Offshore wind farms in Sweden

with special reference to birds

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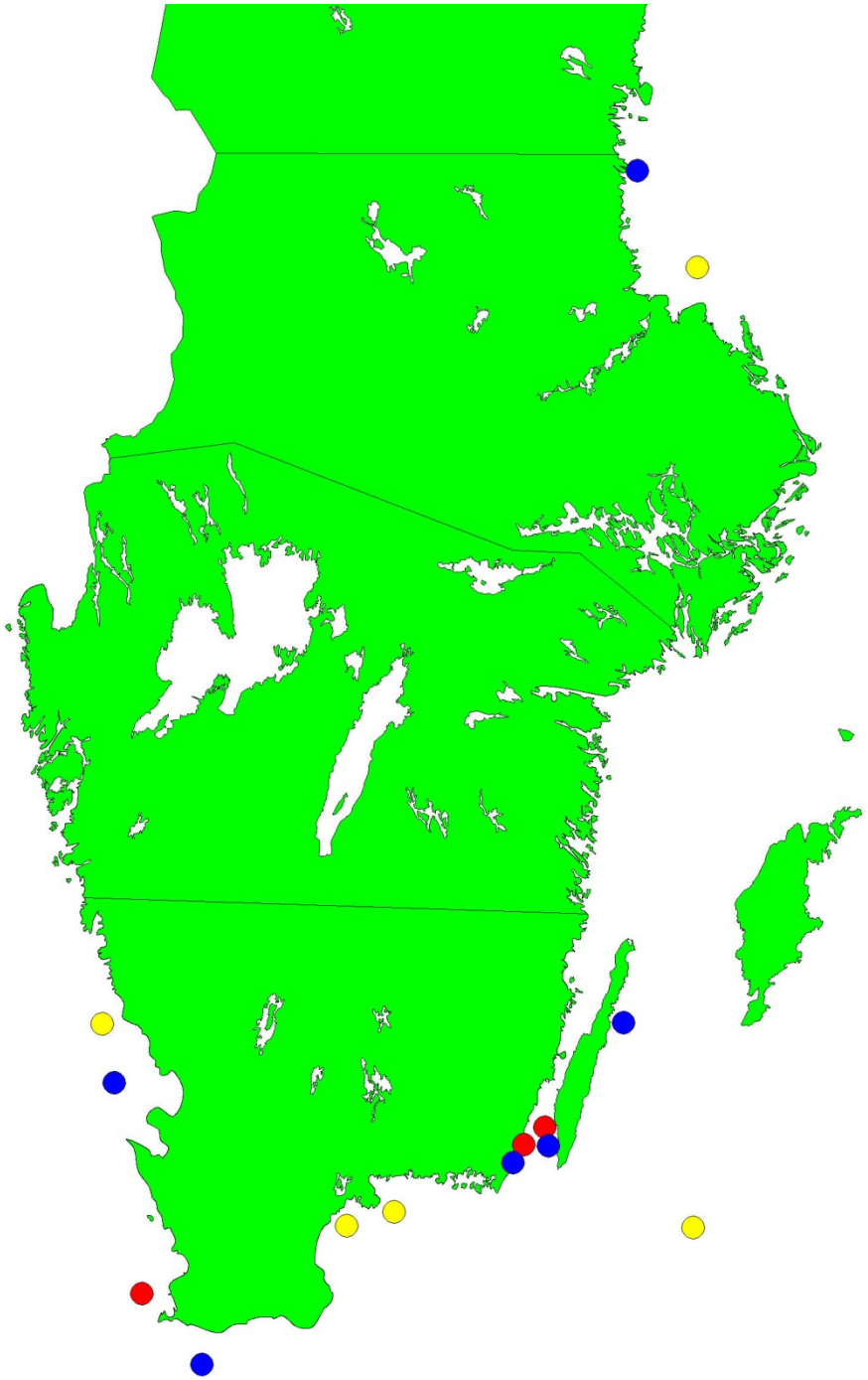


Offshore wind farm projects in Sweden

- In operation
- Permits
- Plans in different stages

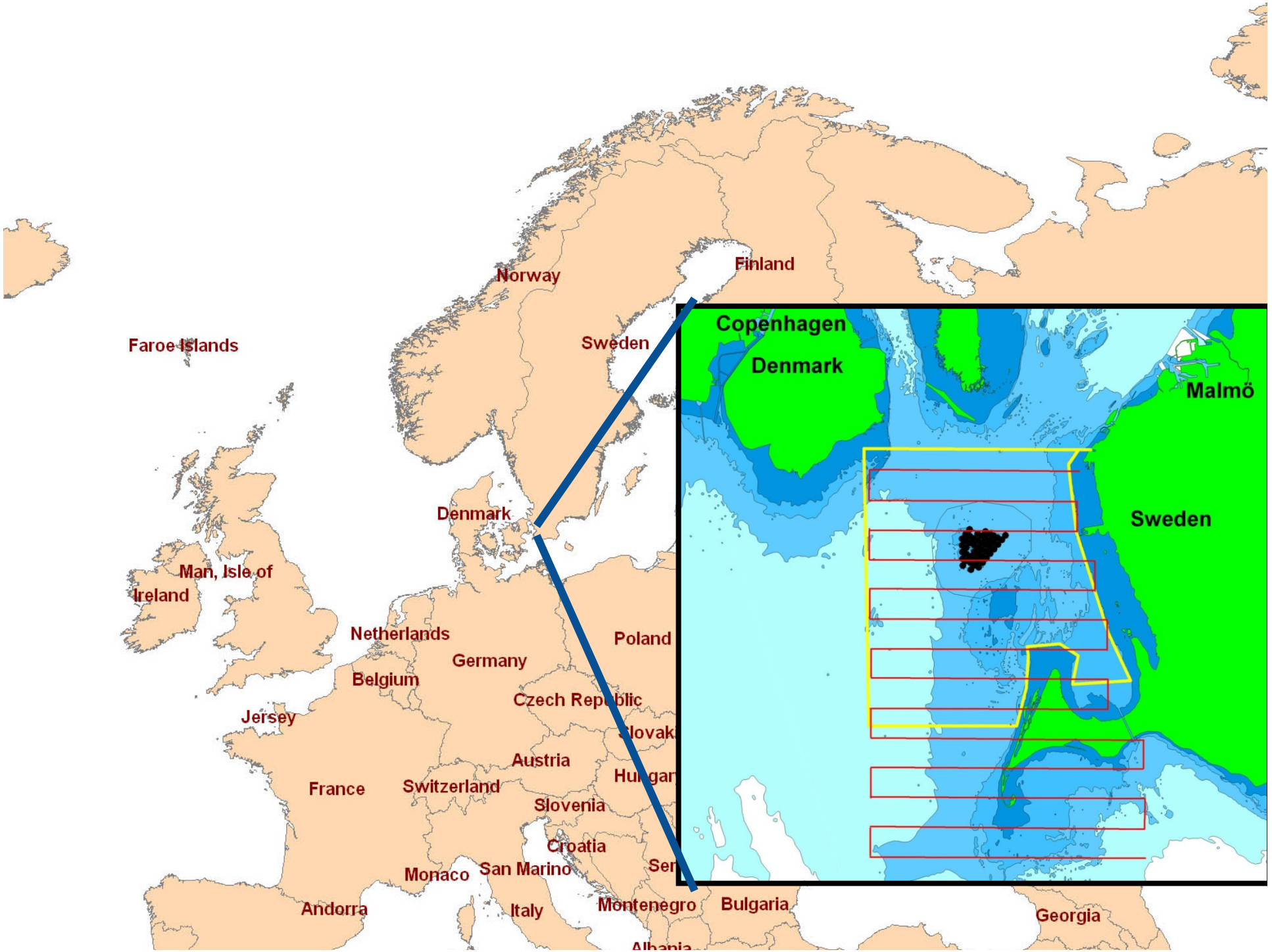
Possible impacts on birds

- 1. Disturbance causing avoidance of feeding areas
- 2. Barrier effects
- 3. Colisions with increased mortality
- 4. Cumulative effects

Lillgrund, Öresund

- 48 offshore windmills
- 110 MW installed effect
- 330 000 MWH yearly production (60 000 housholds)
- Total height 115 m
- Rotor diameter 90 m
- Built 2006 -2007 (start production late 2007)

www.vattenfall.se/sv/lillgrund-wind-farm.htm

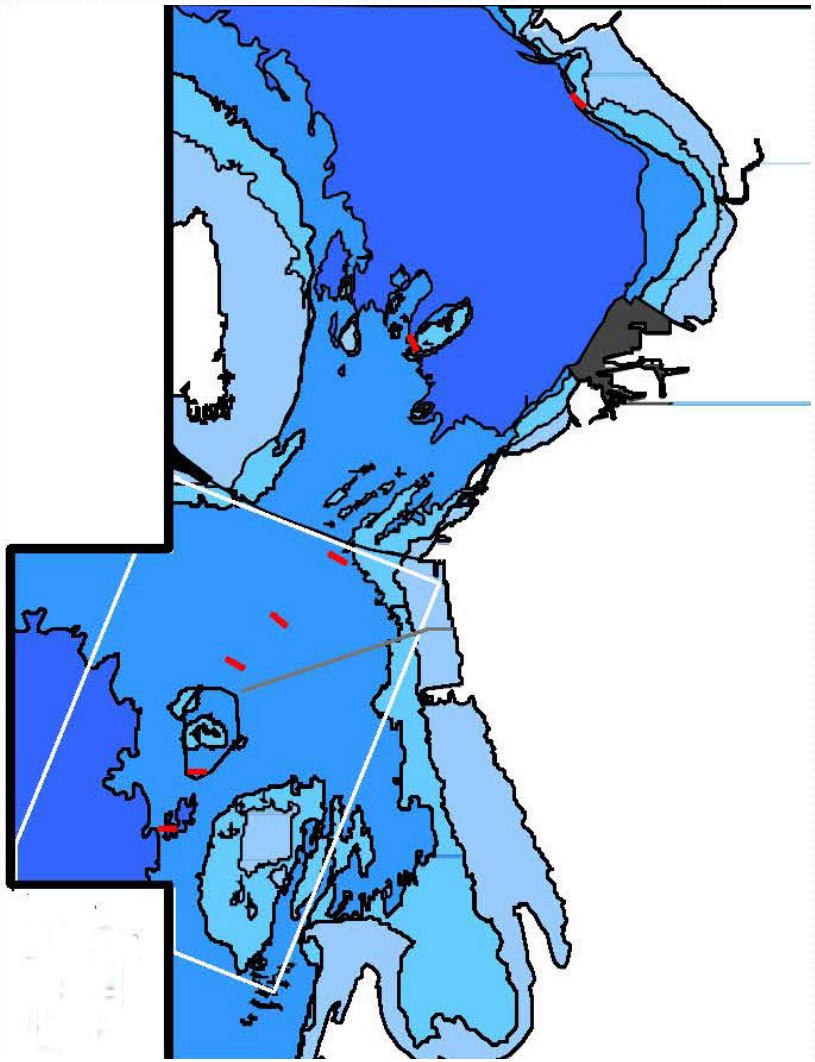

Norway
Finland
Faroe Islands
Sweden
Copenhagen
Denmark
Malmö
Sweden
Denmark
Man, Isle of
Ireland
Netherlands
Poland
Germany
Belgium
Czech Republic
Jersey
Austria
France
Switzerland
Slovenia
Croatia
Monaco
San Marino
Andorra
Italy
Montenegro
Bulgaria
Georgia

Control program Lillgrund

- Birds
- Fish and fisheries
- Bats
- Marine fauna and flora (eelgras and blue mussels)
- Sediment spillage
- Marine archeology
- Monitoring of coastal areas

Base line Construction Operation

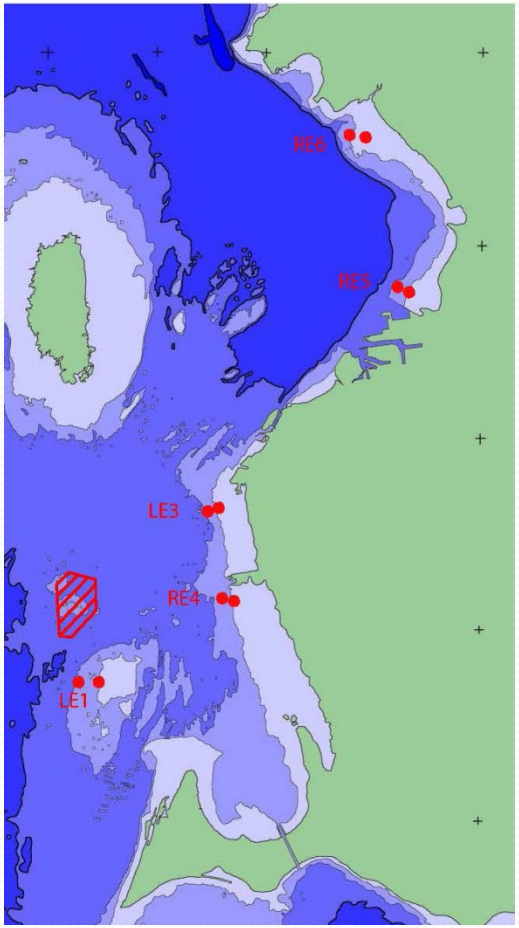
Monitoring of blue mussels



Transects for mapping of blue mussels with video

The areal coverage of Common mussel in the outer impact area should not decrease by more than 25 % compared to the reference areas as an effect of increased sediment spillage from Lillgrund Offshore Wind Farm.

