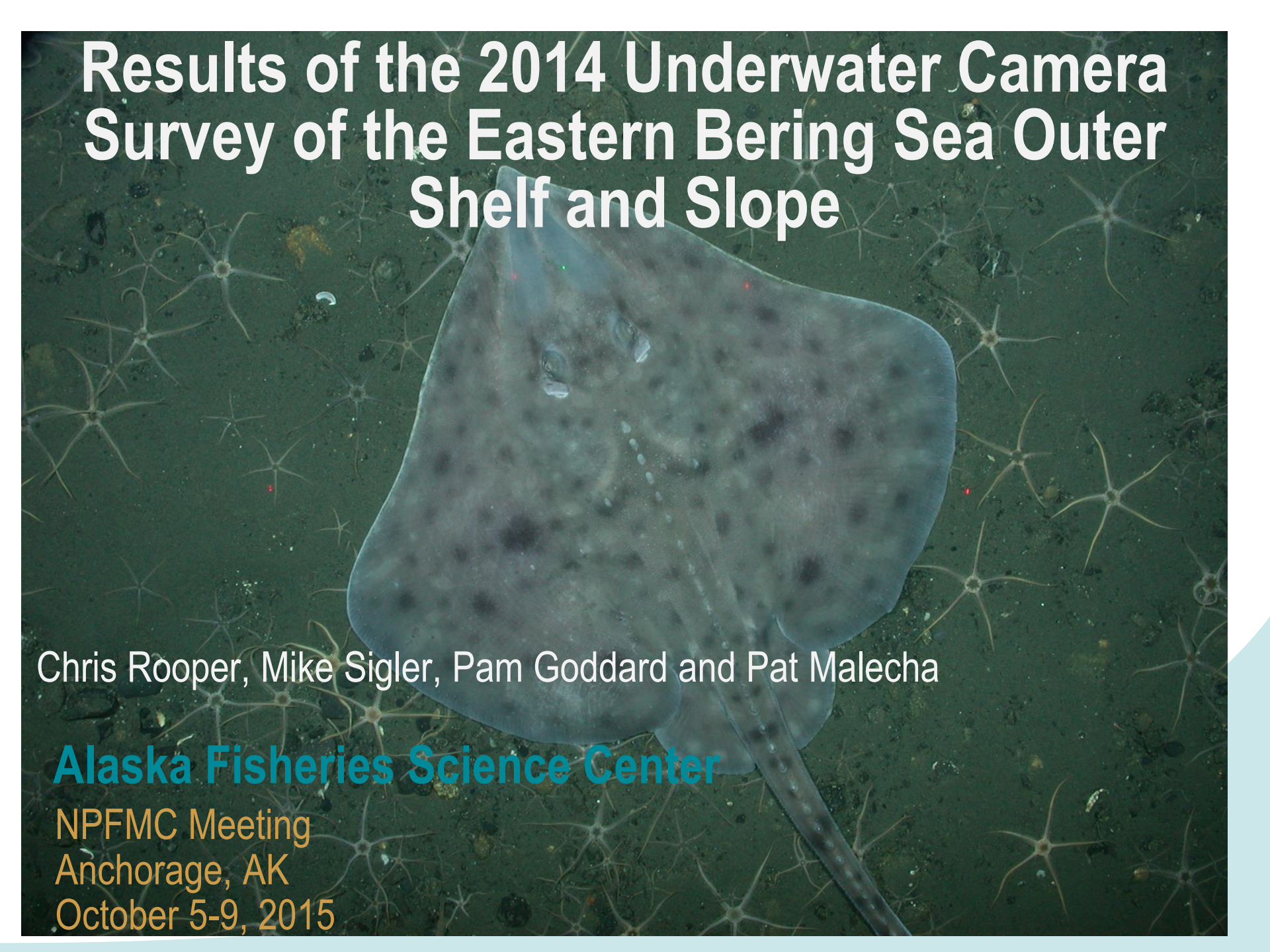


# Results of the 2014 Underwater Camera Survey of the Eastern Bering Sea Outer Shelf and Slope



Chris Rooper, Mike Sigler, Pam Goddard and Pat Malecha

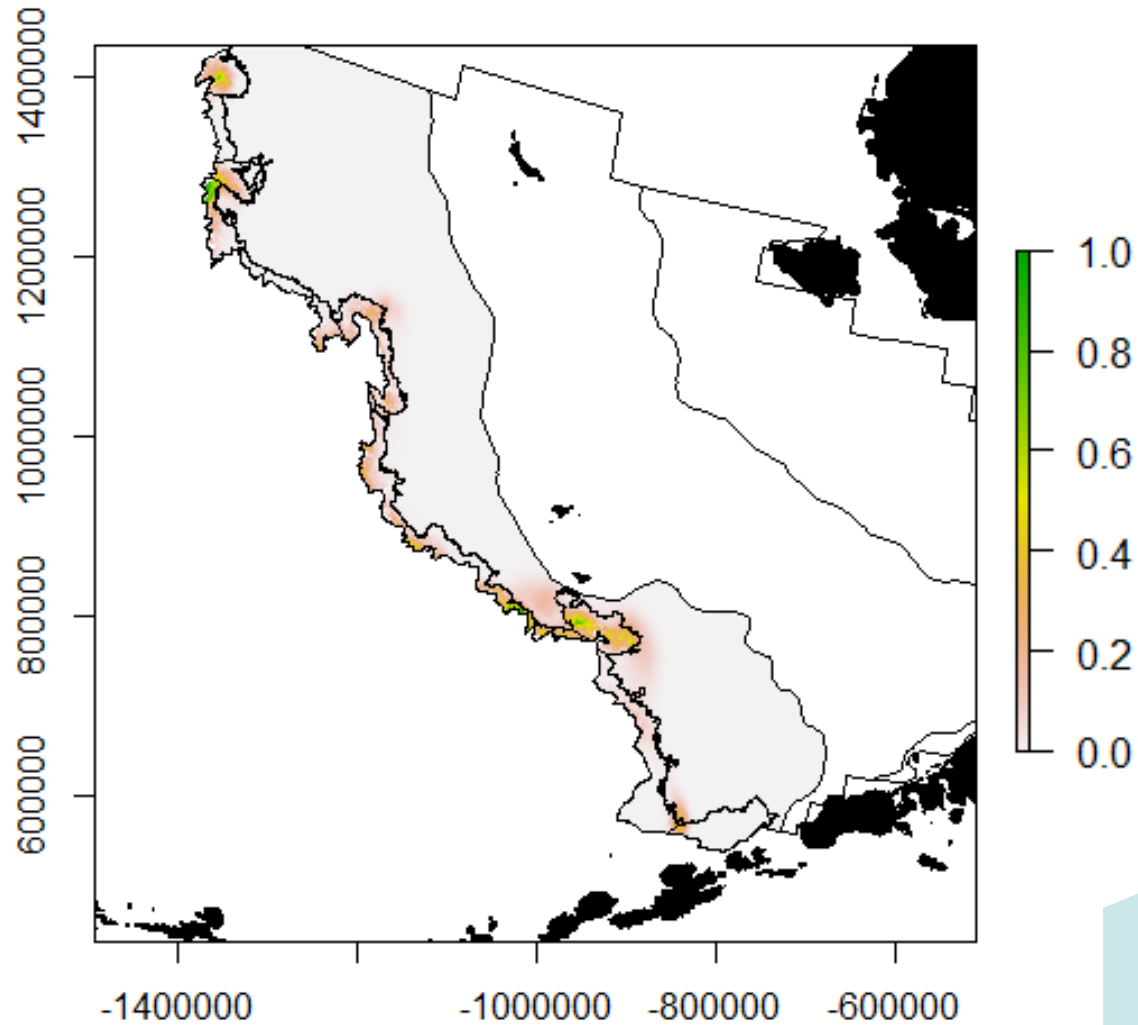
**Alaska Fisheries Science Center**

NPFMC Meeting  
Anchorage, AK  
October 5-9, 2015

# Background and Timeline

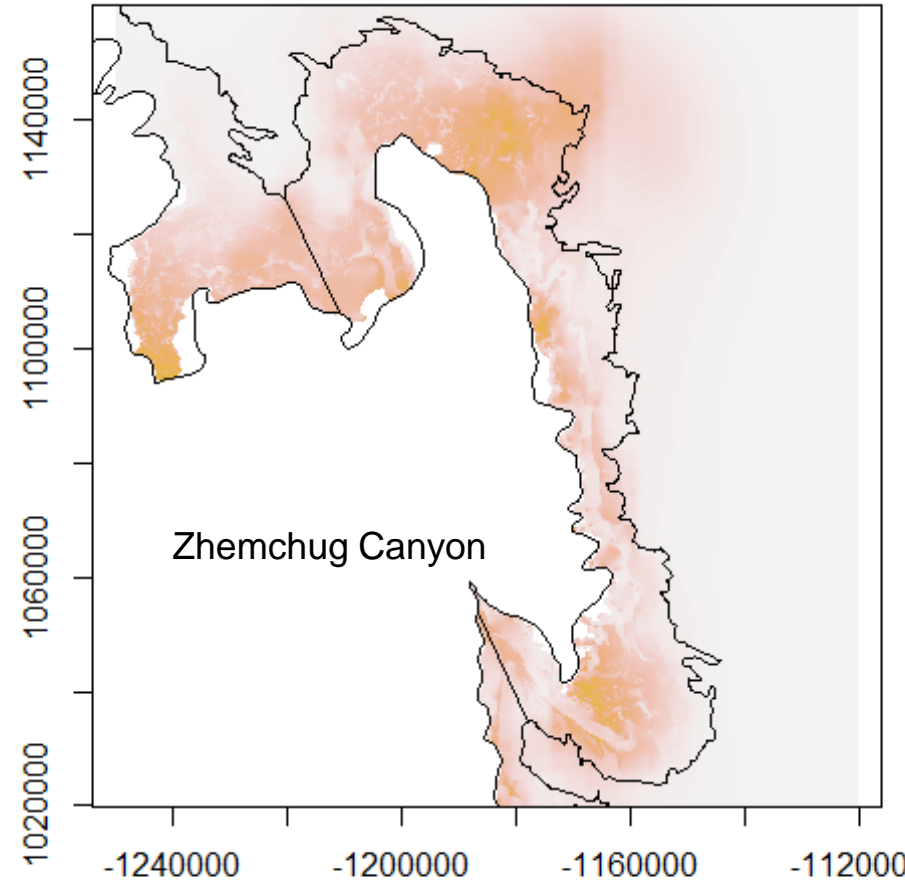
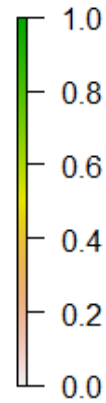
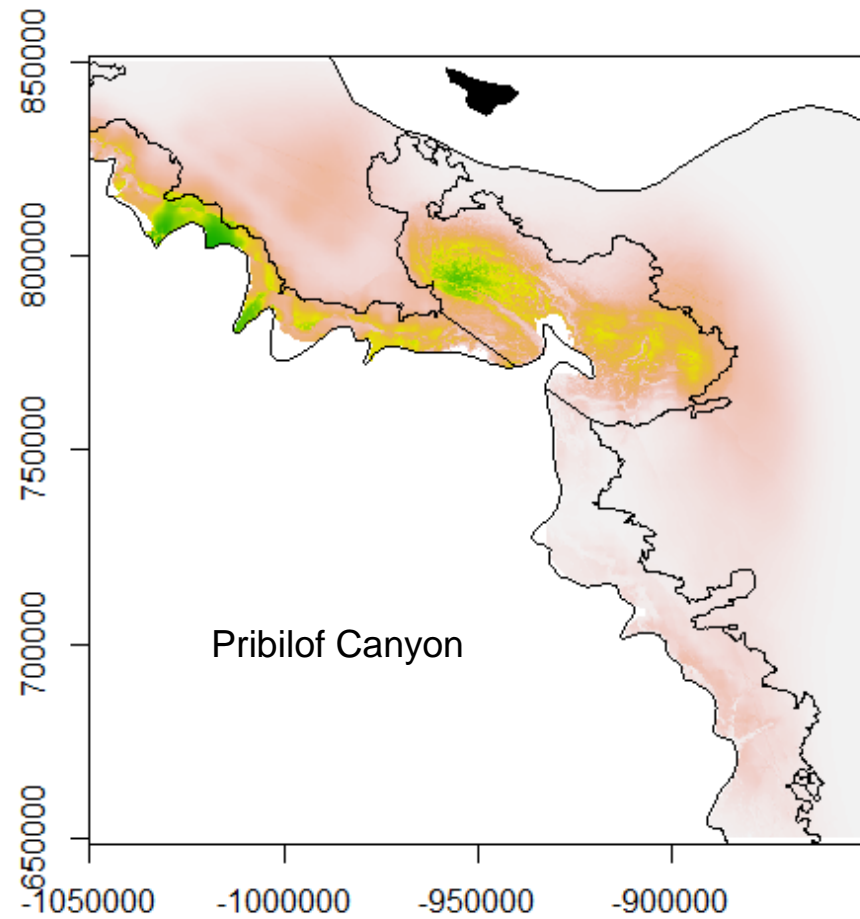
- April 2012
  - NPFMC requested analysis of existing data on the eastern Bering Sea slope and canyons
- June 2013
  - AFSC presented results of the analysis
  - ***Included predictive coral model***
- June 2013
  - NPFMC requests further analysis
  - ***NPFMC requests “groundtruthing” of coral model***
- October 2013
  - Further analysis presented
  - ***Plans for summer 2014 fieldwork presented***
- February 2014
  - EBS Canyons workshop – ***discuss upcoming 2014 survey***
- August-September 2014
  - ***Camera survey conducted***
  - Preliminary results to NPFMC (October)
- March 2015
  - Image analysis completed
  - Preliminary results presented
- June 2015
  - ***Final Results and Report to public***
- October 2015
  - ***Presentation to NPFMC***

