

## Theme Session A

### Structure and dynamics of the benthos in ICES waters

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#### ICES CM 2007/A:01

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##### **ECOVUL/ARPA (Estudio de los eCOsistemas VULnerables y los ARtes de Pesca): A Spanish Interdisciplinary Research Project focused on the Study of the Hatton Bank Deep-Sea Fisheries (ICES XIIb & VIb1) and their Relationship with Vulnerable Ecosystems/Habitats, integrating Fisheries Biology, Marine Geology, Benthic Ecology and Sedimentology**

P. Durán Muñoz, M. Sacau, M. Sayago-Gil, T. Patrocinio, L. M. Fernández-Salas, F. J. Murillo, V. Díaz del Río, A. Serrano, and S. Parra

An interdisciplinary research is being developed by Spain to study the habitual fishing grounds of the Spanish bottom trawlers in the Hatton Bank (ICES XIIb & VIb1), in order to identify vulnerable ecosystems/habitats, particularly cold-water corals, and suitable areas to protect. Preliminary results have been provided to the 2007 ICES-WGDEC and therefore were used to produce the new advice on closed areas. Besides Multidisciplinary Deep-Water Research Surveys (by means of multibeam echosounder, sub-bottom profiler, bottom trawl and dredges), data from observers on board commercial trawlers, Cooperative Surveys and Vessel Monitoring System are also being integrated and analyzed. Fishing effort distribution shows that main Spanish trawl fleet fishing grounds in Hatton Bank are located on the Western slope of the Bank (1000-1500m depth). According to the geologic study of the seabed, these grounds correspond with the uppermost area of the well-known Hatton Drift, a depositional body composed by sediments drifted along the margin. Several features like ridges, mounds, furrows, moats, waves and slumps have been identified along the Drift, but fishing effort distribution data show that trawl fishing grounds are preferably positioned over the soft blanket deposits. In the study area, both bottom trawl and longline catches were clearly dominated by fishes. Most of the benthic invertebrates bycatches in trawl hauls corresponded to species that grow on soft bottom (e.g. echinodermata). Survey ecological indices were calculated. Depth seems to be the main environmental factor determining assemblages spatial patterns. Maps of the seabed integrating the distribution of main vulnerable invertebrates are presented.

Keywords: interdisciplinary research, vulnerable habitats and ecosystems, Hatton Bank, deep-water fisheries, bottom trawl, bottom longline, geology, benthic ecology, sedimentology, bycatches, cold-water corals, sponges.

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#### ICES CM 2007/A:02

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##### **Dominance and community thresholds in Long Island Sound benthic communities**

Pablo Munguia and R. Osman

Community structure tends to change through succession generating changes in species dominance. This has led to studies claiming that different states can occur within the same system. A state can be defined as either the shift in species dominance or the actual change in community structure (the change in the identity of the species present). However, less emphasis has been placed on the changes in the mechanism that drives successional patterns, or thresholds. The main obstacle behind the understanding of community thresholds is the fact that coexisting species have varying life history traits creating both spatial and temporal overlaps in their population dynamics, and thus in community structure. The present study is aimed at understanding community thresholds that may alter the benthic community of Long Island Sound in the northwestern Atlantic. This benthic community is comprised of a large number of sessile benthic species, including bryozoans, ascidians and mussels. The community tends to change over patches as a “shifting mosaic;” altering species dominance that may span different temporal and spatial scales. Here, we use a series of modeling techniques to understand the threshold dynamics of the community. Species with different life history traits, ranging from broadcast spawning to brooding species, were simulated and their population dynamics followed over time. We induced small changes in the mechanisms that may alter dominance, such as dispersal and competitive abilities, in order to determine the relative importance of these mechanisms in inducing thresholds and how it affects the duration and fluctuations in species dominance.

