

## BIOTOPE INFORMATION SHEET

English name: <b>Baltic Sea seasonal sea ice</b>		Code in HELCOM HUB: <b>AC</b>	
Characteristic species: Phytoplankton (diatoms, autotrophic flagellates, dinoflagellates), heterotrophic bacteria, zooplankton (heterotrophic flagellates, ciliates, rotifer), Baltic ringed seal ( <i>Phoca hispida bothnica</i> )			
Past and Current Threats (Habitat directive article 17):  Climate change (reduction of ice M01)		Future Threats (Habitat directive article 17):  Climate change (reduction of ice M01)	
Red List Criteria: <b>A1+2a</b>	Confidence of threat assessment: <b>L</b>	<b>HELCOM Red List Category:</b>	<b>VU Vulnerable</b>
Previous HELCOM Red List threat assessments			
BSEP 75 (HELCOM 1998):		BSEP 113 (HELCOM 2007):	
Greater concern stated by:			

### Habitat and Ecology

Sea ice occurs in the Baltic Sea during a few months every year, usually from October–November until March–April. The seasonality of the sea ice underlines its variable nature. The extent of the ice cover also varies significantly from year to year. On average approximately 45% of the Baltic Sea area is ice covered, or 200 000 km<sup>2</sup>. But during some years only the northern most areas are covered, and during other years practically the entire Baltic Sea freezes over from the northern most bays to the Kattegat. The sea ice is affected by wind and wind induced currents. The ice field shifts during the season and open water areas can appear as the ice field becomes more packed in another area.

Ice cover is an active interface between the atmosphere and the sea as it inhabits diverse and abundant ice organisms which participate in nutrient and carbon cycles. Baltic sea-ice organisms include diatoms as the dominant algae, small autotrophic flagellates, dinoflagellates, heterotrophic bacteria, diverse heterotrophic flagellates and ciliates as well as the metazoa of which rotifers are the main representatives. The biota lives in the brine channel system of the sea ice in which changes in physical and chemical factors can be extreme. For example salinity can decrease from 20–30 psu to approx. 6 psu



During the winter months sea ice shifts due to wind and current conditions and can form pack ice (left panel) or large areas of compact ice (right panel) (Photo: Lena Avellan)

within days during the warm period as a consequence of internal melting and increased brine volume (Kartokallio 2005).



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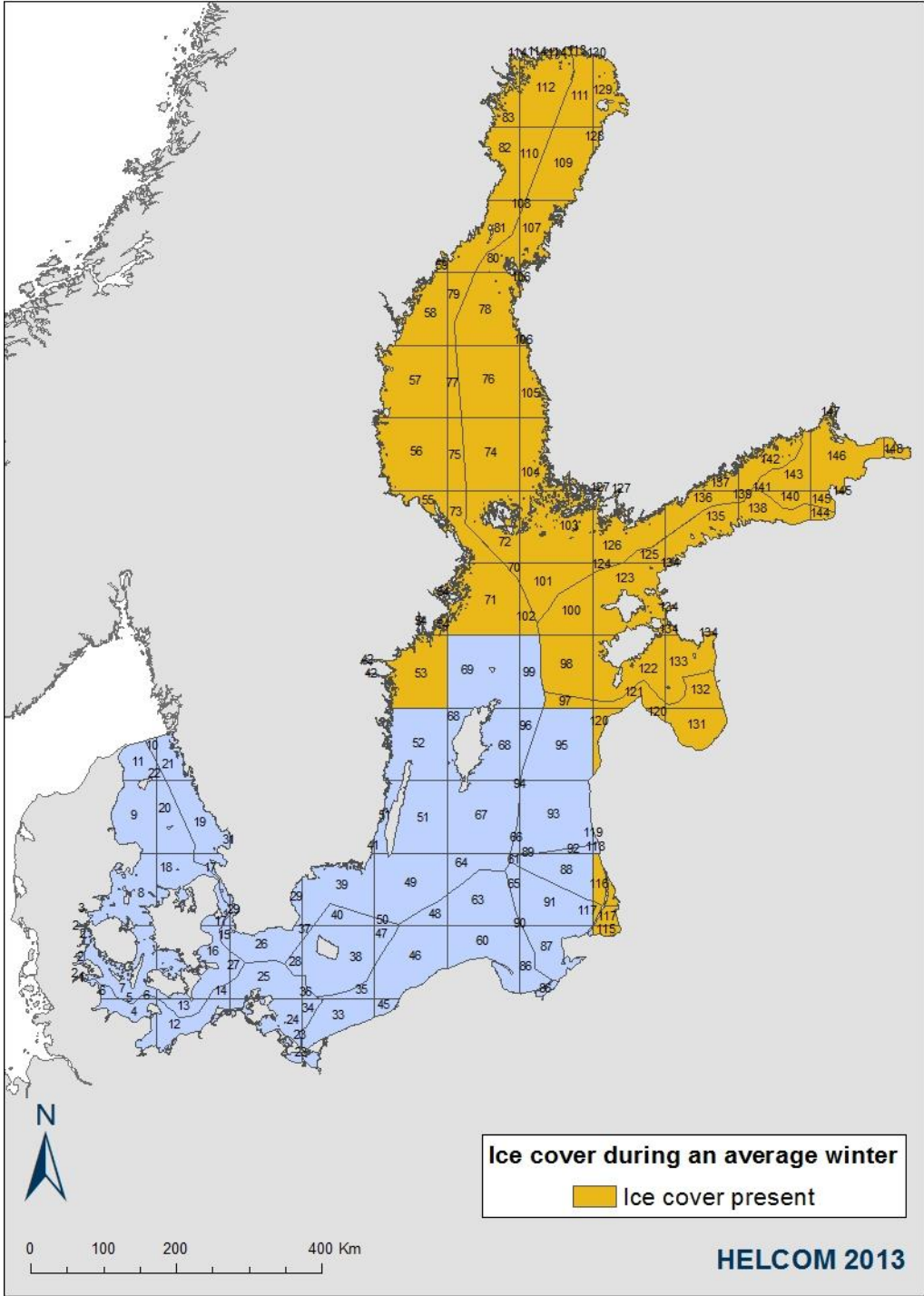
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The Sea ice habitat is an important habitat for the breeding of the Baltic ringed seal (*Phoca hispida bothnica*), an arctic seal species adapted to breeding on ice. The Baltic ringed seal has been classified Vulnerable (VU; A3c) in the HELCOM Red List of Baltic Sea species in danger of becoming extinct mainly due to past reductions in breeding potential due to toxins in the environment. However the predicted future decline in sea ice due to climate change has been identified as a severe threat especially to the southern populations where the availability of nesting areas may already have affected the reproductive rate of the seal (HELCOM 2013a).

