Using Predictive Habitat Models and Visual Surveys to Identify Vulnerable Marine Ecosystems on Seamounts in the North Pacific Fisheries Commission Convention Area

NPFC-2021-SSC BFME02-WP05

Devon R. Warawa[1], Jackson W. F. Chu[1], Chris N. Rooper[1], Samuel Georgian[2], Jessica Nephin[1], Sarah Dudas[1], Anders Knudby[3], Janelle M. R. Curtis[1]

[1]Fisheries and Oceans Canada; [2]Marine Conservation Institute; [3]University of Ottawa

(from Curtis et al. 2015)

NPFC SCC BF-ME 02

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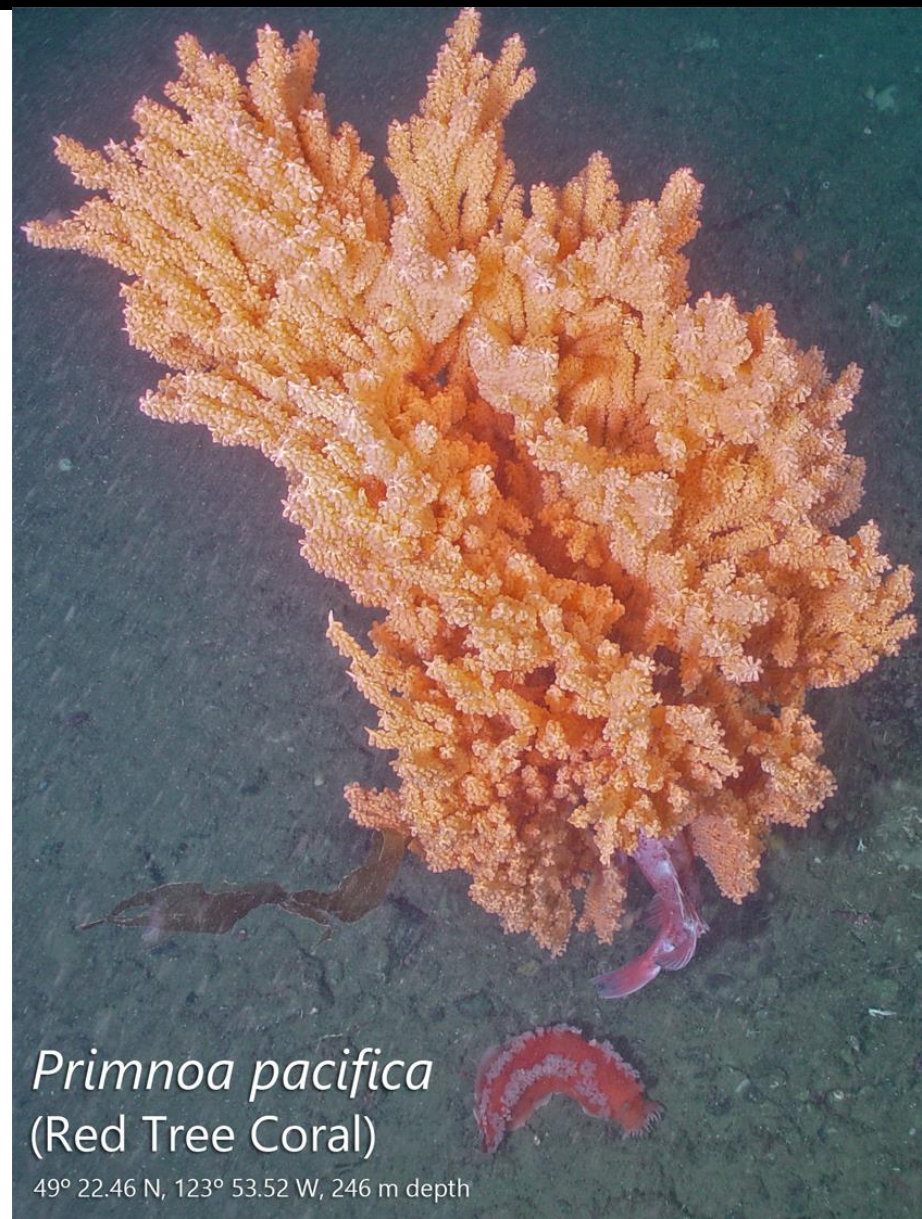
(from Du Preez et al. 2020)

Outline

1. Project background
2. Describe the methods
3. Next steps
4. Feedback and questions

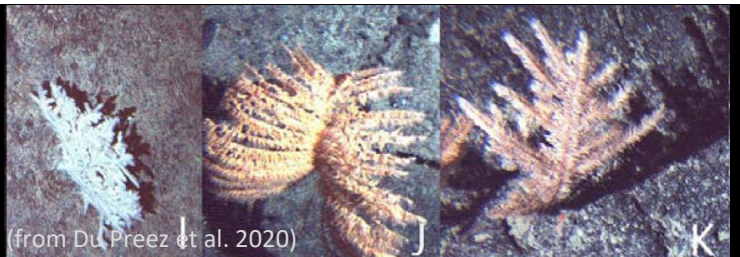


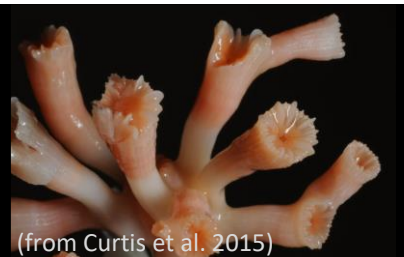
VMEs in the NPFC

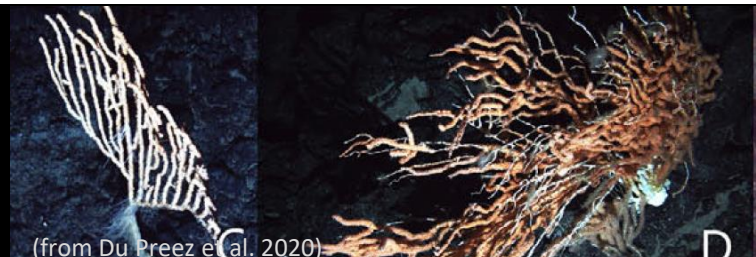
NPFC has identified four taxonomic groups of corals as indicators of potential VMEs but has not yet developed objective and quantitative definitions of VMEs

Four VMEs have been identified in the northwest NPFC CA

No VMEs have been identified in the northeast NPFC CA







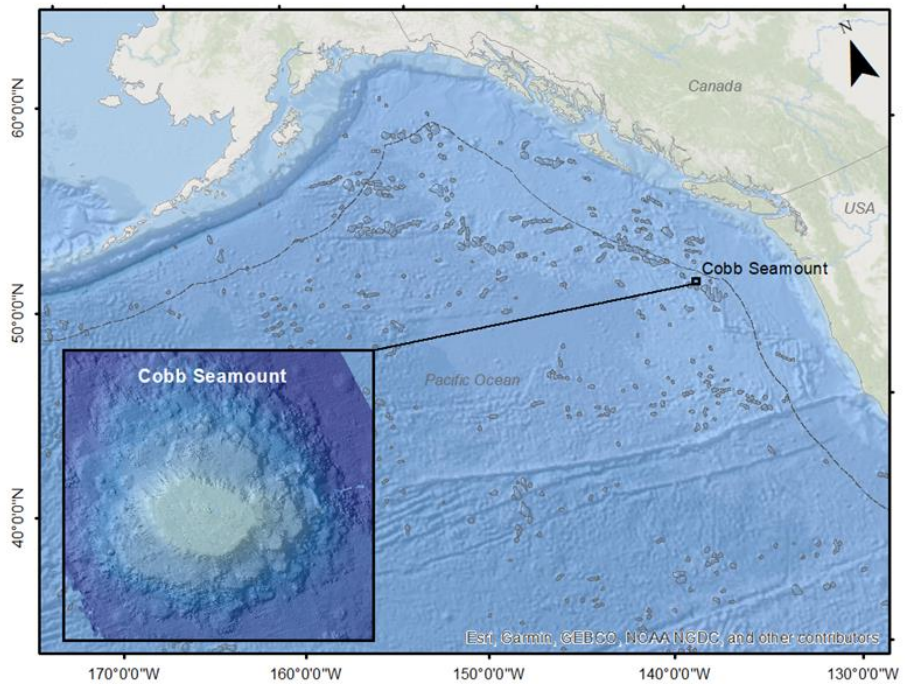
Quantitative method to identifying VMEs in the NPFC

We propose this as <u>one of the approaches</u> NPFC can follow to quantitatively identify VMEs in its convention area

It aligns with:

- NPFC SWG VME's framework (using visual data and model predictions)
- the Convention
- the research plan of NPFC's Scientific Committee.

