

Assessing the spatial dynamics of Small-Scale Coastal Fisheries of the Baltic Sea

A Geographic Information System based approach

Eva Papaioannou¹, Athanasios Vafeidis¹, Jörn Schmidt², Martin Quaas²

¹ *Christian-Albrechts University of Kiel, Institute of Geography, Cluster of Excellence 'Future Ocean', Coastal Risks and Sea-Level Rise RG, Ludewig Meyn Str. 14, 24 098, Kiel, Germany. www.crslr.uni-kiel.de*

² *Christian-Albrechts University of Kiel, Department of Economics, Cluster of Excellence 'Future Ocean', Sustainable Fisheries RG, Wilhelm-Seelig-Platz 1, 24 118, Kiel, Germany. www.economics.uni-kiel.de/eree*



Small-Scale Coastal Fisheries of the Baltic Sea

Coastal fish communities – Important components of Baltic Sea ecosystem

Fish of **various origins** (marine, freshwater species, migratory species).

Herring, cod, European flounder, roach, perch, pike perch, freshwater breams ,etc.

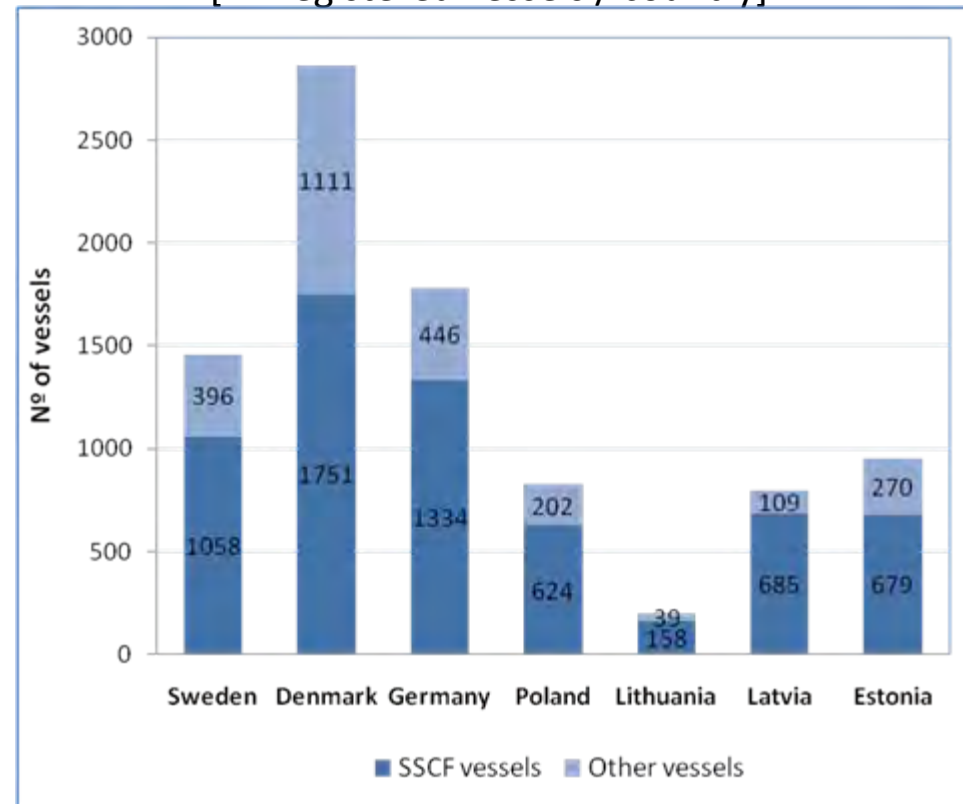


Vessel/Gear characteristics

“Fishing carried out by vessels of an overall length of less than 12 m and not using towed gear” (EU Council Regulation N°1198/2006)

But also: **Country-specific**

Baltic fishing fleet, 2010
[N° registered vessels / country]



Aims & Objectives

Aims

- Explore the spatial dynamics of the SSCF fleet in the Baltic (distribution of vessels, landings, landings' revenues, fishing operations).
- Assessment of spatial/temporal changes in these attributes.
- Associate those changes to changes in environmental (ecological) conditions for the purpose of forecasting the response of SSCF to changes in climate.

Objectives

1. Assess Fleet Register and determine small-scale coastal fishery sector by means of gear used, length of vessel (Loa), etc.