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**ICES CM 2007/A:03**

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**Benthic invertebrates community structure inferred from bottom trawl hauls observations and its relationships to abiotic conditions in the southern North Sea**

S. Vaz, R. ter Hofstede, J. Martin, J.-M. Dewarumez, Y. Verin, D. Le Roy, H. Heessen, and N. Daan

Benthic invertebrates caught during the French and Dutch participation in the 1st quarter IBTS (International Bottom Trawl Survey) in the southern North Sea during the years 2002–2007 were monitored as a response to growing interest in collecting additional information on the ecosystem during these fish surveys. The presence of benthic invertebrates was recorded to the lowest taxonomic level as possible. The data were explored using statistical methods adapted to community analyses showing both the structure of the assemblage with its principal indicator species (TWINSPAN, Principal Component Analyses). Correlations to environmental parameters such as depth, seabed stress, temperature, salinity and chlorophyll A concentration were investigated (Redundancy Analyses). Diversity indices were then used to further explore the differences between each previously defined sub-communities. Finally, the distribution of each type of assemblages were mapped as well as their diversity levels using geostatistics and GIS, resulting into a seabed habitat map for the southern North Sea. Such study may be extended in the future, in order to obtain more detailed information on benthic invertebrate distribution and assemblages, and will prove very useful for the conservation and protection of natural marine habitats. The information obtained will help to elaborate guidelines for the conservation and protection of natural habitats in the face of climate change and anthropogenic disturbances.

Keywords: North Sea, benthic assemblages, seabed habitats, GIS, IBTS.

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**ICES CM 2007/A:04**

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**Habitat suitability as a modelling tool for macrobenthic communities: An example from the Belgian part of the North Sea**

S. Degraer, E. Verfaillie, W. Willems, E. Adriaens, M. Vincx, and V. Van Lancker

Being ecologically important and well-known, the spatial distribution pattern of the macrobenthos is often used to support an ecologically sustainable marine management. Although being increasingly demanded, full coverage spatial macrobenthos distribution maps are however generally lacking. This study therefore aimed at demonstrating the usefulness of habitat suitability modelling as a full coverage mapping tool through (1) the construction of a habitat suitability model for the macrobenthic communities in the Belgian part of the North Sea (BPNS) and (2) predicting the full coverage spatial distribution of macrobenthic communities within the BPNS. Discriminant function analysis (DFA) objectively selected median grain size and sediment mud content and omitted bathymetry, slope and distance to the coast to represent the most important environmental variables determining the macrobenthic community distribution. The consequent empirical habitat suitability model, using both median grain size and mud content, showed an a posteriori average CCI (i.e. Correctly Classified Instances) of 79% (community-dependent CCI ranging from 72 to 86%). The application of the habitat suitability model on the full coverage maps of median grain size and sediment mud content, taken from literature, allowed to reliably assess the distribution of the macrobenthic communities within 96.3% of the 53297 BPNS grid cells with a resolution of 250 m. Next to its applicability to the BPNS, the model is further anticipated to potentially perform well in the full Southern Bight of the North Sea.

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**ICES CM 2007/A:05**

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**Structure of fish assemblages along the Northeastern United States based on trawl survey data: indicators of biodiversity and a basis for ecosystem and area-based management**

A. Jordaan, M. G. Frisk, N. H. Wolff, L. S. Incze, and L. Hamlin

As single-species fisheries management is replaced in favor of an ecosystem approach, it becomes important to understand the structure of fish assemblages (ecosystems) and the constraints placed on them by the environment (boundaries). The present study defines assemblages of fish and invertebrates in the greater Gulf of Maine region using data collected by the National Marine Fisheries Service trawl survey. Principal Component Analysis (PCA) and bootstrapping are used to identify significantly correlated species and extract structure from the dataset. PCA scores were compared to depth, temperature and spatial data using a General Linear Model. Biotope/habitat mapping using the ecological structure determined by the PCA is completed using spatial analyst techniques in ArcMap. Results show that there are identifiable groups of species.

Species assemblage structure had different relationships with environmental parameters depending of the group of species, but clear patterns in species were evident and the structure of species was related to oceanographic differences. The results demonstrate a basis for management of species based on biological and physical differences in the environment. Furthermore, the technique shows promise as a biodiversity indicator and could be used to ensure that all species are being equally protected under an area-based management scheme. The species that are responsible for driving patterns in structure are related to the scale of observation. Therefore, management advice must be taken in the context of the species and geographic boundaries of the analysis.

Keywords: ecosystem structure and boundaries, multivariate analysis, GIS mapping, area-based management, ecosystem approach.

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### ICES CM 2007/A:06

#### **The ICES North Sea Benthos Project 2000: Changes in North Sea macrofauna communities between 1986 and 2000**

Ingrid Kröncke *et al.*

The North Sea Benthos Project (NSBP) 2000 was initiated as a follow-up to the earlier 1986 ICES North Sea Benthos Survey. One major aim of the NSBP 2000 was to compare the outcome with that of the 1986 NSBS, in order to identify any significant changes in the community structure and their likely causes. In general, the spatial distribution of the macrofaunal communities in 2000 was rather similar to that in 1986. But changes were found within communities which were addressed to changes in the hydroclimate caused by changes in the North Atlantic Oscillation influencing changes in currents and sediment structure as well as food availability.

