Marine Habitat Committee **ICES CM 2003/E:05**
Ref. BEWG

REPORT OF THE

Study Group on the North Sea Benthos Project 2000

Yerseke, The Netherlands
24–26 March 2003

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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1 OPENING OF MEETING

The Study Group on the North Sea Benthos Project 2000 (SGNSBP) met from 24–26 March 2003 at the Netherlands Institute for Fisheries research (RIVO), Yerseke, The Netherlands. Dr Rees (Chair) welcomed the participants listed at Annex 1, and recorded apologies from Sabine Cochrane (Norway) and Max Latuhihin (the Netherlands). The Study Group on the North Sea Benthos Project 2000 (SGNSBP) had evolved from an earlier sub-group of the ICES Benthos Ecology WG, following the support of ICES at the 2002 ASC. SGNSBP would report to the Marine Habitat Committee (with links to ACME and ACE), as well as to the ICES Benthos Ecology WG in order to exploit the opportunity for the reciprocal input of expert advice.

The primary purpose of the present meeting was to make progress with the initial compilation of data from several contributors and to conduct preliminary analyses using multivariate techniques. The meeting took the form of a Workshop, involving a sub-set of data contributors acting on behalf of all interested parties, who would be fully consulted on the outcome. Thus the purpose was not to draw any conclusions regarding the environmental significance of patterns in the data at this stage, but rather to facilitate these later objectives (see Section 3, below) by making further improvements to the data set.

2 APPOINTMENT OF RAPPORTEUR

R. Kilbride was appointed as Rapporteur.

3 TERMS OF REFERENCE OF THE STUDY GROUP

The Terms of Reference for the ICES NSBP 2000 Study Group are as follows:

a) collect and harmonize data from stations sampled during the 2000 ICES North Sea Benthos Project (NSBP);
b) augment the NSBP 2000 data with information from other sources (principally from the period 1999–2001) in order to maximise coverage of the North Sea area;
c) propose effective ways for ICES to interact with the NSBP database at the Flanders Marine Institute;
d) prepare a programme of work to resolve problems affecting the compatibility of data sets from different sources;
e) identify patterns in contemporary North Sea benthic assemblages and the causal influences, by reference to supporting environmental data from the NSBP 2000 and other sources;
f) compare the outcome of the NSBP 2000 with that of 1986 and postulate causes for any observed differences, with reference to information on temporal changes in biotic and environmental factors, including human influences;
g) provide a strategic evaluation of the utility of the collaborative exercise for sea-wide quality assessments;
h) make recommendations for the timing and coordination of any future work.

SGNSBP will report by 14 April 2003 for the attention of the Marine Habitat Committee. It will also make its report available to the Benthos Ecology Working Group.

Note: item a) was modified by the substitution of 2000 for 1986 to account for an inconsistency in the original terms of reference.

These Terms of Reference covered the projected activities of the SG for the duration of its existence (predicted to be four years). The content was further reviewed and accepted by the SG as a valid way to proceed.

4 AGENDA

The draft Agenda at Annex 2 was accepted by the Study Group.

5 OUTCOME OF PREVIOUS NSBP 2000 WORKSHOPS

SGNSBP considered that it would be helpful to include the reports of two earlier Workshops (held in Ostende in January 2002 and in Bremerhaven in September 2002) dealing with the development of the NSBP 2000, for the benefit of the wider ICES science community. These are given at Annexes 3 and 4.

6 STATUS OF DATABASE

Edward Vanden Berghe gave an account of the current status of the North Sea database, and an indication of needs for further refinements. A summary of the structure and content of this database is given in ICES CM. 2002/L:09, presented at the 2002 ICES Annual Science Conference.

7 WORKSHOP ACTIVITIES TO IMPROVE DATA QUALITY

A sub-group worked on the compilation of data so far received. Various decisions were made in order to improve between-laboratory consistency; these included the resolution of remaining problems relating to synonymies, mis-spellings and incomplete identifications presumed (in many cases) to be due to the occurrence of juveniles in samples. These changes were incorporated for the purposes of a repeat analysis of the dataset during the present workshop (see below). However, they were also flagged for later attention by the various data contributors, either by reference to sample material or detailed information recorded at the time of processing (e.g., juveniles, damaged specimens and so on). This information will be circulated to data contributors intersessionally by Edward Vanden Berghe (see Action List at Annex 7). All participants should make use of the VLIZ species register to ensure that taxonomic nomenclature is uniform across the data set.

8 SOURCES OF NEW AND HISTORICAL DATA

It was agreed that the earlier decision to restrict data sources to those collected in the period 1999–2001 should continue to be supported. The following additional sources were identified:

Mike Robertson: 40 stations from the northern North Sea. These data should be available for input to the database by the end of June 2003.

Paul Kingston: he is presently compiling data on benthic studies around oil/gas platforms in the UK sector for the period 1998 to the present. These data may be available for use in the NSBP 2000 exercise later this year (see Action List at Annex 7).

English Channel: Data from industry-led environmental surveys carried out in the eastern English Channel may be available. This is to be followed up by H Rees (see Action List at Annex 7).

There was discussion on the scope for accessing historical data as far back as the beginning of the last century or even before. It was proposed to further assess the extent and suitability of data from such sources in order to contribute to future assessments of changes over long time periods.

9 OUTCOME OF PRELIMINARY ANALYSES

All currently available information archived on the NSBP database was classified using TWINSPAN (Hill, 1973) based on (untransformed) species abundances. Animals occurring at a maximum of 2 stations were excluded from the analysis. Cutlevels used were 0, 1, 10, 100, and 1000. The results are shown at Annex 5 (Figures 1–3). The preliminary divisions appear to have ecological relevance (i.e., are not dominated by interlaboratory differences) and therefore provide an encouraging basis for future North Sea-wide assessment, following further refinements and additions to the database.

Figure 4 (Annex 5) shows the distribution of macrobenthic communities of the southeastern North Sea sampled in 2000 (including the eastern part of the Dogger Bank) following analyses using the PRIMER 5 package (data of the Bremerhaven and Wilhelmshaven groups).

Figure 5 (Annex 5) shows the outcome of preliminary analysis of samples collected by CEFAS from the western North Sea, also employing the PRIMER 5 package. A cluster analysis was performed on square-root transformed data, using the Bray-Curtis similarity measure. The samples are seen to cluster broadly according to sediment type.

It was noted that the present NSBP 2000 species/abundance matrix exceeded the capacity of PRIMER 5 and therefore a preliminary holistic analysis using this package could not be pursued at the Workshop. Edward Vanden Berghe would contact Bob Clarke (PML, UK) to explore possible solutions (see Action List at Annex 7).

10 SPATIAL AND TEMPORAL CHANGES IN THE BENTHIC MACROFAUNA OF THE NORTH SEA: CAUSE/EFFECT HYPOTHESES FOR FUTURE TESTING

The following hypotheses assume the occurrence of changes to the status of benthic assemblages in parts of the North Sea between 1986 and 2000, and that the magnitude of these changes are sufficient to warrant further explanation:

- Are changes an artifact of sampling/analytical practices between laboratories/countries?
- Can changes be ascribed to the effects of eutrophication (including amelioration in conditions)?
- Can changes be ascribed to alterations in the pattern and intensity of demersal fishing between 1986 and 2000?
- Can changes be linked to climatic trends/cycles such as increased water temperatures or storminess (including variation in the NAO index)?
- Can changes (especially in coastal environments) be linked with changes to the nature and quantities of contaminant/organic matter inputs?

One approach for future testing will be to compare changes within similar habitat types. Several measures of assemblage structure or function may be employed, including the occurrences of rare species and their sensitivity to natural or man-made influences.

11 DATE/VENUE FOR NEXT MEETINGS

Two further meetings were agreed: a workshop session involving a sub-group of Study Group members from 12–14 November 2003 at the Flanders Marine Institute (VLIZ), Ostende, Belgium and a larger Study Group meeting (incorporating some Workshop activity) at the Senckenberg Institute, Wilhelmshaven, Germany from 29 March–1 April 2004. Further details are given at Annex 6.

12 ANY OTHER BUSINESS

Johan Craeymeersch noted that the website www.okstate.edu/artsi/botany/ordinate/software.htm has useful links to several statistical packages. The possibility of reducing the overall number of stations where sampling has been locally intensive was discussed. This may be achieved using ICES rectangles to ensure a more equitable spatial distribution of stations employed in analyses. However, information on the distribution of habitat (substratum) types may also be very important to ensure that these are adequately accounted for (see Action List at Annex 7).

Dr Rees thanked Dr Craeymeersch and the Institute (RIVO) for the efficient organisation of the Workshop and the hospitality shown to all participants.