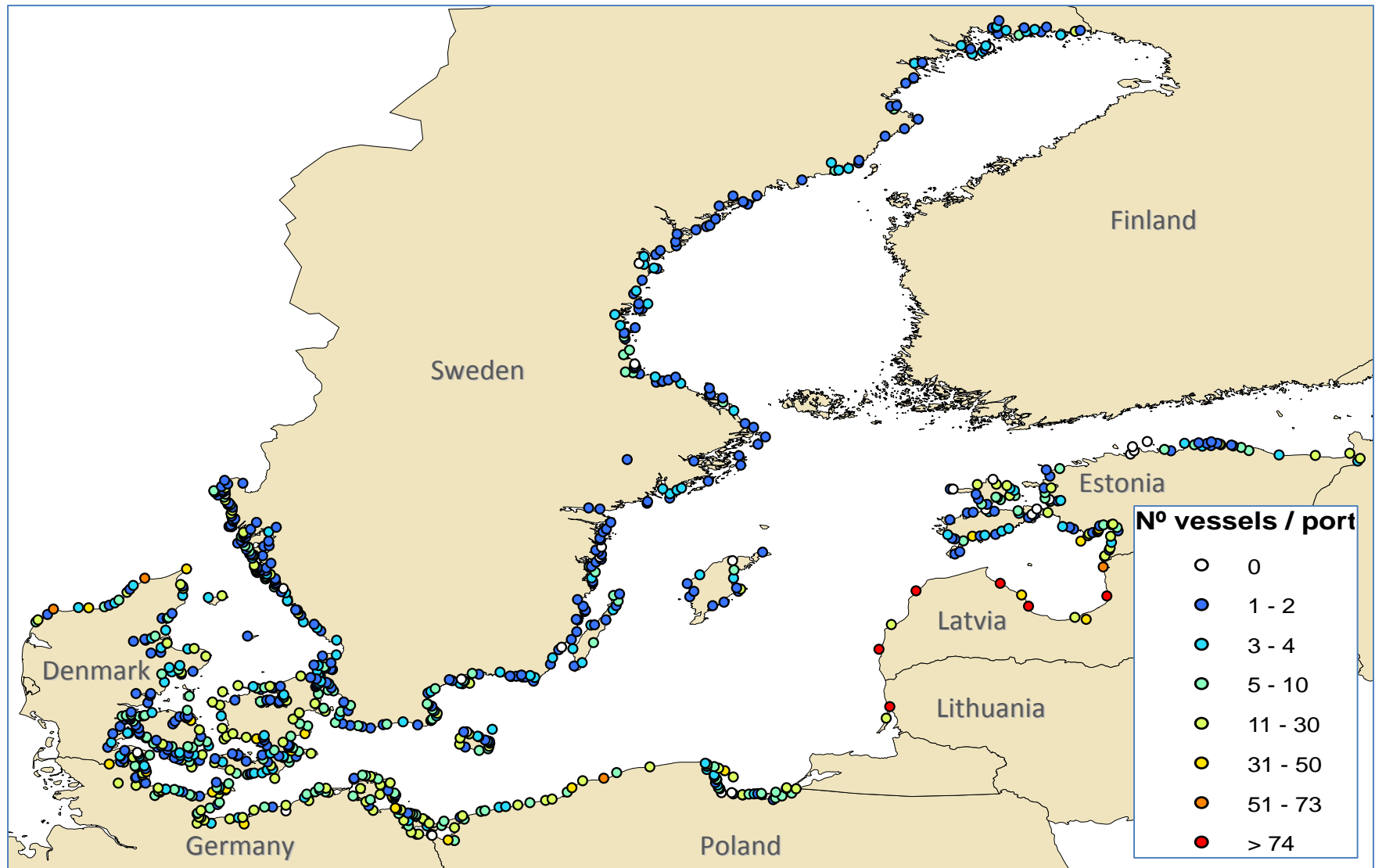
i.e. How many of the registered fishing vessels have as their main fishing gear a static gear (Gillnets, Hooks and Lines, Pots and Traps) and a length smaller than 12 m? N.B. Length: Country-specific.

2. Assess logbook data (landings, landings' revenues, fishing operations, landed species).

3. Incorporate database within Geographic Information System (GIS).

Previous attributes related with port of registration of the vessel / fishing area where the landings originated from / landing port, etc.

