



Debunking Misconceptions:

Marine mammals and seabirds have limited impacts on fisheries catches in the North Sea

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Rationale

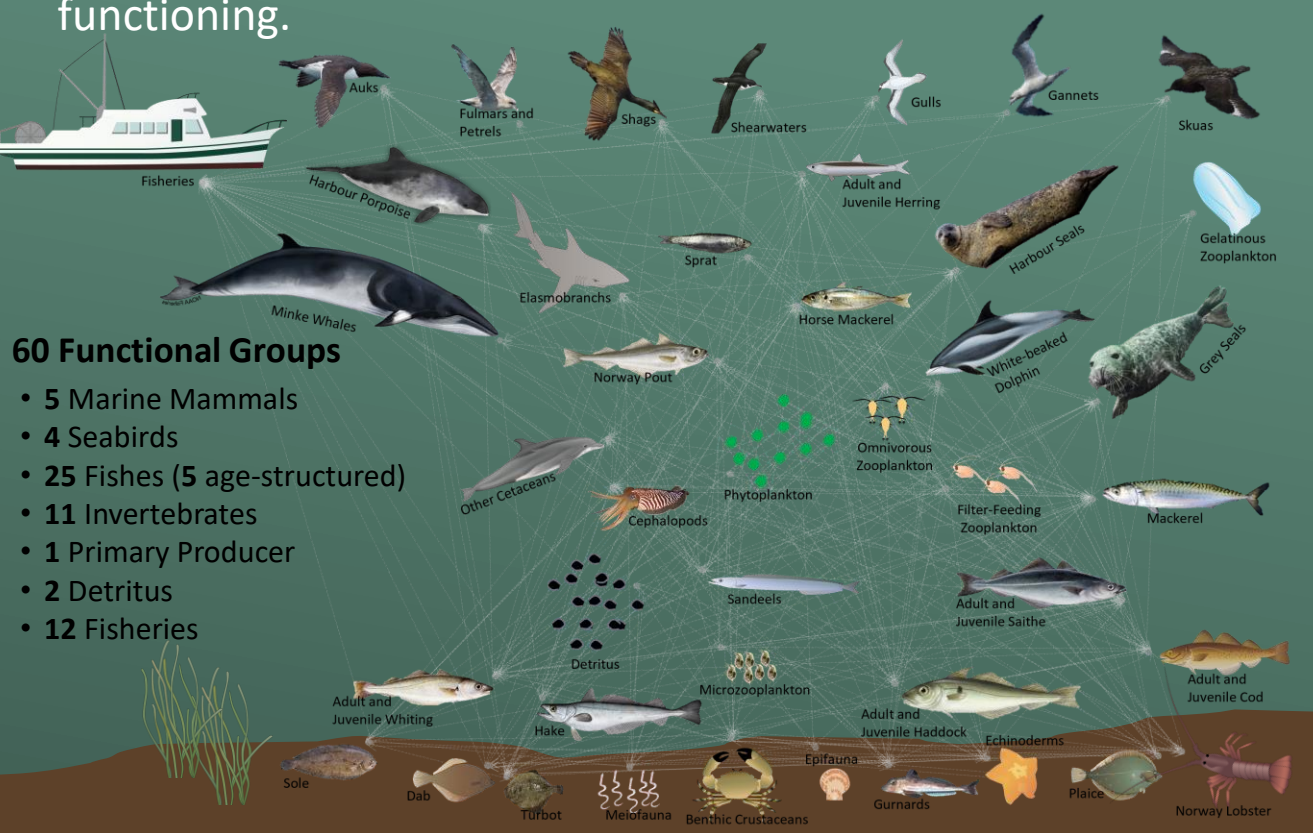
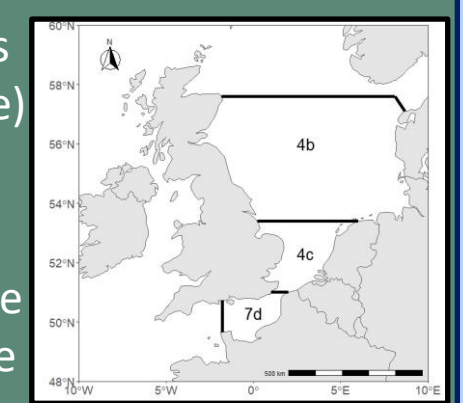
- Since 1990, the marine **mammal abundance has markedly increased** in the southern North Sea and the eastern English Channel, while seabird abundances declined in the 1990s and have been stable since the early 2000s.
- Demersal fisheries has declined, but other fisheries have increased or maintained effort.
- Changes to top predator biomass may influence commercial fish stocks, **creating conflict with fishers**, but this impact compared to the effect imposed by fisheries is enigmatic.

