BALANCE

Where is the fish?
Habitat modelling and applications

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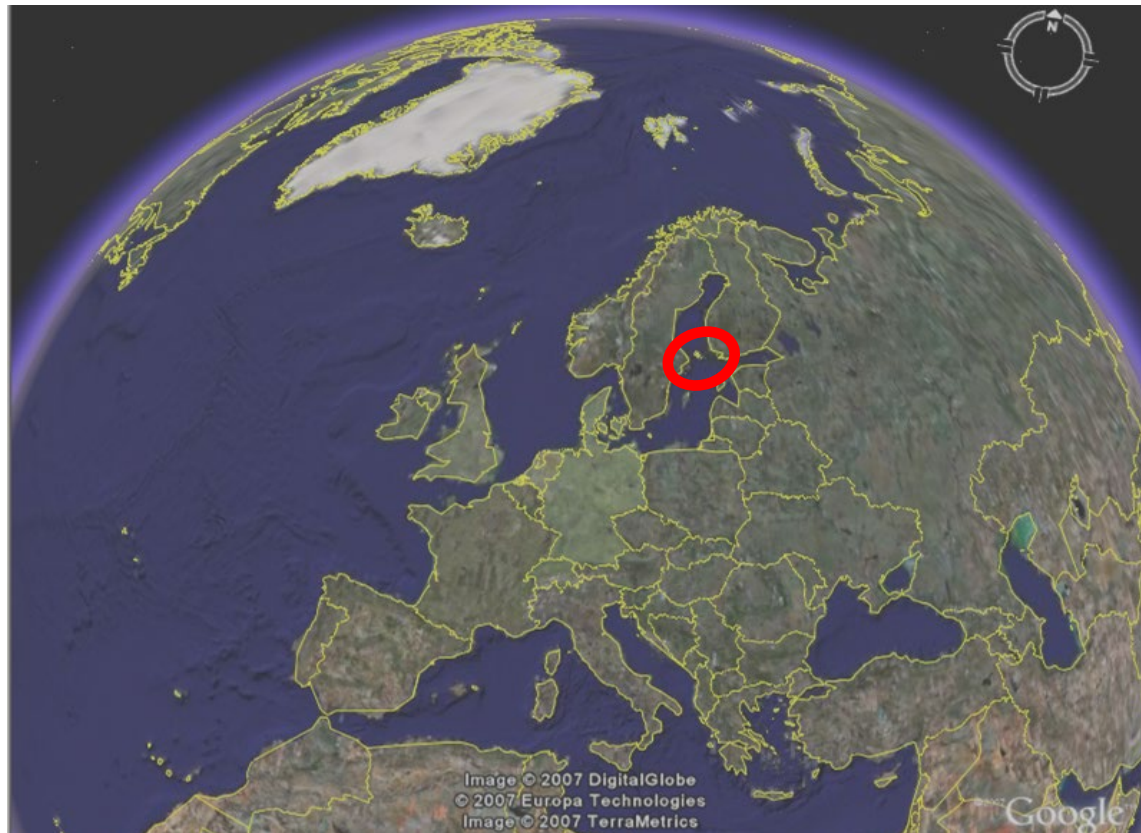OF FISHERIES

Outline

Modelling methods
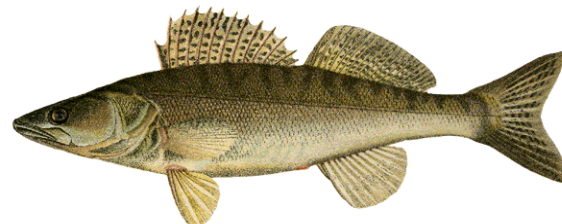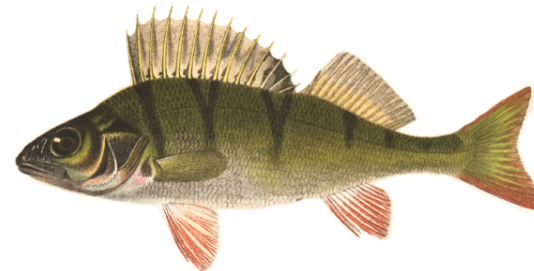
Results