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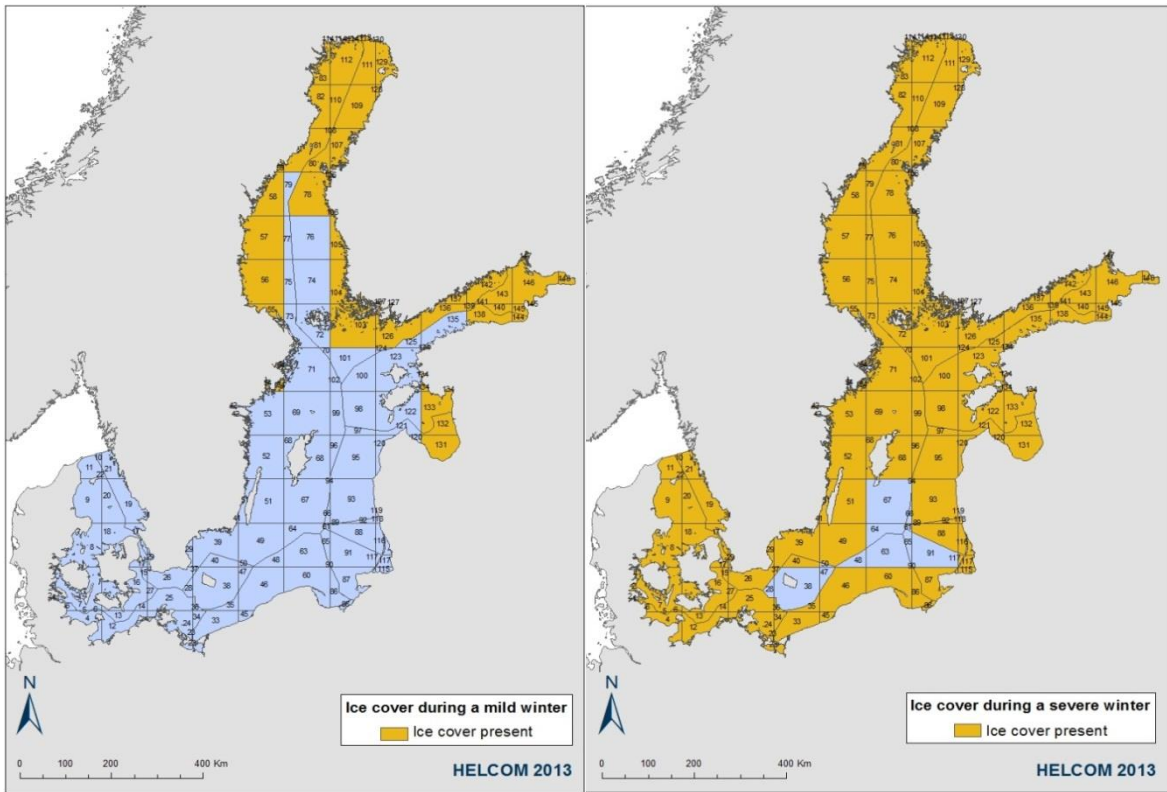
**Distribution and status in the Baltic Sea region**

