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REPORT OF THE STUDY GROUP ON THE NORTH SA BENTHOS PROJECT 2000 (SGNSBP)

10-13 APRIL 2006

NIOZ, TEXEL, THE NETHERLANDS



International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

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1 Executive Summary

1. This report documents progress with the analysis and reporting of data from the 2000 ICES North Sea Benthos Project, and includes exemplary outputs.
2. The Study Group aim to submit a Cooperative Research Report to ICES in 2006, and to pursue parallel publications in the peer-reviewed literature.
3. The draft report, along with the database, is held on the VLIZ/NSBP website. Discussions at the April 2006 meeting included arrangements for future access to the data, and alliances with other relevant initiatives, to ensure that the products are widely available to the scientific community after cessation of the work of the Study Group.
4. The outcome of the project will form the core of a Theme Session at the ICES ASC in 2007, entitled: 'Structure and dynamics of the North Sea benthos'.
5. Actions for 2006/7 are devoted to further work by correspondence to complete and integrate chapters for the CRR
6. An intersessional workshop will be held at VLIZ/Ostende (8–10 November 2006) to finalise the Cooperative Research Report and to summarise key outcomes for the final annual report of the Study Group to ICES in April 2007.

2 Opening of the meeting

The Study Group on the North Sea Benthos Project 2000 (SGNSBP) met from 10–13 April 2006 at NIOZ, Texel, The Netherlands. Dr. Hubert Rees (Chair) welcomed the participants listed at Annex 1 and recorded apologies from Karel Essink (who offered to review the draft Cooperative Research Report and this was welcomed by the Study Group), Heye Rumohr, Johan Craeymeersch, Steven Degraer, Gert van Hoey, Rebecca Smith, Michaela Schratzberger, Ingrid Kroncke, Henning Reiss, Bea Merckx.

3 Appointment of Rapporteur

Jackie Eggleton (UK) was appointed as Rapporteur.

4 Terms of Reference

The ICES Study Group on the North Sea Benthos Project 2000 [SGNSBP] (Chair: H Rees, UK) will meet at NIOZ, The Netherlands, from 10–13 April 2006 to:

- a) review the outcome of an intersessional Seminar/Writing Workshop held at VLIZ, Belgium, from 16–18 November, 2005 to:
 - i) present summaries of findings to date on the following topics:
 - sediments and contaminants
 - patterns and changes in the benthos (1986–2000)
 - ecosystem interactions and causal influences (1986–2000)
 - ii) evaluate and integrate findings across topics;
 - iii) produce a draft of a *Cooperative Research Report* on the ICES North Sea Benthos Project 2000;
 - iv) progress any outstanding analyses and interpretation of data;
 - v) produce additional material for peer-reviewed publications.
- b) work on a final draft of the Cooperative Research Report on the ICES North Sea Benthos Project 2000 with the view to completion in 2006;
- c) progress the drafting of text for peer-reviewed publication;
- d) explore strategic alliances with other relevant initiatives (e.g., MARBEF and EU WFD) to maximise the future utility of data and products arising from the North Sea Benthos Project 2000;
- e) agree structure for a proposed ICES Theme Session on the North Sea benthos in 2007;
- f) make recommendations on the utility of North Sea benthos indicators at the species and community level;
- g) make recommendations for future work on the North Sea benthos, including a procedural framework.
- h) to agree protocols for future access and use of the NSBP 2000 data via ICES database.
- i) work by correspondence until April 2007 to:
 - i) complete the Cooperative Research Report;
 - ii) plan for the 2007 Theme Session.

SGNSBP will report by 1 May 2006 for the attention of the Marine Habitat Committee, ACME and ACE.

5 Adoption of the agenda

The draft agenda (Annex 2) was adopted by the Study Group.

6 Report of intersessional seminar/writing workshop November 2005 (ToR a)

An intersessional seminar/writing workshop was held at VLIZ, Oostende, Belgium, 16 to 18 November 2005. A report of the workshop is attached at Annex 3.

7 Work on a final draft of the Cooperative Research Report on the ICES North Sea Benthos Project 2000 with the view to completion in 2006 (ToR b)

Work continued on populating the final draft of the Cooperative Research Report (CRR) with a view to submission to ICES for publication by December 2006, and this accounted for the majority of effort at the Study Group meeting (see Agenda at Annex 2). All text and plots were sent to Edward Vanden Berghe for entry into Draft 5, on the VLIZ website (private NSBP pages) for all contributors to view and comment on. The latest draft structure of the report is given at Annex 4, and exemplary summary text produced at the meeting is presented at Annex 5.

Significant progress was made both intersessionally and at the Study Group meeting on the accumulation of environmental variables (including outputs from hydrographic models) as aids to the interpretation of patterns in benthic communities. In order to ensure that these outputs, along with correlations with univariate biological measures, were available to the authors of the relevant chapters, it was agreed that W Willems and E Vanden Berghe would complete preliminary analyses and make the results available on the NSBP website (see Actions at Annex 7). W. Willems would further exploit the outcome in developing Chapter 5.5 (predictive modelling), which he leads.

Further progress had also been made on the analysis of sediments for trace metal contaminants by G Irion (reported by I Kroncke) and, on completion, interpreted output by Prof Irion will be available for the draft report (Chapter 4.3). Supplementary text on an interpretation of trace metal concentrations in the <63 micron fraction of sediments of the W North Sea (*via* R Smith) was added to the draft report during the meeting.

8 Progress the drafting of text for peer-reviewed publication (ToR c)

Simultaneous progress was made on the drafting of the planned first publication on 'Structure and Characterising Species' (Eike Rachor *et al.*), and it was expected that several other peer-reviewed papers would arise from the work currently being completed for the Cooperative Research Report. A separate account of the benthic communities and sediment quality of the W North Sea off the UK coast was also being prepared to fulfil national obligations (R. Smith *et al.*).

9 Explore strategic alliances with other relevant initiatives (ToR d)

Strategic alliances have been considered in previous meetings and were further reviewed. The main objective was to ensure that the data products remained 'live' for future research and applications, after cessation of Study Group work. It was agreed that the Benthos Ecology WG would be the appropriate ICES umbrella for promoting data sources and products, and for the pursuit of future ICES-sponsored international collaborative initiatives on comparable scales. Edward Vanden Berghe has already pursued options to link the NSBP and ICES databases. The alliance with interested parties engaged in implementation of the EU 'Water Framework' Directive would be served by Study Group work on the applications of a variety of benthic indicators, as well as future access to the database for referencing against findings from other studies. It was agreed that Hubert Rees should write to the Chair of MarBEF (with prior authority from the data providers: see 10, below) to allow the integration of the NSBP and MarBEF databases. It was also agreed (again subject to prior authority from the data providers) that the NSBP data should be made available to OBIS (Ocean Biogeographic Information System), which is a worldwide database and a project of the Census of Marine Life (<http://www.iobis.org>).

