Potential effects of spatial fishing restrictions and higher fuel prices on North Sea fisheries

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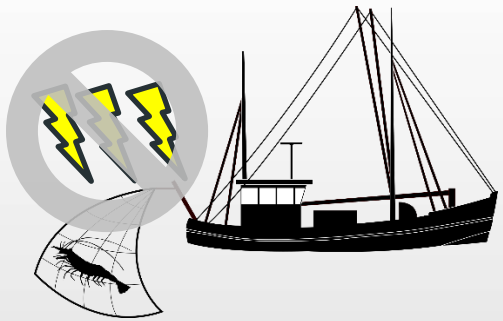
Southern North Sea

Marine spatial uses intensify

- Fisheries increasingly competes for space in the North Sea
  - Displacement of fishing effort
  - Longer steaming times
  - Limited access to fishing grounds
- Increasing fuel prices (Covid-19, Russo-ukrainian war)
- Call for more sustainable fishing gears (e.g. ban of electric pulse gear)



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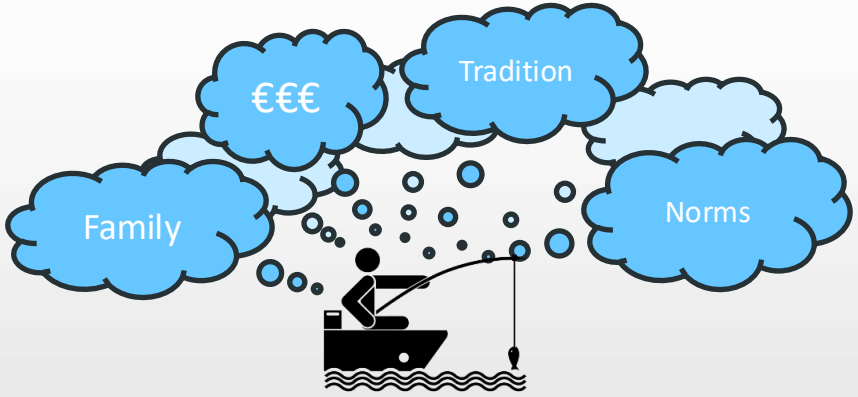
Objectives

Develop an agent-based model (ABM) of German fishing fleets in the southern North Sea

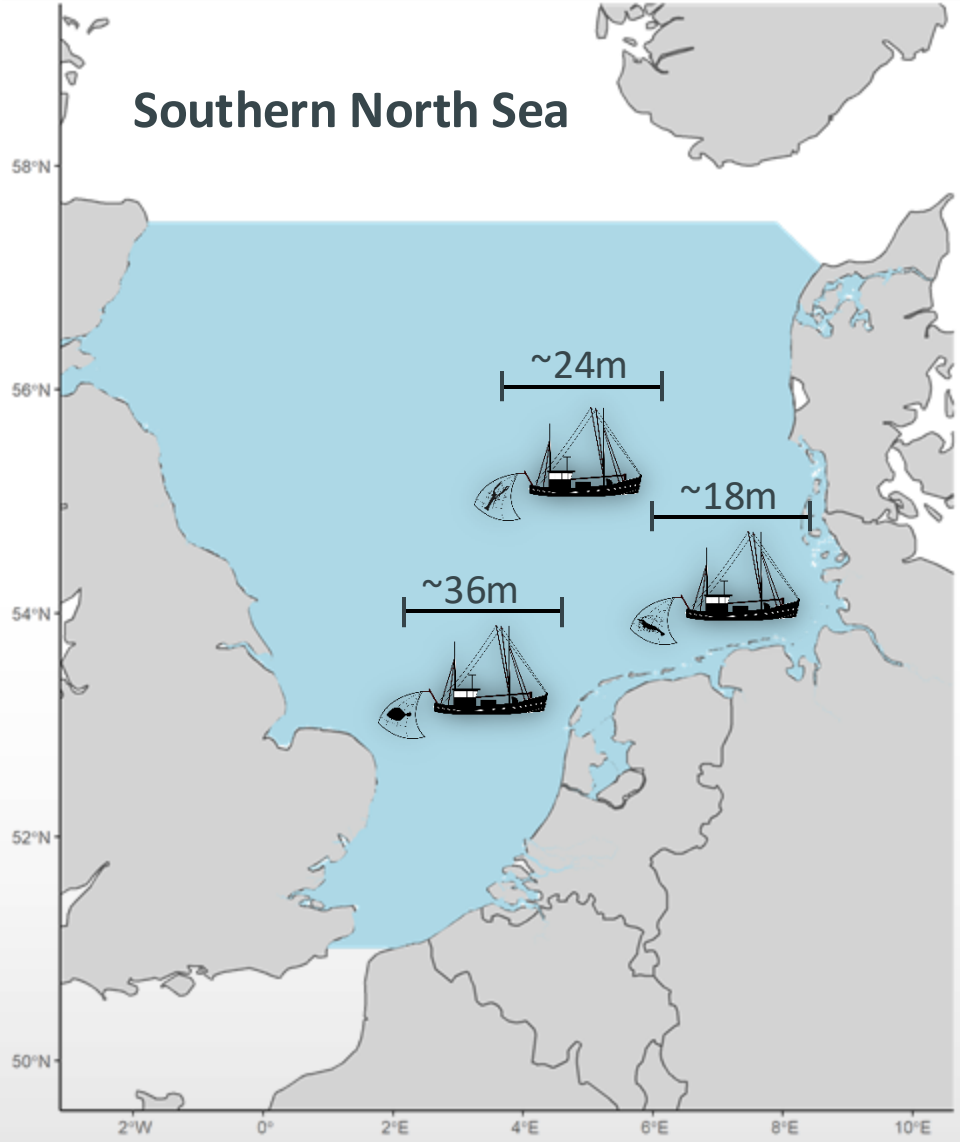
Assess future scenarios and inform marine spatial management