The distribution of the biotope covers the whole Baltic Sea, but is most common in the northern regions. From a time series of the maximum annual ice extent of sea ice, a declining trend can be detected. During the last two decades all ice winters of the Baltic Sea have been between average and extremely mild. The length of the ice season shows a decreasing trend by 14–44 days in the latest century (Vihma & Haapala 2009). The distribution area in the 100 x 100 km grid where the biotope occurs during an average ice winter when the ice covers approximately 200 000 km<sup>2</sup>



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The inter-annual variations of the ice cover, ice thickness, period of the ice cover and the movement and packing of the ice is large. During the mildest winters, only the Bothnian Bay, The Gulf of Bothnia, the Gulf of Finland and the northern coastlines of the Baltic Sea are covered with ice. The Belt Sea, the Arkona Basin and the Bornholm basin only freeze during the most severe winters. However, the shallow lagoon and Bodden areas (e.g. Greifswalder Bodden) along those basins (Southern Baltic Sea) are freezing regularly also in milder winters. The seasonal sea ice coverage varies significantly between years of mild ice winters (left panel) and severe ice winters (right panel)



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### Description of Major threats

Climate change poses the most severe threat to this habitat. Climate change is predicted to increase the surface temperature of the Baltic Sea, and the reduction in sea ice is predicted to depend mainly on the extent of change in the winter surface temperature (HELCOM 2013b). Other predicted changes in environmental factors such as a higher precipitation in the north of the sea and changes in the seasonal wind field are not predicted to have a large effect (HELCOM 2013b). Currently all simulations indicate a drastic decrease in future sea ice cover (HELCOM 2013b).

### Assessment justification

A1

Sea ice coverage has been documented for the Baltic Sea for nearly three centuries. During this time the sea ice coverage has varied significantly. During the past 50 years a 35% decline in maximum sea ice extent has been estimated (Figure 1). If a 150 year time period is considered, the data only indicates a 20% decline.

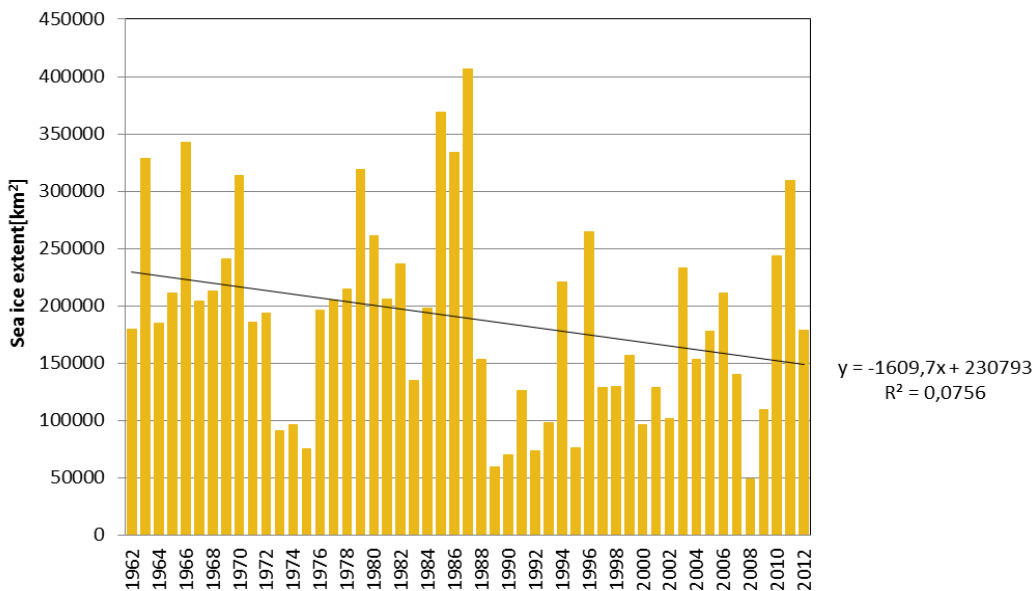


Figure 1. Sea ice extent during the past 50 years (Niskanen et al. 2009)

