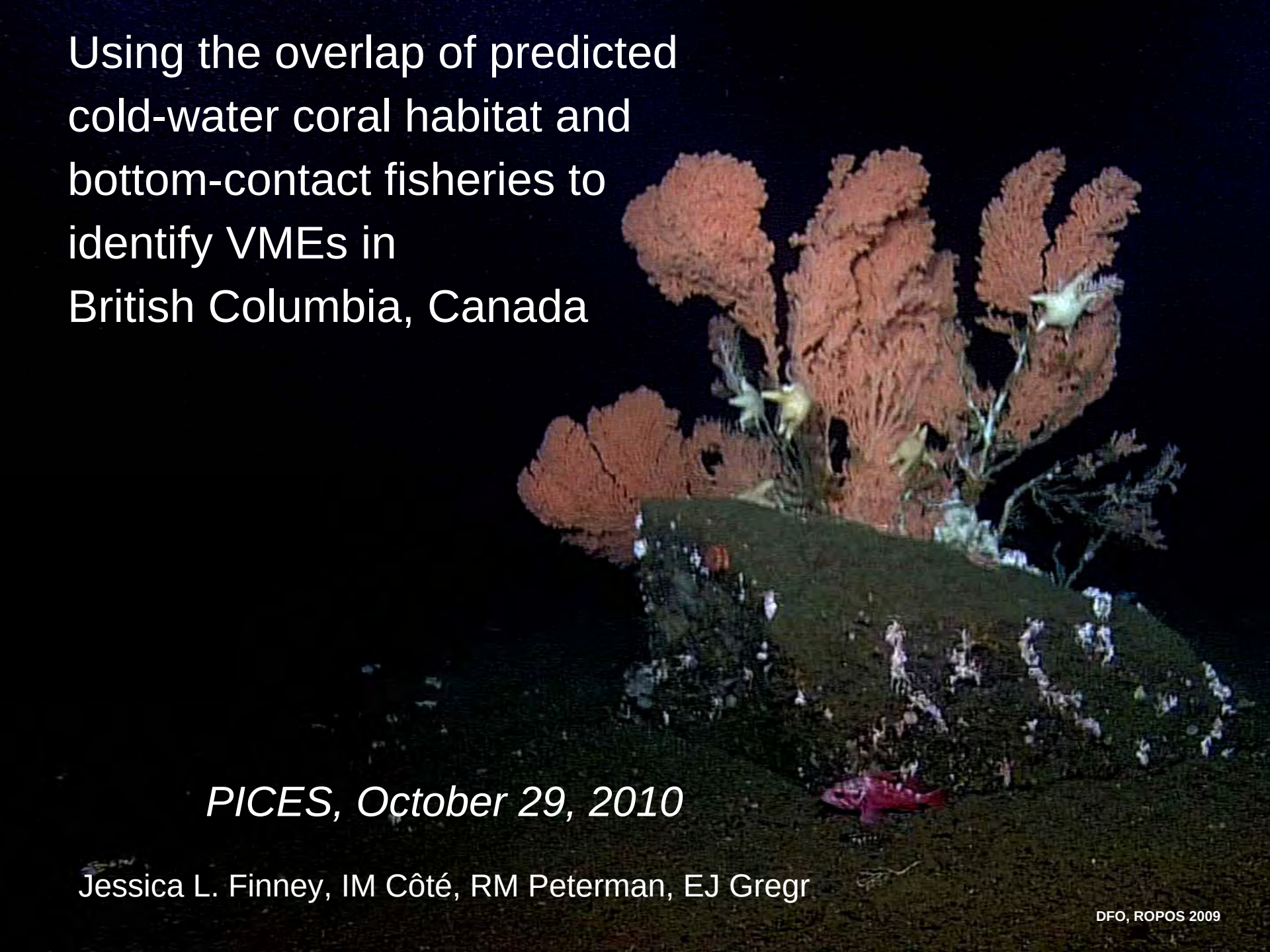
Using the overlap of predicted cold-water coral habitat and bottom-contact fisheries to identify VMEs in British Columbia, Canada



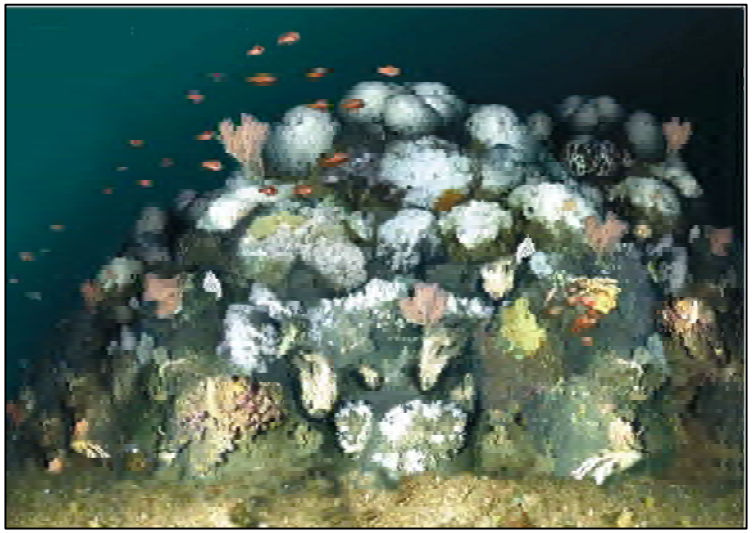
PICES, October 29, 2010

Jessica L. Finney, IM Côté, RM Peterman, EJ Gregr

DFO, ROPOS 2009

Cold-water coral in Pacific Canada

- BC home to a diversity of cold-water coral
- Provide valuable biogenic habitat



Fishing impacts

- Vulnerable to bottom-contact fishing and other human activities
- Low capacity to recover from disturbance
- Canada has committed to protecting coral

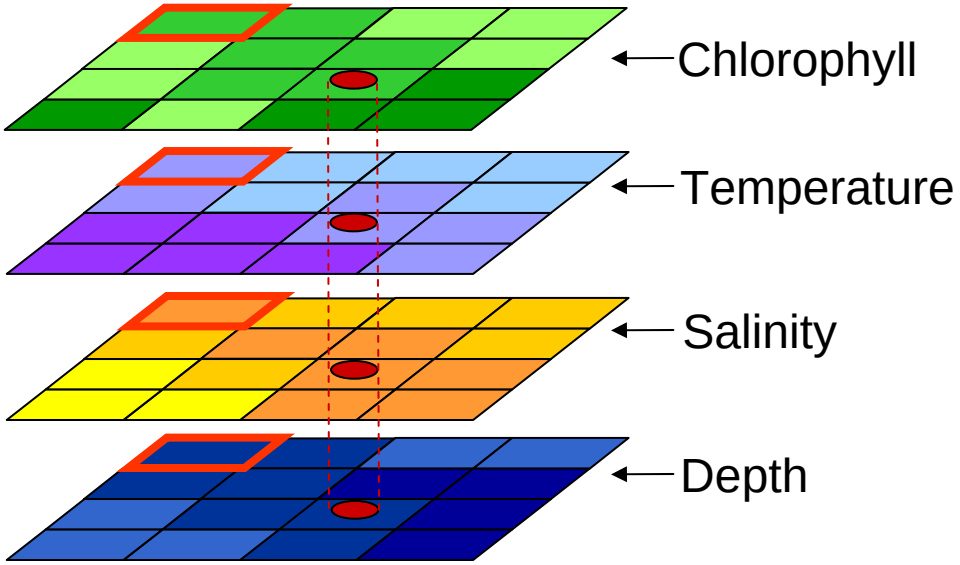
(e.g., Policy for Managing the Impacts of Fishing on Sensitive Benthic Areas, UNGA Resolution 61/105)

Constraints to conservation

- Deep-sea research expensive, logistically challenging
- Distribution largely unknown
- Do not know the extent of overlap between coral habitat and bottom fishing activity
- Species distribution modeling can help meet management needs by predicting areas of habitat suitability

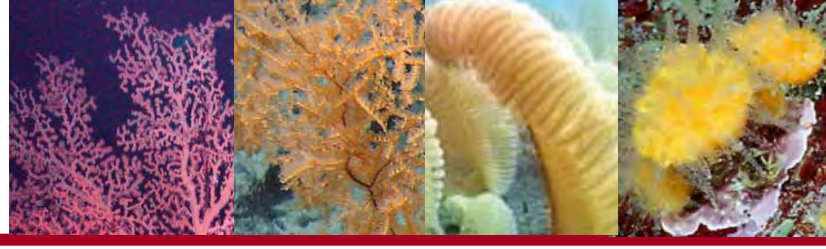
Species distribution models

- Relate occurrence data to background environmental variables to determine a species' niche



- Create maps predicting suitable habitat for coral

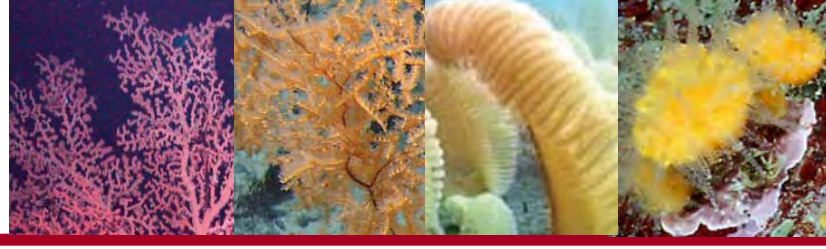
Purpose



1) Predict areas of **suitable habitat** for four orders of cold-water coral in BC

