BALANCE

Application of pelagic habitat models – a spatial management approach

BALANCE Conference

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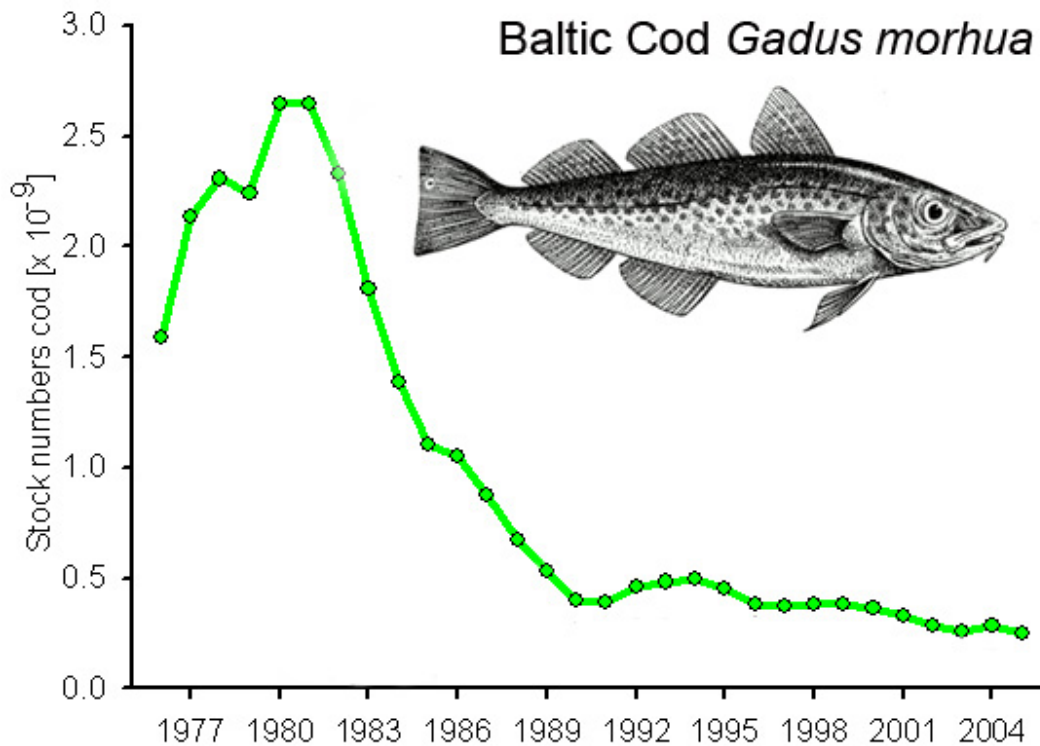**Sørensen, T.K. & Vestergaard, O.**

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Denmark
Estonia
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DTU Danmarks Tekniske Universitet

Danish Institute for Fisheries Research

The problem

Baltic Cod *Gadus morhua*

Why?

Unfavourable environmental conditions

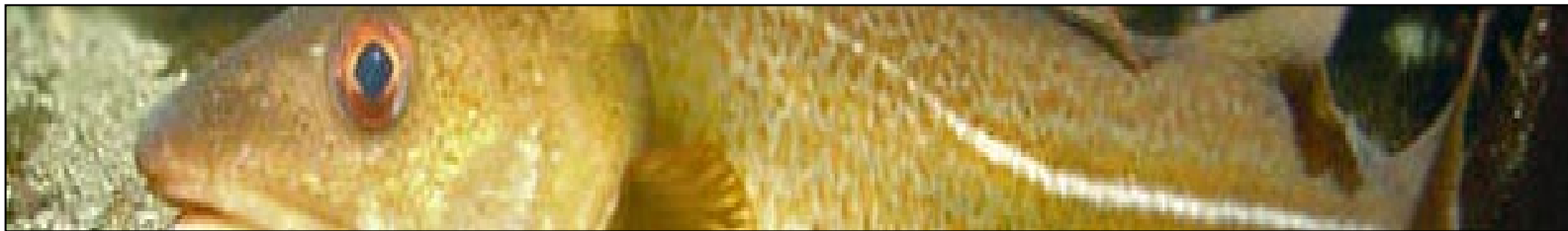Increasing predation on cod eggs by the pelagic sprat

Overfishing

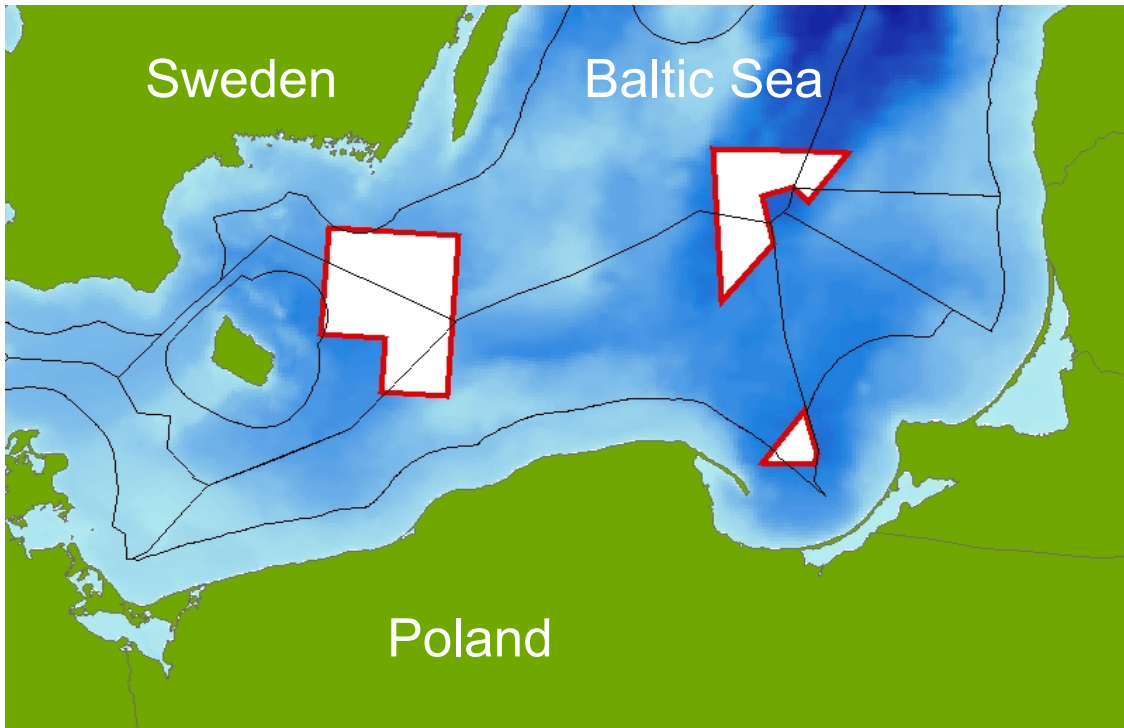**Spatial management may play a *part* in a possible solution!**

