Theme Session J
Comparative dynamics of populations in the Baltic Sea and Gulf of St. Lawrence ecosystems

Conveners: Michele Casini (Sweden) and Daniel Duplisea (Canada)

The Baltic Sea and Gulf of St. Lawrence are large temperate-boreal estuarine ecosystems of similar size. The populations occupying mid-upper trophic levels (zooplankton, invertebrates, fish, sea birds, marine mammals) in these systems have undergone major changes in recent decades and are expected to be strongly influenced by the on-going global change. This session invited contributions which could improve our understanding of the influence of perturbations (e.g. fishing, climate variability, eutrophication, hypoxia) on population dynamics which can aid the development and implementation of an ecosystem approach to management in these systems.

Contributions which address the following topics, particularly involving comparisons between systems, were welcome:

- physical, biochemical and anthropogenic influences on community and species key rates and characteristics (e.g. recruitment, growth, distribution, mortality, condition and maturation);
- interactions within and between species (competition, predation, cannibalism) at mid-upper trophic levels;
- disentangling the influence of fishing and other driving forces (e.g. climate variability) on population development and ecosystem structure;
- analysis of empirical and modelled community and ecosystem indicators.

The development of global comparisons is essential to identify broad scale effects of climate and human-related forces on ecosystems, and the mediator mechanisms linking large-scale processes, regional/local responses, and the corresponding ecological changes. In the current context, inter-ecosystems comparative studies are required to identify underlying mechanisms linking ecological responses (at various scales of organization) to the fluctuations in the triggering forces. This would help increasing our understanding on ecosystem functioning giving crucial information to be implemented into management. The Baltic Sea and Gulf of St Lawrence are particularly suitable for comparison because of their geographical and physical similarities.

The first two invited presentations (J:18 and J:17) furnished an introductory overview of the Baltic Sea and Gulf of St. Lawrence ecosystems, giving a brief description of ecosystem structure and dynamics, significant anthropogenic pressures, climate forcing, and governance approaches already in place and/or under development (see also J:19).

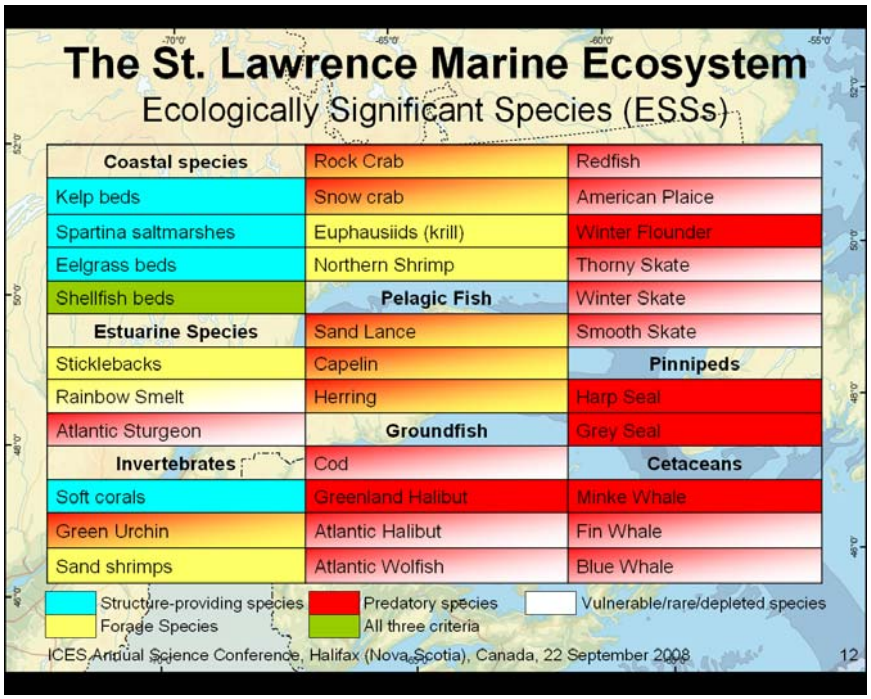

Figure 1: ICES CM 2008/J:18 The Gulf of St. Lawrence Marine Ecosystem: An overview of its structure and dynamics, human pressures, and governance approaches. Michel Gilbert, Réjean Dufour, and Patrick Ouellet.

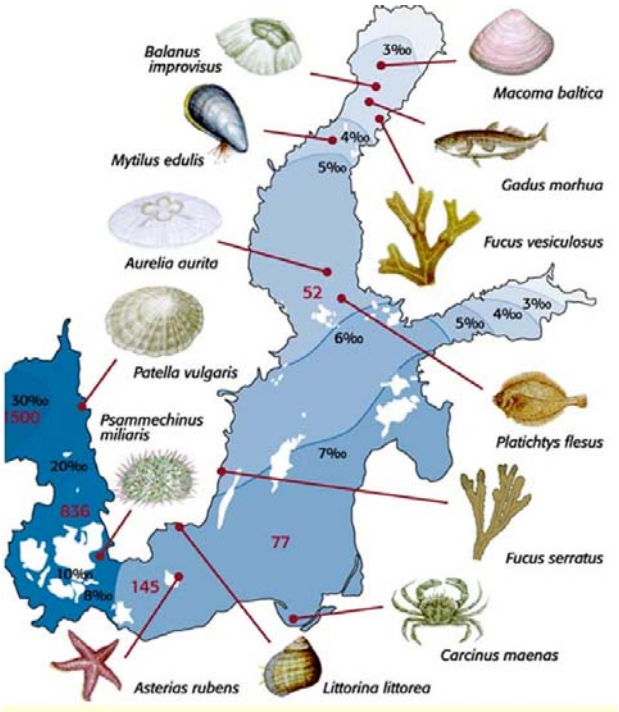

Figure 2: ICES CM 2008/J:17 The Baltic Sea Large Marine Ecosystem: Its structure and dynamics, human pressures and governance approaches. Jan Thulin

