

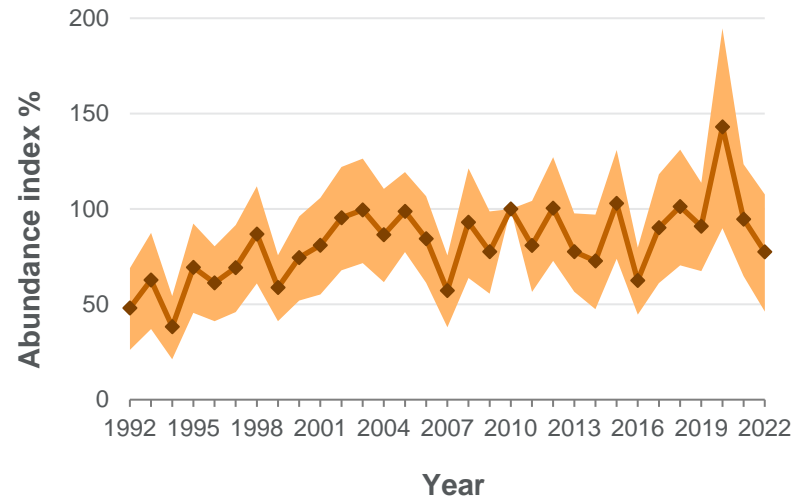
Greylag Goose August survey in Finland 2022–2023: the use of GPS-loggers for estimating flyway population sizes

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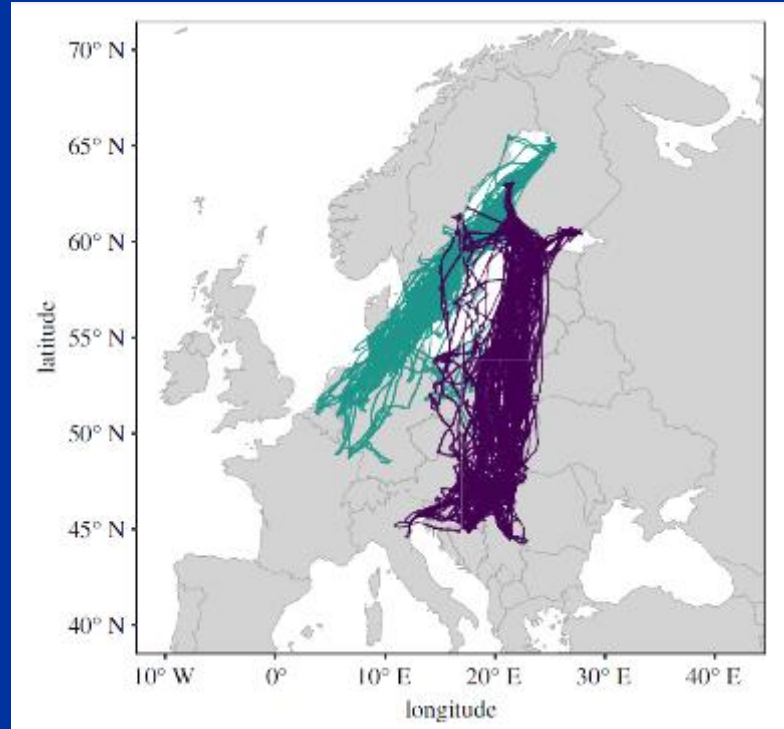
The population monitoring of Greylag Goose in Finland

- Temporal trends (indices) based on the archipelago monitoring scheme
 - Nest and pair counts
 - Voluntary birdwatchers and ringers
- The breeding population has moved closer to the coast – data mainly from outer archipelago
 - ✓ An effect of White-tailed Eagles
 - ✓ Risk of negative bias in trend
- No good prospects for obtaining estimates of population size
- No data on reproductive success

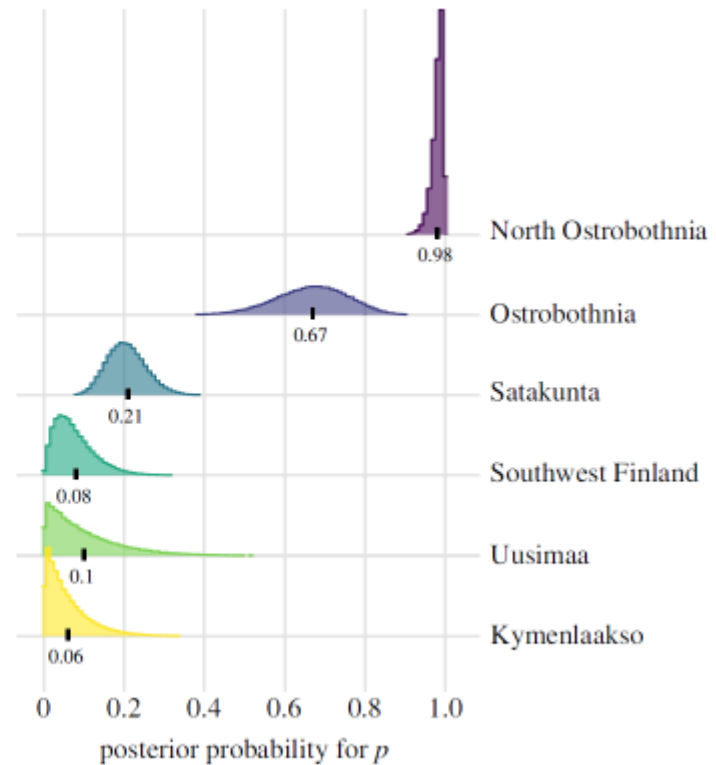
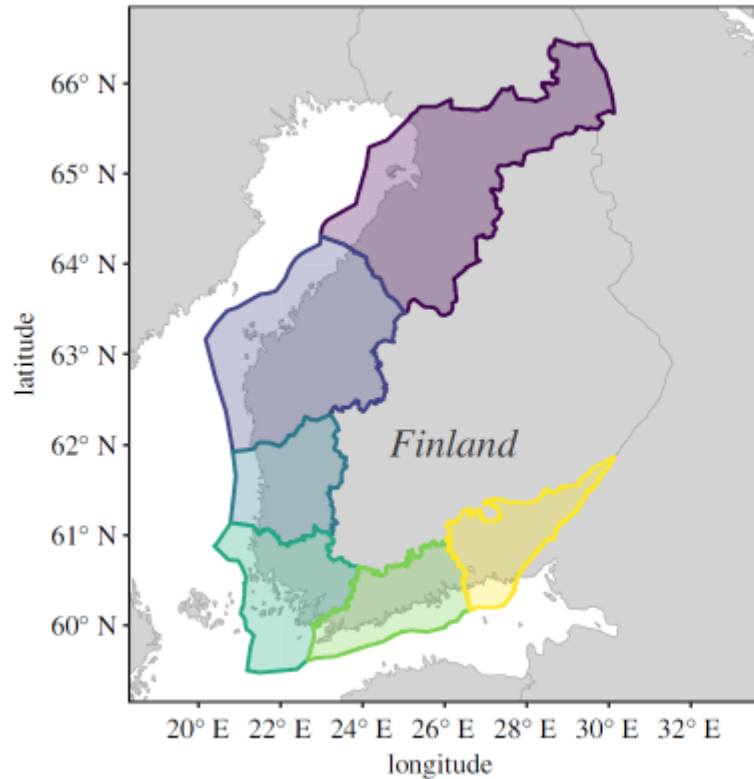
Greylag Goose Finland