# Probability coral present based on bottom trawl survey data



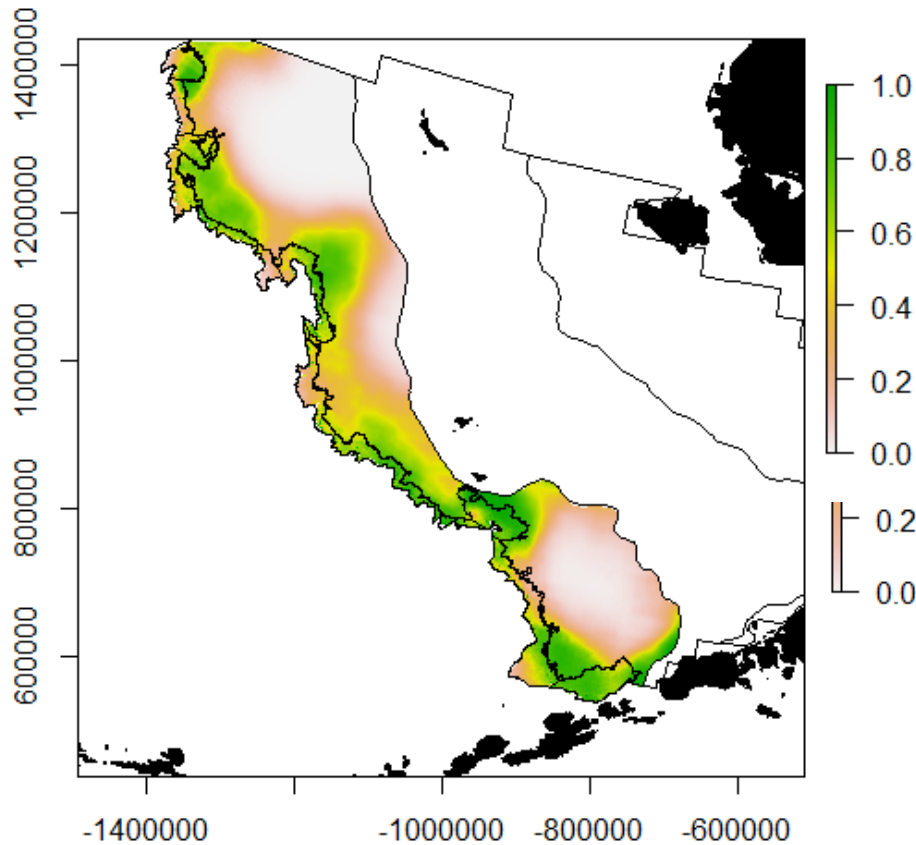


# Probability coral present based on bottom trawl survey data

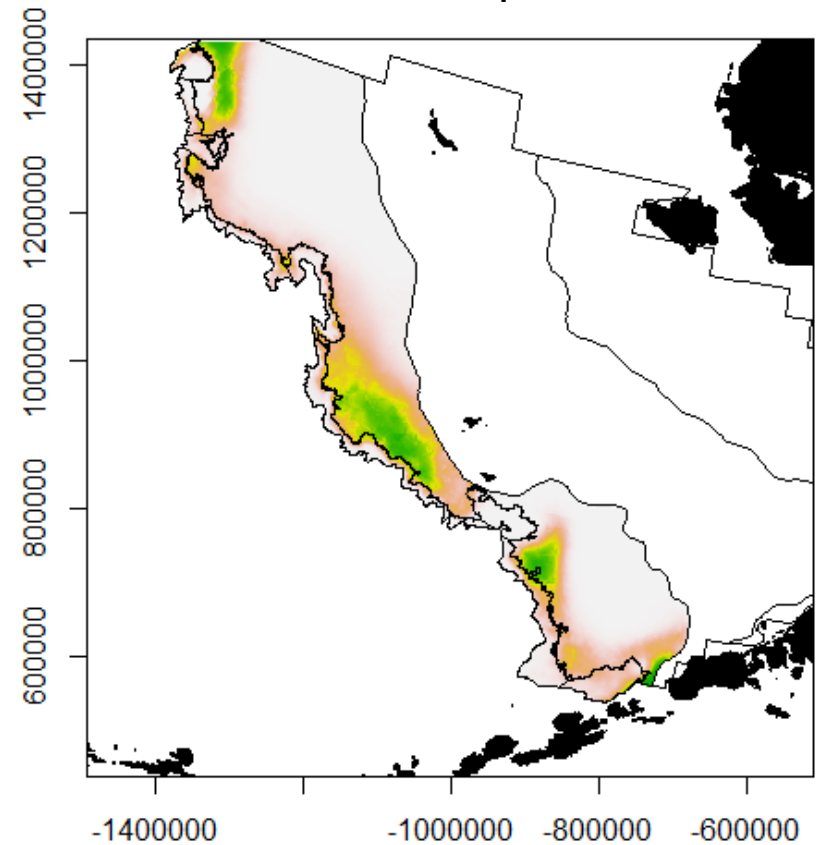


# Probability sponge or sea whips present based on bottom trawl survey data

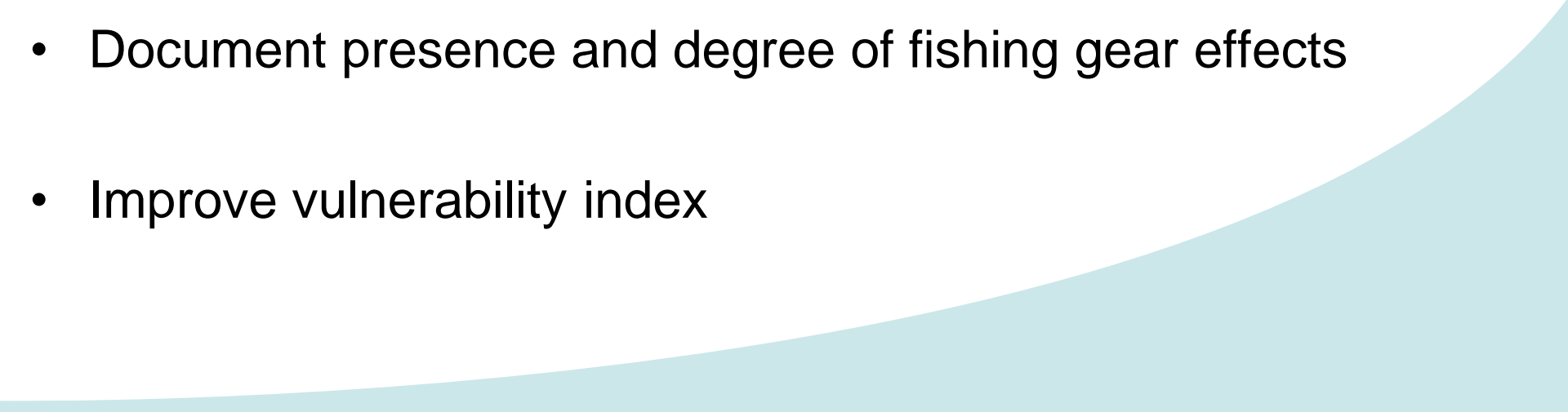
Sponge



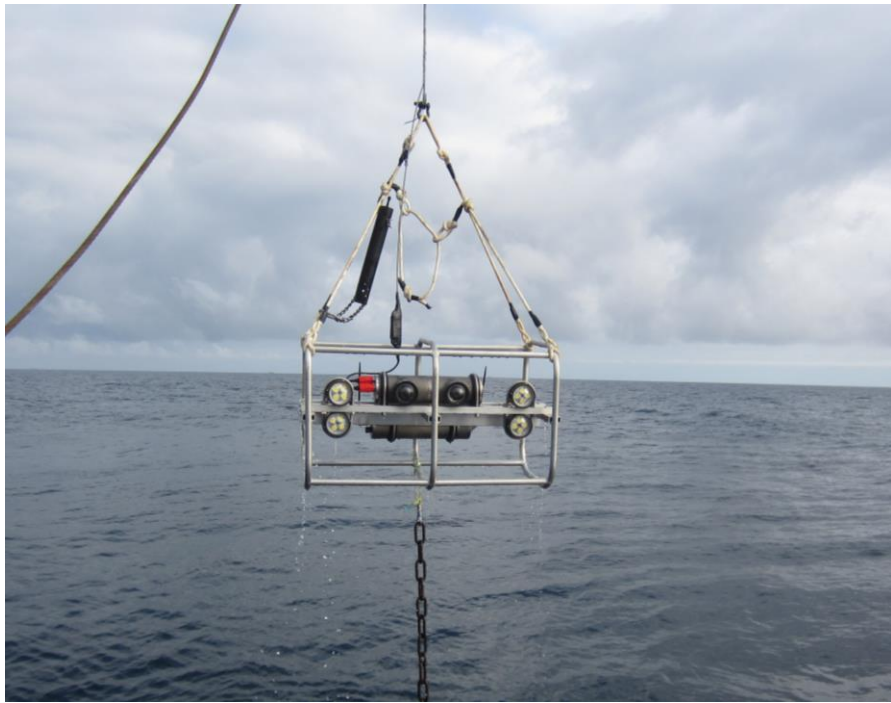
Sea whips



# Fieldwork objectives (NPFMC Motion)

- Validate model predictions
  - Improve/refine predictions of coral presence
  - Acquire height and density data for coral
  - Identify the role of these coral as fish habitat
  - Document presence and degree of fishing gear effects
  - Improve vulnerability index
- 

# 2014 fieldwork



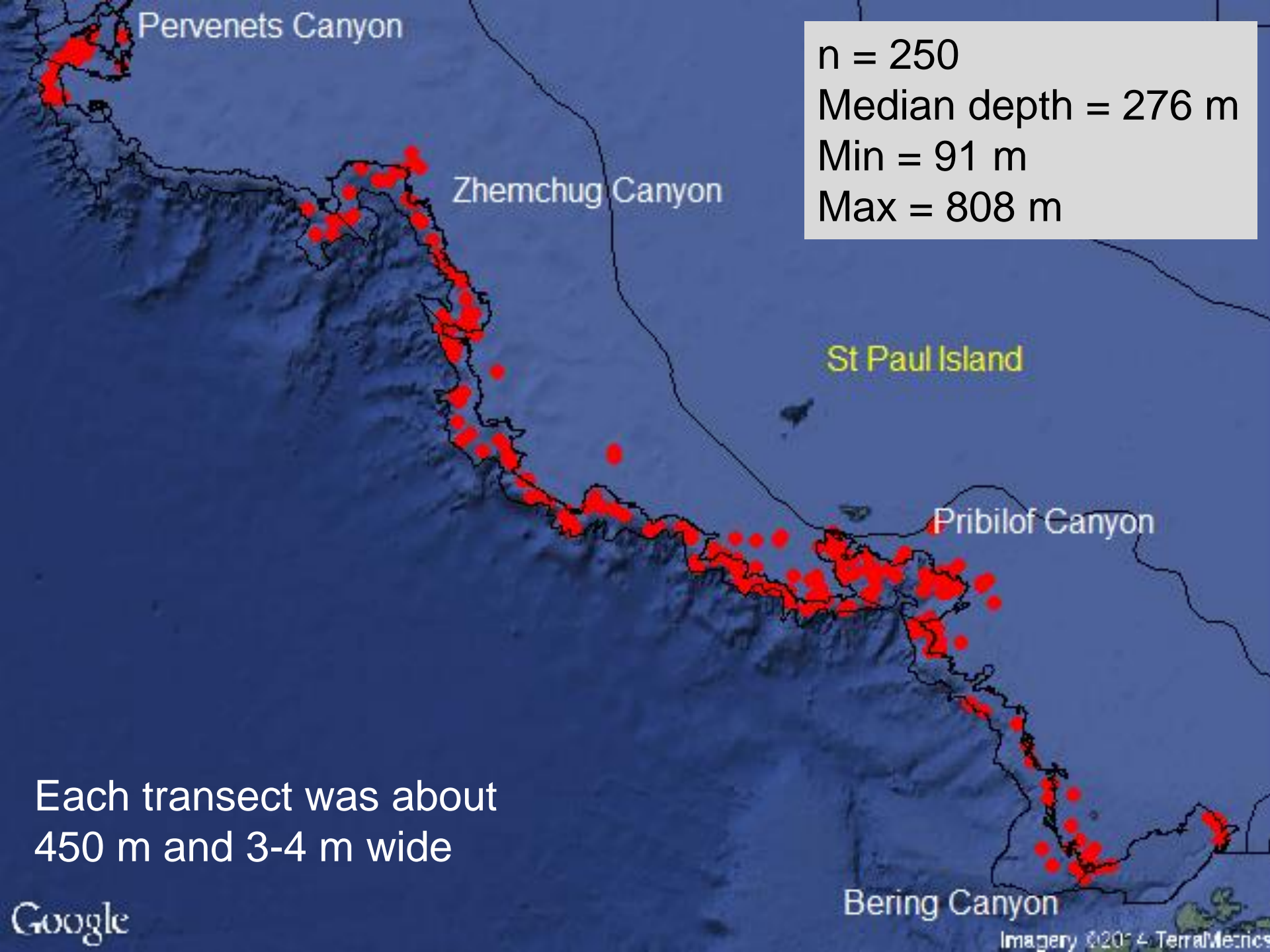
## Stereo drop camera

15 minute tows

300 Randomly selected stations  
more effort in areas of higher  
probability (realized  $n = 250$ )

~225,000 paired seafloor images





Pervenets Canyon

n = 250

Median depth = 276 m

Min = 91 m

Max = 808 m

Zhemchug Canyon

St Paul Island


Pribilof Canyon

Each transect was about  
450 m and 3-4 m wide

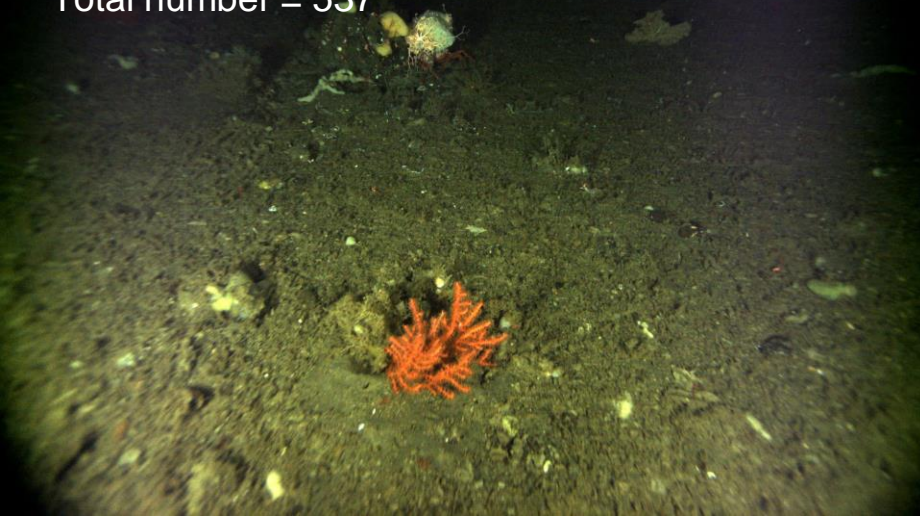
Bering Canyon



# Fieldwork results

- Validate model predictions
  - Improve/refine predictions of coral presence
  - Acquire height and density data for coral
  - Identify the role of these coral as fish habitat
  - Document presence and degree of fishing gear effects
  - Improve data for vulnerability index
- 

Swiftia sp.  
Total number = 537



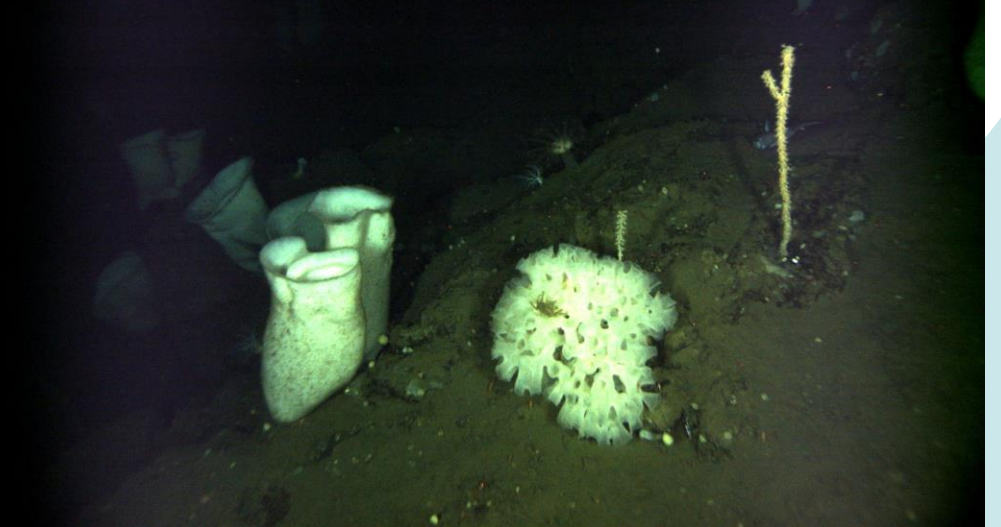
Primnoidae  
Total number = 40



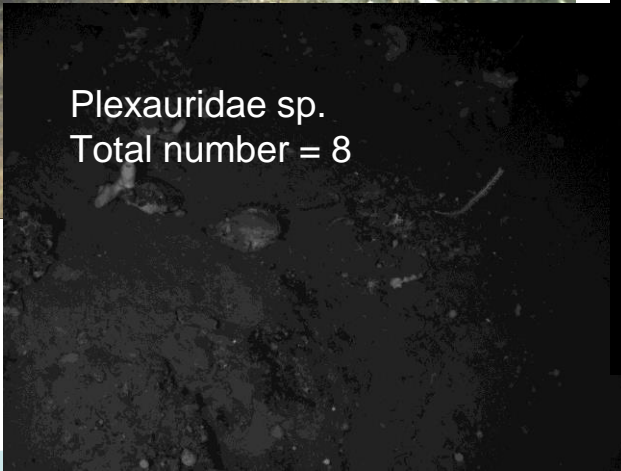
Plumarella sp.  
Total number = 811



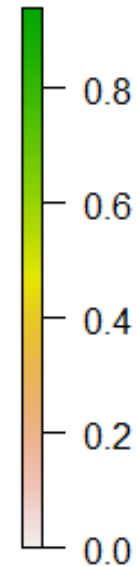
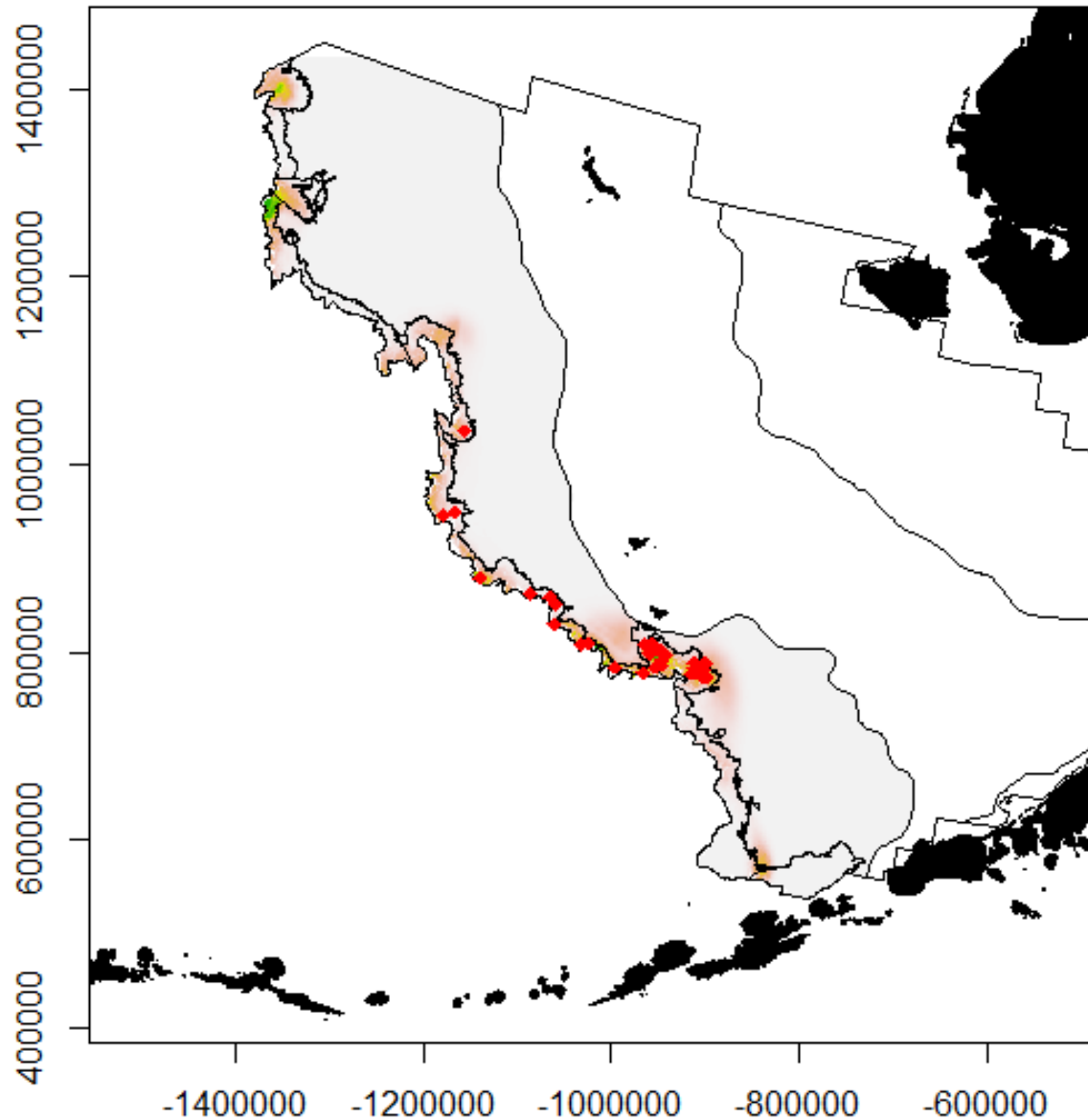
Isididae sp.  
Total number = 69