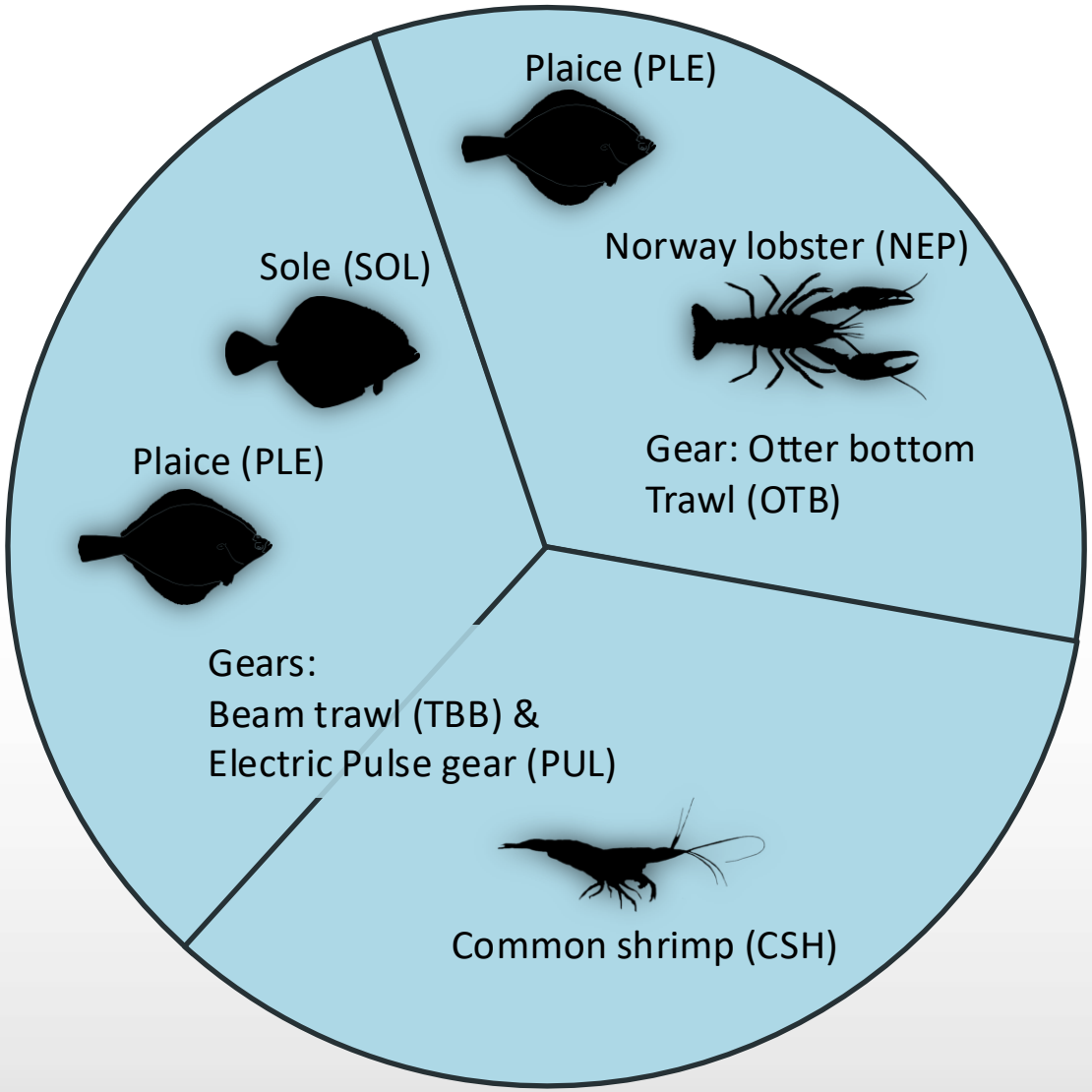
Complex behavioral rules (beyond profit maximization) to enable agents to dynamically adapt to new situations