13 RECOMMENDATIONS/ACTION LIST

The ICES Study Group on the North Sea Benthos Project 2000 recommends that it meet in November 2003 and March 2004 in order to address the Terms of Reference listed at Annex 6. Actions for intersessional activity are listed at Annex 7.

ANNEX 1: LIST OF PARTICIPANTS

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ANNEX 2: AGENDA

Monday 24 March

10.00–13.00	Preparatory work (pc and program set-up; database issues; "trouble-shooting")
14.00–14.30	Plenary session (all participants): appointment of Rapporteur; agree objectives and plan for Workshop
14.30–15.30	Workshop activities: data compilation issues for resolution; preliminary analyses
16.00–17.30	Continue Workshop activities

Tuesday 25 March

09.00–09.30	Plenary session: review progress; amend targets; identify data/analytical issues for immediate (Workshop) or later attention
09.30–13.00	Workshop activities/*ad hoc* discussions
14.00–15.00	Workshop activities/*ad hoc* discussions
15.30 – 16.15	Plenary session: review progress; preliminary identification of issues for follow-up (intersessional) activity; status of data contributors; environmental data: needs and availability; potential new data sources
16.15 – 17.30	Workshop activities

Wednesday 26 March

09.00 – 10.30	Workshop activities
11.00 – 12.30	Plenary session: review analytical outcomes; review draft Study Group report; recommendations for future work (including publications); date/venue for next meeting(s)
13.30 – 15.00	Workshop activities/finish
(15.30 – 16.30	Concluding work on outputs/report by remaining participants)

ANNEX 3: ICES-BEWG NORTH SEA BENTHOS PROJECT WORKSHOP

Oostende, Belgium
28–29 January, 2002

1. Opening of the meeting and appointment of the Rapporteur

The meeting took place at the "Tulip Inn" in Ostende, Belgium. The group was welcomed by the Chair of the Benthos Ecology Working Group (BEWG), K. Essink, who also acted as Chair of the workshop. The list of the 18 participants for the meeting is appended as Appendix 1.

E. Vanden Berghe, acting Data Manager of the NSBP, was appointed as Rapporteur, and was assisted in this task by K. Deneudt. The agenda for the workshop is appended as Appendix 2.

2. Existing structure of the NSBS-1986 data; structure of taxonomic component

E. Vanden Berghe reported on the current way of integration of the NSBS-1986 data into the existing taxonomical database TISBE and on how these data are available on the VLIZ-website. The permission needed for making these data public was discussed. It was concluded that these data were previously published in *ICES Cooperative Research Report* no. 218*;* therefore, there cannot be a problem in making this information public on the VLIZ-website, as long as the ICES report is cited.

3. Data available to NSBP (2000/2001)

In order to get a general idea of the status of the NSBP, the data contribution from each participating group was presented by E. Vanden Berghe. The members of the different institutes explained in detail which data are still to be expected.

The geographical distribution of sampled stations over the entire North Sea area is not nice and even. Some gaps in coverage were identified. To fill in the lack of data in the northern part of the North Sea (meaning north of the area covered by CEFAS), it was agreed that M. Robertson (Aberdeen) and P. Kingston (Edinburgh) should be contacted. Regarding the area in front of the Danish coast there are no Danish benthos programmes known to any of the participants.

The suggestion was made that, in order to be able to get data coming from these areas, it will be advisable not to be too restrictive in accepting data from sampling campaigns. The standard rule is that data from 2000 should be used. Only if there is no other possibility, can data from 1999 and data from 2001 be used.

A short discussion was held on whether the NSBP should not be regarded more as a form of continuous process rather than a strict one-year project. Though the continuous process approach was considered valuable, it was decided to first concentrate on the 2000 NSBP as a finality on its own. Later on, inclusion of data sets from later years may be included in new data analyses in a flexible way.

Action point*:*

K. Essink to contact M. Robertson and P. Kingston for Scottish data.

Other relevant data

The main goal is still, as decided during the BEWG meeting in Wimereux, an overall comparison with the NSBS-1986 data. All the additional information that can help achieving this goal is considered relevant.

H. Hillewaert and S. Degraer were invited by the Chair to inform the other participants about relevant information on seabed maps available through the ICES WG on the Effects of Extraction of Marine Sediments on the Marine Ecosystem (WGEXT) and the ICES WG on Marine Habitat Mapping.

H. Dooley or J.N¢rrevang Jensen (at ICES) should be contacted in order to obtain good bathymetric maps of the North Sea and possibly bottom trawling intensity information. The search for this trawling intensity information should be based on the Monitoring Report 2001 by Ruth Zühlke *et al.*

Furthermore, information on water temperature, water quality and benthic biomass were mentioned as interesting and relevant data. It was decided that data regarding salinity, currents (hydrography), wave-induced bottom stress and primary production-related information are welcome. Also it was considered useful to compare the observed distributions of macrozoobenthos with the results of a number of existing models, such as ERSEM (NIOZ, Netherlands), hydrographic models (Hamburg University, Germany) and models at the BMM in Belgium.

***Action points**:*

- *H. Hillewaert to make available seabed maps available from WGEXT (ICES).*
- *S. Degraer to make available relevant maps or information available from WGMHM (ICES).*
- *E. Vanden Berghe to contact H. Dooley or J.N¢rrevang Jensen (ICES) concerning bathymetric maps of the North Sea.*
- *G. Duineveld, I. Kröncke and H. Hillewaert to provide information on the models available at ERSEM, the Hamburg University and the BMM.*

5. Data ownership, rights and credits

For some of the data owners in the NSBP there are national reporting obligations. Because of this it was agreed that the raw data should be kept within the group of NSBP people for as long as the analyses have not been fully completed and a formal publication has been made under the name of the NSBP.

All data contributors will be co-authors on any publication based on the integrated data set. For any use of raw data by scientists other than the data owner(s), permission has to be asked and obtained from the original data owner(s).

A list of agreed rules with respect to access to, and use of, individual data sets is appended as Appendix 3.

It was agreed that no restrictions apply to the meta-data, as these are data concerning the sampling campaign and do not include the raw data. A list of what constitutes a complete description of meta-data will be sent around to the participants to be filled in with their available meta-data. On an introductory website of the NSBP, these meta-data will be made public.

***Action point**:*

E. Vanden Berghe to send around to the participants a list to be filled in with the available meta-data.

6. Quality control

Other than in normal coordinated projects, the NSBP has to deal with a "*fait acompli*", implying that no proper Quality Assurance and Control could be arranged *a priori.* The participants accepted that for the next steps in the project they have to make the best of it.

Taking into account the large number of species that are reported in only one of the delivered data sets it is agreed that the need for a taxonomical workshop is high. However, it was considered advisable to carry out an exploratory analysis first. In this way a realistic assessment can be made of the extent of this taxonomic issue.

It was considered possible that differences between the data sets can arise out of the fact that a variety of sampling gear was used. However, the use of different gear can only partly explain taxonomic differences.

It was agreed that each data contributor to the NSBP should send a list with quality control procedures and standard operational procedures, including identification keys used, to E. Vanden Berghe. This information will become part of the meta-data documenting the data sets.

***Action points**:*

All data providers to send a description of quality control procedures used to E. Vanden Berghe.

E. Vanden Berghe to circulate a combined list to the participants in the NSBP.

7. Integration of data sets

A large part of this subject was already dealt with under the previous agenda items. Some important questions, however, concerning integration of data sets still remained.

It was decided that for each sample taken, the date, the exact time and information about the sampling gear used should be provided.

In order to standardise the data delivered to the data manager at the level of variables and methodologies used, the ICES standard list should be taken as a reference and therefore distributed amongst the participants. Biomass data should be delivered in units as determined; during data analysis conversion to a common unit will be done.

Regarding taxonomy and nomenclature the following agreements were made. Firstly, every "species cf." and every morphospecies will be integrated in the final database on the genus level. This will be well described. Secondly, species lists will no longer be delivered in form of code. And finally, for each species both the person identifying as well as the keys used for identification should be mentioned.

***Action points**:*

E. Vanden Berghe to investigate which standard lists are prescribed by ICES, and circulate this information.

8. Integration of data structures

E. Vanden Berghe presented a prototype of the database structure, which was to serve as a basis for discussion. A proposal was made to put in extra fields for indication of feeding types, life history traits, etc. The data for the input will be compiled out of existing lists on feeding types and life history traits; it was realised that these lists need to be harmonised. These lists will be delivered to the data manager and after compilation distributed amongst the participants two weeks before the BEWG meeting in Tromsø at the latest.

It was also proposed to put in an extra flag for quality control. This flag should be included in the database structure at the level of the sample.

It was noted that it might be useful to have a field saying whether or not the chemical, sediment and benthos information was gathered out of one and the same sample.