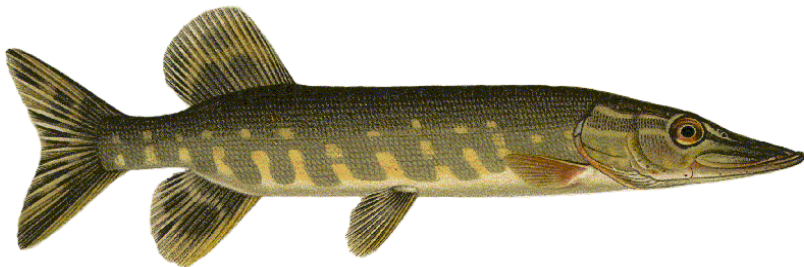Applications
  Ecological coherence
  Habitat bottlenecks

Conclusions

Modelling of fish recruitment habitats

- young fishes are highly dependent on certain habitats, and thus vulnerable to habitat loss

- predictive modelling of recruitment habitats of 4 fish species in 30.000 km^2 archipelago area between Sweden and Finland
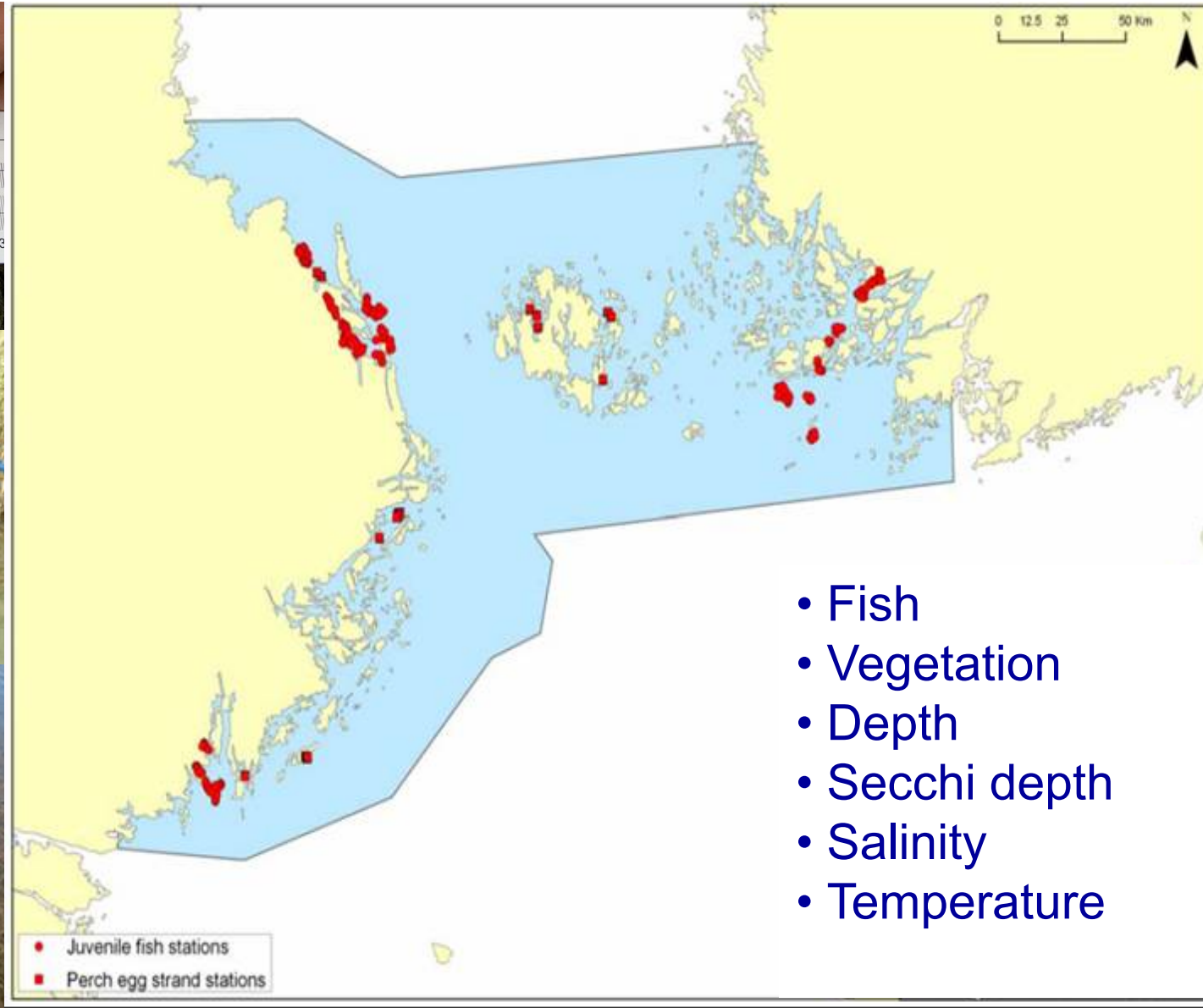
Habitat modelling in archipelagos