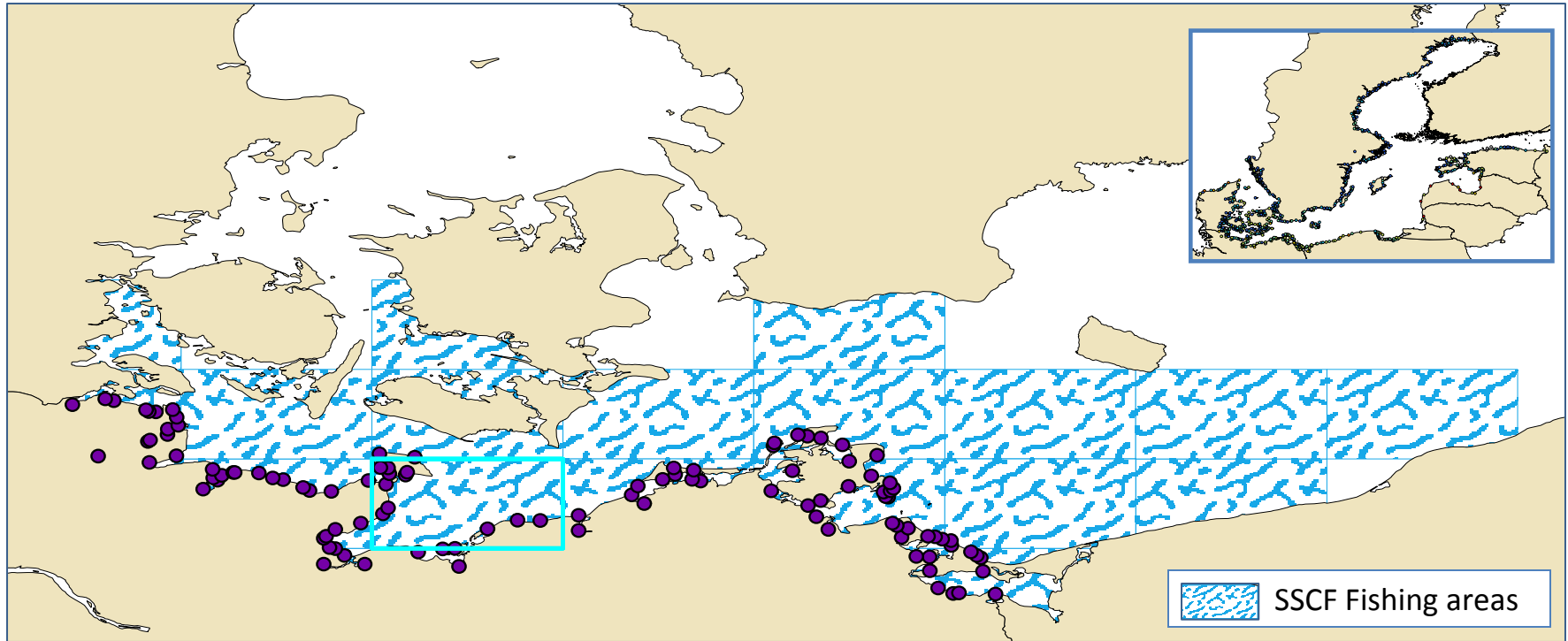
Present state of the Baltic SSCF fleet [2010]



- Which ports have the biggest concentration of SSCF vessels? Which ports have none?
- What is the fleet composition of a particular port at a given time?
- Where are these ports located?

Primary Data Source: EU Fleet Register, 2010

Case Study: Germany

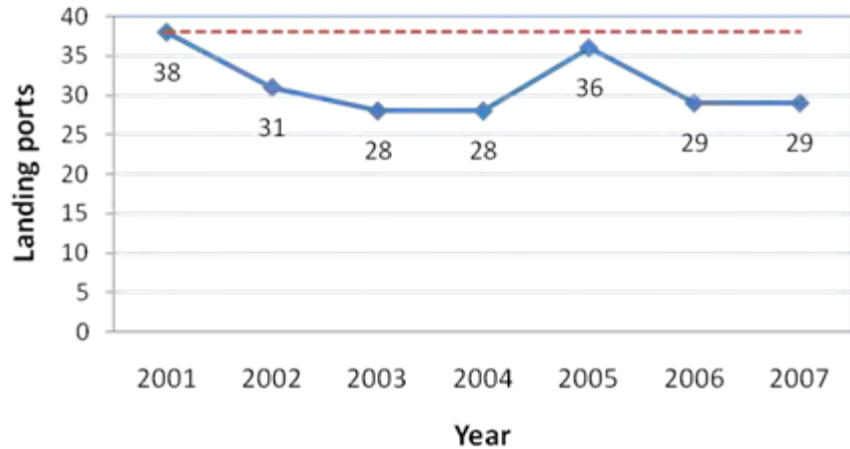


- Logbook data, 2001-2009 [Source: Bundesanstalt für Landwirtschaft und Ernährung (BLE), 2010]
 - Incorporation of data within GIS - Spatial integration of landings, landings' revenues, fishing operations data.
 - Make queries.
 - Visualisation of spatial dynamics of SSCF.
- Selected ICES Rectangle: 37G1