It was finally agreed that the geographical location of the stations and replicates have to be stored. Data from replicates should be kept, data from horizontal slices of cores on the other hand, were not considered useful to store.

Protocols for data exchange were listed and general agreements were made to make the data exchange more efficient. A list of these will be distributed later. Database exchange protocols based on XML were considered unnecessary at this point.

***Action points**:*

J. Craeymeersch, H. Rees, G. Duineveld, I. Kröncke and S. Nehring to deliver lists of feeding types and life history traits to E. Vanden Berghe.

E. Vanden Berghe to distribute a combined/harmonised version of these lists, for further consideration at the BEWG meeting, if necessary.

Deliverables

As decided earlier (BEWG meeting in Wimereux), the final results of the NSBP will lead to publication in an *ICES Cooperative Research Report* and in scientific journals. At this moment, however, it is still too early to make practical arrangements on this matter in more detail. Publications as foreseen at the Wimereux meeting of the BEWG are listed in Appendix 4.

As mentioned under Section 5, a website will be constructed to present the NSBP. On this website a general description will be given of the NSBP, explaining the general aims, presenting the participating institutes and describing the area of the North Sea covered. This website will start off with a hidden link, so that the participants in the NSBP can make remarks and suggestions internally, before the website will be open to visits by the public.

***Action points**:*

E. Vanden Berghe to construct a website presenting the NSBP, and to check this with the participants in the NSBP, before putting it really on the web.

10. Analysis

The Chair invited E. Vanden Berghe to make the primary exploratory analyses, as already discussed. The outcome of this analysis shall be distributed to the participants. Proposals for further analyses shall be made in a later stage, the first opportunity for this being the BEWG meeting in Tromsø.

***Action points**:*

E. Vanden Berghe to make primary exploratory analyses, to be presented at the BEWG meeting in Tromsø.

11. Data distribution

It was agreed that except for the meta-data, no data shall be made public at this moment (see Section 5). The meta-data will be made public on the website as soon as possible. For every use of the raw data, permission is needed from the original data owner.

12. Collaboration with other ventures

Other international projects may be of importance for the NSBP, and may be interested to know of the NSBP. Therefore, it was decided that contact will be made with the data owners of the European Marine Register of Species (ERMS) and the Integrated Taxonomic Information System (ITIS). It was considered too early to consider any formal collaboration with these or any other ventures.

It was noted that also meiofauna samples and data are available at CEFAS (Lowestoft) and University of Gent. As the CEFAS samples have not yet been analysed, and the Gent data do not allow for a comparison with 1986 data, it was decided not to include these data in the NSBP. Meta-data on these samples, however, will be included in the database.

***Action point**:*

E. Vanden Berghe to contact data owners of the ERMS and the ITIS.

13. Timetable

K. Essink indicated that a next meeting of the NSBP will take place during the ICES-BEWG meeting that will take place from 24–27 April 2002 in Tromsø (Norway). Then, among others, the following issues will be on the table: results of exploratory analyses, quality control on taxonomy, and list of feeding types and life history traits.

Another workshop will necessarily have to deal with solving the taxonomy problems in the total NSBP data set. This next workshop is suggested to take place somewhere in autumn this year, possibly at the Alfred Wegener Institute in Bermerhaven (to be checked with E. Rachor).

***Action point**:*

K. Essink to contact E. Rachor in connection with hosting a workshop in autumn 2002.

14. Other business

H. Hillewaert reported on the existence of a portal to marine-related websites developed by the Sea Fisheries Department (SFD) at Ostende.

On a question as to the costs of participating in NSBP meetings/workshops, K. Essink responded that any costs involved in cooperating with the NSBP will be on the budget of the institutes participating.

K. Essink informed the meeting of the end of his term as Chair of the BEWG in 2002. A new Chair has to be chosen at the meeting in Tromsø. In Tromsø, also a decision needs to be made on who will further act as coordinator of the NSBP.

15. Closing of the meeting

K. Essink formally closed the meeting on 29 January 2002 at 12.30 hours, and expressed his thanks and appreciation to the participants for their contributions to this valuable meeting and to the staff of the Flanders Marine Institute for the organisation.

Appendices
Appendix 1: List of participants
Appendix 2: Agenda of the workshop
Appendix 3: Agreed rules with respect to access to, and use of, individual NSBP data sets
Appendix 4: Provisional list of intended publications

APPENDIX 1: LIST OF PARTICIPANTS, OSTENDE WORKSHOP

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APPENDIX 2: AGENDA, OSTENDE WORKSHOP

Monday 14:00–19:00 hrs

0 Introduction and adoption of the agenda/ practical arrangements

1 Existing structure of the NSBS-1986 data; structure of taxonomic component

2 Data available to NSBP (2000/2001)

> stations (including map)
> sampling methodology
- instrumentation
- sample size
- replication
> environmental parameters (plus methodology)
> taxonomic list (plus works used in identification)

3 Other relevant data

> seabed maps
> bottom trawling intensity
> other

Tuesday 09:00–12:00 hrs

4 Data ownership, rights and credits

5 Quality control

6 Integration of the data sets

> Environmental data
> Taxonomy/Nomenclature
- Synonyms/Alternative identifications
- "Qualified" identifications (Juvenile/Indet.)
- Morphospecies (problem of Sp. a, Sp. b...)
> Densities/biomass

7 Integration of data structures

> Structure of the database
> Protocols for data exchange (XML?)
- Adding data
- Updating existing records

8 Deliverables

> Reports
> Scientific papers
> Website
> Job allocation: lead-persons & writer-groups

9 Analysis

> Exploratory data analysis
> Distribution maps

> Analysis of 2000 data
    - Community structures
    - Correlations with environmental parameters
> Comparison with 1986 data
> Gaps and how to deal with them

10 Data Distribution

> What to distribute
> How to distribute
> To whom (role of ICES??)

11 Collaboration with other ventures

> Other North Sea Atlases
    - Epifauna (Ruth Zuhlke)
    - What about meiofauna?
    - Others??

> Taxonomy (e.g., ERMS, ITIS, ETI)

12 Time table

> BEWG (Tromsø) end of April
> Follow-up activities
> Next workshop (at AWI-Bremerhaven?)

13 Any other business

> finances
> other

--

APPENDIX 3: NORTH SEA BENTHOS PROJECT 2000: ACCESS TO, AND USE OF, DATA SETS

The participants of the workshop on the North Sea Benthos Project (NSBP-2000), held in Oostende, Belgium, at 28–29 January 2002 agreed on the following rules with respect to access to, and use of, individual or institutional data sets:

1) The raw data will only be available for participants in the NSBP-2000 for the purpose of data analysis aimed at the production of common reports/publications. At a later moment it will be decided when public access to the raw data can be allowed.
2) All data contributors will be co-authors on any publication based on the integrated data set. For each publication there will be a group-decision regarding the name of the "first" author.
3) The timing of any common report or publication will consider and respect any national requirement with regard to reporting on national data sets.
4) Any participant who wants to use data from another data owner can do so only after receiving consent by the respective data owners.
5) The meta-data regarding individual or institutional data sets will be made available to public access via the web. These meta-data will not include any raw data as mentioned under 1), above, nor species lists.

A) APPENDIX 4: NORTH SEA BENTHOS PROJECT 2000: PRELIMINARY LIST OF ENDPRODUCTS

ICES reports

ICES Cooperative Research Report No. xxx

(comparable *to ICES Coop. Res. Rep.* No. 218 on the 1986 North Sea Benthos Survey)

Publications in scientific journals

1. An overall comparison with the results from the 1986 NSBS. Also indication of limitations of comparison due to differences in approach.
2. Comparison of 1986–2000 data in relation to North Atlantic Oscillation and other environmental settings (e.g., input of nutrients).
3. Testing the applicability of the EUNIS habitat classification system as developed by the European Environment Agency
4. Investigation of the relationship between benthos (long-lived/large species) and bottom trawling intensity. This will be dependent on the degree of detail of fishing intensity data. A similar approach is followed in the CEFAS-coordinated epibenthos surveys (EC Project: 98/021).