Plexauridae sp.  
Total number = 8



# Coral Results



n = 32 (13%)  
Median depth = 451 m  
Min = 201 m  
Max = 770 m



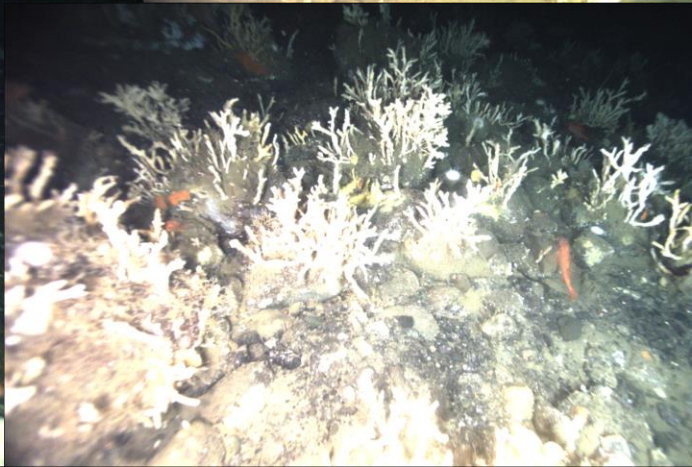
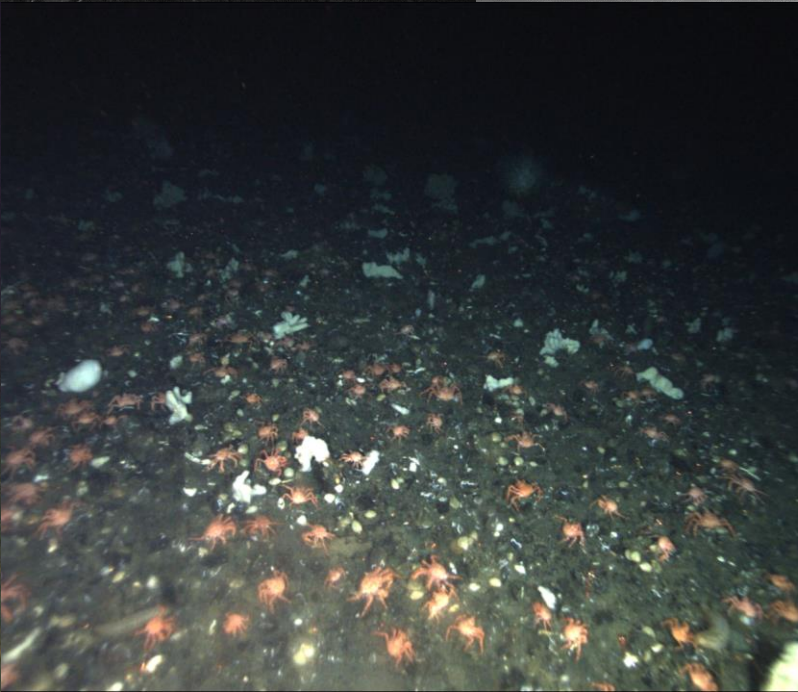


Demosponge  
Total number = 37,682

Hexactinellid sponge  
Total number = 1,952

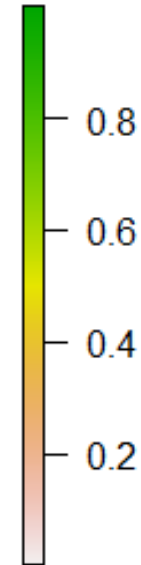
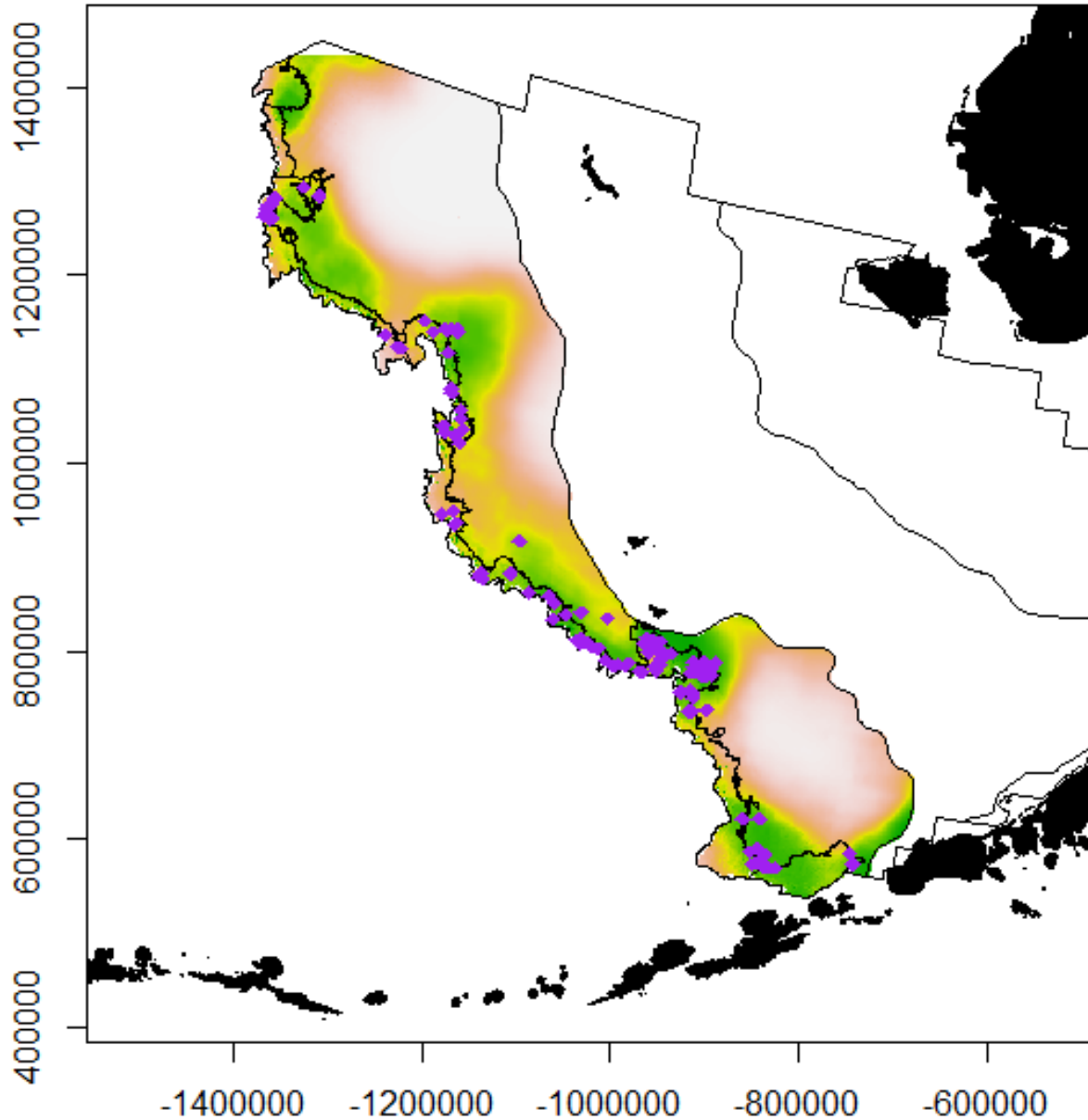
Calcarea sponge  
Total number = 31

Porifera  
Total number = 27



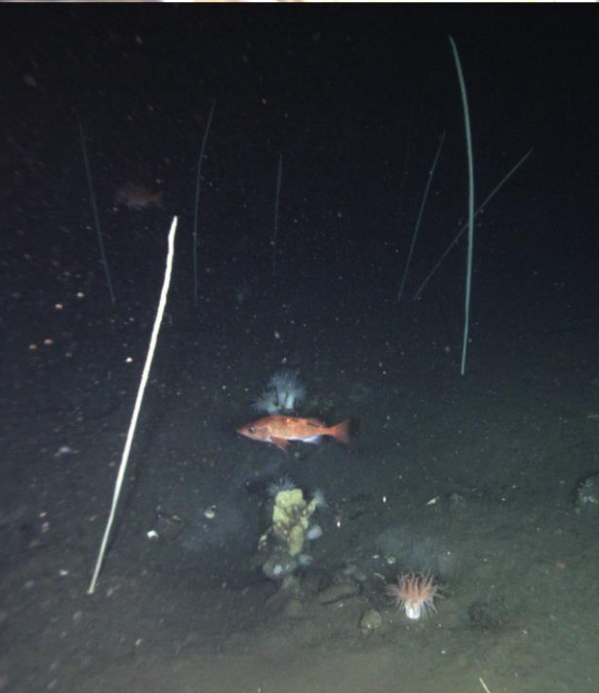
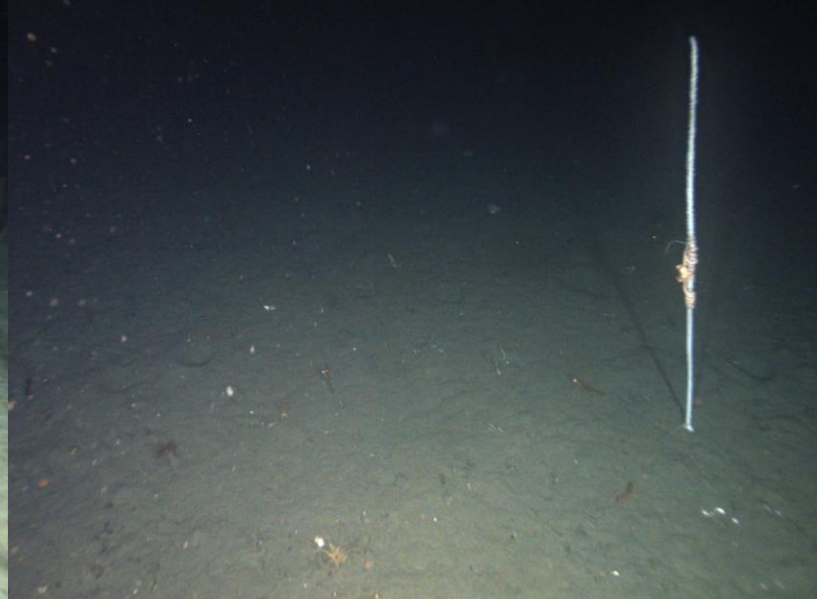
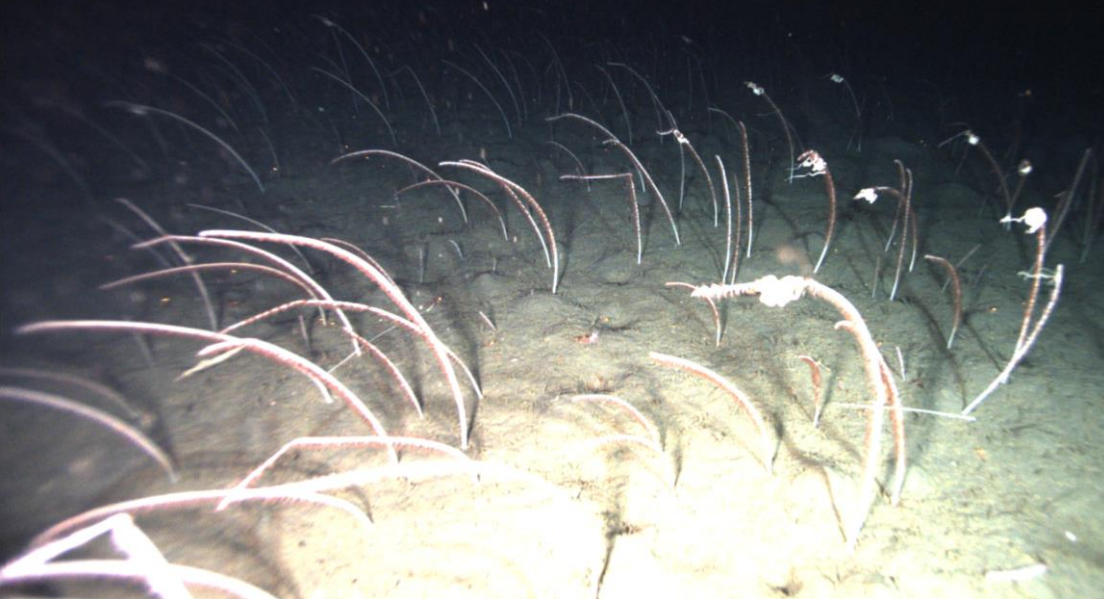


# Sponge Results

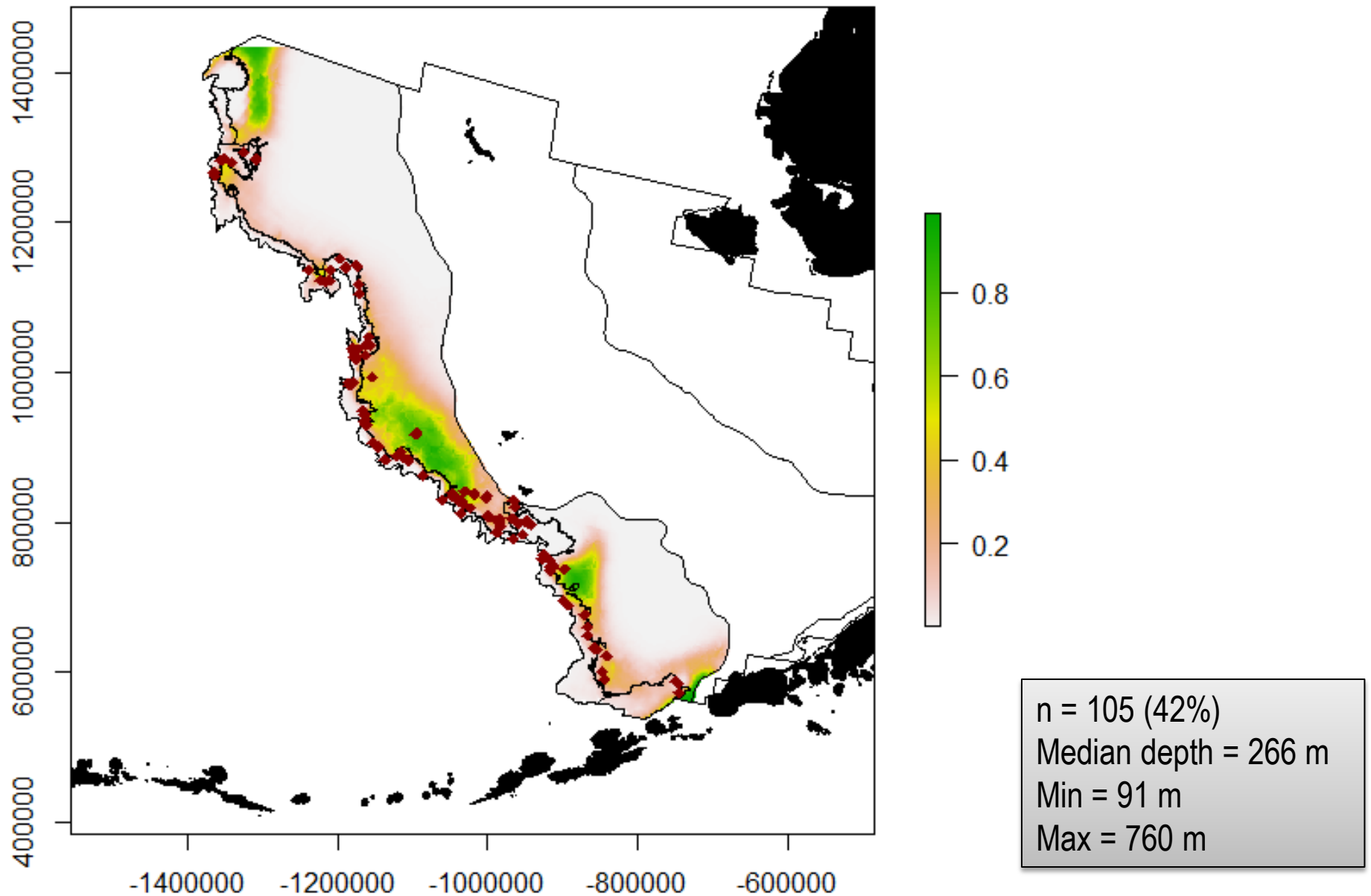


n = 113 (45%)  
Median depth = 311m  
Min = 111 m  
Max = 781 m


Halipteris  
Total number = 29,435



# Sea Whips Results

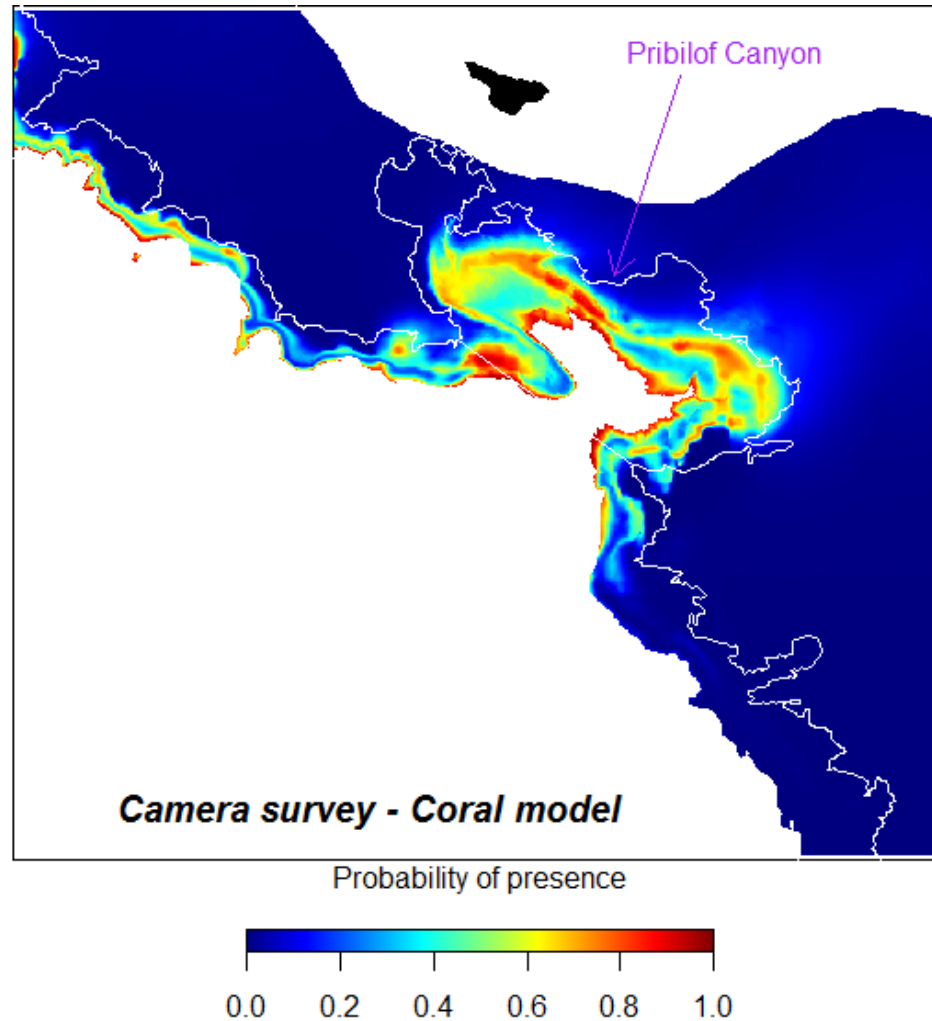


# Fieldwork results

- Validate model predictions
  - **Improve/refine predictions of coral presence**
  - Acquire height and density data for coral
  - Identify the role of these coral as fish habitat
  - Document presence and degree of fishing gear effects
  - Improve data for vulnerability index
- 