Methods demonstrated using Cobb Seamount application*



* no management implications to date

FAO's criteria for identifying VMEs

1. Uniqueness or rarity
2. Functional significance of the habitat
3. Fragility
4. Life-history traits of component species that make recovery difficult
5. Structural complexity → VME indicator taxa increase structural complexity which increases biodiversity of other animals in the area

NPFC's VME indicator taxa

1. Black corals
(Order: *Antipatharia*)

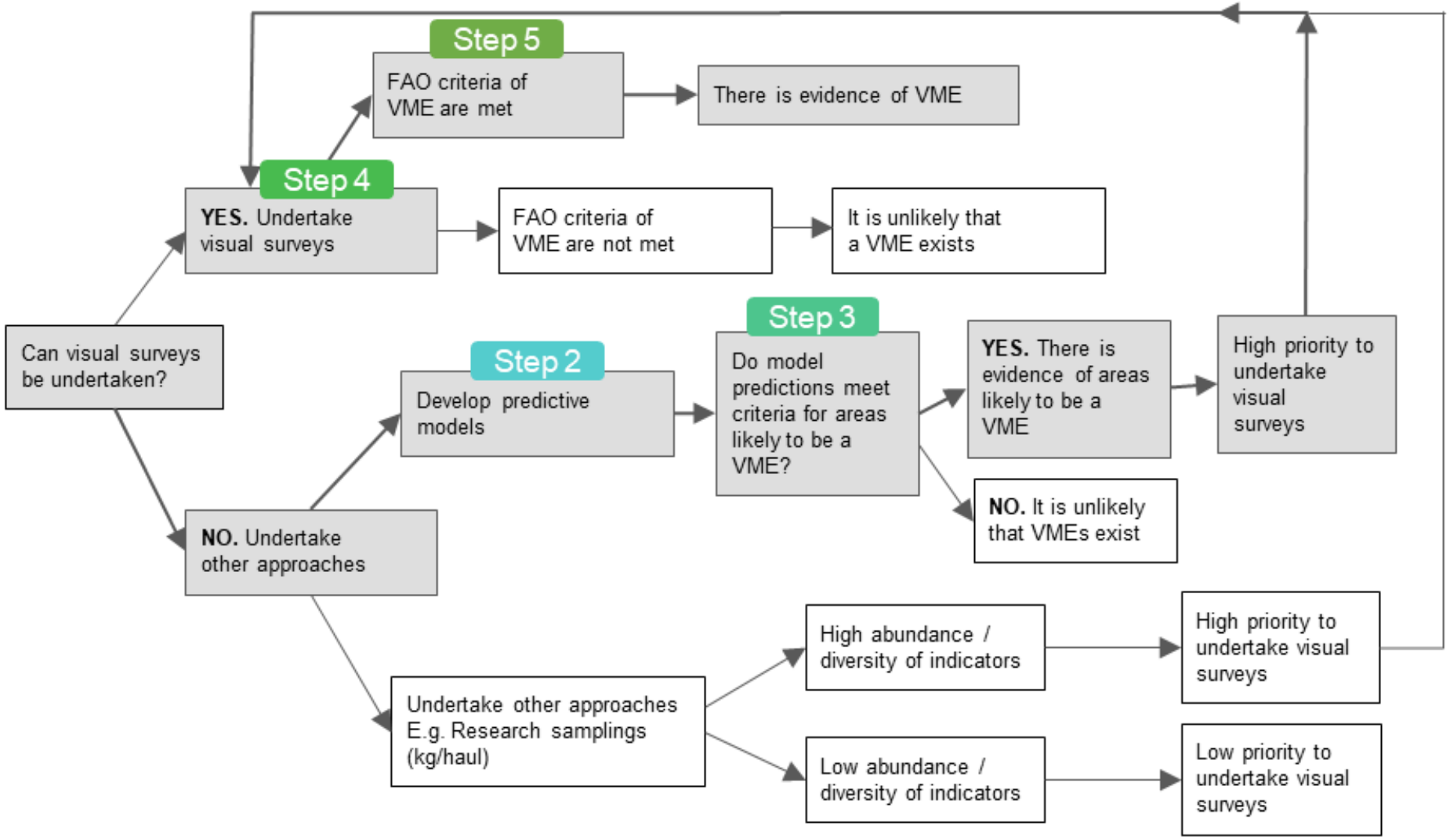
2. Stony corals
(Order: *Scleractinia*)

3. 'Gorgonian' corals
(Order: *Alcyoncea*)
Belonging to 10 families listed by Miyamoto et al. 2017

4. Non-gorgonian soft corals
(Order: *Alcyoncea*)

Step 1 Visual Threshold → **Step 2** Predictive models VME indicator taxa → **Step 3** Identify areas likely to be VMEs → **Step 4** Visual data in areas likely to be VMEs → **Step 5** Identify VMEs with visual data

Framework used to identify data that can be used to identify VMEs



Step 1
Visual Threshold

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Predictive models VME indicator taxa

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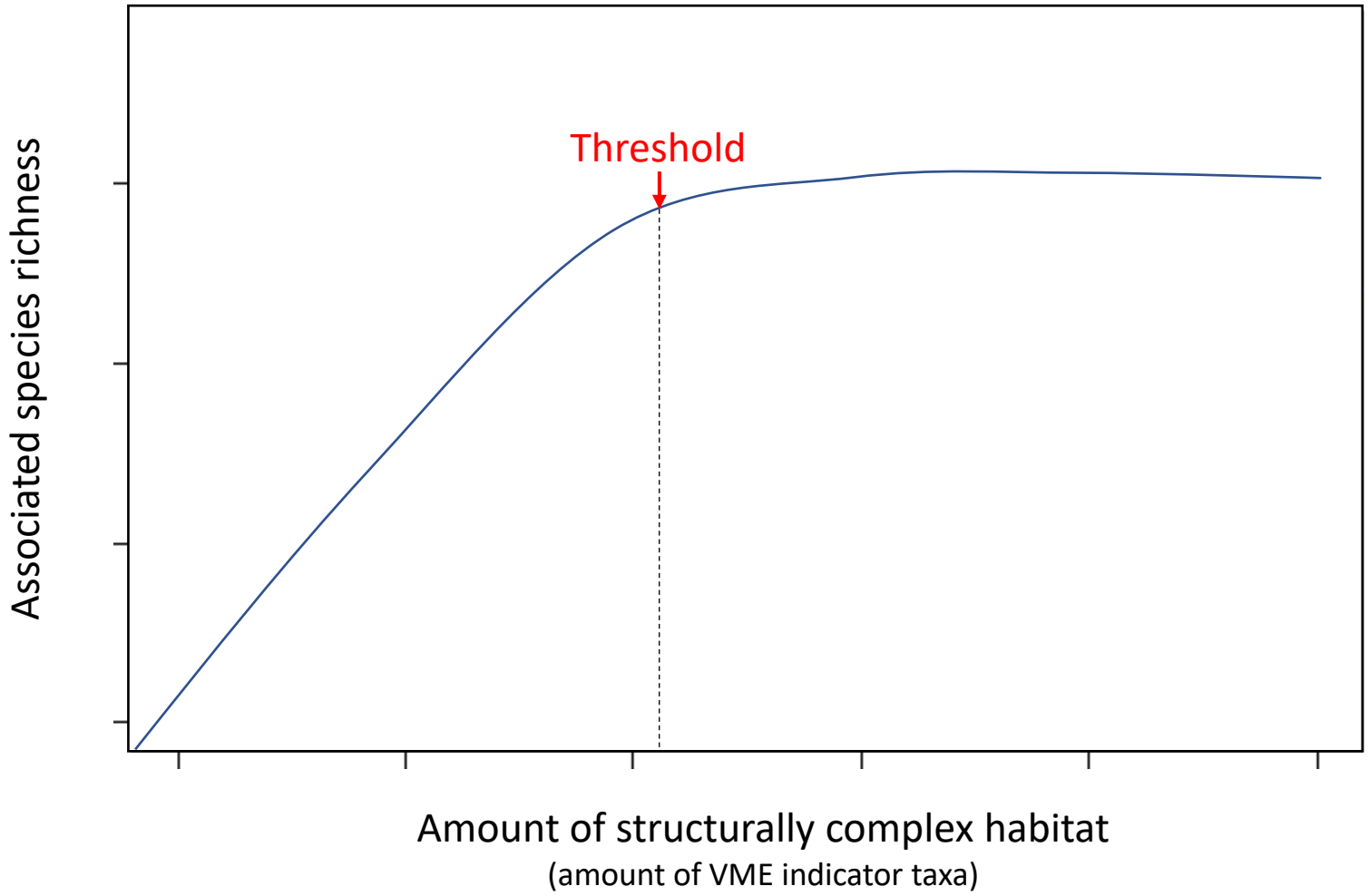
Identify VMEs with visual data