10 To agree protocols for future access and use of the NSBP 2000 data via ICES database (ToR h)

Hubert Rees will contact data providers to ask their permission to release the NSBP data to ICES, OBIS, and MarBEF and, thereby, to promote free access to the marine scientific community. This would be done on completion of the ICES Cooperative Research Report, and would be accompanied by the agreed protocol for data release.

11 Make recommendations on the utility of North Sea benthos indicators at the species and community level (ToR f)

Under Chapter 5.4 of the Cooperative Research Report, a range of indicators are being examined for their utility in identifying spatial and temporal (2000 v. 1986) trends. Interpretation was incomplete at the time of this report, but recommendations will appear in the published Cooperative Research Report.

12 Review of advantages/constraints of a repeat exercise (survey and/or data compilation) in 2010 (ToR g)

The outcome of a review of the advantages and constraints of a repeat sampling exercise is presented in the table below. The issues identified will be synthesised in Chapter 8 (Recommendations) of the Cooperative Research Report.

ADVANTAGES	CONSTRAINTS
Application of a uniform methodology.	A lot of work (<i>i.e.</i> , requires adequate resources).
The process (sampling, analysis, data management <i>etc.</i>) will take less time, since much of the groundwork for a repeat survey has already been done.	Local and North Sea-wide methods have to be comparable.
Homogeneous spatial distribution and quality of samples.	'Opportunistic' exploitation of ship-time and available personnel can, in the absence of adequate resources and planning at an international level, lead to QA problems.
Time-series (1986–2000–2010): climate changes, NAO oscillations.	
Local and regional developments can be compared with the total.	
Evaluation of the success of actions, <i>e.g.</i> , by WFD, Natura 2000, OSPAR activities.	
Evaluation of the success of fisheries management measures.	
Standard-setting for monitoring activities in restricted areas (<i>e.g.</i> , at wind farms, sand and gravel extraction areas, oil and gas platforms, marine nature reserves); incorporation of such data into a wider assessment framework.	Insufficient availability of such ('private') data sets.
Quasi-synoptic; agreed methods.	If sampling is 'scattered' (<i>i.e.</i> , conducted for different purposes and therefore not quasi-synoptic), then comparability as well as data availability will be reduced.
Support for ecosystem studies, including modelling.	Lack of funding.
Keeps a well-trained and experienced group of scientists 'alive' to the process of international collaboration, and the pursuit of excellence.	If there is no longer-term planning of a repetition, it will be difficult to find the (experienced) scientists.
Generates important sea-wide data on benthic biological status for historical comparisons (effects of: global warming, fishing impacts, alien/invasive species <i>etc.</i>).	Lack of public interest.
Basis for exchange of experience and innovations.	Lack of properly-trained benthos specialists.
Benefits to science community/individual specialists arising from the practice of collaboration at an international level; important training ground for younger scientists.	Lack of academic interest.
Strategically important benefit of integrating/amending national approaches for the greater good of North Sea ecosystem assessment and management.	
Sets a realistic (10-year) time-scale for sea-wide re-assessment.	
Provides a 'global' framework for contextualising regional or local surveys, including tests of indicator effectiveness.	
Opportunity for identifying 'representative' (habitat- or assemblage-based) stations for long-term monitoring.	
Fits with the international momentum towards holistic (sea-wide) ecosystem assessments, especially under OSPAR, ICES and EU auspices.	
Achievable given good collaboration, international support and adequate resources.	Earlier proposals for funding of collaborative sea-wide assessments of the benthos have tended to founder on the view that responsibilities and therefore funding rest with individual countries (leading to a circular argument).
New co-ordinated survey work would be an excellent opportunity to implement recent improvements in QA of benthic studies (sampling and analytical procedures; data management) and further exploit the high level of scientific skills of representatives from all North Sea countries.	Opportunistic data compilation can be a 'hostage to fortune', given limitations in spatial coverage and data quality at a given time.

13 Theme Session: Structure and dynamics of the North Sea benthos (ToR e)

This proposal had been agreed by ICES, and would be held at the 2007 ASC. The specification was as follows: “The Theme Session shall attract presentations about joint North Sea studies on benthic ecology and related fields (sedimentology, fishery impact, anthropogenic disturbance and others). Also examples of biotope/habitat mapping are welcome. The basis is the 1986 North Sea Benthos Survey of the BEWG and the North Sea Benthos Project 2000 of the SGNSBP, as well as additional studies in the same timeframe. Historical comparisons and the search for environmental change will be the main focus of this theme session as well as a look forward and the goals of future studies”.

The co-conveners were H. Rees, E Van den Berghe, S. Degraer and H. Rumohr. It was agreed that papers covering the core content of the ICES CRR would be presented on behalf of the NSBP 2000 initiative. The brief was, however, wider and additional contributions would be encouraged. It was noted that a Theme Session on the MarBEF initiative had been postponed to 2007. The Study Group considered that there may be significant scope for synergy at the interface between the two sessions, and it was agreed that H. Rees would contact C. Heip (MarBEF lead/co-convener) to explore links.

14 Work by correspondence until April 2007 (ToR i)

It was agreed that all authors should complete draft chapters by 31 May 2006, to allow editing, integration and review of the combined submissions to proceed in subsequent months, via the website and correspondence.

It was also agreed to hold an intersessional workshop before submitting the report in December 2006. This will be held at VLIZ, Ostende, from 8 to 10 November 2006 to finalise the CRR and to consolidate recommendations for future work on the North Sea benthos, which would also be reported as part of the final Study Group report to ICES in April 2007.

15 Presentation by Erik Meesters (IMARES) of EMIGMA

During the workshop Erik Meesters from IMARES demonstrated a database called EMIGMA, which contains 280 long-term time series datasets from the North Sea and Wadden Sea. A short summary of the system is presented at Annex 6.

16 Terms of Reference for 2006/2007

The proposed Terms of Reference for SGNSBP 2000 activity are given at Annex 7.