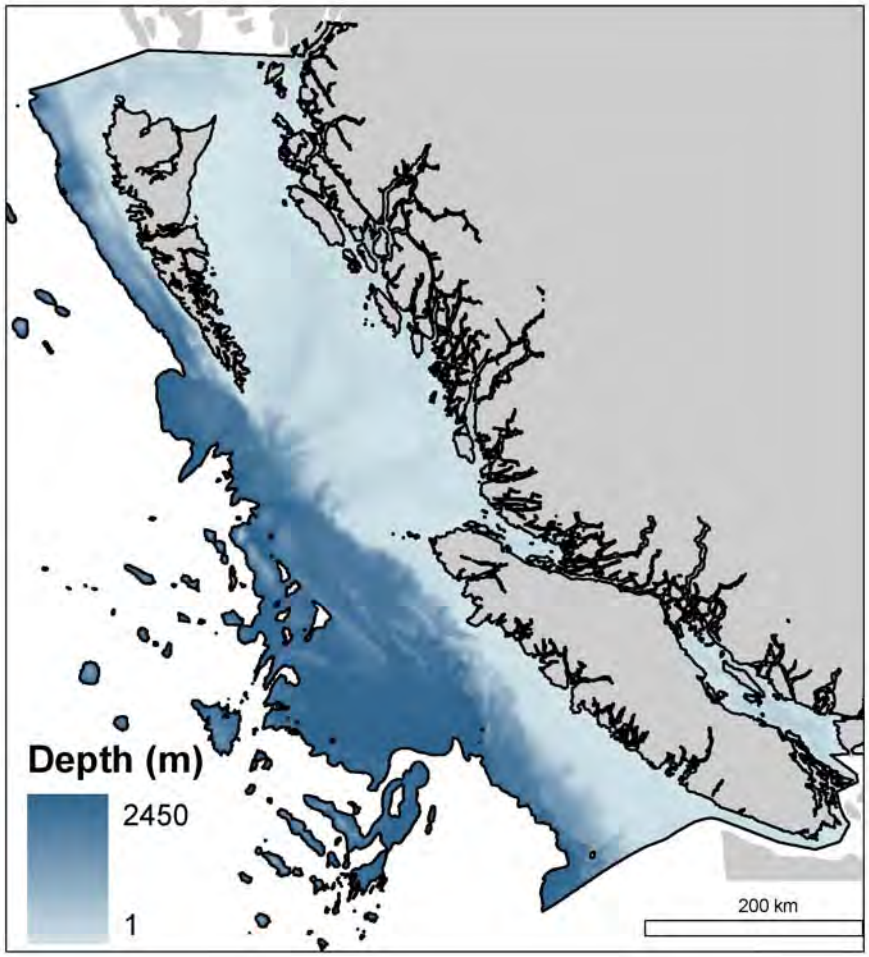
2) Evaluate the **overlap** between bottom-contact fishing activity and predicted coral habitat to identify VMEs

Suitable Habitat:
Environmental data



- 2450m depth cutoff
- 500 m x 500 m grid
  - Bathymetry
  - Slope
  - Chlorophyll *a* conc.
  - Tidal velocity
  - Temperature
  - Salinity
  - Current speed

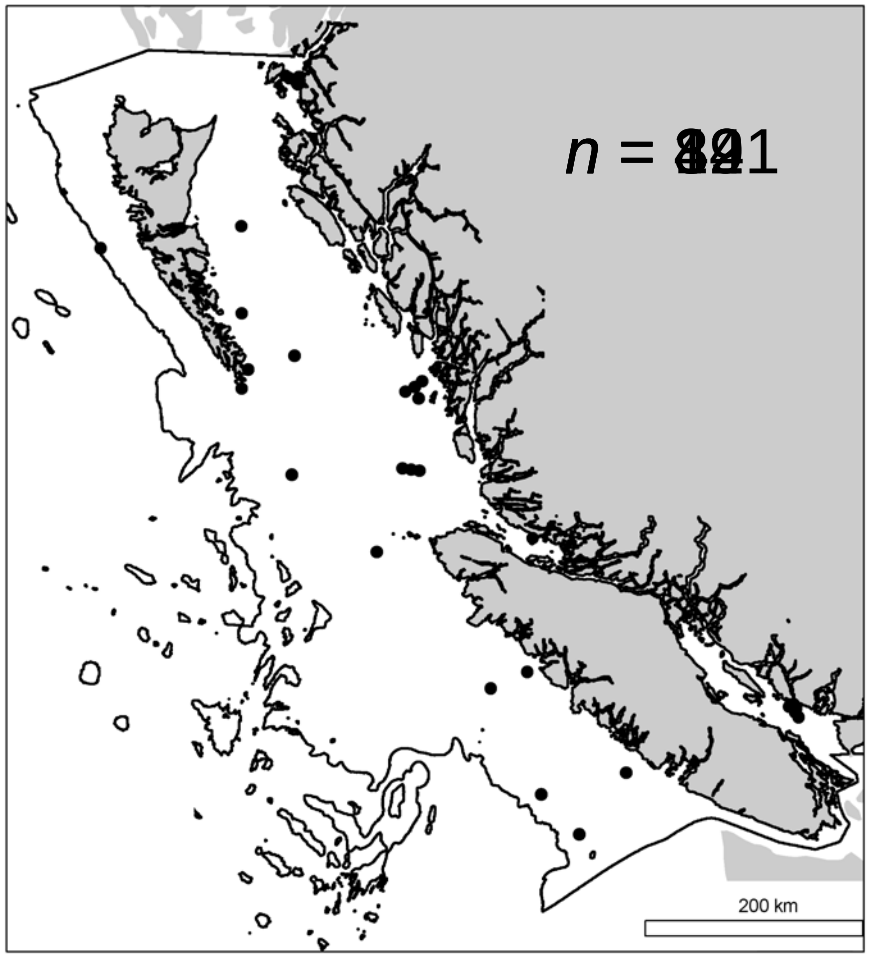
Summer and winter values



Suitable Habitat:
Coral data

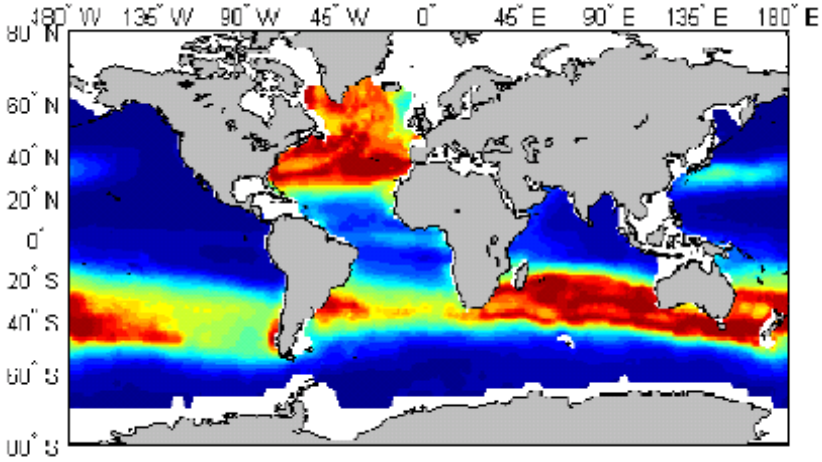
- Criteria:
  - Expert identification
  - Spatial resolution

- Four orders of coral:
  - Alcyonacea
  - Antipatharia
  - Pennatulacea
  - Scleractinia

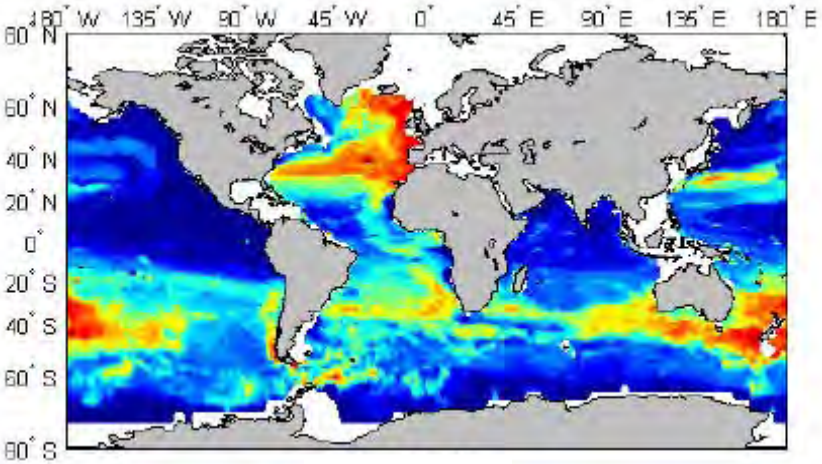


Suitable Habitat:
Previous studies

- Scleractinia on seamounts
- Compared ENFA to Maximum Entropy (Maxent)
- Maxent performed significantly better
- Other studies have shown Maxent performs substantially better than other models
  (e.g., Elith et al. 2006; Phillips et al. 2006)