Monitoring of eelgras (Zostera)

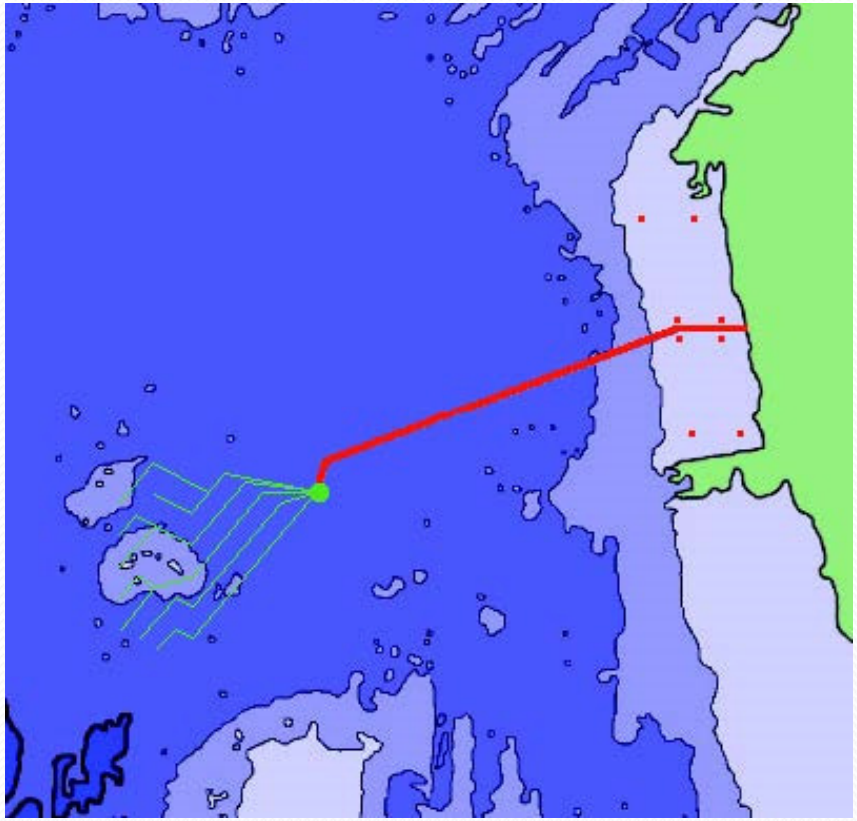


Shoot density, shoot biomass and rhizome carbohydrates were not to decrease by more than 25 % in the outer impact area compared to control areas.

Base-line monitoring 2002 - 2003

Compliance monitoring 2007 -2008

Monitoring of benthic fauna



Monitoring of benthic fauna along the cable to shore:

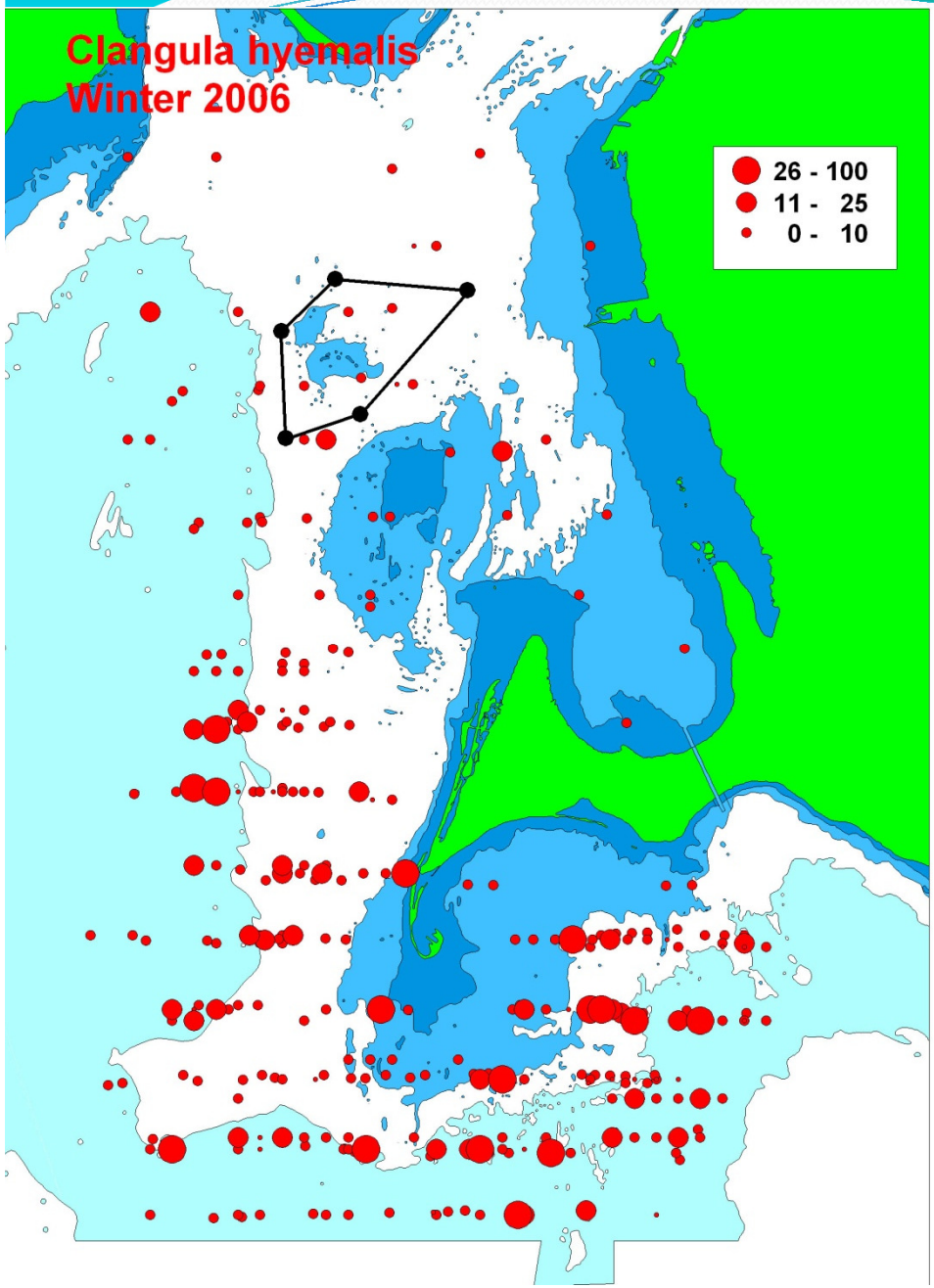
Number of species
Abundance
Biomass

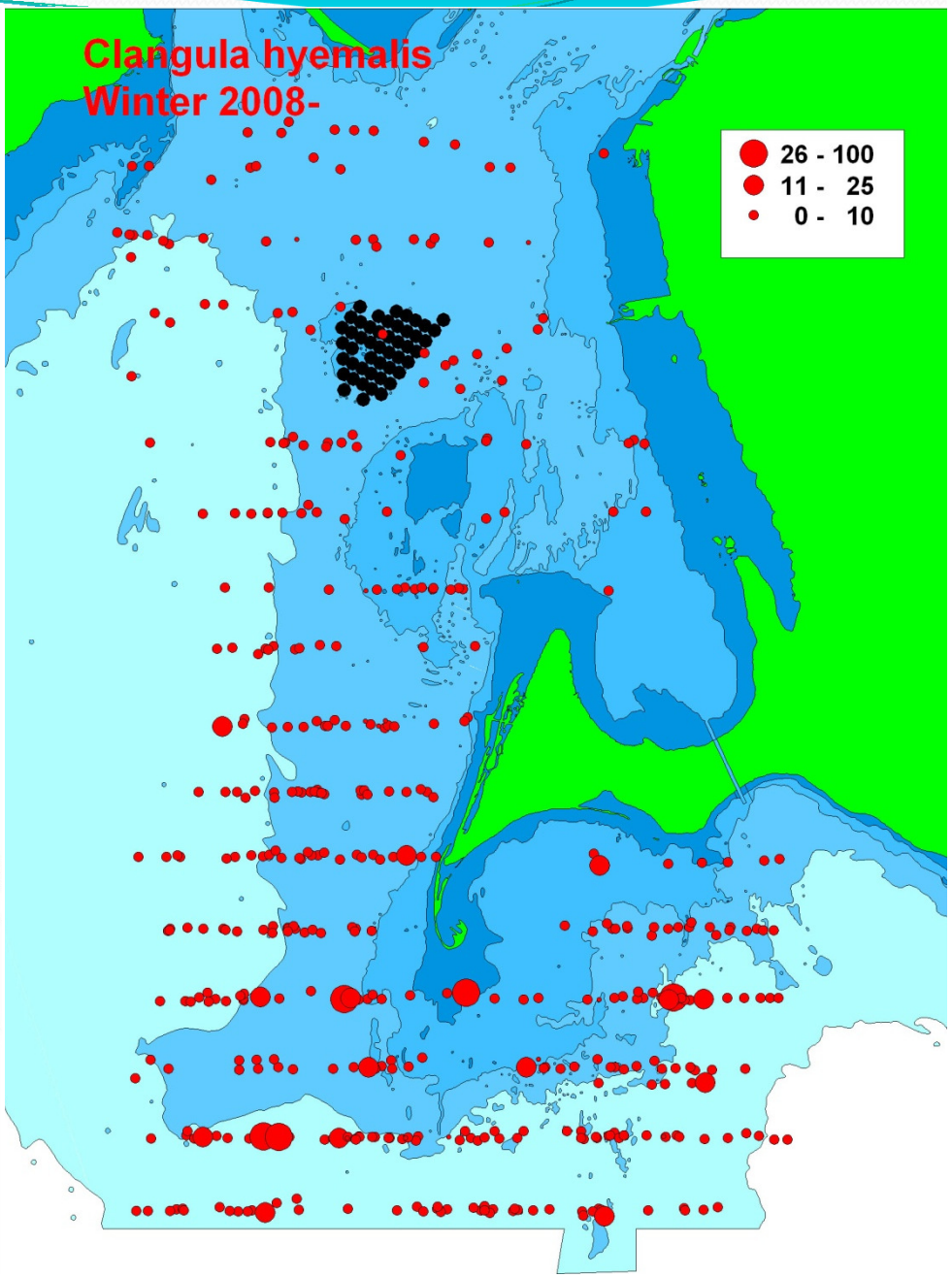
Control Program birds

- Investigations before and after establishment
- Censuses of staging and wintering waterbirds
  Aerial surveys, boat counts
- Radar studies of bird migration
- Study periods
  2001 – 2006
  2008 - 2011

