

Theme Session C – Developing the ecosystem approach to the management of human activities for the Baltic Sea

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The Baltic Sea is a test area of ICES for the implementation of an ecosystem approach to the management of human activities (EA). An important step towards this goal was the implementation of the GEF Baltic Sea Regional Project (BSRP) which has significantly strengthened the environmental assessment and monitoring systems needed to implement an EA for the Baltic Sea. Further, Integrated Ecosystem Assessments have been started in a cooperation of ICES, BSRP, and HELCOM. These preliminary analyses show significant changes in ecosystem structure and functioning caused by natural and anthropogenic drivers. However, the process of translating the knowledge about ecosystem state and development into products usable by managers remains largely unclear. This session intended to review the progress made in the Baltic towards implementing the EA.

A series of papers addressed general aspects and concepts of the EA. HELCOM presented the state of the Baltic Sea Action Plan as a tool for implementing the Ecosystem Approach (C:01). Currently HELCOM is in the process of defining targets for good ecological status and a favourable status of biodiversity as well as having the final series of consultations and drafting sessions before the adoption of the action. As support for implementing the EA, the results of the Baltic Sea Regional Project (BSRP), following the Large Marine Ecosystem Approach (LME) was presented (C:20). BSRP assisted in the development of indicators for ecosystem health (including eutrophication), biological diversity, and productivity and was further instrumental in the development of the Science Plan for the Joint Baltic Sea Research Program BONUS. Based on a review and the conceptualization of the functioning of the upper trophic level Central Baltic Sea ecosystem, a strategy for Ecosystem-Based Fisheries Management (EBFM) of the Central Baltic Sea has been outlined (C:19). The strategy suggests the development of operational objectives and indicators with targets/limits attached of potential use for future EBFM of the area. As a further step towards implementing EBFM and the EA, the modification of the present fish stock surveys into ecosystem surveys is requested and exemplified by a Russian example (C: 13).

A number of studies were presented which were conducted within or connected to the BSRP. Within the ICES/BSRP Study Group on Ecosystem Health a large number of ecosystem health indicators have been screened as a basis for selecting a limited number of priority indicators (C:06). These will be used for the ecosystem health assessments in different Baltic areas and offered to HELCOM for application in the Baltic Monitoring Programme and ecosystem health assessments under the Baltic Sea Action Plan. A biodiversity assessment has been conducted for the eastern Gulf of Finland investigating the role of climatic and anthropogenic factors (C:15). The study exemplified that alien species and eutrophication are the most important threats to biodiversity of the Neva Estuary. Climatic mediated fluctuations in the River Neva runoff and near bottom oxygen conditions are the main natural factors responsible for the dynamics of benthic and planktonic communities in the open waters of the estuary. Further, zooplankton indicators of eutrophication and productivity have been evaluated (C:03). The results of this exercise demonstrate only limited correlation with potential 'eutrophication' factors like winter nutrient concentrations, secchi depth or chlorophyll a concentrations. On the other hand zooplankton indicators have been shown to be significantly related to recruitment of the commercially important fish stocks. The structure and functioning of plankton communities has been recorded along the route of the planned pipeline "Nord Stream" (C:09). The study demonstrated interesting spatial gradients in

phytoplankton and zooplankton species composition, abundance, biomass and production, and suggest no direct impact of water pollution on plankton communities. As an integrative study for the ecosystem, the mutual dependence between productivity and community respiration has been studied for a summer system in the Baltic Proper (C:21). A chlorophyll a-normalized rate of community respiration (CRB) is suggested as overall index of whether regenerated systems are nutrient limited or not. Apparently a CRB above 2 g C g chl-1 h-1 indicated that heterotrophic remineralization satisfies the nutrient requirements of the autotrophs. Finally, analyses of ecosystem state and development as a basis for ecosystem-based management of the Baltic Sea, results of the ICES/HELCOM Working Group on Integrated Assessments of the Baltic Sea have been presented (C:18). These show pronounced regime shifts in 4 subsystems of the Baltic Sea (Fig 1), mainly induced by climatically related changes in temperature and salinity, fisheries and eutrophication.