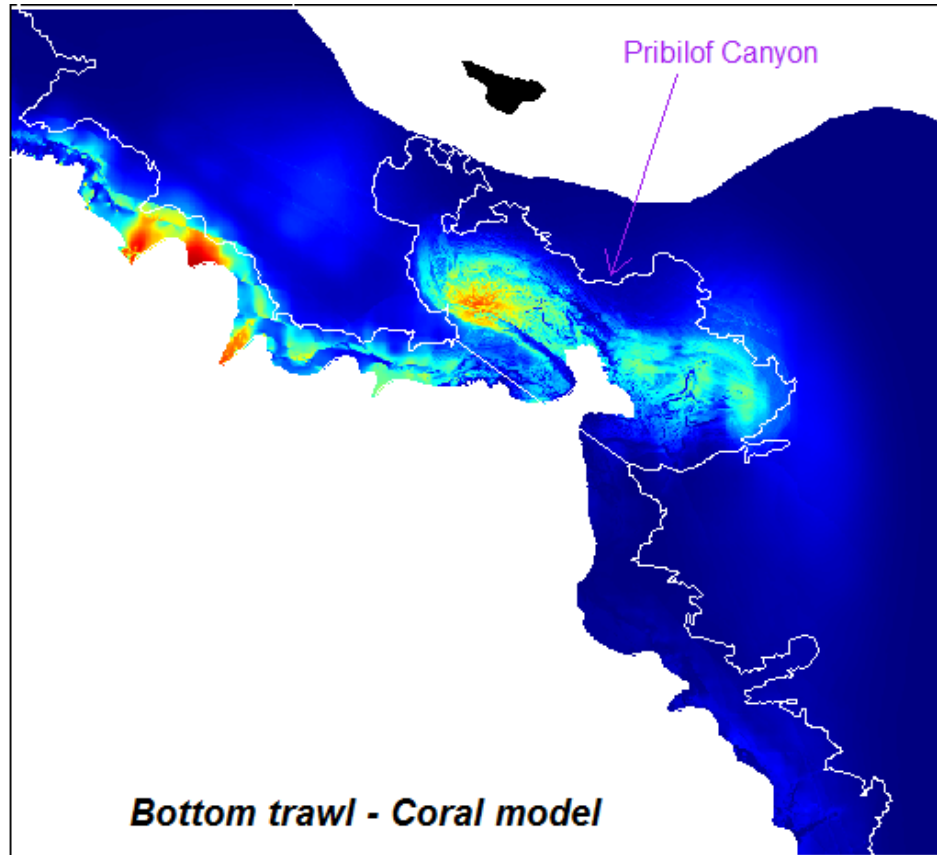
# Probability coral present based on camera survey



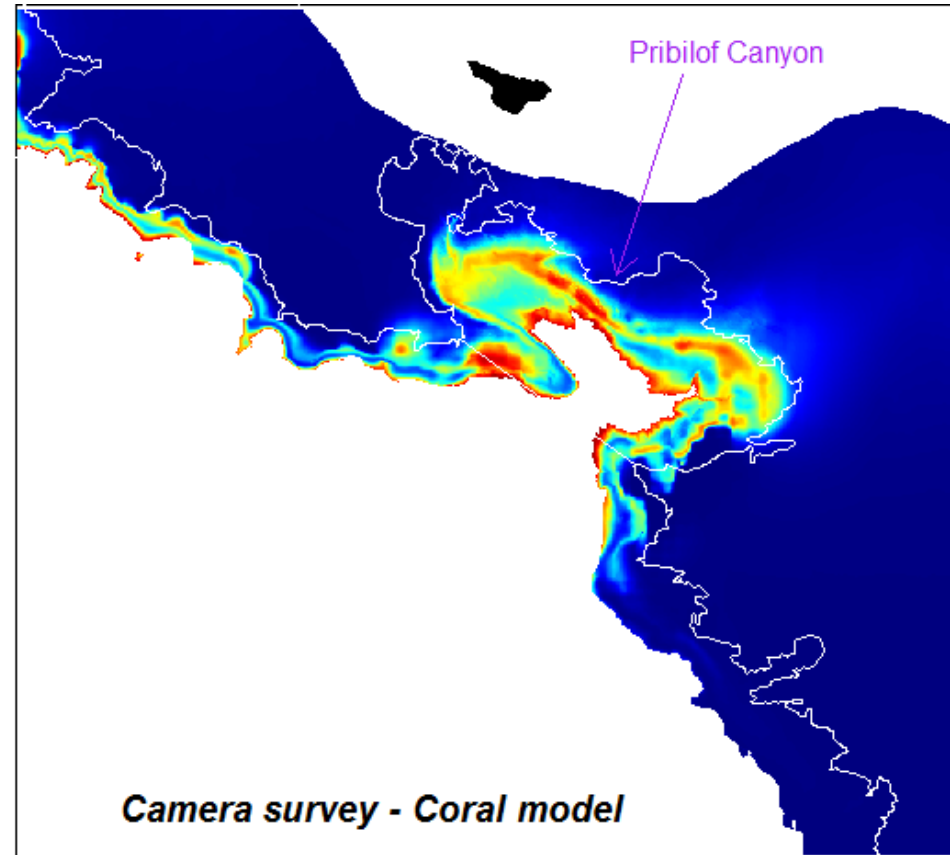
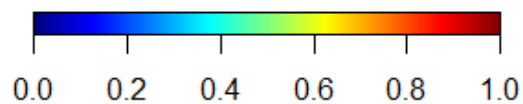
# Combine models

Trawl survey data

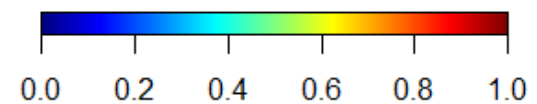
Camera survey data



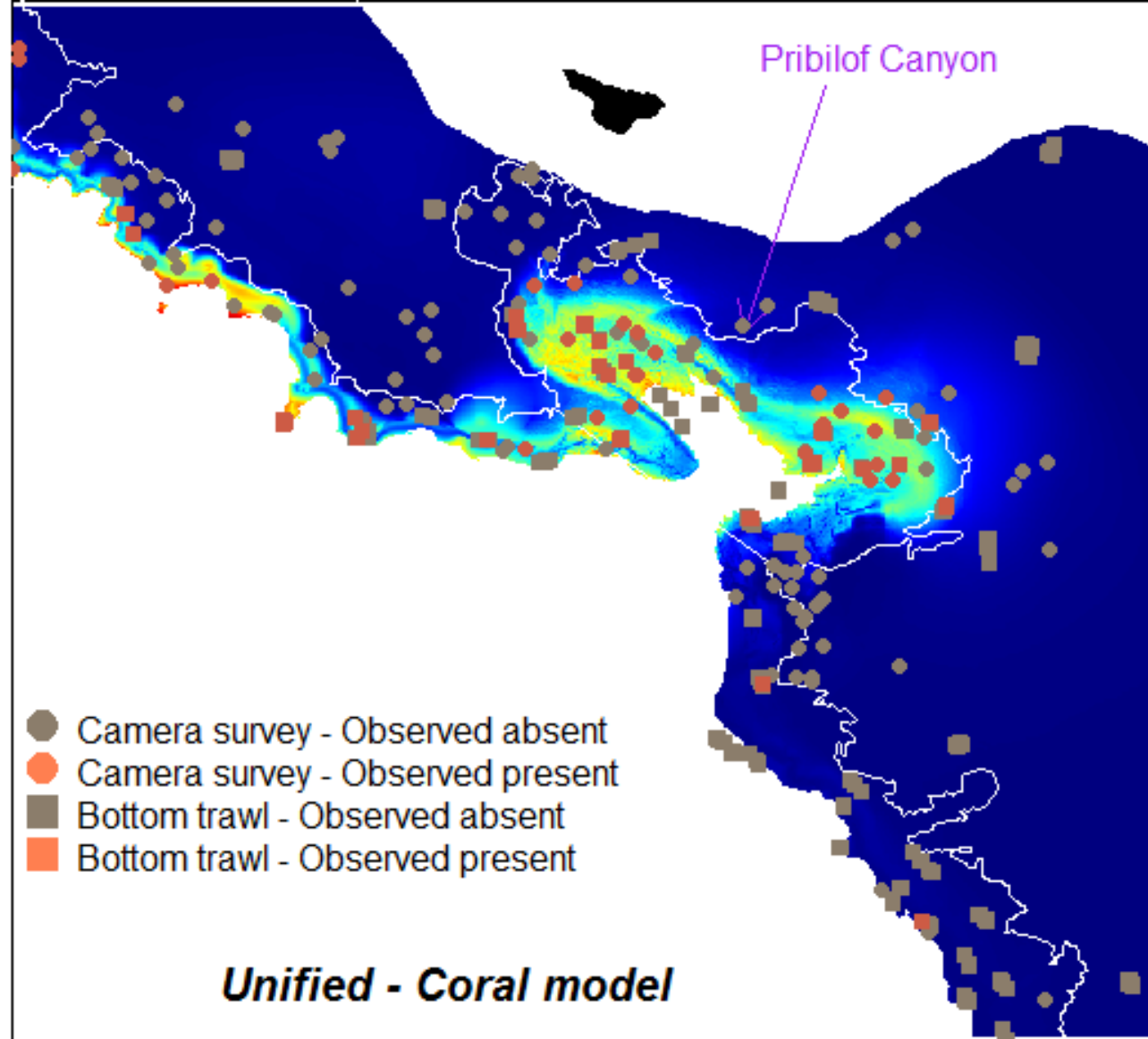
Probability of presence



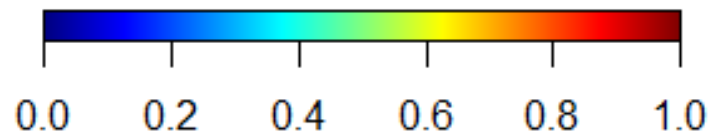
Probability of presence




Probability  
coral present,  
unified coral  
model,  
Pribilof  
Canyon



Probability of presence



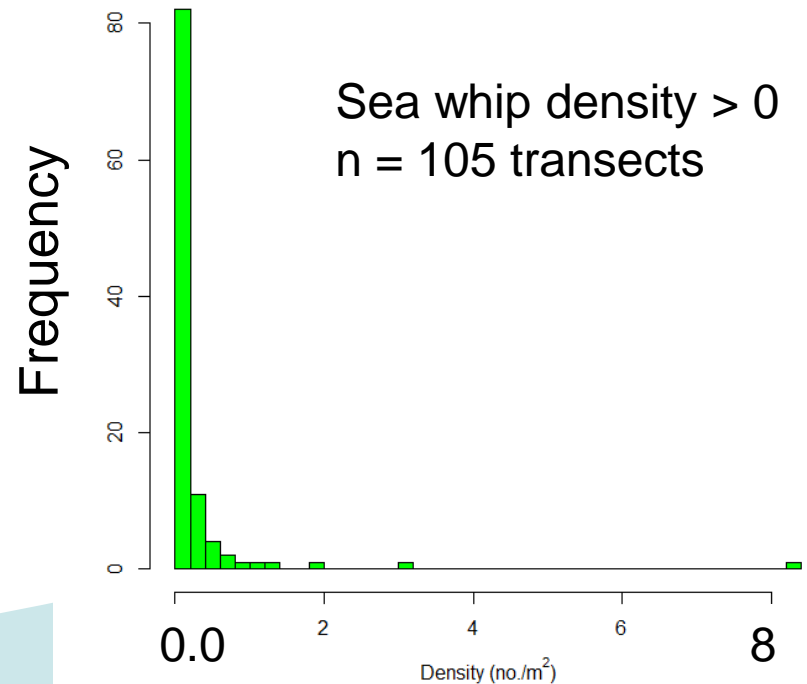
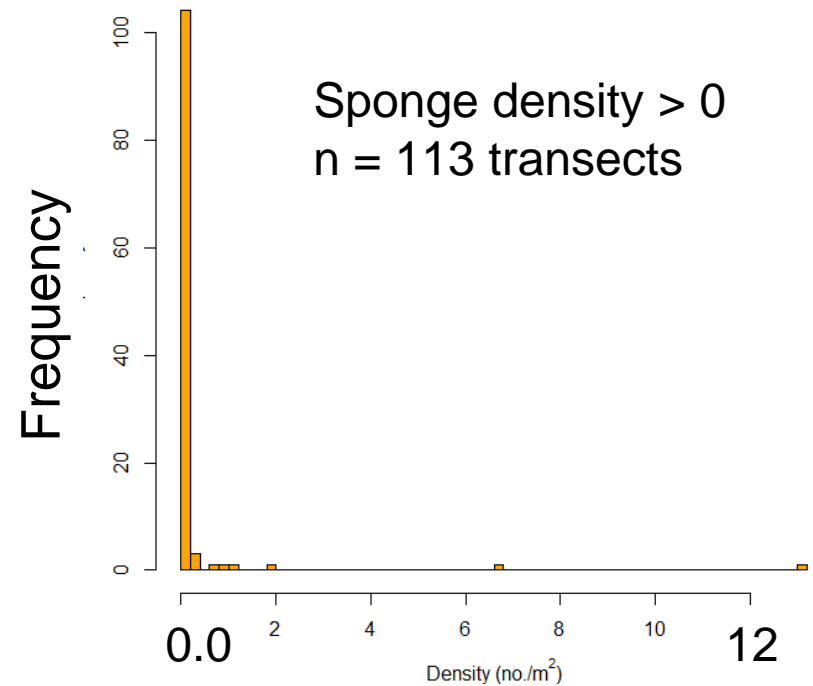
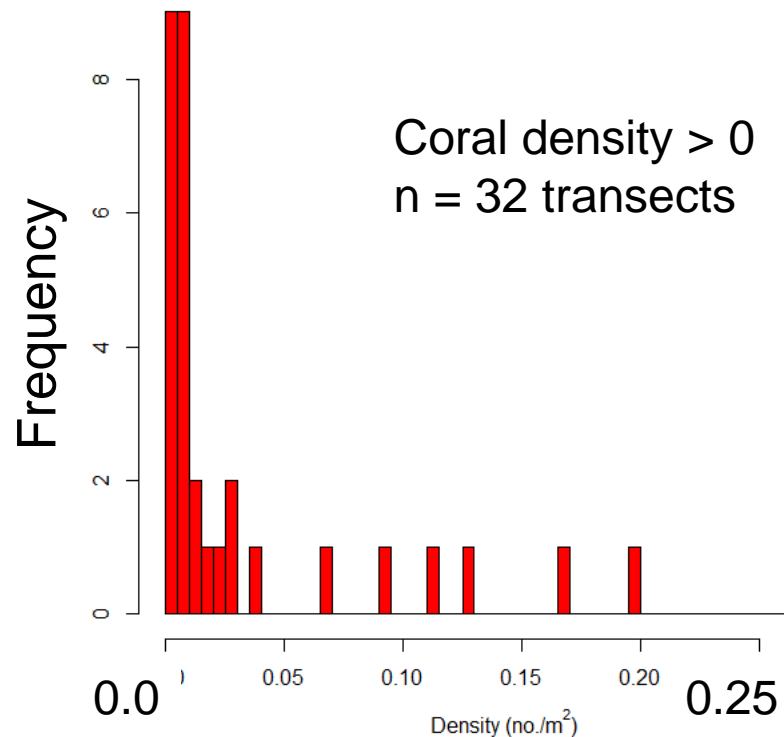
# Fieldwork results

- Validate model predictions
  - Improve/refine predictions of coral presence
  - **Acquire height and density data for coral**
  - Identify the role of these coral as fish habitat
  - Document presence and degree of fishing gear effects
  - Improve data for vulnerability index
- 