A steep migratory divide in Finland



Piironen & Laaksonen
(2023) – Proc. R. Soc. B

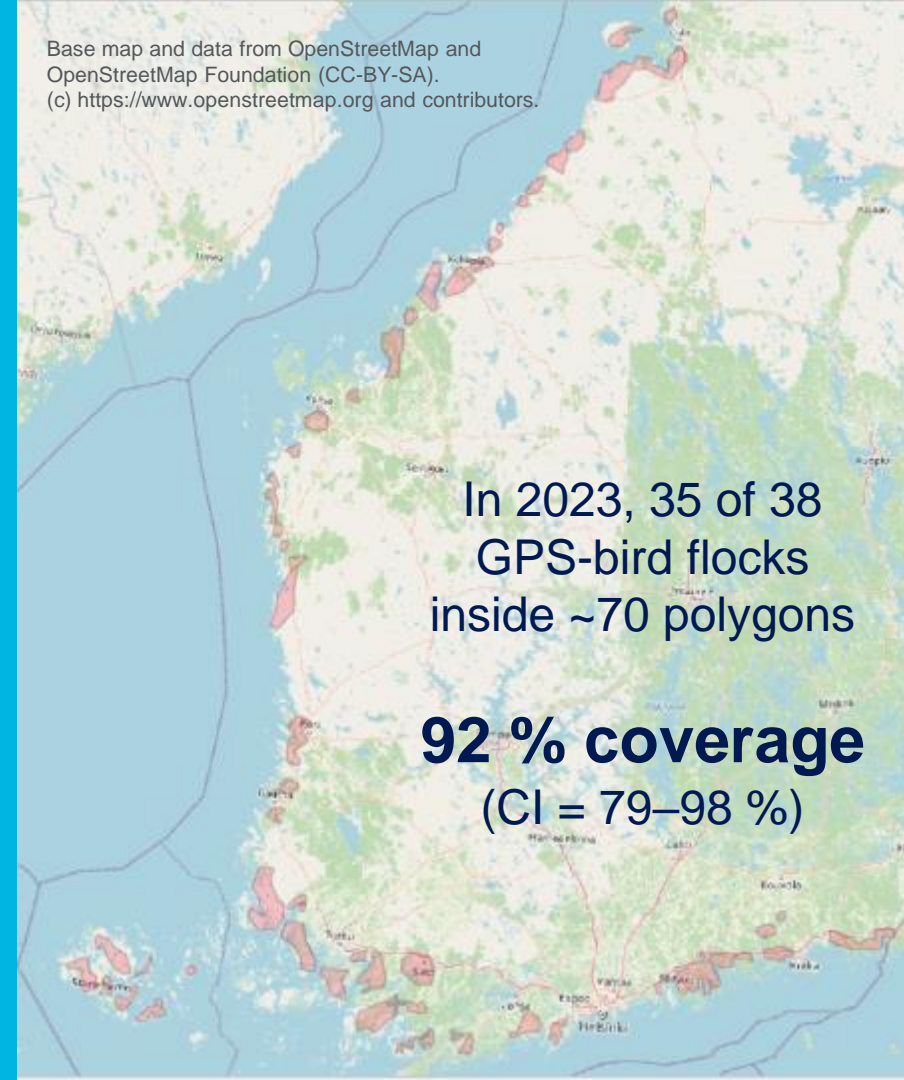


Piironen & Laaksonen
(2023) – Proc. R. Soc. B

August surveys 2022–2023

- Developed by Luke in collaboration with University of Turku/Antti Piironen
- **Primary aim to estimate population sizes of the two flyway populations**
- The GPS birds inform us about
 - Habits of the birds
 - Observability (probability of detection)
 - The probability of flyway population membership
- Geese counted at ca 70 gathering areas (polygons) along the whole coastline
 - Timing: 5.–6. August. Hunting begins 10. August.
 - Survey at the fields: ca 5–9 a.m. or after 6 p.m.
 - Coastal wetlands & estuaries: 10 a.m.–17 p.m.
- Birds of the whole flock or a sample are aged, whenever possible

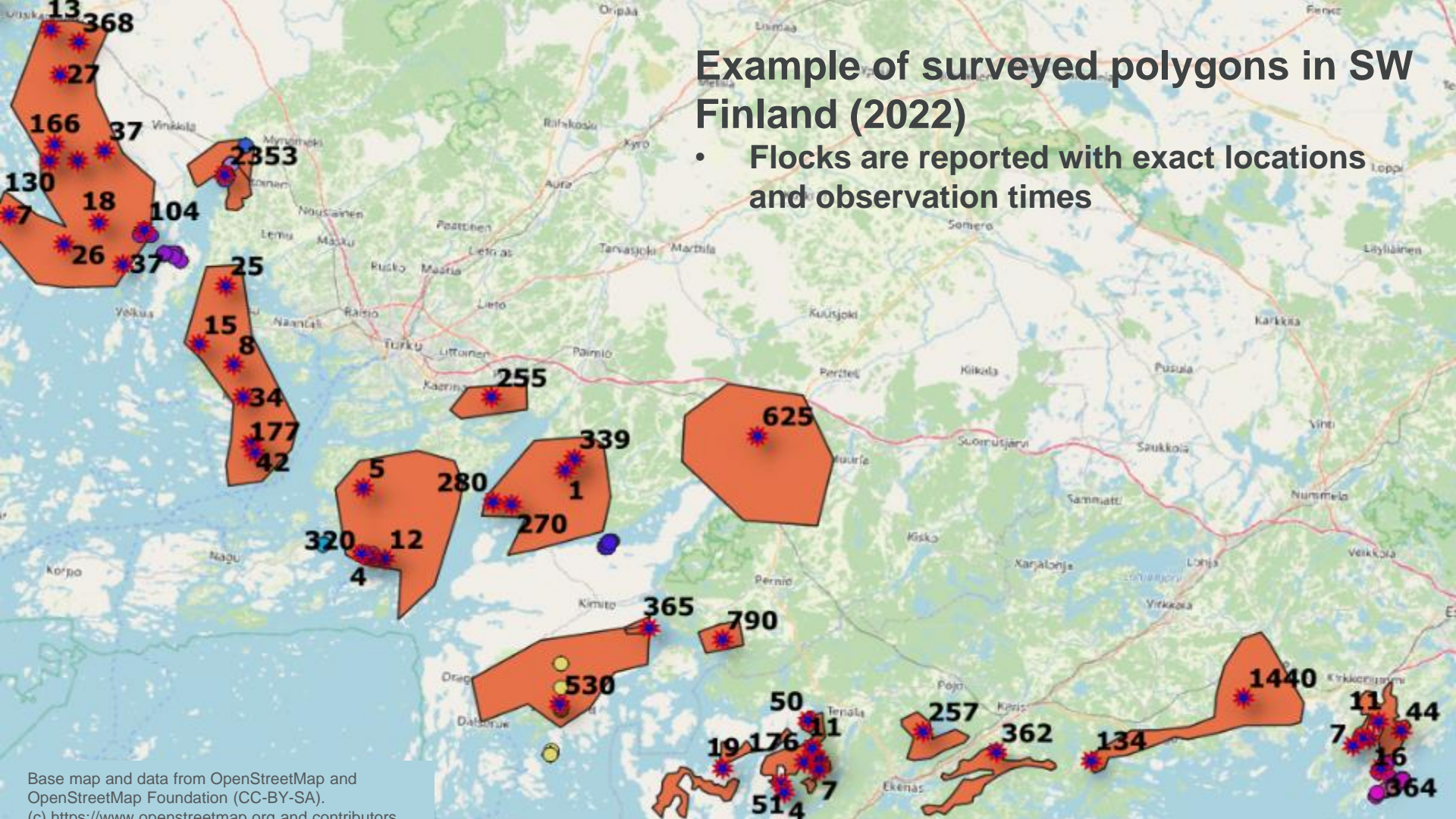
Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA).
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In 2023, 35 of 38
GPS-bird flocks
inside ~70 polygons
92 % coverage
(CI = 79–98 %)