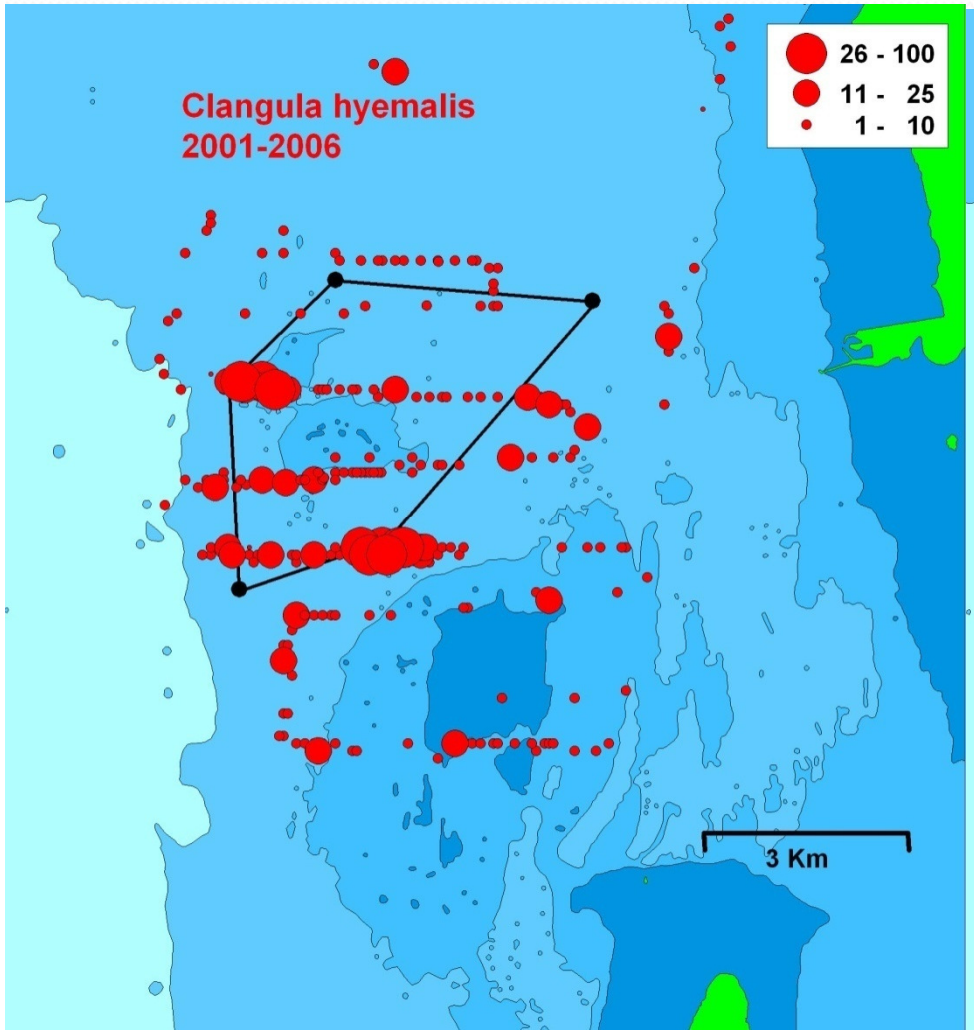

OY-BYZ

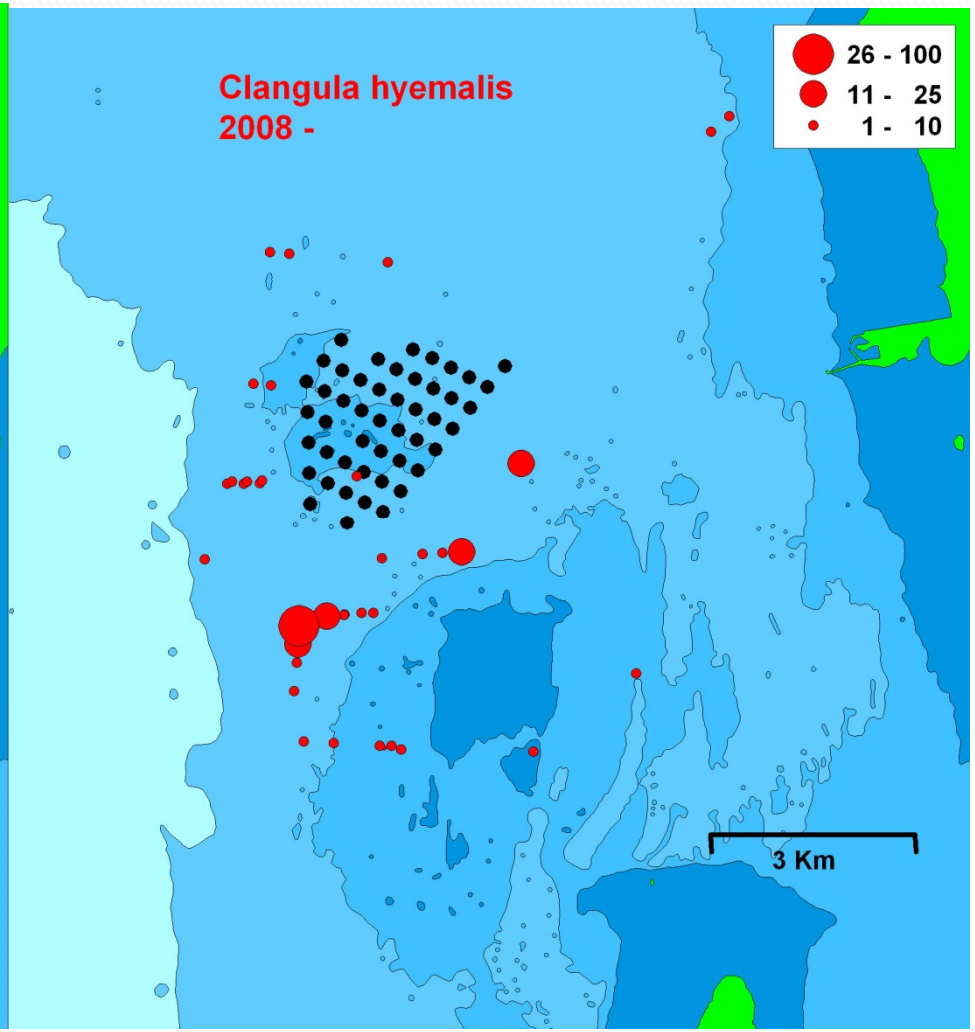

Long-tailed Duck Clangula hyemalis

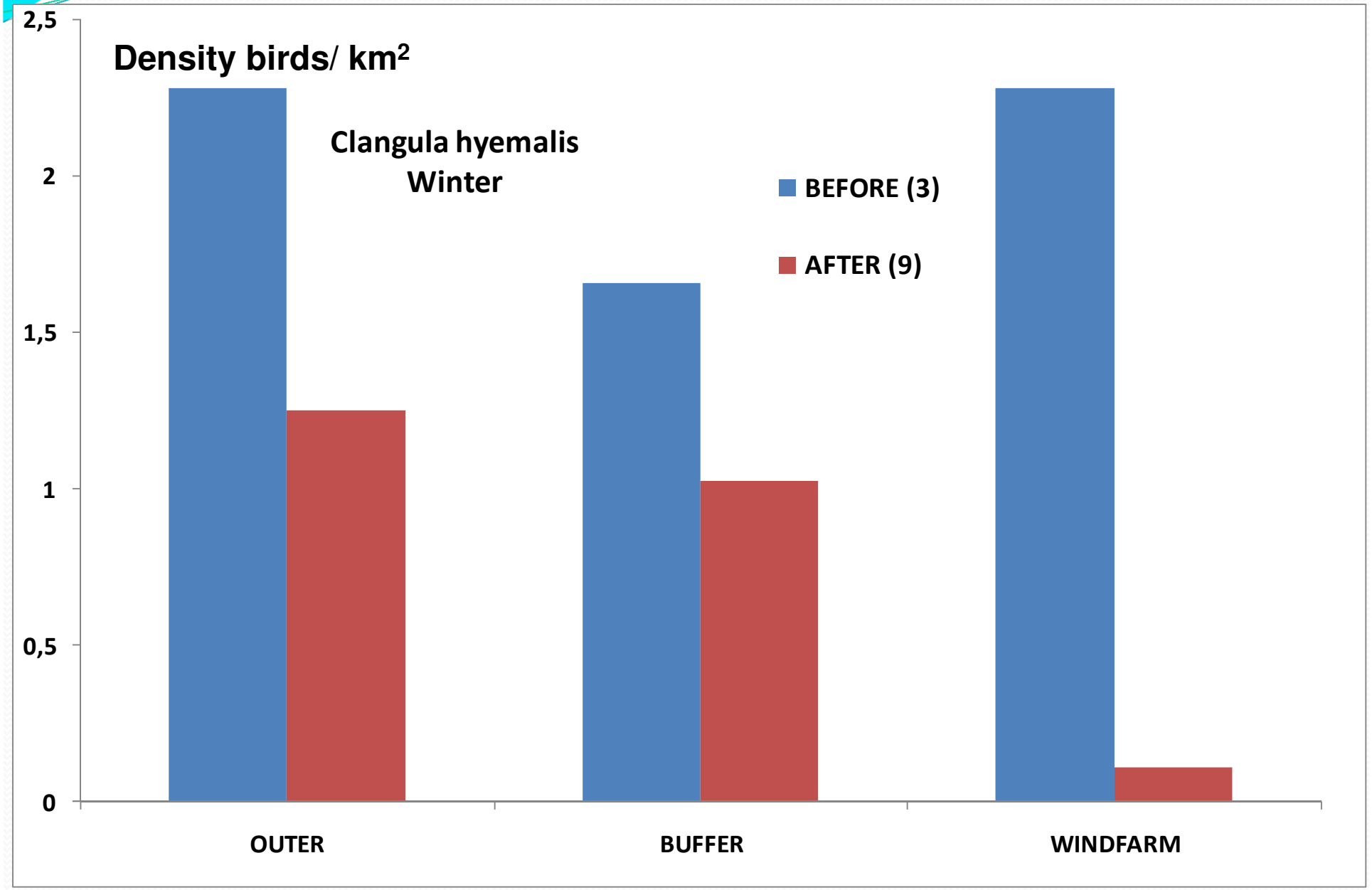

Clangula hyemalis
Winter 2006
26 - 100
11 - 25
0 - 10


Clangula hyemalis
Winter 2008-
26 - 100
11 - 25
0 - 10

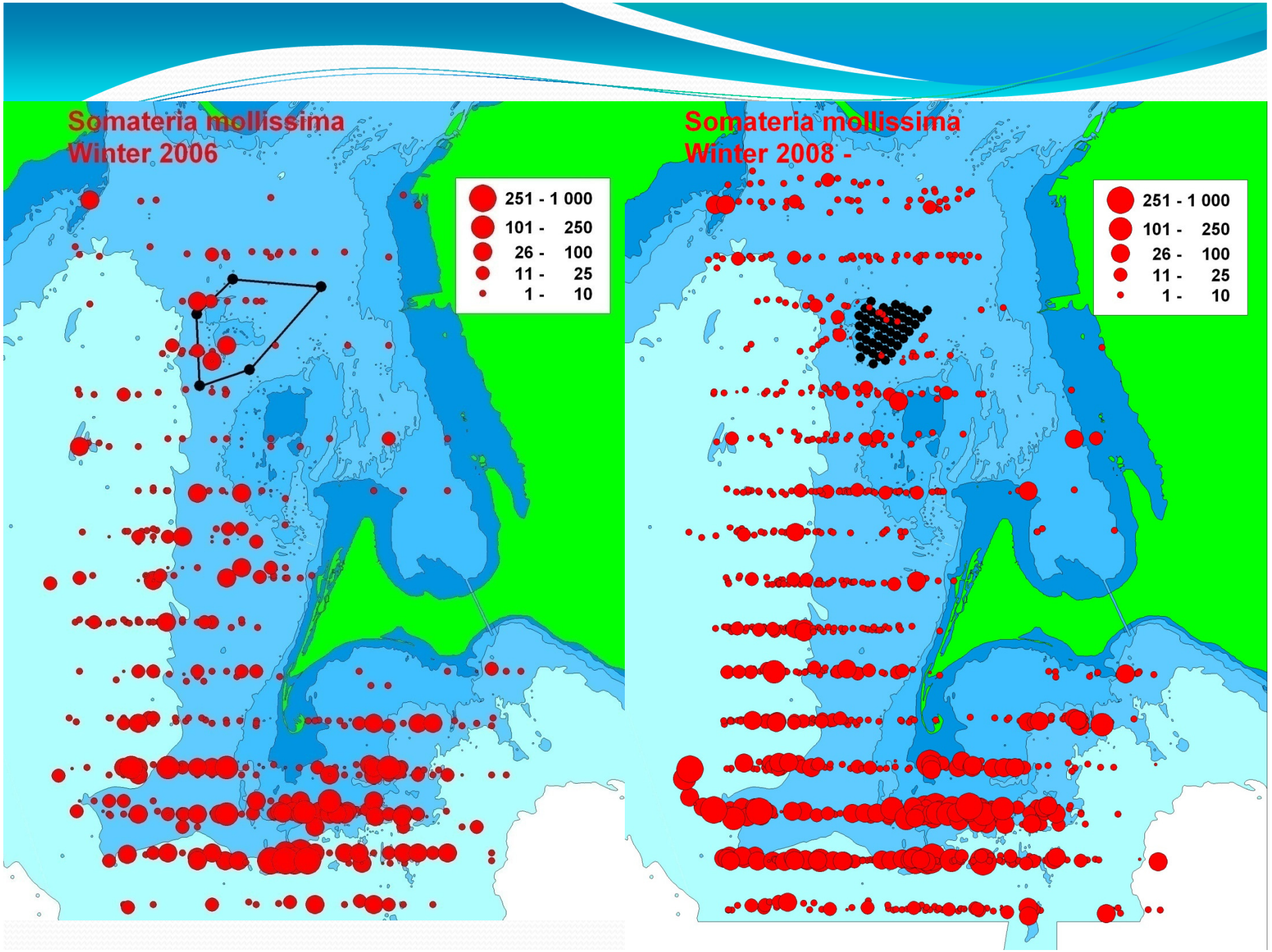
Boat surveys of *Clangula hyemalis*

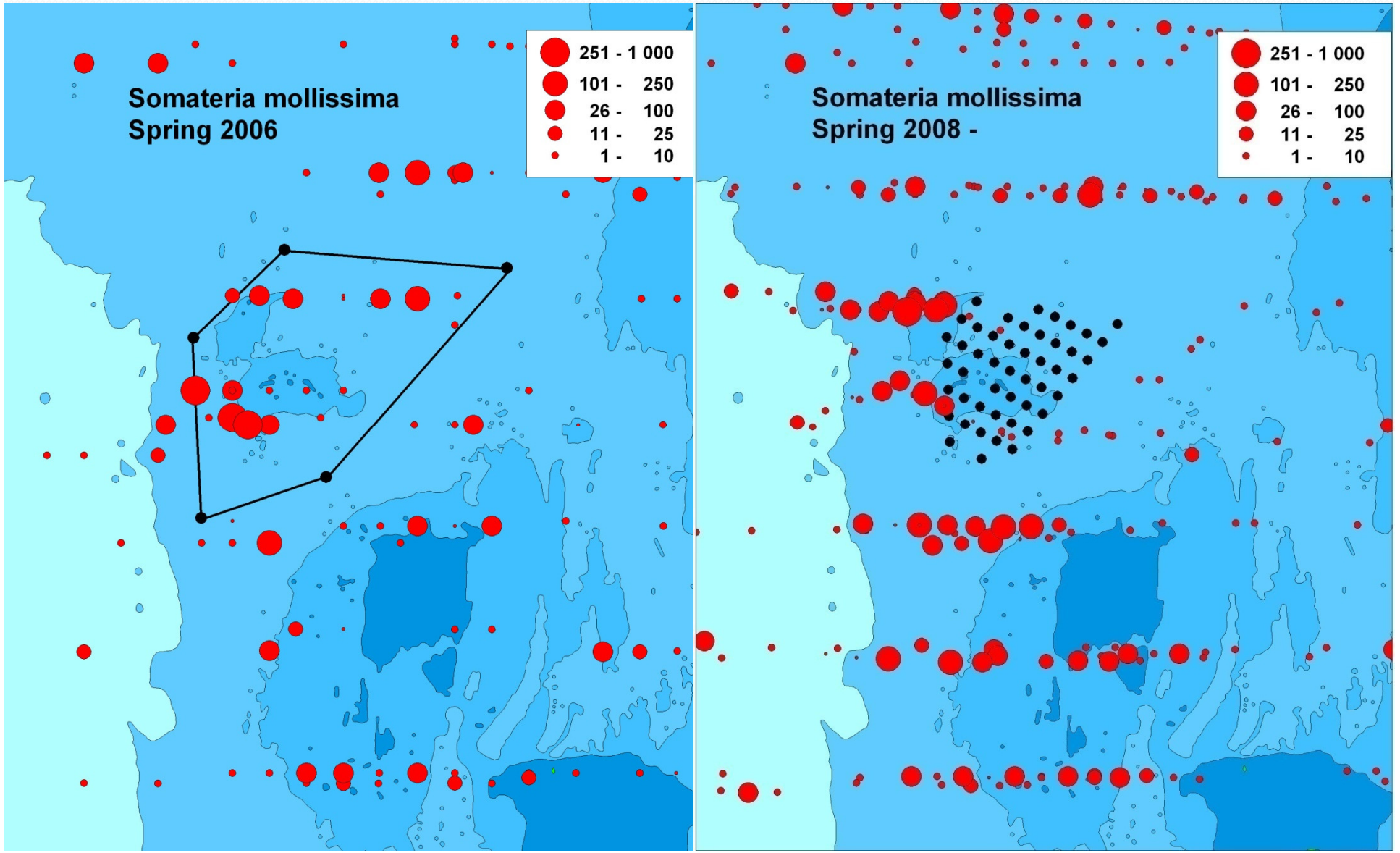