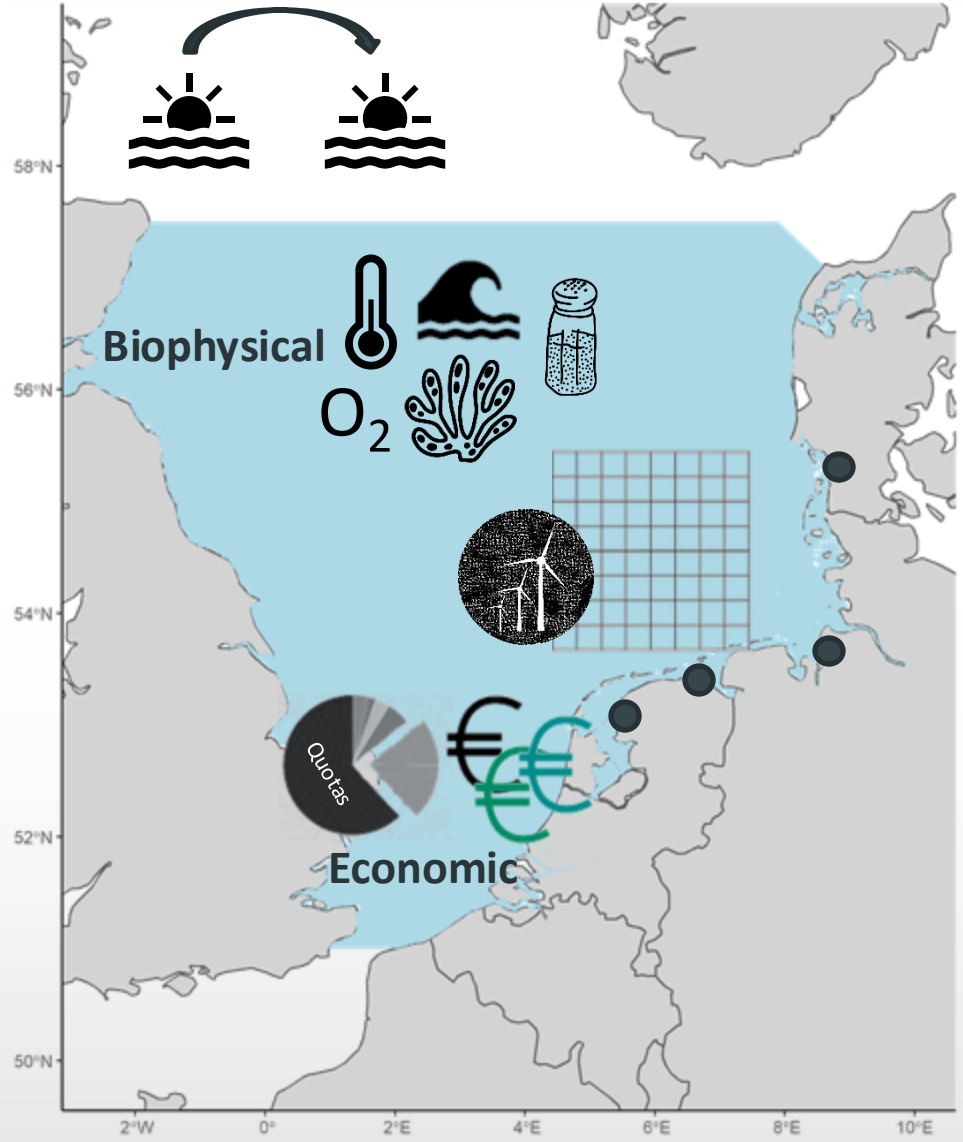
Fisher Icon created by Mywa Benzea from the Noun Project

Study system

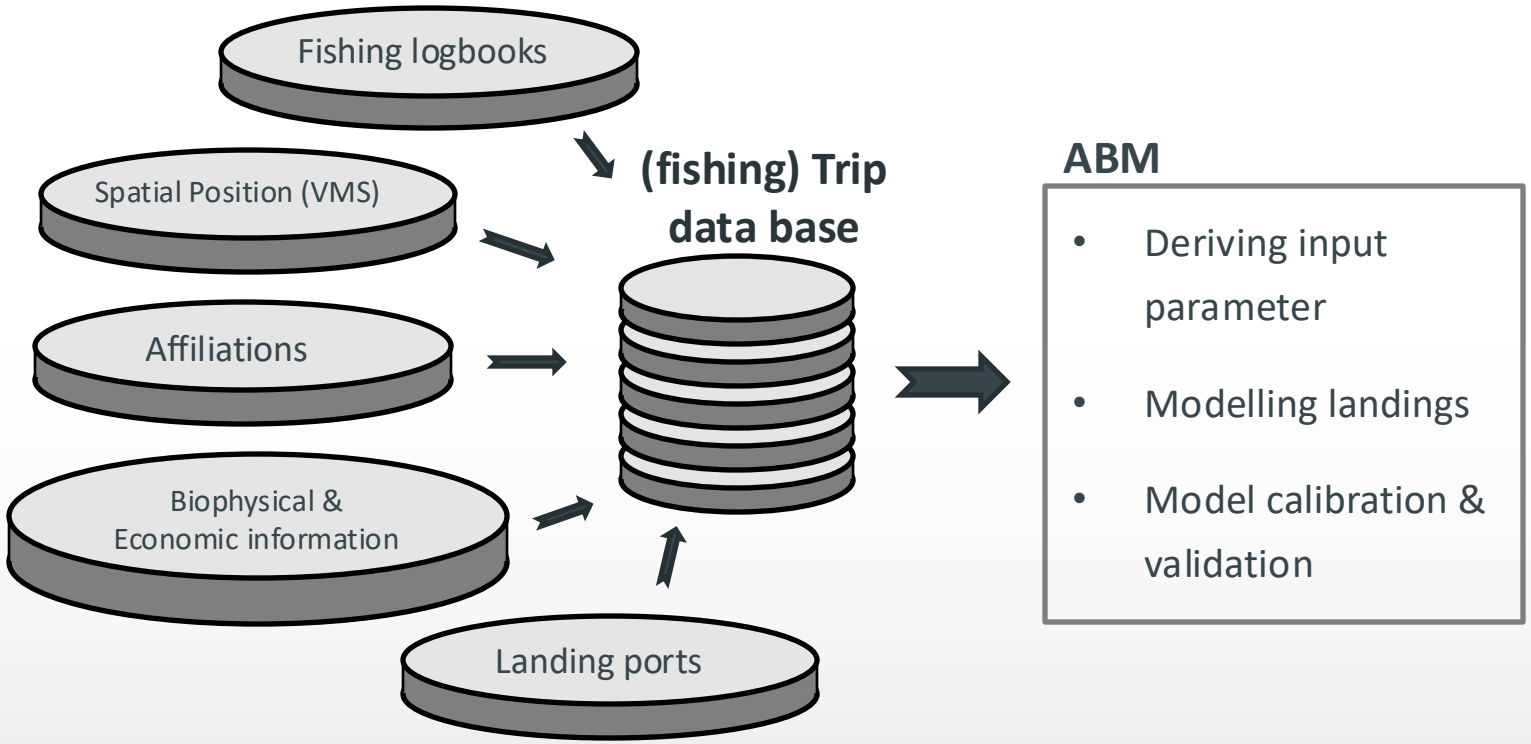




Empirical data



Agents: Fishers **Spatial grid resolution:** ca. 15km^2 **Time step:** daily



Icons created by Hanna Vernydub (algae) and Ray Rivera (Salt) from the Noun Project

FISHCODE – behavioral submodel

FIsheries

Simulation with

Human

COmplex

DEcision-making

Jager et al. 2000, Ecol. Econ.