Visual threshold =
The amount of VME indicator taxa required for an area to be considered a VME

↑

Calculated from visual survey data

Theoretical relationship



(Based on Rowden et al. 2020 Fig.4)

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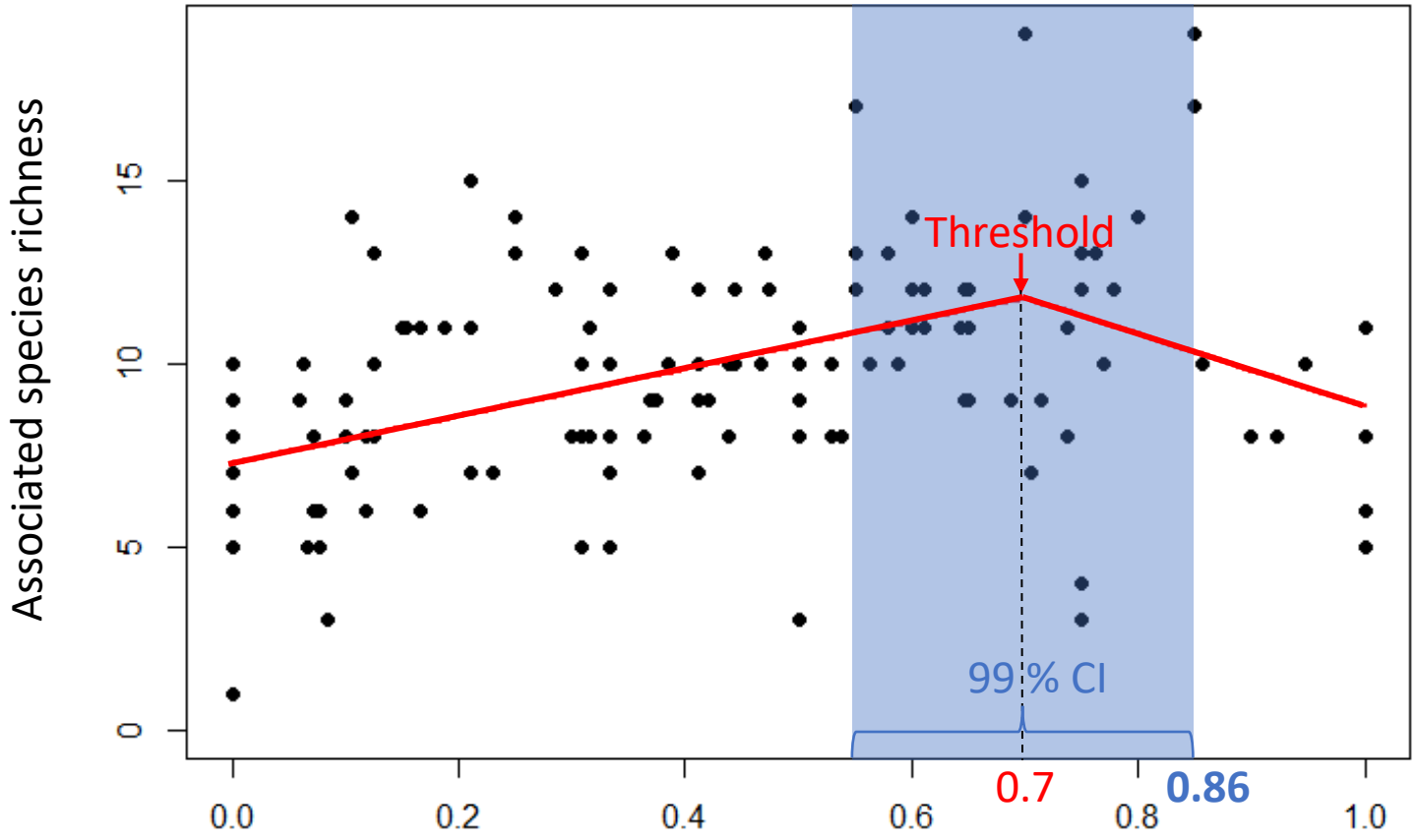
Piecewise regression
(R^2=0.19, AUC=678.35)

Data: Cobb seamount 2012 visual survey AUV photos

Threshold calculation using visual data



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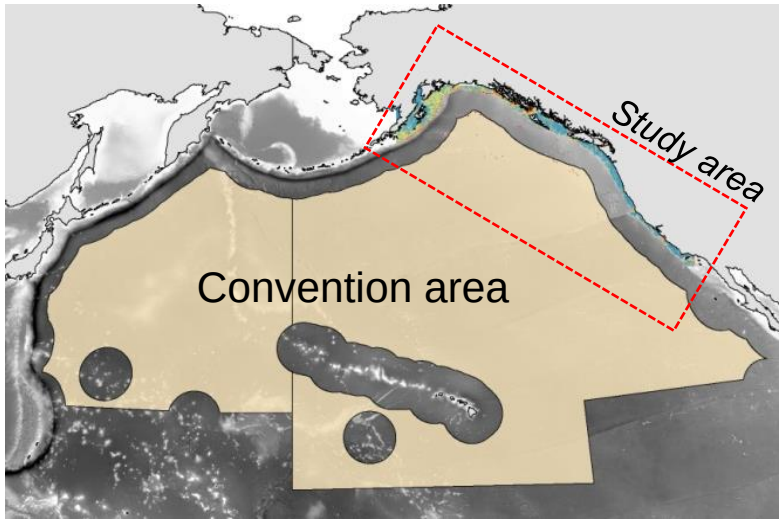
Data for Predictive Habitat Models

