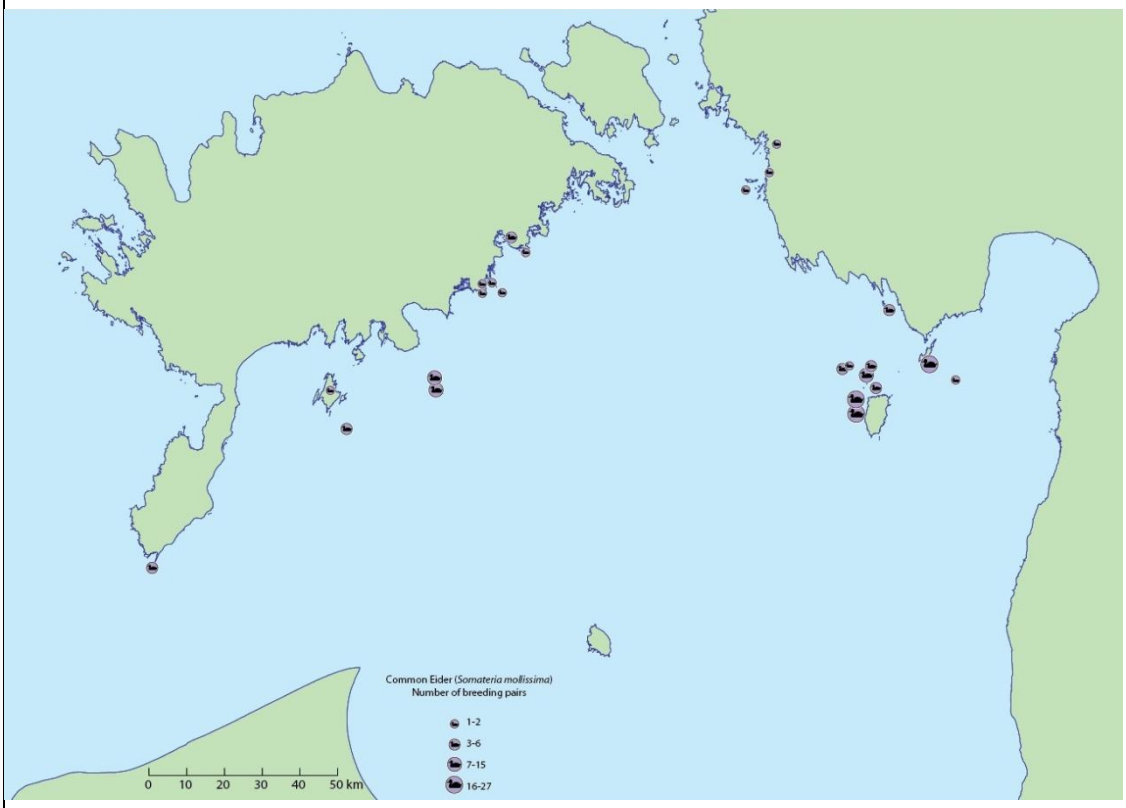
Name of indicator	4.9 Distribution of breeding waterbird species
Type of Indicator	State indicator
Author(s)	Andres Kuresoo, Ainars Auniņš, Leif Nilsson, Leho Luigujõe, Antra Stīpniece
Description of the indicator	This set of single species indicators reflects distribution pattern of breeding populations of particular species. For each species the indicator is expressed as spatial grid with cell values expressing abundance or density of the species. Baltic-wide indicators are calculated separately for each of the following species: Great Cormorant, Common Shelduck, Common Eider, Scaup, Velvet Scoter, Sandwich Tern. Species lists for national and subbasin versions of these indicators are country and subbasin specific.
Relationship of the indicator to marine biodiversity	The indicator reflects status and distribution of important components of the marine biodiversity in spatially explicit way. Change of breeding distribution of population reflects the habitat changes, availability of food resources, and pressures related to climate change.
Relevance of the indicator to different policy instruments	The indicator addresses the population condition as required for assessments of the MSFD qualitative descriptor 1 (biodiversity) (Anon 2008) and stated in the EC Decision 477/2010/EU for the MSFD (Anon. 2010). The indicator can also be used for the assessment of the MSFD qualitative descriptor 4 (food webs) as recommended by the MSFD Task Group 4 (Rogers *et al.* 2010). The indicator addresses the HELCOM ecological objective 'Viable populations of species' which is part of the biodiversity goal 'Favourable conservation status of Baltic biodiversity' (HELCOM 2007). HELCOM CORESET: there is general agreement for the need of this indicator.' Birds Directive (this indicator is needed for Article 12 reporting as distribution and range of all regularly occurring breeding marine waterbird species.
Relevance to commission decision criteria and indicator	1.1. Species distribution 1.1.1. Distributional range 1.1.2. Distributional pattern within the range
Method(s) for obtaining indicator values	Field data collection**:** using any of the standard methods designed for breeding bird surveys such as bird count data (island birds), but also breeding bird atlases from large areas (presence–absence data). Indicator calculation: using density surface modelling approach – GAM or machine learning models based on count data from line transects and spatial covariates (Hedley, Buckland 2004, Elith *et al.* 2011, Drew *et al*. 2011). The result of the computation is a grid where cell values represent estimated abundances or densities of the species in the particular location. The centroids of the historical and present range are compared in range shift analyses, from which the geodesic distance (D) between the two centroids, and the initial azimuth (h) of the geodesic path from the centroids (historical/present range) are calculated Huntley *et al*. 2008).