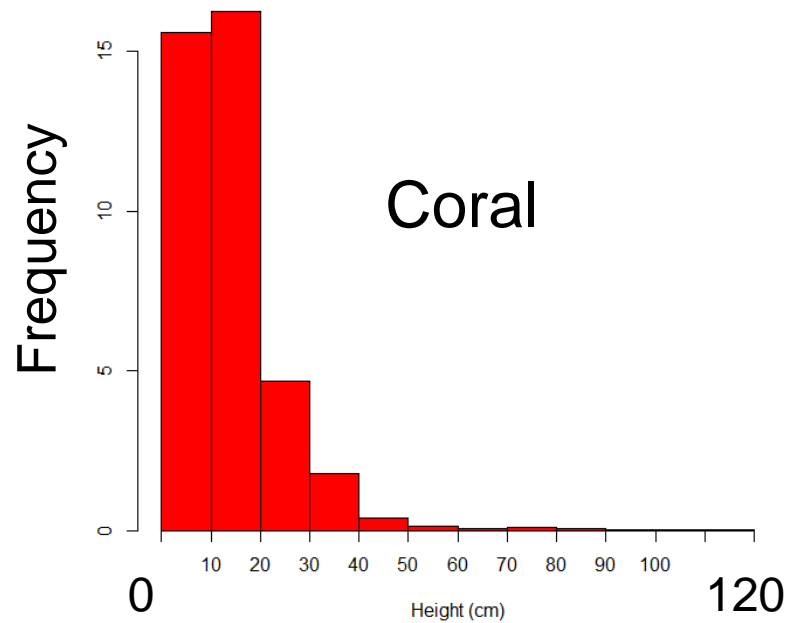
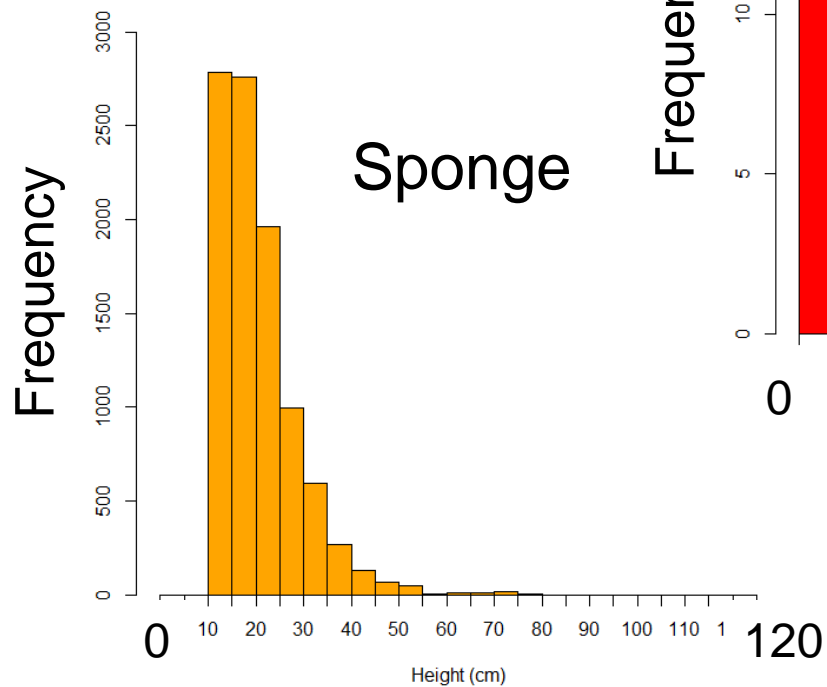
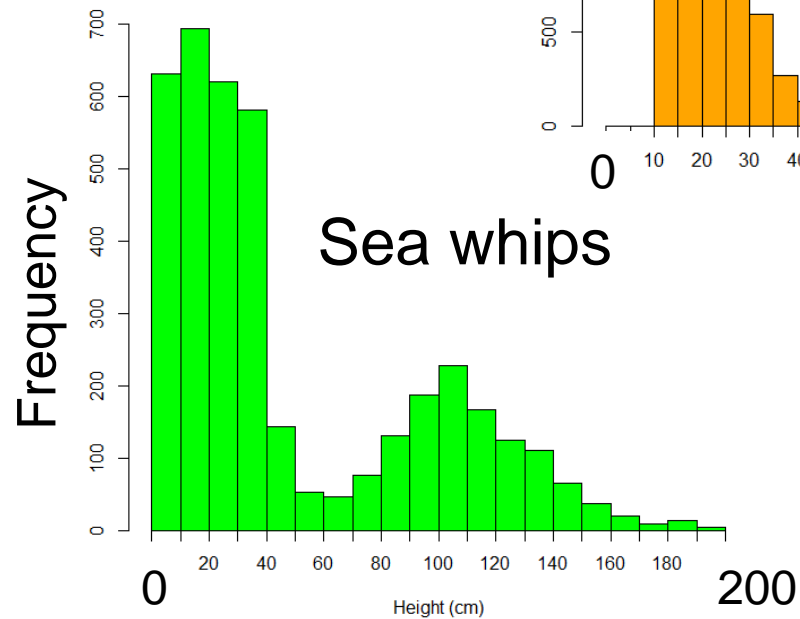
# Observed densities

## Camera survey

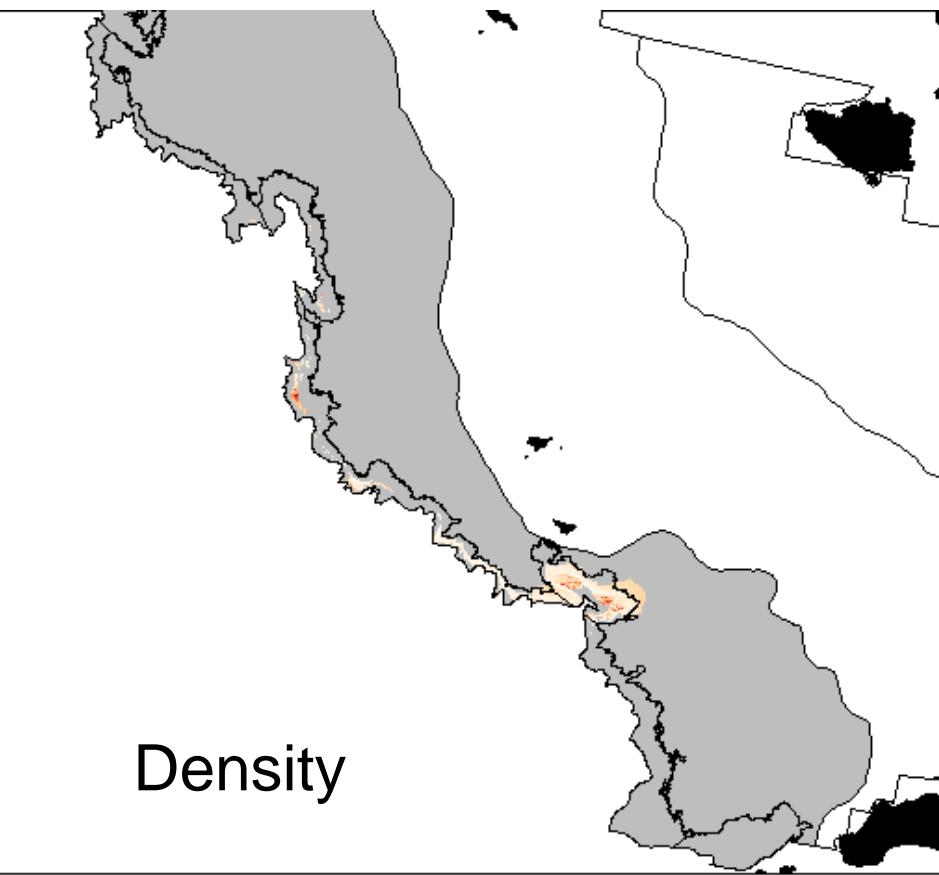


# Observed heights

## Camera survey

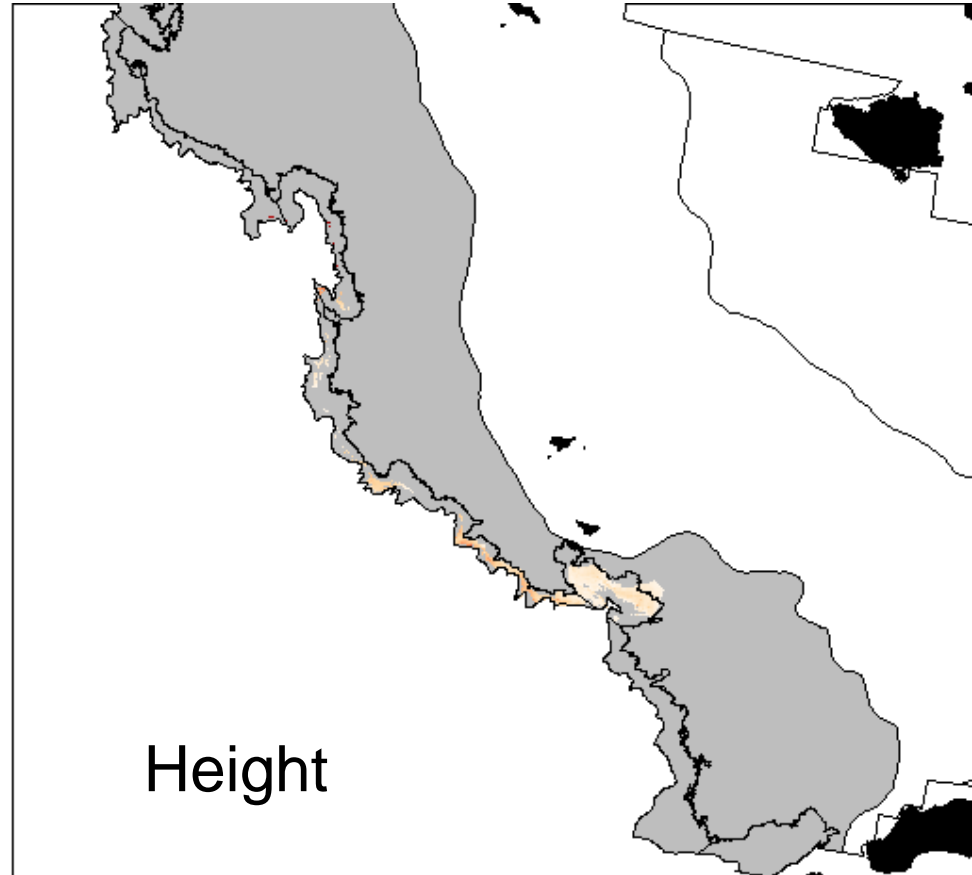
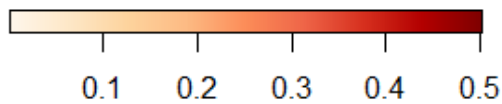


# Coral density and height models (preferred)



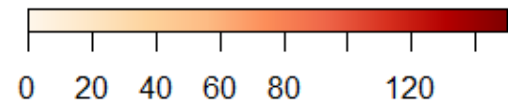
Density

Density (no./m<sup>2</sup>)

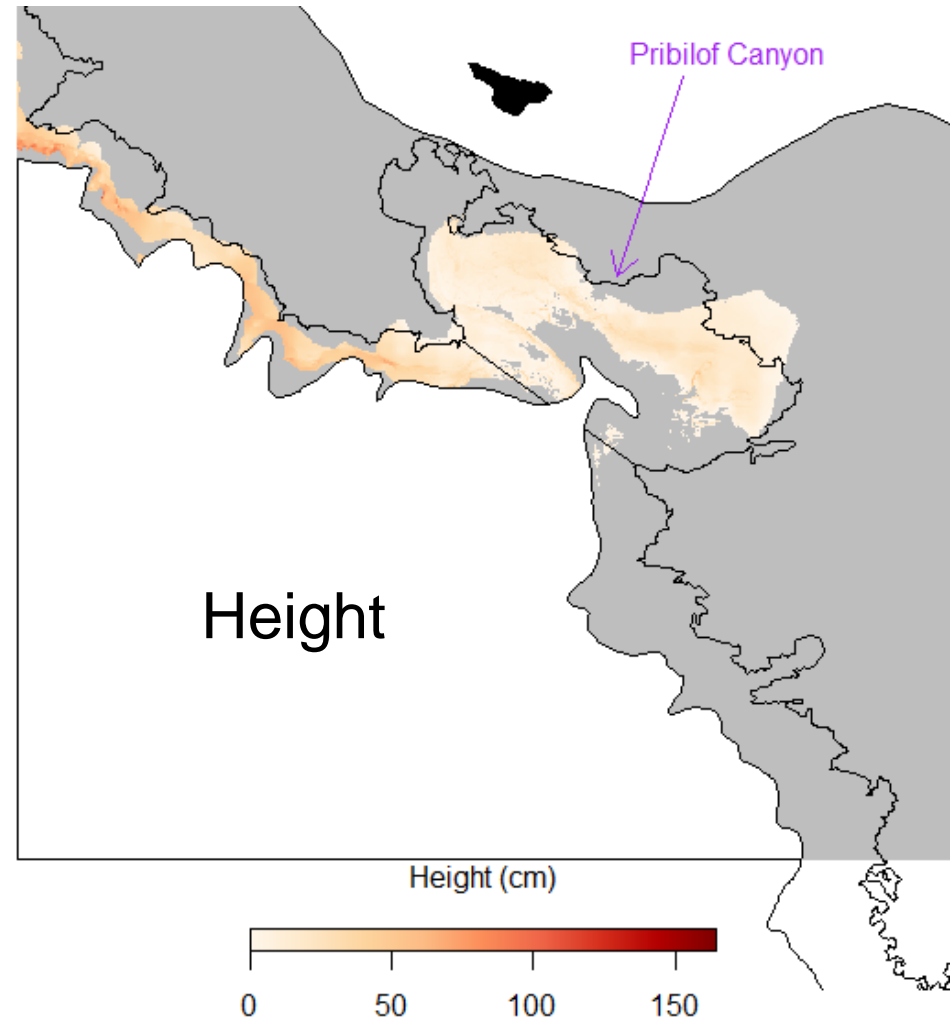
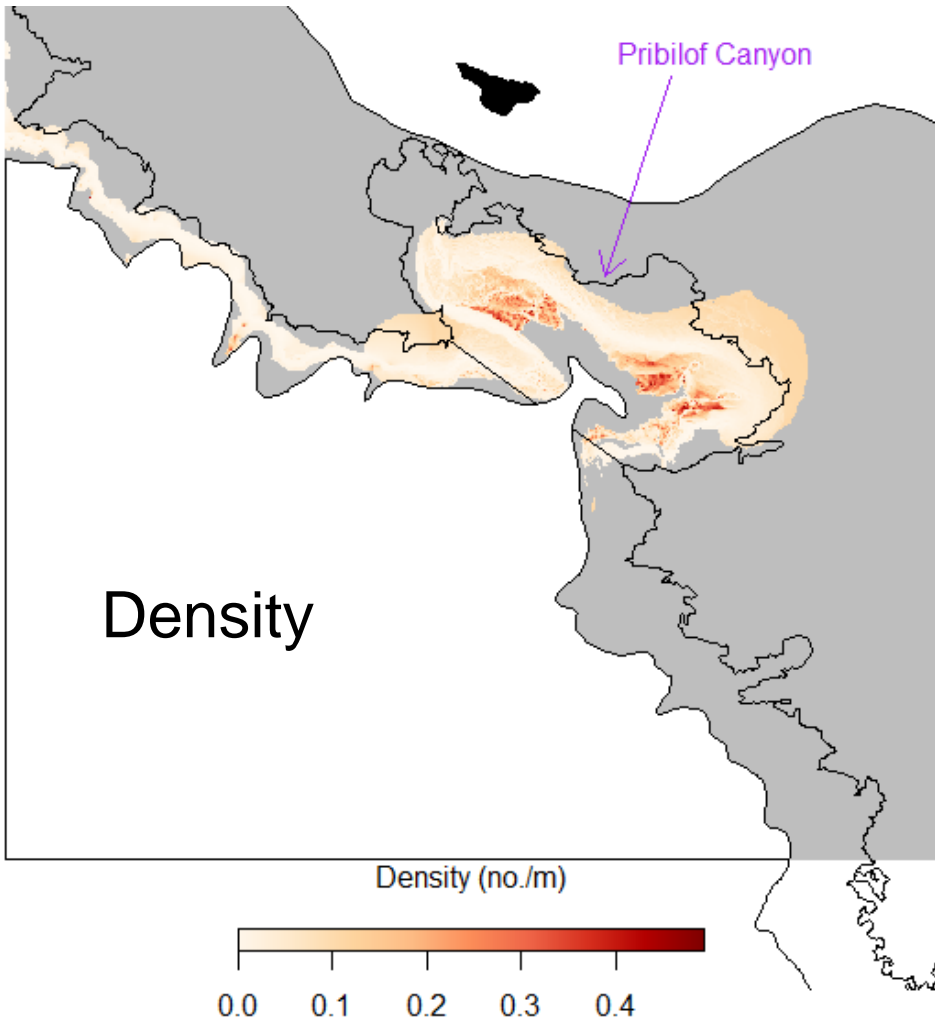


Height

Height (cm)

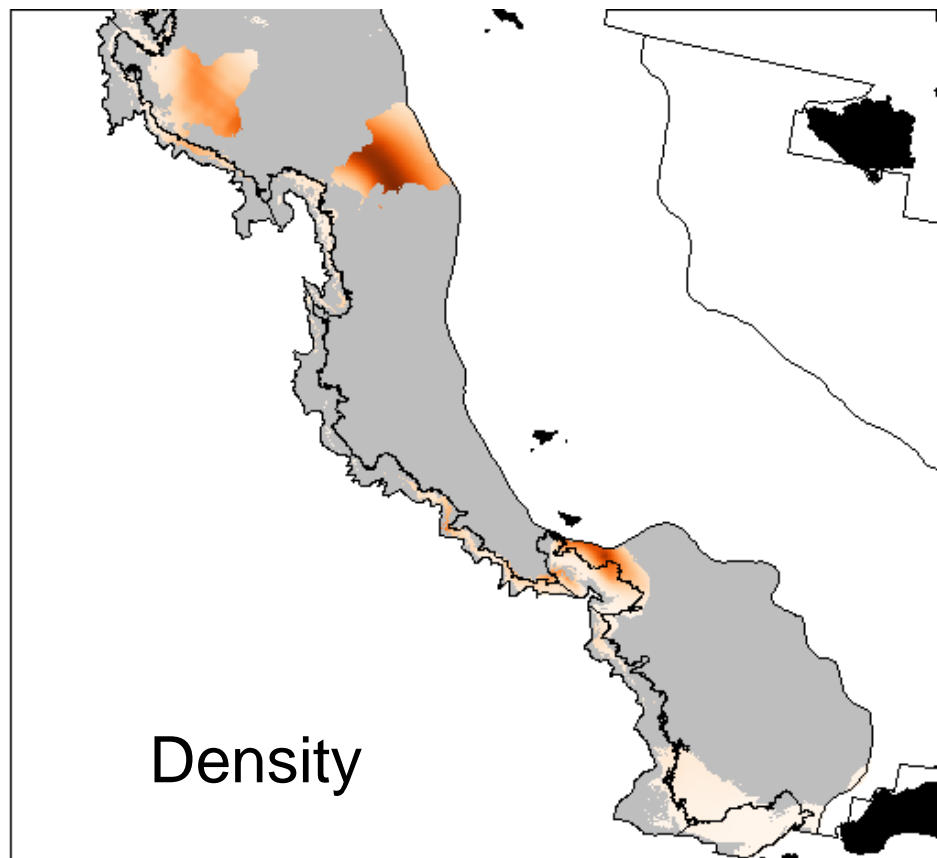


# Coral density and height models (preferred)



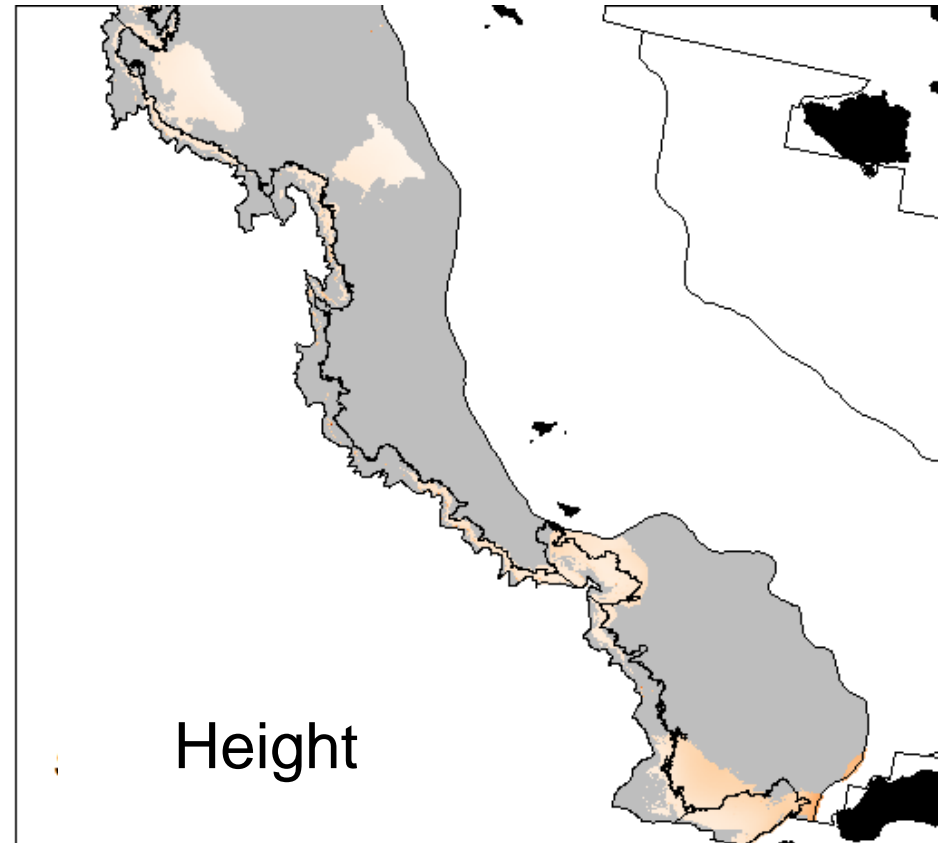
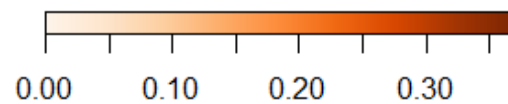