Jager & Janssen 2012, ECCS 2012

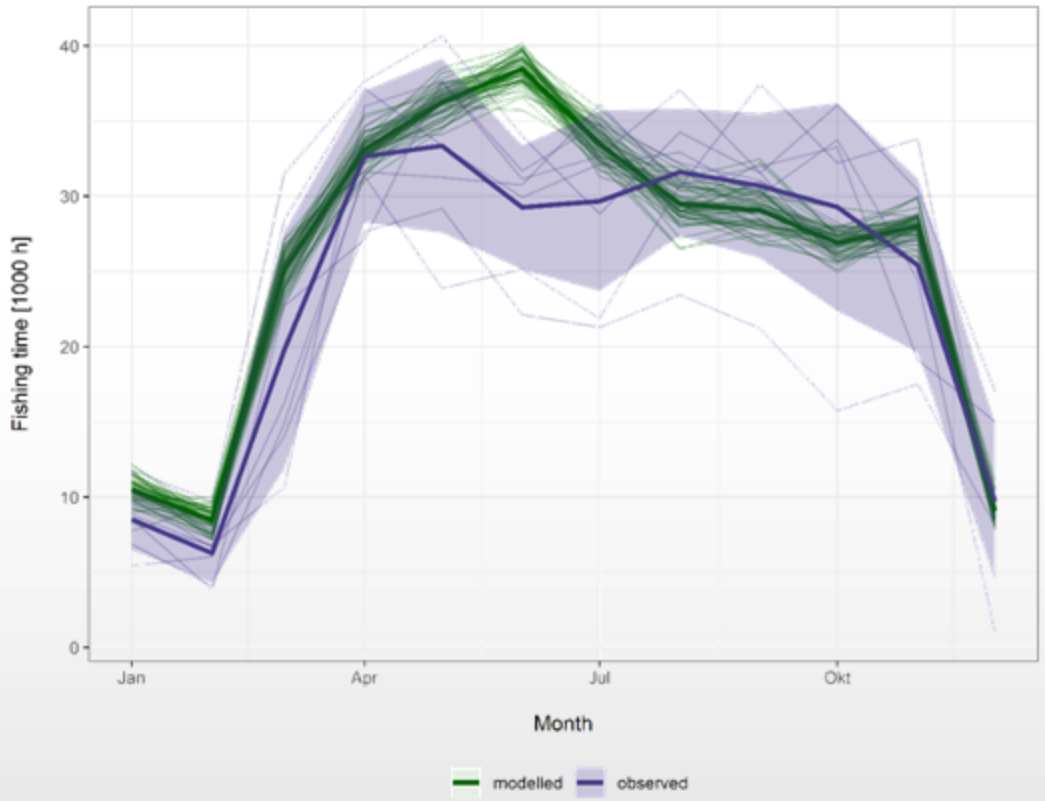
Letschert et al. submitted, Ecological Modelling

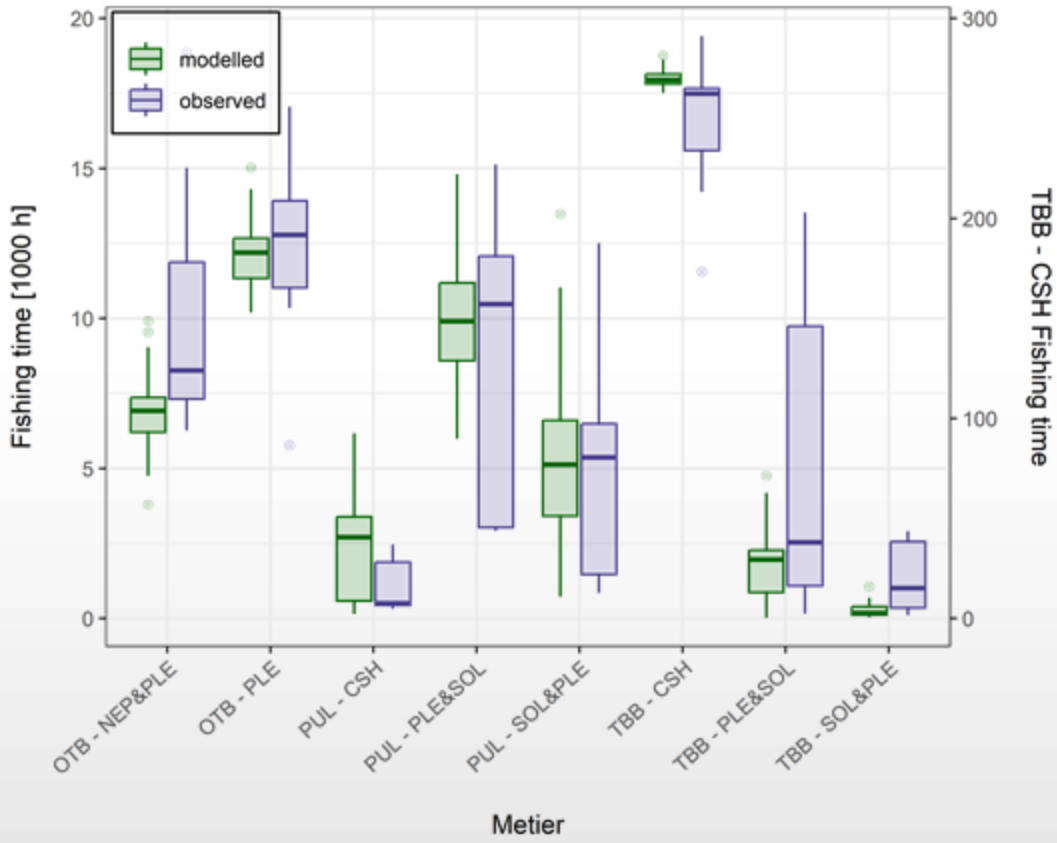
Validation

Modelling one year → Base scenario with averaged exogenous factors (economic & environmental)