The challenge

Management of fish populations and fisheries poses a challenge:

- People fish where there are fish to catch

- Fish go where there is food and suitable habitat
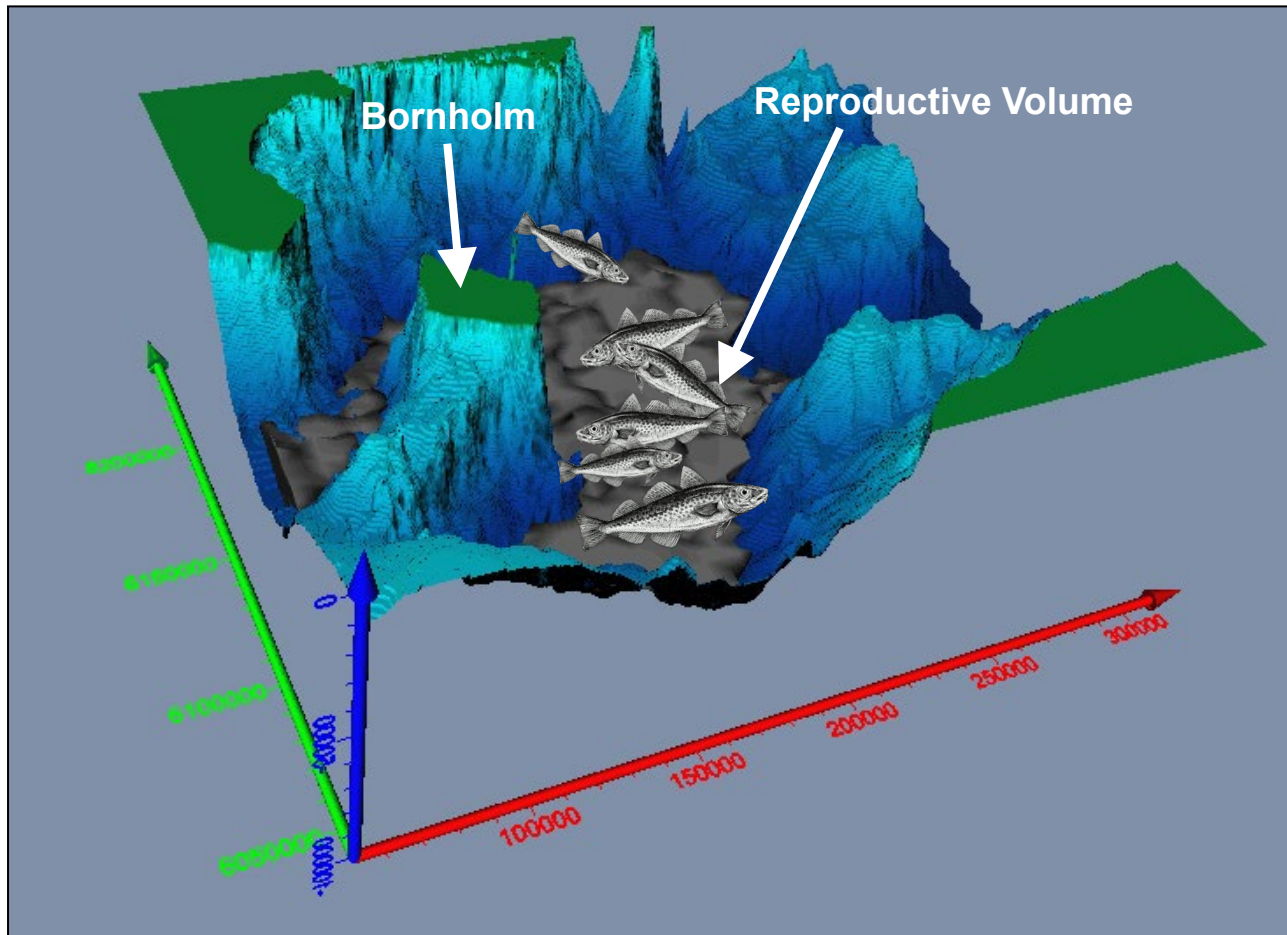
- Ecosystems vary in space and time

Fortunately, **we know where they go *some of the time...***

Baltic cod spawning closures

EU regulation, 2006

Bornholm Basin spawning area

Bornholm

Reproductive Volume

Currently the only large, active spawning area.