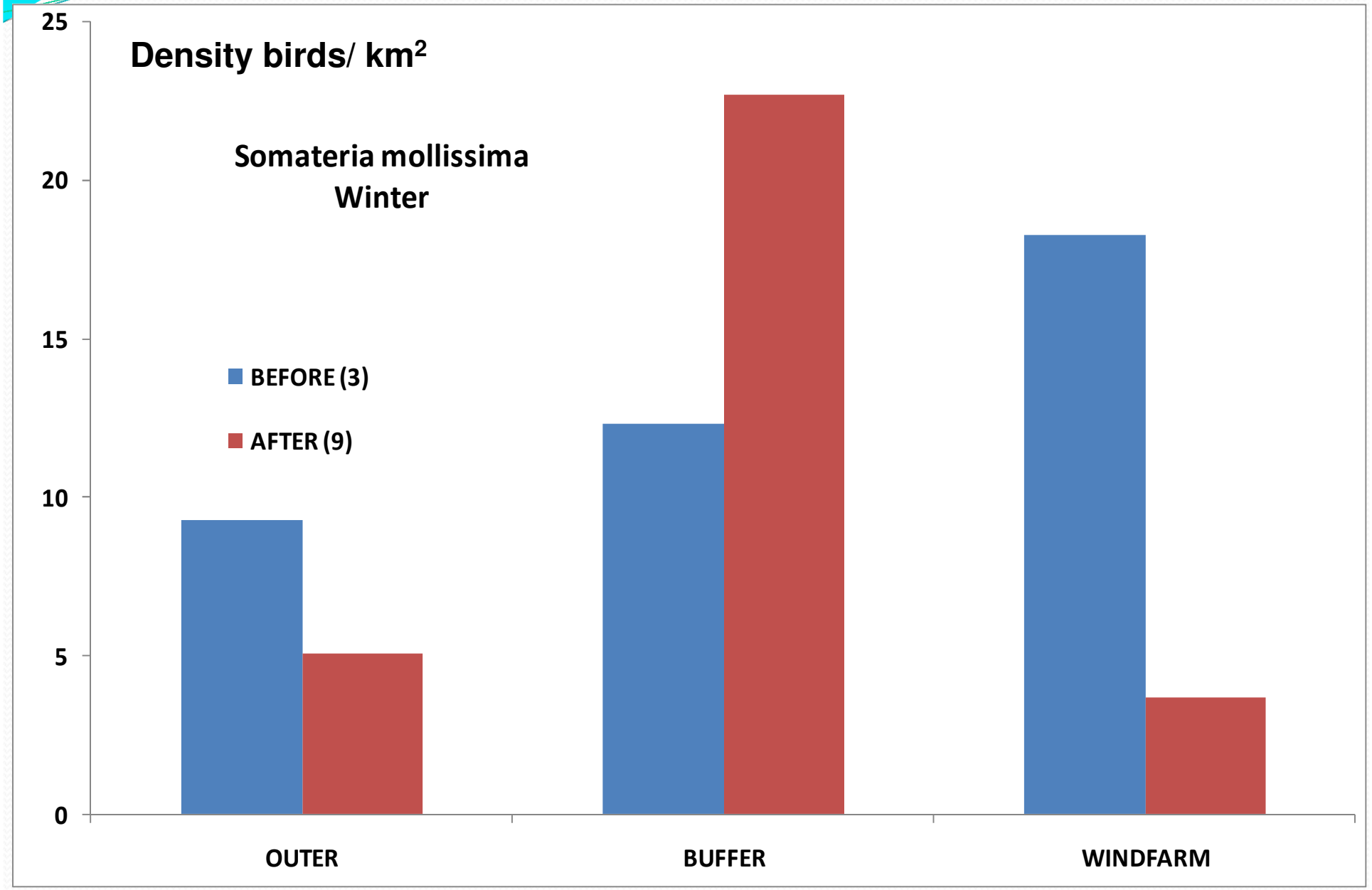


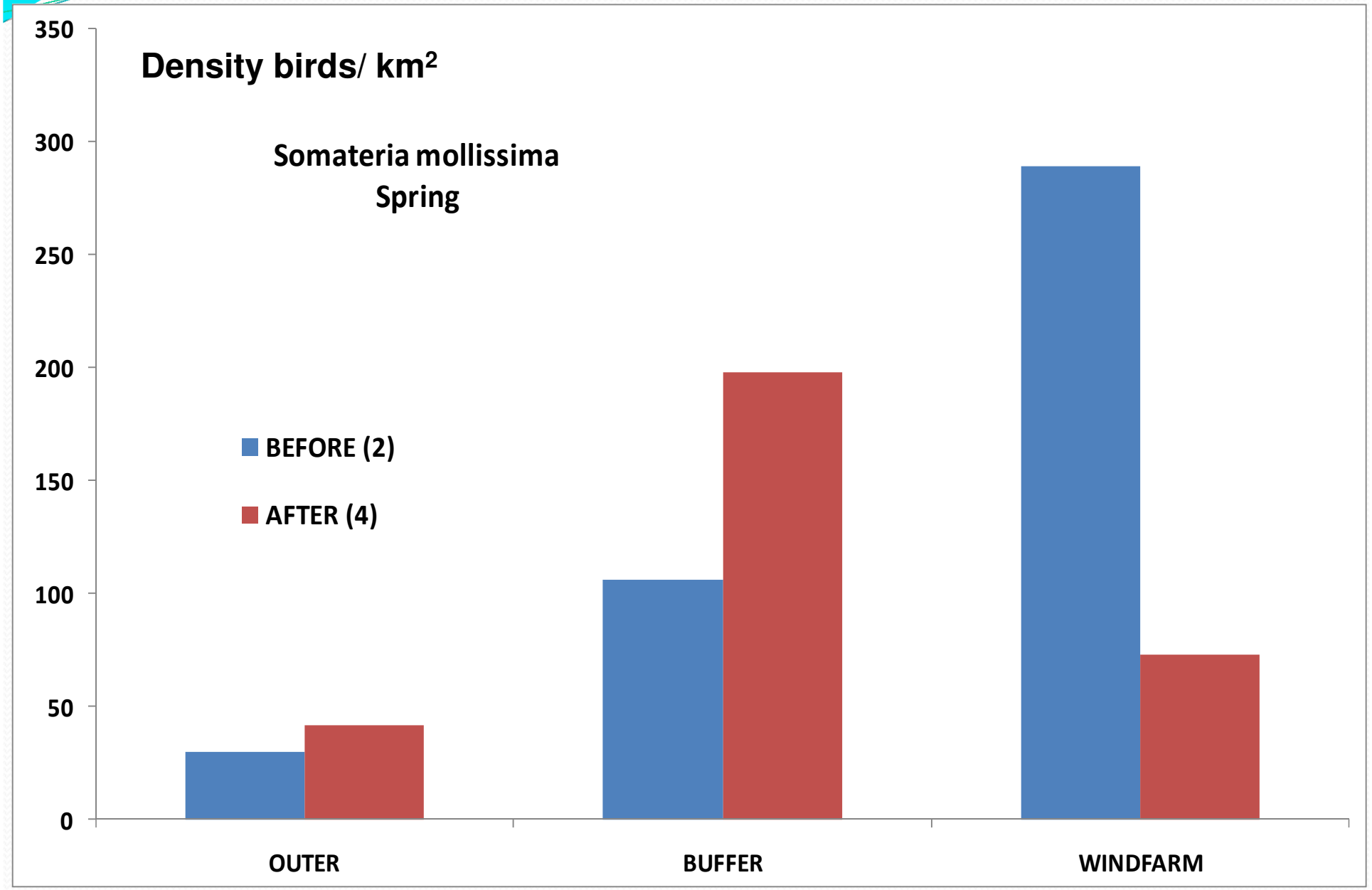

Density birds/ km2
Clangula hyemalis
Winter
BEFORE (3)
AFTER (9)
2,5
2
1,5
1
0,5
0
OUTER
BUFFER
WINDFARM

Eider Somateria mollissima

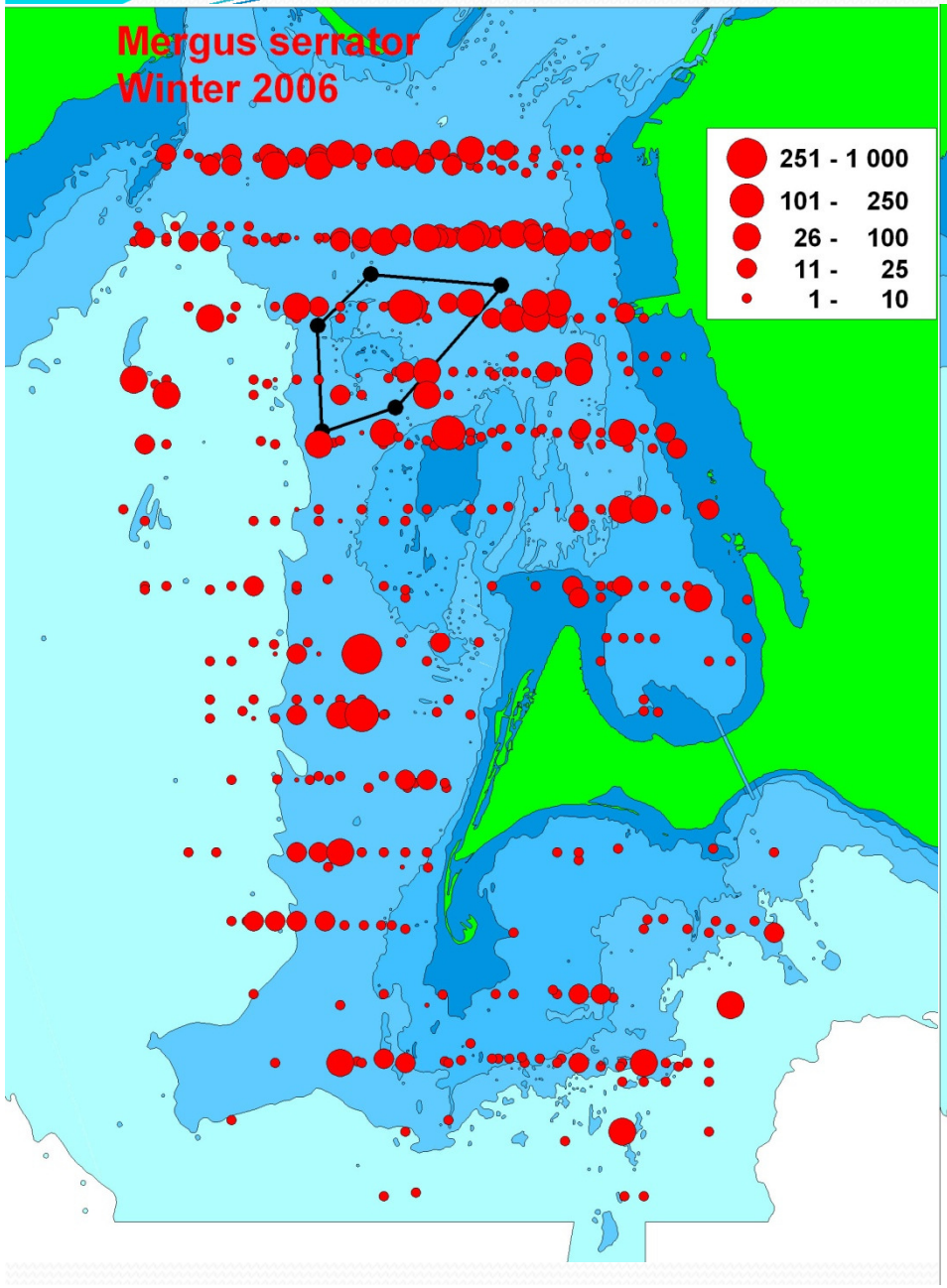

Somateria mollissima
Winter 2006
251 - 1 000
101 - 250
26 - 100
11 - 25
1 - 10
Somateria mollissima
Winter 2008 -
251 - 1 000
101 - 250
26 - 100
11 - 25
1 - 10

