Supporting information for spatial representation of migration routes of Lesser Black-backed Gull *Larus fuscus*

Introduction:

Observations of Lesser Black-backed Gull were collected from the Baltic Sea area for the HELCOM Migratory Sea Birds Workshop (MIGRATORY BIRD WS 1-2018).

HELCOM Recommendation 34E/1 "Safeguarding important bird habitats and migration routes in the Baltic Sea from negative effects of wind and wave energy production at sea" covers both planning and ecology/conservation aspects. It was identified by the State and Conservation Working Group that one of the first steps in the process to implement the Recommendation is to spatially identify migration routes and sensitivity of a given area with regards to migration.

A workshop on migration routes of birds over the Baltic Sea was convened on 20-22 November 2018 at the premises of HELCOM Secretariat, in cooperation with the ICES/OSPAR/HELCOM Joint Working Group on Seabirds (JWG BIRD). The workshop was organized in order to support the implementation of HELCOM Recommendation 34E/1 by producing maps with migration routes of waterbird species covering the entire Baltic Sea Region. The workshop brought together data from:

i) coastal migration counts,
ii) waterbird counts at staging/stopover sites,
iii) tracking data (satellite telemetry, GPS data loggers)
iv) radar observations.

The workshop agreed to produce a written accounts, e.g. relevant information to be included with the maps as part of the metadata information, and seasonal migration maps for selected example species for which reliable information is available and to include the confidence of the expert judgement or data to these maps.

Please note that in their current form the maps are not ready to be used for planning, but that they represent examples of what can be produced with significantly higher quality, given more time and resources. The maps produced in the workshop represent the initial steps in the process to map migration and represent the available information and the most common routes for the respective birds, but they do not mean that there are no birds migrating outside of the delineated areas. Due to lack of time, no buffers, sensitivity scores nor weighting has been added to the layers.

Migration season represented

Pre-breeding (spring) migration and post-breeding (autumn) migration.

Ecology and behavior of species

E.g. species-specific behavior e.g. flying altitudes of the species, temporal aspects (seasonality, monthly and time of day), the numbers of birds using the routes, information on staging areas, behavior when facing barriers or obstacles (e.g. windfarms), as well as more specific information on density and timing of migration, as well as behavior under varying weather conditions etc.

In the Baltic Sea Region, two subspecies of Lesser Black-backed Gull occur. The subspecies *L. f. intermedius* is breeding in the westernmost part of the region east to southern Sweden and migrating to and from wintering areas ranging mostly from W France to W Africa. The subspecies *L. f. fuscus* is breeding from E Sweden to Finland and the White Sea in Russia and northwards up to Northern Norway, the wintering area is in E and C Africa and on the western Arabian Peninsula. Most of the world's population of *fuscus* pass through the Baltic sea region while the *intermedius* population only in minor parts migrate through the HELCOM area. Both subspecies are migrating across land and sea and are not restricted to coastal areas. Migration takes place

both during daytime and at night. In the Baltic Sea Region, spring migration ranges from March to May where the *intermedius* population is in general a bit earlier in their migration than the eastern/northern *fuscus* population that rarely reaches the Baltic Sea region before April. The autumn migration period includes August and September. Observations of the flight behaviour at offshore wind farms show that Lesser Black-backed Gulls are not avoiding such offshore constructions (e.g. Hill et al. 2014, Dierschke et al. 2016) and often fly at rotor height (Bradbury et al. 2014, Johnston et al. 2014), making them prone to collisions.

Conservation status

As a migratory species, Lesser Black-backed Gull is protected species under EU Birds Directive. IUCN (2018) is listing the species as being of least concern (LC). The HELCOM Red List status for breeding birds in the Baltic Sea differs between the two subspecies. While *L. f. intermedius* is of least concern (LC), the status for *L. f. fuscus* is vulnerable (VU).

