Name of indicator	4.6 Distribution of wintering waterbird species
Type of Indicator	State indicator
Author(s)	Ainars Auniņš, Leif Nilsson, Andres Kuresoo, Leho Luigujõe, Antra Stīpniece
Description of the indicator	This is a set of single species indicators that reflects distribution pattern of wintering 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: *Cygnus olor, Cygnus cygnus, Fulica atra, Anas platyrhynchos, Clangula hyemalis, Melanitta nigra, Melanitta fusca, Somateria mollissima, Aythya marila, Aythya fuligula, Bucephala clangula, Aythya ferina, Mergus albellus, Gavia stellata, Gavia arctica, Mergus merganser, Mergus serrator, Podiceps cristatus, Alca torda, Uria aalge, Cepphus grylle, Larus minutus, Larus ridibundus, Larus canus, Larus argentatus, Larus marinus*. 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.
Relevance of the indicator to different policy instruments	MSFD descriptor 1 (species level/distribution range and distribution pattern within range) Habitats Directive (this indicator is needed for Article 17 reporting to report status of typical species of the habitat types 1110 and 1170; Anon 2007) Birds Directive (this indicator is needed for Article 12 reporting as distribution and range of all regularly occurring wintering 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 offshore counts using ships or planes (Komdeur *et al*. 1992, Petersen *et al*. 2005, Camphuisen *et al.* 2006, Nilsson 2012). 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.
Documentation of relationship between indicator and pressure	Each of the species for which the indicator is calculated respond to different pressures and the indicator reflects these responses spatially. The important pressures and response patterns vary among the species. The indicator (depending on species) responds to an ensemble consisting of combinations of the following pressures: eutrophication oil pollution/shipping by-catch hazardous substances fishing pressure hunting fisheries discards coastal development wind energy sand and gravel extraction climate change Eutrophication has impacts on virtually all the species, also effects of bycatch and oil pollution are widespread among the species. Indicator is able to show local effects of these impacts. The indicator might be scale sensitive in this regard. Latest knowledge and summary of related studies 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 needs 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. 2007. Interpretation manual of European Union Habitats. EUR 27. European Commission DG Environment. Aunins A. (ed.) 2010. [Protected habitats of European Union in Latvia. Identification Handbook]. Latvian Fund for Nature, Riga, 320 pp. 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. Camphuysen C.J., Fox A.D., Leopold M.F. & Petersen I.K. 2004. Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the U.K.. Report commissioned by COWRIE for the Crown Estate, London. Royal Netherlands Institute for Sea Research, Texel, 38 pp. 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. Elith. J., Phillips S.J., Hastie T., Dudik M., Chee Y.E., Yates C.J. 2011. A statistical explanation of MaxEnt for ecologists. Diversity and Distributions 17: 43 – 57. Komdeur, J., Bertelsen, J. & Cracknell, G. (Eds.). 1992. Manual for Aeroplane and Ship Surveys of Waterfowl and Seabirds. IWRB Special Publication No. 1, Slimbridge, UK, 37 p. Petersen, I.K, Fox, A.D. 2005. An aerial survey technique for sampling and mapping distributions of waterbirds at sea. Department of Wildlife Ecology and Biodiversity, National Environmental Research Institute. 24 pp. 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

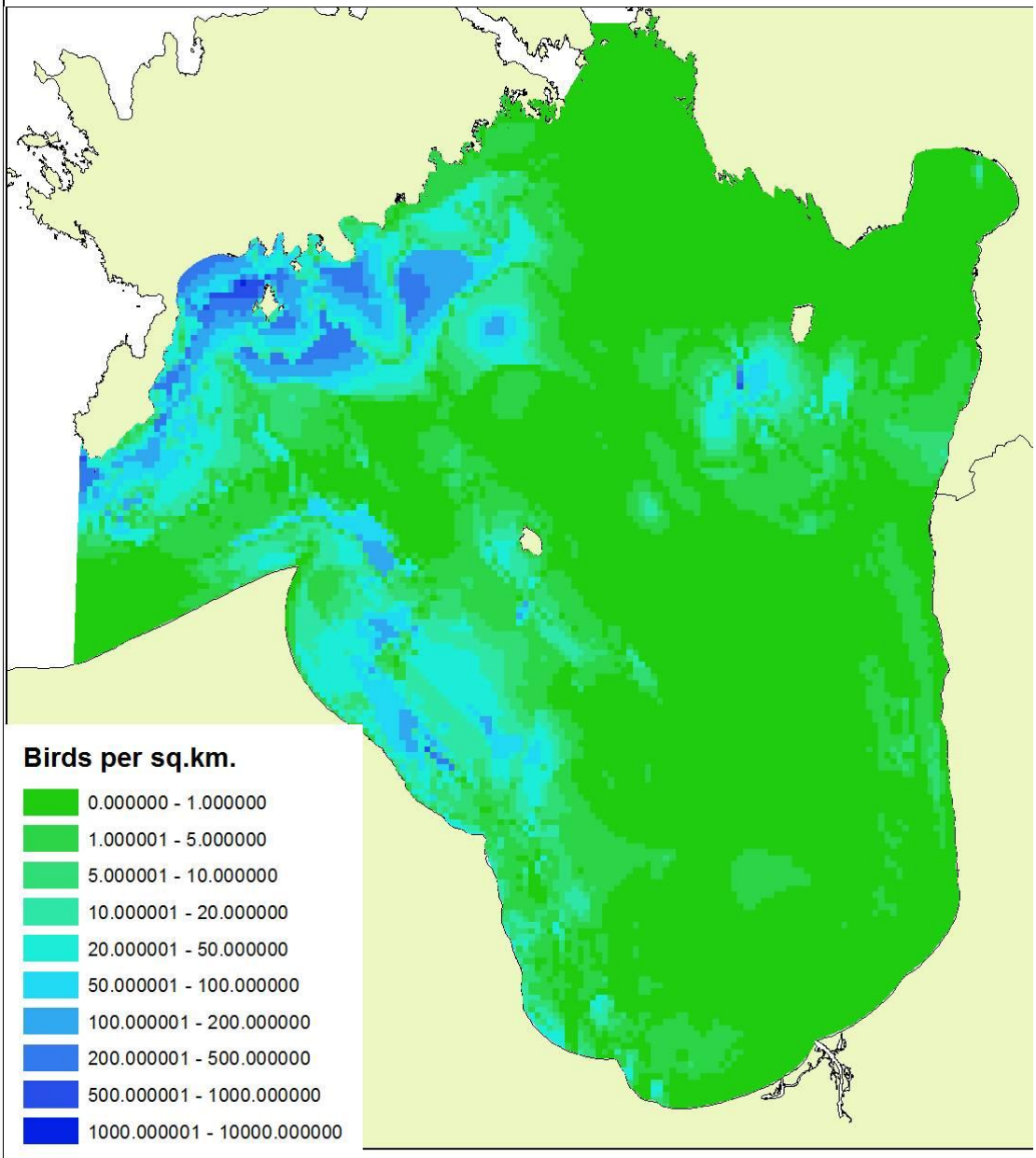

Figure 1. Example draft indicators for the Gulf of Riga (from Aunins *et al*. 2012): Long-tailed Duck *Clangula hyemalis*