

## Summary of scientific results

### **Note on the effects of a large cod stock for the Baltic marine ecosystem**

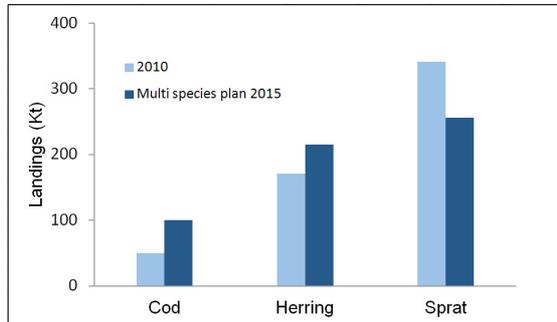
The successful recovery of the eastern Baltic cod stock is a praised example of successful fisheries management in EU and of the strength in following long-term management plans and harvest control strategies. However, the increase of eastern Baltic cod has also raised concerns about the effects on pelagic stocks, highlighting the importance of an overarching ecosystem management policy. Thus, the EU commission has planned to present a multi-species, multi-annual management plan for the Baltic Sea in 2012. This note summarizes a possible scenario of such a management plan in terms of fisheries landings and ecosystem effects based on analyses published by ICES in 2009. BalticSea2020 is looking to secure viable, prosperous fisheries and intends this note to contribute to a balanced well informed discussion.

A multi-species plan is likely to produce long-term, high yield catches of cod, herring and sprat if combined with a harvest strategy similar to the eastern Baltic cod management plan. However, ICES also noted that the balance between predatory and pelagic fish in the Baltic has strong implications for the whole ecosystem by affecting for example fisheries catch quality, water quality and seabirds. Therefore, to avoid duplication of expenses for governments and stakeholders the targets for a multi-species plan in the Baltic should not only include fisheries aspects but also consider water quality, coastal ecosystem quality and extent of anoxic bottoms, thereby contributing to achieve the objectives of the Water Framework Directive, the Marine Strategy Framework Directive and the Baltic Sea Action Plan.

#### **Effect of present cod plan on pelagic stocks and landings**

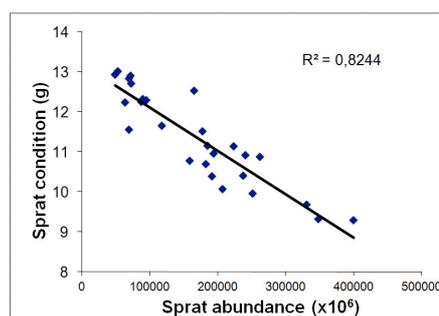
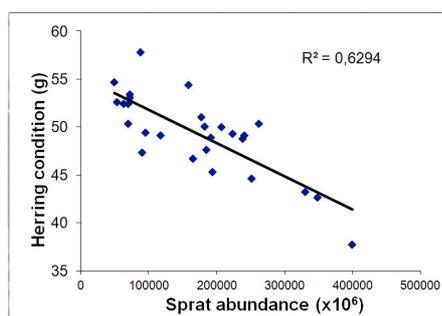
The present management plan for eastern Baltic cod has since its adoption in 2007 improved the status of the eastern Baltic cod stock from “overfished” to “sustainably harvested”. During this time the stock has increased from approximately 90.000 tons to around 300.000 tons, which is about 40% of the maximum stock size ever recorded (i.e. approximately 700.000 tons) (ICES advice May 2011).

The recent periods of higher than average recruitment, in combination with the 15% restriction in inter-annual quota change has lead to higher than average stock increases. This effect will naturally be of limited duration and be counteracted by periods of poor recruitments. The strength of the 15% restriction is that it ensures recovering of the stock when stock size is low but it also guarantees stable yields for the industry. In addition, the 15% restriction provides a buffer for short-term natural variation and assessment uncertainties.



Landings in the Baltic of cod (ICES 24-32), herring (ICES central Baltic and gulf of Riga) and sprat (ICES 22-32) compared to estimated landings with multi-species plan.

The philosophy behind the multi-annual management plan for eastern Baltic cod should indeed be extended to other species to obtain the same stable stock and catch levels. The ICES advice in 2009 (Book 8, 8.3.3) analyzed the likely landings of sprat and herring in the eastern Baltic within a multi-species management plan for cod, herring and sprat that was based on the current cod plan for eastern Baltic cod. Simulations showed that compared to 2010 landings, such a plan could by 2015 result in increased landings of herring by 25% (Central Baltic and Gulf of Riga) as well as improved catch quality (larger and fatter individuals). The larger eastern Baltic cod stock in combination with a reduced sprat stock, would release the present food competition among sprat and herring leading to higher catch quality of these stocks. The reduction of the sprat stock (i.e. landings will also be reduced by 25%) will improve catch quality of sprat, potentially compensating for the reduced landings by increased market prices for better quality fish (8.3.3.1a.1, Book 8, ICES advice 2009; ICES advice May 2011 and Casini et al. 2010). Thus, a reduced sprat stock is necessary to improve catch quality and weaken the feedback loops that lead to increased algae blooms and other ecosystem effects (see below).



The graphs show the effect of the sprat stock on the condition (catch quality) of herring and sprat in the Baltic proper (Based on data presented in Casini et al. 2006; Casini et al. 2010 and Casini et al. 2011).

## Ecosystem effects of multispecies management in the Baltic

The low cod stock levels in the eastern Baltic during 1990's and partly in 2000's lead to a large increase of the sprat stock. Apart from direct economical effects on the fisheries, this also resulted in ecosystem effects such as decreased zooplankton biomass and more pronounced algae blooms (Casini et al., 2008) and thereby anoxic bottoms, possibly reduced

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cod recruitment and impaired seabird reproduction (8.3.3.1d, Book 8, ICES advice 2009, Casini et al. 2010, Österblom et al. 2006). By reducing the sprat stock these effects would be reversed, improving catch quality of sprat and herring, stock size of cod and herring and improving water quality (8.3.3.1d, Book 8, ICES advice 2009; Conclusions from Fisheries and ecology workshop 13-15 January 2010, BalticSea2020) and thereby extent of anoxic bottoms.

## References

- Casini, M., Cardinale, M. and Hjelm, J. (2006). Inter-annual variation in herring (*Clupea harengus*) and sprat (*Sprattus sprattus*) condition in the central Baltic Sea: what gives the tune? *Oikos*, 112: 638-650.
- Casini, M., Lövgren J., Hjelm J., Cardinale M., Molinero J-C., Kornilovs G. 2008. Multi-level trophic cascades in a heavily exploited open marine ecosystem. *Proceedings of the Royal Society*. 275: 1793-1801.
- Casini M., Bartolino, V., Molinero, J.C. and Kornilovs, G. (2010). Linking fisheries, trophic interactions and climate: threshold dynamics drive herring *Clupea harengus* growth in the central Baltic Sea. *Marine Ecology Progress Series*, 413: 241-252.
- Casini, M., Kornilovs, G., Cardinale, M., Möllmann, M., Grygiel, W., Jonsson, P., Raid, T., Flinkman, J. and Feldman, V. (2011). Spatial and temporal density-dependence regulates the condition of central Baltic Sea clupeids: compelling evidence using an extensive international acoustic survey. *Population Ecology*, 53: 511-523.
- ICES Advice 2009, Book 8.
- ICES Advice, May 2011
- Österblom H., Casini M., Olsson O., Bignert A. 2006. Fish, seabirds and trophic cascades in the Baltic Sea. *Marine Ecology Progress Series* 323: 233-238.