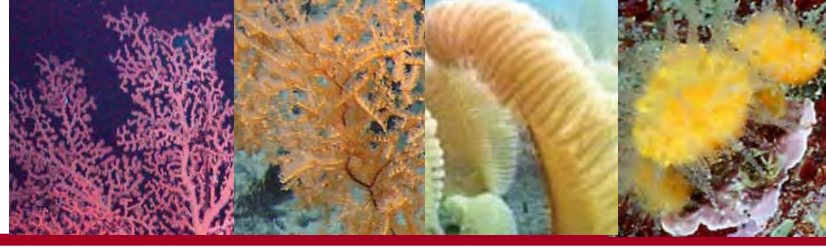
ENFA



Maxent

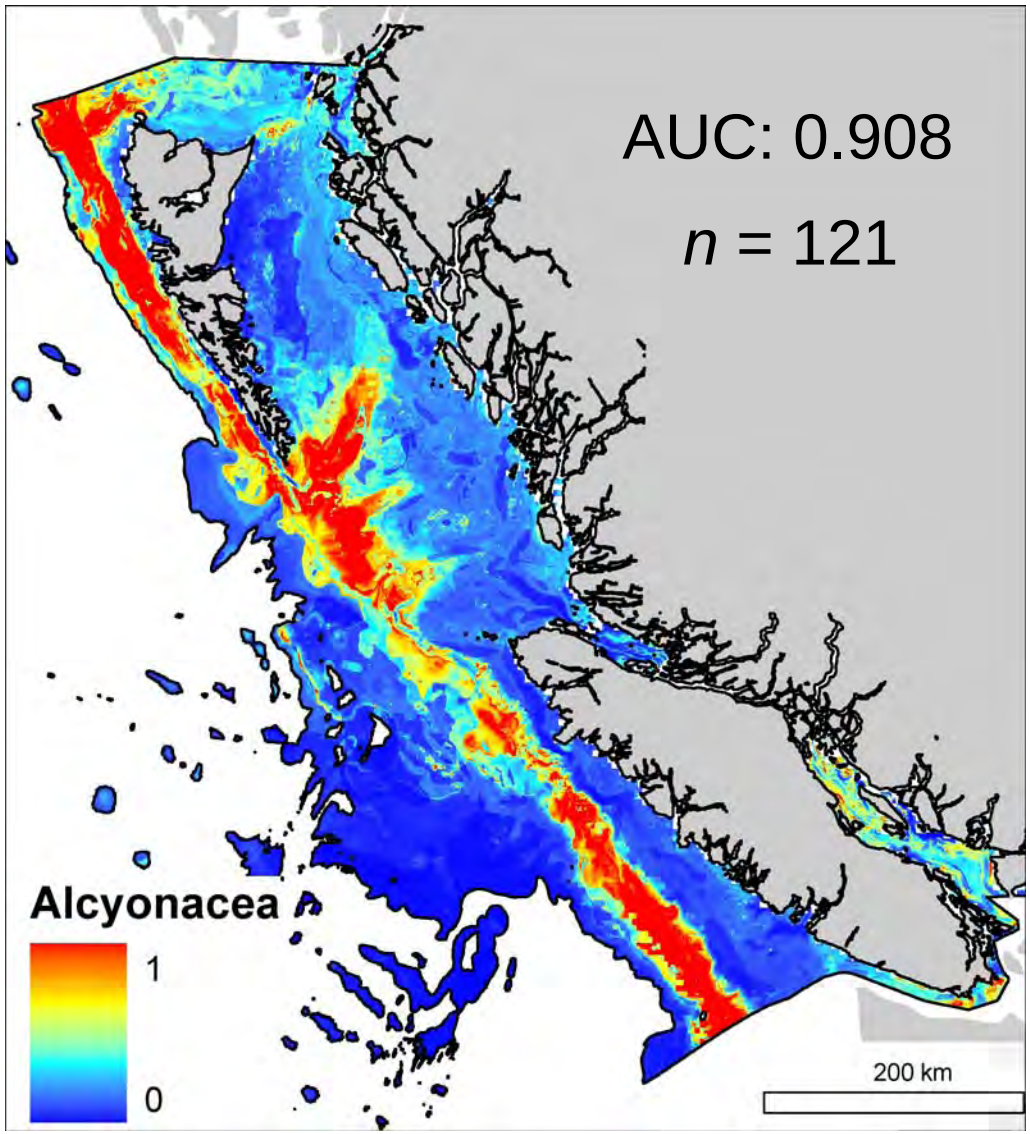
From Tittensor et al. 2009, *J. Biogeogr.*

Suitable Habitat:
Maxent

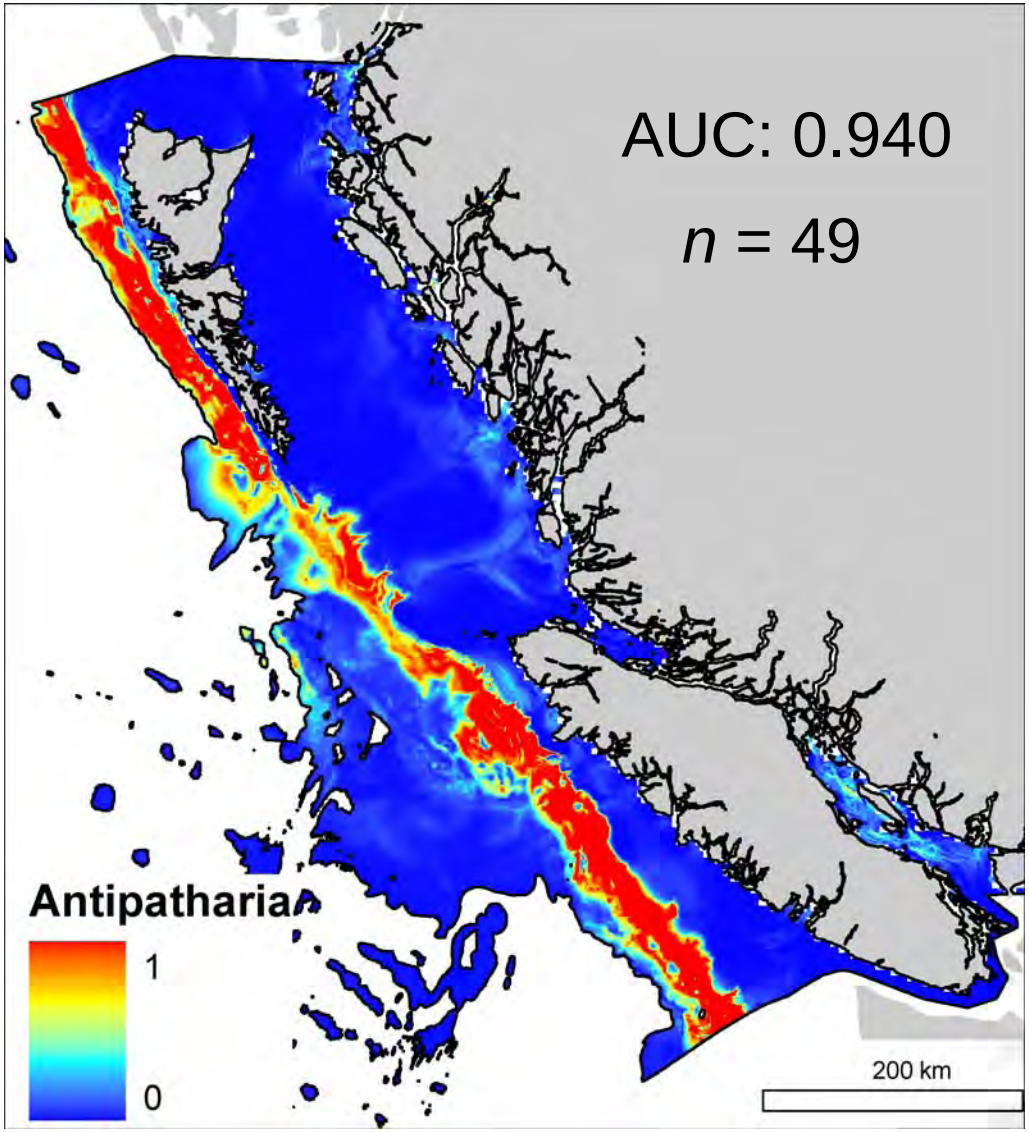


- Maximum-likelihood method
- Starts with a uniform distribution
- Iteratively updates the probability of occurrence at known coral locations
- Produces a continuous map of probability of occurrence