17 Actions

Actions arising from the SGNSBP 2000 meeting of April 2006 are given at Annex 8.

18 Close of meeting

The meeting closed at 16:00 on 13 April. On behalf of the SG, the Chair thanked Marc Lavaleye and Gerard Duineveld for hosting the meeting at NIOZ, and for their hospitality.

Annex 1: List of participants

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Annex 2: Agenda

10 April

10:00–10:15 Introduction/appointment of Rapporteur (H Rees)

Review of progress (CRR):

10:15–10:30 NSBP 2000 database and data management issues/Chapter 3 (E Vanden Berghe)

10:30–10:45 The North Sea environment/Chapter 4: including sediments and contaminants (H Hillewaert/H Rees/E Vanden Berghe)

10:45–12:15 Patterns and changes in the benthos (1986–2000): Chapter 5.

This will be a round-table discussion, with an outline of progress by the lead authors for sections i-vi. (c. 5 minutes for each).

12:15–13:00 Ecosystem interactions (1986–2000): Chapter 6.

This will also be a round-table exchange, with an outline of progress provided by the lead authors for sections i-iv. (c. 5 minutes for each).

An Action List will be prepared during the morning session, for attention during the meeting.

14:00–14:15 Agree sub-groups.

This should follow logically from the provisional list of authors, but will be amended according to availability. The sub-groups will decide who does what and ensure that all needs are covered.

14:15–15:30 Allocate responsibilities within S-Gs; proceed with data analyses/drafting of text.

16:00–17:30 Data analyses/drafting of text.

11 April

09:00–09:15 Plenary to briefly review progress: identify any major issues for resolution.

09:15–10:30 Sub-group activity.

11:00–13:00 Sub-group activity.

14:00–14:45 Plenary: T of R d): strategic alliances (e.g., with EU MARBEF) to maximise the future utility of NSBP 2000 data, and e): structure for ICES ASC Theme Session. Other matters arising.

14:45–15:30 Sub-group activity.

16:00–17:30 Sub-group activity.

12 APRIL

09:00–09:15 Plenary to briefly review progress: identify any major issues for resolution.

09:15 – 10:30 Sub-group activity.

11:00 – 13:00 Sub-group activity.

14:00–15:00 Plenary: T of R f): recommendations on North Sea species/community-level indicators, and g) recommendations on future North Sea benthos studies. Other matters arising.

15:00–15:30 Sub-group activity.

16:00–17:30 Sub-group activity.

13 April

09:00–10:30 Sub-group activity: agree summary of progress/highlights for Plenary.

11:00–12:00 Plenary: review of outcomes by Sub-Group leaders.

This will take the form of: a) brief presentations of progress in analyses/drafting with highlights, along with actions for immediate or later attention; b) round-table contributions aimed at improving/integrating sections and avoiding overlap.

12:00–13:00 Sub-group activity/address actions.

14:00–15:00 Sub-group activity: agree latest draft text for entry onto the Co-op. Res. Rep. template.

15:00–15:30 Plenary: agree summary of meeting and actions.

Close of meeting.

Annex 3: Report of the SGNSBP 2000 Intersessional Workshop at VLIZ/IODE, Ostende, Belgium, 16–18 November 2005

Present: Hubert Rees (Chair - HR), Rebecca Smith (Rapporteur - RS), Edward van den Berghe (Host - EVB), Jacqueline Eggleton (JE), Eike Rachor (ER), Henning Reiss (HeR), Gerard Duineveld (GD), Marc Lavaleye (ML), Johan Craeymeersch (JC), Hans Hillewaert (HH), Steven Degraer (SG), Gert Van Hoey (part – GVH), Wouter Willems (WW), Michaela Schratzberger (part - MS).

Dr Rees (Chair) welcomed the participants. Rebecca Smith was appointed as Rapporteur for the meeting. The primary purpose of the present meeting was to make substantial progress towards the write-up of findings for the Cooperative Research Report and also for peer-reviewed publications. The meeting commenced with a review of the Terms of Reference for the Study Group. The proposed agenda was agreed and work commenced to the agenda timetable.

On behalf of the members, the Chair of the SGNSBP2000 thanked the Inter-governmental Oceanographic Commission (IOC) project office for the International Oceanographic Data and Information Exchange (IODE) for their hospitality in hosting the meeting along with VLIZ. Vladimir Vladymyrov, head of the IODE project office, provided a welcome and short overview of the work of the new unit.

Following presentations of progress to date, participants were allocated to the following sub-groups to continue data analysis and reporting for the remainder of the workshop.

Sub-groups:

- 1 – HH – sedimentology
- 2 – ER, SG, GD, HeR, (JC) – patterns in 2000 and comparisons
- 3 – RS and JE – species distribution
- 4 – ML and JC – functionality
- 5 – HR, EVB, GVH (with MS) – indices
- 6 – WW (JC) – Predictive modelling

Each sub-group was tasked to produce a summary document of progress for inclusion into a draft of the Cooperative Research Report, which will be circulated, by the end of November to data contributors and authors. Following review of sub-group activities, as per the agenda, a full list of actions for completion prior to the next meeting was collated (below).

Venue and date for next meeting:

NIOZ, The Netherlands, 10-13 April, 2006.

General actions

Ensure all draft material is submitted by 17 March 2006 at the latest to allow collective review of the draft CRR for the 10-13 April 2006 meeting (Texel).