Keywords: macrofauna communities, long-term variability, NAOI, sediments, North Sea.

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### ICES CM 2007/A:07

#### **Small-scale heterogeneity in the mobile macro-epifauna associated with mud, sand and coarse habitats**

J. R. Ellis, T. Maxwell, M. Schratzberger, K. Warr, and S. I. Rogers

In recent years, several studies have utilised groundfish surveys as sampling platforms for the broadscale examination of epibenthic fauna. Several fisheries laboratories utilise a 2m steel beam trawl with chain mat for the sampling of epifauna, although only single samples are usually collected at the sampling stations. Hence, although such surveys provide valuable information on the broadscale distribution of epibenthic assemblages, their utility for examining issues relating to species diversity may be restricted by lack of replication. Intensive replicate sampling with 2m beam trawl has now been conducted on specific offshore biotopes around the British Isles, including two mud biotopes (Celtic Deep and north-western Irish Sea), three sand biotopes (outer Bristol Channel and inner and outer Carmarthen Bay), two sand banks (Swarte and Broken Banks in the southern North Sea) and two coarse grounds (a gravel bed in the North Sea and a shell-gravel habitat in the western English Channel). For most sample sites, sampling involved five replicate tows at a central station with single tows taken at eight surrounding grid stations (2 nm and 6 nm NW, NE, SW and SE of the central station). The similarities between catches at these stations and the cumulative number of species observed are described, with the implications for the resource required for monitoring diversity on offshore grounds discussed.

Keywords: beam trawl, demersal assemblage, epibenthos, biodiversity.

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### ICES CM 2007/A:08

#### **The ICES North Sea Benthos Project 2000: Relations and interactions between environmental factors and biotic properties**

Wouter Willems, H. Rees, M. Vincx, P. Goethals, and S. Degraer

The ICES North Sea Benthos database contains information on the diversity, density, biomass and individual weight of the benthic macrofauna, along with a set of environmental variables. The goals of this contribution

to the ICES North Sea Benthos Project 2000 were 1) to explore the relation between the macrobenthos and the available environmental variables, 2) to highlight any differences between the 1986 and 2000 ICES surveys.

The wide geographical coverage and high number of samples allowed for a test of several macro-ecological hypotheses. The diversity increased with increasing latitude, contrary to the 'global' hypothesis. The biomass increased with decreasing winter temperatures in February. No relation between surface chlorophyll a and biomass was found. Larger-scale patterns were found in the structure (diversity and density) and functional attributes (biomass and mean individual weight) of the macrobenthos in the North Sea. It was often difficult to distinguish correlative and causal relations between biotic and abiotic variables. Some relationships might also be limited to the North Sea. The multivariate clustering of the samples based on abiotic variables coincided well with clustering based on the macrobenthic communities, identified by other authors. The communities thus show a relatively close and predictable relationship with the environment when variables are explored in combination. Though being part of the greater North Sea as defined by OSPAR and the EU, the benthic assemblages and coarse substrata of the eastern English Channel clearly distinguish from the rest of the North Sea, dominated by finer sediments.

Keywords: North Sea Benthos Project, NSBP, Abiotic variables, diversity, biomass, North Sea.

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## ICES CM 2007/A:09

### **Spatial variation of the macrobenthos species and communities of the Belgian Continental Shelf and the relation to environmental variation**

Ine Moulart, Kris Hostens, Hans Hillewaert, and Jan Wittoeck

Macrobenthos data for the Belgian Continental Shelf were used (1) to give an overview of the spatial pattern of the different macrobenthic species and communities of the Belgian Continental Shelf and (2) to examine the influence of different environmental variables on the spatial distribution of the macrobenthos species and communities on different spatial scales. The Belgian part of the North Sea is a highly dynamic area with a continuous succession of gullies and sandbanks. A variety of human activities like sand extraction, dredge dumping and fishing also affect the ecosystem. Samples were collected in the framework of different monitoring programs during 2004 and 2005 using the same sampling techniques. Total abundance, number of species and diversity indices were calculated and used for spatial comparison. The differences in community structure were investigated through multivariate analyses. Several abiotic variables were measured and used in statistical tests to investigate the relation to the distribution of the macrobenthos on different spatial scales. Multivariate analysis distinguished five major groups, with a clear separation of the coastal from the offshore samples. The groups were characterised by the presence and/or absence of certain species and the relative abundance of the different taxonomic and feeding type groups. The average density, species richness and diversity were highly variable within each group. The distribution pattern of certain species was clearly related to the environmental variability. Univariate measures correlated best with depth and salinity, whereas multivariate analysis identified median grain size, mud content and salinity as the major environmental variables influencing the faunal patterns.

