



Predicting habitat suitability for the basking shark (*Cetorhinus maximus*) in the Northwest Atlantic



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Background

Problem:

- Marine species are shifting their distributions poleward in response to climate change^{4,5}
 - This can increase the risk of entanglement, bycatch, or vessel collisions if species distributions are unknown^{4,5}
- Ocean management should adapt and respond to these range shifts to be effective

The basking shark:

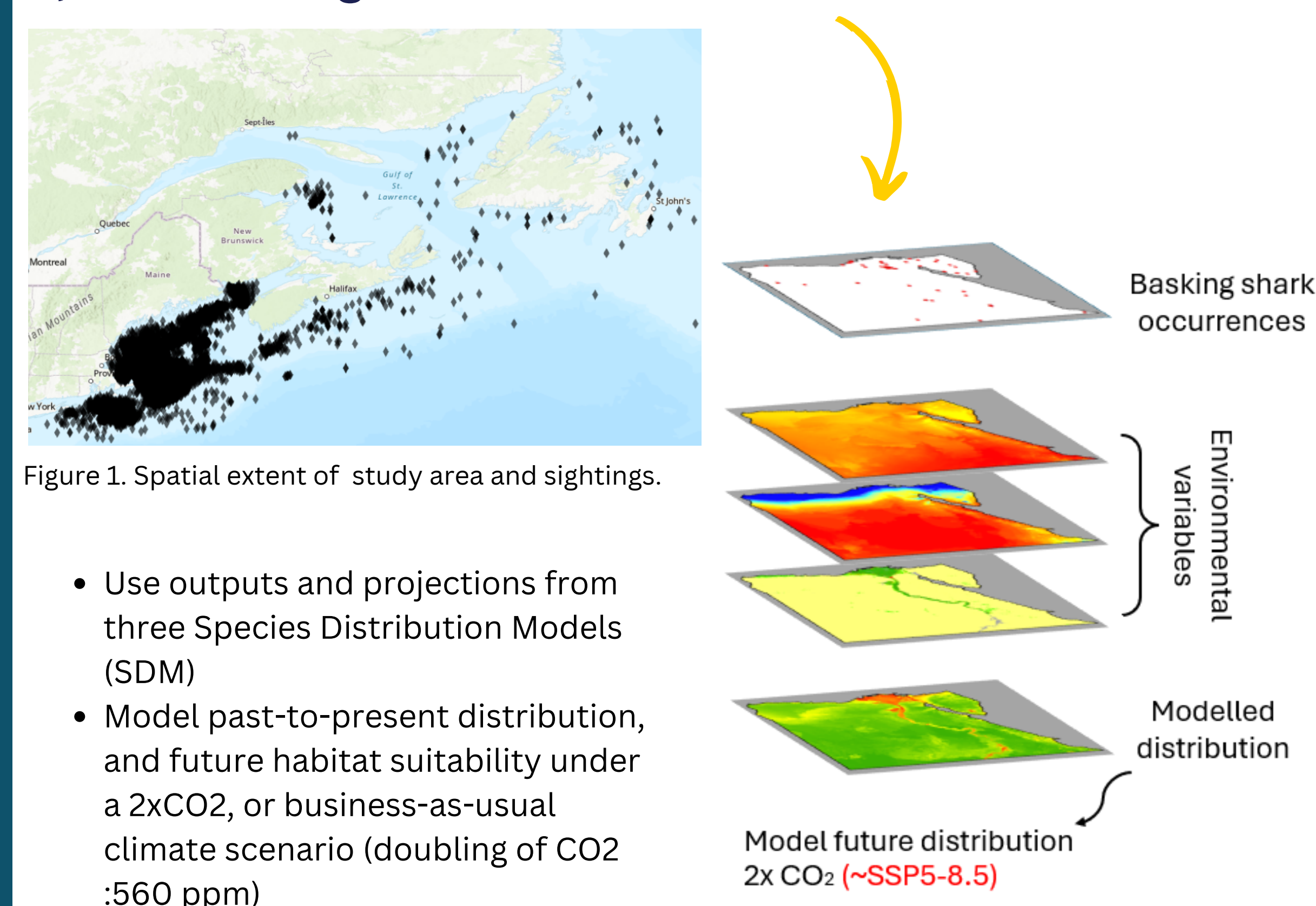
- Occurs seasonally in the NWA¹
- Migrations linked to prey availability and oceanographic factors^{2,7}
- Globally endangered and slow life history
 - Current threats: entanglement, bycatch, and vessel collisions^{1,6}
- Listed as of “*Special Concern*” in Atlantic Canada by COSEWIC over 16 years ago, recent distribution poorly understood¹

Research questions:

- Which environmental variables drive basking shark distribution in the NWA?
- What are the areas of suitable habitat and how might they change under climate change?

Methodology

9,172 basking shark observations in the NWA



Results

I. The model identified sea surface salinity (SSS) as the most influential predictor of basking shark occurrence

Environmental variables of significance					
SSS	SST	NPP	Bathy	Shelf	Slope
0.3657	0.2164	0.1978	0.1289	0.0339	0.0017

Table 1. Average Mean Decrease Accuracy (MDA) Scores for environmental variables of significance. Ranked in order of importance, the higher the score, the more important the variable.

