Integrating spatial processes into ecosystem models for sustainable utilization of fish resources

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Summary

Process-based understanding of changes in commercial fish spatial distributions, and to disentangle the role of natural drivers and various anthropogenic impacts, is a challenging research topic with high relevance to resource management. The new four-years BONUS project ''Integrating spatial processes into ecosystem models for sustainable utilization of fish resources' (INSPIRE) will fill in the most persistent gaps in knowledge of the spatial ecolology of the major commercial fish and thereby support the effectiveness of the relevant policies and ecosystem-based management of the Baltic Sea. The project would serve as a *„framework axis project*" which other Baltic Sea reasearch could be related to.

INSPIRE is designed to substantially advance our knowledge on the major commercial fish species in the Baltic Sea (cod, herring, sprat and flounder). These fish form more than 95% of the commercial catches, and represent key elements of the Baltic Sea ecosystems. The objectives of the INSPIRE project are to:

1. Quantify processes generating heterogeneity in spatial distributions of cod, herring, sprat and flounder.
2. Quantify and map potential hazards to the connectivity between identified key habitats, and assess the impact of anthropogenic and climatic environmental changes on habitat connectivity.
3. Quantify the population dynamics and interactions of the fish species in a spatially explicit context.
4. Develop spatially explicit advice for ecosystem-based fisheries management of Baltic cod, herring, sprat and flounder, accounting for the spatial heterogeneity in fish distributions

To accomplish these objectives, INSPIRE will answer the following fundamental research questions:

1. *What habitat marine conditions characterize the spatial distributions of cod, herring, sprat and flounder?*
2. *To what extent do fishing and species interaction affect the local and basin-scale distribution of commercially exploited stocks?*
3. *What drives spatial connectivity and migrations of different fish species/populations?*
4. *How does stock structure and separation of natural populations impact stock assessment outcomes?*

INSPIRE proposes pilot ecosystem field surveys to resolve the habitat requirements of different life-stages of fish species by combined use of traditional methods and application of modern advanced

analysis techniques, for example otolith microchemistry and biochemical techniques. The surveys are conducted in close collaboration with local fishermen. Their inclusion will strengthen then participatory spirit in the implementation of INSPRE results into ecosystem-based fisheries management, and improve the data collection.

INSPIRE will generate new data and operational models that allow making projections on spatial distributions of Baltic key commercial fish species on different spatial and temporal scales, and their integration in analytical assessments and ecosystem-based fisheries management. Moreover, as main providers of management advice on Baltic fish stocks, INSPIRE partners are also able to translate these model outputs into urgently needed advice on how best to move beyond spatially homogeneous approach of current fishery and ecosystem assessments, and adopt spatially explicit ecosystem-oriented management. The INSPIRE project is addressing major research objectives set forth by the revised EU Common Fisheries Policy, the EU Marine Strategy Framework Directive, the EU Marine and Maritime Research Strategy, and the HELCOM Baltic Sea Action Plan.

Stakeholder involvement starts already at the data generation phase and continues till the end of the project. The major stakeholders for INSPIRE are: Baltic Sea Regional Advisory Council (Baltic Sea RAC), International Council for the Exploration of the Sea (ICES), and Baltic Marine Environment Protection Commission (HELCOM). In addition, we also closely cooperate with national fisheries management bodies and ministerial authorities.

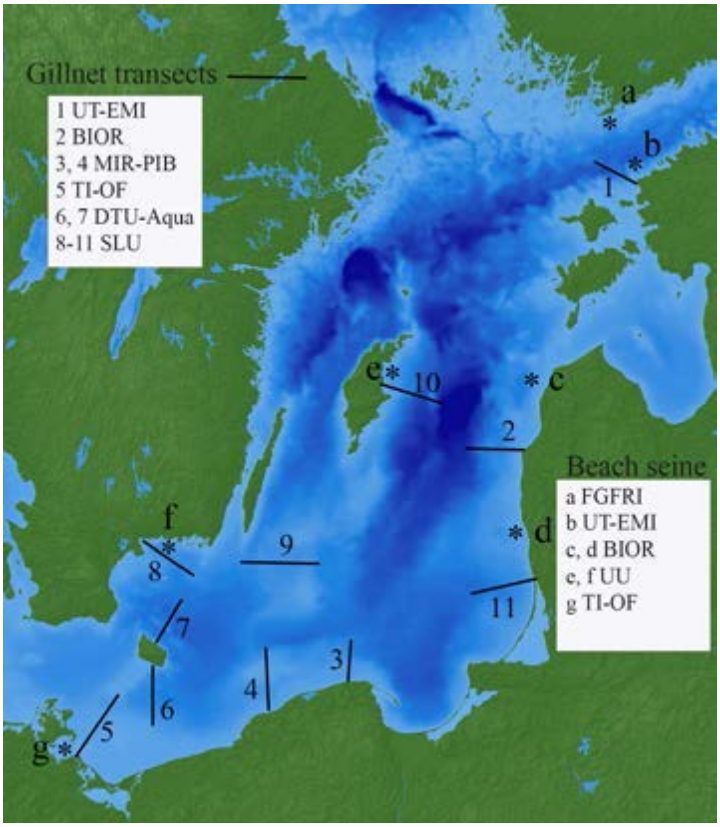

Figure 1. Schematic map illustrating approximate locations of gillnet transects and beach seining to collect data for habitat mapping and modeling of juvenile flounder and cod.