Mean survival probability (color scale) and mean egg stage 1a distribution 1989 – 2003 (dots; n/m²) in relation to area closures
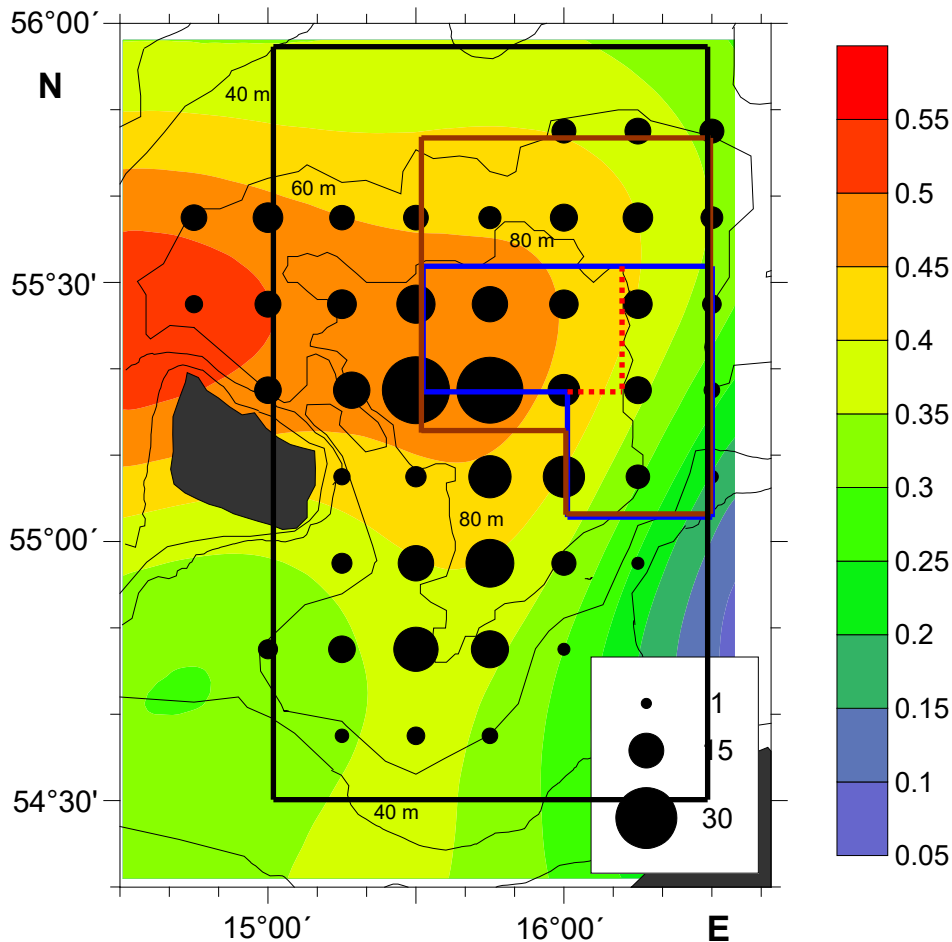
Past EU Baltic cod closures

Enforced May–August 1995-2003

Enforced **15.5.-31.8.2004**

Enforced **Year around 2005**
And 1.5.-31.10.2006

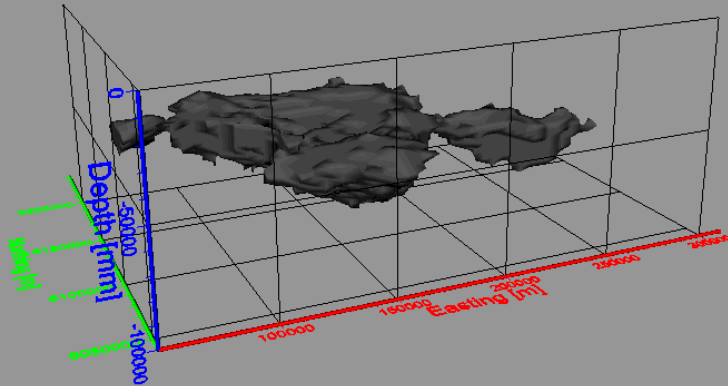Large closure considered by EU-Commission, but never implemented.

- are such static closures effectively addressing ecosystem variability?

Pelagic mapping of spawning habitat

Bornholm Basin of the Baltic Sea
1994 3. Qrt

Reproductive volume of the
Bornholm Basin (w/o bathymetry)

A dynamic system requires adaptive management!

Based on hydrographic observations in March/April, *model forecasts can estimate Reproductive Volume* and thus the *optimal size of a closure* for that spawning season.

Real-time cod spawning closures

Bornholm Basin of the Baltic Sea
1994 3. Qrt
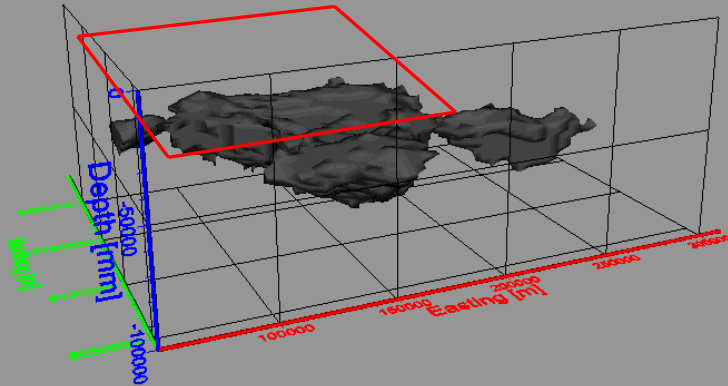
Closed areas should at least be large enough to cover natural spatial variability in hydrography, covering areas with most favourable spawning conditions.

Real-time closures: some years require big closures, other years smaller ones.

Bigger doesn't always necessarily mean better!

Real-time cod spawning closures

Outcome:

More robust scientifical base for closed areas than the one in place

More adaptability of management to environmental change

These considerations may increase support from fishermen to implement future conservation measures
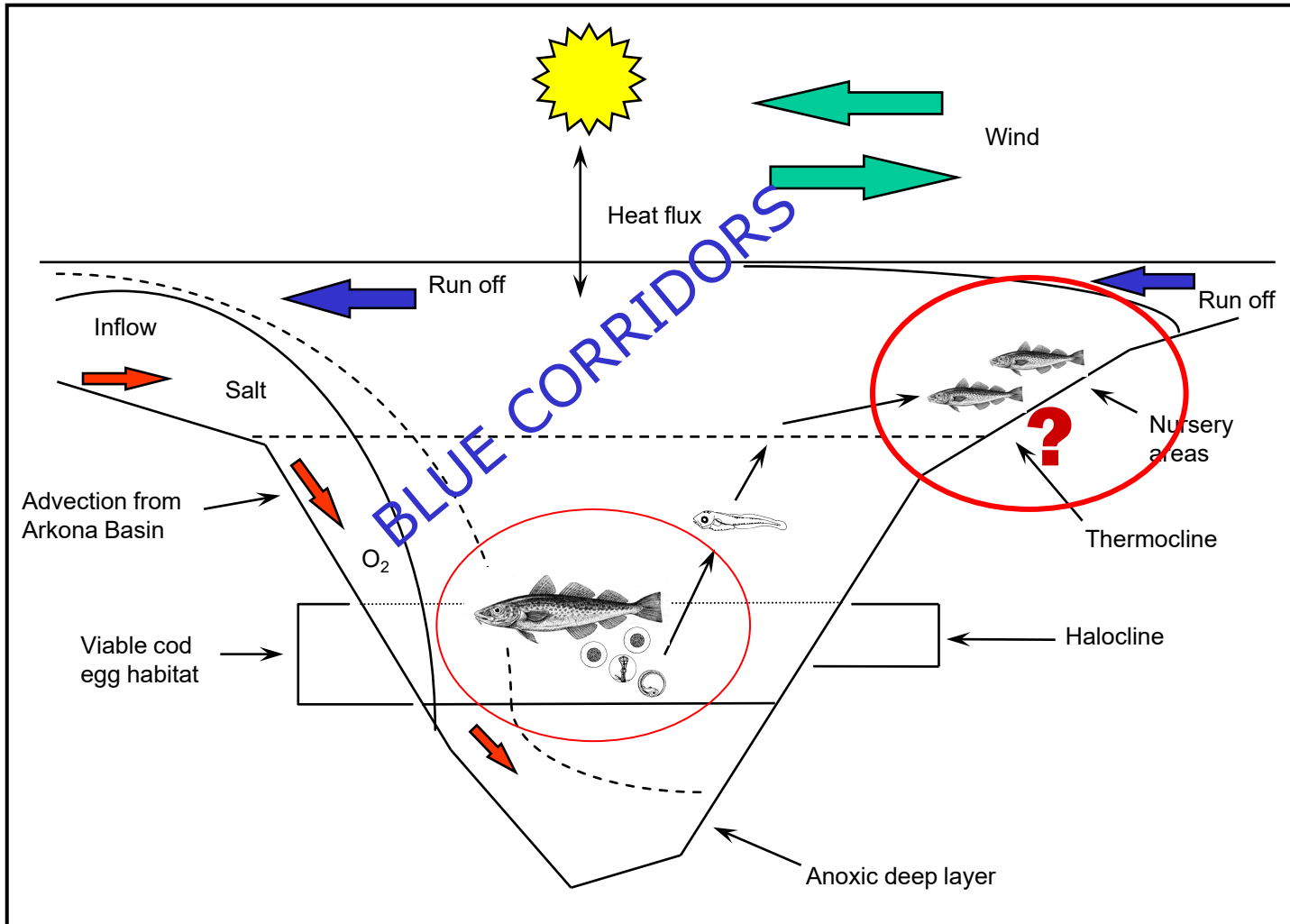
Pelagic habitat mapping may assist spatial management of *other*
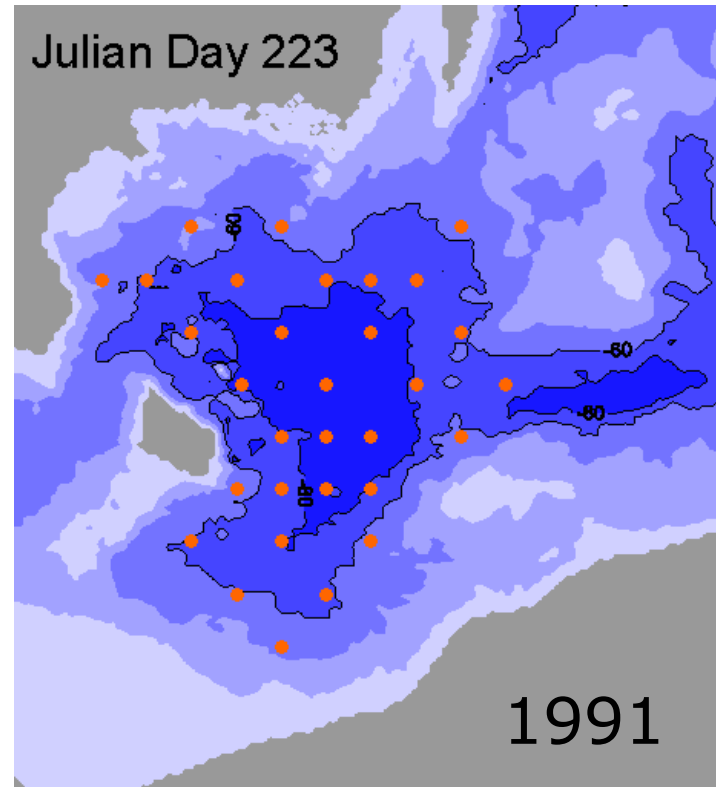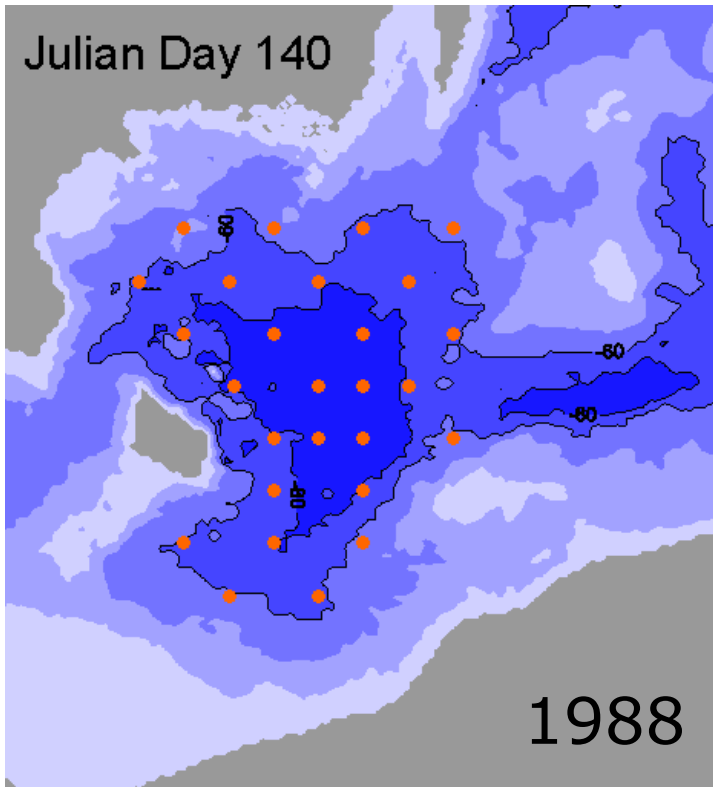
*v*ulnerable species?