Specific actions

- 1) HR + HeR + IK to draft text on 'Other human activities' by end-February 2006.
- 2) MS to obtain 'human activities' map (Cefas) asap.
- 3) HH to provide locations of North Sea aggregate sites to EVB asap.
- 4) HR to provide locations of North Sea dredgings disposal sites to EVB asap.
- 5) HR to provide locations of prospective windfarm sites.
- 6) HR to compile available new (end-of-meeting) text and circulate a revised draft of the CRR asap.
- 7) RS to circulate short meeting report with actions asap.
- 8) ER + SG + GD + HeR to complete draft of CRR text for structure and characterising species by 31 January 2006.
- 9) MS to produce text for Parallel Studies section by 28 February 2006.
- 10) HR + EVB + MS to draft text for up-dated indicators section and forward to GVH by 28 January 2006, for further work prior to submission by 17 March, 2006.
- 11) HH to draft end-of-meeting text on sediment psa, and place the derived statistics on the NSBP 2000 website for access by others; produce final draft of text on psa by 28 February, 2006.
- 12) RS + JE to produce end-of-meeting text on species distributions together with draft plots; to produce a final draft of text by 28 February, 2006.
- 13) EVB to produce and circulate revised draft on data management by 17 February 2006.
- 14) ML, GD + JC to produce end-of-meeting text + Figures on functional properties; to produce final draft by 28 February 2006.
- 15) HeR to consult GI to produce an a/c on trace metals in sediments (<20 microns) by 28 February 2006.
- 16) RS to provide summary a/c of trace metal concentrations in the western North Sea by 28 February 2006.
- 17) HeR + IK to produce an end-of-meeting outline + preliminary results on community structure changes between 1986 and 2000, and to produce a final draft by 28 February 2006.
- 18) HR to produce draft Conclusions + Recommendations by 17 mid-March 2006.
- 19) JC to produce draft text on Fishing practices by 17 March 2006.
- 20) WW to produce end-of-meeting draft on Predictive modelling and final draft by 28 February, 2006.
- 21) GVH to produce draft text on Structuring species (case study) by 17 March 2006.
- 22) GD (Dutch coast), JC (Dutch coast), HeR (German Bight and Dogger Bank), ER (German Bight), SG/HH (Belgian coast), HR (NE English coast) to submit a summary of time-series studies (with Figure(s)) to HR by 28 February, 2006.
- 23) EVB to compile available biomass data by December 31, 2005; JC, RS, to assess the quality of the data with reference to any methodological problems, by 31 January 2006.
- 24) SG to set up an MSc student for a project on biomass from the NSBP 2000 and NSBS 1986 surveys (February–May 2006).
- 25) HR/EVB to circulate the revised draft CRR by 1 April, 2006.

Annex 4: Draft structure for Cooperative Research Report

1. Summary (H. Rees)

2. Introduction (H. Rees)

3. NSBP 2000 Data Management (E. Vanden Berghe)

3.1 Taxonomic problems

3.2. Sources of data

3.3 Database structure

3.4 Access to NSBP 2000 data

4. The North Sea environment

4.1 Synopsis and human influences (H. Rees)

4.2 Sediment particle size (H. Hillewaert)

4.3 Heavy metals in sediments (G. Irion)

5. Patterns and changes in the benthos (1986–2000)

5.1 Structure and characterising species of macro-zoobenthos communities in 2000
(E. Rachor, S. Degraer, G. Duineveld, H. Reiss)

5.2 Changes in community structure (1986–2000) and causal influences
(I. Kröncke, H. Reiss)

5.3 Species distributions (R. Smith, J. Eggleton)

5.4 (Role of) biotic/diversity indices (G. Van Hoey, H. Rees, H. Reiss, J. Craeymeersch)

5.5 Predictive modelling (W. Willems, S. Degraer)

5.6 Parallel studies (M. Schratzberger, G. Duineveld)

5.7 Structuring species: a case study. (G. Van Hoey)

6. Ecosystem interactions (1986 – 2000)

6.1 Links between infauna, epifauna and fish distributions (H. Reiss)

6.2 Functional diversity (M. Lavaleye)

6.3 Fishing practices (J. Craeymeersch, M. Lavaleye, G. Duineveld, M. Bergman)

6.4 Benthic community studies over relevant time-scales (GD, JC, HeR, ER, SG/HH, HR)

7. Conclusions (H. Rees)

8. Recommendations (H. Rees)

9. Acknowledgements

10. References

Annex 1 Collaborative projects relevant to the assessment of benthic communities of the North Sea

Annex 5: Exemplary output

Chapter 5.1 of Cooperative Research Report: 'Structure and characterising species of macro-zoobenthos communities in 2000'

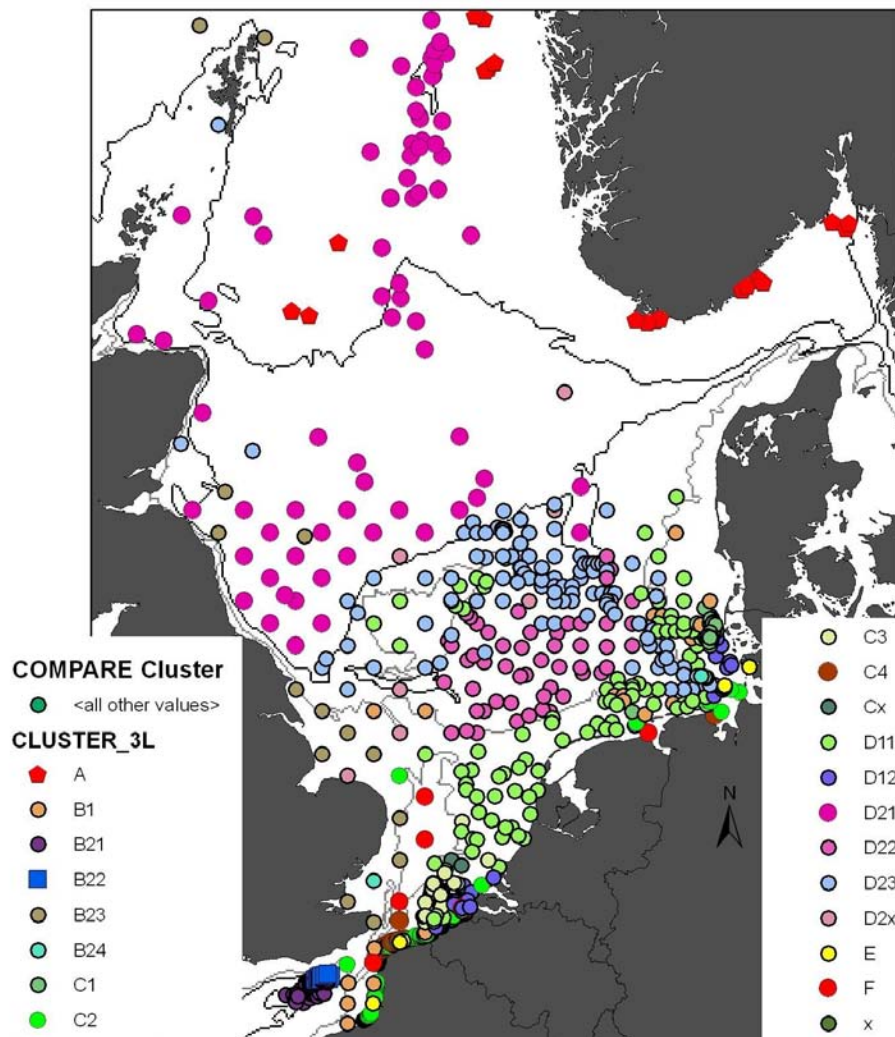


Figure A5.1: Distribution of assemblages in the North Sea in 2000 according to cluster analysis on similarity.

