICES to support intercessional work on the case studies (detailed work provided in the report for case studies 1–5).	ICES Secretariate
4. Facilitate the links between SGCBNS and Modelling group (WGPBI), WGBIODIV, BEWG.	SGCBNS, WGBIODIV, BEWG Chairs
5. ICES to actively feedback research needs and scientific priorities for the next FP7 call.	SGCBNS Chairs through ICES Head of Science Programme
6. VLIZ to assist in preparing data for case study 2 and to develop the website for the Benthos Network.	VLIZ through SGCBNS Chairs
7. The SG to support an additional workshop in Plymouth for case study 1.	SGCBNS