

## Theme session D

### New approaches to measure and assess biodiversity

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The biodiversity session (D) was titled “New approaches to measure and assess marine biodiversity”. The idea for this theme originated out of the ICES Working Group on Biodiversity (WGBIODIV), which found that there are still many problems associated with using biodiversity indicators within environmental assessment frameworks. In particular at the ecosystem level it has been proven to be very challenging for the member states to provide meaningful initial assessments in 2012, revealing knowledge gaps on how to capture, understand and assess observed patterns of biodiversity. Therefore this session aimed at gathering innovative ways of observing, measuring, understanding and assessing biodiversity. In particular it was hoped that approaches for developing new biodiversity indicators will be presented.

Several presentations focused on new ways to observe and measure biodiversity across a wide array of ecosystem components. A talk by Hufnagel *et al.* showcased a beautiful example of ecosystem sampling: On a transect from Germany to Scotland, a suite of abiotic parameters such as depth and temperature, and biotic data, including plankton, and sightings of birds and marine mammals, were collected simultaneously. The combined monitoring approach by these authors could help to improve the understanding of ecosystem functioning. Presentations by Zaiko *et al.* and Aguirre *et al.* demonstrated genetic barcoding approaches to capture the biodiversity of the microbiome in sediment samples and biofilms. Other talks focused on newly gained knowledge of the biodiversity patterns of special taxa, e.g. Gorgonians in the western Mediterranean Sea (Grinyó *et al.*) or krill in the Indian Ocean (Sutton *et al.*).

In general, monitoring of marine biodiversity is a very costly operation and countries have only limited resources to spend on their monitoring. A number of techniques were presented that could reduce costs in sampling and monitoring programmes. A study by Dudeck *et al.* on zooplankton in the English Channel illustrated how traditional and costly labour intensive plankton sampling could be substituted by automated real time size frequency sampling using a Zooscan device. Olivier and Planque talked about biodiversity in the Barents Sea and showed that it is possible to reduce the complexity of a foodweb from 350 to 50–100 entities without losing biodiversity signals. Yates *et al.* showed that models predicting biodiversity for one local ecosystem could under certain conditions be transferred successfully to other localities. And the application of Next Generation Sequencing, a DNA barcoding technique, allows for rapid and cost-effective identification of large numbers of marine species. Zaiko *et al.* used it to identify microscopically small species in New Zealand, only hours after their settlement on experimental settlement plates.

Many presentations showed new approaches on how to understand observed patterns of biodiversity. Certain and Planque provided a comprehensive overview of biodiversity and the application of biodiversity indicators. The authors reviewed Hill's biodiversity indices and argued that combining the frameworks of Whittaker (1972), Hill (1973) and Leinster and Cobbold (2012) would lead to a more consistent

framework to quantify species diversity by taking  $\alpha$ -,  $\beta$ - and  $\gamma$ -diversity into account. Fock presented an approach comparing the parameters of species-abundance curves across ecosystems to identify shifts in biodiversity in space and time. Fredrikson and Payne found that climate change may affect the biodiversity of the North Sea fish community by altering the distributions of boreal and Lusitanian species. In the Baltic Sea, Pécuchet *et al.* showed that by linking fish traits (functional diversity) to environmental characteristics, patterns in biodiversity could be better understood.

Finally, several talks dealt with the usability of biodiversity indicators for environmental assessments as required for policy frameworks such as the EU Marine Strategy Framework Directive (MSFD) or Habitats Directive (HD). For example, Gert van Hoey provided an overview and compared the performance of various benthic indicators used within the North Sea. Teixeira *et al.* introduced a software tool from the DEVOTES project (DEVOTool), which provides an overview on 557 biodiversity indicators currently used by European member states for the implementation of the MSFD. Certainly, not all of these indicators will be used in future assessments, as many of them were not operational yet. Larila-Pant *et al.* emphasized the importance of integrating the social, ecological and economic dimensions when assessing biodiversity by applying evaluation approaches.

A major constraint for the operation ability of indicators is the lack of assessment targets representing good environmental status (GES) due to missing pressure-state relationships. An impressive example of how to derive such a pressure-state relationship was provided by Rambo *et al.*, who introduced a new indicator for the North Sea fish community, the Cumulative Sensitivity Index (CSI). The CSI was highly sensitive to fishing pressure, with negative nonlinear pressure-state relationship. Exactly this kind of nonlinear pressure-state relationships will allow defining GES-limits in future. Fredricson and Payne focused on the effects of climate change on the fish community in the North Sea, and emphasized that the max and min seawater temperatures could have a large effect on the range of species.

A brief discussion at the end of the session revealed that in many cases we are still far away from having operational indicators for assessing biodiversity with regards to structure and functions of communities and ecosystems. This was reflected by the large number of studies devoted to measuring and understanding patterns of biodiversity with regards to function within foodweb or the structure within communities in different regions of the world. Knowledge gaps in these aspects will prevent to derive meaningful assessments of biodiversity and eventually guidance on how to conserve biodiversity will remain incomplete until these gaps are closed.

The session was well attended, with a total of 18 oral presentations (one withdrawn) and 3 posters (presented during the poster sessions, not in plenary). Unfortunately, one oral presentation and four posters were withdrawn from this theme session, but we hope that the authors of these presentations will soon find an opportunity to disseminate their work in appropriate outlets. Overall, we were very content with the quality of the submitted presentations and the attendance by the audience of the ICES ASC. We thank the ICES staff for making this session possible.