Example of surveyed polygons in SW Finland (2022)

- Flocks are reported with exact locations and observation times





~100 km²

Hailuoto survey area (polygon) and geese in 2022

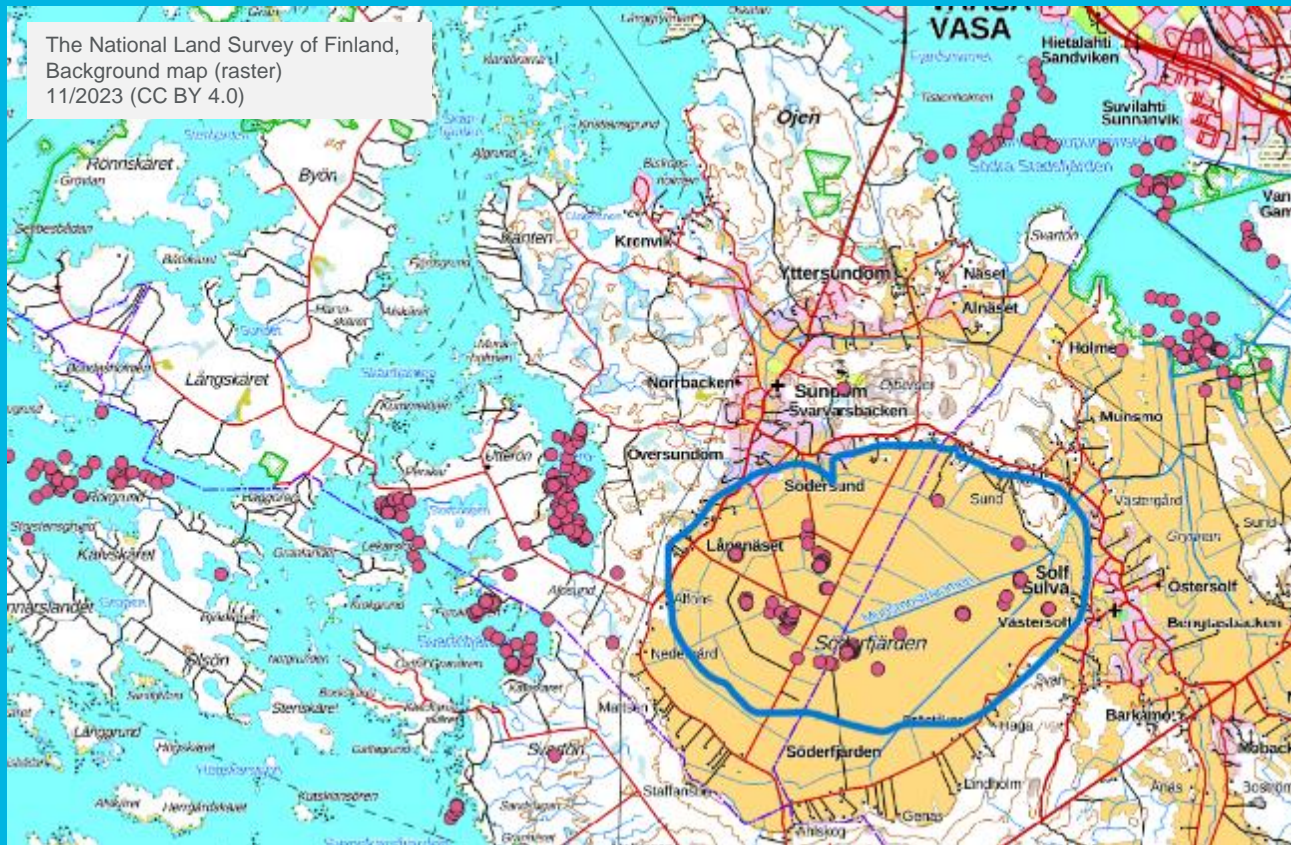
The National Land Survey of Finland, Background map (raster) 11/2023 (CC BY 4.0)