- High environmental complexity at small scales

- Habitat maps should incorporate this complexity to be useful in regional spatial planning

- Detailed maps of environmental variables needed = bottleneck

Field data collection

- Fish
- Vegetation
- Depth
- Secchi depth
- Salinity
- Temperature

• Juvenile fish stations
■ Perch egg strand stations

Modelling methods

- Generalized Additive Models (GAM) for statistical description of species-habitat relationships

  - depth, wave exposure (GIS-derived) and water clarity (GIS-derived) used as predictor variables

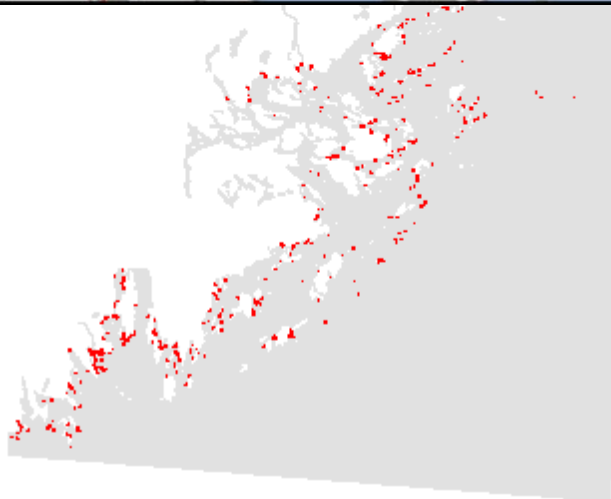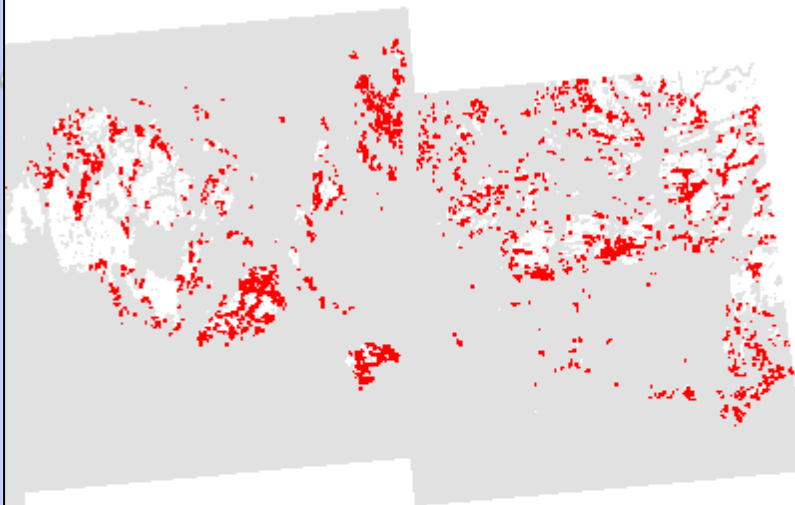 - side-study: satellite imagery for mapping of coastal characteristics
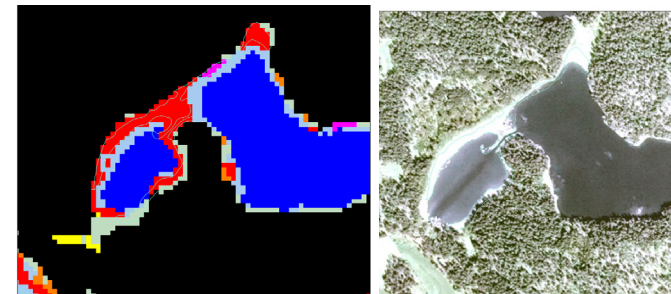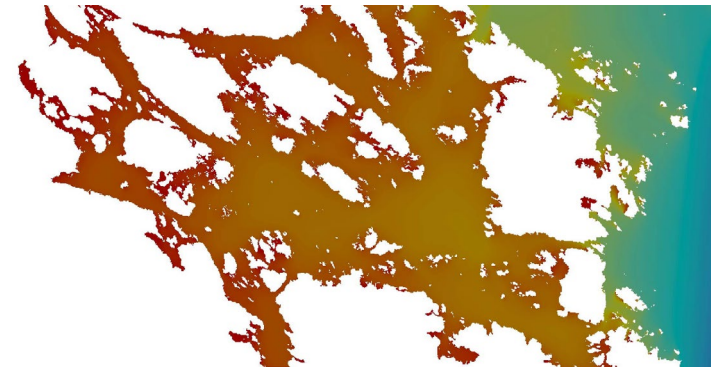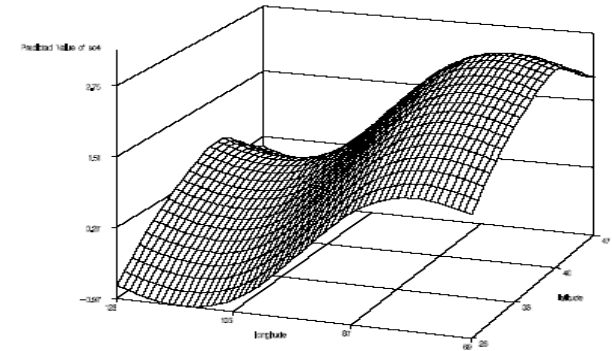
Modelling results