Table A5.1: Assemblages of macro-zoobenthos in the North Sea in 2000 with information on the area, the sediments/habitats, water depths, dominating and characterizing species as well as structural descriptors.

CLUSTER	AREA	WATER DEPTHS (M)	SEDIMENTS	NAME GIVING SPECIES	DOMINANTS	CHARACTERIZING SPECIES	AV. SIM.	AV. DIVERSITY ES(50)	AV. DENSITY & SD	STATION NUMBERS
A	Near Norway & Fladen Ground	> 100	Mud		<i>Heteromastus filif.</i> <i>Paramphinome jeffr.</i>		37.6	18.6	1655 1320	20
D 21	Northern & central NS	> 50	Muddy sand	<i>Myriochele</i>	<i>Myriochele</i> <i>Owenia fusiformis</i>	<i>Myriochele</i>	36.6	19.4	1536 1146	74
D 23	Around Dogger Bank & in the Pleistocene Elbe valley (PEV)	35-50	Slightly muddy sand	<i>Amphiura</i> with <i>Spiophanes</i>	<i>Spiophanes bombyx</i> <i>Amphiura filiformis</i>		39.3	14.1	2276 1386	121
D 22	Oyster Ground & outer part of the PEV	35-50	Muddy sand	<i>Amphiura</i> with <i>Corbula</i>	<i>Amphiura filiformis</i> <i>Corbula gibba</i>		50.7	15.1	1520 838	55
D 11	Offshore sand areas in the southern NS (SNS) & Dogger Bank	15-35	Fine sand	<i>Tellina fabula</i>	<i>Magelona johnstoni</i> <i>Spiophanes bombyx</i>		35.8	12.5	1177 1064	128
D 12	Sand areas nearer to coast in the southern NS	10-20	Fine to med. sand		<i>Spiophanes bombyx</i> <i>Lanice conchilega</i>		36.7	10.9	3578 4342	118
E	Inshore southern NS		? Muddy sand ?		<i>Chaetozone</i>		24.6	7.1	585 1454	58
B 1	Banks with coarse sands (SNS)	15-35	Coarse sand, partly gravelly	<i>Spisula</i> spp <i>Goniadella.</i>	<i>Aonides paucibr.</i> <i>Branchiostoma lanc</i>		19.8	13.2	828 705	26
C 1	SE-NS banks?	15 ?	Med. sand ?		<i>Nephtys cirrosa</i>		30.3	10.0	169 158	28
C2, C3 and F	Southwestern NS	< 20	? sand ?		<i>Gastrosacchus spin.</i> <i>Magelona johnstoni</i>		29-37	6.6, 8.5	209, 430 291, 280	75, 88
	Southern NS		sand ?		<i>Nephtys</i> spp.		14	7.1	72 52	7
B 23	Western NS & north of Shetlands	?	Coarse to med. sands		<i>Lanice conchilega</i> <i>Sabellaria spinolosa</i>	<i>Protodorvillea</i> <i>kef. ?</i>	29.3	19.7	1648 1394	14
B 21 and B 22	Eastern English Channel	?	Sand to gravel		<i>Hesionura elongata</i> <i>Aonides paucibranch.</i>		51.1	24.0	823 283	91
	as 21		as 21		<i>Pomatoceros triqu.</i>		50.7	12.1	536 295	12

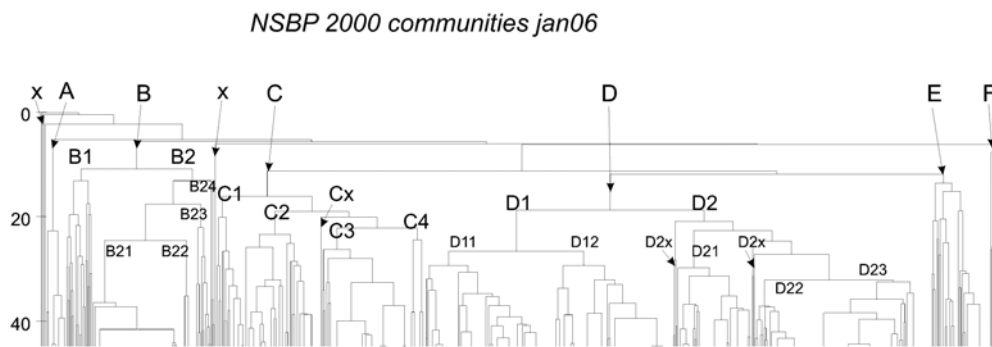


Figure A5.2: Cluster dendrogram (upper part only) of the groupings shown in Figure A5.1.

Some general results

As in earlier descriptions (Heip *et al.*, 1992), a main division of the macro-zoobenthos in the North Sea between its northern and southern parts again appears in the results of the 2000 survey. This is well seen in the separation of assemblages along the northern deep slope margin (at about 50–60 m depths in the cluster results, Figure 8, and at a bit greater depth, 60–70 m, comparable to the results from 1986. Major large-scale changes are mainly seen in the community of the submersed Pleistocene Elbe valley (*Amphiura filiformis* with *Spiophanes bombyx*), which is also inhabiting the outer margins of the Dogger Bank (see chapters 5.2 and 5.3, e.g. the spreading of *Acrocnida brachiata* towards the inner German Bight and on the Dogger Bank).

Accordingly, also the general latitudinal trends in diversity and density from the South to the North of the sea as described by the 1986 data (Heip *et al.*, 1992) were again shown in 2000. They are at the same time related to water depths, which follows the same general trend. The deepest stations in the Norwegian Skagerrak part, however, do not follow this rule, presumably, because they are exceptionally deep (> 350 m). Lowest diversities were found in the very inshore waters along the whole southern North Sea coast. This seems not only related to the reduced salinities there, but, also to the high climatic and hydrological variability and disturbing human influences including pollution.

The west-to-east trends shown with univariate methods indicate that the eastern North Sea (especially a large part of the German Bight in the Southeast) is generally impoverished in diversity. This part of the North Sea is most remote and biogeographically sheltered from the species-rich Atlantic Ocean and most strongly under the mentioned disturbing “continental” (mainland) influences.