Greylag Goose surveys 2022–2023

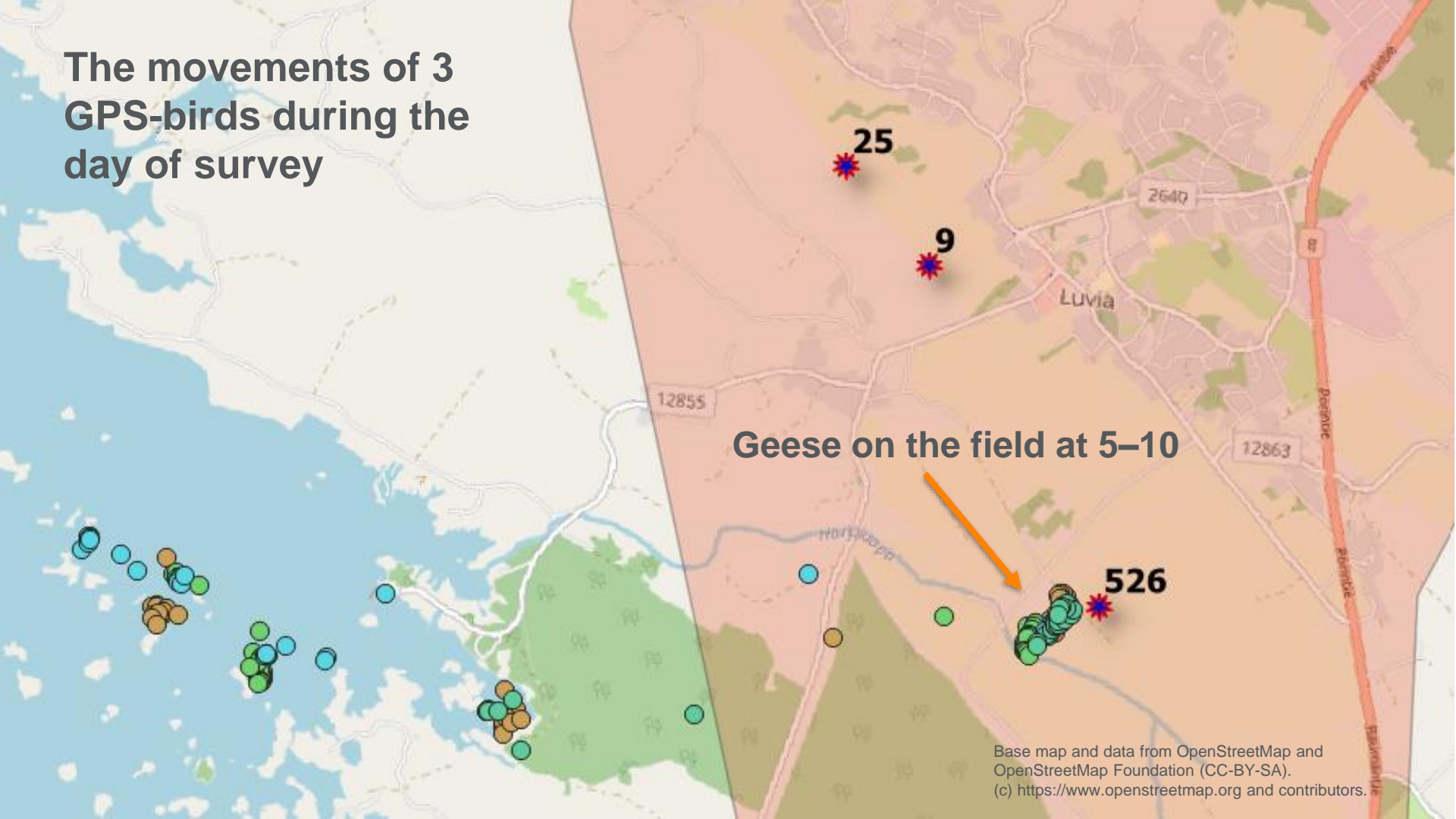
Daily patterns fairly well known – geese feed on the fields early mornings or late evenings

- 4 GPS GLG daily tracks (every ten minutes)
- At the fields: 06:16– 10:40 and 18:40–22.30
- Rest of the day at roosting sites at sea

The National Land Survey of Finland,
Background map (raster)
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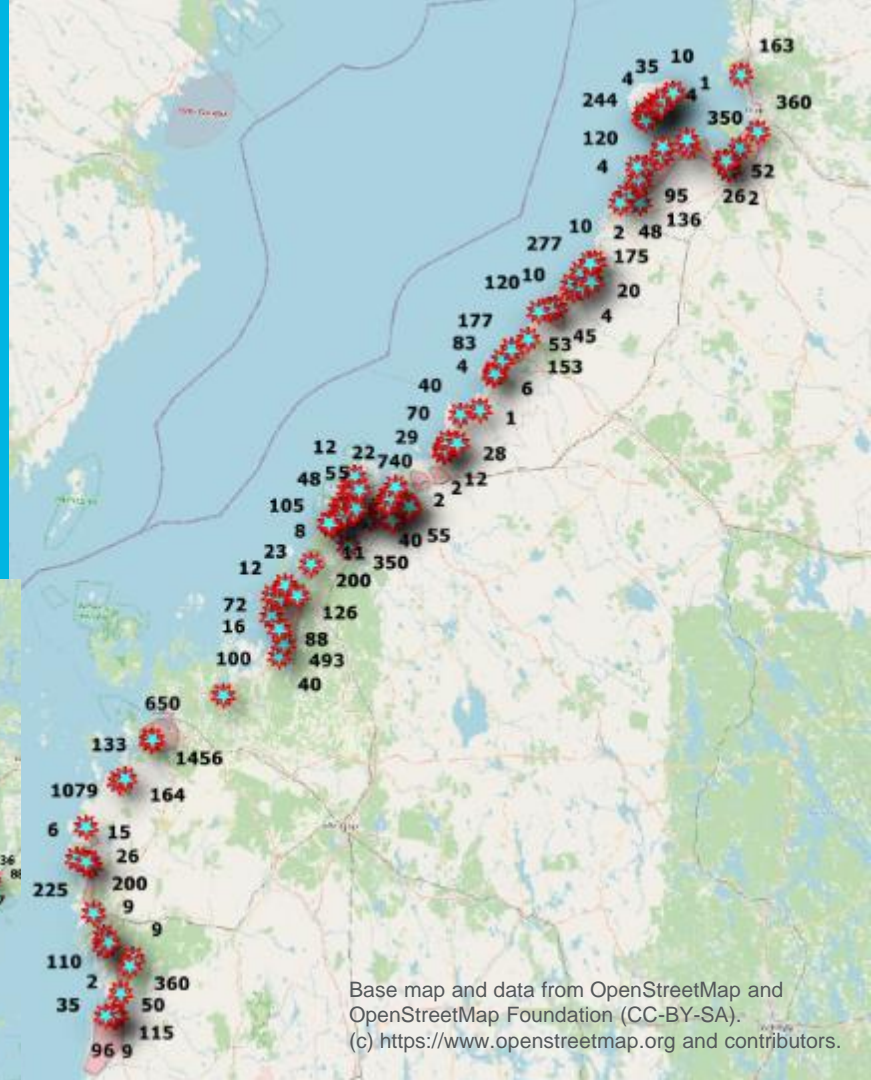
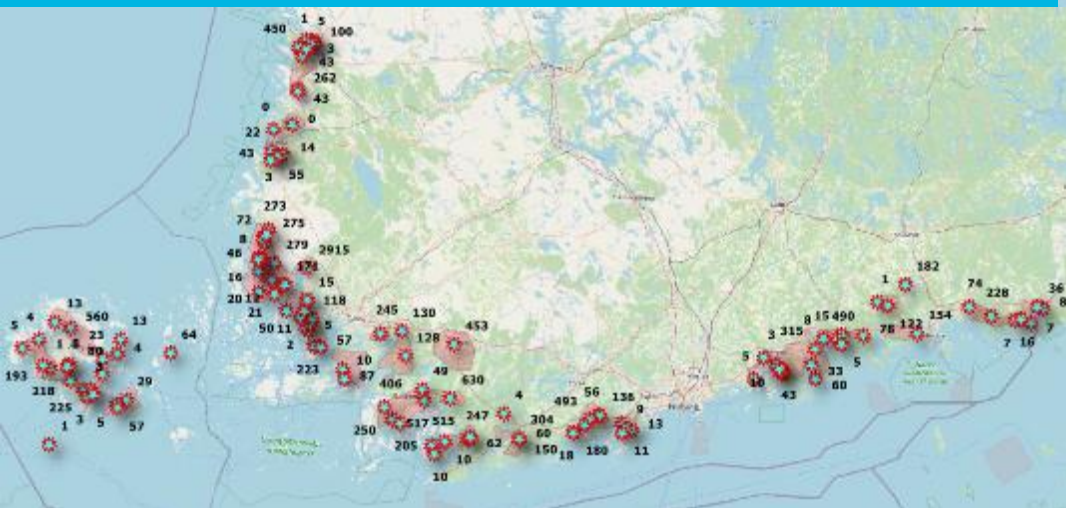
The movements of 3 GPS-birds during the day of survey