II. Lower habitat suitability predicted in the northern range of the NWA under a BAU climate scenario

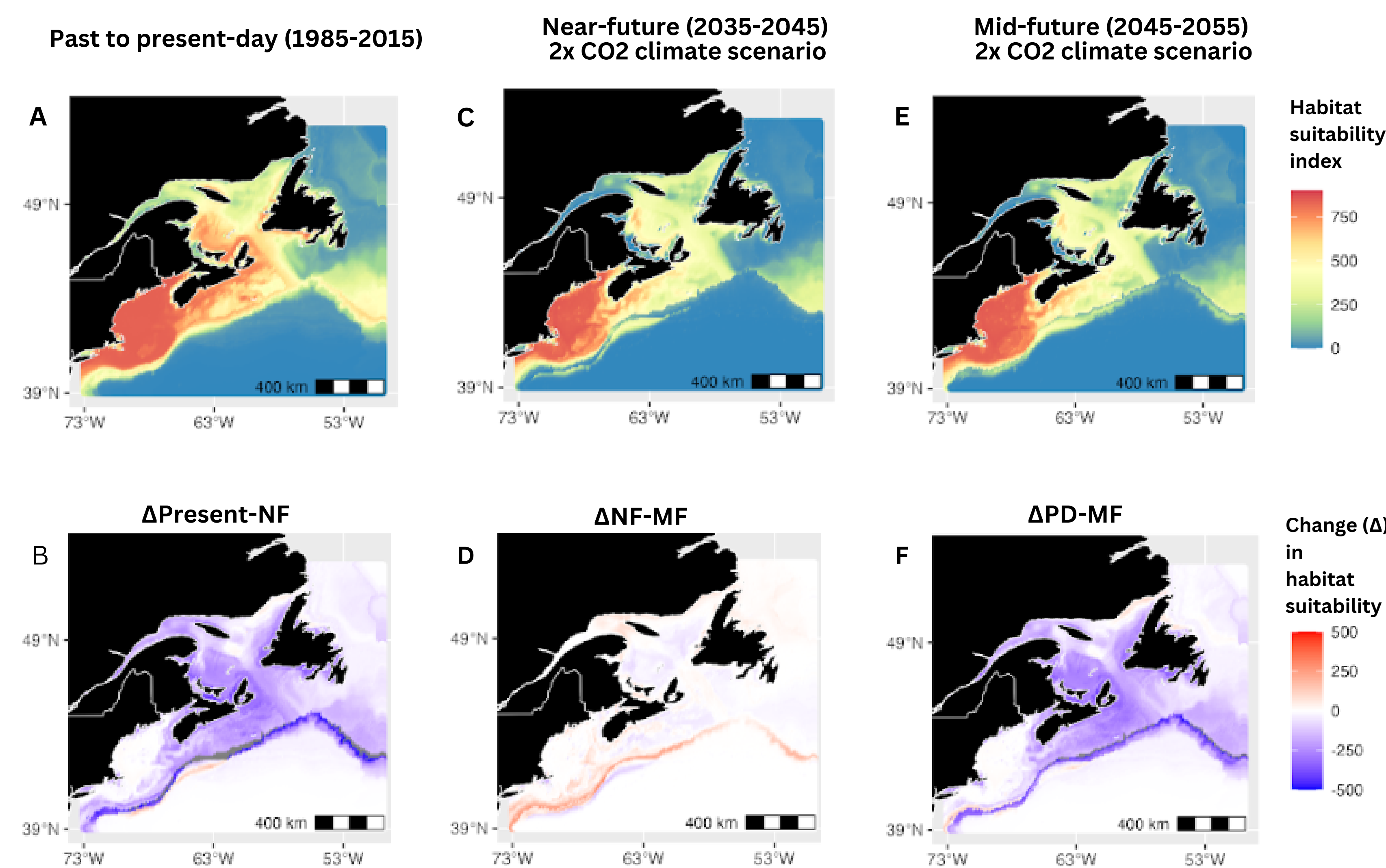


Figure 2. Habitat suitability model estimates for basking sharks in the NWA. (A) Past to present-day (1985 – 2015). (B) Change from A to C (C) Near-future (2035-2045). (D) Change from C to E (e) Mid-future (2045-2055). (f) Change from A to E.

In the near-to-mid future under a 2x CO₂ scenario:

- High habitat suitability predicted in nearshore areas of the Gulf of Maine, Georges Bank, lower Bay of Fundy, and the Western Scotian Shelf
- Reduced habitat suitability towards the Eastern Scotian Shelf, the Gulf of Saint Lawrence, Newfoundland (Grand Banks), and offshore areas

Discussion

- High habitat suitability characterized by high SSS and lower SST in the near to mid-future
- SSS is the most influential variable
 - Possibly a result of basking shark occurrences in this study being entirely from the NWA region with high saline water
- SST as second most influential - basking sharks prefer temperate habitat conditions^{1,2}
 - Cool NWA waters = higher ocean mixing, productivity, and prey availability³
- In association with NPP - basking shark is believed to migrate seasonally to follow preferred prey (zooplankton; copepods)^{1,2,7}
- Further investigation is in progress to better understand specific mechanisms

Research significance

- Identify priority areas for species management
- Forecast changes in habitat quality
- Design dynamic spatial protections that reduce overlap with known threats such as vessel collisions, entanglement and bycatch

Acknowledgements

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References