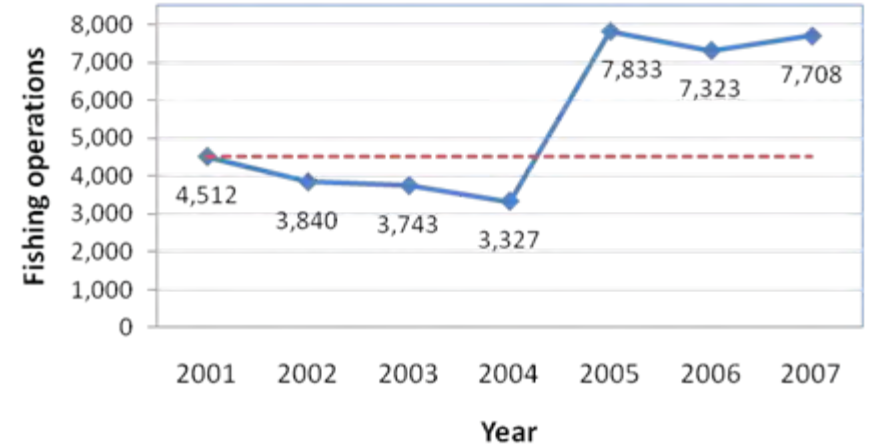
→ Investigate spatial patterns in catch/landings/revenues trends (i.e. aggregation of landing ports, fishing areas, changes in relative distance between fishing area-landing port, etc)

37G1 ICES Rectangle temporal trends

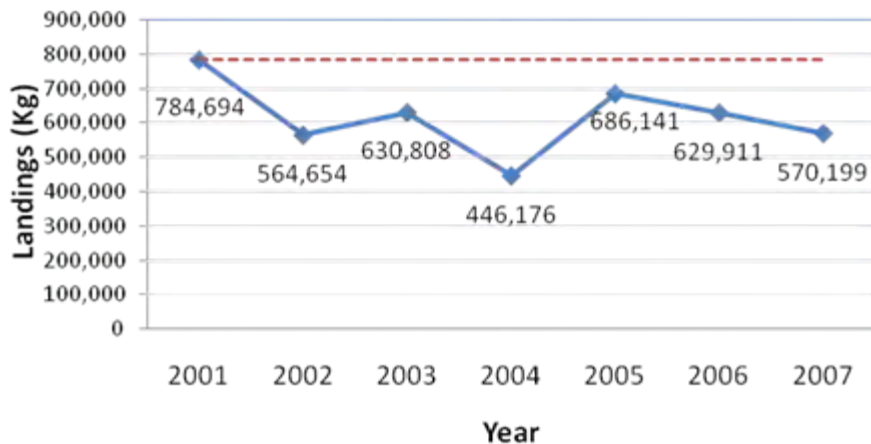
Nº Landing Ports / Year [37G1]



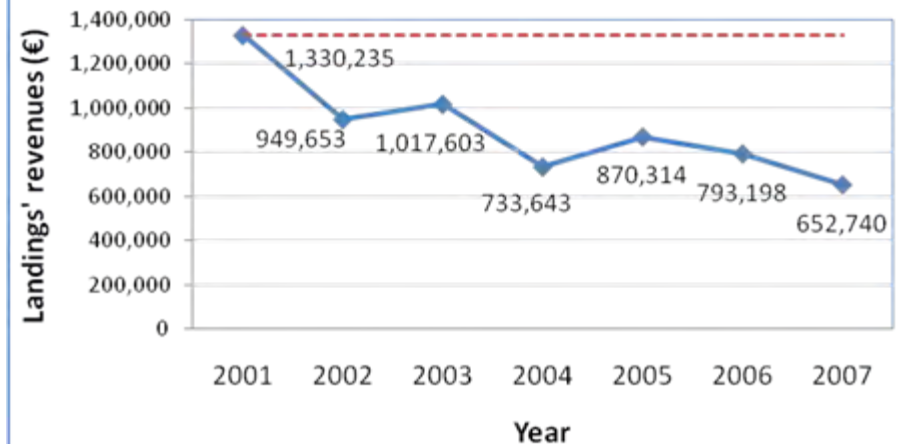
Fishing Operations / Year [37G1]