Data type and sources

Satellite telemetry:

1. unpublished data: BirdLife Swedens project for conservation of threatened costal birds.
2. unpublished data: Centre for Animal movements, Professor Susanne Åkesson, Lund University
3. Wikelski, M., E. Arriero et al. (2015): True navigation in migrating gulls require intact olfactory nerves. Scientific Reports 5: 17061. DOI: 10.1038/srep17061.
4. Pütz, K., A.J. Helbig, K.T. Pedersen, C. Rahbek, P. Saurola & R. Juvaste (2008): From fledging to breeding: long-term satellite tracking of the migratory behaviour of a Lesser Black-backed Gull *Larus fuscus intermedius*. Ringing & Migration 24: 7-10.
5. Isaksson, N., Evans, T., Shamoun-Baranes, J. and Åkesson, S. 2016. Land or sea? Foraging area choice during breeding by an omnivorous gull. Movement Ecology 4, 11
6. Lötberg, U. & Åkesson, S. 2018. Silltrutens Cillas sällsamma resor. I: SOF-BirdLife 2018. Fågelåret 2017. Halmstad, 42–49.

Method used and rational

Tracks of individual Lesser Black-backed Gulls equipped with satellite transmitters or GPS-loggers, which communicate either through base stations or through GSM network, were generalized and geo-referenced.

Level of confidence in presented results

For communicating the degree of certainty in key findings, confidence in the validity of a finding is presented, and is expressed qualitatively.

Each contributing scientist has rated their confidence in the evidence presented. An overall confidence rating of high, medium or low is derived by qualitatively assessing both the amount and consistency of the available information (e.g. the type, amount, quality, and consistency of evidence (e.g., mechanistic understanding, theory, data, models, expert judgement) and the degree of agreement, or conflicting evidence or differing opinions). Where both are high there is high confidence about what is happening. But if either are insufficient there is a high degree of uncertainty and an overall confidence rating of low (figure X).

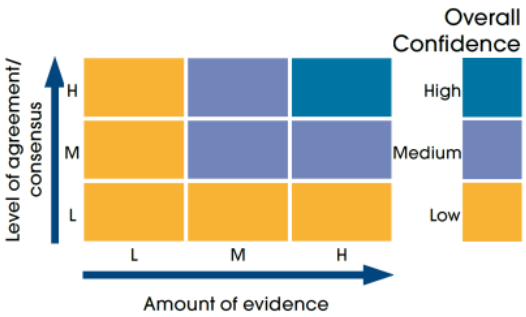


Figure X.

Confidence in the presented information:

Medium.

Justification for confidence level:

Whenever possible please provide traceable accounts describing your evaluations of evidence and agreement (e.g. references).

Experts agreed in high quality information concerning the main migration route (H). The amount of evidence is medium (M), because migration routes of birds breeding in Finland are not covered.

Knowledge gaps and resource priorities

Migration data for the Finnish focus population is missing. This should be added to get a full view of the Lesser Black-backed gull ssp *fuscus* migration through the HELCOM area.

References

Bradbury, G., M. Trinder, B. Furness, A.N. Banks, R.W.G. Caldow & D. Hume (2014): Mapping seabird sensitivity to offshore wind farms. PLOS ONE 9: 1-17.

Dierschke, V., R.W. Furness & S. Garthe (2016): Seabirds and offshore wind farms in European waters: Avoidance and attraction. Biol. Conserv. 202: 59-68.

Hill, R., K. Hill, R. Aumüller, K. Boos & S. Freienstein (2014): „Testfeldforschung zum Vogelzug am Offshore-Pilotpark alpha ventus“ und „Auswertung der kontinuierlich auf FINO1 erhobenen Daten zum Vogelzug der Jahre 2008 bis 2012“. StUKplus Final Report (FKZ 0327689A/Avitec1 and Avitec2). Avitec Research, Osterholz-Scharmbeck.

Johnston, A., A.S.C.P. Cook, L.J. Wright, E.M. Humphreys & N.H.K. Burton (2014): Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines. J. Appl. Ecol. 51: 31-41.