→ Comparison to historic data (2012-2019)

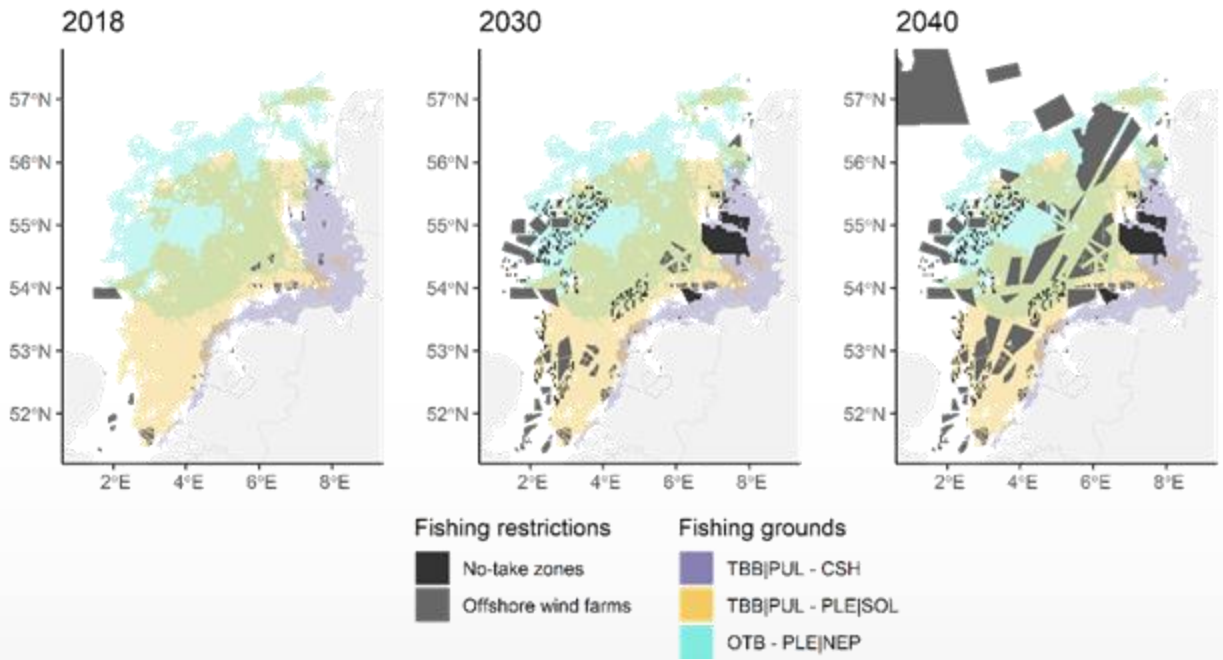
→ Per fishing metier (i.e. fishing gear and target species)