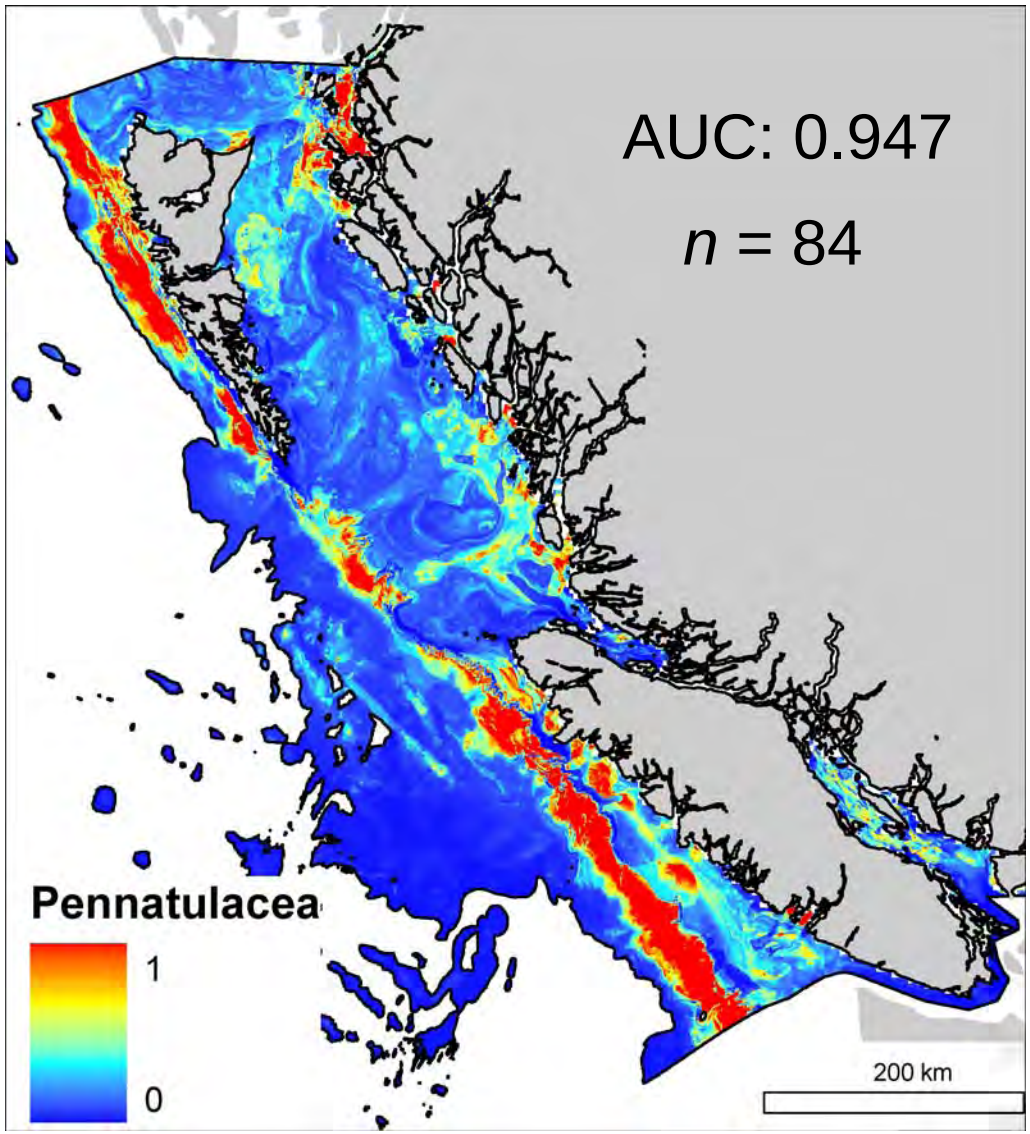
Suitable Habitat:
Alcyonacea



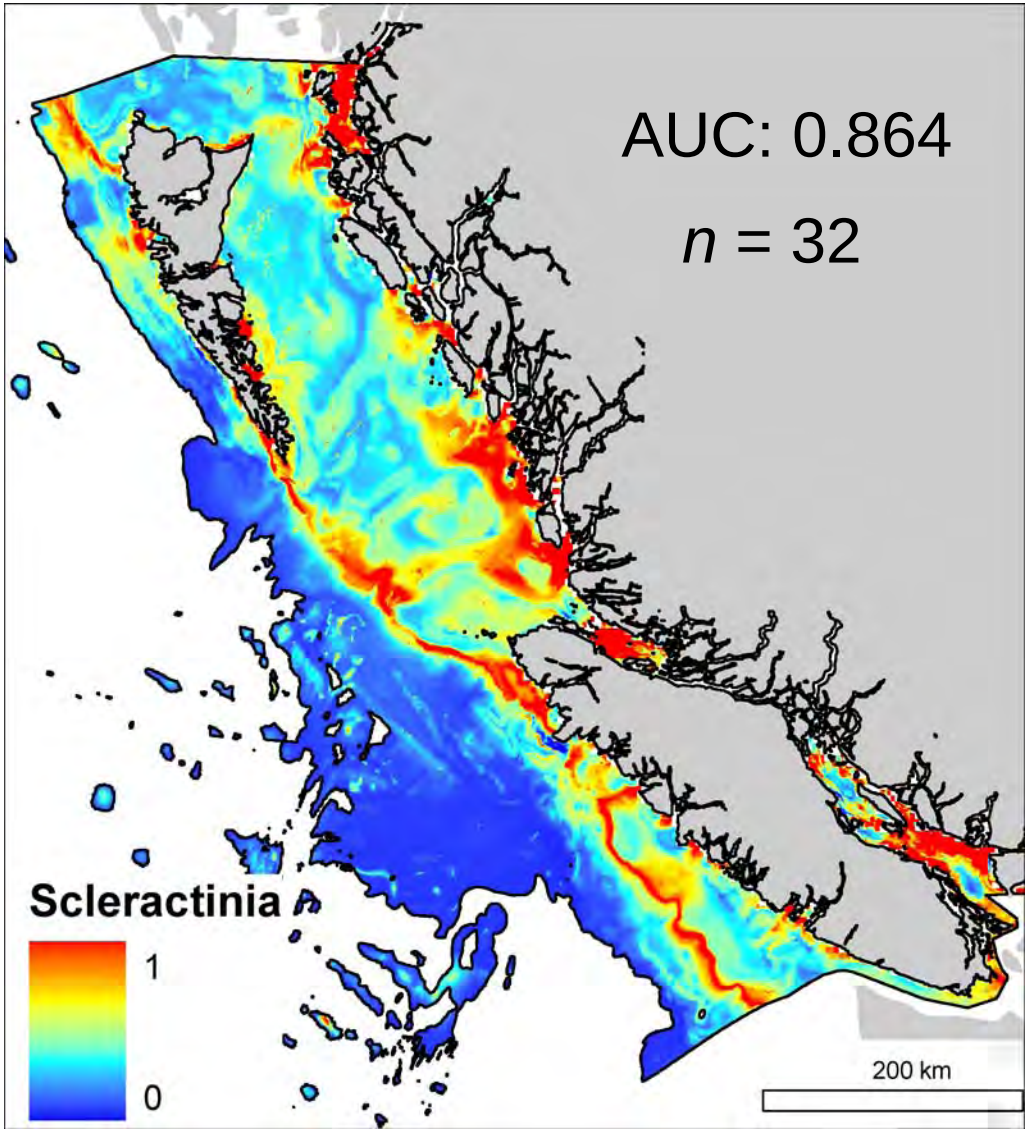
Suitable Habitat:
Antipatharia



Suitable Habitat:
Pennatulacea



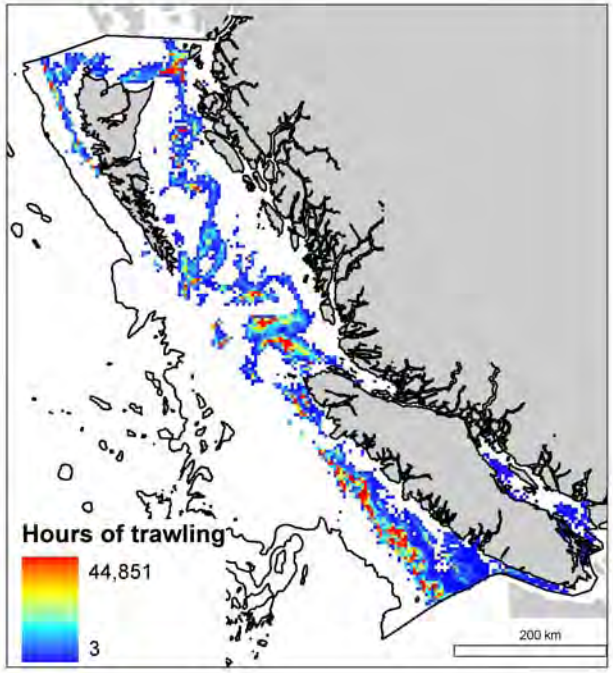
Suitable Habitat:
Scleractinia



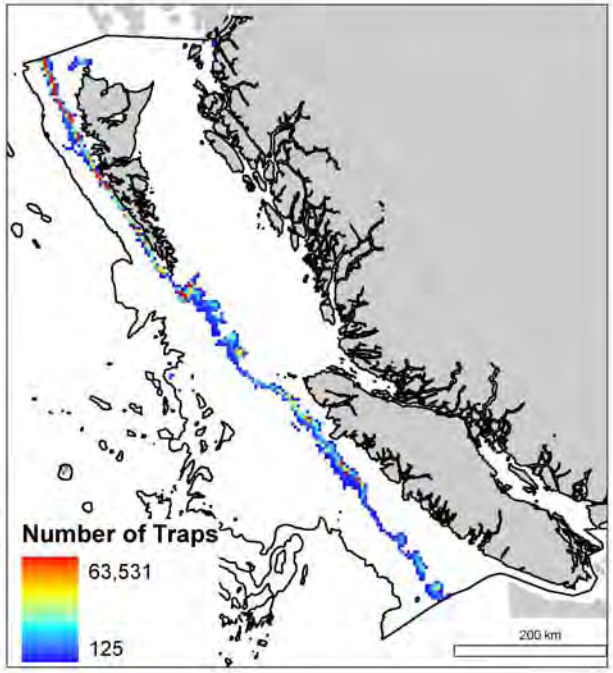
Overlap:
Fishing activity

Data on effort in a 4 km grid, at least 3 vessels/grid cell

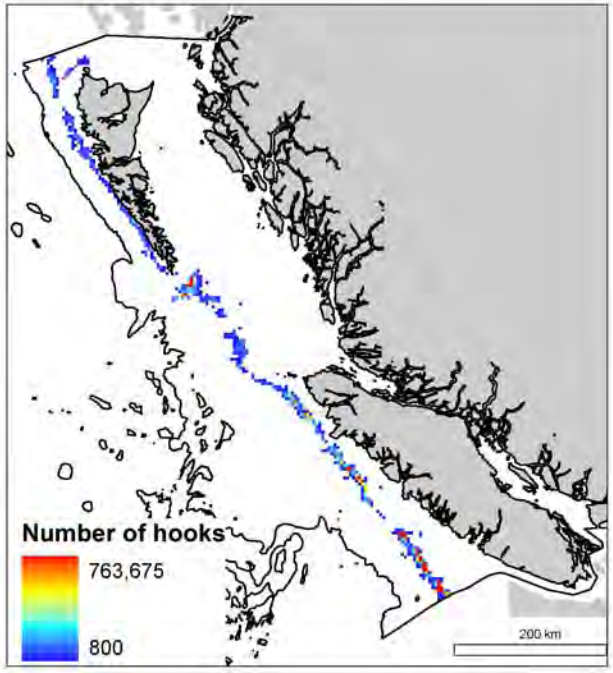
Data summed over all years (1996-2004)