ANNEX 4: ICES NORTH SEA BENTHOS PROJECT 2000: WORKSHOP AT THE ALFRED WEGENER INSTITUTE, BREMERHAVEN, 9–11 SEPTEMBER 2002

Objectives of the workshop:

1) Review current status of NSBP 2000 database and future developments.
2) Evaluate the nature and extent of inputs to NSBP 2000 so far. Issues include:
    - spatial coverage
    - compatibility (sampling/analytical methods; infauna/epifauna; timing; species identification)
    - implications for holistic analysis.
3) Attend to problems associated with species identification (including laboratory investigations).
4) Consider appropriate analytical methods in the light of 2) above, and appropriate manipulations of the raw data (e.g., pooling to higher taxonomic levels, presence/absence, relative abundance, absolute abundance).
5) Consider the scope for comparisons with the 1986 NSBS.
6) Consider parallel sources of benthos data (e.g., time-series data) and the benefits of inclusion.
7) Consider supporting environmental variables.
8) Themes and procedures for publication (reformulate as necessary in the light of Workshop considerations); timing; authorship.
9) Complete ICES paper outlining the objectives of NSBP 2000 and forward to ICES at the end of the meeting. (Incorporate key elements of this Workshop).

1. Current state of the NSBP database

Edward Vanden Berghe described the actual state of the database.

Data sets were provided by

S. Cochrane, Aquaplan Niva (N),
S. Degraer, University of Gent (B),
G. Duineveld, NIOZ (NL),
M. Latuhihin, RIKZ (NL),
E. Rachor and I. Kröncke, AWI/SNG (D),
J.-M. Dewarumez, University of Lille, Wimereux (F), epifauna only,
H. Rees, CEFAS (UK),
J. van Dalfsen, TNO (NL),
H. Hillewaert, Fisheries Institute (B)
S. Nehring, BfG (D),
E. Oug (N),
M. Robertson, Fisheries Lab Aberdeen (UK), epifauna only.

J. Craeymaersch will provide a list with feeding types of macrofauna species for the database.

The database includes 1708 species prior to discussion of taxonomic problems. Data from NL, D, N, B have been inserted; data from UK will follow. Species names were checked and standardized using ITIS. One of the objectives of the NSBP should be to contribute to ITIS. Data that are submitted to ITIS from the NSBP should be checked against other sources, such as the Species Directory of Howson and Picton.

2. Evaluate nature and extent of data received so far

2.1. Spatial coverage

See Figure 1.

Coverage of the southern North Sea is good, but is limited for the northern part. Some additional data may be available from studies at FRS, Aberdeen (M Robertson). E. Rachor announced the possibility to fund the taxonomy of some of these samples. H. Rees might also be able to negotiate a funding source. (This initiative is presently being followed up in discussions with M Robertson.)

J.-M. Dewarumez/N. Desroy have Hamon grab data (2 mm mesh sieve) from French coastal waters, and will submit these to the NSBP 2000 database.

J. Craeymeersch mentioned the possibility to get funding from EU for the analysis of data as a 'concerted action'; E. Rachor will check EC funds for regional studies.

2.2. Compatibility

The following meta information is needed for harmonisation:
(Desirable / Indispensable)

Data collection

Collector (Person responsible for the collection)
Collection date
Collection method (van Veen…)
Sieve mesh size
Area sampled (grab/core size); penetration depth
Position: either: station name or lat/long; if station name: station should be known in database, including lat/long
Lat/long: decimalised degrees (WGS 84); if different: should be documented

Meteorological conditions
Oceanographic conditions: temperature, humidity
Sediments

Suspended solids, temperature, salinity
Bottom temperature, salinity
Bottom depth
Tide
Sedimentology
Heavy metals, TOC, pigments

Ship name
Project/Cruise
- Abstract/Objective
- Sponsor
- Beginning and end date of Cruise/Project
- Coordinator/Chief Scientist

Identification/Samples/Specimens

Identifier
Name
- Institutional affiliation
- Certification
- Other AQC activities

Identification key(s)

Museum accession number of
- Sample
- Specimen

SOP documentation (reference; if possible full text) if relevant

Each participant is asked to send the relevant Standard Operating Procedures (if available) to Edward to be included in the database. A list with the information will be distributed within the NSBP 2000 group.

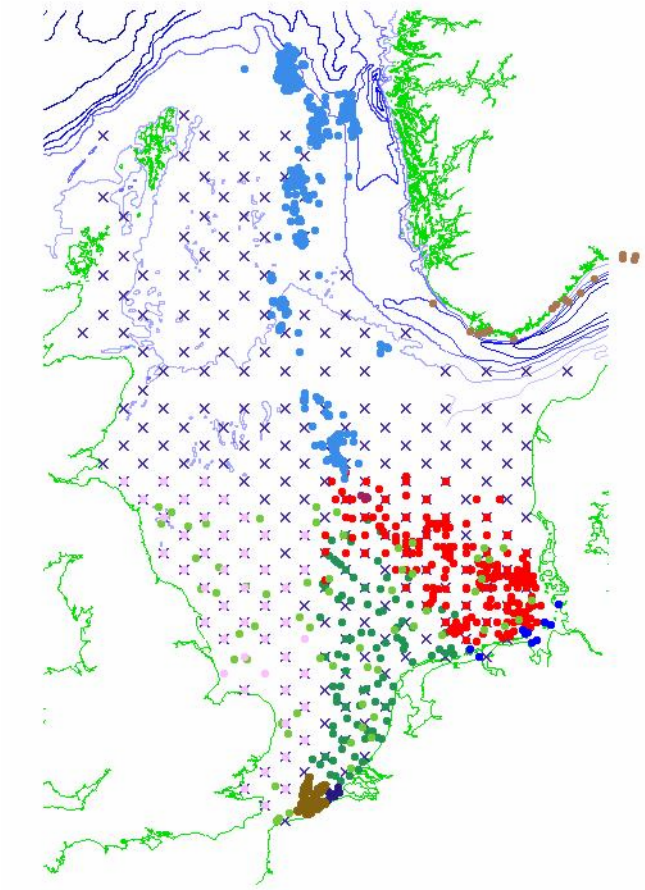

Figure 1. Spatial coverage of stations of NSBS 2000; Dots are locations for NSBP 2000, crosses locations for NSBS 1986.

2.3. Methodology

A short summary within the group reflected that most of the sampling in 2000 was conducted with a 0.1 m^2 van Veen grab and samples were sieved over 1 mm mesh size. 2–3 replicates per station were taken. Sampling occurred mainly in spring and early summer of 2000.

Dutch samples were taken with a box corer, British samples with a Day or Hamon grab depending on the sediment type.

Biomass was estimated by most of the labs from wet weight to ash-free dry weight. Conversion factors can be used to standardize biomass for all data sets. It was concluded that both raw and derived data should be included in the database, but that the derived data should be appropriately flagged. AFDW and wet weight conversion data are available from NIOZ and Wimereux; conversion factors of Rumohr *et al.* (1987) should be checked; conversion factors can be stored in the project database.

Samples for sediment composition were taken by all participants using extra grabs or were taken from each grab used for faunal analysis. Samples for analysis of contaminants as well as meiofauna were taken only by CEFAS.

2.4. Implications for holistic analysis

Different priorities were put on data sets for analysis:

1st priority on the macrofauna (infauna) data from 2000 or the period 1999 to 2001;

2nd priority on epifauna data sampled in 2000;

3rd priority on estuarine or coastal data such as from Nehring (BfG, D).

3. Attend to problems associated with species identification (including laboratory investigations, if feasible).

Help for identification of different taxonomic groups is available on the web through "list servers" on:

- Molluscs: http://web.inter.nl.net/users/Meijer.T/UM/um-listserv.html
- Crustaceans: http://www.vims.edu/~jeff/crust-l.html
- Annelids: http://biodiversity.uno.edu/~worms/ANNELIDA-list.html
- Marine biology: http://www.mote.org/marbio.phtml

Identification keys via the www are available also:

- Amphipod families: http://www.crustacea.net/crustace/amphipoda/index.html
- Polychaete families: http://www.ea.gov.au/biodiversity/abrs/about/publications/polikey/index.html

General problems to be addressed:

The core of the database will include all submitted data of appropriate quality.

A restricted list with data sampled <60°N will be used for the initial analysis, since coverage of the southern part is more comprehensive.

Skagerrak/fjordic data (Josefson and Oug) will also be excluded from the restricted list since no data are presently available for Danish waters from 2000.

Taxonomic problems:

If no species is available in list but only the genus, keep the genus.

If a common species is given once as, e.g., *Notomastus* spp., and all other participants found *Notomastus latericeus*, then keep *N. latericeus*.

Holothurians may be lumped except the Synaptidae. For the NSBP analysis, *Cucumaria elongata* could be kept separate, since it is easily distinguishable, and a common species.

All difficult groups, e.g., Nemertini, sipunculids, phroronids, Scaphopoda will be lumped.

Flag all meiofauna in the list as such, and exclude from the analysis.

Thyasira flexuosa will be kept, lump the 2 remaining *Thyasira* species.

Flag all epifauna species.

J.-M. Dewarumez will review molluscs and polychaetes in the database for recent changes.