Geese on the field at 5-10

Greylag Goose survey 2022–2023

What?	2022	2023
Southern coastline	14997	14615
Northern coastline	8088	12171
Åland archipelago	1479	1641
GPS GLG in Finland	44	38
GPS GLG nr. in counted areas	33	35
GPS GLG nr. in counted areas	25	20



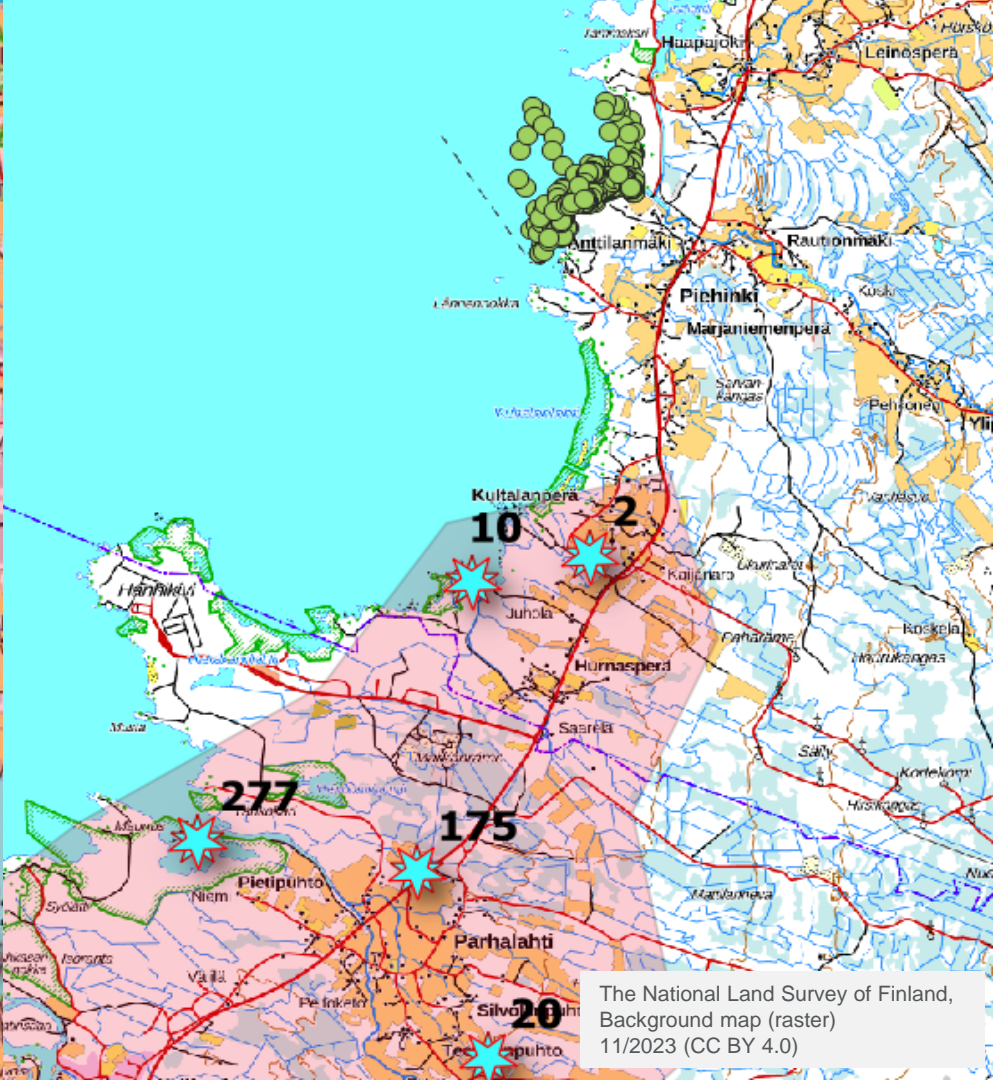
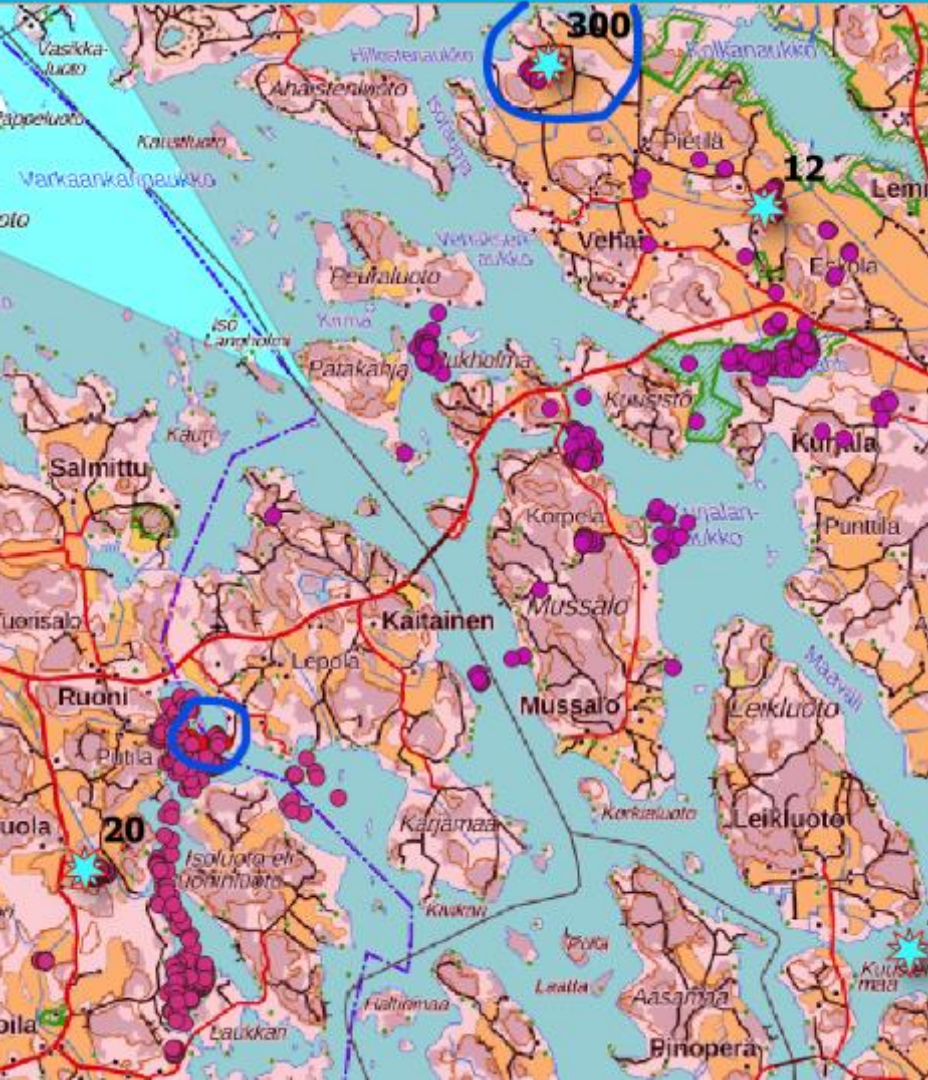
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Reasons for imperfect detection