Keywords: spatial variation, macrobenthos, Belgian Continental Shelf.

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## ICES CM 2007/A:10

### **The ICES North Sea Benthos Project 2000: Infauna, epifauna and demersal fish in the North Sea: community patterns and underlying processes**

Henning Reiss *et al.*

In order to provide a broader ecosystem context for the interpretation of the infauna data of the North Sea Benthos Project (NSBP) 2000, the data were analysed in conjunction with epifaunal and demersal fish assemblage data collected under other (EU and ICES) auspices. Due to differences in the life-cycle traits and the mobility of the three faunal components, ranging from relatively sessile infaunal species to highly mobile fish species, the community structures as well as the responses to environmental variables are expected to differ among these faunal groups. Therefore, the objective of this study was to analyse and compare the spatial community patterns of the infauna, epifauna and demersal fish.

Patterns in the distribution of infaunal, epifaunal and fish assemblage types determined from cluster analyses were very similar, with major distinctions between the southern (<50 m), central (50-100 m) and northern

(100-200 m) North Sea. Furthermore, the comparison of the (multivariate) similarity matrices of all three components revealed significant correlations, whereas differences among the components were found for the patterns of univariate measures. Analyses relating spatial patterns in the different faunal components to environmental variables provided an insight into the functional similarities and differences between the components.

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**ICES CM 2007/A:12**

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**Post-extraction evolution of a macrobenthic community on the intensively extracted Kwintebank site in the Belgian part of the North Sea**

Ine Moolaert and Kris Hostens

The Kwintebank, a sub-littoral sandbank in the western Belgian part of the North Sea, is highly extracted, mainly due to the short distance to the coast and the suitability of the sand for construction purposes. After 30 years of exploitation, a depression was formed in the 'central' part of the Kwintebank. To allow the geomorphologic rehabilitation of the area, it was decided to cease extraction in this part of the exploitation zone in 2003. The recovery of the macrobenthos in this depression was followed for several years through the analysis of Van Veen grab samples taken twice a year at six locations in the depression and at several locations spread over the Kwintebank. The poor macrobenthic community that was found in the central depression directly after the cessation of the extraction activities, clearly evolved to a community with higher densities, species richness and diversity three years after the sand extraction activities stopped. The species with the highest increase were the interstitial polychaetes *Hesionura elongata* and *Polygordius appendiculatus*, juvenile and adult *Nephtys cirrosa* and the amphipod *Urothoe brevicornis*. These are characteristic species also for the other highly dynamic sandbanks of the Belgian continental shelf. As the 'central' Kwintebank site will stay closed for another 3 years, we will get the opportunity to investigate whether the recolonisation/recovery of the macrobenthic community will remain stable.

Keywords: sand extraction, Kwintebank, Belgian Continental Shelf, macrobenthos, recolonisation, recovery .

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**ICES CM 2007/A:13**

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**Development of a sea cucumber (*Cucumaria frondosa*) commercial fishery: evaluation of short-term impact of dredging on the north coast of Gaspé (Québec, Canada) ecosystem**

Jérôme Laurent, M.-H. Rondeau, D. Grelon, M.-J. Leblanc, P. Archambault, and M.-L. Larrivée.

In the context of a sea cucumber (*Cucumaria frondosa*) development commercial fishery, located on the north coast of Gaspé (Québec, Canada), the aim of this study was to 1) evaluate short-term effects of the fishing gear on species living on the seabed of the fishing zone area; 2) determine composition and abundance of species caught by the dredge; 3) describe effects of other dredges or disturbances on the ecosystem; 4) suggest modifications to the fishing gear according to the project results and observations. The selected dredge is a "light green sweep urchin" (LGS) type and its impact was observed with a submarine video recording system, which could be fixed on the dredge or on a sledge. A BACI (Before, After, Control, Impact) protocol was elaborated for quantifying the short term impact of the LGS dredge. Results of statistical analysis shows that LGS dredge has a short term significant impact on sea-cucumbers, scallops and soft corals. The composition of the captured species indicates that, in the context of our study, this fishing gear is quite selective and efficient for the targeted species. However, this fishing gear could be enhanced in several ways, to achieve better efficiency with a minimal disturbance on the seabed. Also, precautionary approach should be adopted to guarantee a sustainable fishery.