Documentation of relationship between indicator and pressure	Each of the species for which the indicator is calculated is affected by all pressures acting on species forming the indicator. Thus the indicator responds to ensemble of following pressures: coastal development eutrophication hazardous substances predation by non-native species (e.g. American Mink) fisheries discards climate change To a lesser extent also: oil pollution/shipping by-catch wind energy sand and gravel extraction Latest knowledge and summary of related studies on response of marine waterbird species

	to important pressures are given in Skov *et al.* 2011. Contribution of each particular pressure on a given species can be assessed by including additional explanatory variables characterising the level of the pressure as covariates in the statistical model used for the indicator calculation.
Geographical relevance of indicator	1. Local 2. Regional 3. National waters 4. Baltic Sea wide
How Reference Conditions (target values/thresholds) for the indicator were obtained?	Reference conditions are based on proportion of occupied ecogeographically suitable grid cells. Target level is 100%. The actual GES threshold for each species still need to be defined.
Method for determining GES	Currently GES levels have not been set. The method itself is based on proportion of ecologically, climatically and geographically suitable grid cells that are occupied by particular species. More ecological studies are needed to set species specific GES thresholds.
References	Anon. (2008a): Directive 2008/56/EC of the European Parliament and the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). Official Journal of the European Union, L 164/19, 25.06.2008. Anon. (2010): Commission decision of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters (2010/477/EU). OJ L 232/14, 2.9.2010. Aunins A., Kuresoo A., Luigujoe L. 2012. Distribution and numbers of birds in the Gulf of Riga 2011. Deliverable 3.3. Gulf of Riga as a resource for wind energy –GORWIND. Riga and Tartu, Latvian Fund for Nature and Estonian University of Life Sciences. Bergman G (1980): Single-breeding versus colonial breeding in the Caspian Tern *Hydroprogne caspia*, the Common Tern *Sterna hirundo* and the Arctic Tern *Sterna paradisaea*. (Räyskän, kalatiiran ja lapintiiran pesimisestä yksittäispareina ja yhdyskunnittain). – Ornis Fennica 57: 141–152. Drew C.A., Wiersma Y.F., Huettmann (eds.) F. 2011. Predictive Species and Habitat Modeling in Landscape Ecology. Concepts and applications. 1st edition. Springer, 314 p. Edler L, Kononen K & Kuosa H (1996) Harmful algae. In: HELCOM (1996), Third periodic assessment of the state of the marine environment of the Baltic Sea, Chapter 8.1. Available at: http://www.baltic.vtt.fi/balticinfo/index.html Hario M, Kastepold T, Kilpi M, Staav R, & Stjernberg T (1987): Status of Caspian Terns *Sterna caspia* in the Baltic. – Ornis Fennica 64: 154–156. HELCOM (2012) Development of a set of core indicators: Interim report of the HELCOM CORESET project, PART A. Description of the selection process. Baltic Sea Environment Proceedings No. 129 A. Available at: www.helcom.fi/publications. Hokkanen T (2012) Eastern Gulf of Finland, seabird populations, ornithological surveys. Nature Protection Publications of Metsähallitus. Series A 195. [In Finnish, abstract in English and Swedish] Huntley B, Collingham YC, Willis SG, Green RE (2008) Potential Impacts of Climatic Change on European Breeding Birds. PLoS ONE 3(1): e1439. Nordström, M., Högmander, J., Laine, J., Nummelin, J., Laanetu, N., Korpimäki, E. 2003. Effects of feral mink removal on seabirds, waders and passerines on small islands in the Baltic Sea. Biological Conservation, 109: 359–368. Ottvall R, Edenius L, Elmberg J, Engström H, Green M, Holmqvist N, Lindström Å, Tjernberg M & Pärt T (2008) Populationstrender för fågelarter som häckar i Sverige. Naturvårdsverket Rapport 5813. [In Swedish, summary in English] Rogers, S., Casini, M., Cury, P., Heath, M., Irigoien, X., Kuosa, H. *et al.* (2010) MSFD, Task Group 4 Report, Food webs. European Commission Joint Research Center and ICES. Available at: http://www.ices.dk/projects/projects.asp.

	Skov. H., Heinänen S., Žydelis R., Bellebaum J., Bzoma S., Dagys M., Durinck J., Garthe S., Grishanov G., Hario M., Kieckbusch J.J., Kube J., Kuresoo A., Larsson K., Luigujõe L., Meissner W., Nehls H.W., Nilsson L., Petersen I.K., Roos M.M., Pihl S., Sonntag N., Stock A., Stipniece A., Wahl J. 2011. Waterbird Populations and Pressures in the Baltic Sea. Nordic Council of Ministers, Copenhagen, 201 pp.
Illustrative material for indicator documentation	 Figure 1. Distribution and numbers of breeding Common Eider *Somateria mollissima* in the Gulf of Riga (image from Aunins *et al*. 2012).