Objective

Evaluate the impact of changes to top predator abundances and fishing pressure on fisheries productivity

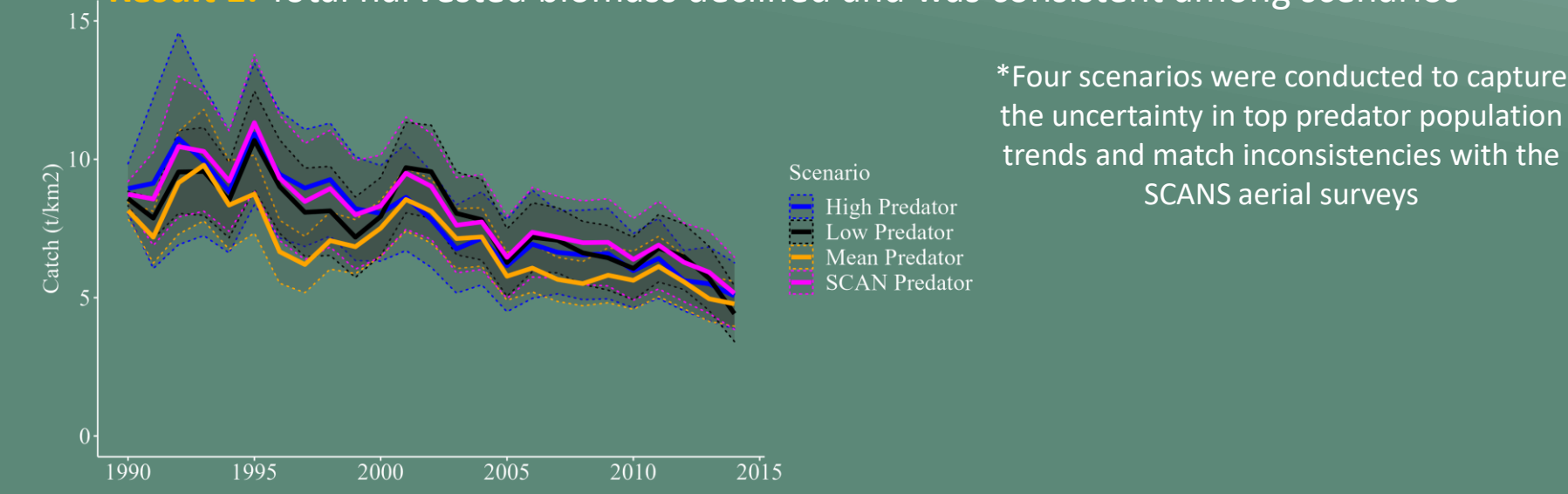
Methods:

- Develop an ecosystem model for the years 1990–2014 (Ecopath with Ecosim software)
- Southern North Sea and eastern English Channel (ICES Regions 4b, 4c, and 7d)
- Simulate trends in top predator abundance and commercial fishing effort and evaluate fisheries productivity and ecosystem functioning.