While the northern and central parts of the North Sea were partly poorly covered with sampling stations in 2000, the nearshore areas from the Channel and along the French and Belgian coasts were sampled with very high spatial resolution. The groups identified there by both, clustering and TWINSpan, may be regarded as local sub-associations of larger communities (e.g. the *Macoma* or the *Goniadella-Spisula* communities) reflecting the high spatial variability of environmental conditions in such near- and inshore waters.

Enfacing the larger North Sea, these details appear to be of minor importance, and it is referred here to the relevant publications for these areas (e.g. Degraer *et al.*, 200x; “Dutch”; Rachor and Nehmer, 2003). Nevertheless, distinctions according to sediment conditions, water depths as well as longitude are apparent.

While the more offshore (fine to medium) sand areas in the Dutch and German waters as well as the higher Dogger Bank appear inhabited by a quite homogenous community of the *Tellina fabula* type, the sand areas off the English east coast (with water depths of less than about 30 m) are less uniform in their sediment substrates and, accordingly, inhabited by different assemblages.

North of the “Frisian Front” with very muddy sediments at about 30 m depths, the Oyster Ground with mixed fine substrates up to the southern margin of the Dogger Bank is inhabited by the *Amphiura filiformis* community with *Corbula gibba*, partly reaching across the Pleistocene Elbe valley in the East. This influence is more strongly expressed in the TWINSPAN results, while the clustering shows up with a stronger relation to the central North Sea *Myriochele* community in the depression east of the Dogger Bank (tail end).

Chapter 5.4 of Co-operative Research Report: ‘BIOTIC/DIVERSITY INDICES’

Comparison of Indices

The following plots explore relationships between the ‘AMBI’ and ‘BQI’ biotic indices (Borja *et al.*, 2000 and Rosenberg *et al.*, 2004, respectively) both with each other, and over time (1986 and 2000 North Sea benthos surveys). Here we take the opportunity to simply illustrate the scope of the data to provide a platform for large scale comparisons of indicator performance and consistency. Further details of these and other comparative assessments will appear in the Cooperative Research Report.

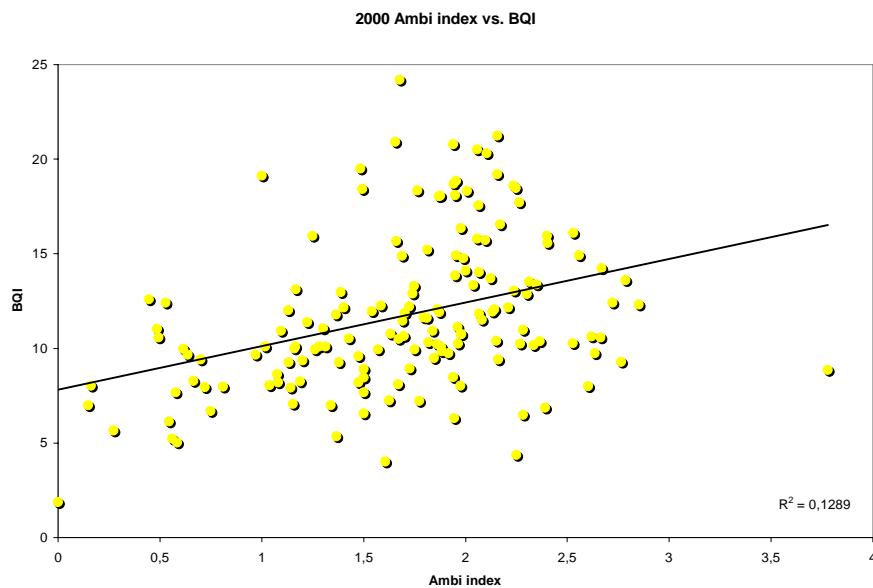


Figure A5.3: Relationship between AMBI and BQI in 2000.

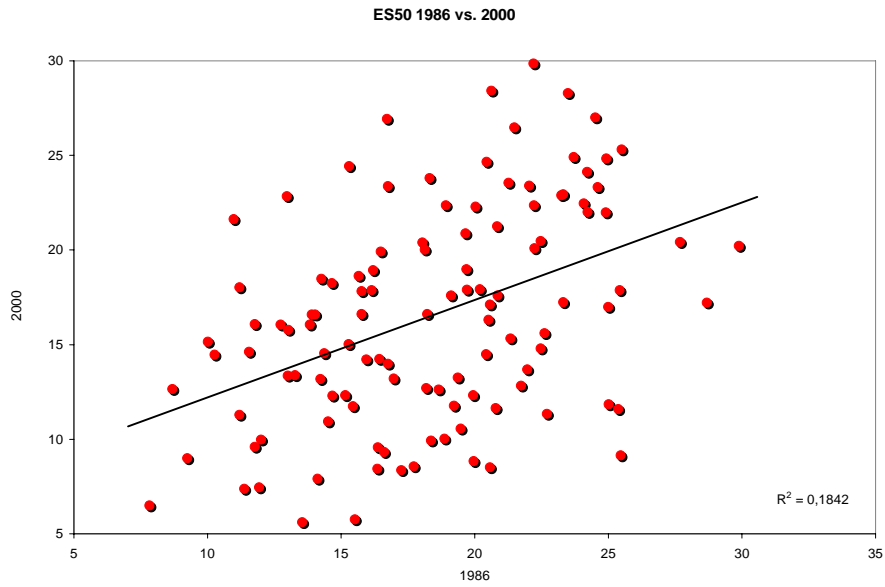


Figure A5.4: Relationship between ES50 in 1986 and 2000.