- statistical models fairly good: ROC-values 0.66-0.90

- GAMs exported to GIS to produce map predictions

- partial response curve provides information how species react to environmental variables

water clarity   wave exposure   depth
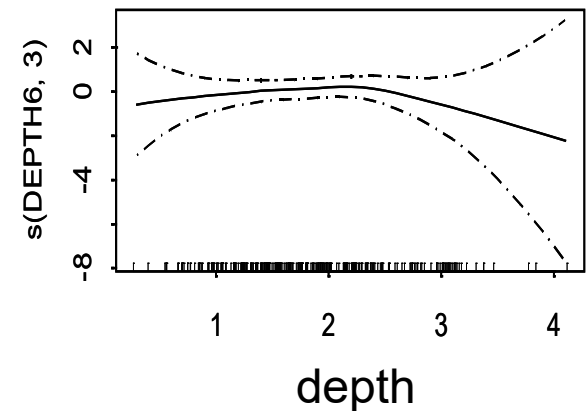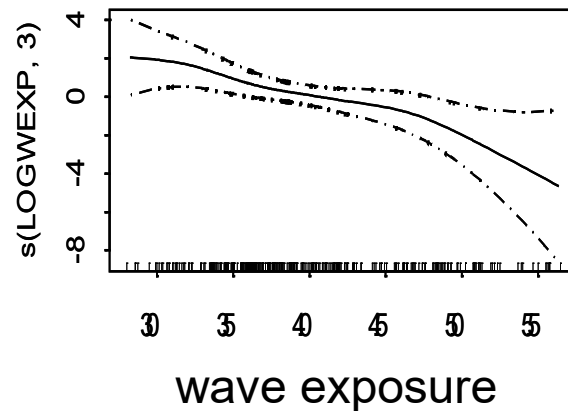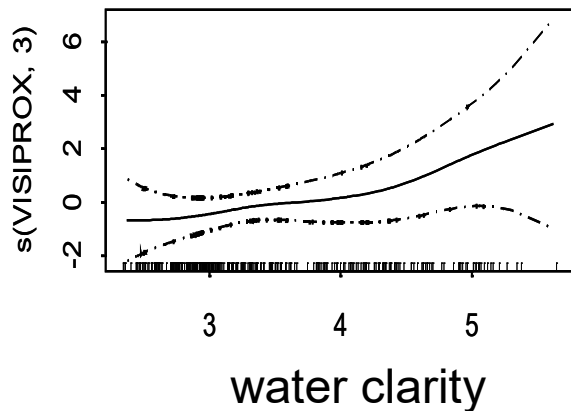
Perch spawning habitat
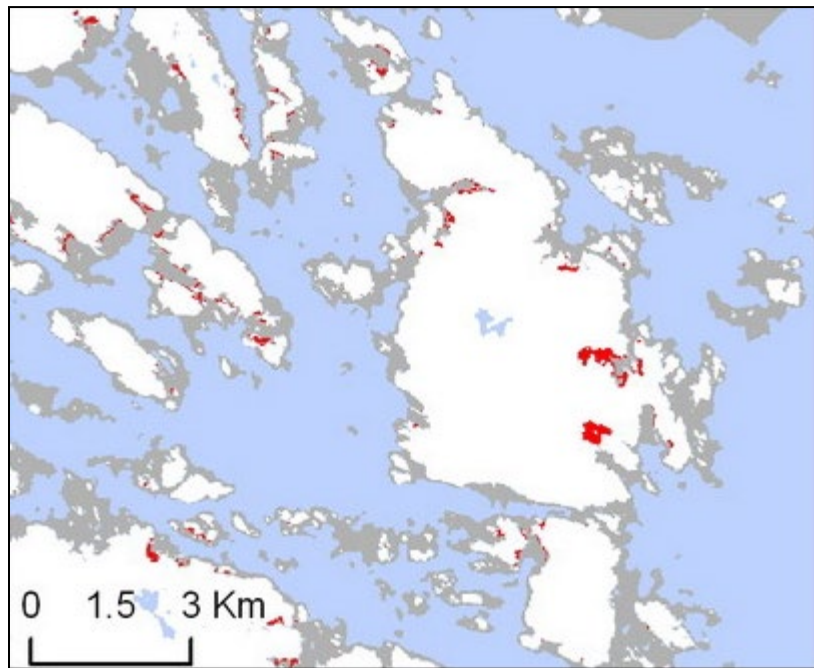
Application 1