# Sponge density and height models (preferred)



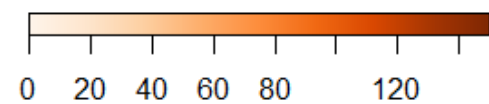
Density

Density (no./m<sup>2</sup>)

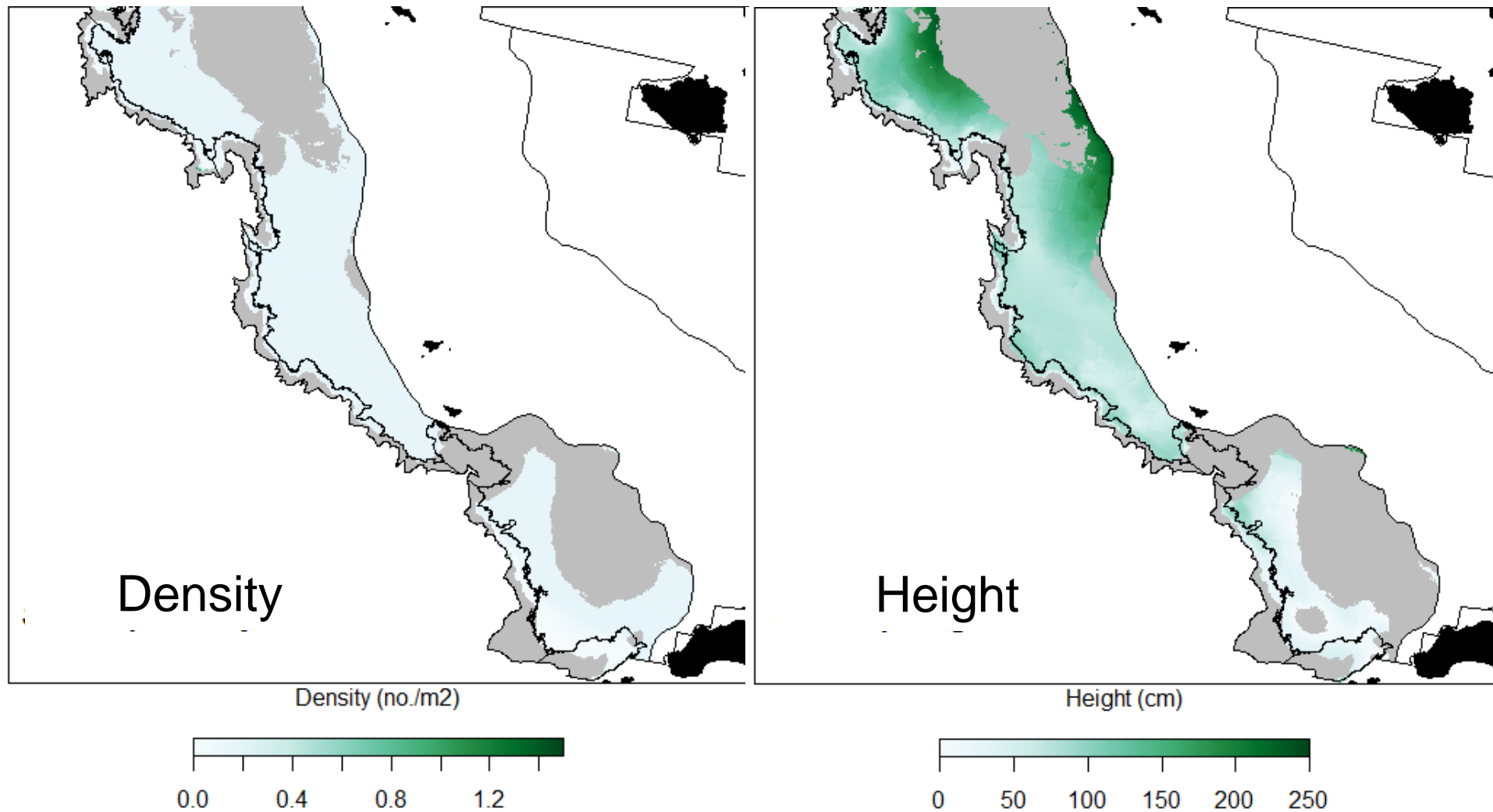


Height


Height (cm)

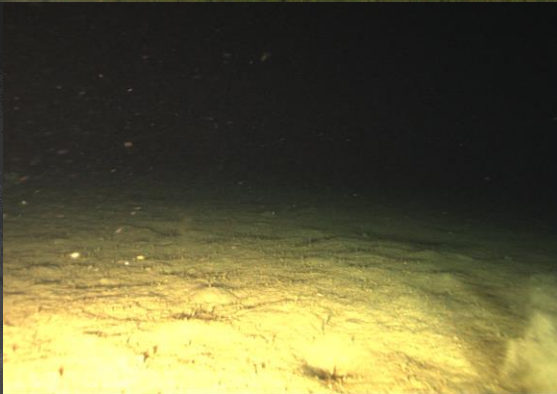
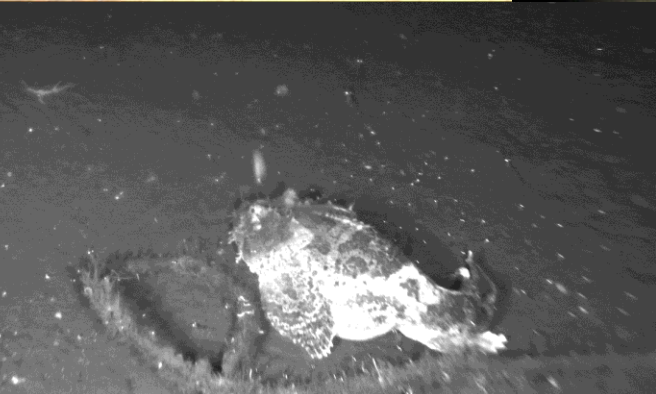


# Sea whip density and height models (preferred)




# Fieldwork results

- Validate model predictions
  - Improve/refine predictions of coral presence
  - Acquire height and density data for coral
  - **Identify the role of these coral as fish habitat**
  - Document presence and degree of fishing gear effects
  - Improve data for vulnerability index
- 





- 
- An underwater scene with several fish swimming in a dark, slightly hazy environment. A crab is visible on the left side. The bottom right corner of the image is a light blue gradient.
- Observed fishes and crabs = 7,362
  - Dominated by
    - Crabs
    - Eelpouts
    - Sculpins
    - Poachers
    - Snailfish
    - Flatfish
    - Grenadiers
    - Skates
    - Shortspine thornyhead
    - Pacific ocean perch



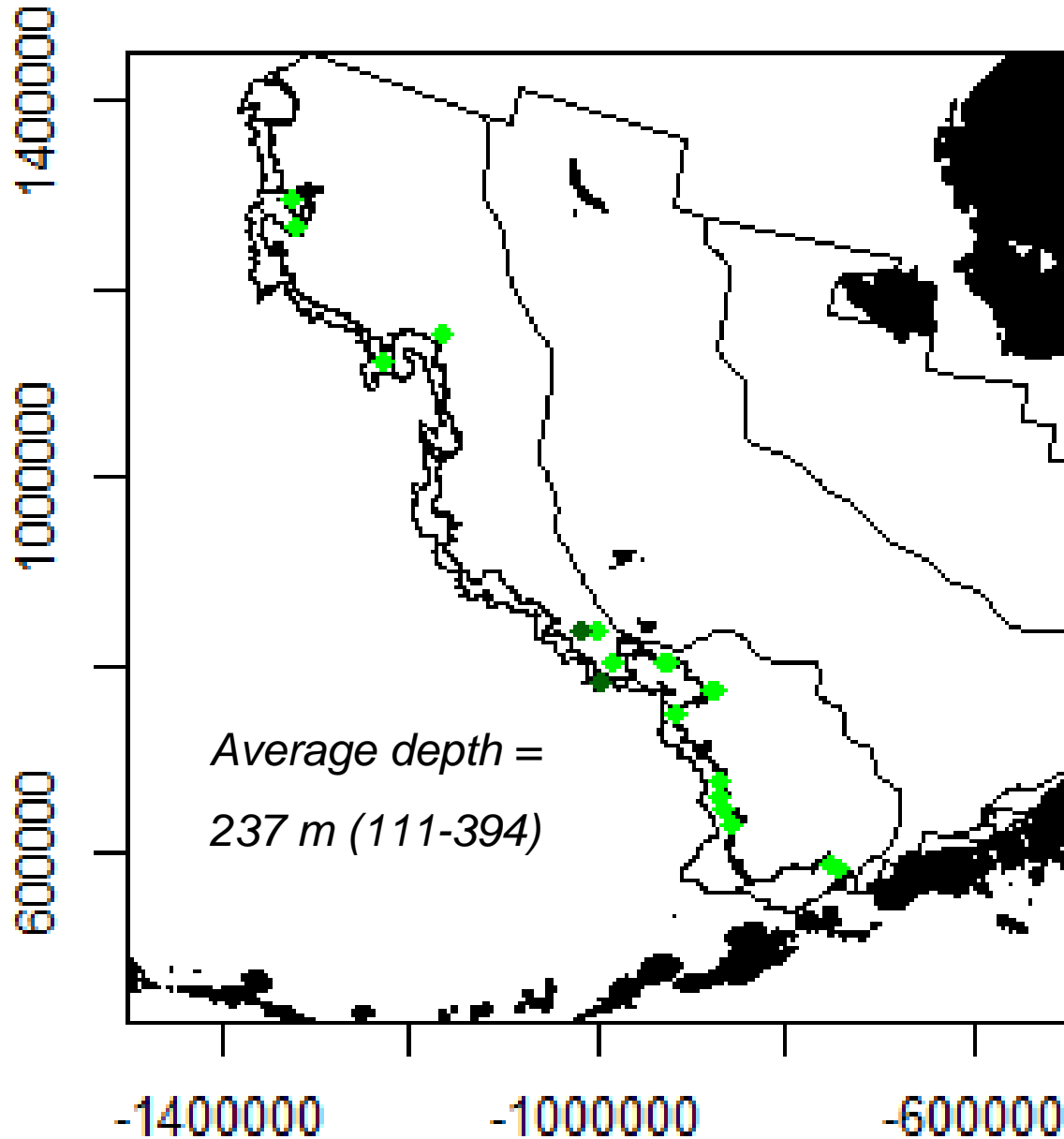
# Effect of presence of invertebrates on fish density

Species/group	Main			
	Sponge	Coral	Whips	Depth
Rockfish (all Sebastes)	sig +	sig -	ns	sig
POP	sig +	ns	ns	sig
Shortraker	ns	sig +	ns	ns
SST	ns	ns	sig -	sig
Cod	ns	ns	sig -	sig
Sculpins	ns	ns	ns	sig
Grenadier	sig -	sig -	sig -	sig
Flatfish	ns	ns	sig +	sig
Pollock	ns	ns	ns	sig
Chionoecetes	sig -	sig -	ns	sig
King crabs	sig +	sig +	ns	sig
Skates	ns	ns	ns	sig
Northern rockfish	ns	ns	ns	ns
Rougheye/blackspotted	ns	sig +	ns	ns
Sablefish	ns	ns	ns	ns

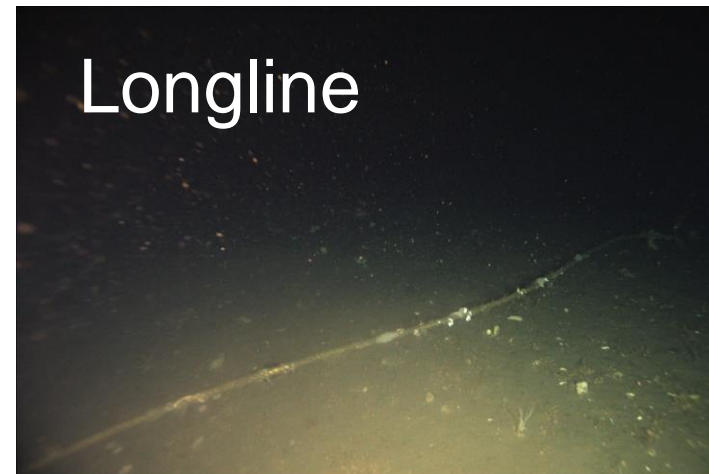
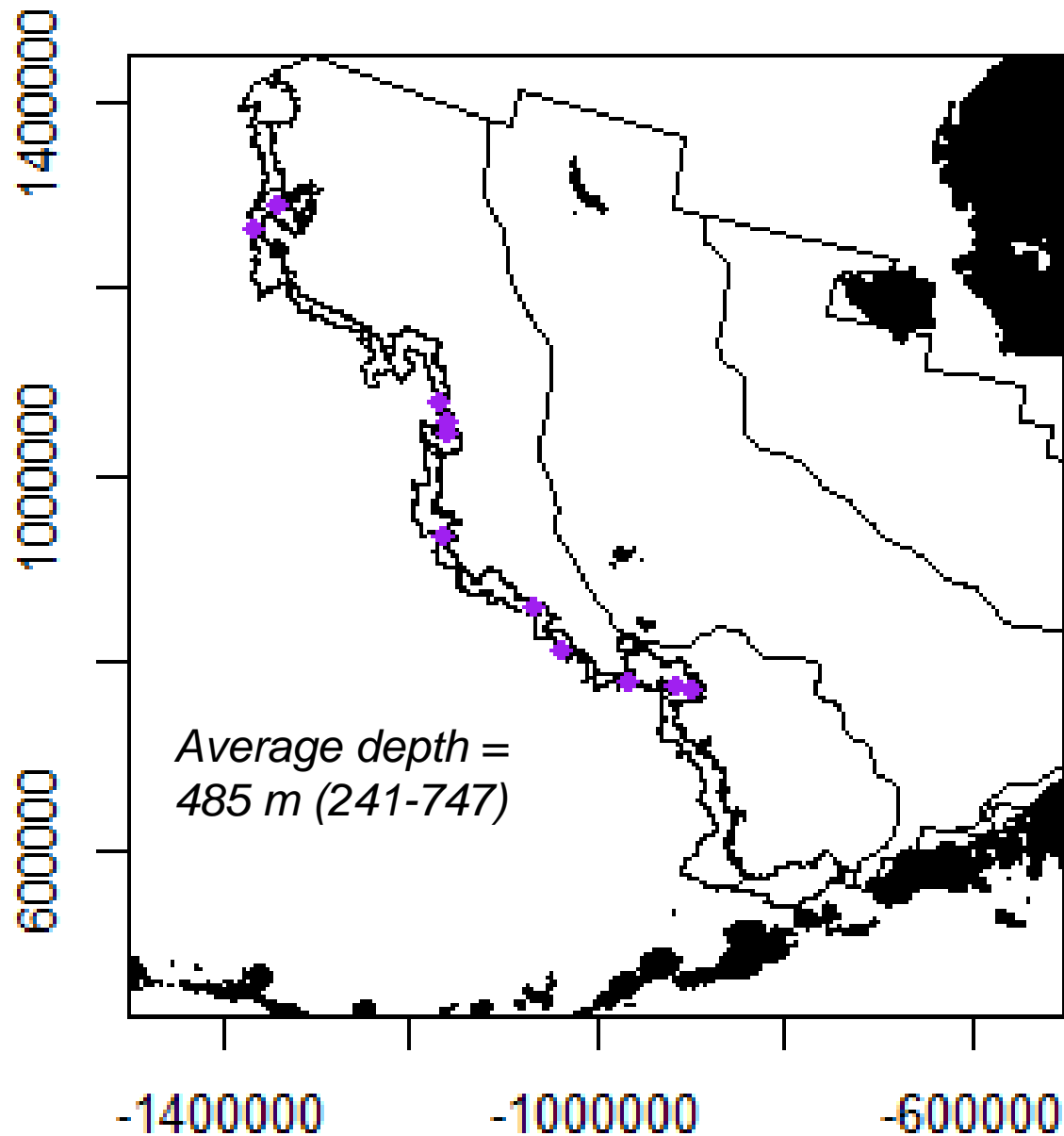
# Fieldwork results

- Validate model predictions
- Improve/refine predictions of coral presence
- Acquire height and density data for coral
- Identify the role of these coral as fish habitat
- Document presence and degree of fishing gear effects
- Improve data for vulnerability index