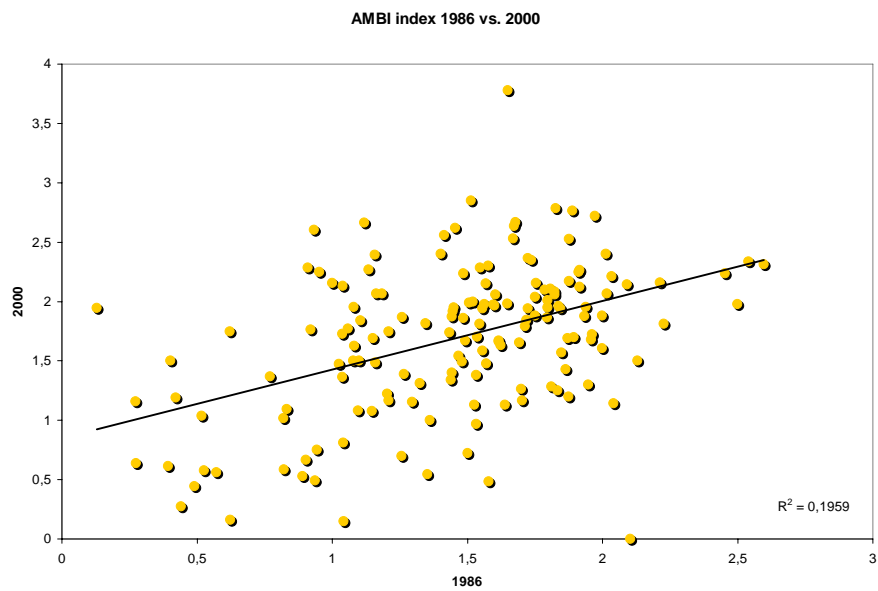


Figure A5.5: Relationship between the AMBI index in 1986 and 2000.

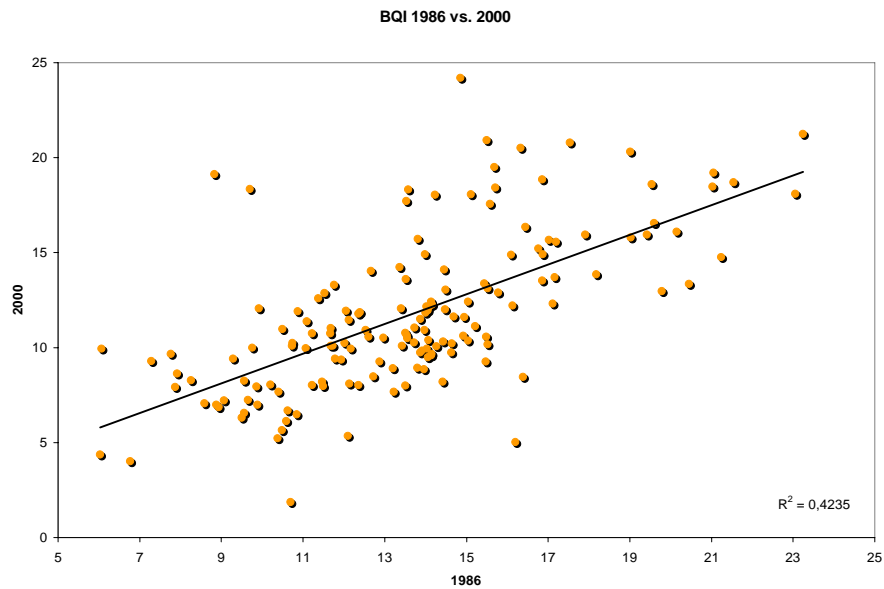


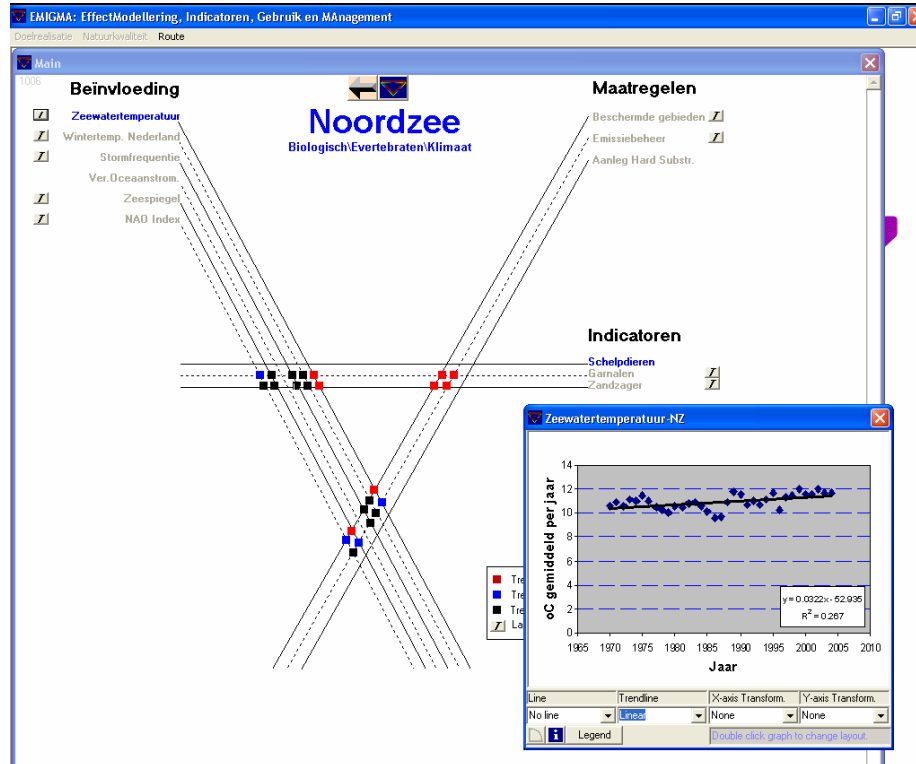
Figure A5.6: Relationship between BQI in 1986 and 2000.

References

- Borja, A., Franco, J., and Perez, V. 2000. A Marine Biotic Index to Establish the Ecological Quality of Soft-Bottom Benthos within European Estuarine and Coastal Environments. *Mar. Poll. Bull.*, 40(12): 1100–1114.
- Rosenberg, R., Blomqvist, M., Nilsson, H.C., Cederwall, H., and Dimming, A. 2004. Marine quality assessment by use of Benthic species-abundance distributions: a proposed new protocol within the European Union Water Framework Directive. *Mar. Poll. Bull.*, 49: 728–739.

Annex 6: EMIGMA Demonstration

The EMIGMA system



What is EMIGMA?