Displacement of fishery?

However, when establishing any closure, there is an inherent risk of fisheries shifting their effort to other important areas!
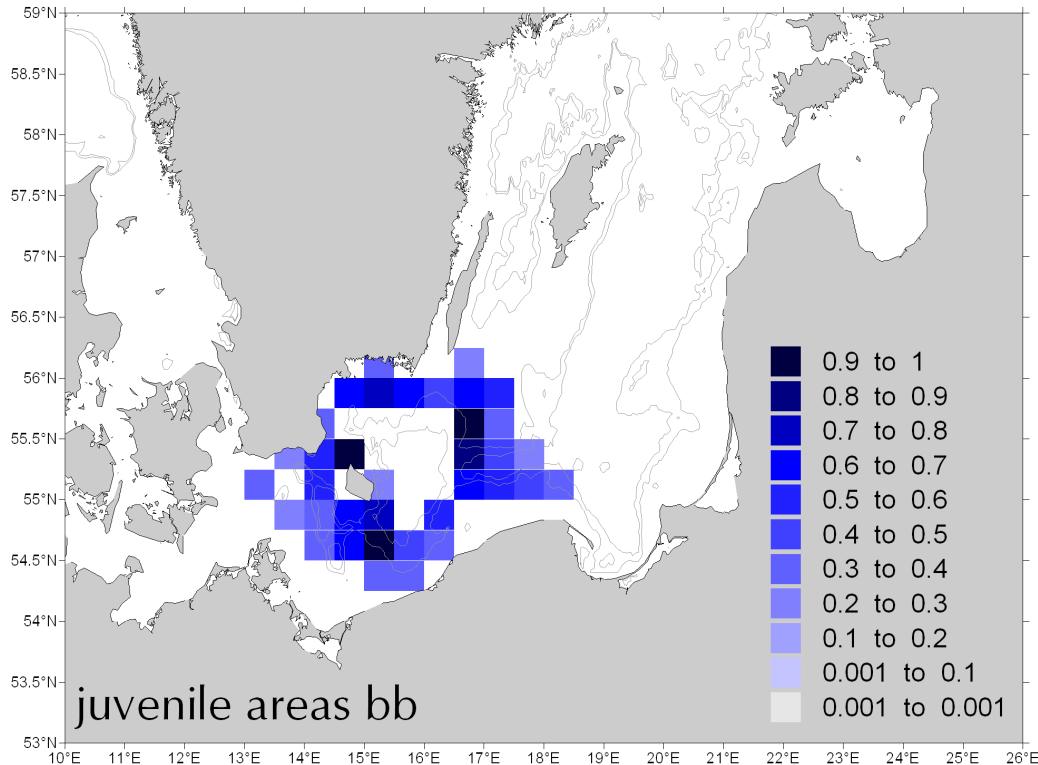
Managing other essential cod habitats

St. John & Köster, 1997

Pelagic blue corridors...

Julian Day 140 — 1988

Julian Day 223 — 1991

Drift models help to predict location of nursery areas

H-H. Hinrichsen/PROTECT

...leading to cod nursery habitats?

juvenile areas bb

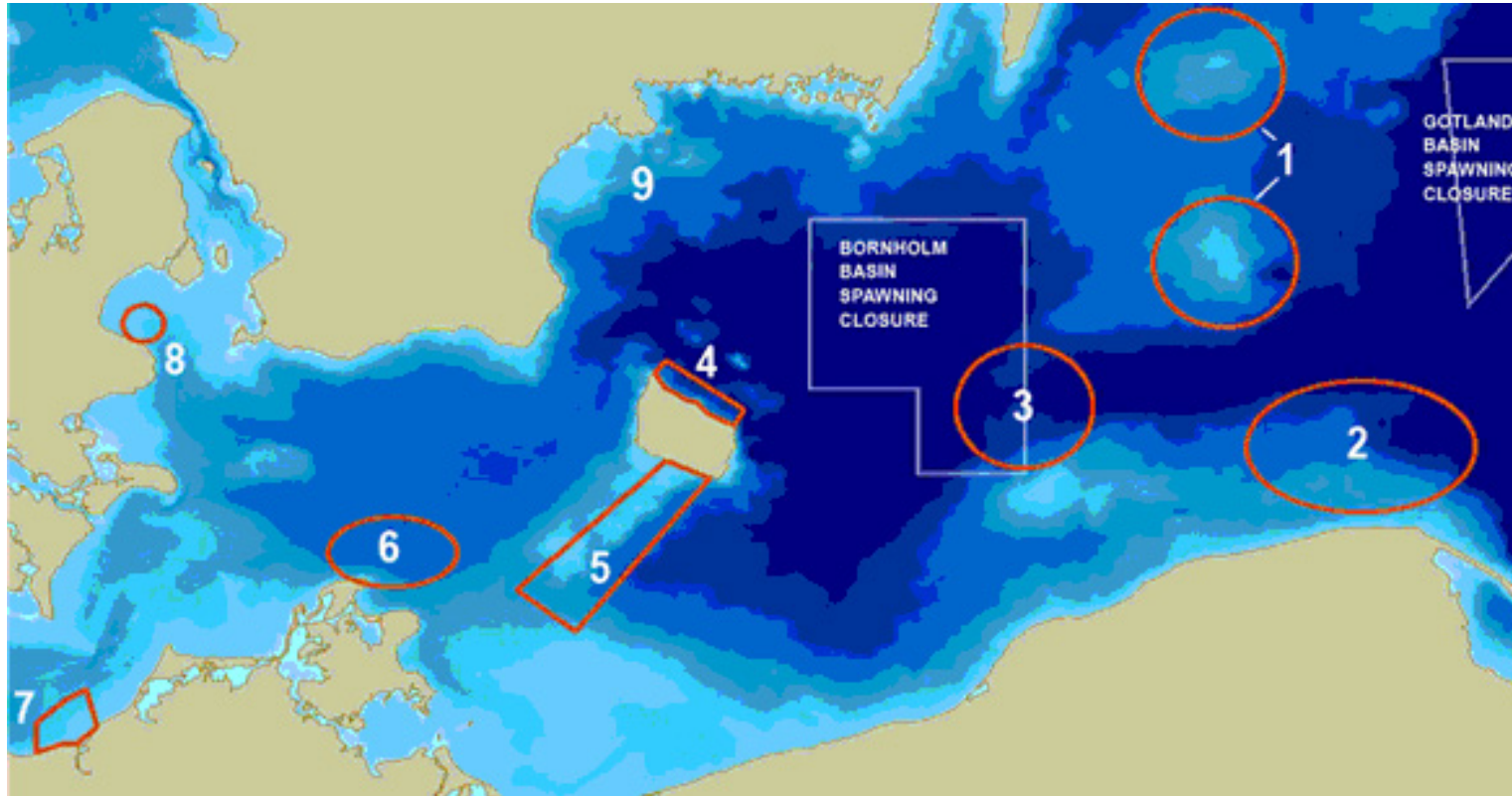|	
■	0.9 to 1
■	0.8 to 0.9
■	0.7 to 0.8
■	0.6 to 0.7
■	0.5 to 0.6
■	0.4 to 0.5
■	0.3 to 0.4
■	0.2 to 0.3
■	0.1 to 0.2
■	0.001 to 0.1
■	0.001 to 0.001