Keywords : sea-cucumber, fishery impact, BACI.

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**ICES CM 2007/A:14**

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**Observations on macrobenthos from a beam trawl survey in the German Bight**

Ulrich Damm

Data on macrobenthos bycatch in a beam trawl survey targeting common sole, covering three decades in the German Bight, are analyzed for trends and shifts in abundance of selected macrobenthos species.

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**ICES CM 2007/A:15**

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**Benthic macroinvertebrates vertical distribution – The influence of tidal cycle**

Inês Cardoso, José Pedro Granadeiro, and Henrique N. Cabral

In this work we evaluated vertical distribution pattern of benthic infauna during the tidal cycle at one of the most important mudflats of the Tagus Estuary. Samples were collected hourly during 24 hours periods at eight different tidal cycles, using a corer specifically designed for the study purpose, that allowed easy and effective separations of 15 different sediment layers. General linear models were used to fit negative binomial. We found that different species have different distribution and abundance according to sediment layers. During the tidal cycle the best model fitted to describe vertical migration was observed for Ostracoda. At high tide, individuals tend to be concentrated in the upper layers, contrasting with a more homogeneous distribution along the vertical profile during low tide periods.

Keywords: macrobenthic community; tidal cycle; vertical distribution; GLM; mudflats; Tagus estuary.

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**ICES CM 2007/A:16**

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**Long-term changes in the meroplankton of the North Sea**

J. A. Lindley and R. R Kirby

Data from the continuous plankton recorder (CPR) survey have shown large scale changes in the abundance and phenology of the meroplankton in the North Sea. Early results indicated that abundance of decapod larvae was low and the seasonal peak of abundance was late following cold winters. The phenological effect of temperature was shown to be consistent with relationships between both geographical and interannual patterns of variation. The phenology of the meroplankton has changed more than that of the holoplankton, with echinoderm larvae showing the greatest shift in timing. Echinoderm larvae have also increased in abundance to become the most abundant taxon in the CPR samples in the North Sea. It has been concluded that the variations have been mainly attributable to increasing abundance and earlier occurrence of larvae of a resident species, *Echinocardium cordatum*, and not the result of a change in species composition. The remarkable scale of the changes in abundance and phenology of the meroplankton has stimulated the development of further research into the causes and effects of these changes

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**ICES CM 2007/A:17**

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**The ICES North Sea Benthos Project 2000: North Sea Benthic Communities by 2000**

Eike Rachor and SGNSBP members

Under the guidance of the ICES Benthos Ecology Working Group, surveys by several institutes in UK, F, B, NL, N and D were performed in 2000 (and a few additional surveys also in 2001) to re-investigate the macro-infaunal assemblages of invertebrates in the North Sea and compare these with earlier descriptions, mainly the survey of 1986 (Künitzer *et al.*, 1992; Heip *et al.* 1992).

Altogether, 24 clusters were identified based on Bray-Curtis-similarity and group average linkage after fourth root transformation of the abundance data. These assemblages are distributed according to water depths and sediment conditions and show very similar distributional patterns as in earlier investigations, especially in the 1986 North Sea survey.

A main separation is seen north of the Dogger Bank near the 50 m depth contour. The assemblages of coarse sand, gravel and stony fields are well separated from such inhabiting finer substrates. While the majority of

the assemblages are regarded communities, a few inshore and coarse sand/gravel clusters may be regarded as local expressions (sub-communities) of larger, widely distributed community types.

All identified assemblages are compiled in a table (annexed below), which also presents information about environmental conditions, internal similarity, densities and species diversity as well as on dominating and characterizing and name-giving species.

Several general trends, e.g. diversity versus latitude and depth, are presented, while abundance is only weekly increasing from the South to the North. When comparing on a community level instead of comparing all stations at once, several differences and trends become more obvious. In a few cases, shifts in the distribution of communities can be shown (e.g. of the mud-inhabiting *Nucula-nitidosa*-community in the Pleistocene Elbe valley in the German Bight). They are related with shifts of some dominant species, which can partly be explained with the warming in the southern North Sea.