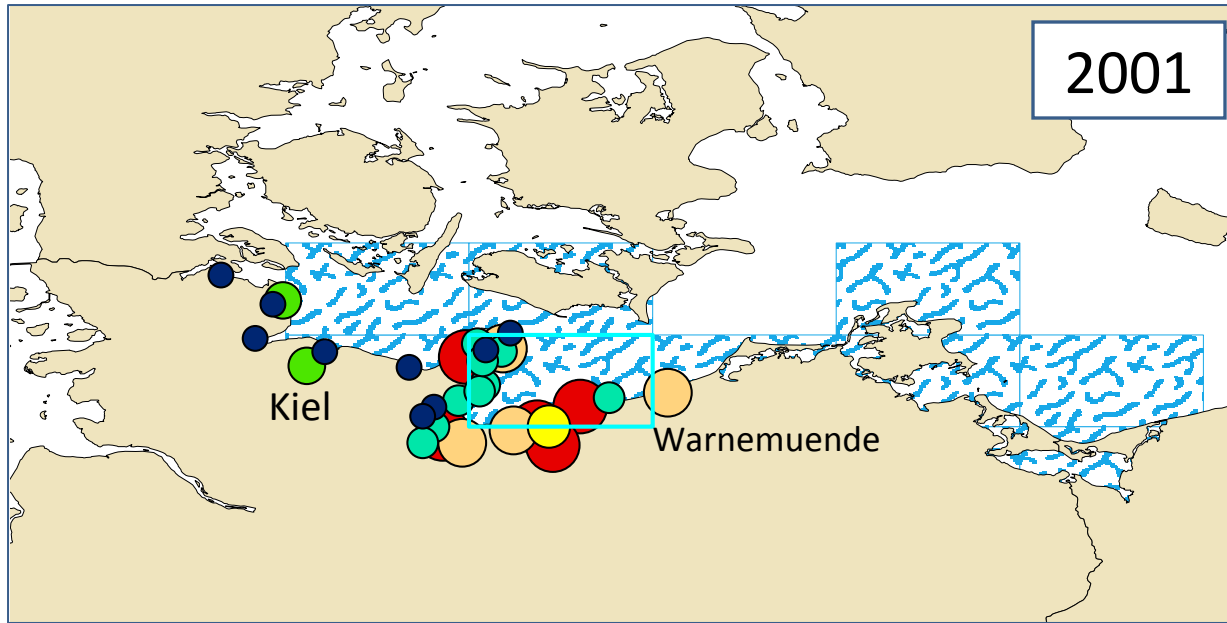
Landings (Kg) / Year [37G1]



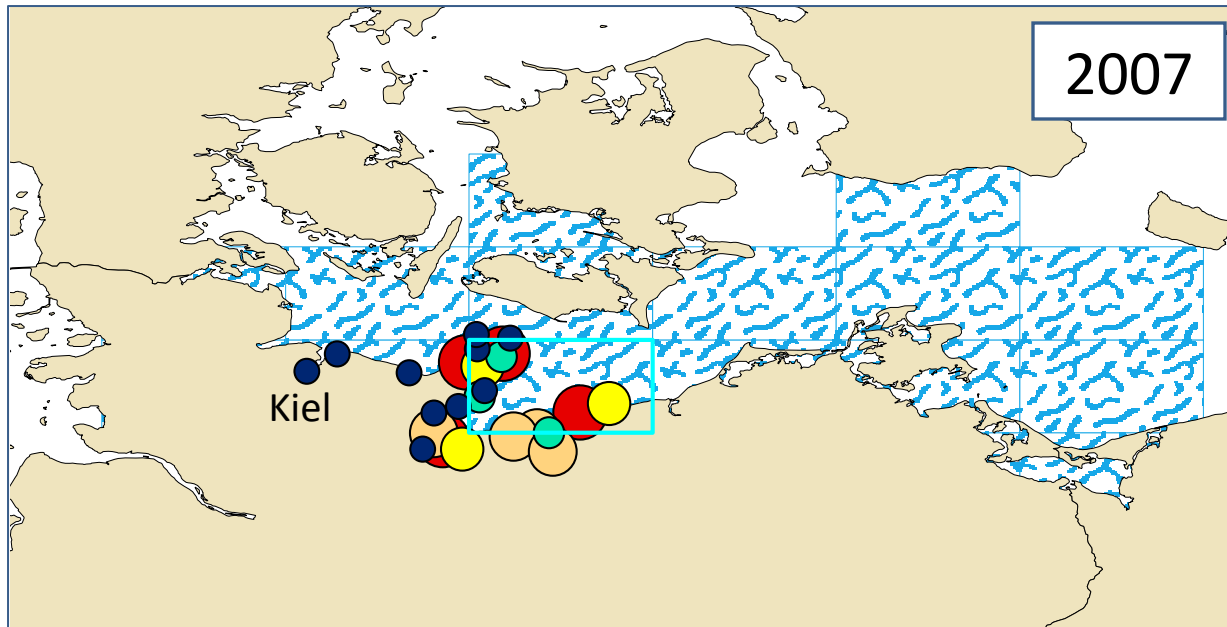
Landings' revenues / Year [37G1]