EMIGMA is a database application system that contains many time series of Indicators, Pressures and Management actions of North Sea and Wadden Sea built by IMARES, part of Wageningen University. EMIGMA stands for Effect Modelling of Indicators, Pressures (“Gebruik” in Dutch) and Management. The time series data are aggregated at a high level (yearly means). At the moment there are almost 280 long-term time series in the database and EMIGMA offers ample opportunities to look at these series in various ways. EMIGMA is now divided into two geographic regions, the North Sea and the Wadden Sea and efforts are made to include the delta area in the south of the Netherlands as well. In each region indicators, pressures and management action data series are put together in meaningful ways that are visualized as different levels one can zoom in to (e.g. Pressures are divided into climate change, fishery data series and many others; Indicators also have many sublevels, e.g. biological, chemical, physical etc.). In addition, within the North Sea part of EMIGMA some subdivisions in different regions are included as sublevels. EMIGMA is now still available as a (Dutch) demonstration model, but efforts are underway to make it available (also in English) to anyone who is interested.

What can you do with EMIGMA?

With EMIGMA you can study time series of Pressures and Indicators. Plot them separately or against each other and apply various smoothing techniques and transformations to the data. Through every data series in EMIGMA one can easily access all kind of extra information such as source and contact information, reports and articles, and distribution maps.

EMIGMA includes the possibility to evaluate time series with respect to safety limits (e.g. minimum viable population) and targets. EMIGMA also offers a quick way to assess the significance of correlations between different time series, apply different simple regression and smoothing techniques and transform axes in several ways. The database is very easily updated with extra time series, data points and levels in EMIGMA. Changes in the database are directly visible in the application. Depending on the type of user that is logged in one can also directly access the plotted data and insert new levels and data series into EMIGMA.

What are the advantages of EMIGMA?

EMIGMA brings together aggregated data of many time series of indicators and pressures and offers a quick and easy way to access, plot and study them. EMIGMA is very easily accessed providing simple and efficient ways to keep the included time series up to date. EMIGMA can be used to study correlations between time series and give insights and stimulate hypothesis building.

Where do we want to go with EMIGMA?

Presently EMIGMA is entering the demonstration phase. In the future we like to include more background information such as scientific articles, grey literature and distribution maps. We are very interested in people who want to participate in the project in any way. Ultimately we would like to make EMIGMA freely available to everybody interested (research, government, industry), most likely as an internet based application. If you are interested in EMIGMA and like to obtain more information, please send a mail to emigma@wur.nl or erik.meesters@wur.nl.

Annex 7: SGNSBP 2000 Terms of Reference 2006

The Study Group on the North Sea Benthos Project 2000 [SGNSBP 2000] (Chair: H Rees, UK) will meet intersessionally (VLIZ, Ostende, 8-10 November, 2006) and work by correspondence to:

- a) complete and submit an ICES Co-operative Research Report on the structure and dynamics of the North Sea Benthos;
- b) plan for the 2007 ICEAS ASC Theme Session on the outcome of the North Sea Benthos Project and related work;
- c) produce a summary of key findings and lessons for future international collaborative assessments of a comparable nature
- d) continue work towards peer-reviewed publications.

SGNSBP 2000 will report by DATE for the attention of the Marine Habitat, ACME and ACE Committees.

Supporting Information

Priority:	High (the assessment of benthic biological status in the North Sea is relevant to the ongoing interests of ICES, OSPAR and the EU, particularly with regard to its contribution to the development of an ecosystem approach to environmental management).
Scientific justification and relation to action plan:	Proposed T of R a)-d) will be met by further intersessional work and interactions between the co-authors. A sub-group of co-authors, acting on behalf of the data contributors, will meet inter-sessionally in November 2006 to complete the co-operative research report for submission to ICES in December 2006. This will be essential as a final check on the quality and consistency of the analytical and interpretational outputs, including the overall conclusions and recommendations. Thereafter, the SG will continue to work by correspondence, to consolidate a structure for the 2007 ASC Theme Session, and to summarise the important outcomes and lessons for future collaborative work on benthic communities, arising from the NSBP. The work of this SG contributes to Action Plan Nos. 1.2.1, 1.11, 2.8 and 2.9.
Resource requirements:	N/A
Participants:	Benthic ecologists participating in the project.
Secretariat facilities:	N/A
Financial:	None.
Linkages to advisory committees:	ACME, ACE.
Linkages to other committees or groups:	BEWG, WGECO, WGEXT, WGMHM, WGSDEM, WGMDM, STGQAB
Linkages to other organizations:	OSPAR, EU.
Secretariat marginal cost share:	ICES 100%

Annex 8: Actions

- 1) Eike Rachor, asap, to discuss progress on Chapter 5.2, and on links with 5.1, with Ingrid K/Henning R.
- 2) All SG/ April 2006 attendees: complete post-meeting revisions of chapters currently in draft at the April 2006 meeting not later than 31 May 2006.
- 3) Johan Craeymeersch to communicate with Gerard D. and Magda B. re. progress on chapter 6.3 (fishing practices).
- 4) E Vanden Berghe to place draft 5 of the CRR on the VLIZ/NSBP website.
- 5) J Eggleton/R Smith/E Vanden Berghe to finalise the compilation of biomass data.
- 6) E Rachor/Hans H to report on progress under SG NSBP 2000 to the May 2006 BEWG meeting.
- 7) H Rees to report on progress/plans under SG NSBP 2000 at the ICES ASC (MHC).
- 8) W Willems to report progress on indicators applied to NSBP data to G Van Hoey; GVH, HR and EVB to further develop the chapter asap.
- 9) G VAN HOEY to forward the text on Lanice to EVB and H Rees, for inclusion in the draft CRR
- 10) HR to further develop the conclusions and recommendations, for discussion among co-authors and inclusion in the latest draft of the CRR
- 11) H Rees to liaise with Carlo Heip over the scope/benefits of harmonising elements of the MARBEF and NSBP Theme Sessions (ASC, 2007).
- 12) HR/EVB to draft a letter to data contributors on recommendations for future access to the NSBP database, following completion of the CRR
- 13) H Rees to contact Carlo Heip over linking the NSBP 2000 database to the MARBEF initiative, following the outcome of 12, above.
- 14) All: to forward to H. Rees short summaries of time-series studies under national sponsorship, with an example of a trend, for inclusion in Chapter 6.5, and use in other chapters (especially chapter 5.2).
- 15) EVB to pursue future links between the NSBP database and OBIS.
- 16) Hans H to transpose the current draft CRR into the ICES template, prior to transmission of the final product to ICES (Dec 2006).
- 17) Wouter W. and EVB to generate
 - a. Multiple correlation and PCA outcomes for global patterns in abiotic and selected univariate biotic variables, and
 - b. Similarly for station groups according to assemblage types.Data to be placed on the VLIZ/NSBP website and communicated to the Cooperative Res. Rep. co-authors.