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### ICES CM 2007/A:18

#### **The ICES North Sea Benthos Project 2000: data management issues, outcomes and recommendations**

E. Vanden Berghe

Data for the ICES North Sea Benthos Project 2000 were provided by 15 organisations, organised as 18 separate data sets. Also the data from the 1986 North Sea Benthos Survey were available for analysis and comparison with the 2000 data sets. Sampling occurred mainly in spring and early summer of 2000 and covered almost the whole North Sea from the English Channel to about 60°N. All biogeographic data were integrated in a single database, resulting in a dataset with 91,362 distribution records, from 1570 stations, 2609 samples, and 1954 different taxa. Great care was taken to standardise taxonomic names used, and to deal with incomplete and uncertain identifications in a clear and consistent way. Preliminary plotting and analysis made it clear that there are large biases in sampling locations, resulting from the needs and objectives of the original data collector. Sample size was not always recorded, and had to be reconstructed from the data in some cases. Also, sample size was very uneven, and necessitated extra caution in interpretation in the results of the analysis. However, a comparison of 1986 data (where there was an agreed-upon plan before sample collection) and 2000 data (where data were used opportunistically) showed that patterns were consistent between the two sampling periods, and hence that the opportunistic nature of the 2000 dataset did not invalidate any possible science. Obviously, integrated data sets like the one presented will never be a substitute for carefully planned joint research, but it is argued that there is great merit in exercises such as this. Existing data are given a second lease of life, thereby greatly increasing their value, without going to the cost of collecting new samples. Integration of data offers an opportunity for an extra quality control, and can bring to light potential problems not detected at first analysis. Last but not least, integration will lead to much larger data sets than what can be achieved with centrally-planned research; it leads to datasets commensurate with the scale of environmental problems humankind is presently confronted with.

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### ICES CM 2007/A:19

#### **The ICES North Sea Benthos Project 2000: sediment characterization and trace metal concentrations in sediments from the North Sea.**

P. J. Kershaw, C. Mason, H. Hillewaert, and G. Irion

All the sediments sampled in the 2000 survey were relatively coarse grained, with 90% containing < 10% silt/clay (< 63µm), and with most samples being predominantly sandy in nature. Comparison of median particle size for earlier (1986) samples and NSBP 2000 samples, showed no statistically significant difference.

As part of the NSBP 2000, trace metal concentrations in sediments were investigated in two sub-regions: the UK sector of the western North Sea (Cefas) and the German Bight (Senckenberg Institute). The results were compared with the OSPAR recommended Background Concentrations (BCs) and Background Assessment Criteria (BACs) (OSPAR, 2005). This provided a means of assessing the overall contamination of the North Sea sediments. It is clear that the fine fraction of surface sediments over large areas of the North Sea are contaminated with trace metals, using the criteria recommended by OSPAR (i.e. BCs and BACs). It is likely that this is a consequence of the long history of industrialisation and high population densities of the coastal fringe. The sediments act as a store for metals released over the past two centuries. The trace metal

concentrations showed no link with biological community structure. It has not been possible to provide an adequate comparison of the contamination status in 2000 and in 1986 (Irion and Müller 1987) due to differences in the size fractions used for analysis. For the same reason it has not been possible to compare directly the results from the German Bight and the western North Sea, and such procedural differences need to be overcome before embarking on a similar collaborative exercise.

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## ICES CM 2007/A:20

### The ICES North Sea Benthos Project 2000: species distributions and changes (1986–2000)

J. D. Eggleton, B. K. Smith, H. Reiss, E. Rachor, E. Vanden Berghe, and H. L. Rees.

The distributions of selected infaunal species in the North Sea were examined for changes using data from matching stations sampled in 1986 and 2000. The species investigated included examples of those that were characteristic of communities identified in both surveys, those that are characteristic of certain sediment types and those that are known to be sensitive to certain anthropogenic stressors. Species were mapped according to their broad distributional similarities. In general, the information suggests that while there is some evidence of flux, which may be attributable to natural variation in recruitment, there is no indication of a consistent directional trend. For the majority of species investigated, the distributions remained broadly similar between the two sampling occasions. However, there is some evidence to suggest that 3 species (*Ophelia borealis*, *Chamelea gallina* and *Nuculoma tenuis*) have shown movements away from the eastern North Sea, while others that require warmer water in order to reproduce successfully (e.g. *Amphiura brachiata*), have shown increasing presence in this area. Other factors such as bottom fishing may also be influential in the distributional changes seen in some species (e.g. *Arctica islandica* and *C. gallina*) illustrated in this study. Further investigation via additional data sources may be required to confirm these patterns.