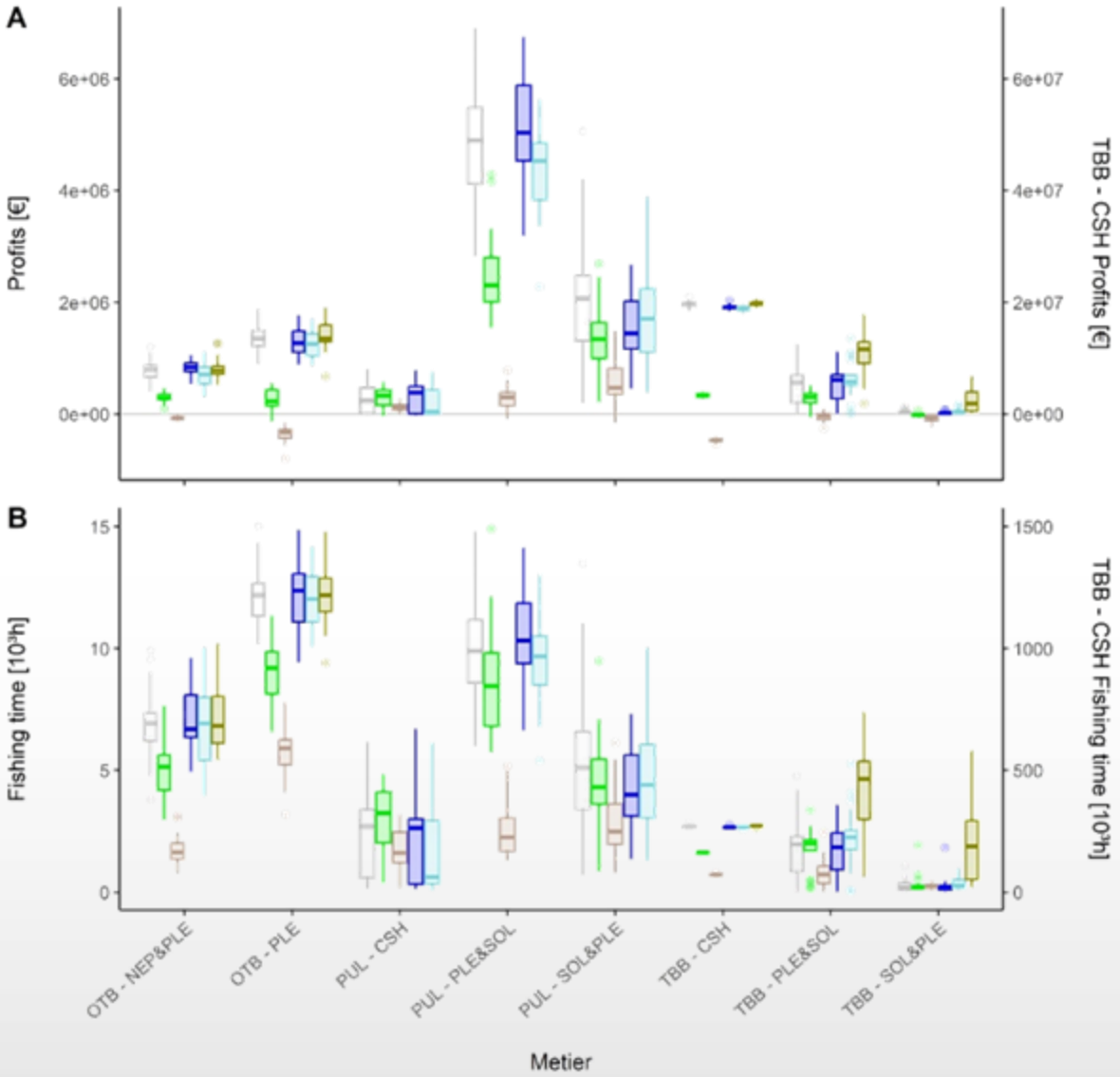
FISHCODE – Scenarios

Scenario name	Spatial fishing restrictions	Fuel price	Electric pulse gears
Base-run	OWF status of 2018	100%	yes
OWF2030+NTZ	OWF status of 2030 and NTZs	100%	Yes
OWF2040+NTZ	OWF status of 2040 and NTZs	100%	Yes
Fuel-300%	OWF status of 2018, no NTZs	300%	Yes
Fuel-600%	OWF status of 2018, no NTZs	600%	Yes
PUL-false	OWF status of 2018	100%	No



Modelling one year

Non-spatial scenario results



Fuel scenarios lowered fishing effort and profits for all metiers. Agents adapted by decreasing steaming time and increasing LPUE.

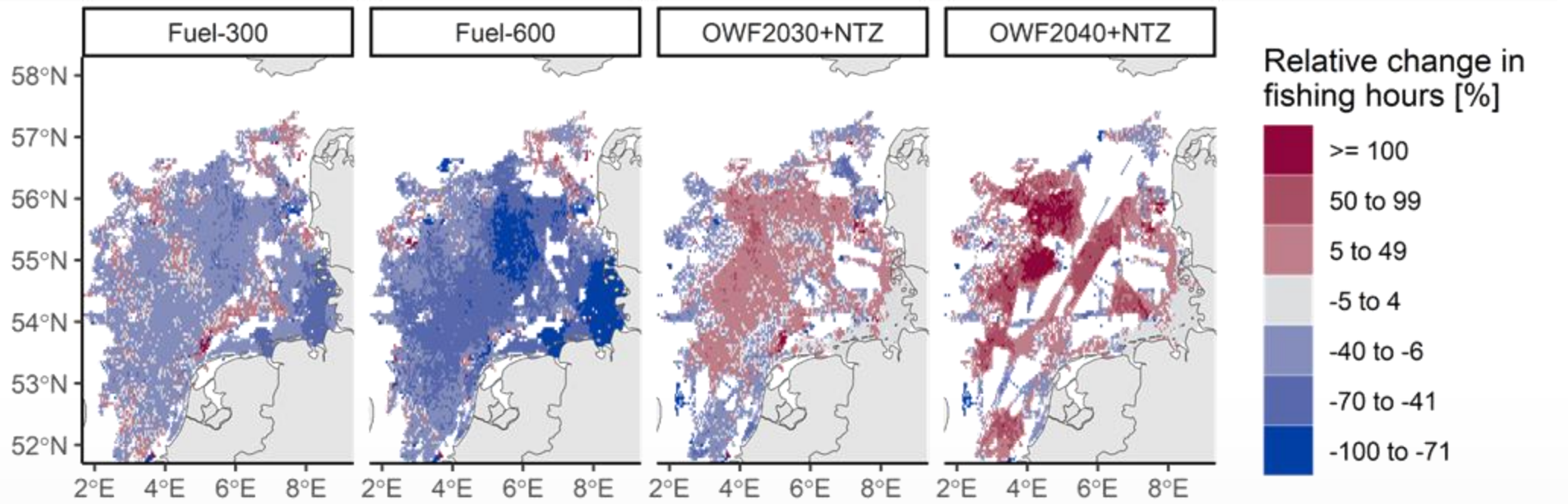
In comparison, **spatial fishing restriction scenarios** had a much weaker effect.

Banning electric pulse gear increased fishing effort and profits of equivalent gears (TBB).

base
Fuel-600
OWF2040+NTZ
Fuel-300
OWF2030+NTZ
PUL-false

OTB = Otter bottom trawl; **PUL** – Electric pulse gear; **TBB** – Beam trawl; **PLE** = plaice; **SOL** = sole; **NEP** = Nephrops; **CSH** = common shrimp