Lump Maldanidae, Sabellidae, Pholoe, Chaetozone, Magelona and Ampharete.

Flag mysids except *Gastrosaccus*, Crangonidae, Galathidae, Portunidae, Porcellanidae, Pandalidae, Paguridae, Nephropidae, fish and birds (!) as epifauna.

Results of the taxonomic lab work:

Because of limited available material and the limited laboratory time it was only possible to focus on a few taxonomical problems:

Magelona johnstoni versus *Magelona mirabilis*. The identification key by Fiege *et al.,* 2000 was distributed. Until now *M. mirabilis* was only recorded from more estuarine areas, e.g., Weser estuary.

The splitting of *Pholoe minuta* into four species (*P. inornata*, *P. baltica*, *P. pallida*, *P. assimilis*). According to the ICES taxonomic workshop held in 1997 and to the key of M. Petersen the new names should be used in future.

Sipunculida. G. Duineveld presented 3 species of the quite abundant genus *Golfingia* which are easily to distinguish:
- *G. procera* (rough and strong skin, not translucent, small papillae outside);
- *G. vulgaris* (dark posterior end with prominent papillae, anterior end with irregularly distributed papillae);
- *G. elongata* (uncoloured and smooth posterior end, papillae of anterior end in rows).

Clausinella fasciata. Small specimens of *Chamelea gallina* might be confused with *C. fasciata*. According to the recent investigation no specimen of *C. fasciata* could be found in the German Bight. It is only recorded in the western part of the English Channel (pers. comm., J-M Dewarumez).

(The mentioned keys can be provided by P. Nehmer or H. Reiss).

4. Consider appropriate analytical methods in the light of 2, above, and appropriate manipulations of the raw data (e.g., pooling to higher taxonomic levels, presence/absence, relative abundance, absolute abundance)/ 5. Scope for comparisons with the 1986 NSBS

For the analysis of data the following aims were stated:

Analyse the macrofaunal biodiversity in 2000 including all samples (stations).

Overall comparison with data from 1986 only for those stations which coincide with the 1986 ICES grid. Also indication of limitations of comparison due to differences in approach.

Comparison of 1986–2000 data in relation to climate-related changes such as North Atlantic Oscillation and other environmental settings

Testing application of habitat classification schemes, e.g., EUNIS.

Compare benthic communities and anthropogenic influences (especially fishing effort and input of nutrients) in different regions.

Further details of proposed analyses are given in the NSBP 2000 ICES paper (see Section 9, below).

6. Consider parallel sources of benthos data (e.g., time-series data) and the benefits of inclusion

For comparison of data sets, additional data and information on macrofaunal long-term series is useful and available from Table 1. Ongoing long-term series are (for details see Table 1):

- off Northumberland (Buchanan, Frid),
- German Bight (Rachor, Knust, Schröder),
- Dutch sector (BIOMON, Duineveld),
- off Norderney (Kröncke),
- Transect German Bight – Dogger Bank (Kröncke),
- Dogger Bank (Kröncke),
- German Bight (Bund-Lander-Messprogramm, Monitoring),
- Skagerrak (Josefson),
- Danish waters (monitoring),
- Tees Bay (NE English coast): see paper Warwick *et al.* MEPS 2002. Day grab: annual monitoring from 1970s to mid-1990s, 5 stations, sandy, about 20 m depth, 1 mm mesh size,
- UK National Marine Monitoring Programme: macrofauna at about 6 North Sea stations, May/June, 1 mm mesh size, Day grab, Intermittent sampling 1990 to present,
- NE English coast: 3 muddy stations at 50 m depth, Day grab, 0.5 mm mesh size, annual sampling from 1986 to present (see Rees *et al.* 1992),
- Outer Thames estuary: 2 shallow stations (5–15 m depth), Day grab, 0.5 mm mesh size, annual sampling (Feb–April) from 1985 to present (unpubl.),
- GRAVELINES, two stations since 1976, 120 and 160 samples, respectively, on 1 mm mesh size.

6. Consider supporting environmental variables

Supporting long-term environmental data are needed for:

CPR
NAO
Meteorology (wind)
Fishing effort
Temperature, salinity
Nutrients
Water quality (chemistry)
Helgoland data on nutrients and plankton

7. Sediments

Sediment maps exist for many regions in the North Sea. As many stations as possible, for which there are sediment data available from the NSBP in 2000, should be investigated. G. Irion from the Senckenberg Institute, Wilhelmshaven offered the opportunity to do the grain size as well as heavy metal analyses.

8. Themes and procedures for publication

Participants considered that it was still too early to fully document the range of anticipated published outputs. The general procedures to be followed are documented in the report of the 2002 NSBP Workshop in Ostende, and there was endorsement of their continued validity.

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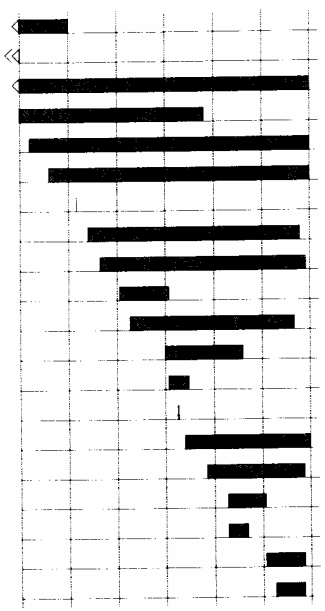
Table 1. Data sets of the parameter "abundance of macrofauna" filtered from the SYCON Data Inventory database. Data sets are listed in accordance with the start of the project (see time scale). Data are described by the type of data (F= field data), name of project, investigated ICES boxes, spatial and temporal resolution and the time scale covered (data sets starting before 1970 are indicated by arrows). The number of values is not given (counts=0). For tables of other parameters see appendix. Further detailed information (e.g., sampling methods, availability, contact address, literature, comments) can be derived from the SYCON Data Inventory from the IFM, Hamburg.

SYKON DATA INVENTORY - parameter : abundance macrofauna [number / m²]

T	project	count	ICES boxes 1 2a2b3a3b 4 5 6 7a7b 8 9 10	spatial resolution	temporal resolution	FG
F	Deutsche Bucht (Ziegelmeier)	0		various, 19 stations	half yearly	10
F	Doggerbank, BIRKETT (195	0		various, 175 stations	yearly; FG10	10
F	AWI Long-term series	0		various, 4 stations	half yearly	10
F	Skagerak long term series, P	0		1D, 3 stations, 2 levels	yearly; FG10	10
F	Northumberland benthic time	0		1D, 2 stations, 2 levels	half yearly	10
F	NOR oil platform monitoring	0		various	various	10
F	Deutsche Bucht (Salzwedel et	0		various, 66 stations	none	10
F	UK oil platform monitoring	0		various	various	10
F	Norderney long-term series	0		2D, dx=1nm, dz=10-20m	quarter of year or half year	10
F	Benthic fauna of northern No	0		3D, dx=30nm, dy=15nm, dz=depth	various	10
F	Skagerak long term series, P	0		various, 12 stations	yearly; FG10	10
F	NL oil platform monitoring	0		various	yearly; FG10	10
F	DOGGERBANK (Kröncke)	0		3D, dx=40', dy=8', dz=depth, 50 stations	yearly; FG10	10
F	NSBS	0		2D, 30 x 35nm, 193 stations	none	10
F	BLMP	0		Various, 6 stations	yearly; FG10	10
F	Danish Monitoring Program	0		unknown	monthly	10
F	BIOMON	0		various, 25 transect stations	yearly; FG10	10
F	Milzon-Benthos II	0		random sampling	yearly; FG10	10
F	DOGGERBANK (Kröncke)	0		3D, dx=40', dy=8', dz=depth, 50 stations	yearly; FG10	10
F	BIOMON	0		various, 100 stations	yearly; FG10	10



9. Complete ICES paper

Contributions from several participants were made, and the completed paper was submitted to ICES in time for inclusion on the CD-ROM for ASC 2002.

10. Any other business

There was discussion on the future organization of the work programme for NSBP 2000, and it was agreed that a proposal should be made to ICES for the formation of a Study Group.

11. Further actions/deadlines

I. Participants are asked to inform I. Kröncke by end of September 2002 how many sediment samples they can provide for grain size and heavy metal analyes to be carried out by G. Irion.

II. Provide E. Vanden Berghe with information on SOPs by beginning of December 2002.

III. Check the revised taxa list from Edward Vanden Berghe.

- Send corrections and data set to Edward by beginning of December 2002.
- A preliminary analysis of data is planned for March 2003 in Yerseke. Participants will be the NSBP 2000 Steering Group and additional invited persons.
- Participants to send information on feeding types to J. Craeymeersch.
- Epifauna data from the NSBS 1986 are not yet in the database. Available data should be sent to Edward. Data should be available for the next BEWG meeting in April 03.
- H Rees to explore a possible link with the Plymouth Marine Laboratory regarding the application of taxonomic indices.
- G Duineveld to forward documentation on AFDW conversions to Edward.
- H Rees to forward a recommendation to ICES for formation of a NSBP 2000 Study Group
- H Rumohr to present the NSBP 2000 ICES paper at the ASC 2002, and the Study Group proposal.