Relative cumulative distributions of juvenile cod based on larvae drift modelling

Applied nursery areas (threshold level 20%; i.e. all rectangles that received less than 20% of the drifters are not considered)

H-H. Hinrichsen, PROTECT

Cod nursery habitats
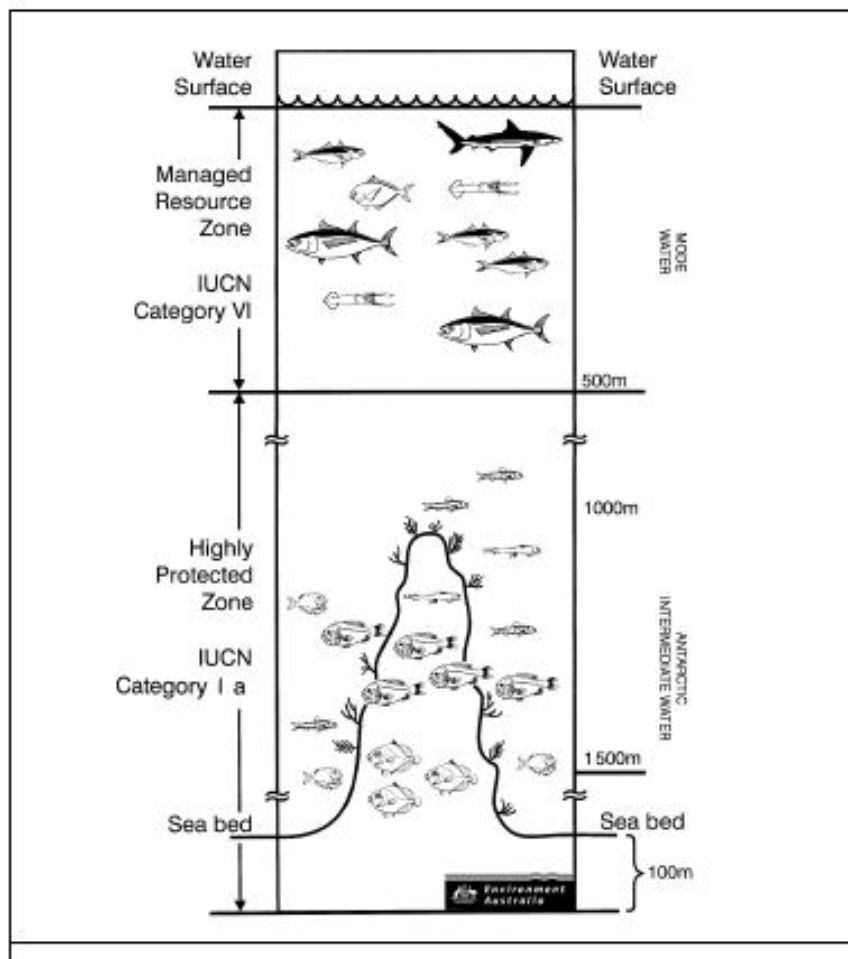

Areas where interviewed Bornholm fishermen reported consistent and large bycatches of juvenile cod.
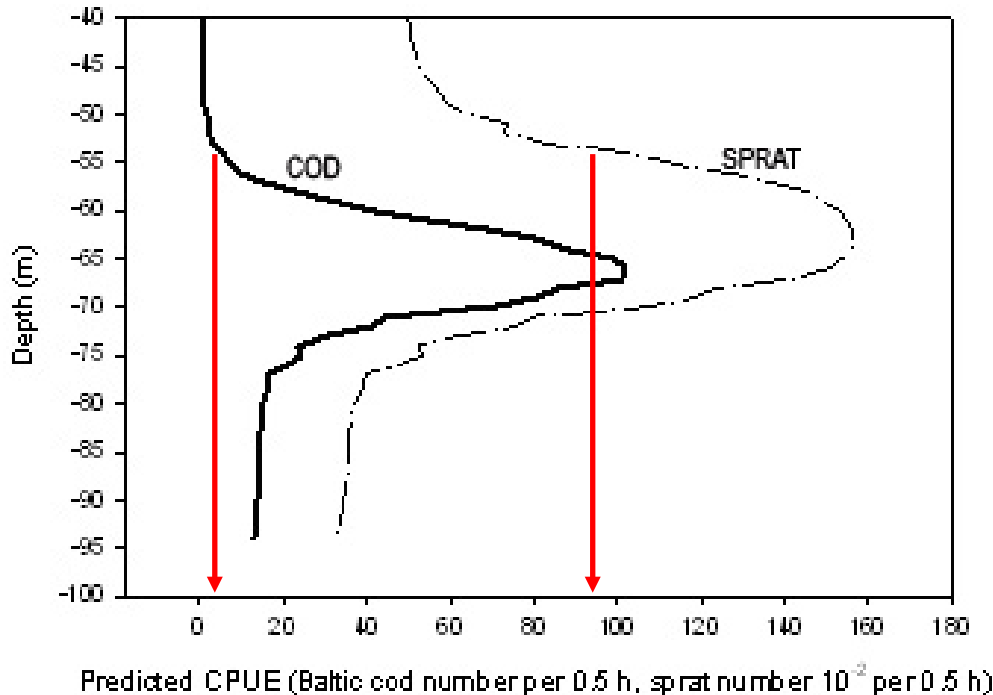
Applications

How can we apply our knowledge of the ecosystem in spatial management of the Baltic Sea and its living resources?