Scenario results

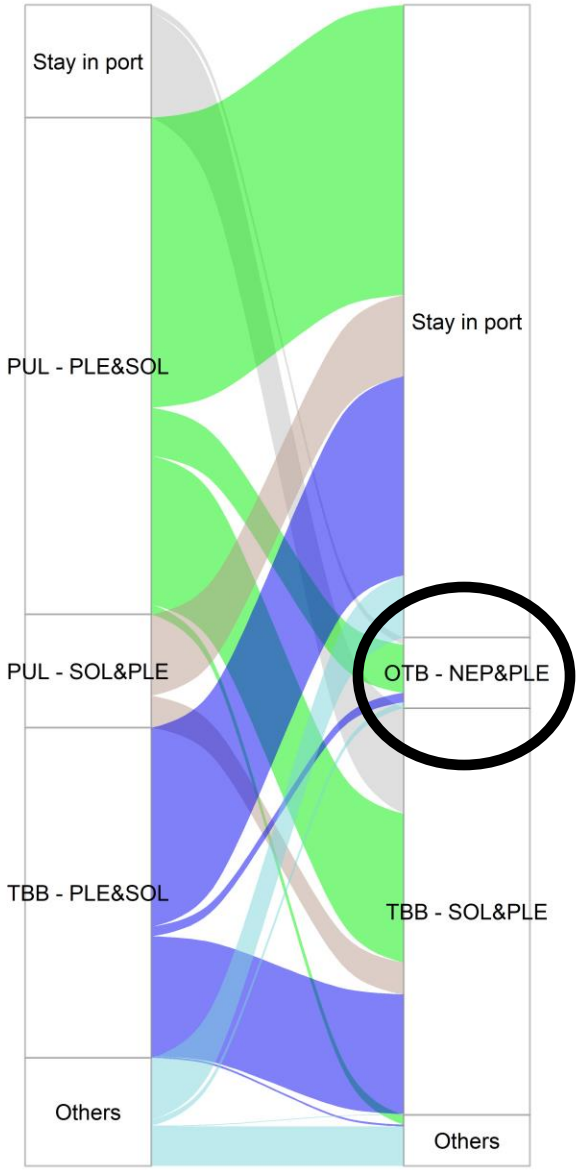


Fuel scenarios reduced spatial fishing effort systematically.

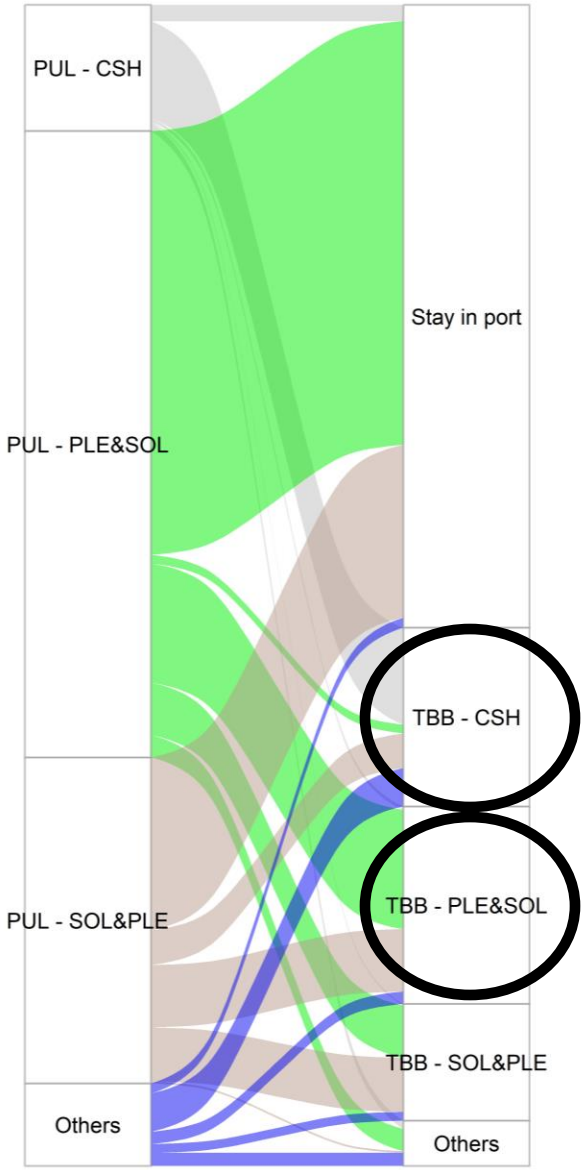
Spatial fishing restriction scenarios lead to a concentration of fishing effort (more than tripled in hotspots).

Banning pulse gears

Observed



Modeled



… so what?

Most model outcomes from scenarios are as expected – will that be useful?