12. Acknowledgements

Workshop participants are very grateful to AWI/Bremerhaven (especially E. Rachor and P. Nehmer) for organization of the event and the accompanying hospitality.

Participants:

Eike Rachor (host, AWI/Bremerhaven)
Petra Nehmer
Alexander Schröder
Rainer Knust (Monday only)
Inken Struck (Monday only)
Edward Vanden Berghe (NSBP 2000 database manager)
Gerard Duineveld
Gert van Hoey
Hans Hillewaert
Henning Reiss (Rapporteur)
Heye Rumohr
Hubert Rees (Chair)
Ingrid Kröncke (Rapporteur)
Jean-Marie Dewarumez

Jens Heuers (Monday only)
Johan Craeymeersch
Nicolas Desroy
Regine Bönsch

ANNEX 5: OUTCOME OF PRELIMINARY ANALYSES OF DATA FROM THE NORTH SEA BENTHOS PROJECT 2000

Figure 1. Output from TWINSPAN (4 groups): NSBP 2000.

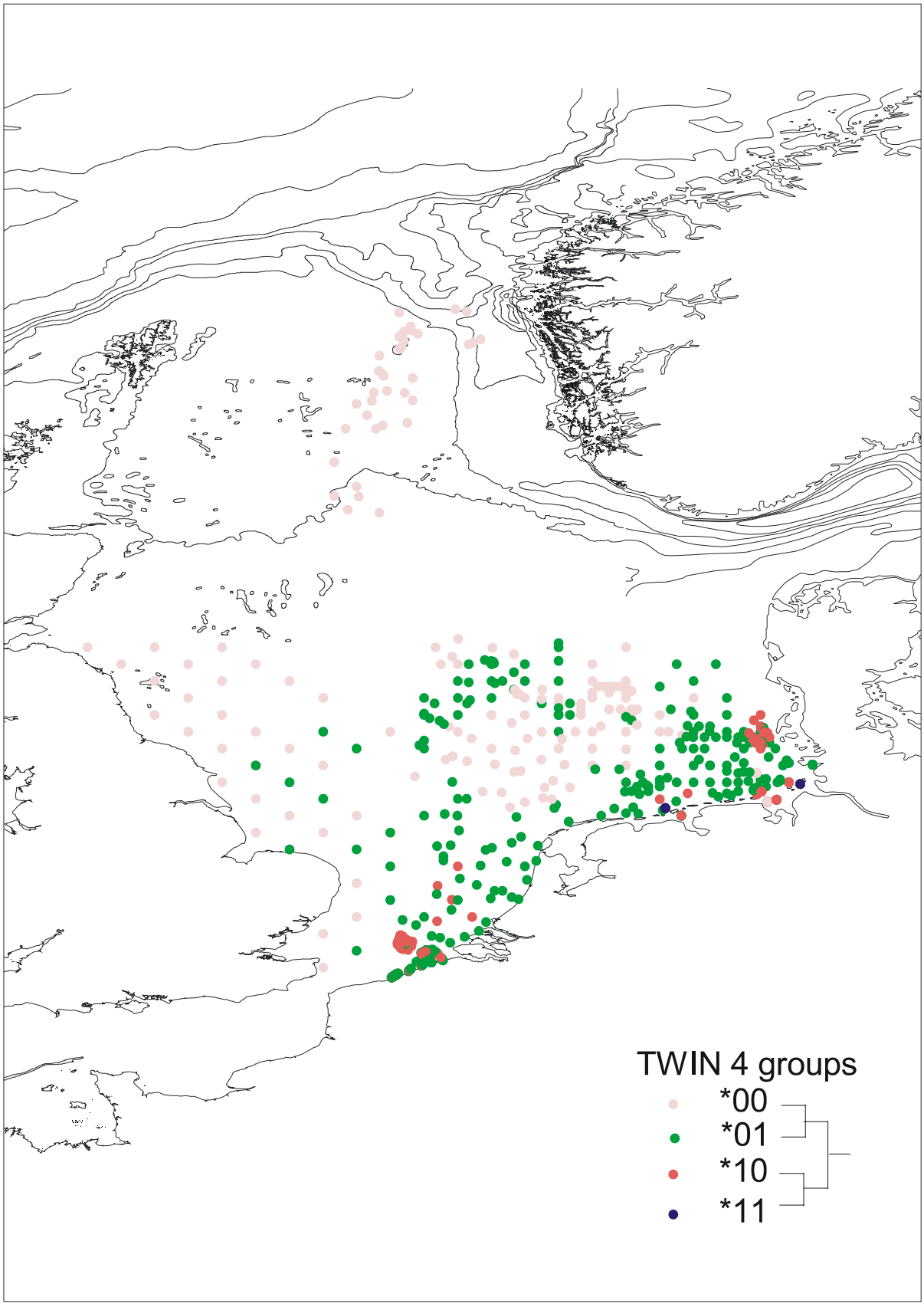


Figure 2. Output from TWINSPAN (8 groups): NSBP 2000.

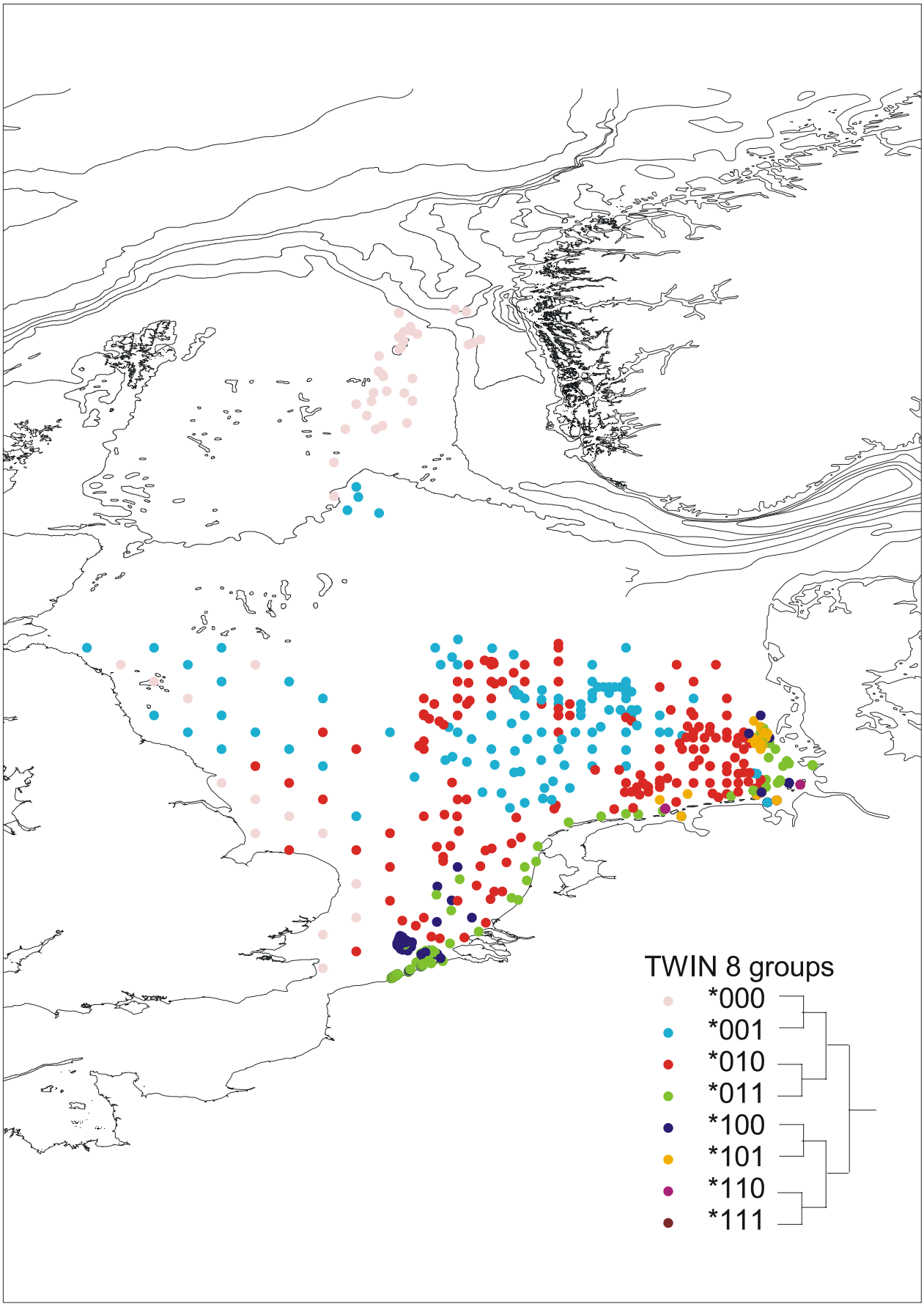


Figure 3. Output from TWINSPAN (15 groups): NSBP 2000.