A large part of the papers focused on the cod (*Gadus morhua*), one of the fish species most depleted during the past decades in both systems. Different aspects of cod physiology and

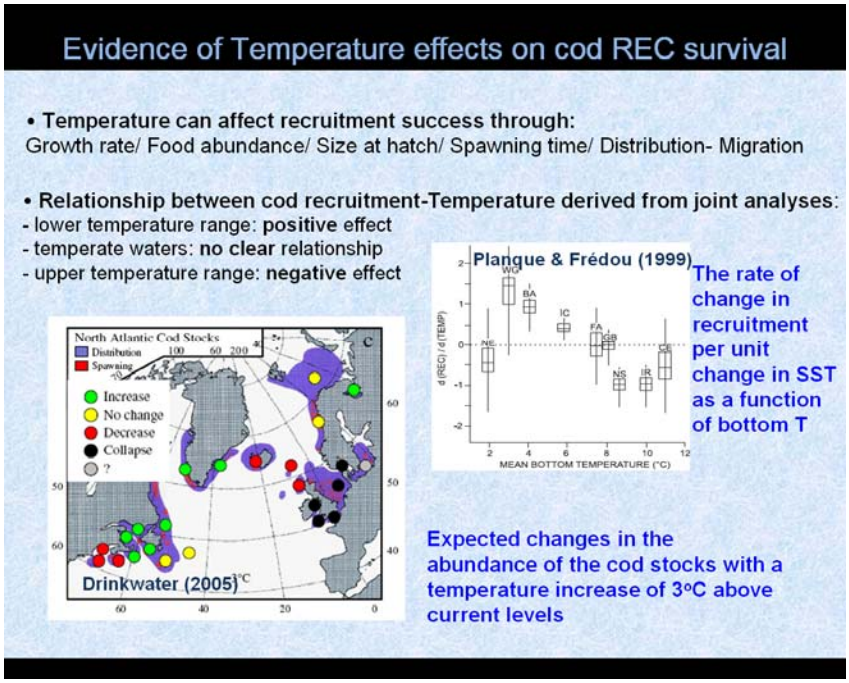

Figure 3: ICES CM 2008/J:07 Hierarchical modeling of temperature and habitat effects on carrying capacity and maximum reproductive rate of North Atlantic cod in the Baltic Sea, Gulf of St. Lawrence and throughout the North Atlantic. Irene Mantzouni and Brian R. MacKenzie

ecology were presented, as growth (J:12), spawning time (J:03), production (J:01, J:04), spatial distribution (J:09) and carrying capacity (J:07), using both field time-series and experimental analyses. It was clear that understanding the magnitude of human impacts compared to natural variability is of particular importance in order to recover depleted fish stocks and manage sustainably fisheries and ecosystems (J:08). Separating the effects of different factors on fish populations is however often difficult, partly related to the shortness of available time series and to co-varying driving forces. Therefore, the use of laboratory experiments and modelling approaches become also relevant.

Some papers (J:01, J:07) compared directly the two systems showing how temperature have important effects on cod productivity. Stock production seems to be mainly related to recruitment, but also growth and natural mortality. This stresses that in order to predict and respond quickly to changes in stock productivity, information on changes in life history traits should be made promptly available to the managers (J:01). However, it was also emphasized as the response of life history traits (i.e. recruitment, growth), and therefore stock production, to environmental conditions are not invariant across ecosystems, but area-dependent (J:01). For example, the different effect of temperature on the stock-recruitment relationship of geographically-separated stocks was also stressed (J:07).

Low oxygen concentration (hypoxia and anoxia) seems to be also a common problem for the Baltic Sea and Gulf of St. Lawrence ecosystems (J:08, J:15, J:09). In both systems, low oxygen level impacts directly and indirectly many aspects of the biology of cod, including survival, distribution, swimming performance, growth and reproductive output (J:15). Large habitat loss is one example of the effects of decreased oxygen concentration on the Baltic Sea

cod stock (J:08, J:09). Low oxygen levels, as other disturbances, can also have deep consequences for the benthic fauna (J:05, J:20).

Research is required to better understand and hopefully predict the variations in temperature (J:01, J:07), oxygen (J:15) and nutrient input (J:11), especially in the current context of major climatic changes. This information could be used in short-term and medium-term stock forecasts. Examples of stocks whose recruitment prediction can be significantly improved by using environmental data already exist for the Baltic Sea (J:10). There is also the need to better understand the interaction between heavily exploited fish stocks and higher trophic levels (e.g. aquatic mammals, J:02, J:14).

In conclusion, a wide variety of presentations from bioturbation by small benthic invertebrates to factors influencing the distribution of blue whales in the Gulf of St. Lawrence have been shown. A management decision support and scenario testing system for the Baltic was described. It was apparent that, although there are differences in the two systems, there are more similarities in the communities: ecological forcing, human-induced influences and the issues forcing managers in each of the systems. Comparisons between ecosystems can be a very useful tool for the understanding of ecosystem functioning and for the implementation of an ecosystem approach to management.