Groundfish Trawl

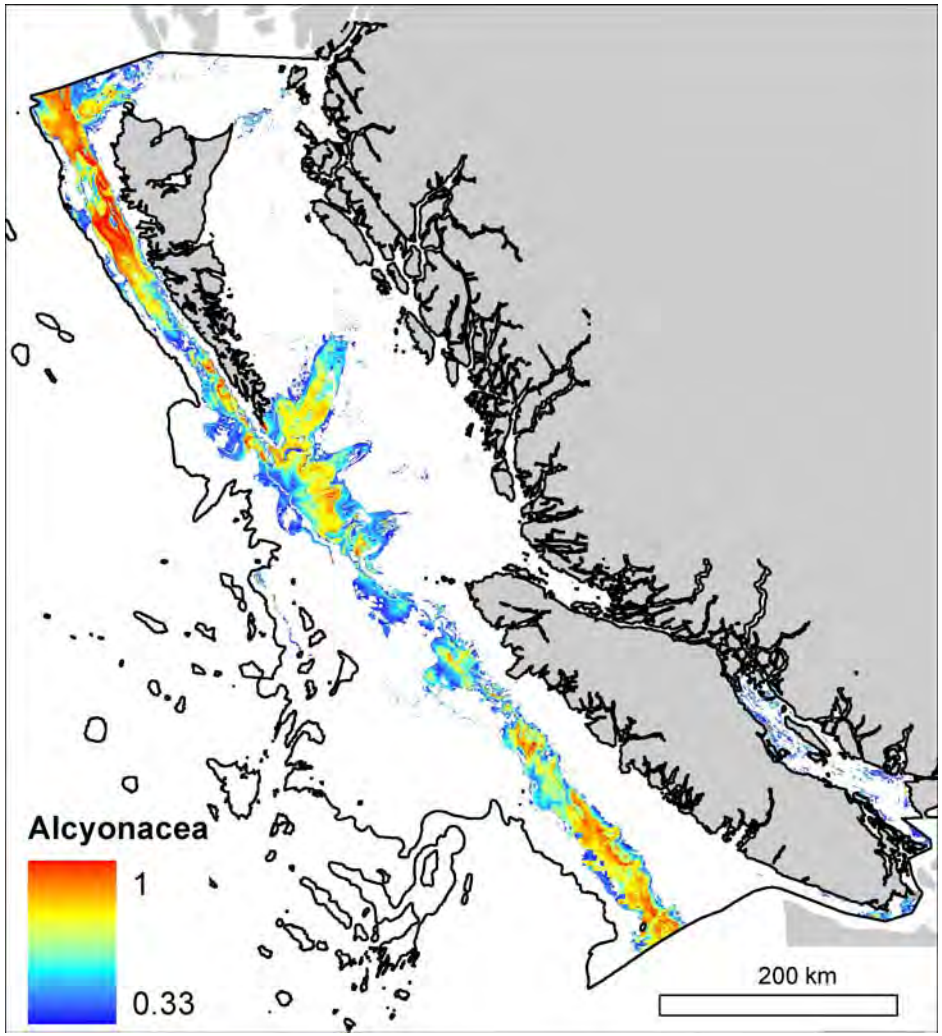


Sablefish Trap

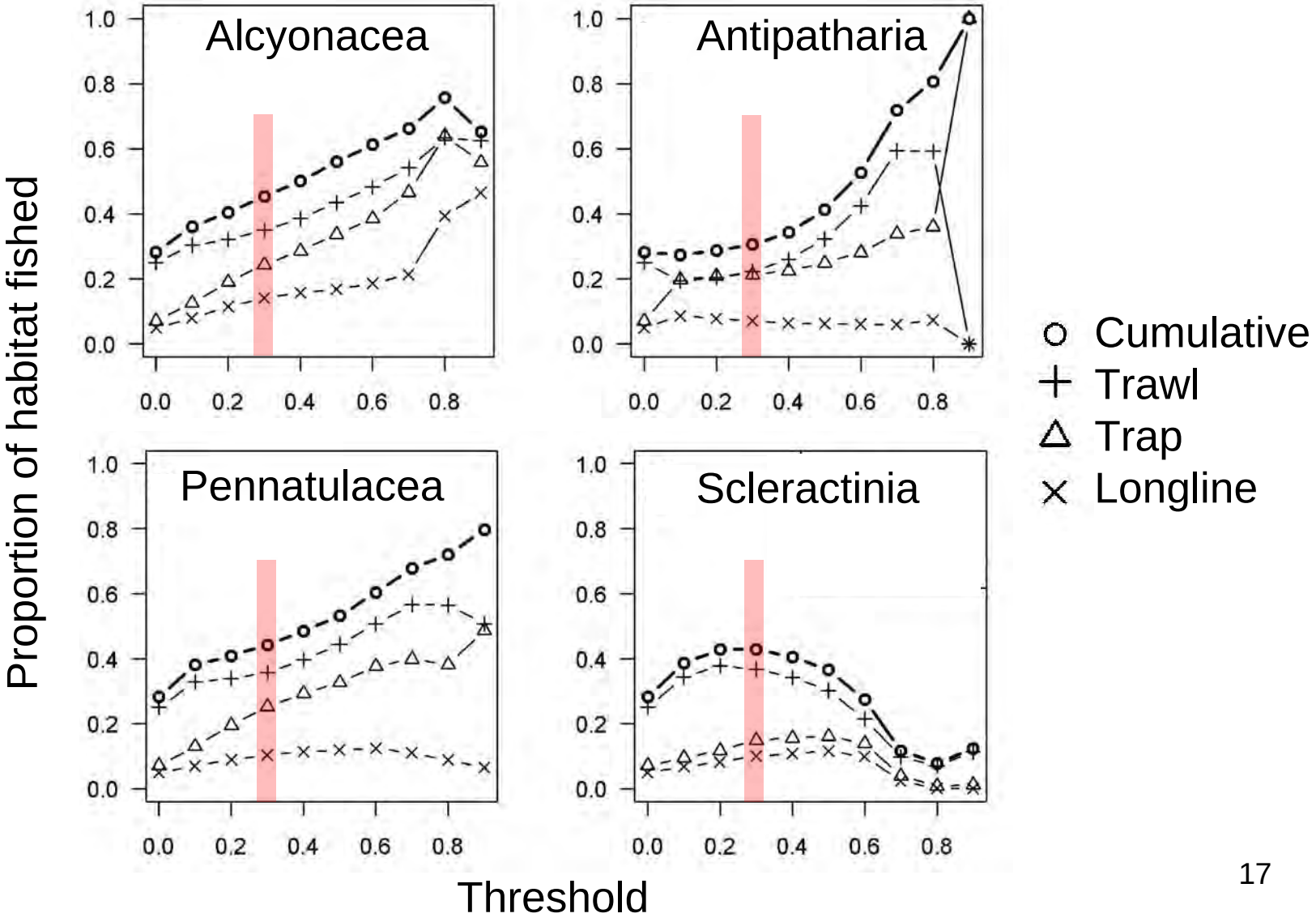


Sablefish Longline

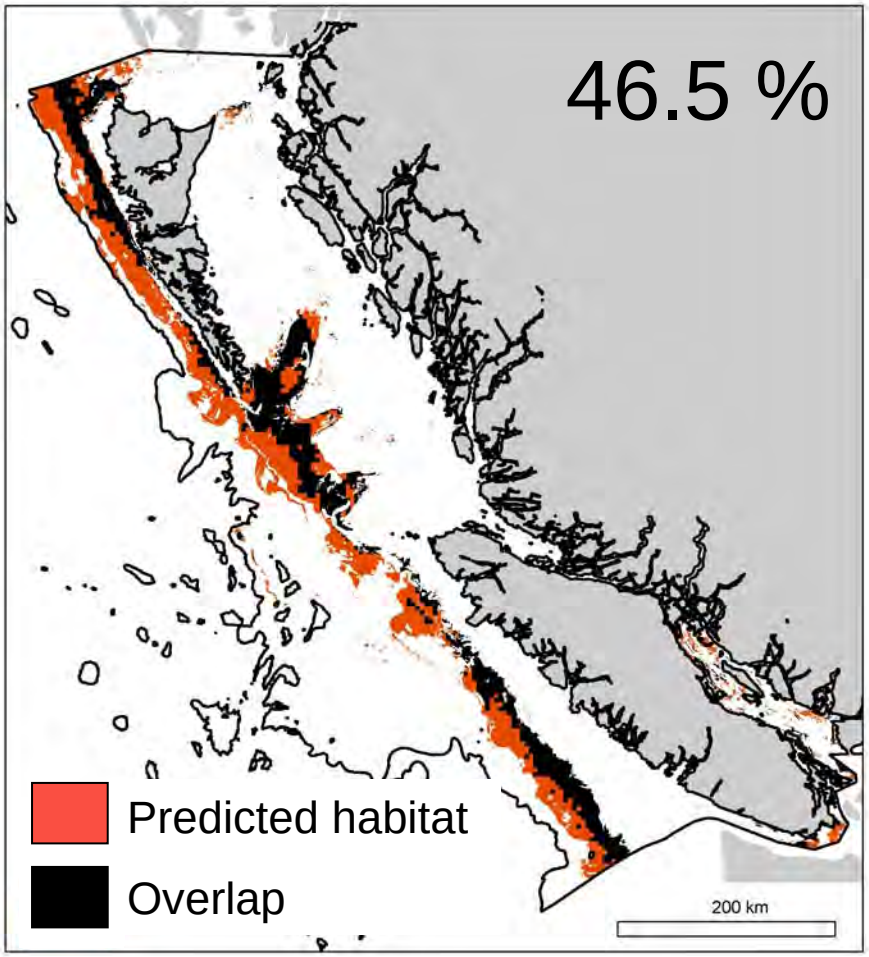
Suitable Habitat:
Alcyonacea



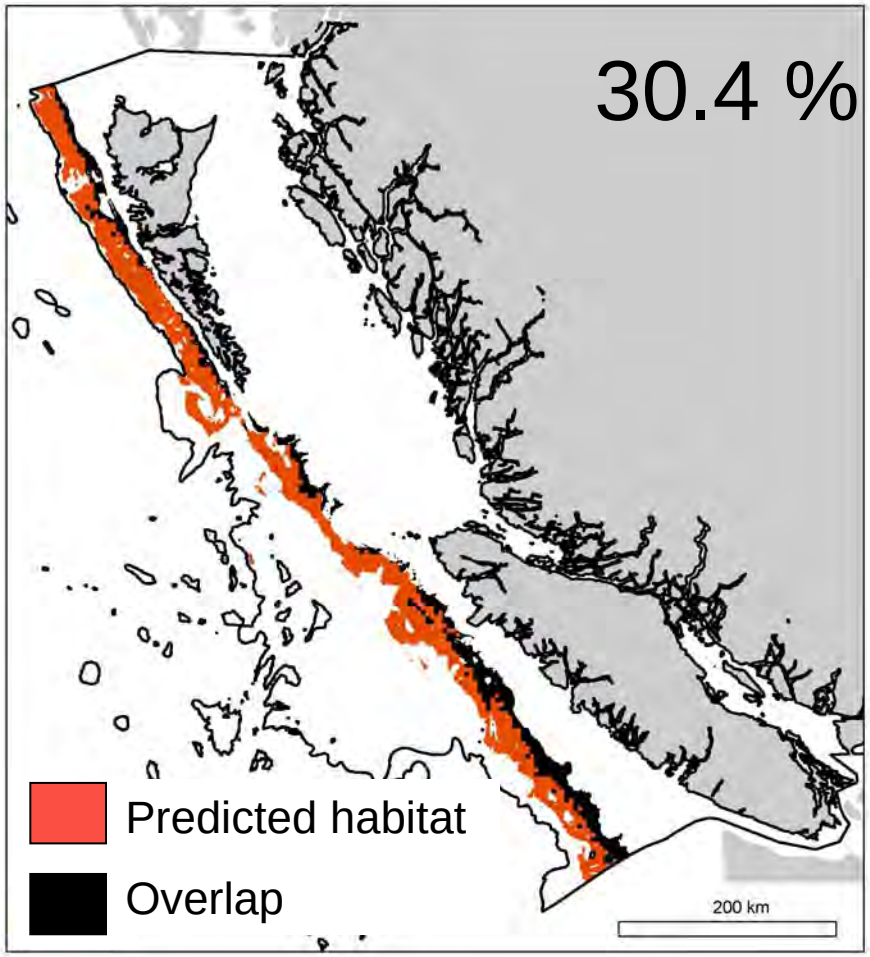
Overlap:
Fishing overlap



Overlap:
Fishing overlap

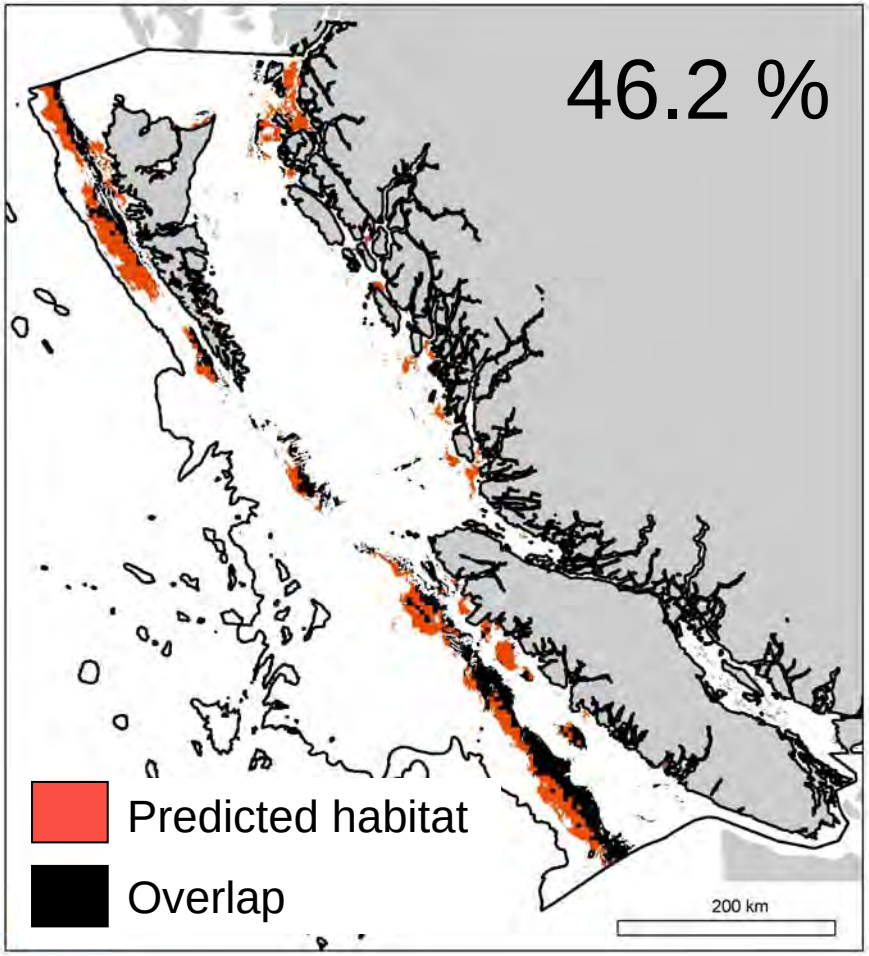