North Pacific environmental data

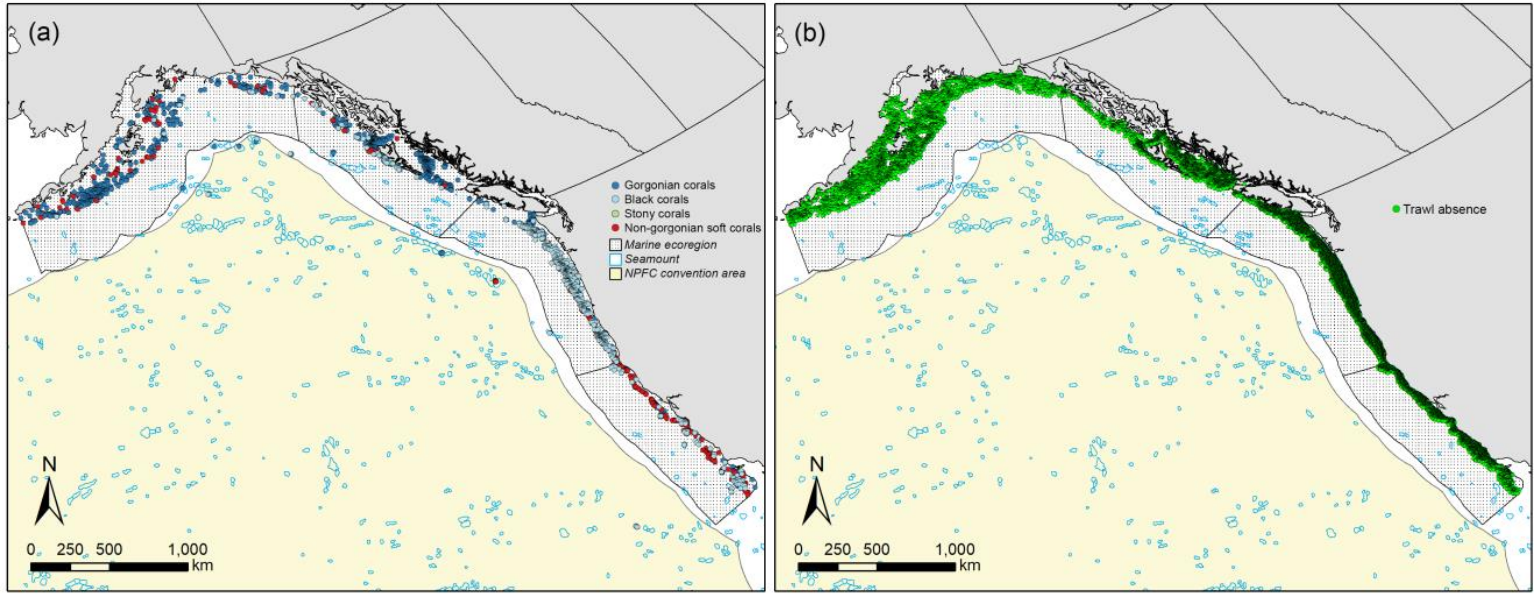
- Product of PICES WG32: Biodiversity of Biogenic Habitats
- 32 variables, 1 km^2 grid resolution
  - Bathymetry & Terrain metrics
  - Oceanographic properties
  - Surface layer characteristics



VME indicator taxa records

Presence records
From NOAA, DFO, and academics

Absence records
From NOAA and DFO trawl surveys



Predictive habitat model results (Maxent)

	performance metrics				
VME group	**Test AUC**	**Training AUC**	**1st ranked**	**2nd ranked**	**3rd ranked**
Black corals	0.88	0.90	Oxygen (48%)	PAR (19%)	Regfl (7%)
Stony corals	0.87	0.92	Oxygen (14%)	Chl-A (13%)	SST (13%)
Gorgonian corals	0.86	0.85	PAR (37%)	Oxygen (16%)	BPI20000 (11%)
Non-gorgonian soft corals	0.91	0.92	Roughness (36%)	Oxygen (16%)	POC (8%)

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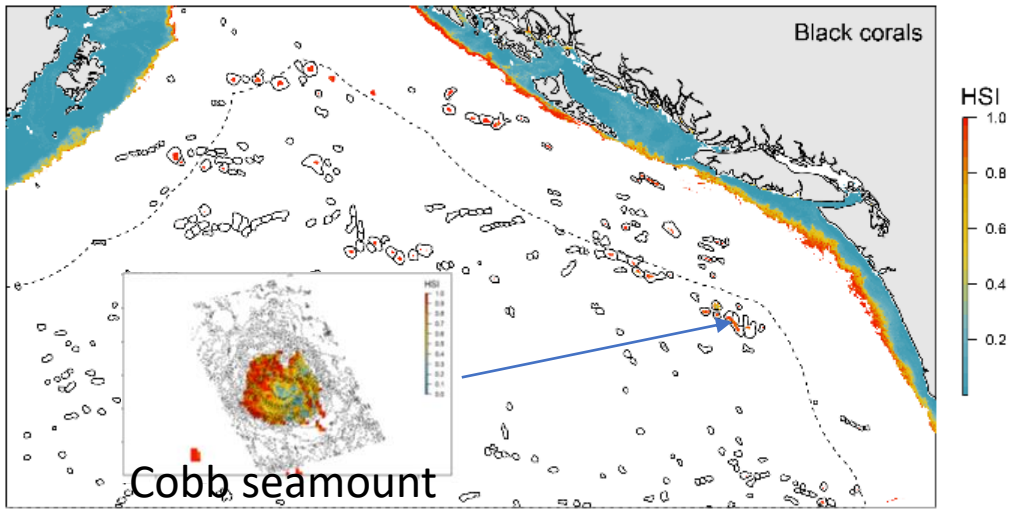

