

Title Theme Session G

Comparative study of climate impact on coastal and continental shelf ecosystems in the ICES area: assessment and management

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Session Synopsis in Call for Papers: Whereas the impact of climate variability and change has been intensely studied in single marine systems or on single species/species groups across several systems, few comparisons of climatic influences on coastal and continental ecosystems in the Atlantic realm have been carried out so far. There is empirical evidence that gradual increases in temperature and associated physical factors can be amplified in coastal communities, such that biotic variables may be early indicators of climate change. Some implications for managing coastal resources are that existing fisheries may become unsustainable while new fisheries arise for species with shifting distributions. Biological reference points may need to be revised in response to changes in productivity and carrying capacity; a precautionary approach may be required to cope with rapid and unanticipated changes; and new management approaches may be needed to address the temporal scale at which climate changes occur. As marine ecosystems are not amenable to experimental investigations with respect to climate impact, the comparative method is the best way to enhance our knowledge on the reaction of ecosystems and the populations embedded in them. Contributions were encouraged to address climate-induced changes in a comparative manner with respect to ecosystem structure and function, species distributions, and phenology. Examples of integrated ecosystem assessments were sought.

Fourteen papers and four posters were presented in this session with an audience of between 45 and over 100 through the session. The comparative studies generally fell into two main areas, one comparing responses on a particular species due to different environmental conditions and the other comparing different regions. The geographic scale of the comparative studies ranged from small local areas, as in single estuaries or embayments; to regional, such as within the Baltic Sea or the Gulf of Maine; to comparison across four ocean regions of the Northern Hemisphere; to the entire Northern Hemisphere considered as one teleconnected system. Geographically, most of the papers looked at regions within the ICES study area, with half of the papers providing analyses of the Baltic and adjacent seas. An interesting contrast was provided by a case study of the lobster fishery along the east coast of Tasmania.

It was widely recognized in the session that physical changes in the environment caused by changes in the climate, often in combination with the impacts of human activities, can drive ecological changes. All of the papers in this session were based on this fundamental concept.

The most compelling work involved sophisticated analyses that integrated information from numerous physical and biological data sets. Blenckner et al. combined 218 data sets across six regions of the Baltic Sea, and, using a combination of principal components analysis and general additive models, detected fairly synchronous regime shifts in these regions, driven by climate, fishing, and eutrophication. Niiranen et al. combined multivariate analyses with Ecopath and Ecosim modelling to investigate mechanisms for the regime shift in the Baltic, including the decline of the cod stock and increase in the sprat stock. Frusher et al. examined how projected increases in water temperatures in Tasmanian waters may impact lobster growth and recruitment, kelp habitats, and species invasions by 2070. Suursaar et al. modelled the Väike Strait in the Baltic prior to the building of a causeway that blocked the entire flow through the Strait and compared it to post-causeway situation. Alheit et al. took a hemispheric perspective, looking at how changes in patterns of atmospheric pressure can lead to changes in winds and currents, causing synchronous regime shifts in widely separated regions of the world's oceans.

The session concluded with considerable animated discussion. The audience and speakers generally agreed that the comparative approach provided useful insights. Support was expressed for both modelling, which allows integrated analyses and development of hypotheses for large systems, as well as experimentation for testing hypotheses. The importance of regime shifts in understanding the influence of climate on coastal and marine ecosystems was recognized, and was suggested as a future theme session for an ICES Annual Science Conference.

Although several presentations included sophisticated analyses of complex datasets that yielded promising results, concern was expressed that this complexity may make it difficult to communicate this information and hence influence public policy. One member of the audience wondered how the results could be explained to a neighbour. This led to a brief discussion about the possibility of developing indicators of climate change and regime shifts, which might have predictive power that could also be communicated to a non-technical manager and to the general public.

It was recognized that modelling can provide the means to assess different scenarios, addressing questions of "what happens if?" This is information that managers often need. Insights and understanding of mechanisms can be gained, and models can be developed and tested, by studies of similar species in different systems, comparisons of subsystems within systems and comparisons of similar systems in different regions, and by comparing different systems across large regions.