Alcyonacea

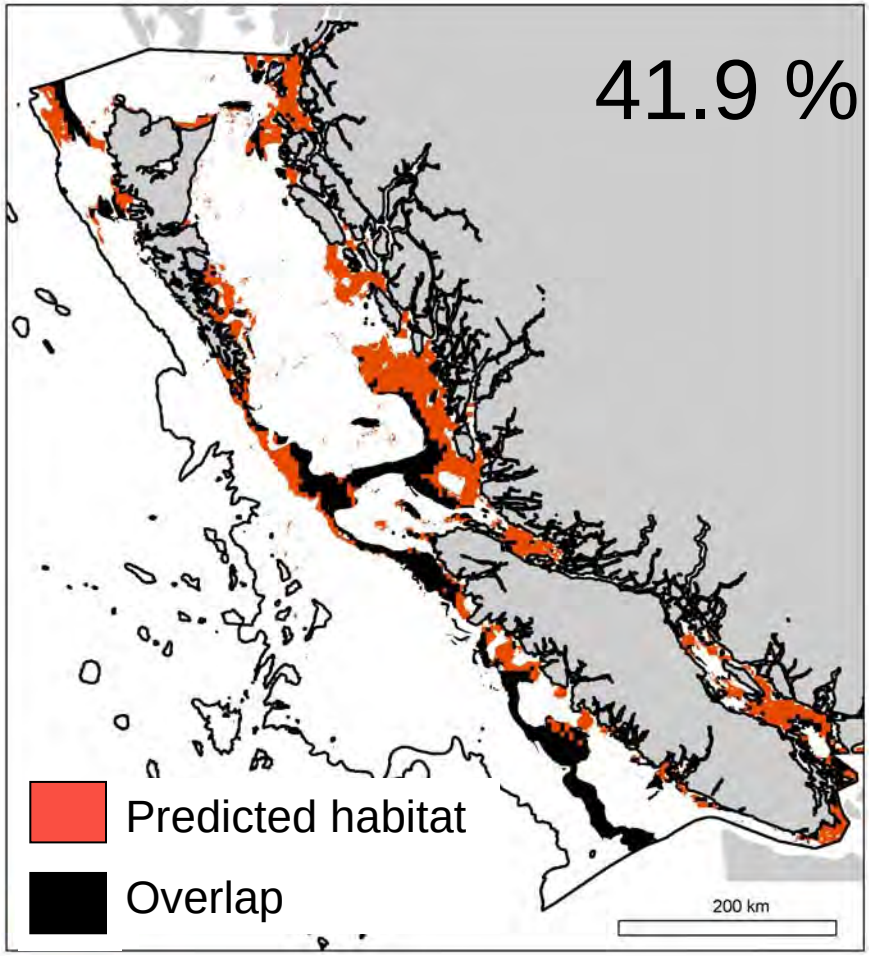


Antipatharia

Overlap:
Fishing overlap

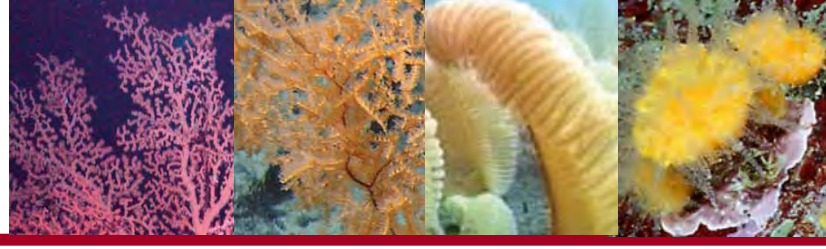


Pennatulacea



Scleractinia

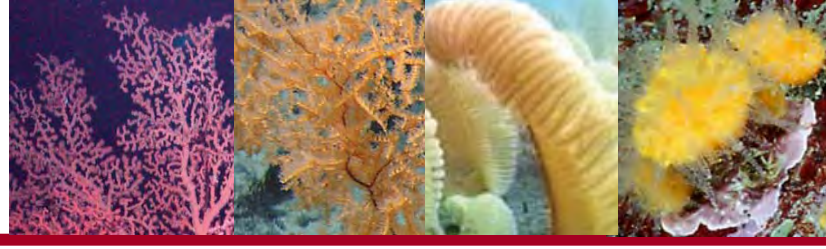
Discussion



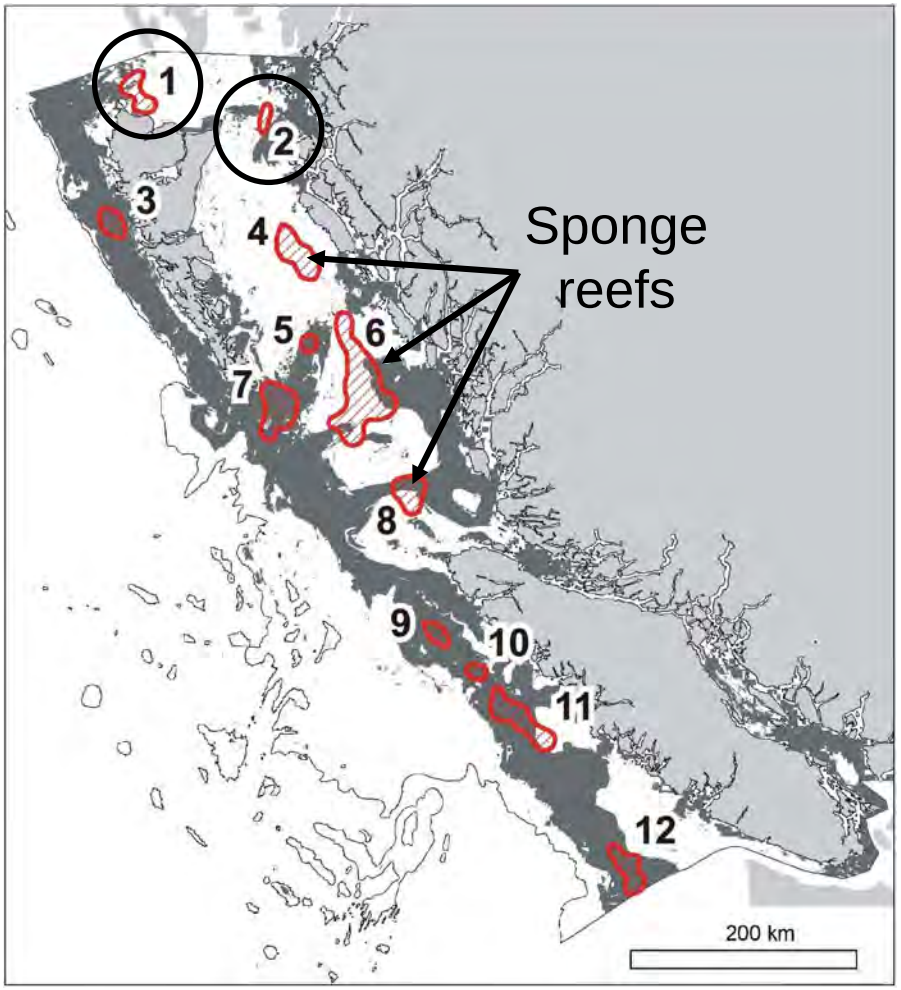
- Maxent appears to provide robust predictions of **suitable habitat** for cold-water coral in BC