Ecological coherence of the Natura 2000 network

A fish perspective on Natura 2000

Most fishes are not explicitly protected by N2000

BUT shallow vegetated areas are

AND that is the main habitat for many juvenile fishes

Perch spawning habitat + Natura 2000 areas

4% of habitats protected

Connectivity among habitats
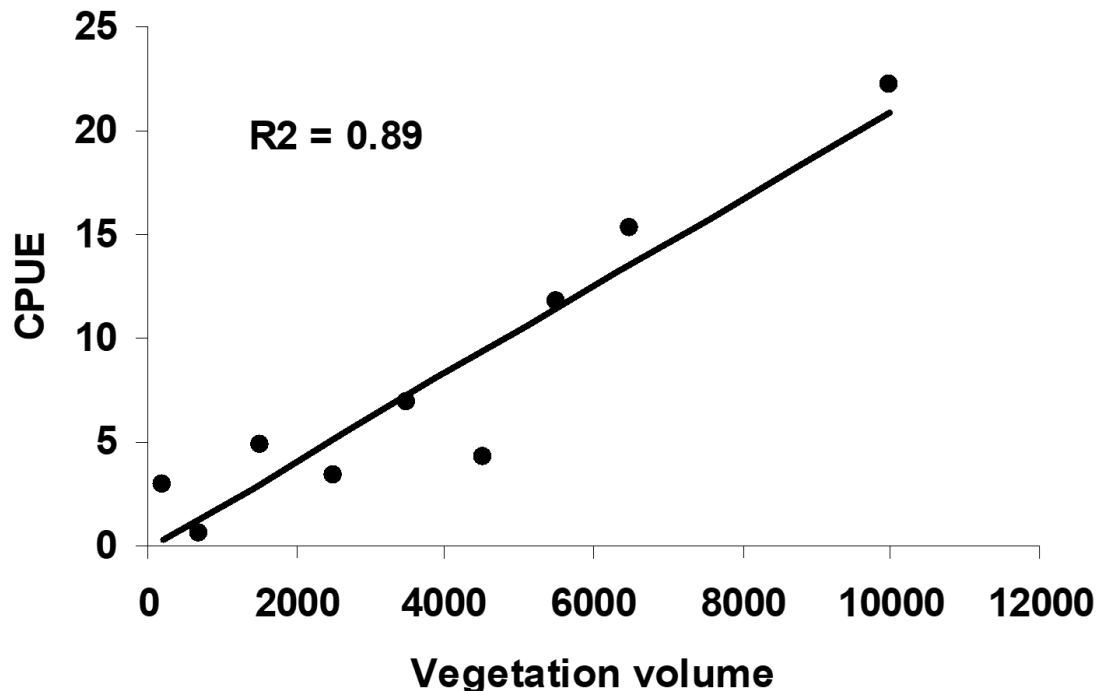
- **habitat maps & migratory behaviour combined**