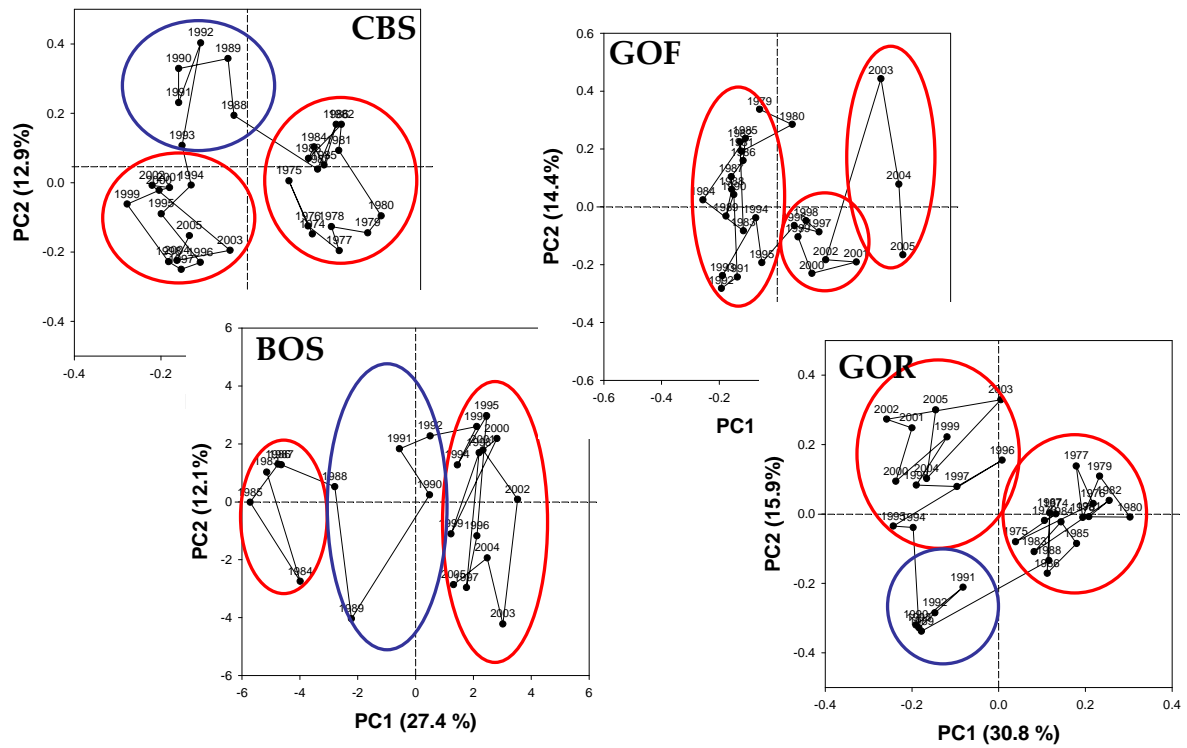
Two studies investigated the dynamics of the major Central Baltic fish stock cod (*Gadus morhua*), sprat (*Sprattus sprattus*) and herring (*Clupea harengus*). First, salinity as an index for environmental forcing on cod recruitment in spawner-recruit relationships has been investigated (C:04). The model including the environmental factor explained 85% of the interannual variation in the recruitment of cod from 1974–2004. The relationship was then used in a robust dynamic model of the interactions between the three fish stocks (C:11). Test runs show the model output to be sensitive to the functional response in predation by cod on herring and sprat.

The effect of hunting a top-predator has been investigated for grey seal (*Halichoerus grypus*) from the Bothnian Bay spring ice (C:12). The results show that hunting of grey seals on the spring ice in the Bothnian Bay has an influence on the herring stock, but it does not, at least directly, help the management of the salmon stock.