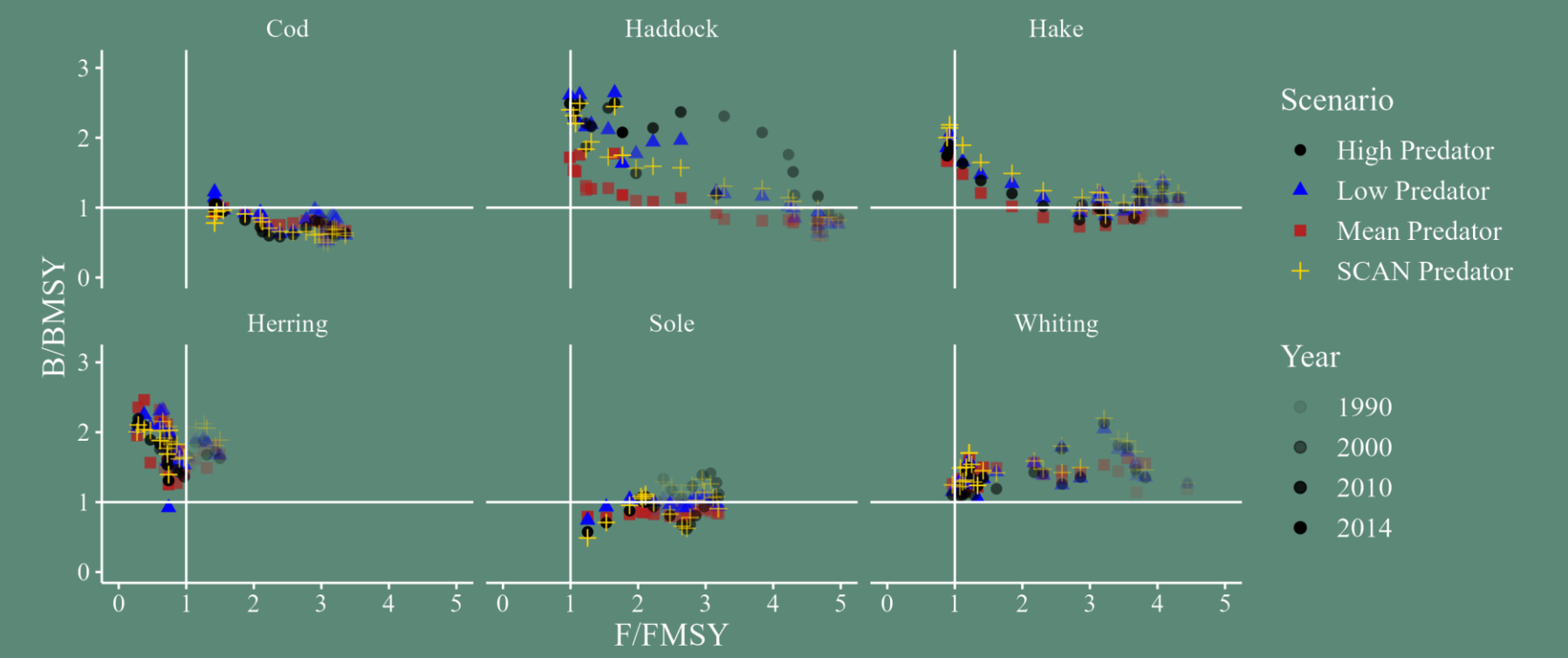
- 60 Functional Groups**
- 5 Marine Mammals
 - 4 Seabirds
 - 25 Fishes (5 age-structured)
 - 11 Invertebrates
 - 1 Primary Producer
 - 2 Detritus
 - 12 Fisheries