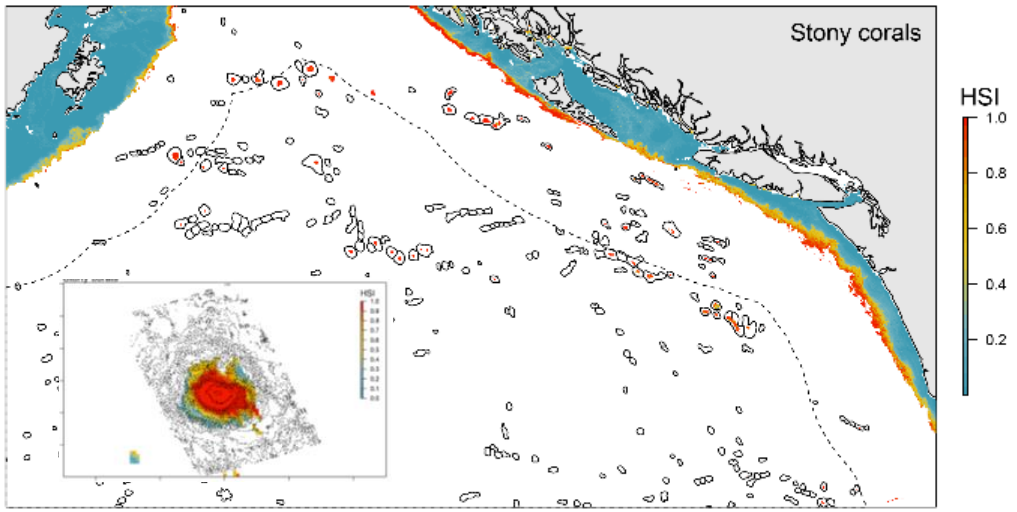

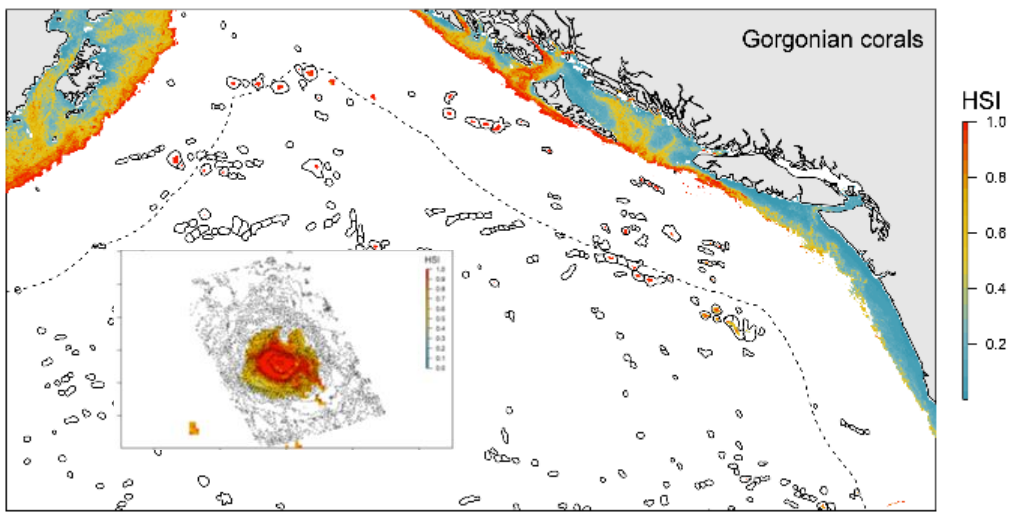

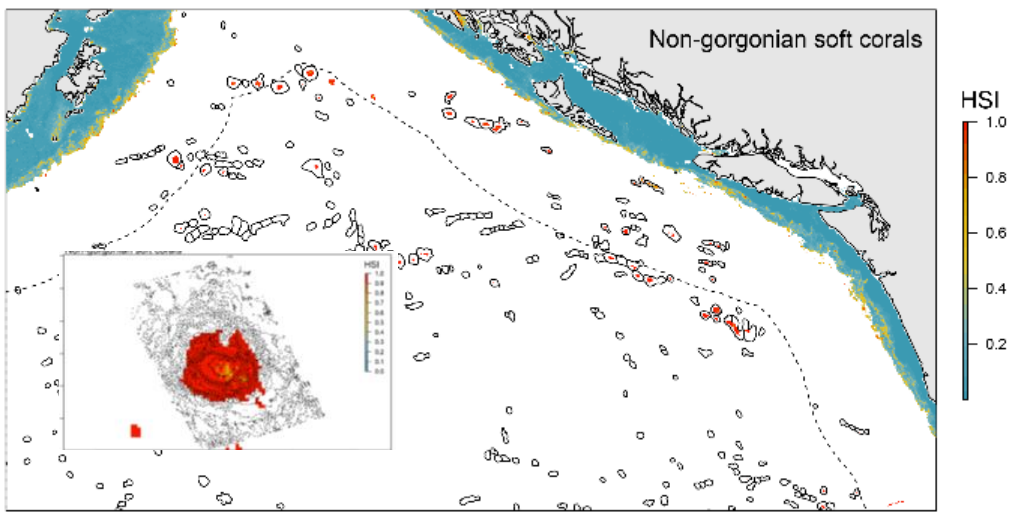

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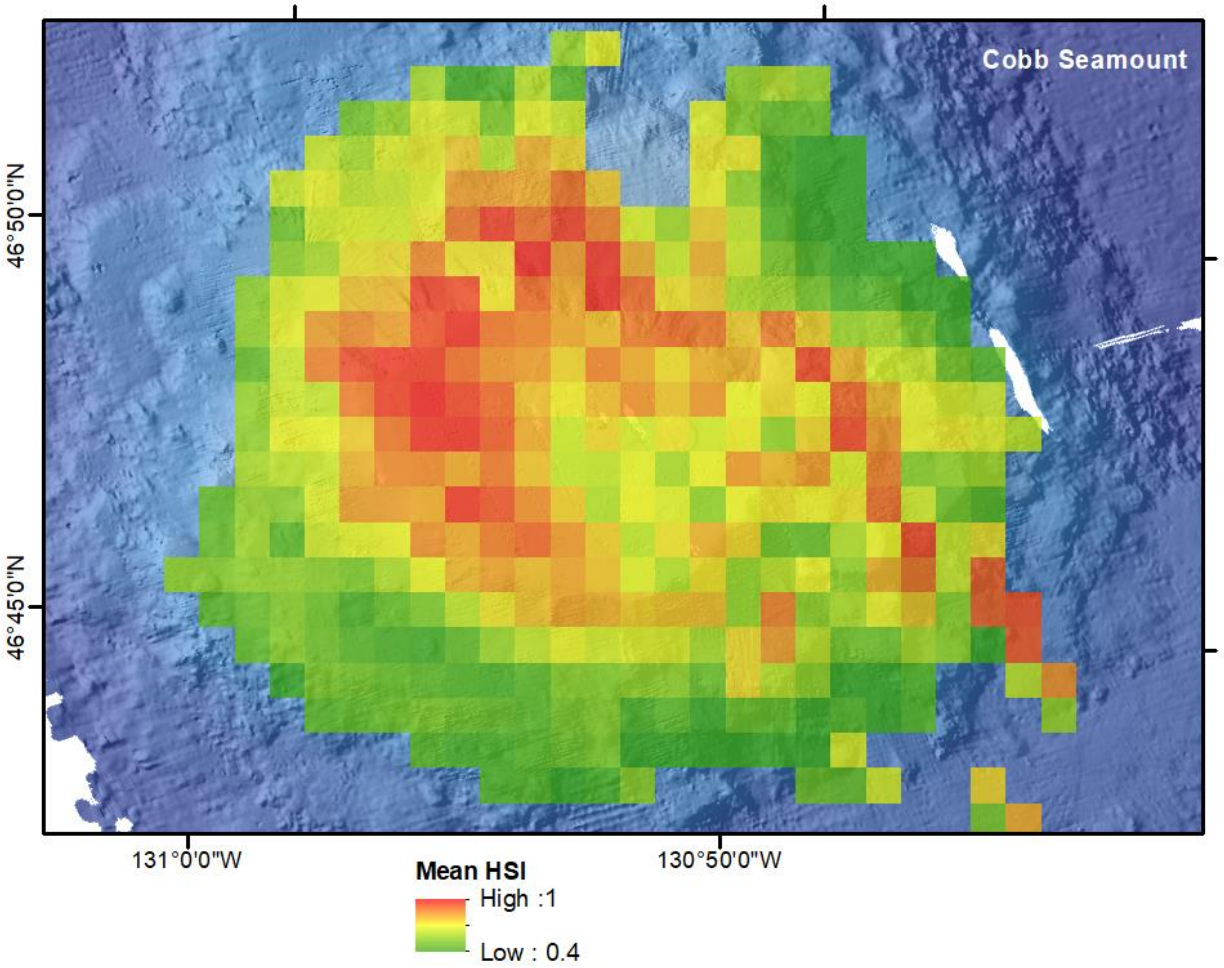
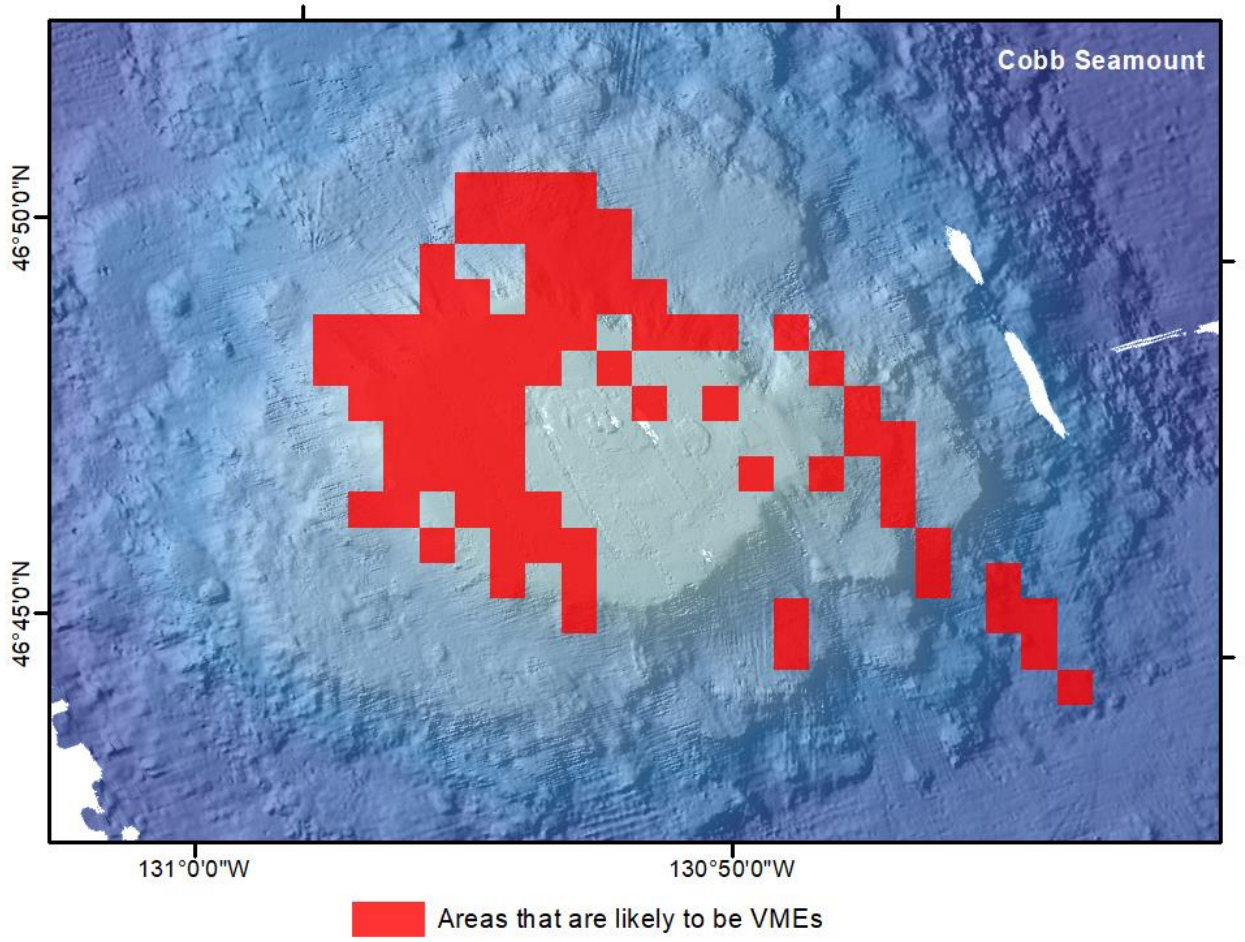
Mean