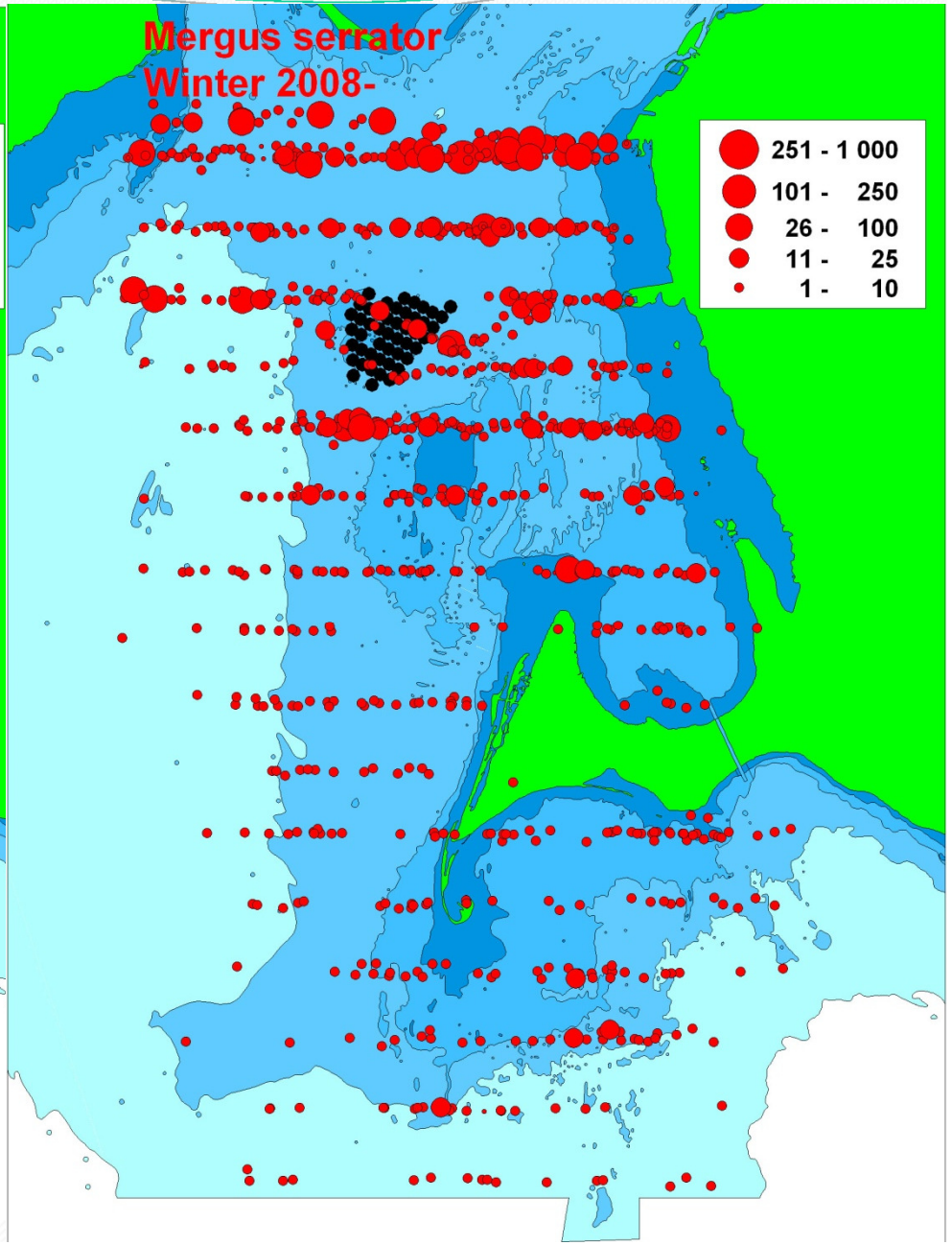

Somateria mollissima
Spring 2006
251 - 1 000
101 - 250
26 - 100
11 - 25
1 - 10
Somateria mollissima
Spring 2008 -
251 - 1 000
101 - 250
26 - 100
11 - 25
1 - 10

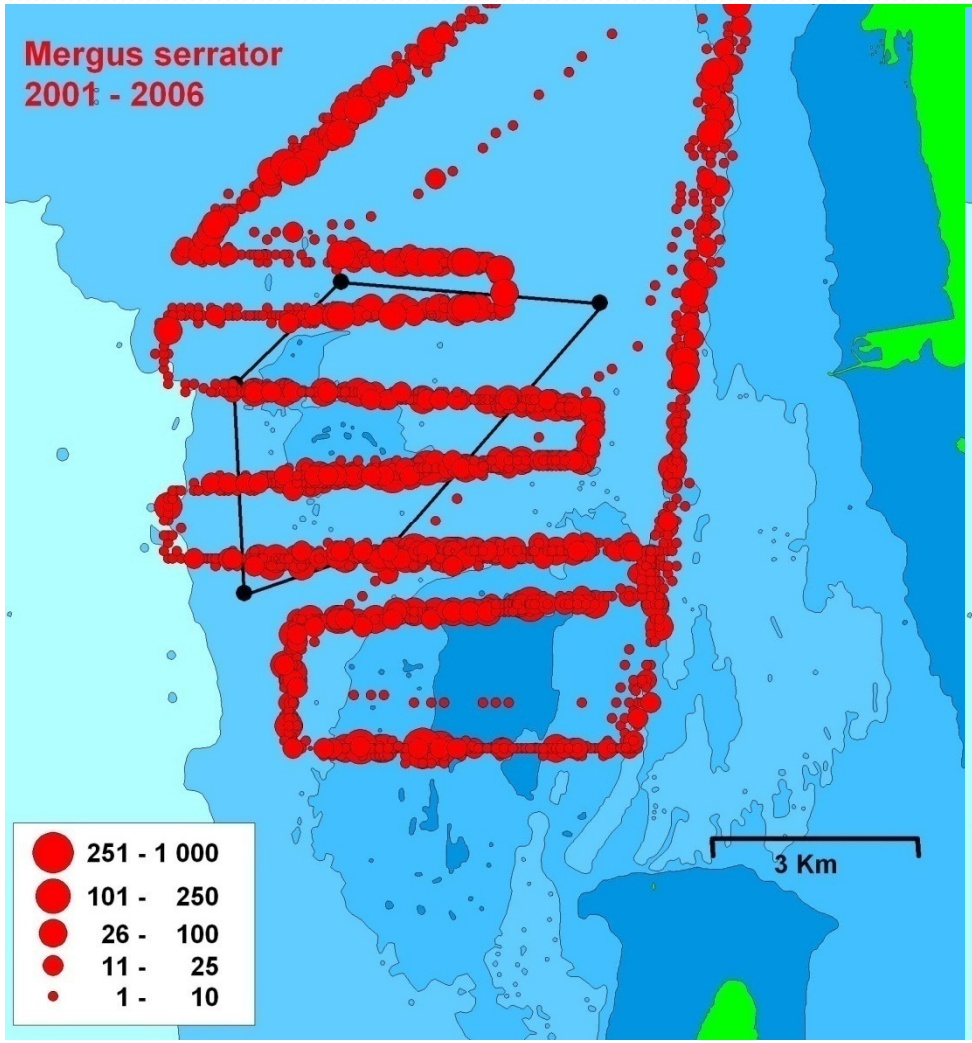

Density birds/ km2
Somateria mollissima
Winter
BEFORE (3)
AFTER (9)
25
20
15
10
5
0
OUTER
BUFFER
WINDFARM

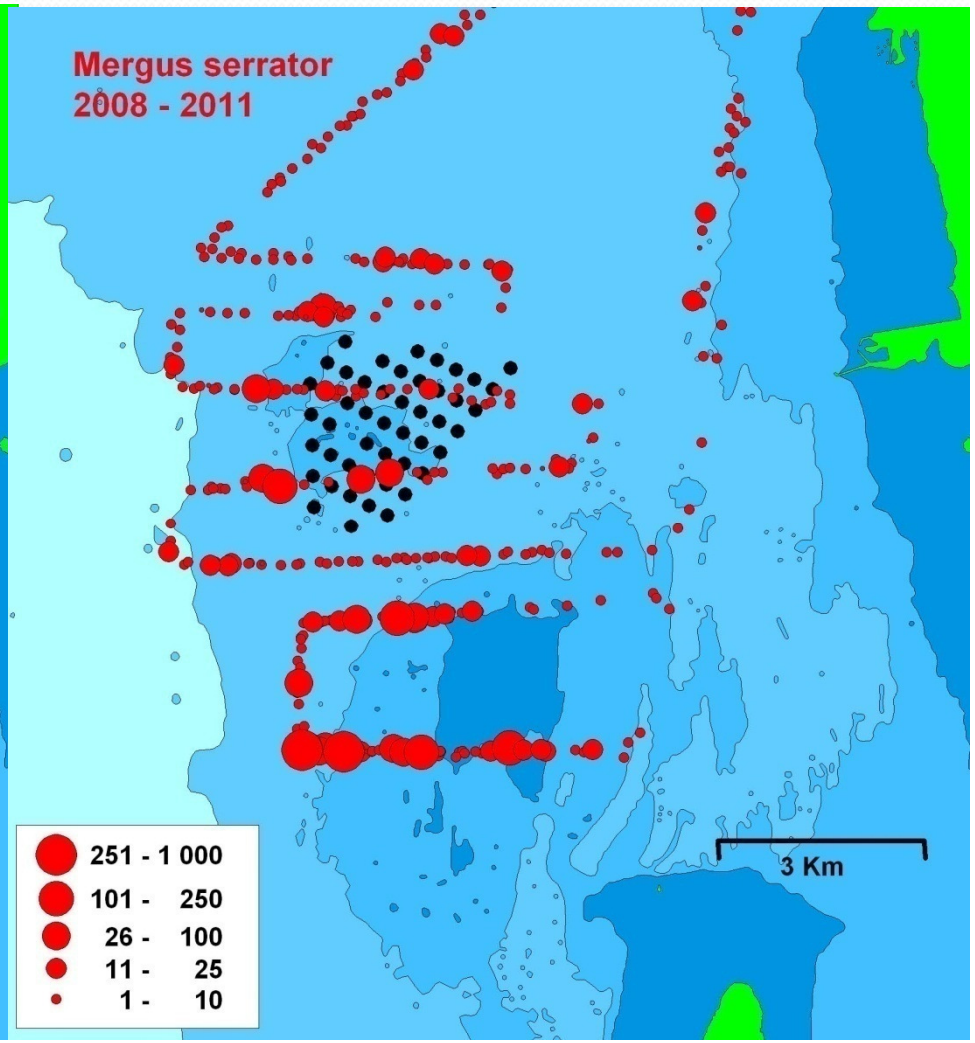

Density birds/ km2
Somateria mollissima
Spring
350
300
250
200
150
100
50
0
BEFORE (2)
AFTER (4)
OUTER
BUFFER
WINDFARM