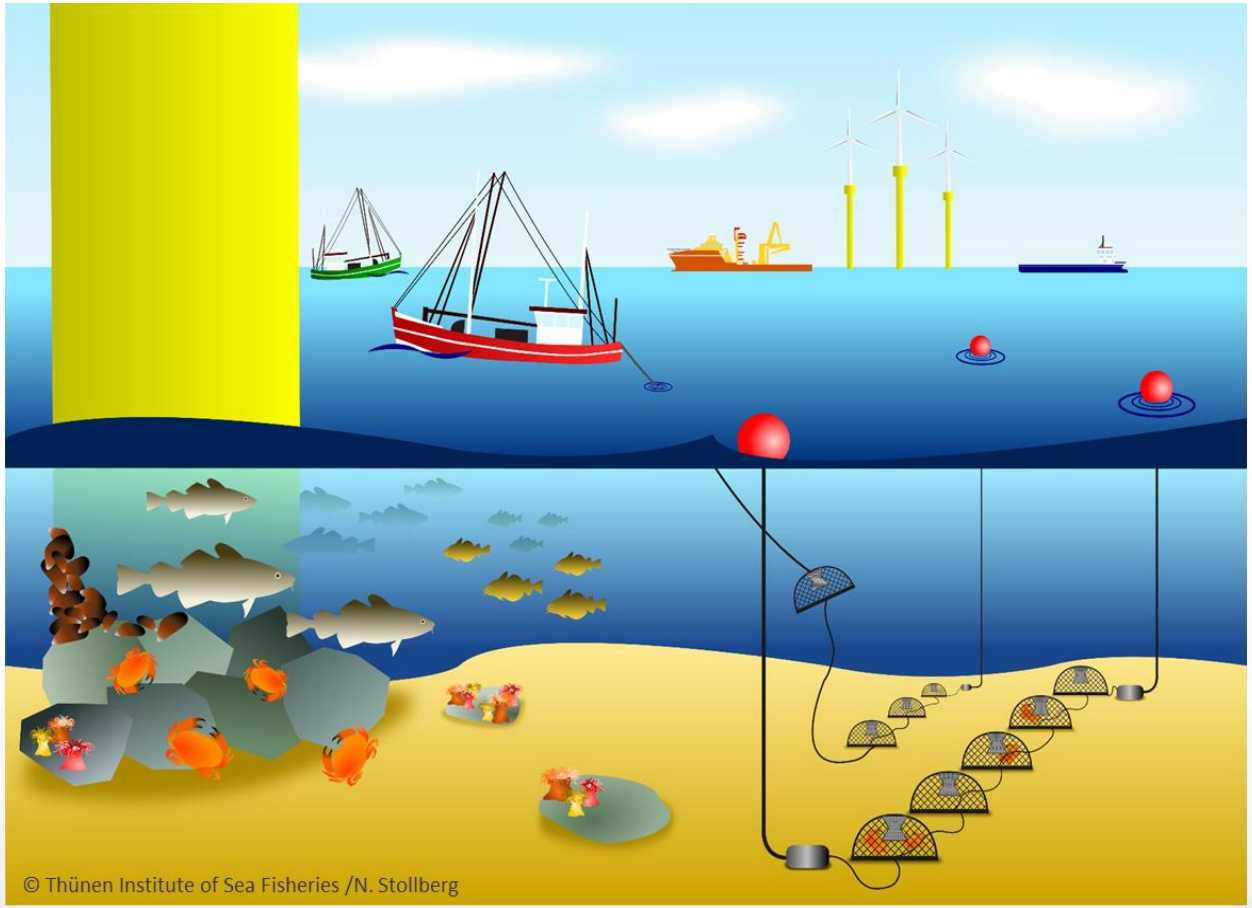
Yes and **No**

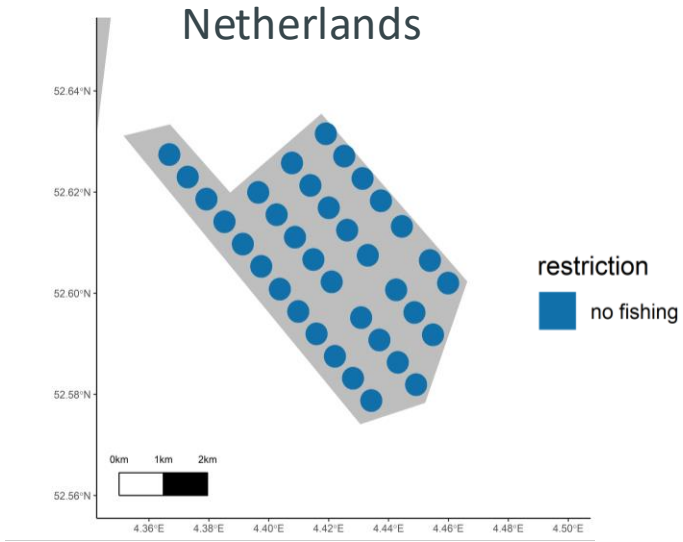
- Scenario results on fishing effort can be used to manage potential hotspots and mitigate harmful effects for the environment
- Scenario results on profits by metier and port could identify the needs for subsidy programs or alternative target species

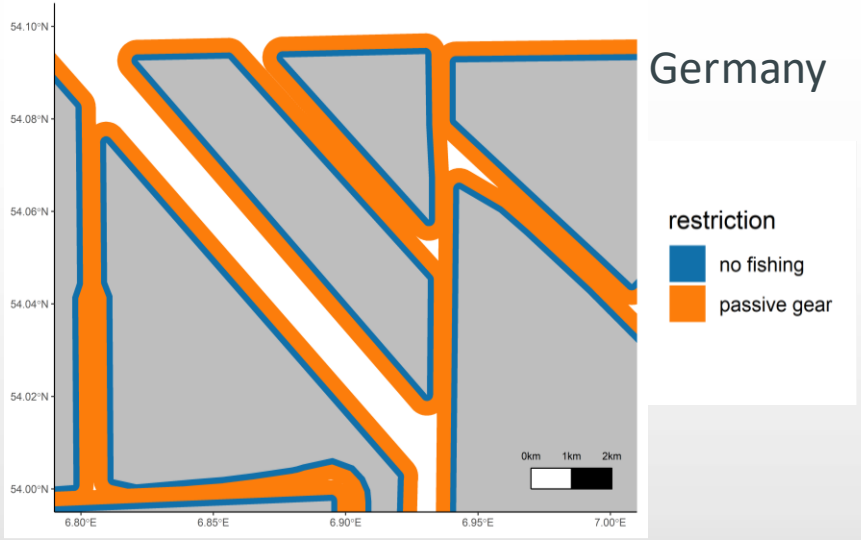
- North Sea fisheries might look completely different in 10 to 20 years
  - Few successors for family businesses
  - Climate change
  - Policies suggestions to phase out bottom trawling
  - Windfarms, fuel prices, ect.

→ How could future fishery look like?

Co-location of fisheries and offshore windfarms







Summary

- ✓ FISHCODE as virtual laboratory for the German North Sea fisheries
- ✓ Agent decision-making enables to adapt to new situations (spatially & technically, i.e. ban of pulse gears)

- ➢ Transformation of fishing sector makes it difficult to simulate scenarios of 10 to 20 in the future.
- ➢ Instead of recreating the past in our models, we should try to simulate future vessels and fishing techniques

Thank you for your attention!

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www.seawiseproject.org

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Contributed to FISHCODE

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SeaUseTip

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