Mean > visual threshold (0.86)

Areas likely to be VMEs





(Mean = average of 4 VME indicator model predictions)

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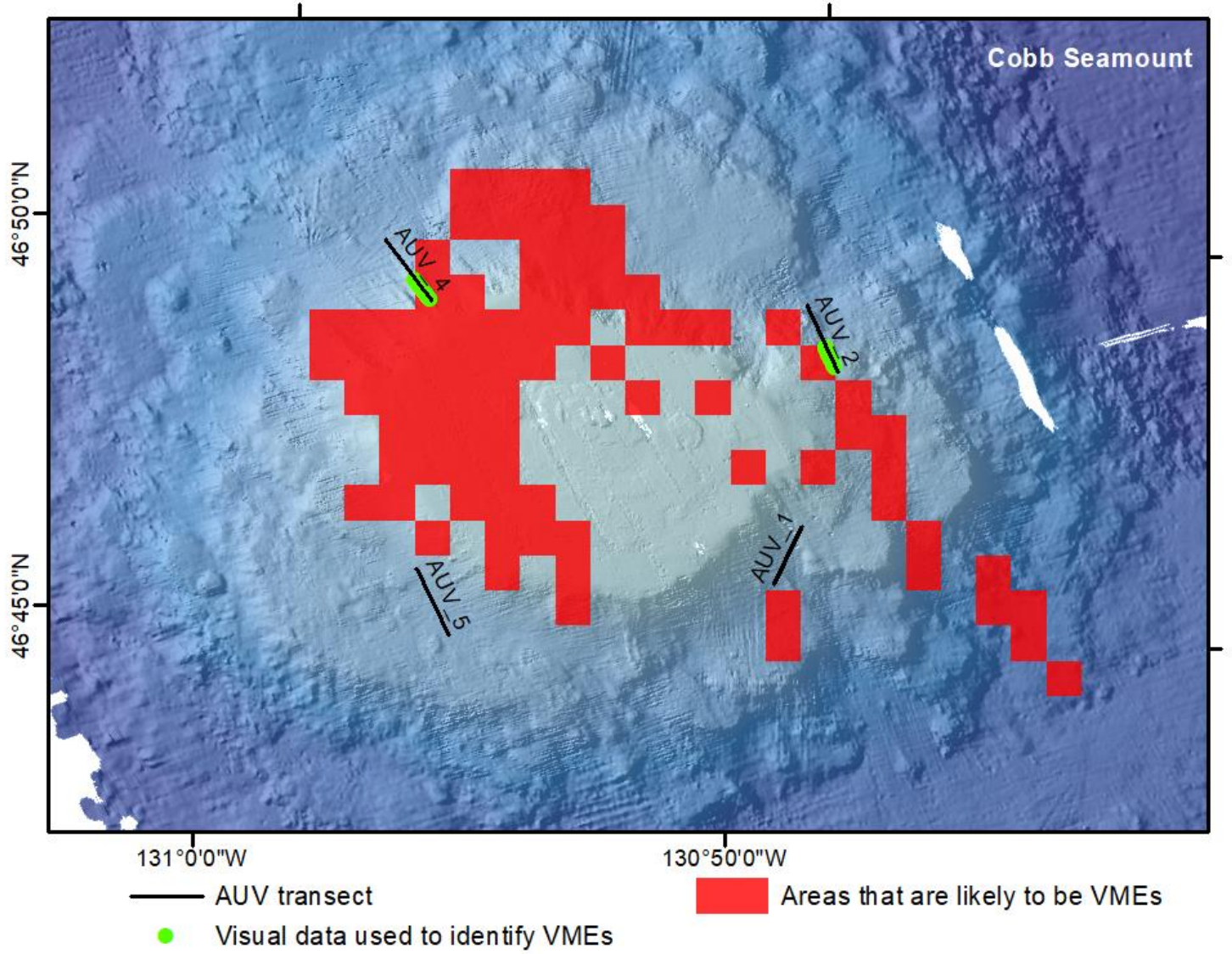
Visual data is collected from areas identified as areas likely to be VMEs based on SDMs

Visual data are from Curtis et al. (2015)

2012 Expedition to Cobb Seamount: Survey methods, data collections, and species observations. Canadian Technical Report of Fisheries and Aquatic Sciences, 3124



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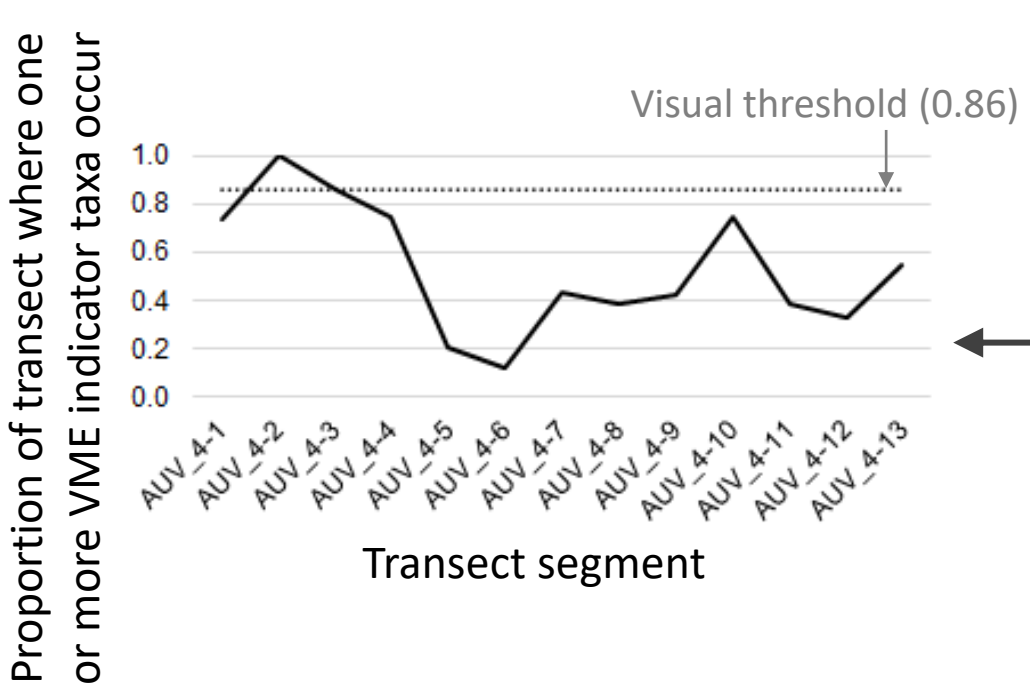