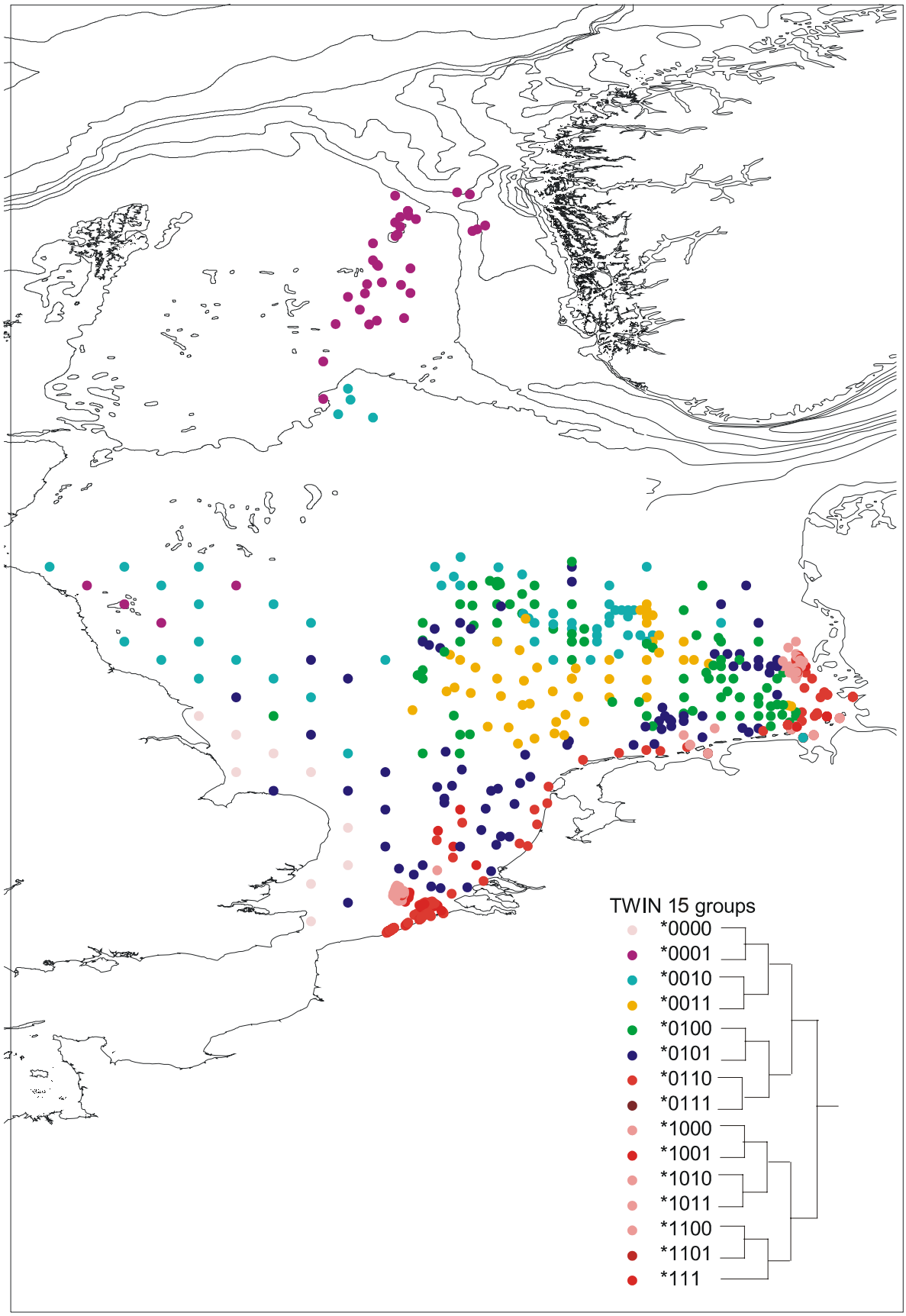


Figure 4. Distribution of assemblage types in the German Bight, employing cluster analysis.

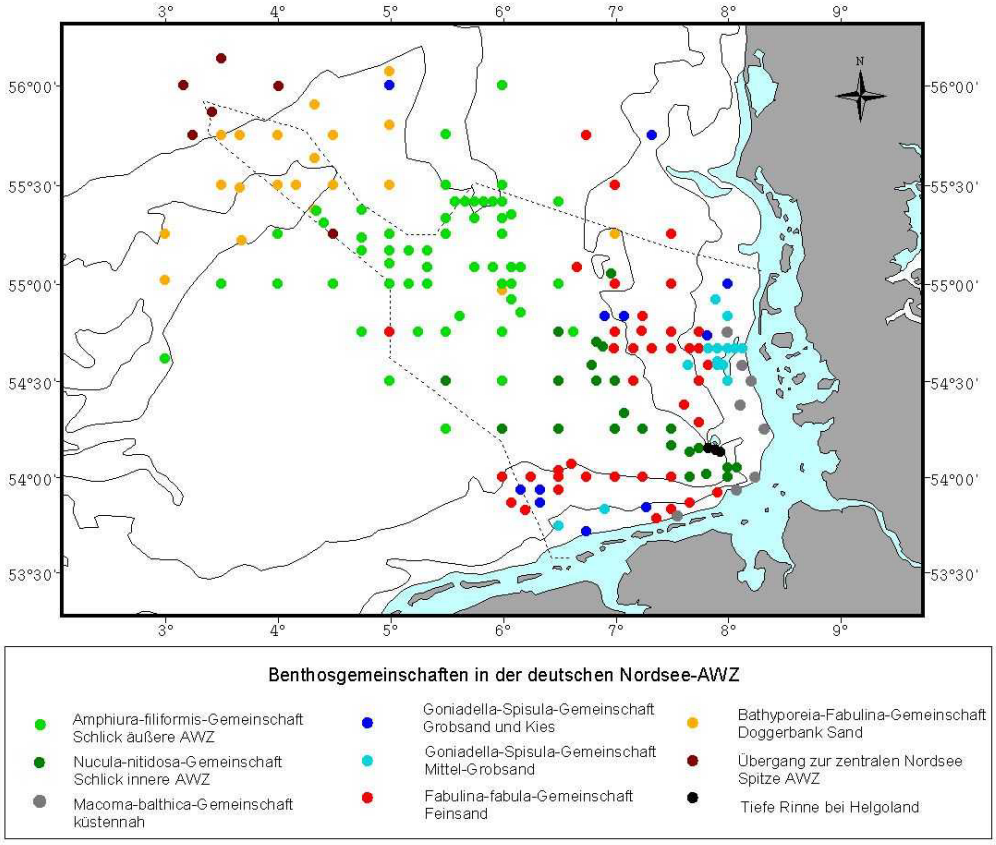
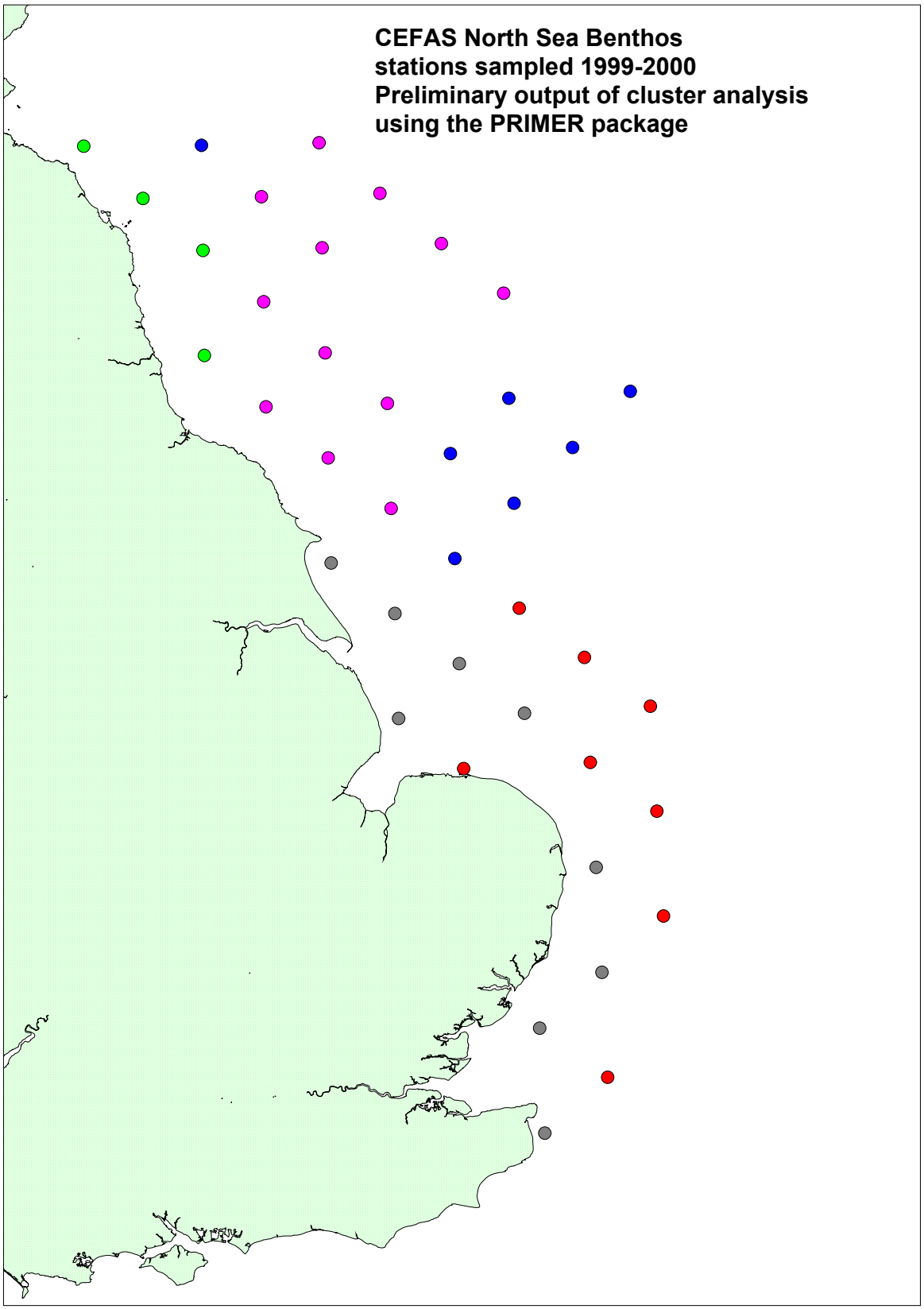