- ✓ GPS goose outside survey area (2023: 3 / 38)
- ✓ GPS goose with the goslings at sea – not visiting the fields! (1 or 2 / 38)
- ✓ GPS goose present in survey areas but missed:
 1. Complex landscape, birds using parts of fields impossible or difficult to observe
 2. Goose are longer/shorter times than expected at the sea or roosting
 3. Disturbance – birds leave for day-roosts earlier than expected or change fields without detection = bad luck!



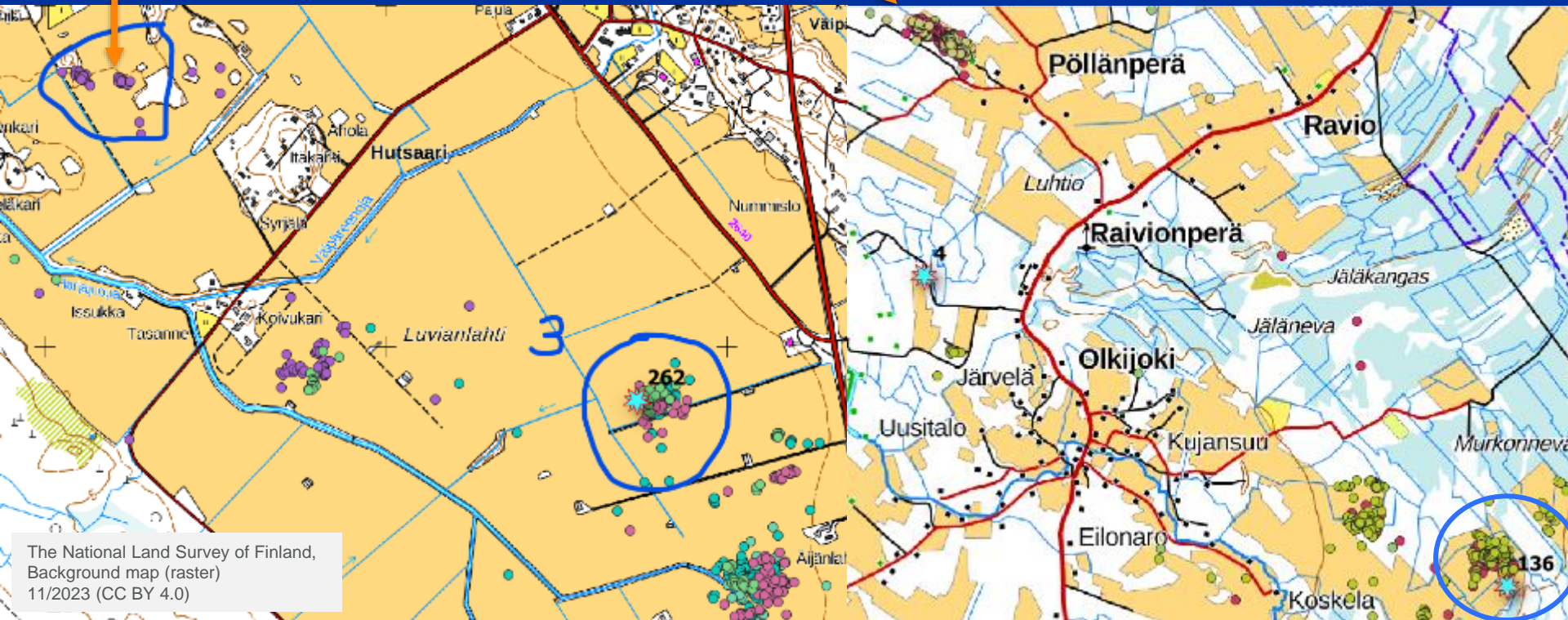
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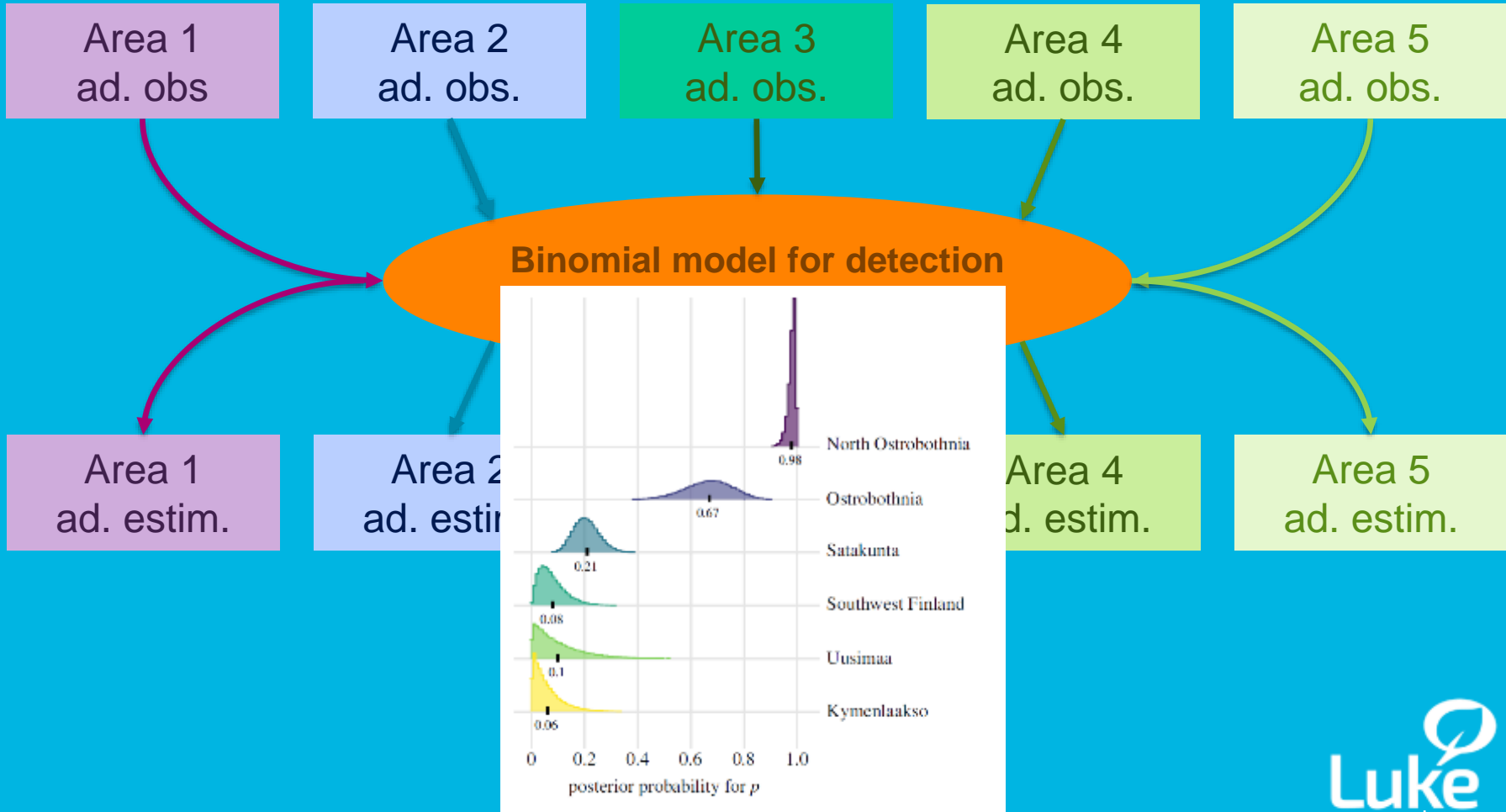