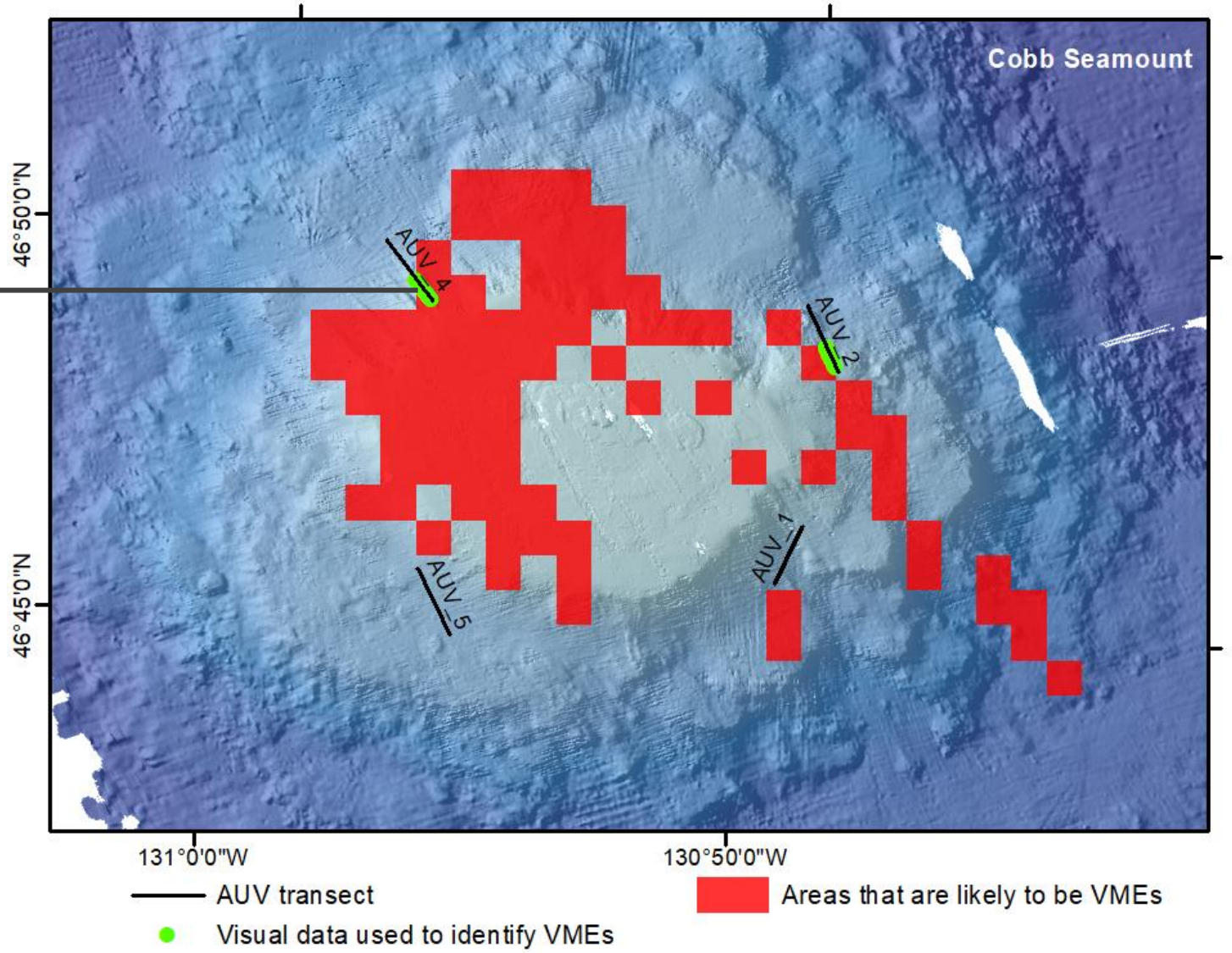

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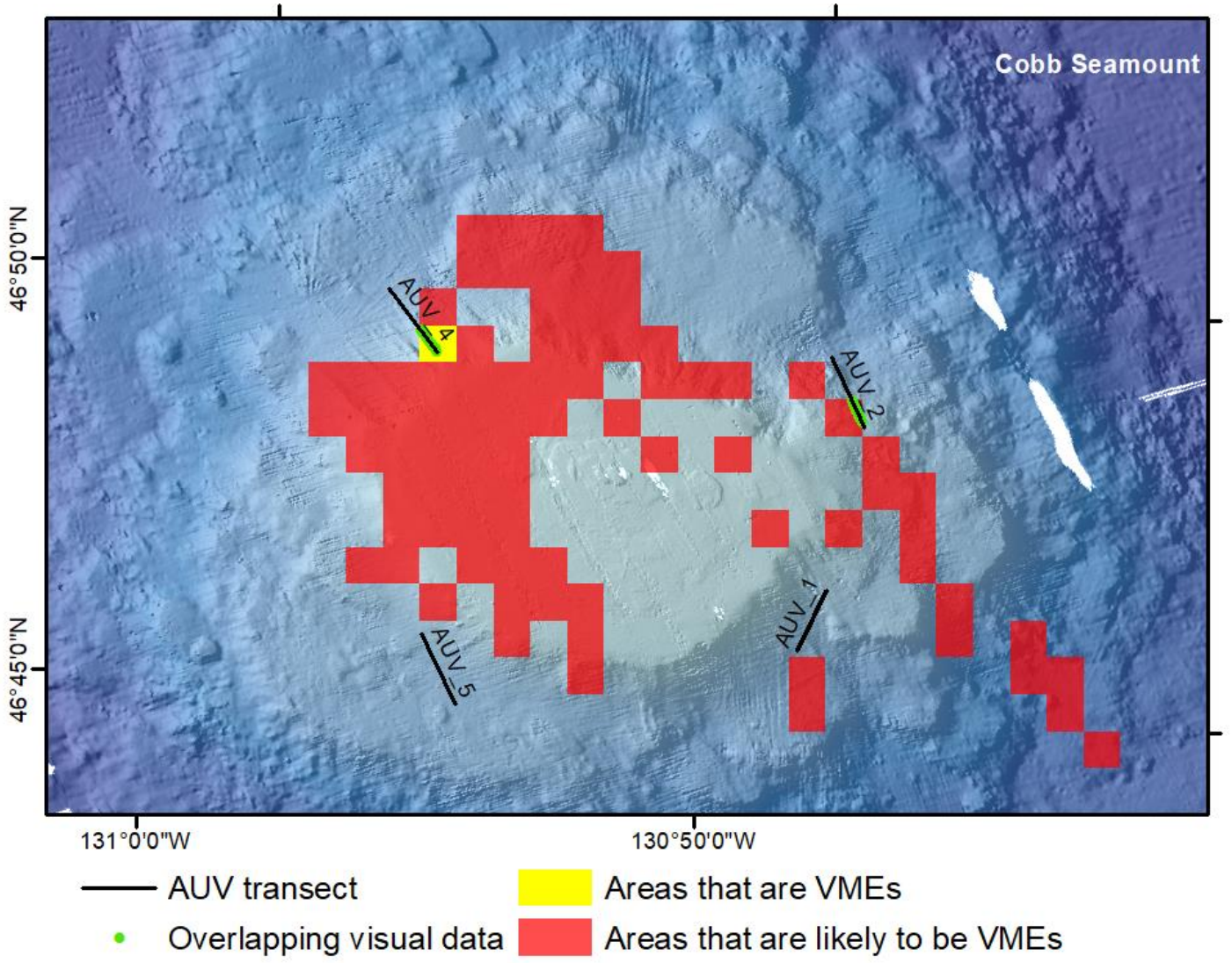
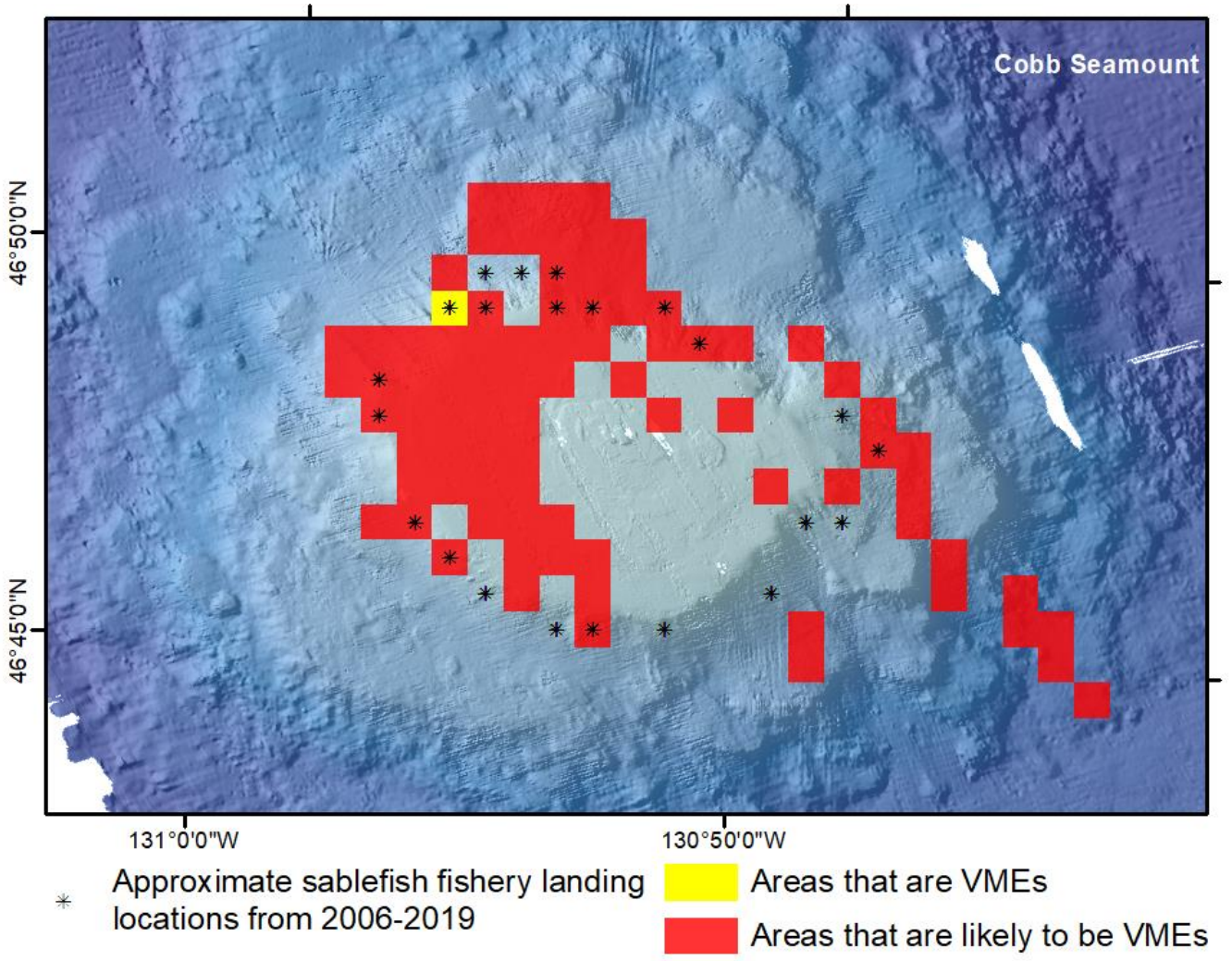
Our preliminary results suggest one VME identified on the northwest part of Cobb Seamount at a depth of approximately 600 m with an area of 1km^2