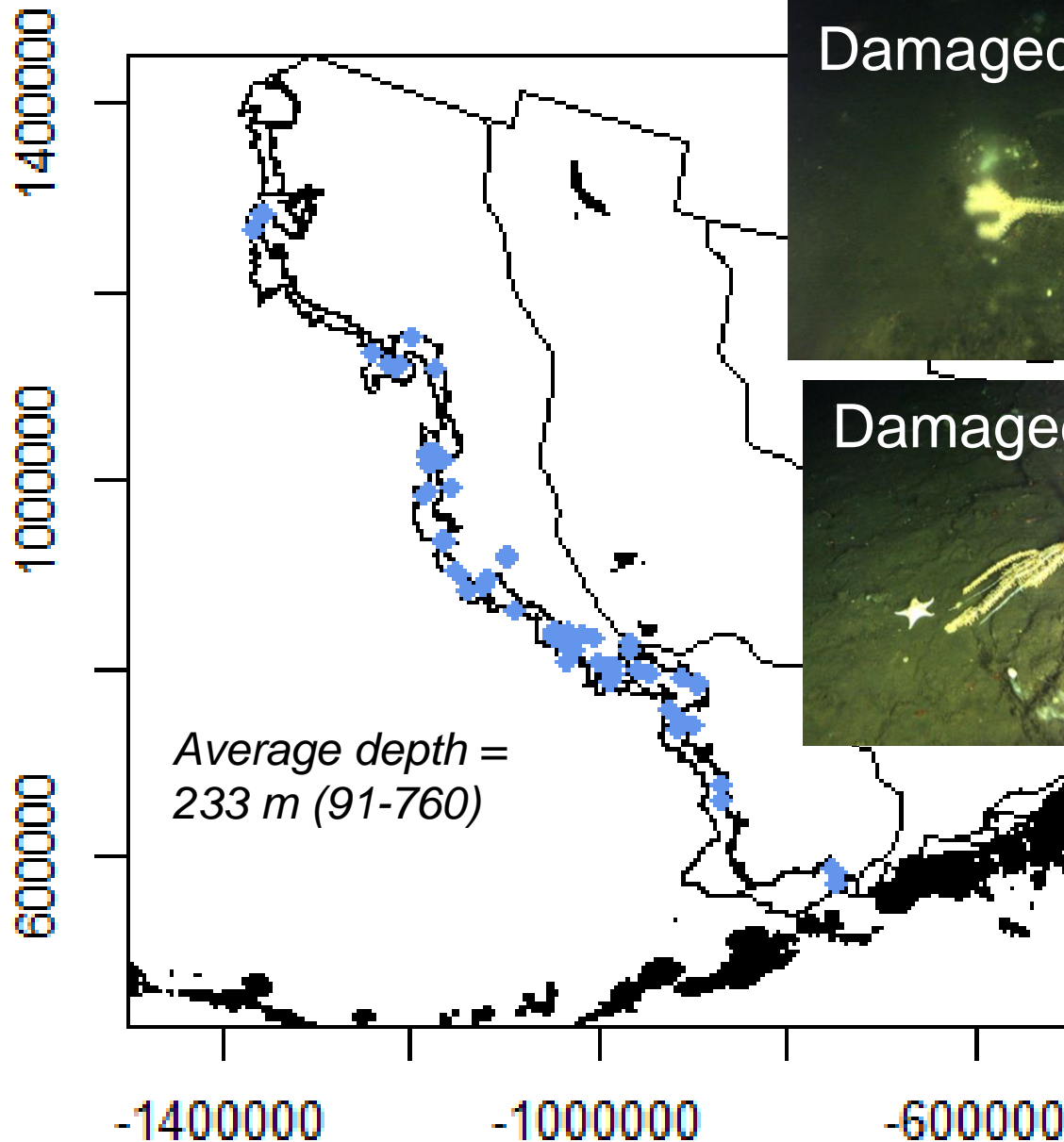
# Trawl net or tracks (n = 21 transects)



# Longline or crab gear (n = 11 transects)



# Damaged invertebrates (n = 68 transects)



Damaged coral



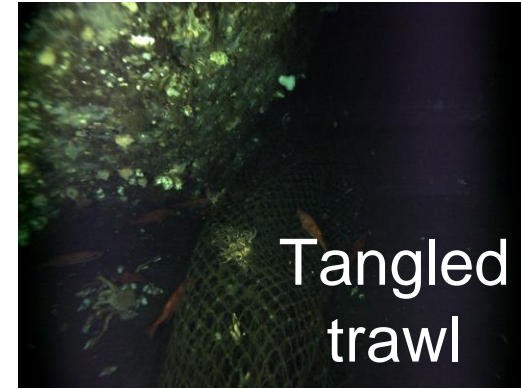
Damaged coral



Abraded sea whip



Tangled trawl





Tangled longline





# Summary

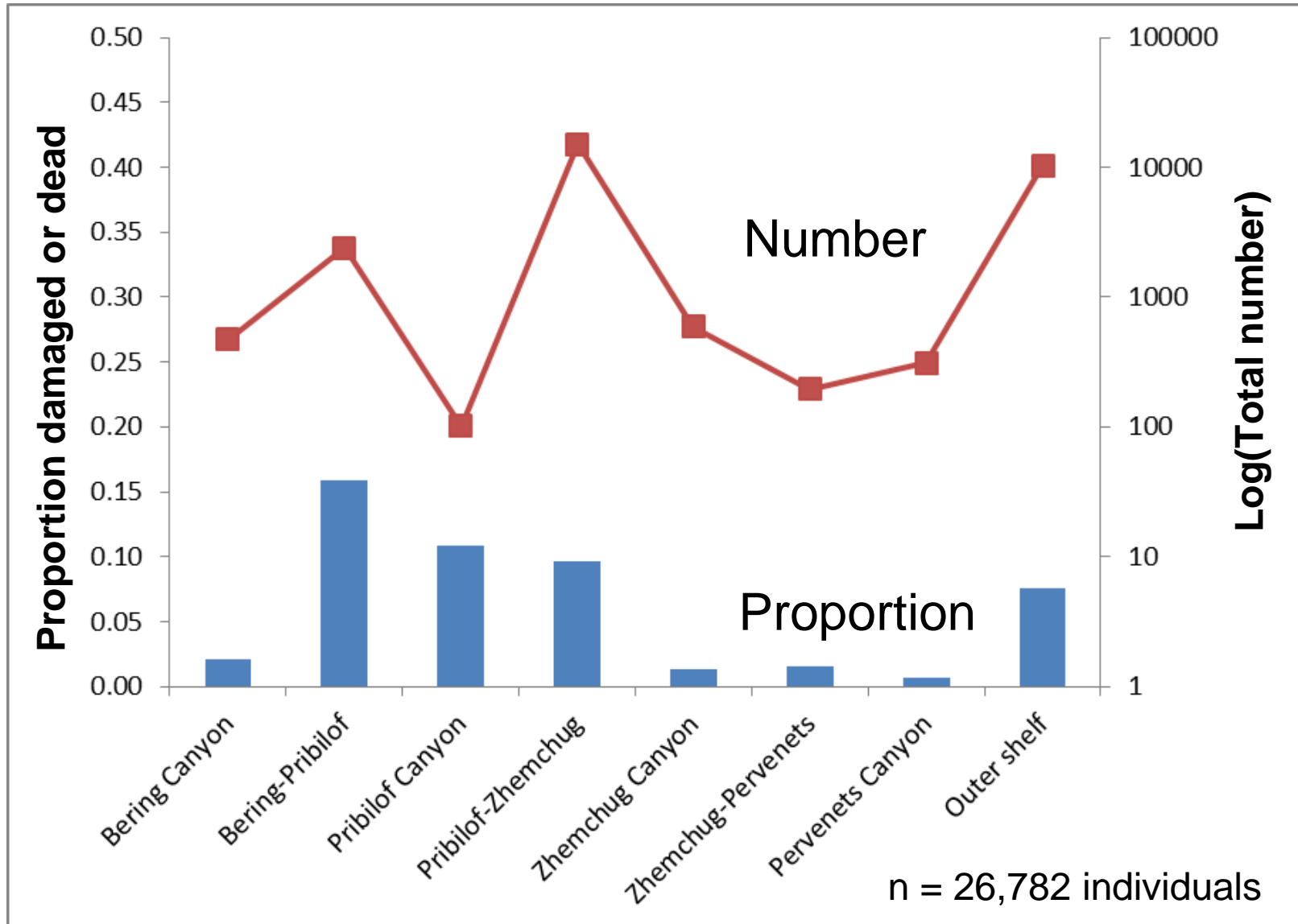
Classification	Number of transects	Percent of transects
Longline or crab gear	11	4%
Trawl net	2	1%
Trawl tracks	19	8%
<b>Evidence of fishing subtotal</b> 	32	13%
Damaged Isididae	2	1%
Damaged Demosponge	7	3%
Damaged Halipteris	60	24%
<b>Damaged taxa subtotal</b> 	68	27%
Damaged taxa <u>or</u> evidence of fishing total	92	37%
Damaged taxa <u>and</u> evidence of fishing total	8	3%

# Damaged taxa

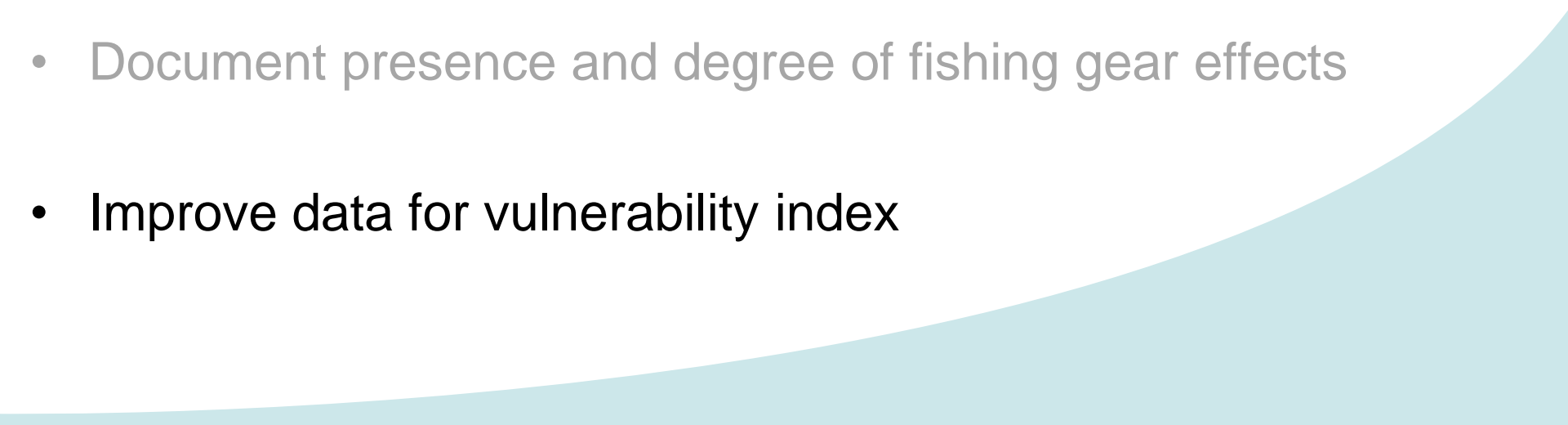
<b>Classification</b>	<b>Number of transects</b>	<b>Percent of transects</b>
Damaged Isididae (coral)	2	1%
Damaged Demosponge	7	3%
Damaged Halipteris (whip)	60	24%
<b>Damaged taxa subtotal</b>	<b>68</b>	<b>27%</b>

- No other damaged taxa were observed
- Cause of damage (i.e., anthropogenic or natural) is difficult to determine (but literature shows effects of fishing on size and viability)

# Overall, 9% of individual sea whips were horizontal, damaged, or dead



# Fieldwork results

- Validate model predictions
  - Improve/refine predictions of coral presence
  - Acquire height and density data for coral
  - Identify the role of these coral as fish habitat
  - Document presence and degree of fishing gear effects
  - **Improve data for vulnerability index**
- 

# Vulnerability

Function of:

- **Initial Size**
- **Initial Abundance**
- Recruitment
- Growth
- Impact rate



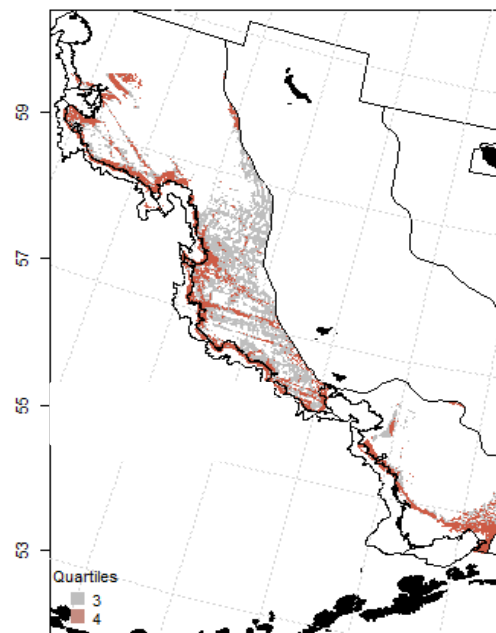
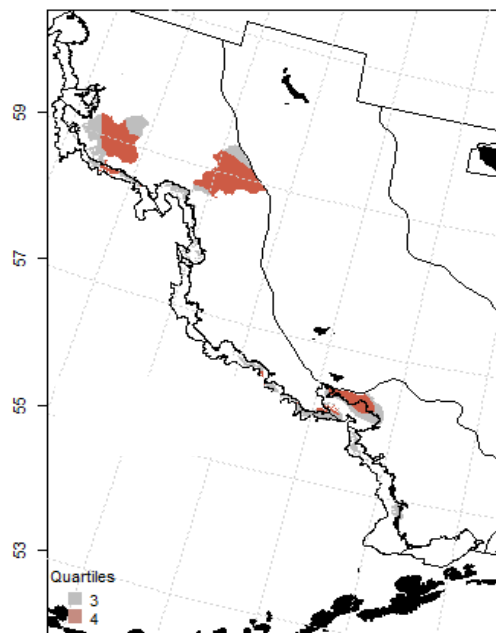
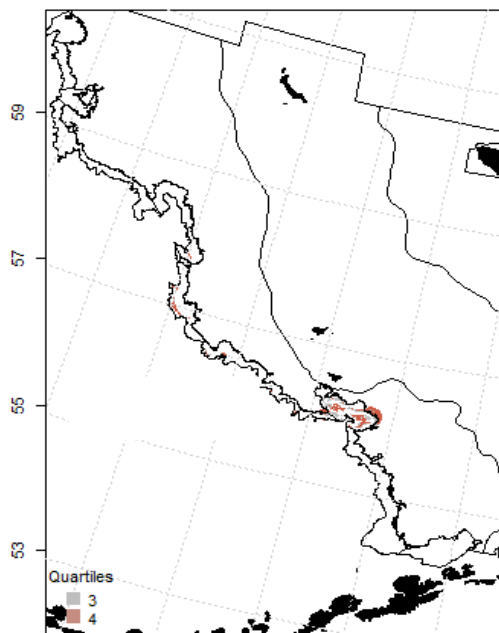


# Coral

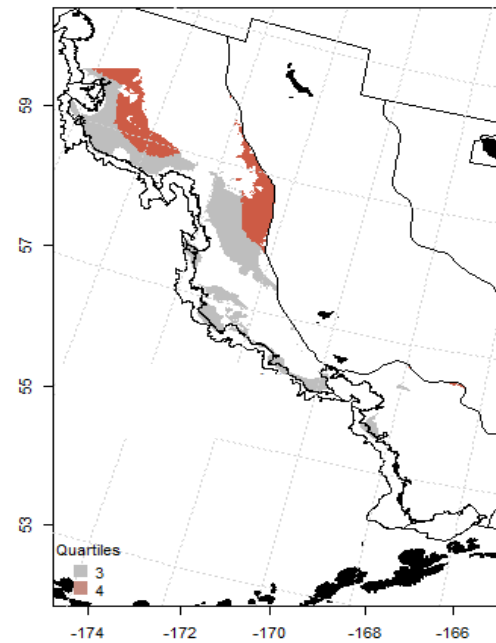
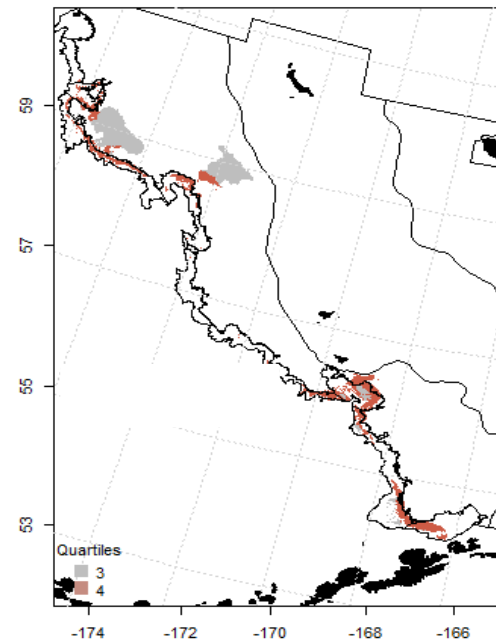
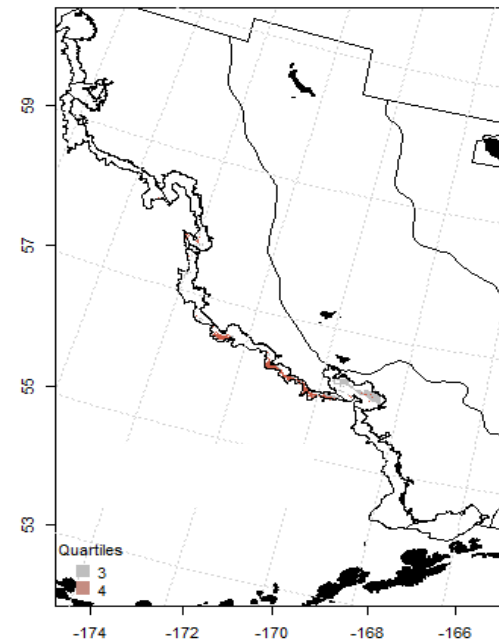
# Sponge