What about connectivity among protected spawning habitats?

Perch spawning area connectivity

- No spawning areas
- Connected spawning areas
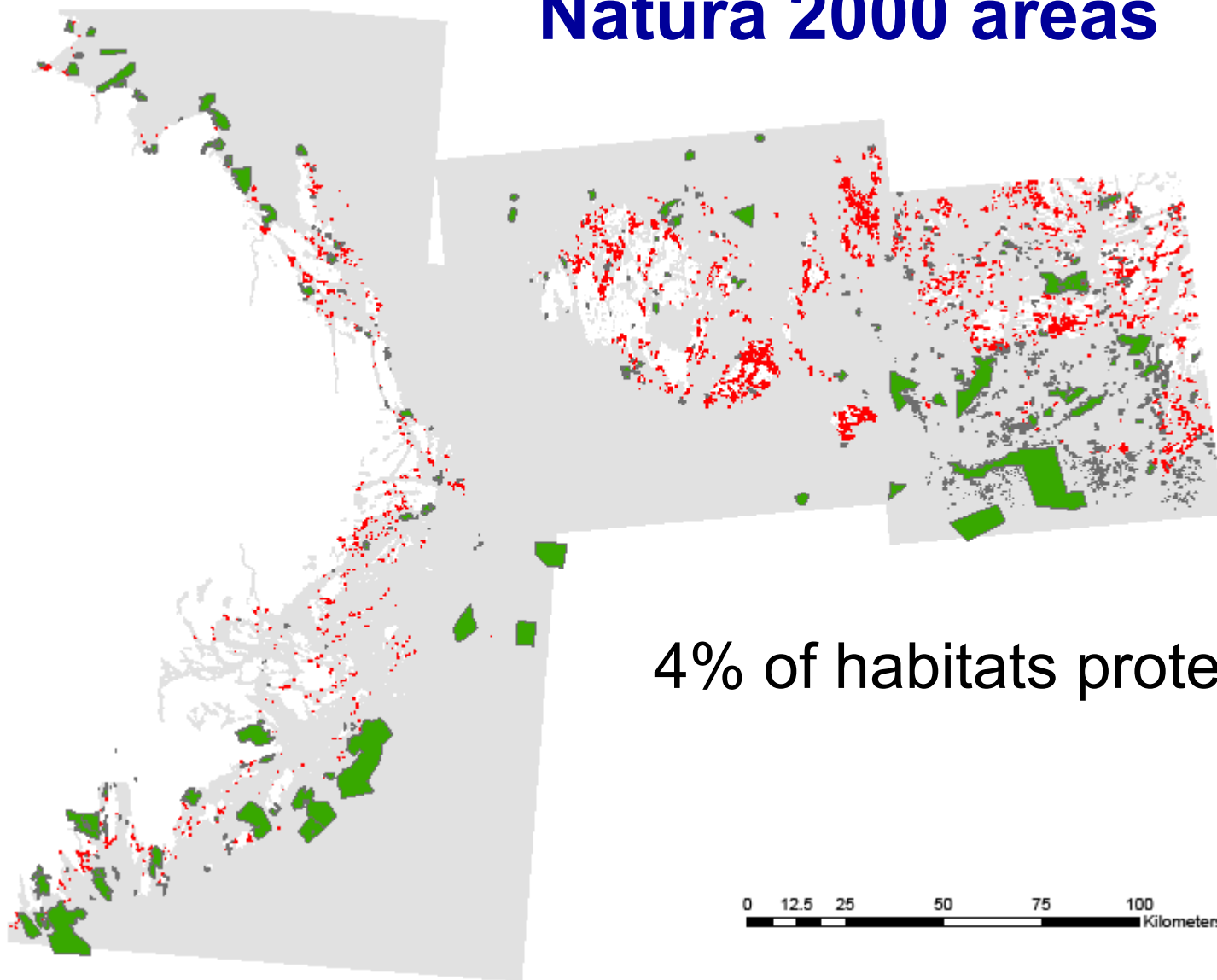
0 12.5 25   50   75   100
Kilometers

