

## Executive summary

---

WGIAB was setup in 2007 as a forum for developing and combining ecosystem-based management efforts for the Baltic Sea. The general approach of WGIAB is to assess the state and development of the different Baltic Sea sub-ecosystems considering all trophic levels and the impact of climate, fisheries and eutrophication. WGIAB therefore is intended to serve as a counterpart and support for the ICES Baltic Fisheries Assessment Working Group (WGBFAS), but also to support related HELCOM assessment efforts such as HELCOM BIO and HELCOM FISH.

WGIAB has given itself 3 main tasks:

- 1) to conduct holistic ecosystem assessments based on large multivariate datasets;
- 2) to consider the use of ecosystem modelling in the assessment framework; and
- 3) to develop adaptive management strategies for the different Baltic Sea ecosystems.

During the meetings in 2007 and 2008 WGIAB concentrated on collection and analyses of large multivariate datasets. This effort resulted in ecosystem assessment for 7 subsystems, i.e. the Sound, Central Baltic Sea, Gulf of Riga, Gulf of Finland, Bothnian Sea, Bothnian Bay and a coastal ecosystem (ICES, 2008a). These ecosystem assessments (above Task 1) demonstrated dramatic changes (i.e. regime shifts) during the last 3 decades on all trophic levels of the ecosystems related to climate variability and human exploitation (Möllumann *et al.* 2006, Möllumann *et al.* 2009, Lindegren *et al.* 2010, Blenckner *et al.* in prep.). A major product of these analyses is an ICES Cooperative Research Report on “Integrated ecosystem assessments of seven Baltic Sea areas covering the last three decades” (Diekmann and Möllumann, 2010) which will be published during the next month.

During the 2010 meeting time series of three out of the seven Baltic sub-systems were updated, including the Bothnian Sea (BoS), the Gulf of Riga (GoR), and the Central Baltic Sea (CBS). The BoS data set was thereby largely revised. The CBS was analysed in four different ways: First, the dataserries from previous years were simply updated until 2008. Then, an alternative analysis was conducted accounting for newly available zooplankton data. Finally, to account for the observed changes in the spatial distribution of the sprat stock, separate analyses were conducted for the Bornholm basin (SD 25) and the Gotland basin (SD 28). Eventually the Kattegat was included as a new sub-system to the datasets and ecosystem analyses conducted by WGIAB. The analyses of the now 8 sub-systems analysed confirmed pronounced structural changes in the last two to three decades, related to climate, fisheries and eutrophication.

Another major activity of WGIAB (in relation to above Task 2) is the “Biological Ensemble Modelling Approach (BEMA)” which was started during the 2009 meeting. WGIAB performed comparative analyses of a set of cod population dynamics, multi-species and food web models following the ensemble approach in climate research. Different models are forced with the same scenarios (e.g. fishing and future climate) and their projections are collected in an ensemble. By this WGIAB evaluated alternative fisheries management scenarios for cod and sprat under alternative scenarios of further climate change. The main aim of the modelling in the 2010 WGIAB meeting was to further BEMA as a tool for the final step in an IEA: management strategy evaluation on ecosystem level. This entailed developing (i) simulations of indicator

beyond those covered in the 2009 meeting, (ii) coupling of economic analyses to the ecological simulations, and (iii) the deterministic BEMA into stochastic simulations providing probabilities of alternative ecological outcomes.

While continuing and further developing data-based ecosystem analyses and BEMA, beginning with the 2010 meeting WGIAB started to tackle above Task 3). WGIAB will thereby follow the international development towards a broader understanding of “Integrated Ecosystem Assessments (IEAs)” developed by NOAA (Levin *et al.* 2009, Tallis *et al.* 2010). The central WGIAB-activities, i.e. the multivariate analyses on ecosystem status and trends as well as BEMA, already cover some aspects of the IEA-process. During the 2010 meeting WGIAB conducted considerable work on developing indicators and indicator systems for ecosystem-based management. This included (i) reviewing the indicator systems of the HELCOM Baltic Sea Action Plan and the EU Marine Strategy Directive and relating them to WGIAB models and data, (ii) developing indicators systems to support ecosystem-based assessment of the Baltic fish stocks and the ecosystem, and (iii) projecting simple indicators using the BEMA as well as network indices using individual food-web models. A further activity in 2010 was a back-to-back meeting with WGBFAS with the aim to discuss ways to include environmental information generated by WGIAB (and other Baltic expert groups) into fish stock advice and management. By presentations, exemplifying ways towards more ecosystem-based approaches, the discussion between both groups on ways to integrate environmental information into the assessment routine was initiated.

In 2011 WGIAB intends to continue its work along the above described lines, conducting (i) Integrated Status and Trends Assessments for the different Baltic Sea subsystems, (ii) continue developing the “Biological Ensemble Modelling (BEMA)”, (iii) continue the work on indicator selection, testing, and target level evaluation, (iv) further develop and promote ecosystem-based advice for Baltic Sea fish stocks. A further task for 2011 (and potentially intersessional work) is a WGIAB contribution to the suggested Baltic Sea ecosystem observing system.