A2a

The extent of sea ice cover in the Baltic Sea is inferred to decrease on average by  $\geq 30\%$ . The climate change models indicate an increase in precipitation in the northern areas of the Baltic Sea, milder winters and increased water temperature (HELCOM 2013b). Modelling the sea ice extent for the entire Baltic Sea for the coming 50 years, indicates that the rate of decline may increase compared to the past 50 years (Figure 2.). The model is based on various IPCC scenarios (Friedland et al. 2012). The occurrence of the sea ice habitat will decrease. The models generally do not predict the future change in sea ice quality. The thickness and ice-type affects some of the organisms inhabiting the ice, but these changes have not been assessed.

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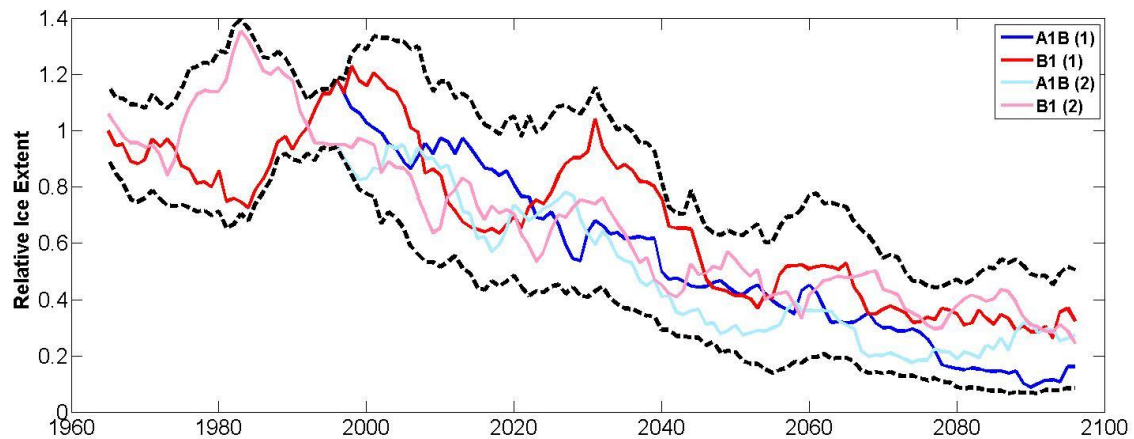


Figure 2. Modelled sea ice extent based on various IPCC models. (Courtesy of IOW)

### Recommendations for actions to conserve the biotope

Climate change mitigation actions such as reducing anthropogenic CO<sub>2</sub> and other greenhouse gas emissions globally, is inferred to slow the rate of climatic change. It is unclear how regional measures may affect the sea ice coverage in the Baltic Sea.

### Common names

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### References

- Friedland, R., Neumann, T., Schenewski, G. (2012) Climate change and the Baltic Sea action plan: Model simulations on the future of the western Baltic Sea. *Journal of Marine Systems* 105-108: 175-186.
- HELCOM (2013a) Species information sheet; *Phoca hispida bothnica*. HELCOM Red List Marine Mammal Expert Group. Available at [www.helcom.fi](http://www.helcom.fi) > Baltic sea health > Biodiversity > Red List
- HELCOM (2013b) Climate change in the Baltic Sea Area: HELCOM thematic assessment in 2013. *Baltic Sea Environmental Proceedings* XXX.
- Kaartokallio, H. (2005). Sea-ice ecology in the Baltic Sea with special emphasis on bacteria. Doctoral dissertation. University of Helsinki, Helsinki. 41pp.
- Niskanen T., Vainio J., Eriksson P., Heiler I. (2009) Maximum extent of the Baltic sea ice recalculated for the period 1971-2008, Rep. Ser. Geophys. 0355-8630; No. 61, 164-167.
- Vainio, J. (2012) The Sea Ice season 2011-2012. HELCOM Baltic Sea Environment Fact Sheet(s) 2012. Online (viewed 30.7.2013) [http://www.helcom.fi/environment2/ifs/en\\_GB/cover/](http://www.helcom.fi/environment2/ifs/en_GB/cover/)
- Vihma, T., Haapala, J. (2009). Geophysics of sea ice in the Baltic Sea: A review. *Progress in Oceanography* 80: 129-148.