Sablefish fishery interactions

38 % of fisheries landings come from areas likely to be VMEs

2 % of landings come from areas that are VMEs



Fishing locations in this map are limited to points where three or more vessels reported landings for a time or area of interest to preserve confidentiality

Next steps

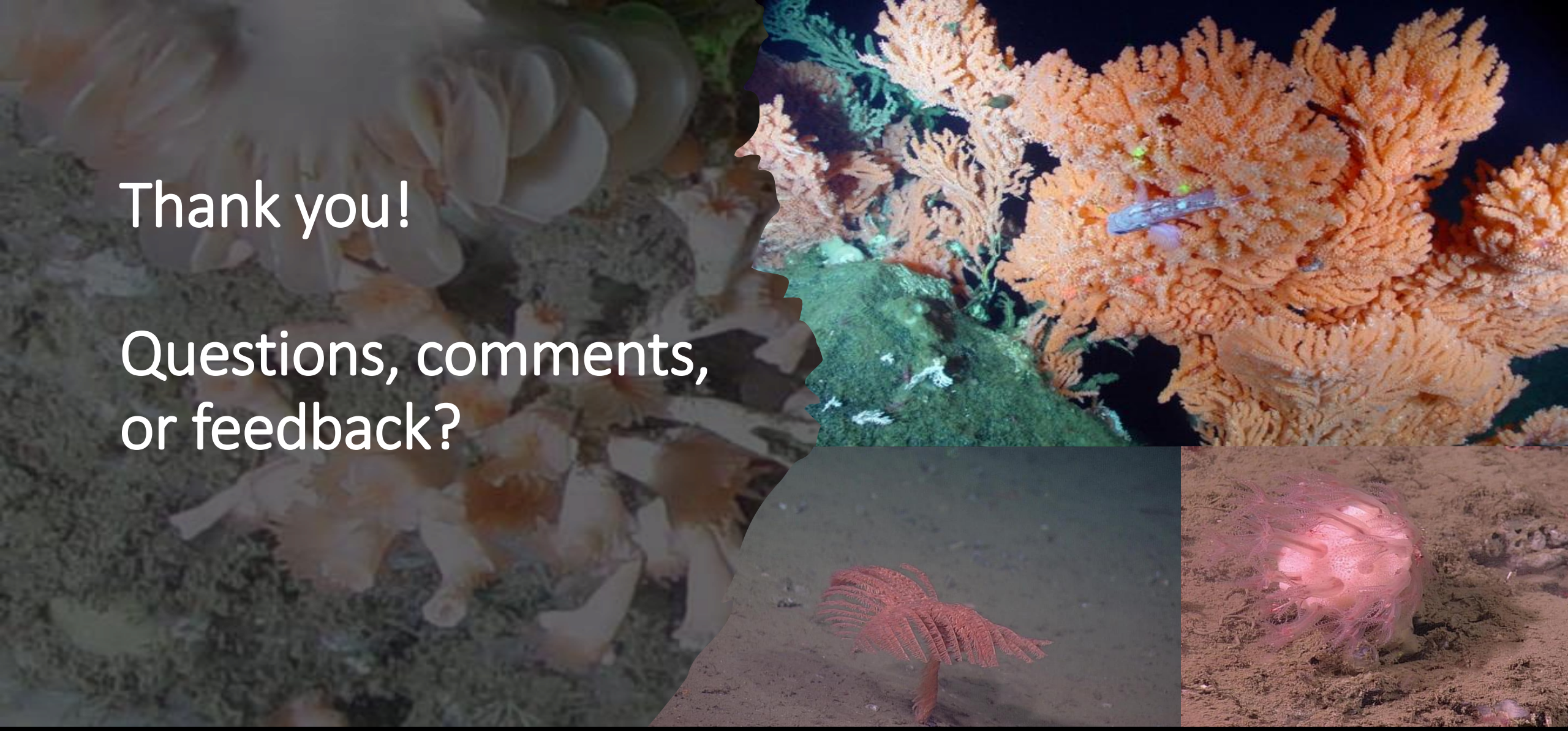
- Receive comments and suggestions from NPFC members, observers, and stakeholders
- Revise our methods
- Apply revised methods to parts of the NE NPFC CA
- Areas likely to be VMEs will become priorities for visual surveys
- Periodic review as new data or information become available

Recommendations

1. NPFC SSC BFME endorse this as one method for identifying VMEs in the NPFC CA

2. Canada moves forward with revising based on feedback and using this method to identify VMEs and areas likely to be VMEs in the eastern NPFC CA



Thank you!

Questions, comments, or feedback?

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