Connectivity among protected spawning habitats

23% of areas connected with protected spawning habitats

Perch spawning area connectivity

- No spawning areas
- Connected spawning areas, not protected
- 3-5 connected & protected spawning areas
- 6-10 connected & protected spawning areas
- >10 connected & protected spawning areas

0   12.5   25   50   75   100 Kilometers
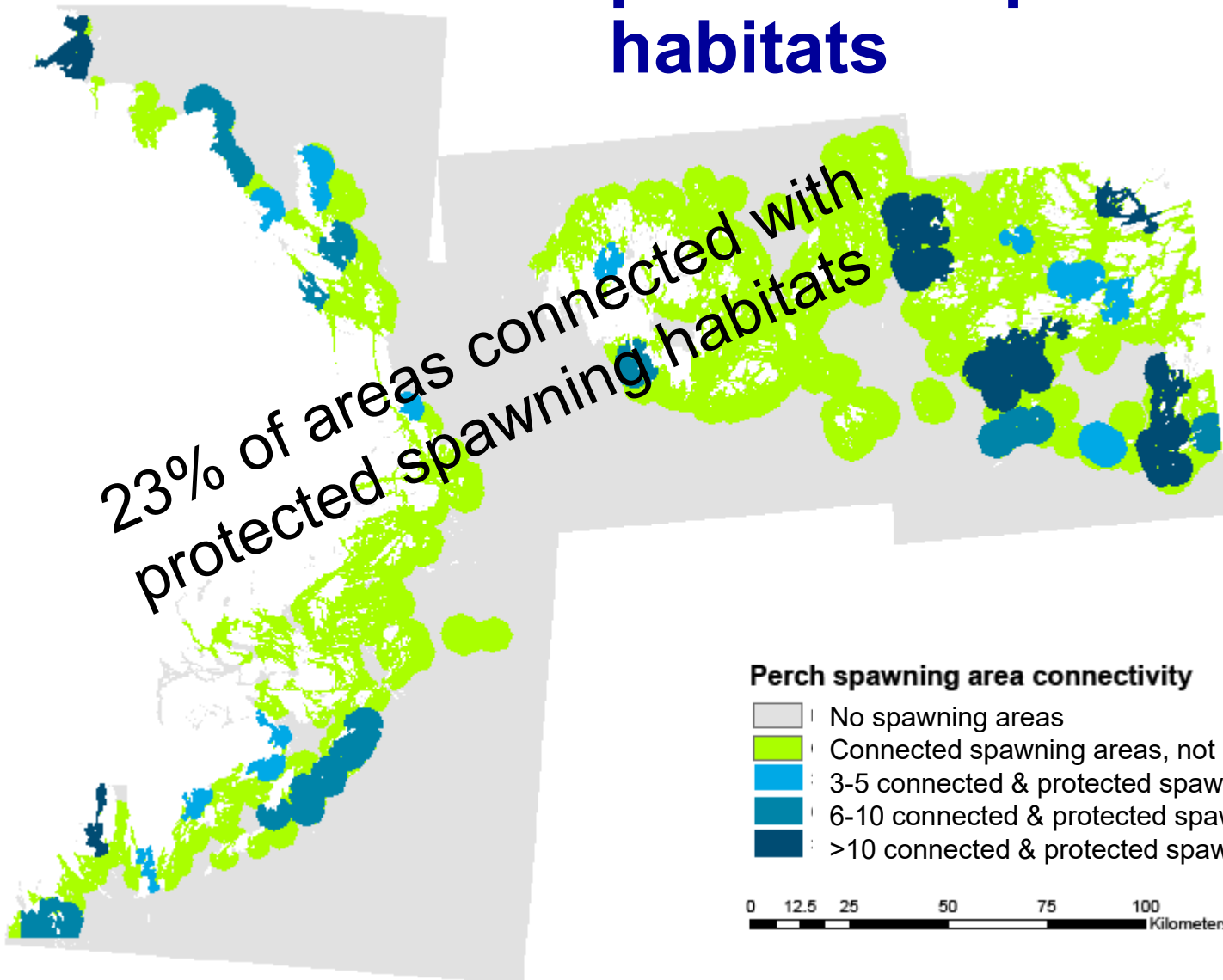
Is the Natura 2000 network coherent?