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## ICES CM 2007/A:21

### The ICES North Sea Benthos Project 2000: aims, outcomes and recommendations

H. L. Rees *et al.*

This paper provides an overview of a collaborative initiative to re-assess the status of the North Sea benthos, following an earlier (1986) synoptic survey, also conducted under ICES auspices. The background, organisation and scope of the ICES North Sea Benthos Project (NSBP) 2000 are described. Unlike in 1986, the NSBP 2000 was more reliant on the opportunistic gathering of existing data from various sources. This presented special challenges for locating willing contributors, and then for combining and managing the sources effectively, a task which was greatly facilitated by dedicated data management support. The range of interpretational approaches aimed at evaluating spatial patterns and changes over time are summarised and the overall conclusions are presented. These highlight traits both of resilience and adaptability over different scales. Finally, lessons learnt from the ICES NSBP 2000 initiative are summarised, and recommendations are made for the conduct of future surveys on comparable scales in the North Sea and elsewhere.

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## ICES CM 2007/A:22 Withdrawn

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## ICES CM 2007/A:23 Poster

### Epifaunal sampling in the Celtic Sea

J. R. Ellis, G. Burt, and S. I. Rogers

The Celtic Sea is an extensive area of continental shelf to the south-west of the British Isles. Despite having important fisheries for hake, megrim and anglerfish, the structure of epibenthic communities in this area have been little studied since the pioneering studies of Le Danois in the first half of the 20th Century. During the period 2000–2006, approximately 150 tows with 2m-beam trawl have been undertaken during groundfish surveys of this area. Catches along the edge of the continental shelf (130–350 m deep) were characterised by large numbers of the anemone *Actinauge richardi*, with the hermit crab *Pagurus prideaux* dominating on coarse grounds in shallower waters. This poster describes the spatial distribution of the epibenthic fauna.

Keywords: beam trawl, demersal assemblage, epibenthos, biodiversity.

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**ICES CM 2007/A:24 Poster**

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**The Barents Sea Benthos Survey, 2003–2006**

B. I. Berenboim, N. A. Anisimova, I. E. Manushin, and P. A. Lubin

PINRO has been carrying out regular benthos research in the Barents Sea since 1923. As a result extensive database on the bottom invertebrate communities under different environmental conditions and anthropogenic changes in this area was accumulated in PINRO.

The regular benthos survey was conducted by PINRO in 2003–2006. The aims of this survey were the description of the current state of the bottom communities in the Barents Sea and the estimation of variations caused by climatic factors and anthropogenic impact (fishery, introduction of new species, oil and gas development).

The survey was carried out throughout the Barents Sea (including coastal waters of archipelago Spitsbergen but excluding the Norwegian Economic Zone). At each station 5 samples by van Veen bottom sampler were collected and ten-minute trawlings by Sigsby trawl were performed. In total 335 samples were collected.

New data on the state of bottom inhabitants in the southern part of the Barents Sea including the Motovsky Bay and the Russian part of Varanger fjord were obtained. Species composition, abundance, biogeographical and trophic structure, main biodiversity characteristics, ratio of major ecological groups, distribution and features of bottom communities and their complexes were analyzed.

In total 1027 macrobenthos species were identified. The highest mean biomass was registered offshore in the southern part of the sea (95.2±15.4 g/m<sup>2</sup>), and slightly lower values were observed in Motovsky Bay (74.7±12.7 g/m<sup>2</sup>) and Varanger fjord (36.7±7.6 g/m<sup>2</sup>). It was revealed that the most unfavourable ecological situation was observed in Varanger fjord as compared to the other areas investigated.

Keywords: bottom communities, climate factors, human impact, macrobenthos species, Motovsky Bay, Varanger fjord.