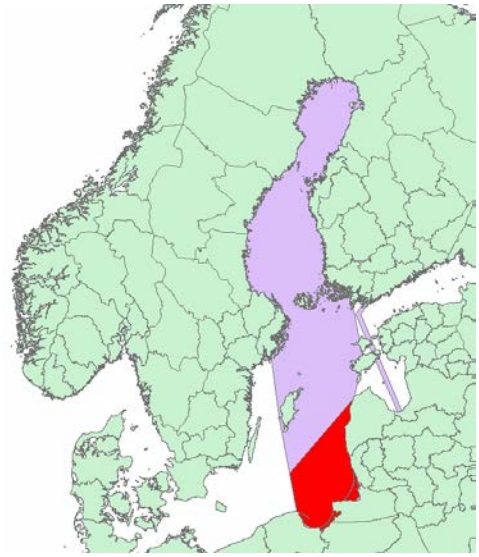
Spatial data product (map) metadata:

Categories	Filled in by Secretariat
Keywords	Filled in by Secretariat e.g. *marine birds *migration *environment
Language	English
Resource identifier (System generated ID)	Filled in by Secretariat
Legal constraints	Data product can be used, given that the source (HELCOM) and underlying data used for creating the data product (the references listed in lineage section) must be referred as original sources.
Resource Constraints	Map based on aggregated data from various sources.
Contact for the resource	HELCOM Secretariat

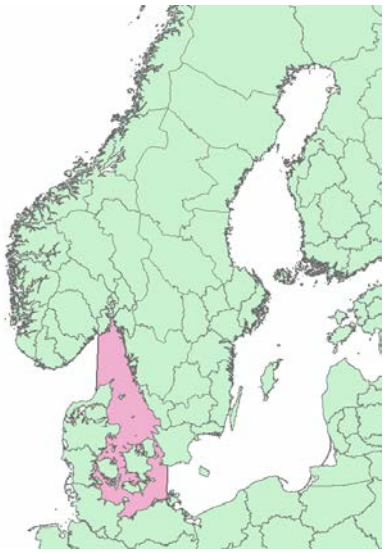
Technical Information

Representation type	Vector/raster
Coordinate reference system	ETRS89LAEA
Format	ESRI Shapefile / TIFF
Lineage (This is a statement on process history and/or overall quality of the spatial data set. Where	Origin of the dataset, e.g.

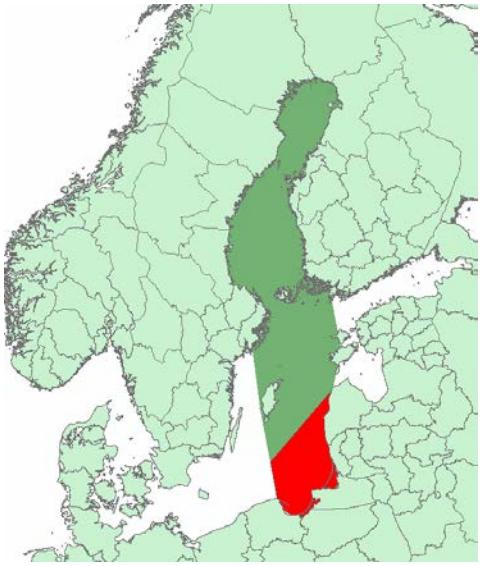
appropriate it may include a statement whether the data set has been validated or quality assured, whether it is the official version (if multiple versions exist))	This dataset displays spatial representation of the migration routes of **Lesser Black-backed Gull** according to the HELCOM migratory sea birds workshop (MIGRATORY BIRD WS 1-2018) based on the following data sources: Satellite telemetry: 1. unpublished data: BirdLife Swedens project for conservation of threatened costal birds. 2. unpublished data: Centre for Animal movements, Professor Susanne Åkesson, Lund University 3. Wikelski, M., E. Arriero et al. (2015): True navigation in migrating gulls require intact olfactory nerves. Scientific Reports 5: 17061. DOI: 10.1038/srep17061. 4. Pütz, K., A.J. Helbig, K.T. Pedersen, C. Rahbek, P. Saurola & R. Juvaste (2008): From fledging to breeding: long-term satellite tracking of the migratory behaviour of a Lesser Black-backed Gull *Larus fuscus intermedius*. Ringing & Migration 24: 7-10. 5. Isaksson, N., Evans, T., Shamoun-Baranes, J. and Åkesson, S. 2016. Land or sea? Foraging area choice during breeding by an omnivorous gull. Movement Ecology 4, 11 6. Lötberg, U. & Åkesson, S. 2018. Silltrutens Cillas sällsamma resor. I: SOF-BirdLife 2018. Fågelåret 2017. Halmstad, 42–49.



LBBG fuscus autumn



LBBG intermedius spring & autumn



LBBG fuscus spring