- Estimates of **overlap** between bottom-contact fishing and predicted habitat range from **30.4%** to **46.5%**

Discussion:
Suitable habitat

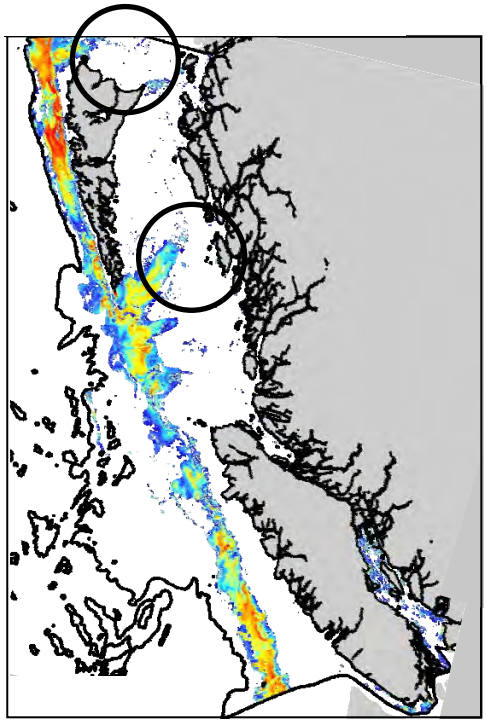


- Ardron and Jamieson (2006)
- Density analysis on commercial bycatch of coral and sponges
- Used to identify coral and sponge EBSAs in BC