Representativity: 4% of spawning habitats protected (goal 20%). Less than by chance!

Connectivity: 23% of areas connected with protected spawning habitats (goal 100%)

Similar results for 3 other of the most important coastal species in the area
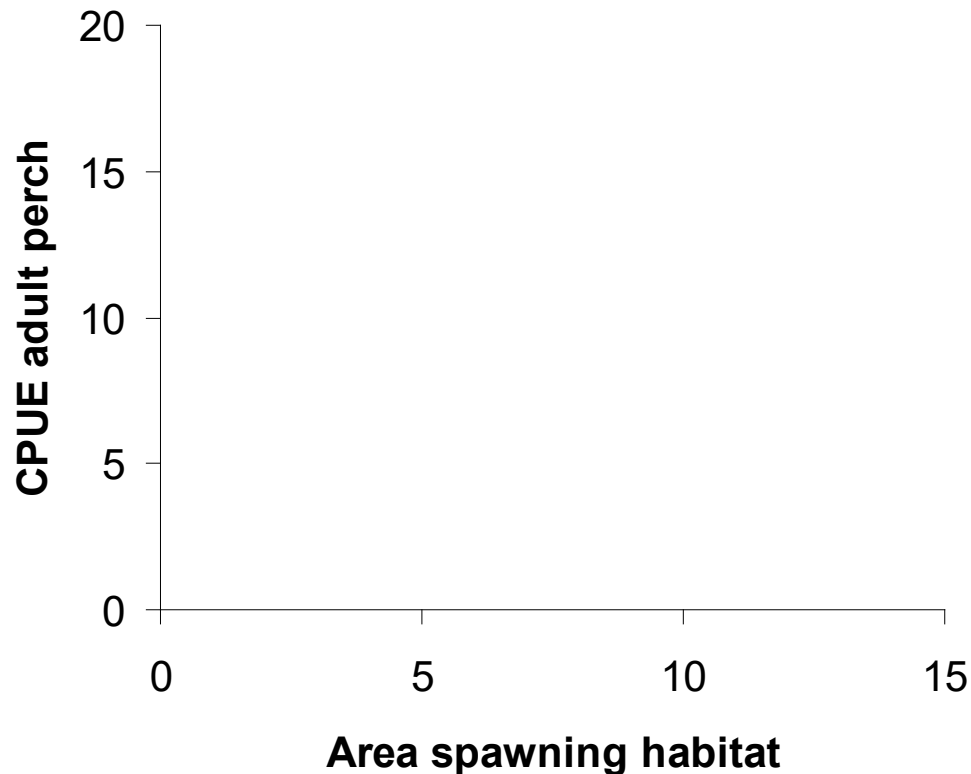
Conflict zone!

Photo: Johan Persson

Application 2

Habitat bottlenecks

Is habitat availability regulating adult populations?

- correlation between population density of adult perch and area of recruitment habitat

Habitat protection may give rise to higher fish catches

= connection between conservation and fisheries

Conclusions

- Simple predictor variables may produce good habitat maps

- High-resolution maps on e.g. depth and seabed substrate needed for increasing model accuracy

- Great demand for large-scale habitat mapping - The fish habitat maps are already in use in management

Next steps?

- more habitat modelling: refine methods, increase the spatial coverage, models for other species → feed into management

- ecological applications: habitat-fish production relationships

- towards integration of fisheries and nature conservation

Ecosystem approach in practice

Thanks to

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you for listening!