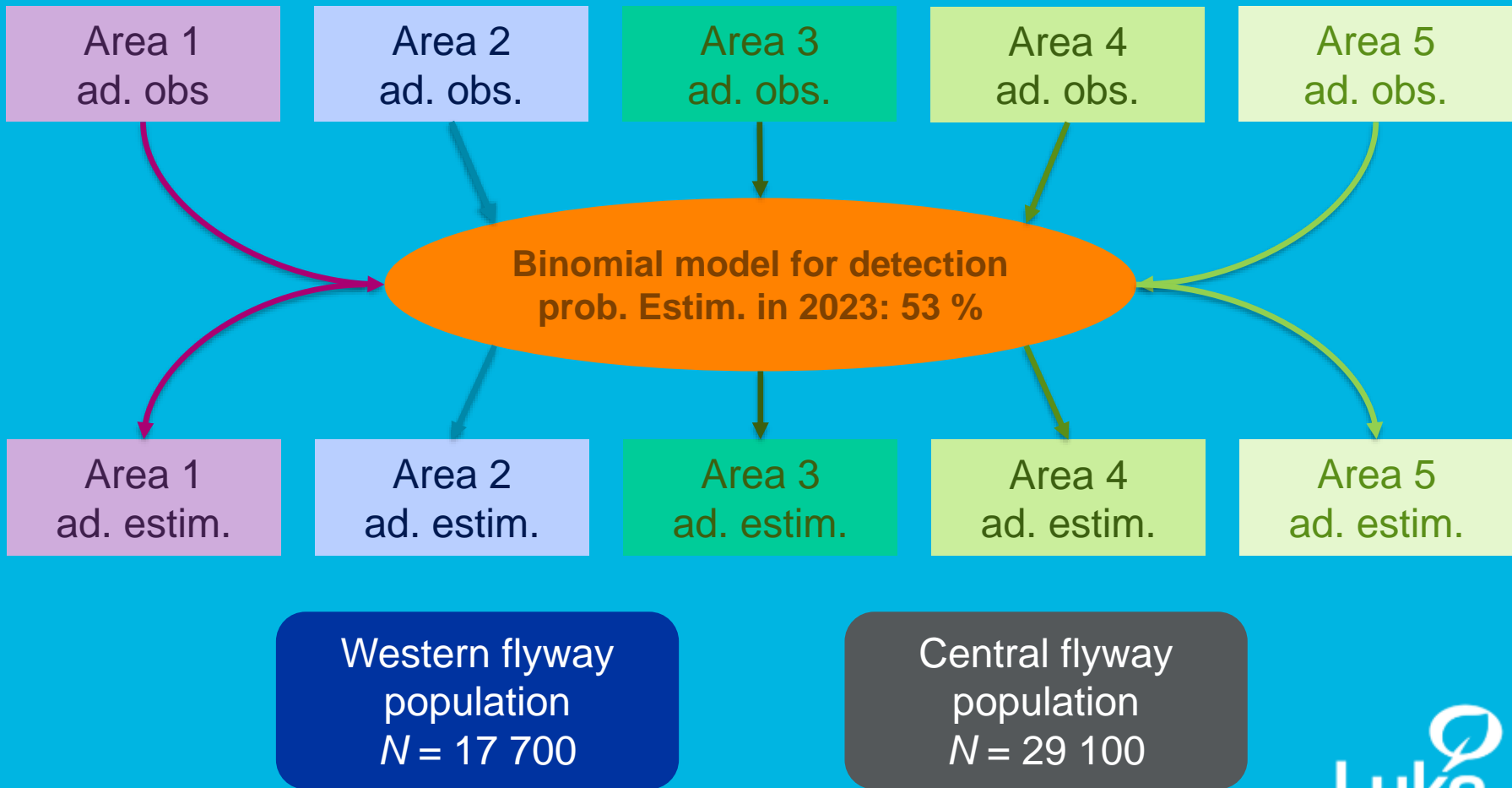
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3 GPS birds observed
and 1 hiding in a closed
scenery and not seen