Stratified environment and *vertical* management

Stratified environment and *vertical* management

Modified from Neuenfeldt & Beyer 2003

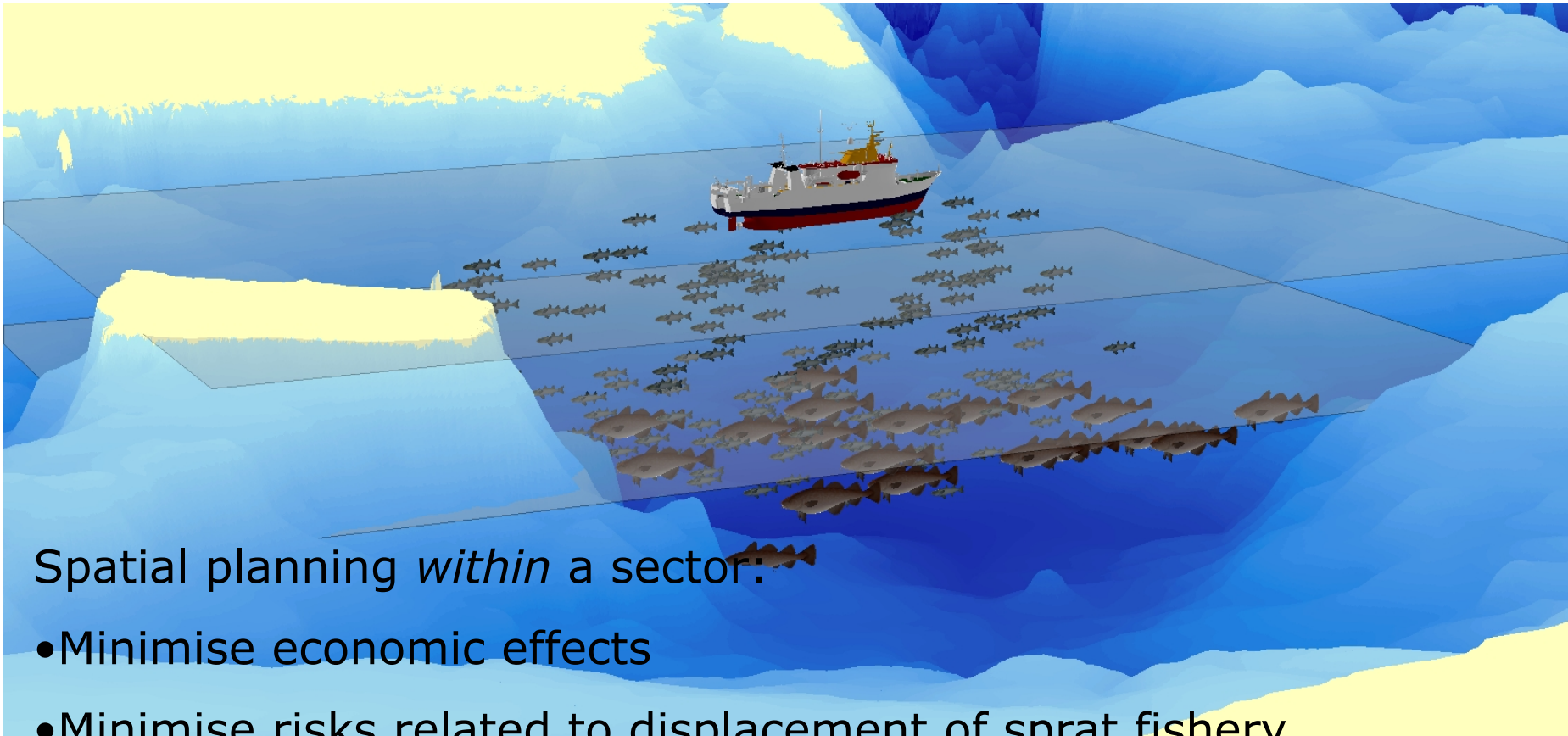Sprat fishery is also excluded from the spawning closure.

However, stratified distribution of cod and sprat means these species may be managed separately.

Cod below the halocline, sprat above.