Result 1: Total harvested biomass declined and was consistent among scenarios

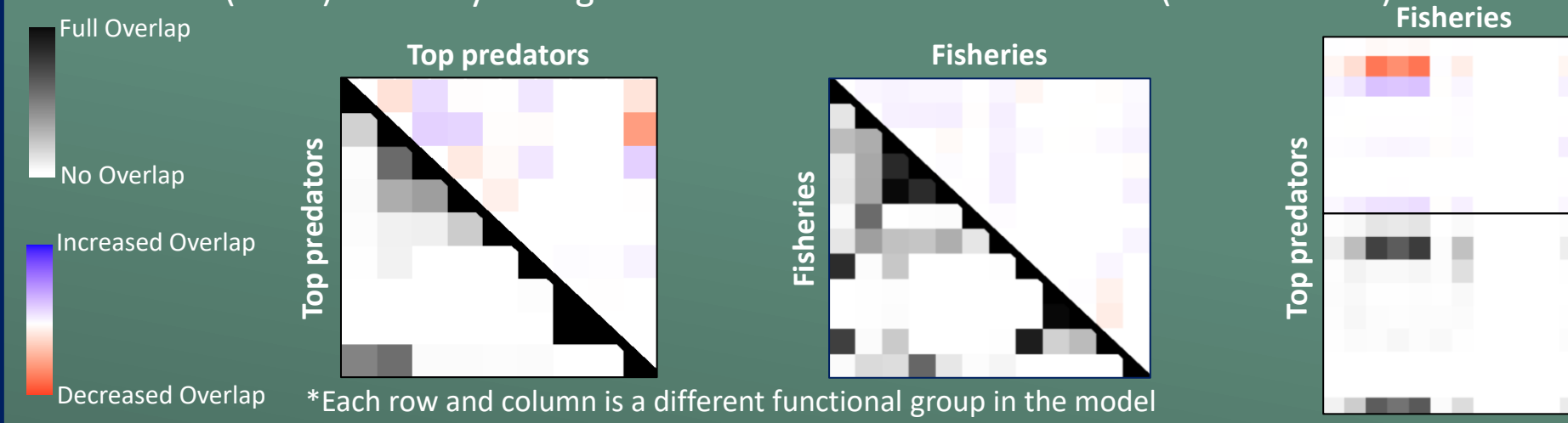


*Four scenarios were conducted to capture the uncertainty in top predator population trends and match inconsistencies with the SCANS aerial surveys

Result 2: Most fisheries progressed towards current biomass and fishing mortality targets



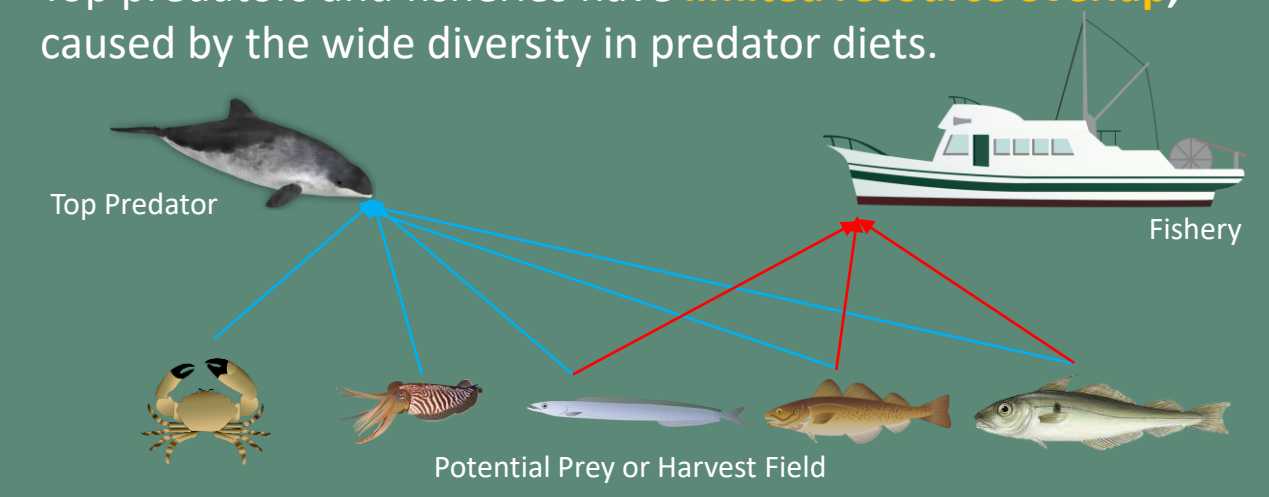
Result 3: Fisheries have a greater resource overlap with other fisheries than top predators (black) and only changed over time in a few interactions (red and blue)



*Each row and column is a different functional group in the model

Conclusions

- The cumulative **fisheries harvest declined** over time, which was largely driven by the decline in beam trawl fishing effort.
- Commercially important fish stocks **approached sustainable management goals**.
- As population size fluctuated throughout the simulation, so did the strength of predator-prey interactions.
- Top predators and fisheries have **limited resource overlap**, caused by the wide diversity in predator diets.



- Although the predation impact of marine mammal species increased with their increasing abundances, **this increase was negligible** relative to the annual fisheries harvest

Implications

- The conflict between top predators and fisheries is not trivial, as increased marine mammal abundances may not necessarily lead to an additive increase in resource competition.
- Due to the presence of mixed fisheries (target multiple species) in the region, fishers are likely competing with other commercial fishers more than marine mammals and seabirds.
- Localized and seasonal effects may exist that are unaccounted for in this modeling effort.



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