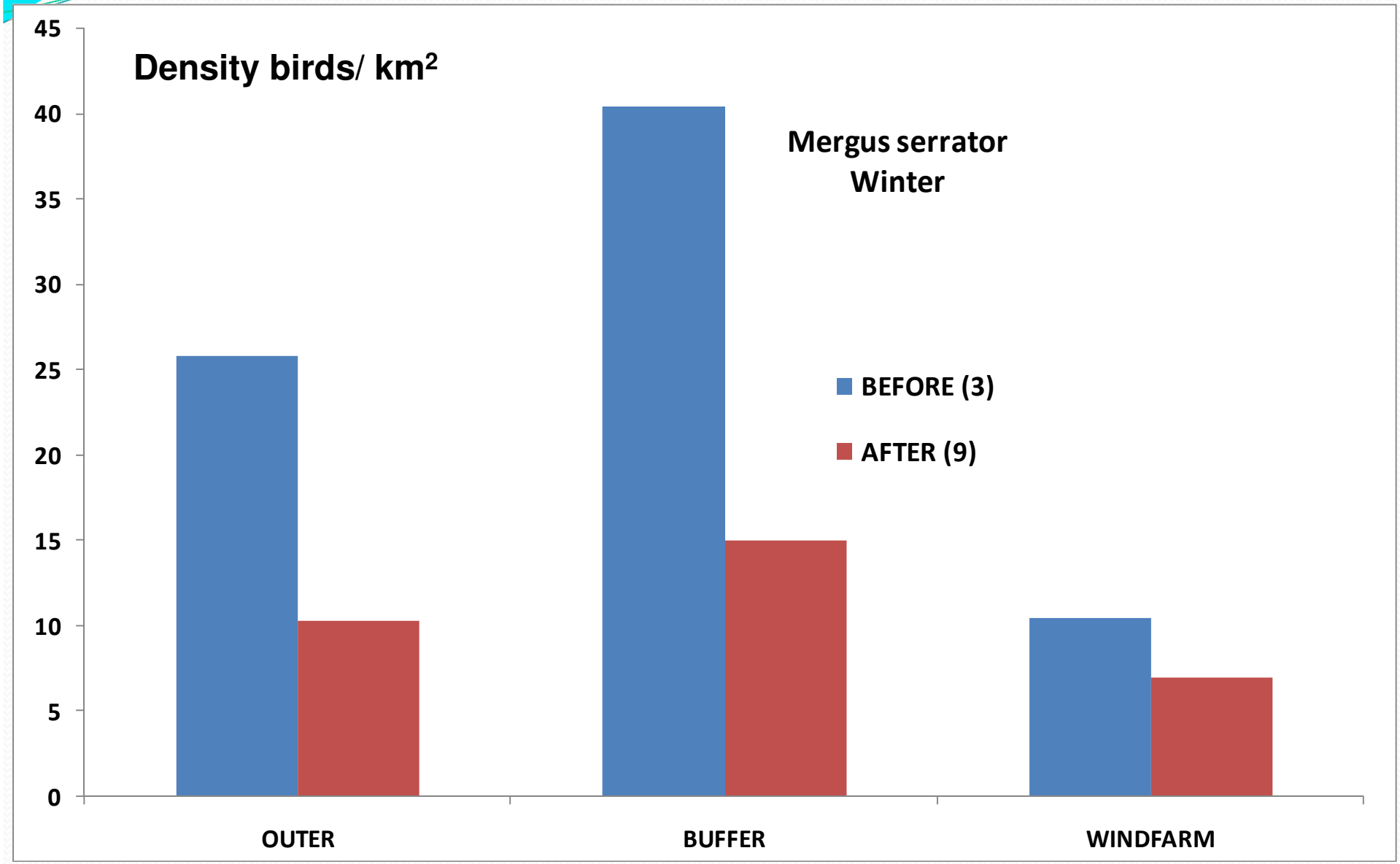
Red-breasted Merganser Mergus serrator


Mergus serrator
Winter 2006
251 - 1 000
101 - 250
26 - 100
11 - 25
1 - 10

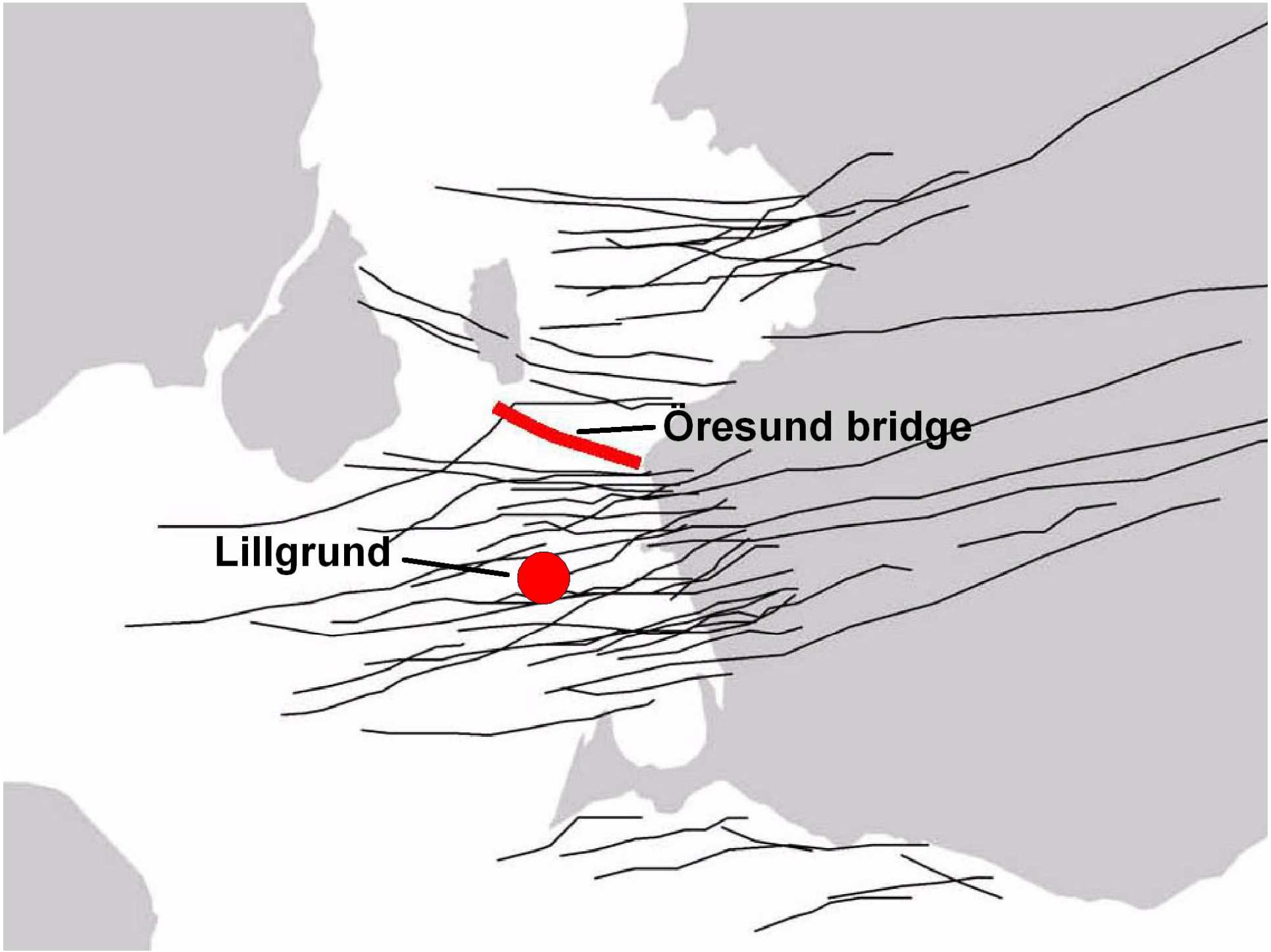

Mergus serrator
Winter 2008-
251 - 1 000
101 - 250
26 - 100
11 - 25
1 - 10

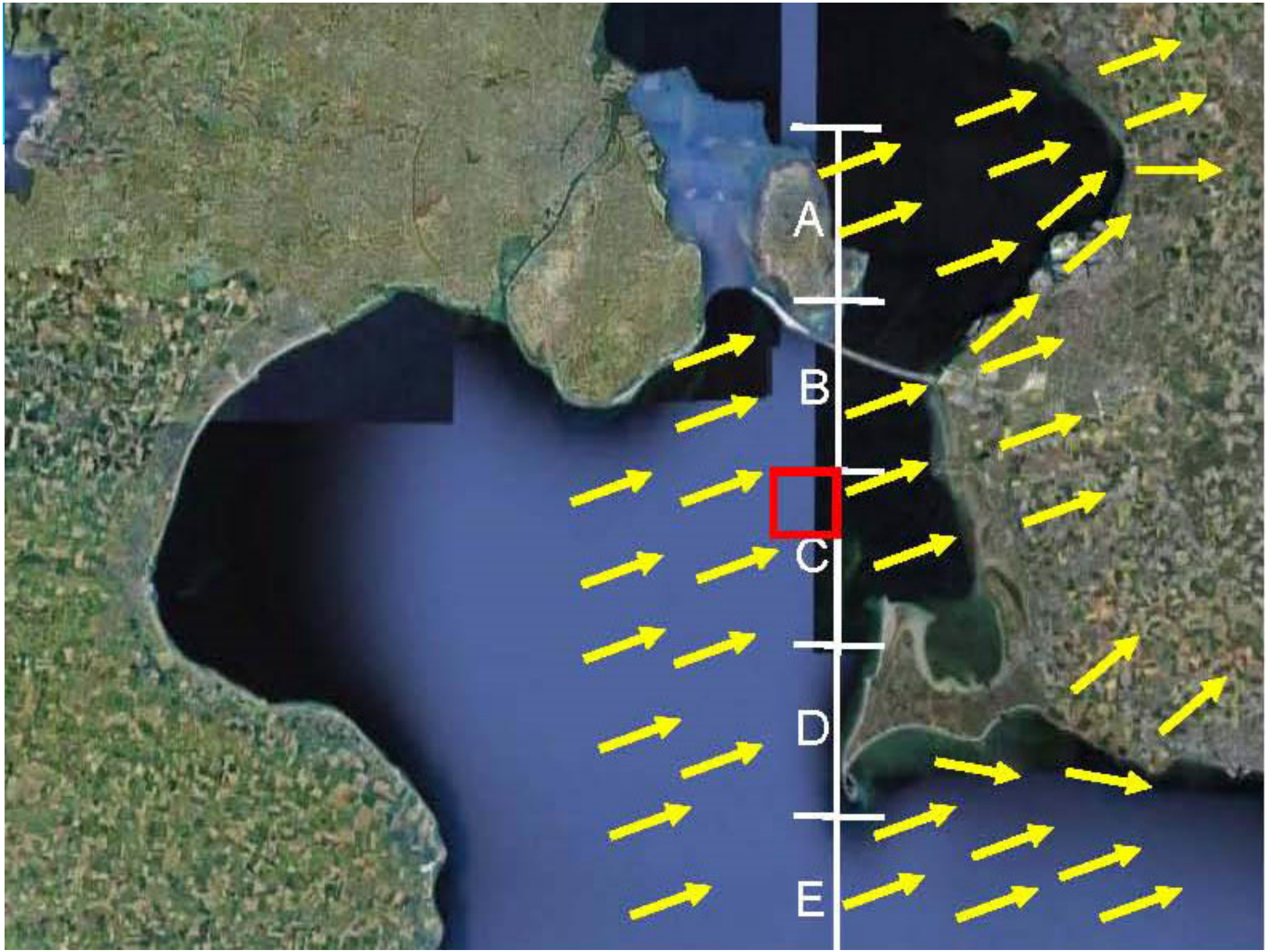

Mergus serrator
2001 - 2006
251 - 1 000
101 - 250
26 - 100
11 - 25
1 - 10
3 Km


Mergus serrator
2008 - 2011
251 - 1 000
101 - 250
26 - 100
11 - 25
1 - 10
3 Km

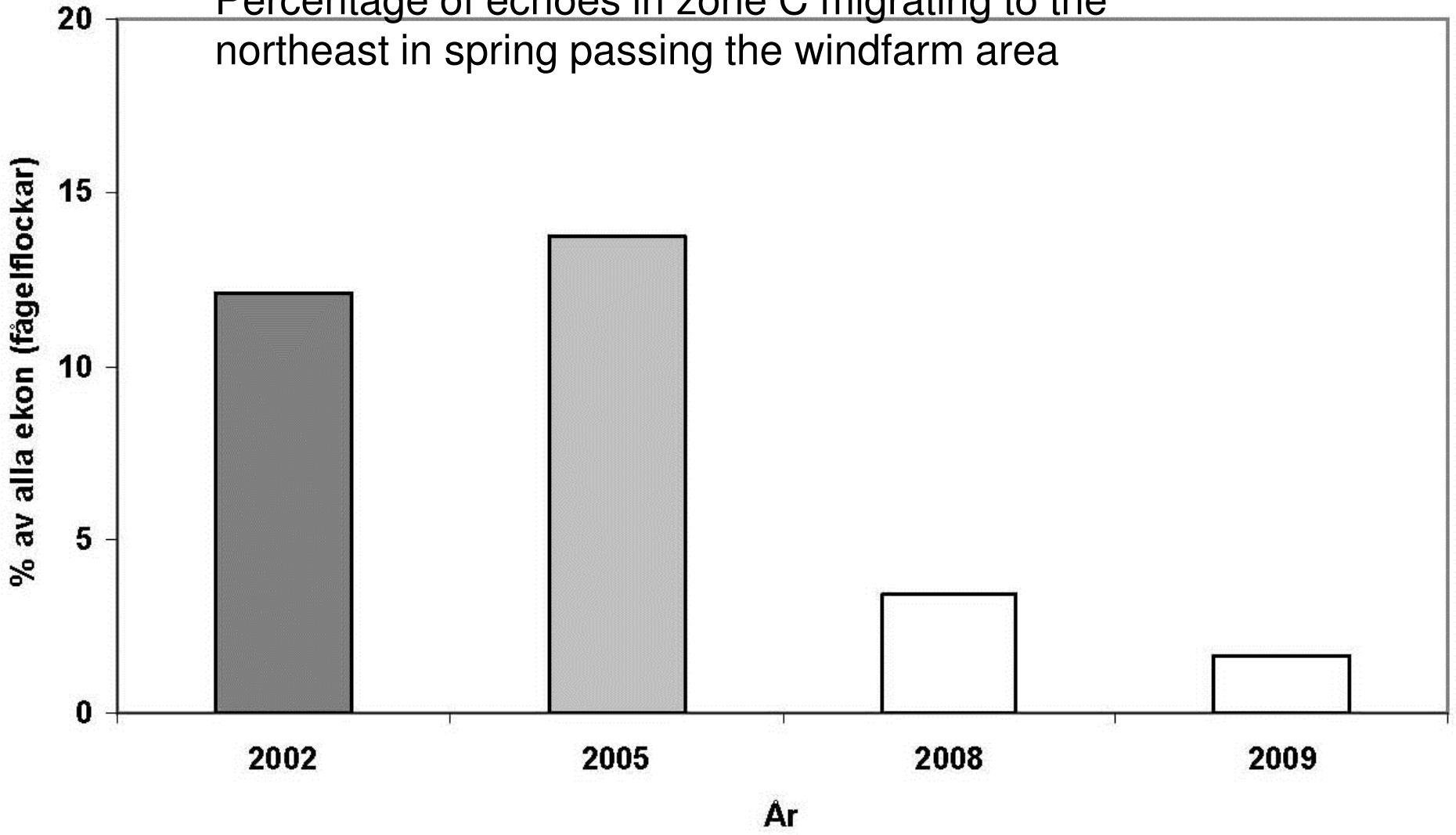

Density birds/ km2
Mergus serrator
Winter
BEFORE (3)
AFTER (9)
45
40
35
30
25
20
15
10
5
0
OUTER
BUFFER
WINDFARM

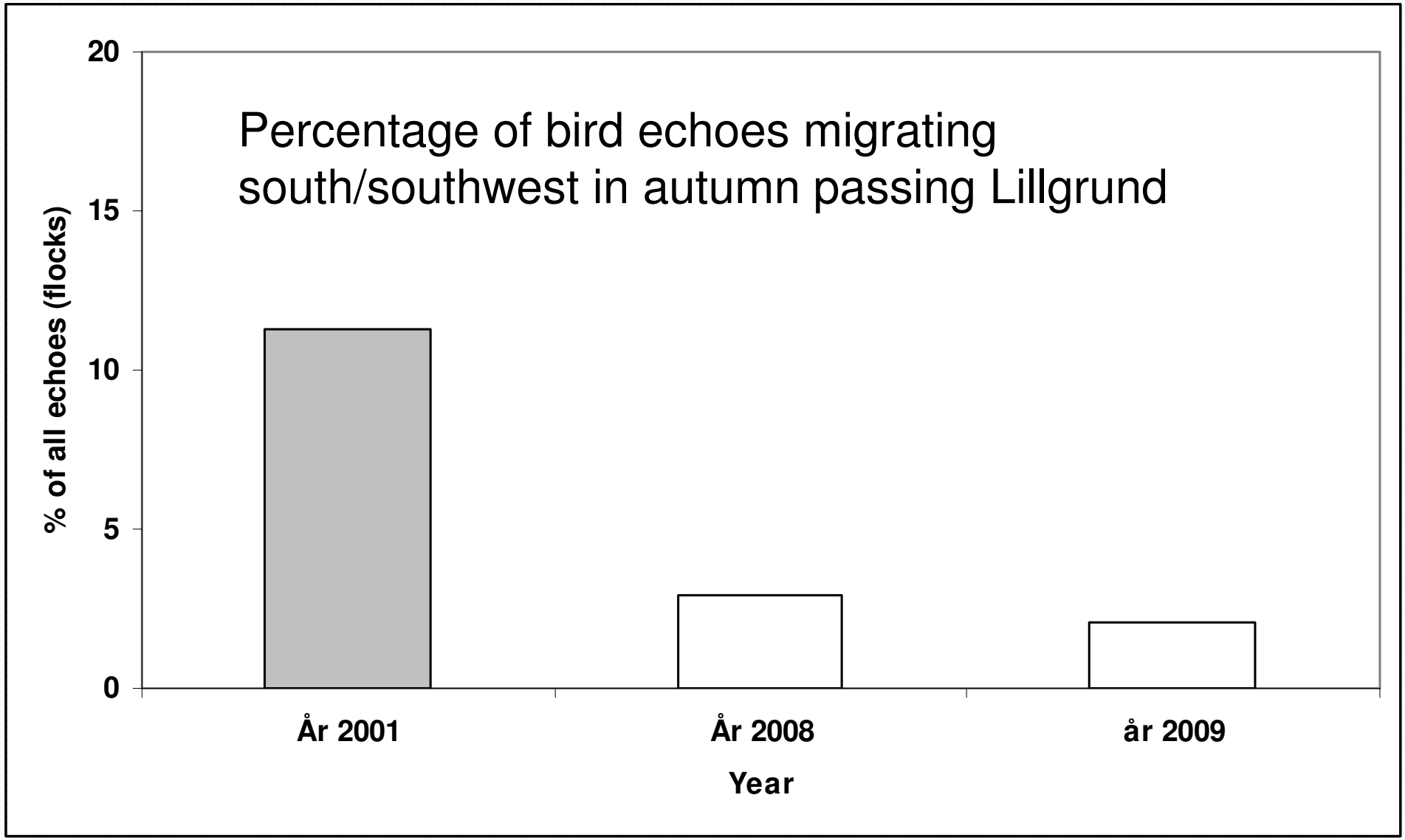
Migration of birds


Öresund bridge
Lillgrund


A
B
C
D
E

Percentage of echoes in zone C migrating to the northeast in spring passing the windfarm area