Risk assessments of management actions are a crucial part of ecosystem-based management strategies. Three presentations introduced the Bayesian risk assessment methodology. A decision model was presented investigating the risk of biodiversity loss due to eutrophication (C:07). Thereby existing monitoring databases, knowledge from published literature and expert knowledge was integrated and analysed using a decision tool containing of a suite of sub-models (Fig. 2). A similar methodology using biological knowledge and decisions of society was applied to evaluate the spatial prioritization of oil combating (C:02). The study showed the importance of minimizing long term effects on populations considering the ecological role, rarity and genetic uniqueness of species instead of aesthetic or economic values. Similarly, a net Environmental Benefit Analysis for the Gulf of Finland was presented (C:10) which uses the oil incident modeling framework to determine the most appropriate response options in order to minimize the overall environmental impact of an oil spill.

In conclusion the session demonstrated the broad range of science conducted in the Baltic Sea useful for ecosystem-based management approaches. In addition, increasingly efforts are being made to use these in the EA.

Figures



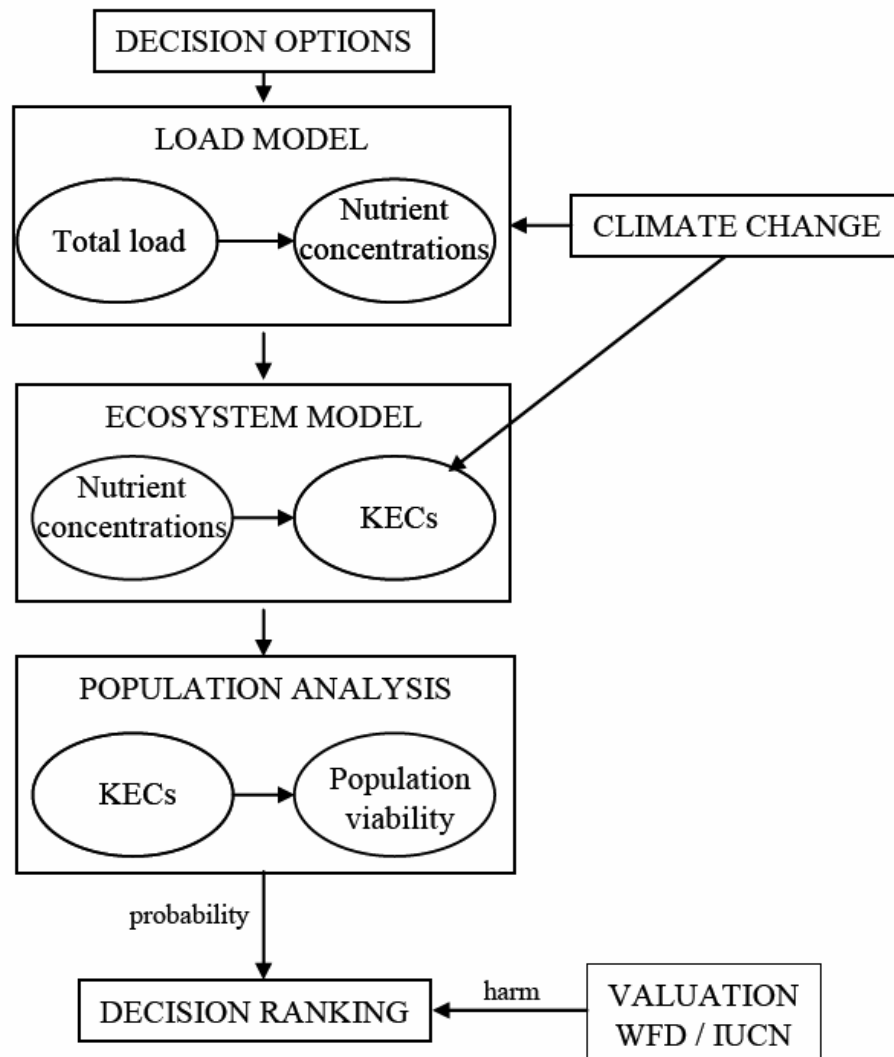


Figure 2. A simplification of the model suite (KECs – key environmental correlates, WFD – EU water framework directive, IUCN – international conservation status classification).