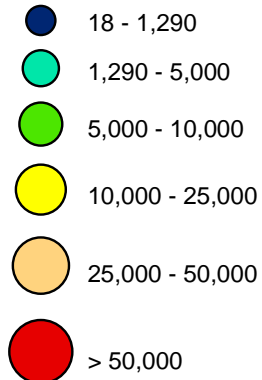
Landings (Kg) per landing port – spatiotemporal trend [37G1]



- Decline in maximum distance traveled from fishing grounds to landing ports (\neq Overall increase in German SSCF range)
- ‘Concentration process’ (wide-spread \rightarrow localised distribution)
(Direct proximity of 37G1)

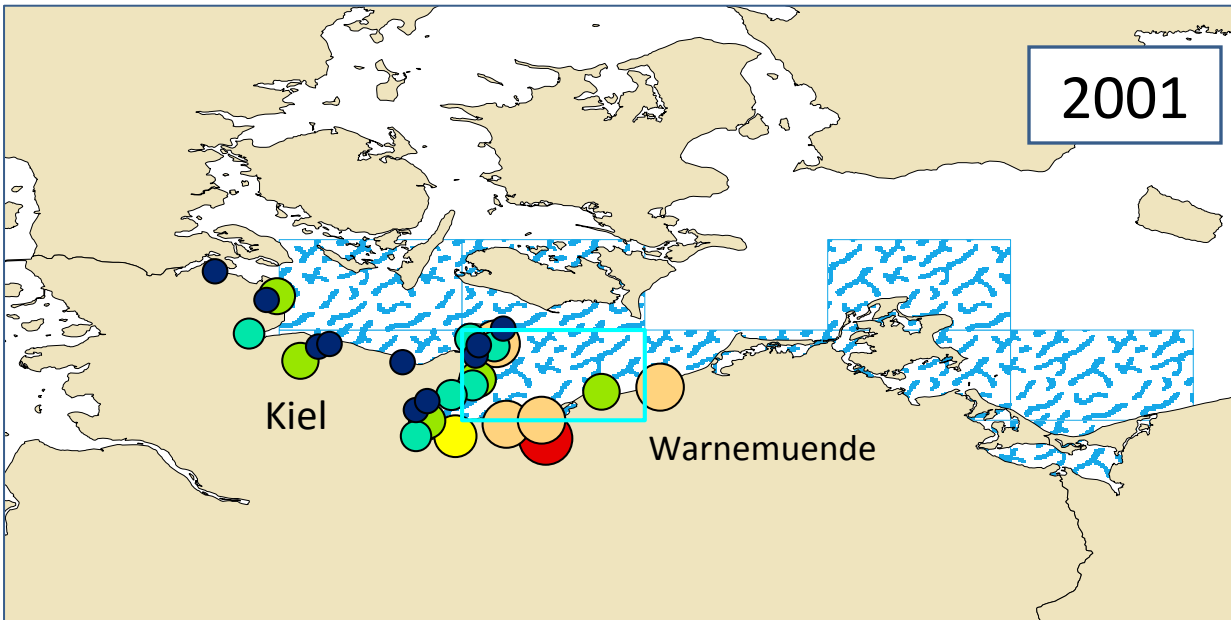


Landings (Kg) / port

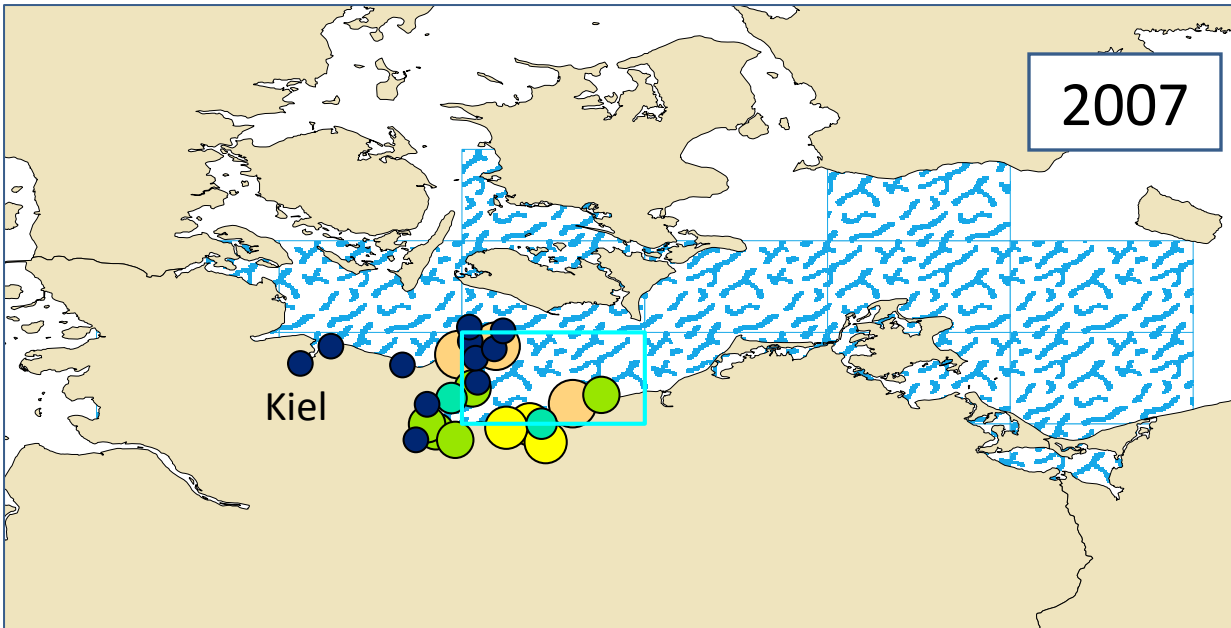


 SSCF Fishing areas

Landings' revenues (€) per landing port - spatiotemporal trend [37G1]



- Decline in the profitability of landings of main fishing harbours.
- Increase in profitability of landings of secondary landing harbours.



Landings' revenues (€) / port

- 0 - 3,175