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**ICES CM 2007/A:25 Poster**

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**Distribution of Invertebrates on artificial reefs along South-eastern Coast of Jeju Island, Korea**

Kim Byoung Sub, Sei Seong Ho, and Choi Im Ho

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**Fishery impact on demersal fish prey in the Barents Sea**

Lis Lindal Jørgensen, Raul Primicerio, Ole Jørgen Lønne, and Arne Hassel

Projects integrating benthic ecology, distribution and diet of bottom-associated fish, and impact of bottom fisheries are currently under development in Norwegian waters. In the Barents Sea, the above ecosystem approach to marine monitoring and management includes quantitative sampling of the bottom fauna, demersal fish, an evaluation of trawl bycatch, fish stomach analysis, and physical and chemical quality of the water column. Such work covers large areas and consequently a diverse spectrum of habitats and patterns. To detect possible impact of fishery on demersal fish benthic prey it is critical to analyze the spatial variation in fish diet composition and relate it to the distribution of invertebrate prey vulnerable to bottom fishery. Ordination techniques were used to map and quantify the potential impact of fishery on the most important and vulnerable benthic prey. The detected relationships between fish diet and bycatch indicate a possible threat to demersal fish via impact of fishery on prey availability. Further mapping and assessment of vulnerable benthic prey will provide the basis for demersal fish management that safeguards vulnerable feeding grounds.

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**Distribution patterns of benthic macro-invertebrate in the artificial reef settled in the Southwestern waters, Korea**

Choi Im Ho, Seo Seong, and Kim Byoung Sub

Artificial reef in the ocean is artificially used to helping a protection, culture, breeding of fishery resources. This study investigates the distribution patterns of benthic macro-invertebrates in the artificial reef settled in the Southwestern waters of Korea.

Samplings were carried out at 30 artificial reefs from June to September, 2006. Benthos samples were collected by Scuba diving using the quadrat method (50cm×50cm) and examined the species composition, biomass, dominant species.

We found the 101 benthic macro-investigate species (2,484 indiv. m<sup>-2</sup>, 51,474 g·m<sup>-2</sup>) in the 30 artificial reefs. Mollusk was most abundant with 43 species and then cnidarian 21 species, arthropod 17 species, echinoderm 11 species, bryozoan 5 species, porifera 3 species, sipunculida and annelida 1 species at each. Distribution patterns of benthic macro-investigates were different depending on the types of artificial reef and settlement time. That is, artificial reefs either square type or settlement in the 90's showed the high appearance above 52%.

Keywords: benthic macro-invertebrate, artificial reef.

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**Benthic prey quantity and quality in the main mudflat feeding areas of the Tagus estuary: implications for bird and fish populations**

Inês Cardoso, José Pedro Granadeiro, and Henrique N. Cabral

Estuaries are among the most productive environments in the coastal zone that may act as sink of pollutants. In this work we evaluated how levels of heavy metals contamination can be reflected in macroinvertebrates communities in the Tagus estuary mudflats areas inferring its consequences to upper trophic levels. For that we used Shannon-Wiener diversity, Pielou evenness and Simpson dominance to characterize benthic communities along the sites that presented different metal contamination loads. Those stations with high levels of contamination presented a lower diversity but also the highest prey density. This study pointed out that unhealthy area can still perform their ecosystem function with costs than remain to be evaluated. The biodiversity can be impoverished compared to other sites less contaminated, but with regard to their utilization as feeding areas by birds and fishes this is not a limiting factor. For this particular function of the mudflats, the prey availability is the main characteristic that determines the choice of one particular site as a birds and fishes feeding area which may not be affected by heavy metal contamination.

Keywords: macrobenthic community; heavy metals; contamination; tagus estuary; mudflats; birds; fishes.

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**ICES CM 2007/A:29     Poster**

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**A new appearance of the benthic amphipod *Dyopodos monacanthus* (Metzger, 1875) in the southern Baltic Sea, the first record in the Slupsk Furrow**

Diana Dziaduch

The present paper reports on the occurrence of epibenthic amphipod *Dyopodos monacanthus* (Metzger, 1875) in the Baltic Sea. This species belonging to the family Dulichiidae is found in the North Atlantic and European coastal waters ranging from northern Norway to English Channel and Danish Straits. In the past, over 50 years ago, only a few individuals of *D. monacanthus* were occasionally sighted in the western Baltic, in the Arkona and Bornholm Basins. In summer 2006, the new specimens of amphipod were noticed at five deep stations of Slupsk Furrow. It is the first time when *D. monacanthus* was observed in that area, which is currently the easternmost part of occurrence of this species in the Baltic Sea. This presentation is describing historical and recent distribution of these crustaceans in the Baltic together with hydrological data. Biological characteristic of this species is provided as well. Environmental changes during last years, which might have been responsible for the spreading of *D. monacanthus* are discuss.

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