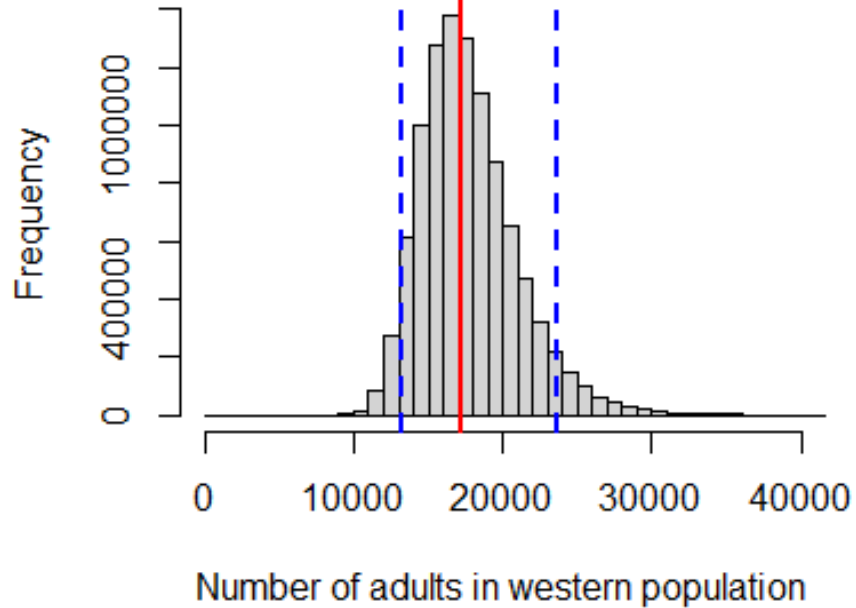
3 GPS birds undetected in a very
isolated and closed field;
1 seen



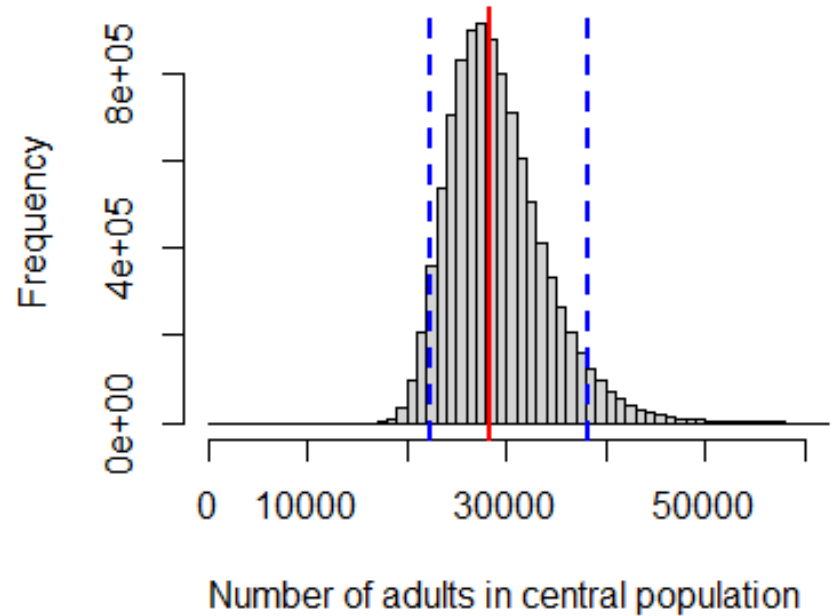




Western flyway
population
 $N = 17\,700$



Central flyway
population
 $N = 29\,100$



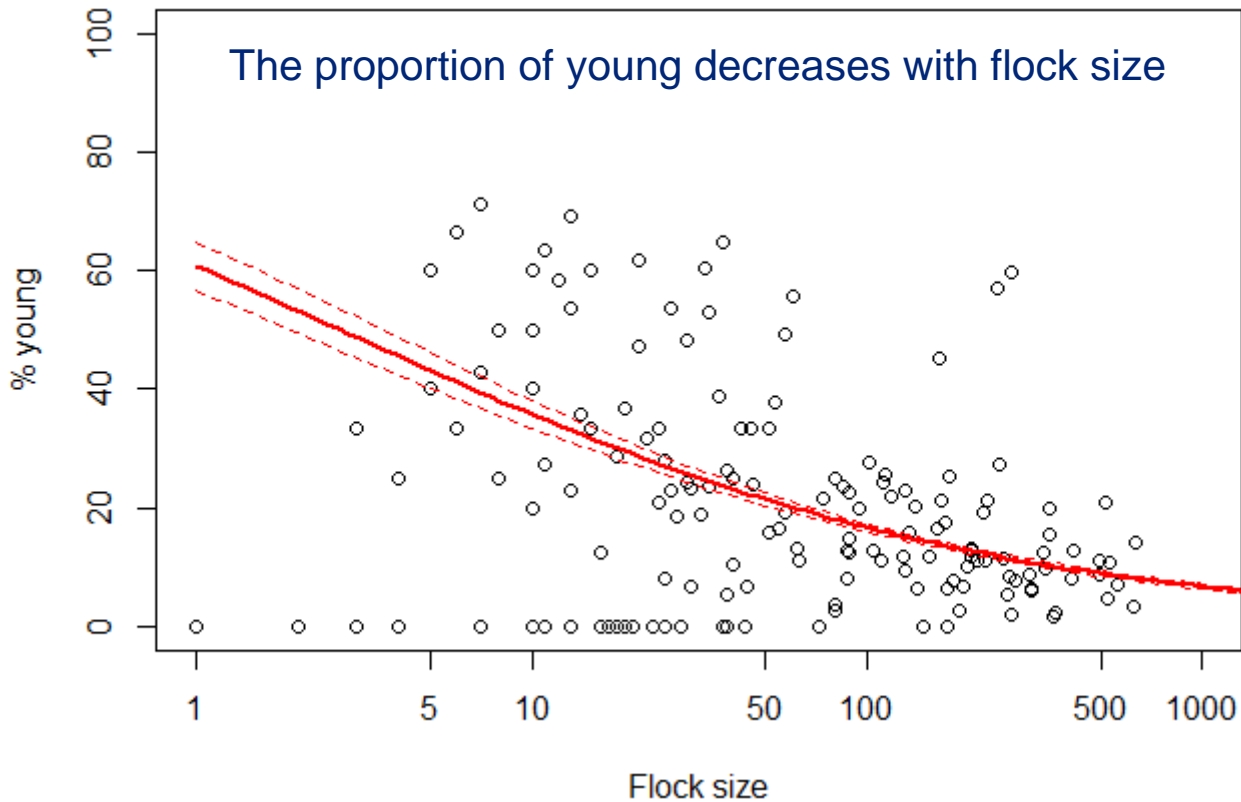
Suggestions for improvement

- Multi-year model
 - Multiple trials for each GPS bird: improved statistical power
 - Linking to archipelago monitoring data: calibrating the population size
 - IPM, incorporation annual transitions in population size as a function of demographic traits (but poor survival data)
- Spatio-temporal covariates in detection probability
 - Year; time of day
 - Area; habitat
- Flock based model (?): the detection probability applies for flocks rather than individuals
 - Flocks vary in size, and large flocks are easier to detect
 - A given bird has a larger chance of being in a larger flock
 - The proportion of adult birds is clearly larger in large flocks



Photo: Artur Rydzewski
"Greylag Goose, *Anser Anser*" (CC BY 2.0)

The proportion of young decreases with flock size



Thank you!



Photo: Andreas Lindén



Ministry of Agriculture
and Forestry of Finland