Percentage of bird echoes migrating south/southwest in autumn passing Lillgrund
% of all echoes (flocks)
20
15
10
5
0
År 2001
År 2008
år 2009
Year

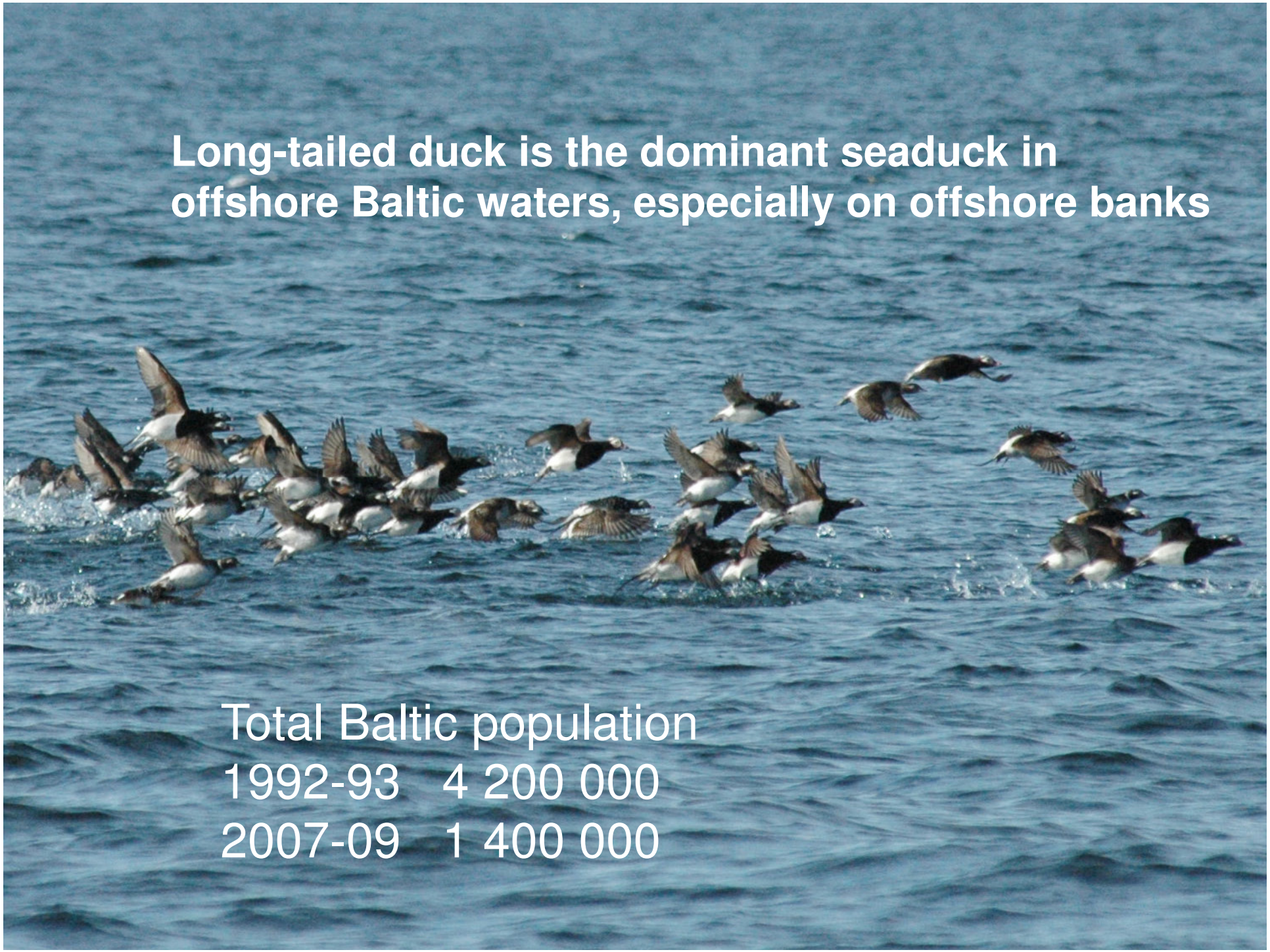
Conclusions Birds at Lillgrund:

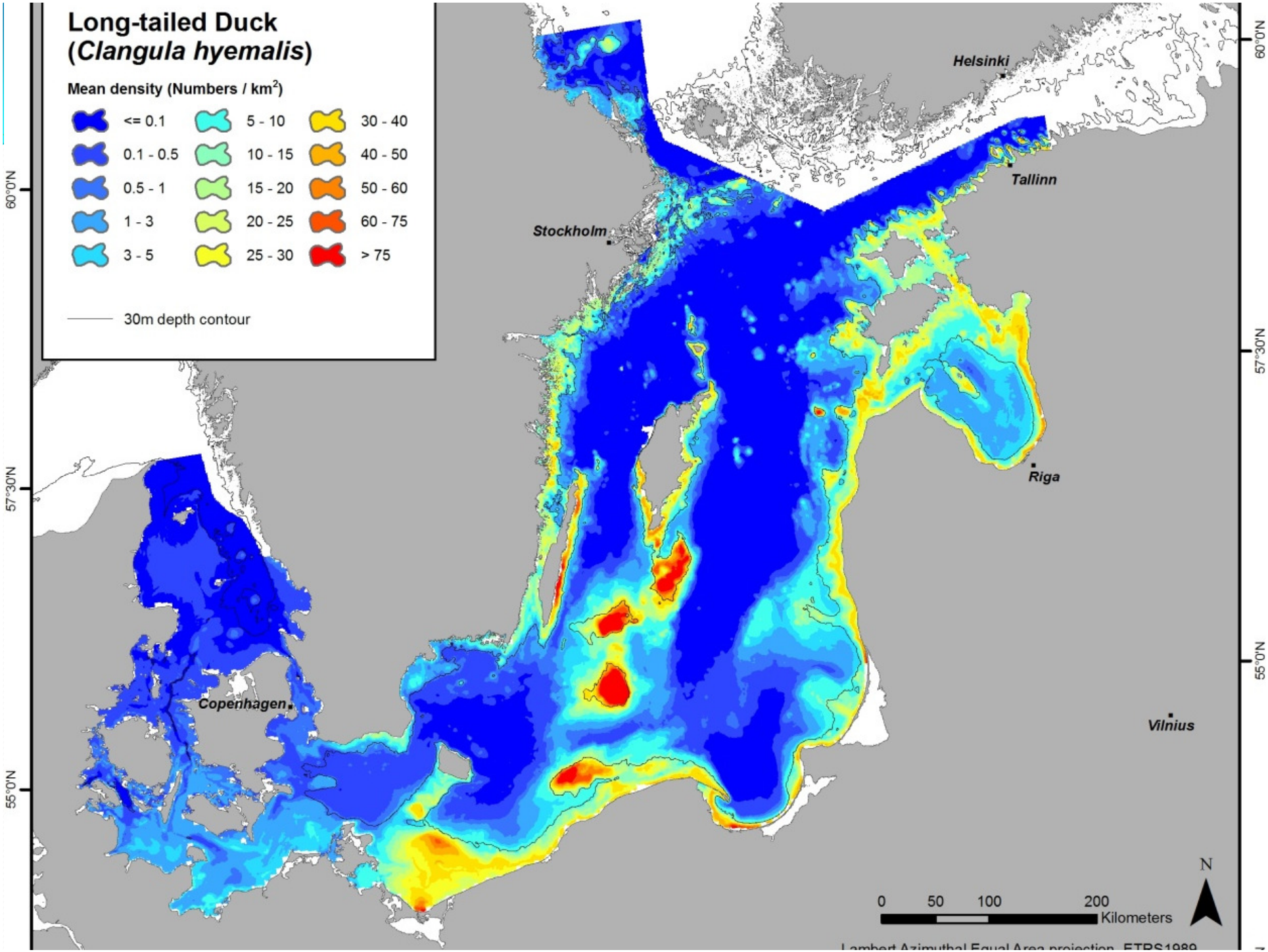
- Small avoidance effects of Eider and Long-tailed Duck (obs small numbers of LtD)
- Habituation of Eiders after first three years
- Unclear effects on Red-breasted Merganser (possible effect during first year)
- Migrants avoided the actual windfarm to a large extent
- No significant barrier effects

Birds and offshore windfarms in the Baltic
Conflict areas

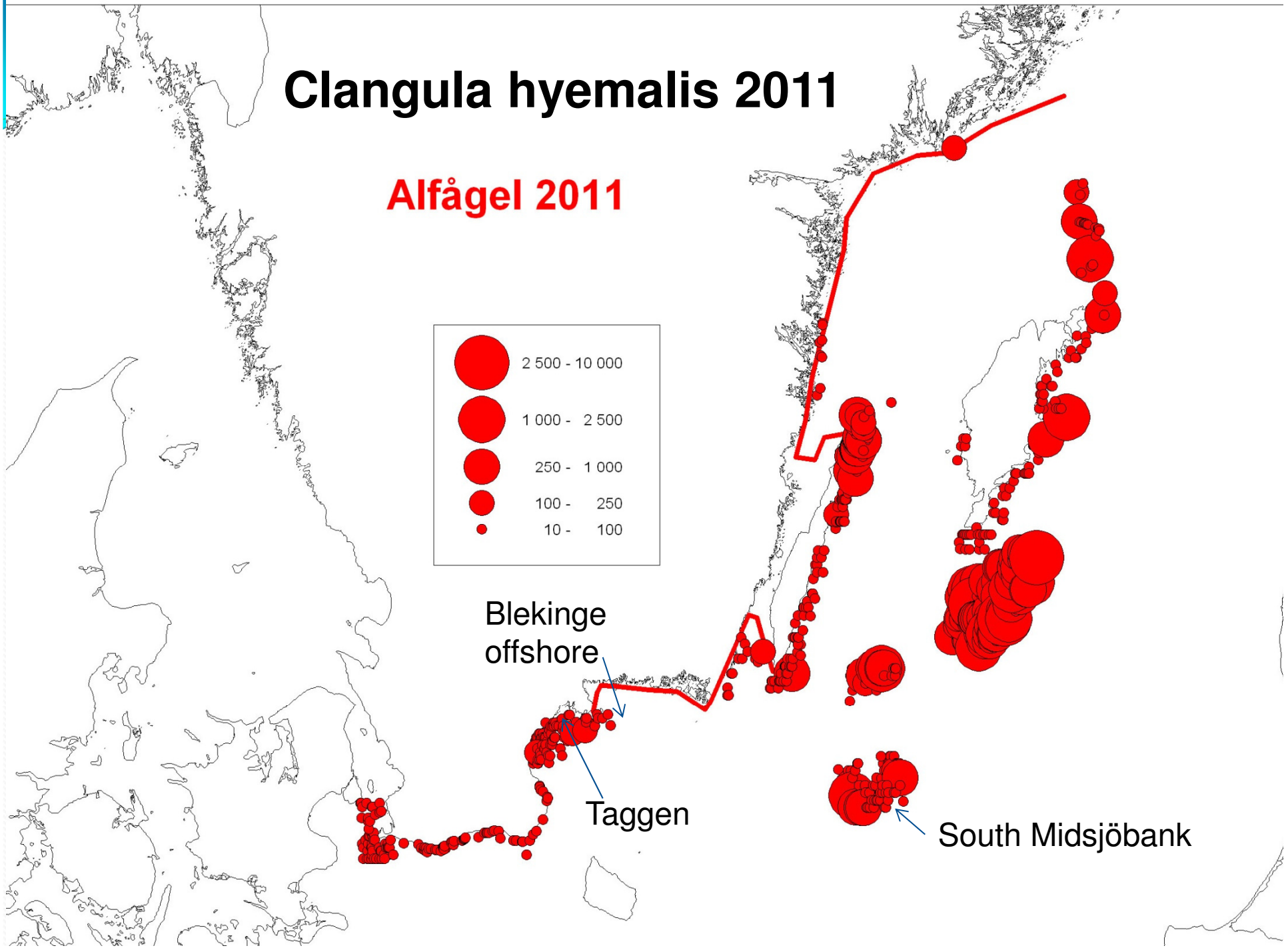
- Offshore banks are the most important feeding areas for Long-tailed Ducks