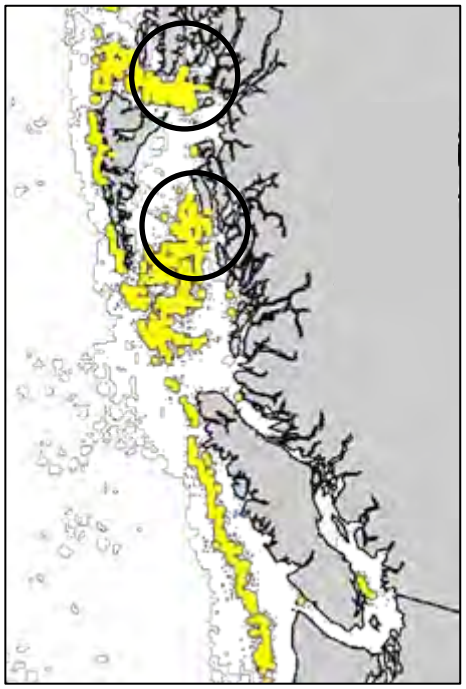


Discussion:
Suitable habitat

- Bryan and Metaxas (2007)
- ENFA predictions for Alcyonacea



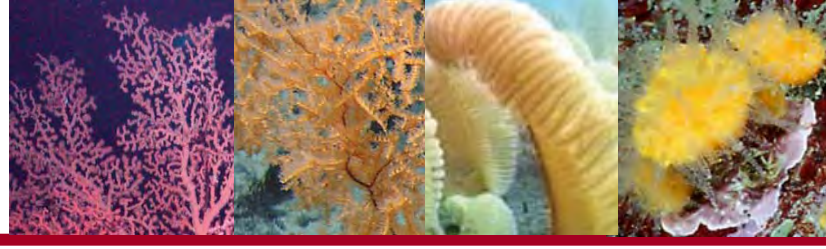
Maxent



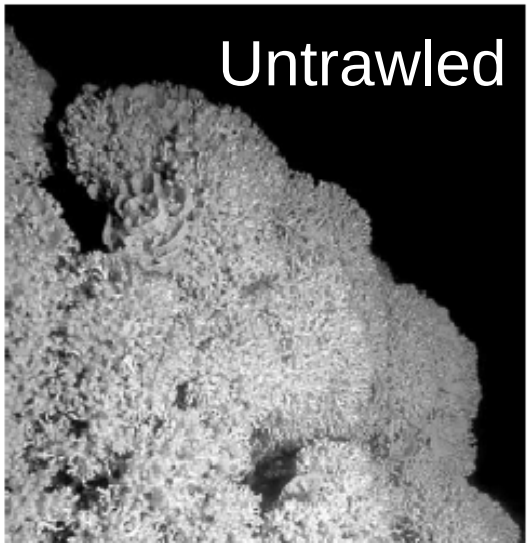
ENFA

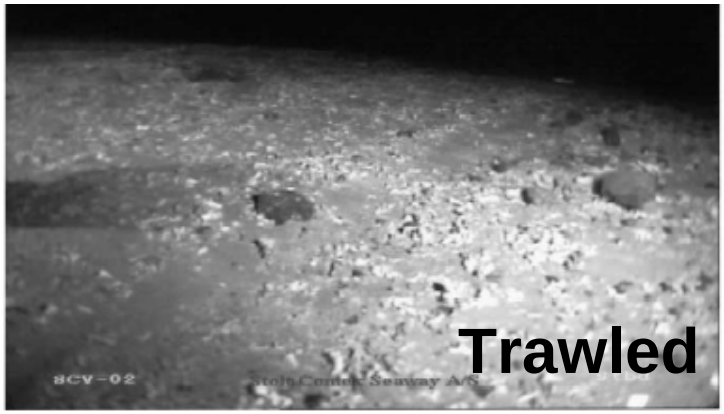
Adapted from Bryan and Metaxas 2007, *Mar. Ecol. Prog. Ser.*

Discussion:
Overlap



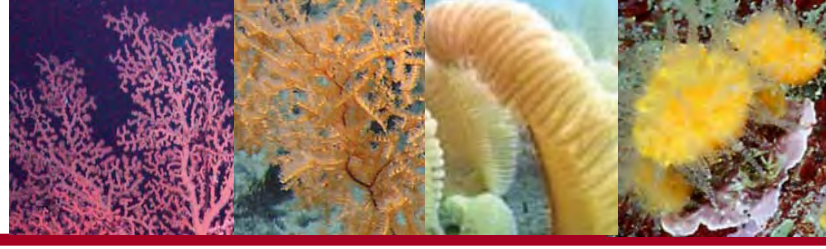
- Vulnerable to bottom-contact fishing and other human activities
- Low capacity to recover from disturbance





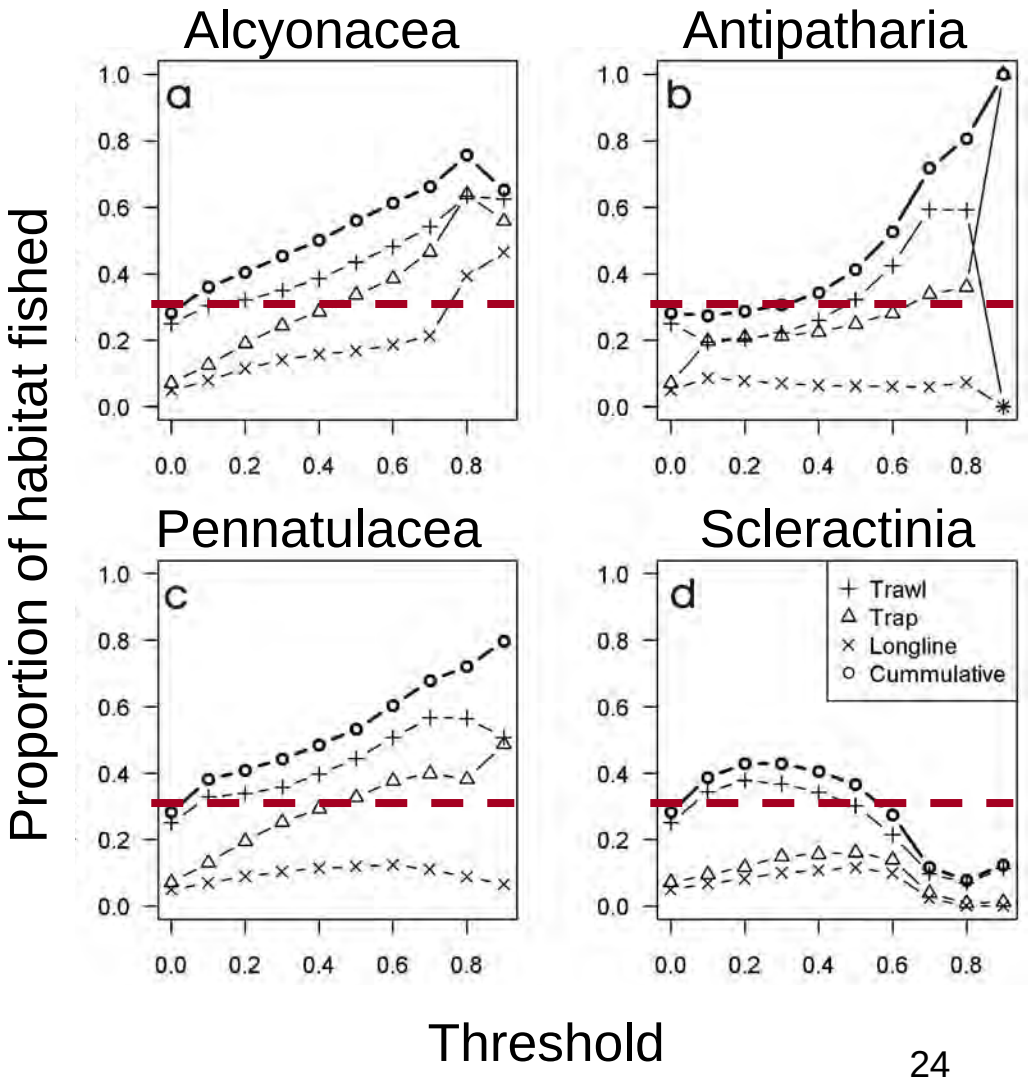
From Fosså et al. 2002

Discussion:
Overlap

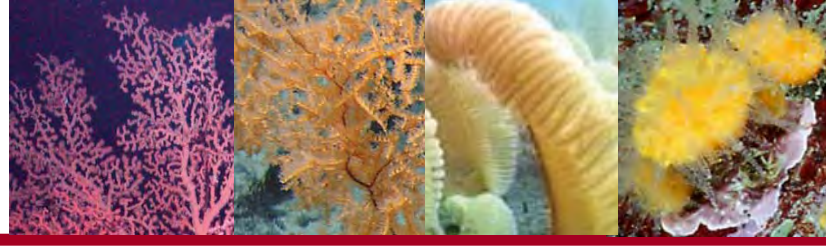


- A taxon is considered vulnerable or threatened if there is a population reduction of ≥ 30%

(IUCN 2001, COSEWIC 2009)



Conclusions

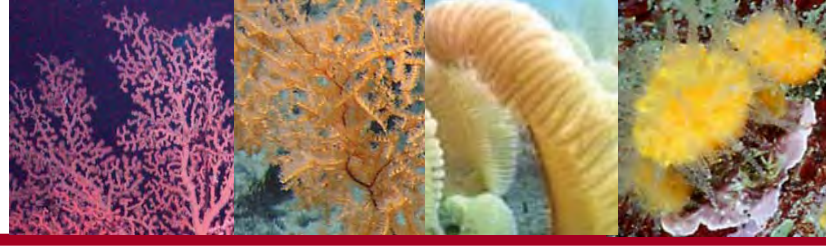


- This study facilitates marine conservation efforts by identifying areas of predicted coral habitat that are vulnerable to fishing activity

- Estimates of overlap are substantial, and the long-term viability of coral populations may be at risk

- A formal assessment of the conservation status of coral in BC should be a priority

Acknowledgements



- Ian Perry and James Boutillier
- Mike Foreman
- Fisheries Science and Management Research Group (SFU)
- Earth2Ocean Group (SFU)

Fisheries and Oceans Canada

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