Figure 5. Distribution of assemblages from cluster analysis.



ANNEX 6: RECOMMENDATIONS

The **Study Group on the North Sea Benthos Project 2000** [SGNSBP] (Chair: H. Rees, UK) will meet in Wilhelmshaven, Germany from 29 March – 1 April 2004 to:

a) consider the outcome of discussions of an intersessional sub-group to:

   i) finalise the benthic macrofaunal data set for the NSBP 2000 and generate outputs from multivariate analyses,

   ii) adjust the 1986 NSBS data set for compatibility with NSBP 2000 and generate outputs from multivariate analyses,

   iii) make a preliminary statistical comparison of the 1986 and 2000 data, employing ICES rectangles as a basis for station selection,

   iv) make recommendations regarding sub-sets of habitat-specific stations for historical comparisons,

   v) progress the compilation of ancillary environmental data and identify additional needs,

   vi) review regional data assessments prepared by national agencies and others;

b) review the outcome of data compilations and analytical outcomes to date;

c) identify database and analytical issues for further resolution;

d) conduct a preliminary evaluation of findings in relation to hypotheses for natural and anthropogenically induced changes and make recommendations for follow-up work, particularly in relation to forthcoming publications;

e) make recommendations on the utility of the available data for classification of North Sea habitats based on structural and functional properties of assemblages;

f) conduct further univariate and multivariate analyses and consider alternative statistical applications for future work;

g) identify and locate additional biotic/environmental data to aid interpretation of the causes of benthic biological changes;

h) evaluate the scope for contemporaneous and historical comparisons of the status of North Sea epifaunal communities in the context of the NSBP 2000 assessment.

SGNSBP will report by 16 April 2004 for the attention of the Marine Habitat Committee.

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-level approach to environmental management).
Scientific Justification:	Proposed TOR a)–h) will be met through a combination of Workshop and Plenary activity by Study Group members, as follows: a) a sub-group, representative of the major data contributors, will meet intersessionally from 3–5 November 2003 (at VLIZ, Ostende) to make further progress with the compilation and initial analyses of recent North Sea benthos data. This practical (workshop-based) activity is essential to maintain the momentum of the exercise in order to ensure timely outputs; b) progress to date, with particular reference to the outcome of the November 2003 workshop, will be reviewed by the wider Study Group membership at the March 2004 meeting (Wilhelmshaven), and recommendations will be made for immediate resolution, or later (intersessional) work; c) similar progress will be sought with respect to the important issues of further database development (including the interface with the ICES Biological Community Database), and univariate and multivariate methodologies for data analyses; d) this task will support the central objective of the analyses of recent and historical North Sea benthos data in relation to appropriate indications of natural and human-induced changes; e) this anticipates a need to consider habitat-specific responses to natural and human influences. The work will contribute to the activities of the ICES WGMHM, and cooperative links with this group are being established;

	f) a proportion of the meeting will consist of practical workshop-based activity to augment earlier progress intersessionally, and to identify promising new approaches to data analyses; g) the accessibility and utility of parallel data sources for use as explanatory variables will be reviewed, and potential new sources identified; h) to date, the Study Group has concentrated on the macro-infauna sampled by grabs and corers, since this accounts for the main effort in national monitoring programmes. However, significant additional effort has also been directed periodically at the macro-epifauna of the North Sea. The Study Group will make recommendations on the scope for incorporating this component into the overall assessment of quality status.
Relation to Strategic Plan:	Scientific Objectives 1(c), 1(e), 3(d).
Resource Requirements:	N/A
Participants:	Primarily benthos 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, WGSAEM, WGMDM, SGQAE
Linkages to other Organisations	OSPAR, EU
Secretariat Cost Share	ICES 100%

ANNEX 7: ACTION LIST ARISING FROM THE MEETING 24–26 MARCH 2003

1. All data contributors to the NSBP to submit Standard Operating Procedures or comparable detailed descriptions covering approaches to the sampling and laboratory analyses of the North Sea benthic macrofauna and associated environmental variables to Edward Vanden Berghe by September 2003.

2. All data contributors to provide metadata associated with sampling effort to Edward Vanden Berghe by June 2003 (see p. 3 of the Bremerhaven Workshop report at Annex 4 for information needs).

3. H Rees to contact Paul Kingston regarding the scope for, and timing of, any contributions to the NSBP arising from an ongoing review of recent surveys at oil/gas platforms in the UK sector.

4. R Kilbride to submit outstanding quality-controlled data for English waters by June 2003.

5. M Robertson to submit outstanding quality-controlled data for Scottish waters and other North Sea locations by June 2003.

6. All data contributors to the NSBP to ensure that **raw** data (i.e., data for individual samples) are provided to Edward Vanden Berghe as soon as possible.

7. Johan Craeymeersch/Edward Vanden Berghe to prepare a plan for comparison of 1986 and 2000 data (especially in relation to the uneven distribution of stations sampled between 1999–2001) prior to the Workshop of November 2003.

8. H Rees to contact the Chair of the WGSAEM regarding progress with the NSBP with a view to collaboration on further statistical analyses of the data.

9. Edward Vanden Berghe to liaise with ICES regarding ongoing developments with the NSBP database, and the use of ICES as a route for requesting ITIS codes for uncoded species in the NSBP 2000 database.

10. H Rumohr to compile available information on benthic habitat types in the North Sea by October 2003.

11. H Rees to explore the availability of benthic community data for the eastern English Channel arising from recent surveys sponsored by the aggregate extraction industry.

12. Edward Vanden Berghe to add data from the French and Norwegian coasts (provided by Drs Dewarumez/Deprez and Oug, respectively) to the NSBP 2000 database.

13. Johan Craeymeersch to compile a list of feeding types for benthic species in the NSBP 2000 database for the November 2003 meeting.

14. Edward Vanden Berghe to circulate a list of queries to data providers requesting resolution or acceptance of proposed changes by the end of June 2003. The taxonomy will then be updated and all data providers will be requested to conduct a final check of the NSBP 2000 compilation, via the VLIZ website.

15. Edward Vanden Berghe to contact Bob Clarke (PML, UK) with regard to the scope for increasing the capacity of PRIMER 5 to accept the entire NSBP 2000 species/abundance matrix.