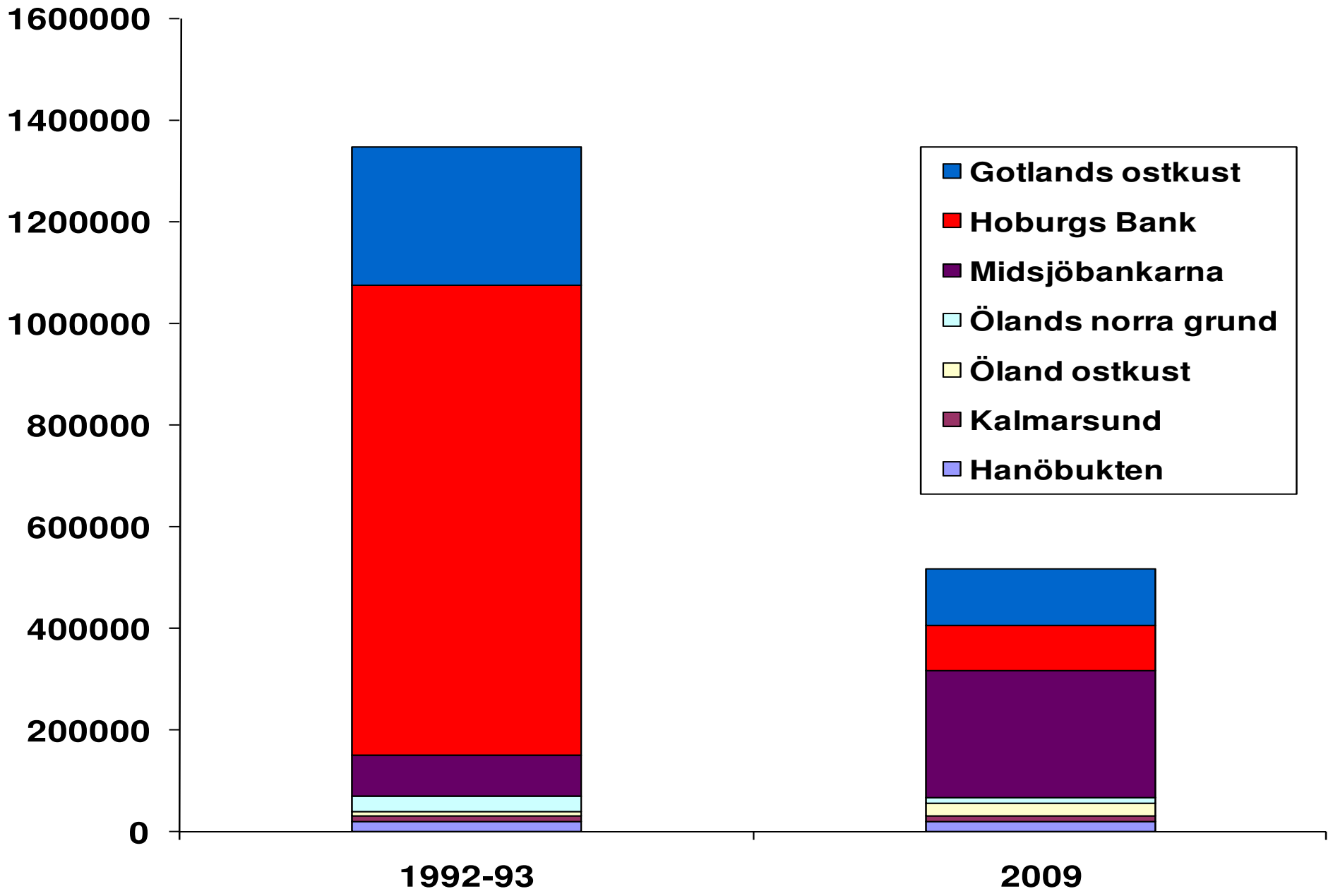
- Offshore banks have a sutiable depth for windfarms


Long-tailed duck is the dominant seaduck in offshore Baltic waters, especially on offshore banks
Total Baltic population
1992-93 4 200 000
2007-09 1 400 000


Long-tailed Duck
(Clangula hyemalis)
Mean density (Numbers / km2)
<= 0.1
0.1 - 0.5
0.5 - 1
1 - 3
3 - 5
5 - 10
10 - 15
15 - 20
20 - 25
25 - 30
30 - 40
40 - 50
50 - 60
60 - 75
> 75
30m depth contour
Helsinki
Tallinn
Stockholm
Riga
Copenhagen
Vilnius
60°0'N
57°30'N
55°0'N
0
50
100
200
Kilometers
N
Lambert Azimuthal Equal Area projection, ETRS1989

Clangula hyemalis 2011

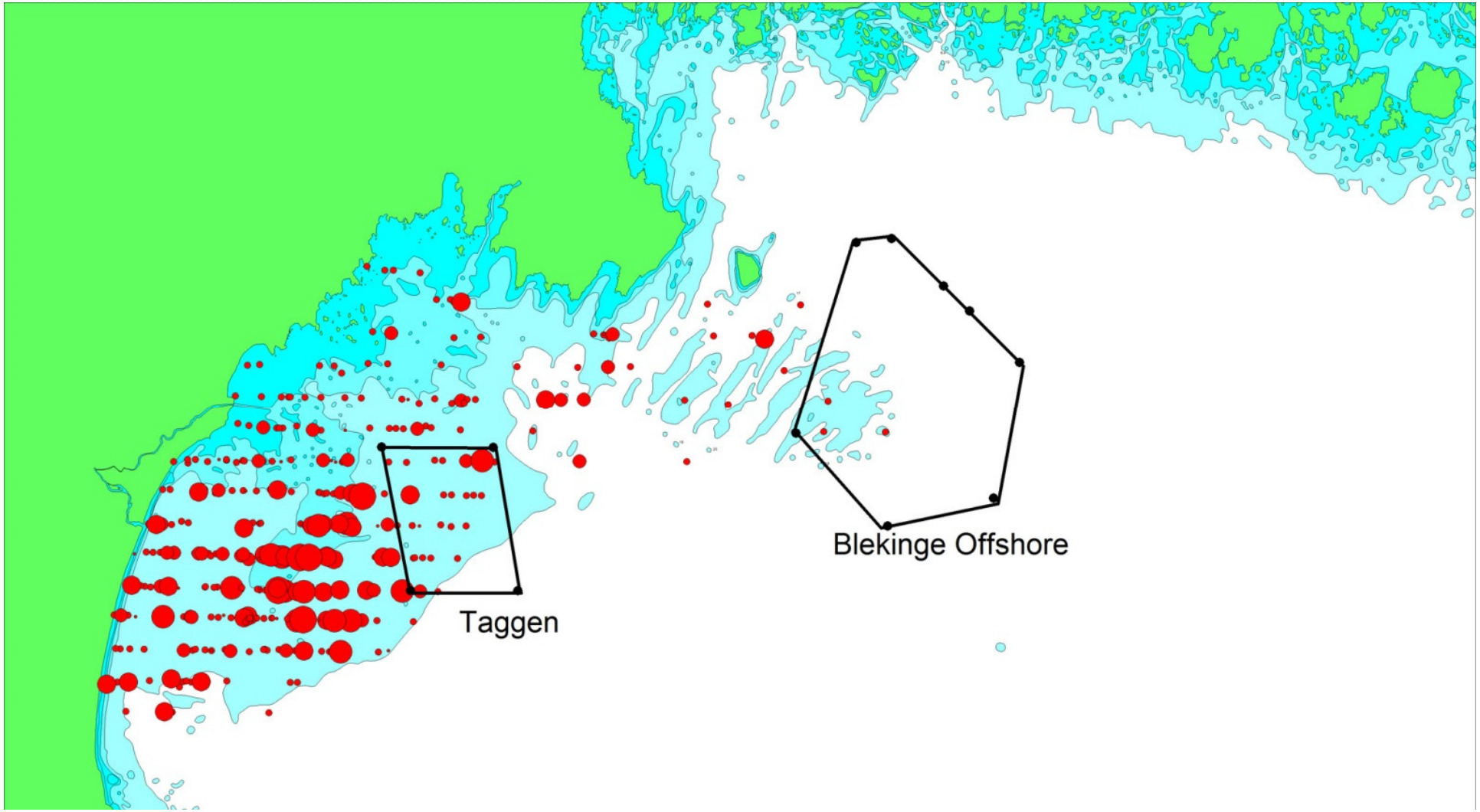


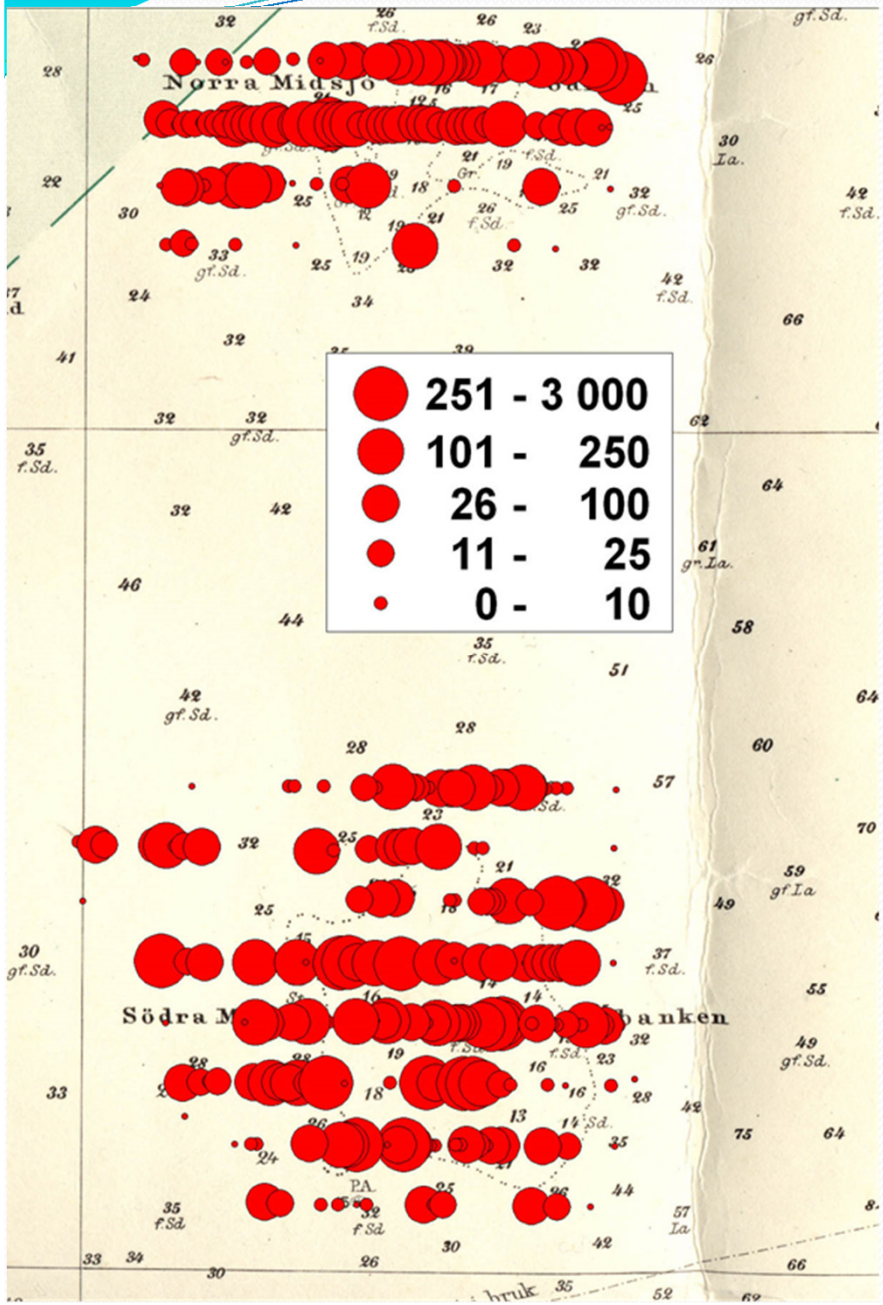

1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
1992-93
2009
Gotlands ostkust
Hoburgs Bank
Midsjöbankarna
Ölands norra grund
Öland ostkust
Kalmarsund
Hanöbukten

Windfarms on planning stage in relation to marine birds

Windfarm	Importance for birds		Studies on birds	
	Staging/Winter	Migration	Staging/Winter	Migration
Kriegers flakk	Moderate	Moderate	Yes	Yes
Taggen	Important	Important	No	Prel report
Blekinge Offshore	Not important	Important	Yes	Prel report
Midsjö Bank	Important	Not important	Yes	Prel report
Finngrunden	Moderate	Important	Yes	Yes

Hanöbukten :
wind farms and Long-tailed Ducks





Clangula hyemalis
Midsjö banks

Estimated totals on the banks			
	2005	2009	2010
North		76000	74000
South	160000	137000	132000
		213000	206000

Total estimated population for the Baltic (2009): 1 400 000

Problems with EIA and offshore wind farms: birds

- 1. Lack of agreed principles for what should be included in an EIA
- 2. Lack of agreed routines of how to evaluate and what to demand of EIAs from the authorities issuing permits.

- Lack of overall planning. E. g. known IBAs and other areas of conservation concern should be taken into account at an early stage of planning.

Recommendations for EIA: birds

- 1. Initial judgement of proposed area for a development of a wind farm etc. using available large scale surveys of the areas such as SOWBAS, national surveys and information on migration papperns.
- 2. Base-line studies including
  a) Censuses of staging/wintering birds
  b) Studies of bird migration
- 3. Standardized methods should be used in 2. Base – line studies are to be included in control programs.

Control programs for birds

- 1. 3 years before and 3 years after the construction phase
- 2. Detailed program based on base-line studies.
- 3. Surveys of staging/wintering birds
  a) Aerial and/or boat surveys (line transects)
  b) Establish occurence of birds in the impact area, buffer zone and a more distant reference area
- 4. Migration studies by radar and visual observations


Thank you for your attention!!