- 3,175 - 9,285
- 9,285 - 39,576
- 39,576 - 71,775
- 71,775 - 192,533
- > 192,533

SSCF Fishing areas

Environmental variability and SSCF dynamics

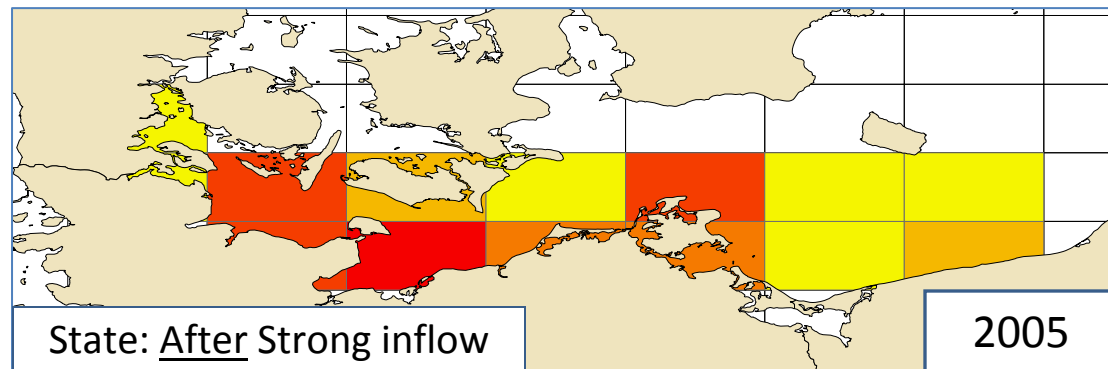
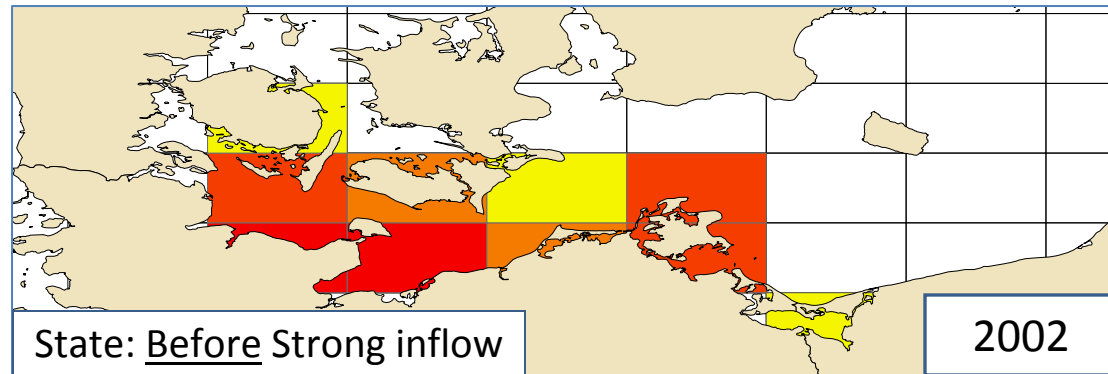
- Did past environmental variability affect the German SSCF fleet?

- How did the German fleet respond to the 2003 Strong Inflow event?

e.g. Did the SSCF vessels targeting cod exhibit any spatial/temporal change?

- 2003 N.Sea Inflow event: Saline, cold O₂ rich water enters the Baltic.
- Cod enhanced recruitment.
- **Was the SSCF sector targeting cod affected?**

- Increase in the overall volume of cod landings.
- Increase in the fishing grounds cod caught by SSCF (10 → 14 ICES Rect.)