Virtually no cod at depths under 55 m

At same depth approx. 1/3 of expected max. catch rate for sprat!
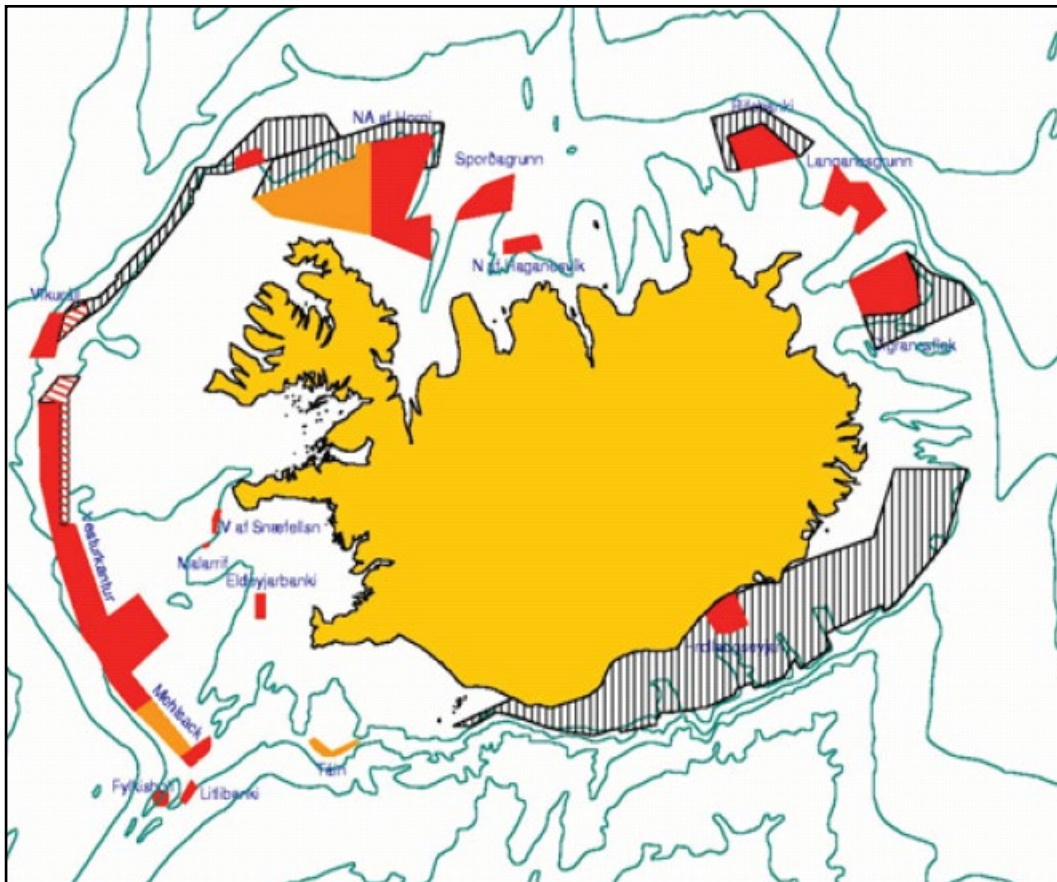
Vertical zoning of fisheries

Spatial planning *within* a sector:

• Minimise economic effects

• Minimise risks related to displacement of sprat fishery

• Reduce predation on cod eggs during spawning season

Vertical zoning of fisheries
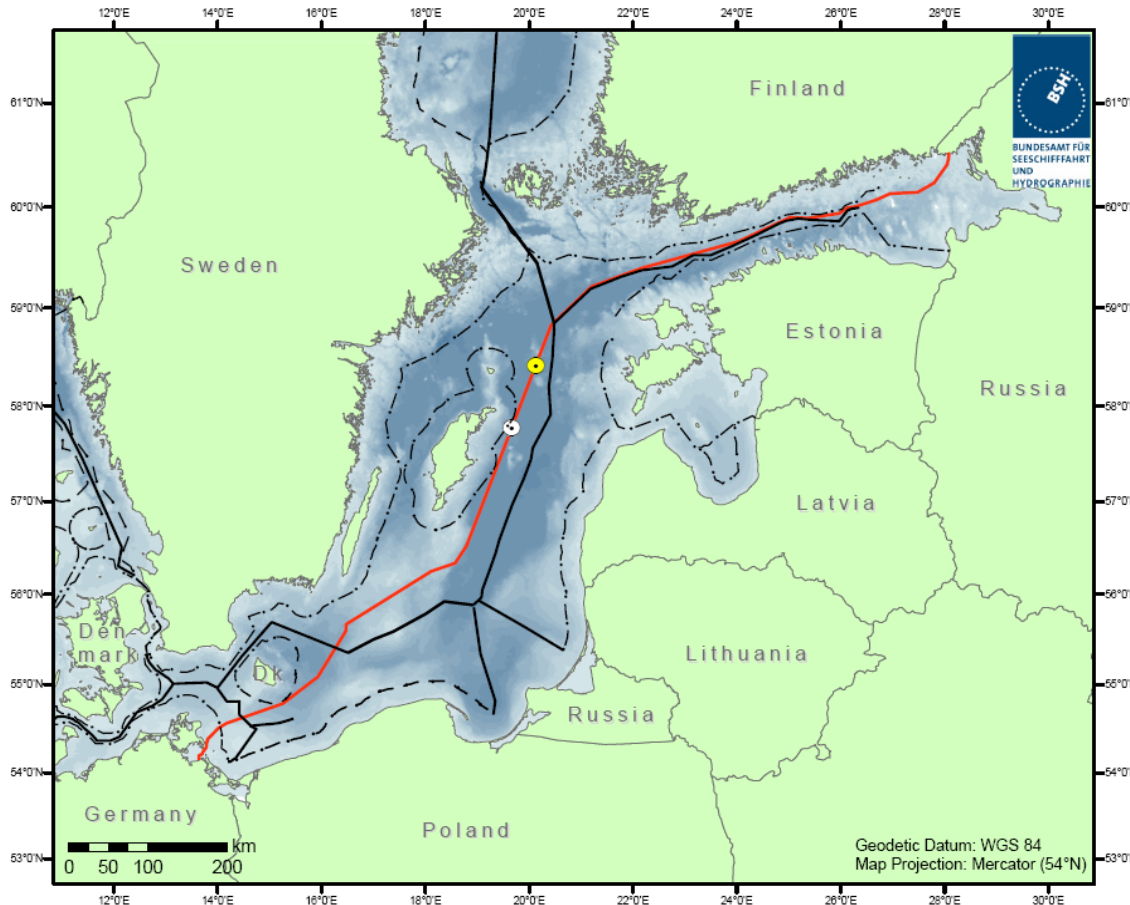
Real-time cod closures in Iceland

Could we aim do the same in the Baltic?

(require mandate under EU Common Fisheries Policy)

Many think that this may be a solution.

Essential habitats in spatial planning

The Baltic pipeline project is a good case where the importance of mapping and protecting essential fish habitats is evident in marine spatial planning.

Conclusions & perspectives

Key messages

Pelagic habitat models are a useful tool for spatial management of Baltic cod – and possibly other marine species!

Dynamic ecosystems require adaptive spatial management that is robust in relation to environmental change.

Management of all Essential Fish Habitats (covering different fish life stages) are important.

Next steps?

Enhance the basis for real time management system

Further mapping of blue corridors and nursery areas

Perspectives
Move from current fisheries management to truly science and ecosystem based management!

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Thank you for your attention