SSCF cod landings (Kg)



-3,568
-25,176
-131,971
-257,023
> 257,023

Climate Change and SSCF

Climate Change projections:

1. Past environmental variability incidents
2. Simulation of future climate change scenarios.

Extrapolate:

- Future state of marine environment (T, S, O₂ etc)
- Future distribution of fish resource

Questions that will be addressed:

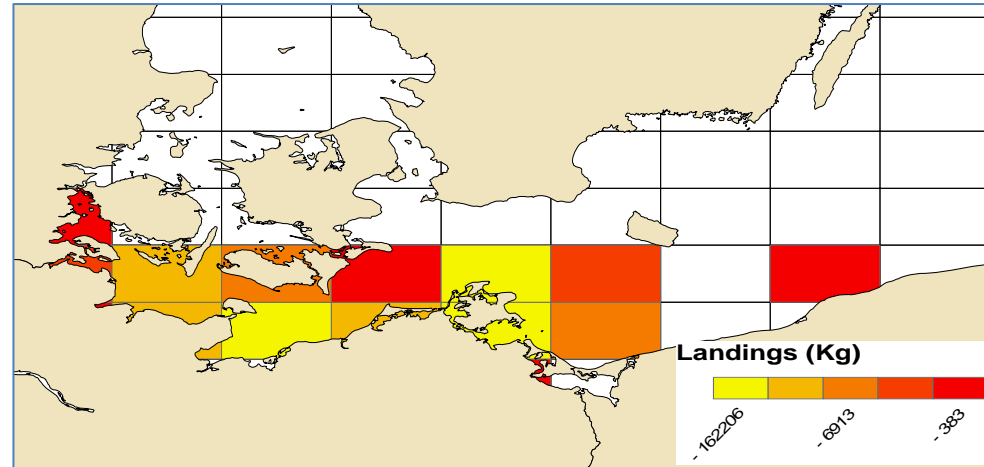
- Will SSCF vessels be able to adapt to the shift in the distribution of the fish resource?
- Will they be capable of reaching the new fishing areas?

coupled with:

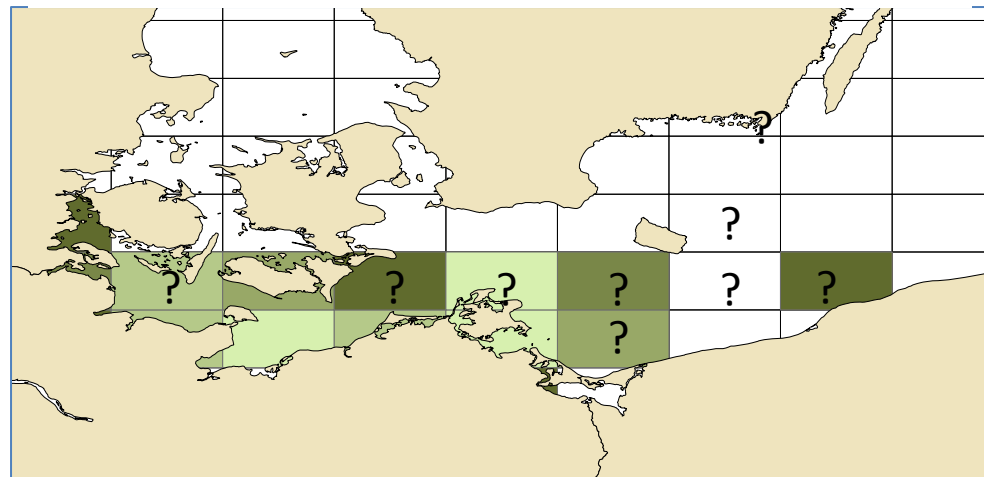
Economic projections:

- How will the landings/revenues change respectively? 'Will it -still- be profitable?'

German SSCF landings, Cod
Year 2009



German SSCF landings, Cod
Year 2050



Preliminary Conclusions

Importance of spatial framework of fisheries' information

Distance - Shifts in furthest distance travelled between fishing grounds – landing ports.

Aggregation - Clustering in the ports that showed most significant changes (landings, revenue, fleet).

Reallocation (?)

Policy management implications:

- Spatial patterns / patterns of abundance
- Movement of vessels
- Climate Change impacts mitigation.

e.g. ports/fishing areas that become obsolete (landings, revenues) - financial aid to SSCF fishermen that will be most affected by 'reallocation' vs ports/fishing areas that are still profitable

Environmental variability and fishing fleet dynamics

- Did past environmental variability affect the Danish Baltic fleet?
- How did the fleet respond to the 1987-1989 Regime Shift in the Baltic?
e.g. Did the vessels targeting cod exhibit any spatial/temporal change?