# Sea whips

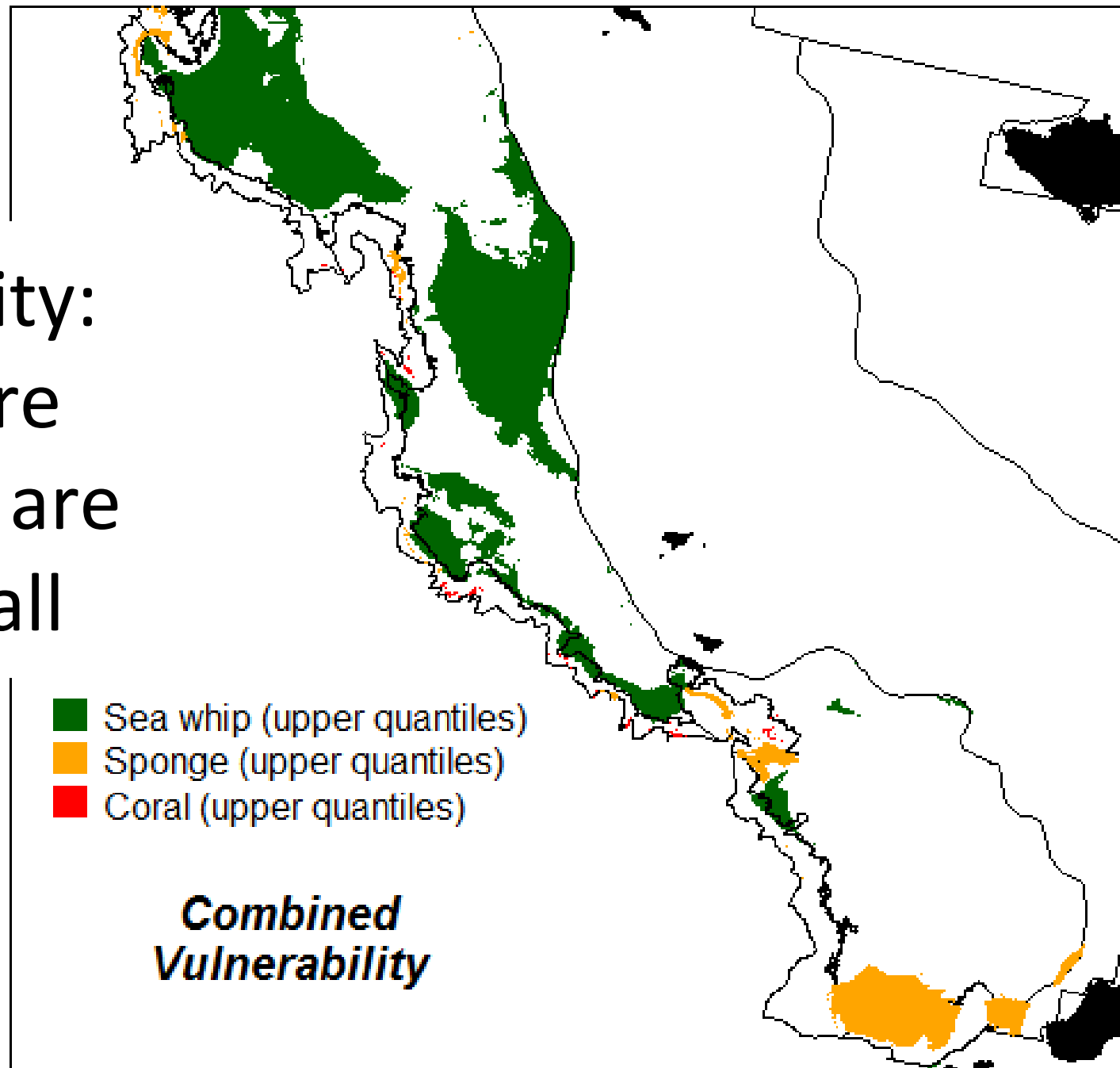
Denser



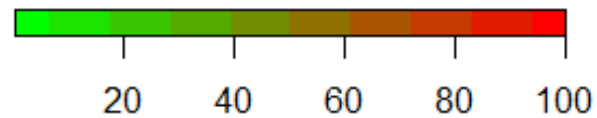
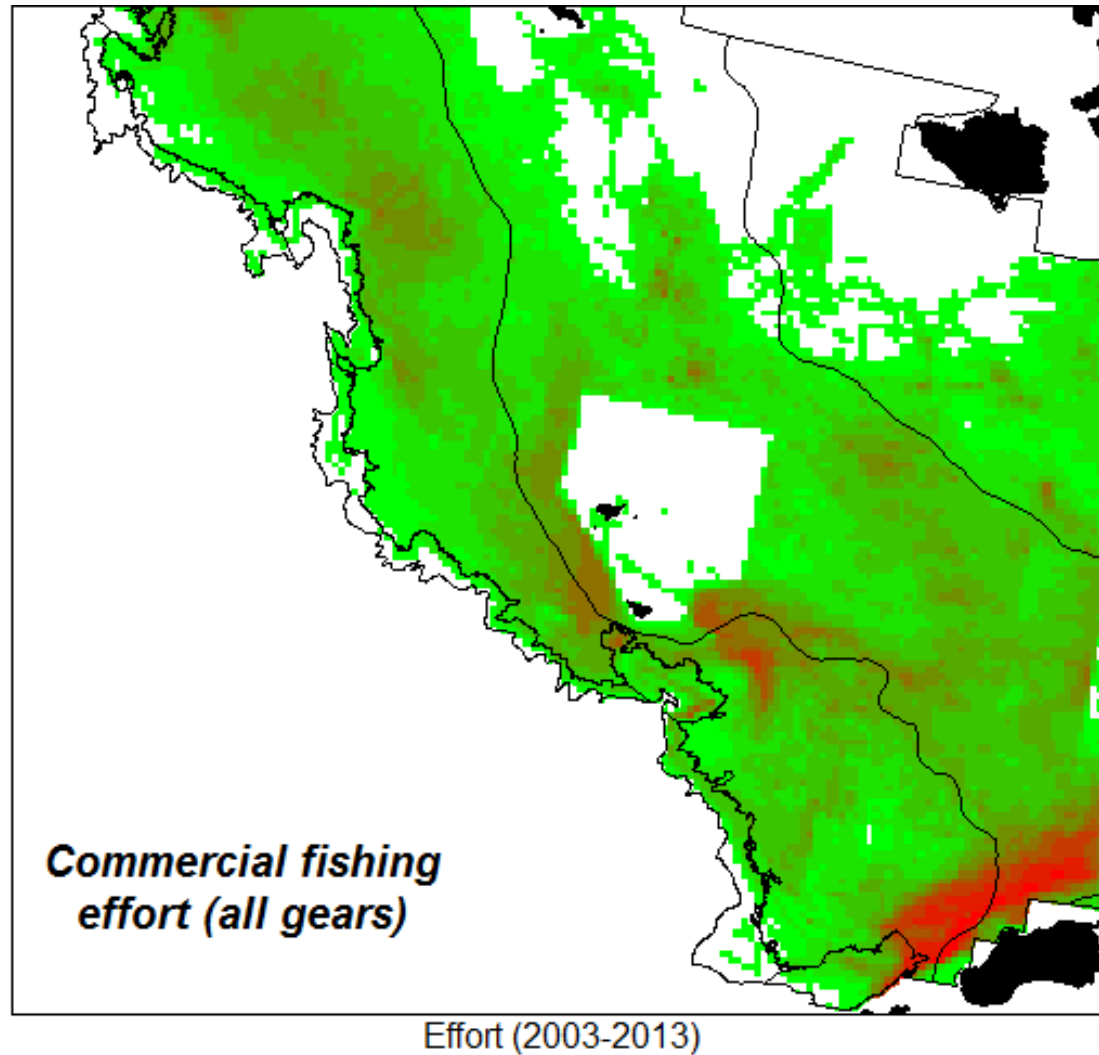
Taller



Vulnerability:  
areas where  
organisms are  
dense or tall



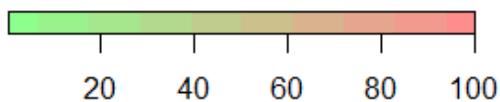
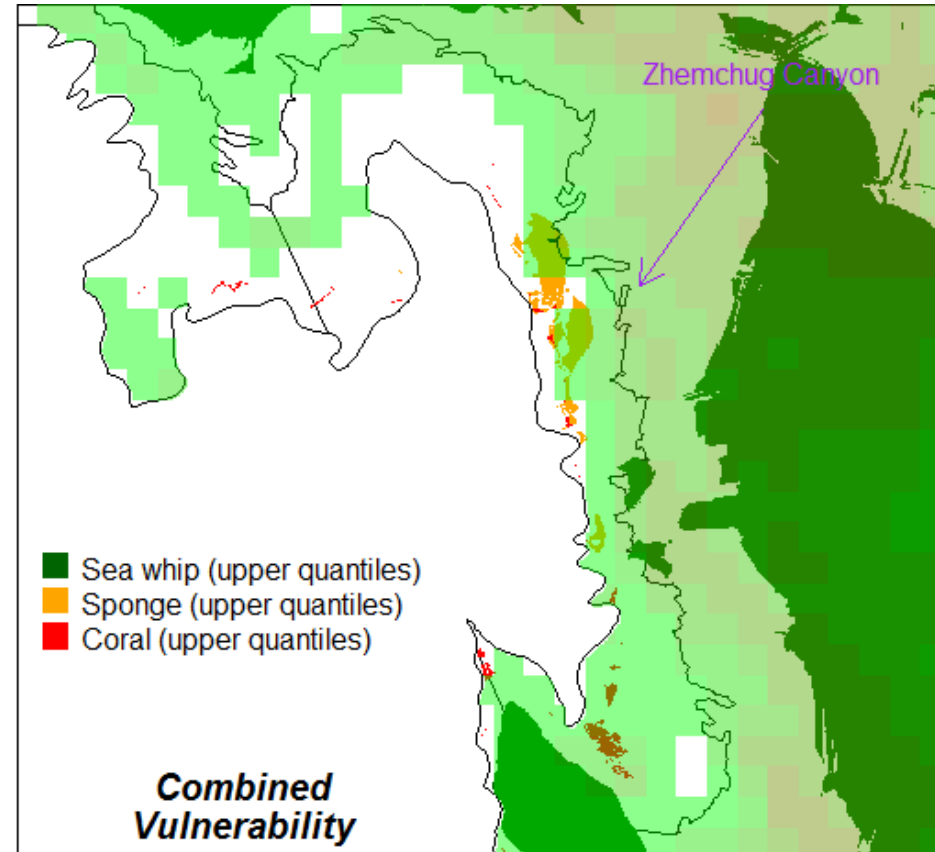
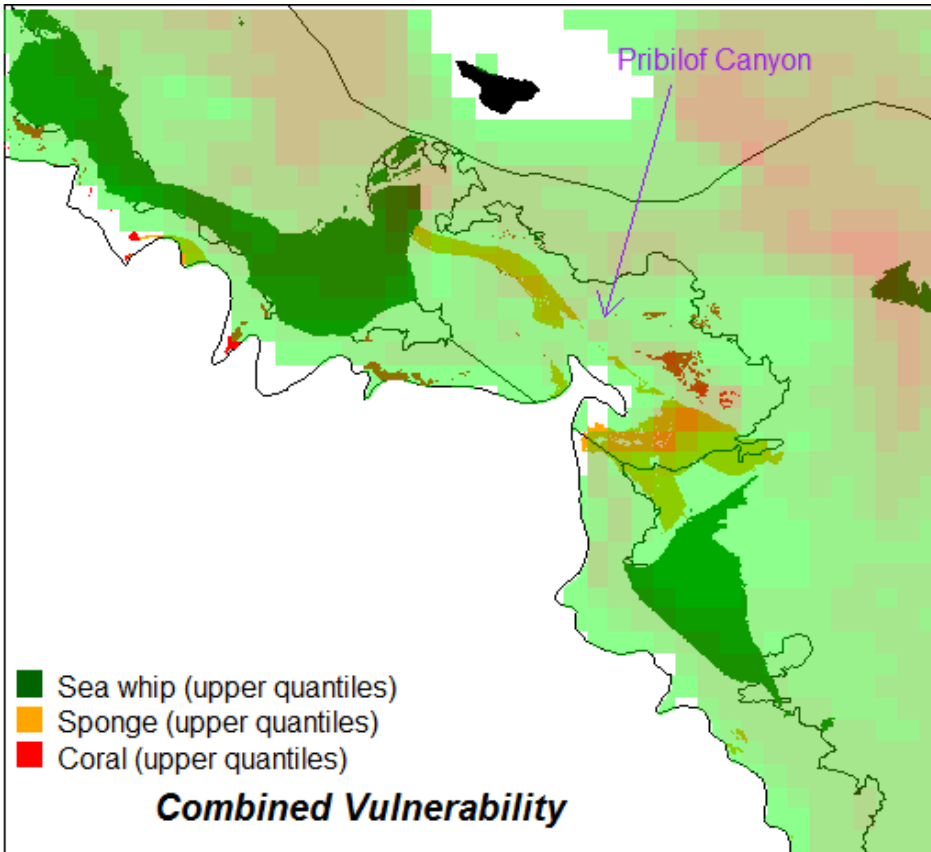
# Fishing effort (2003-2013)



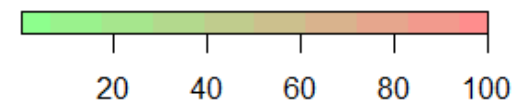
# Overlay fishing effort on vulnerability map

## Pribilof Canyon

## Zhemchug Canyon



Fishing effort (2003-2013)



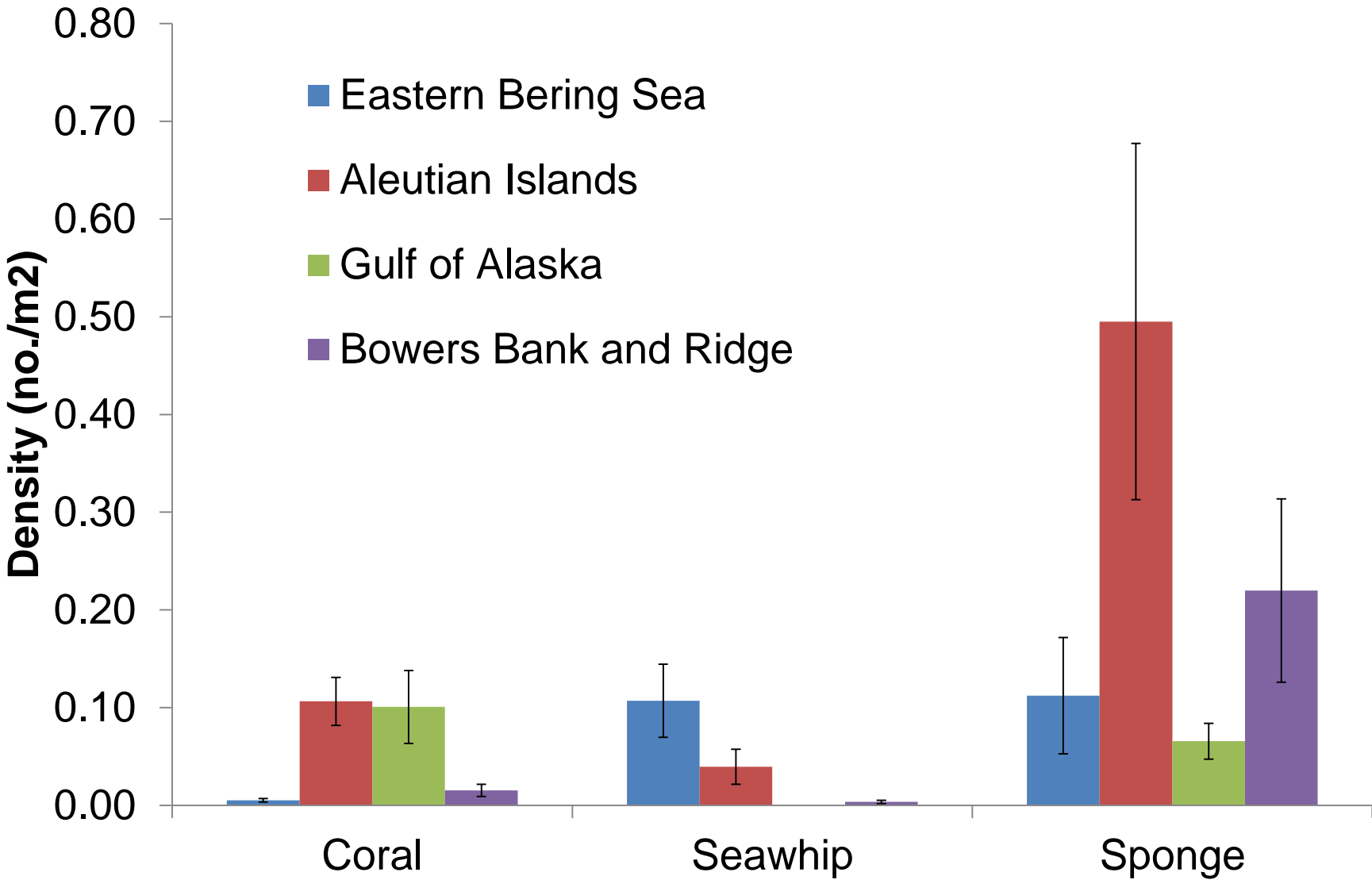
Fishing effort (2003-2013)



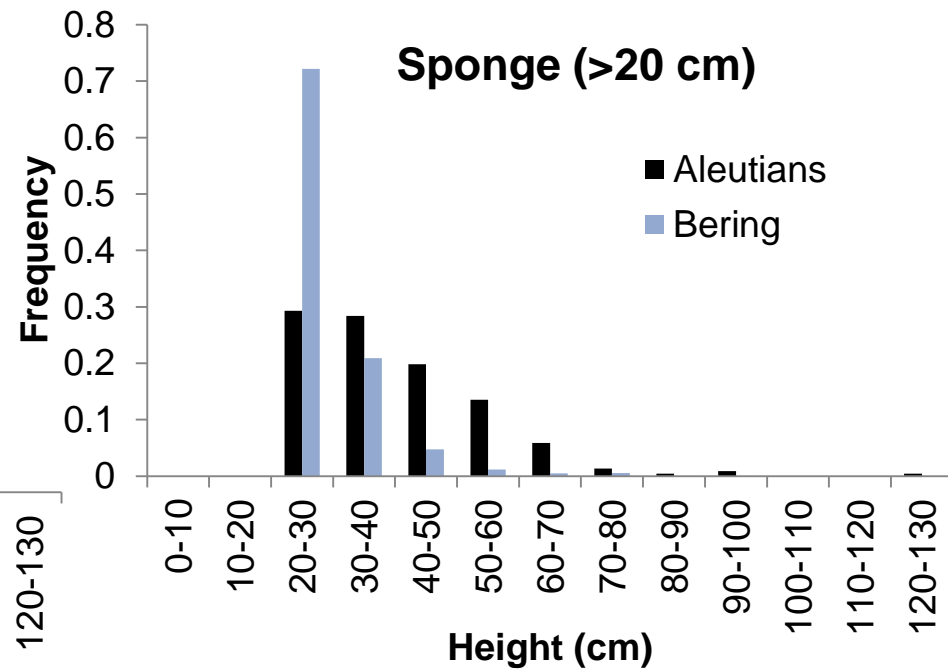
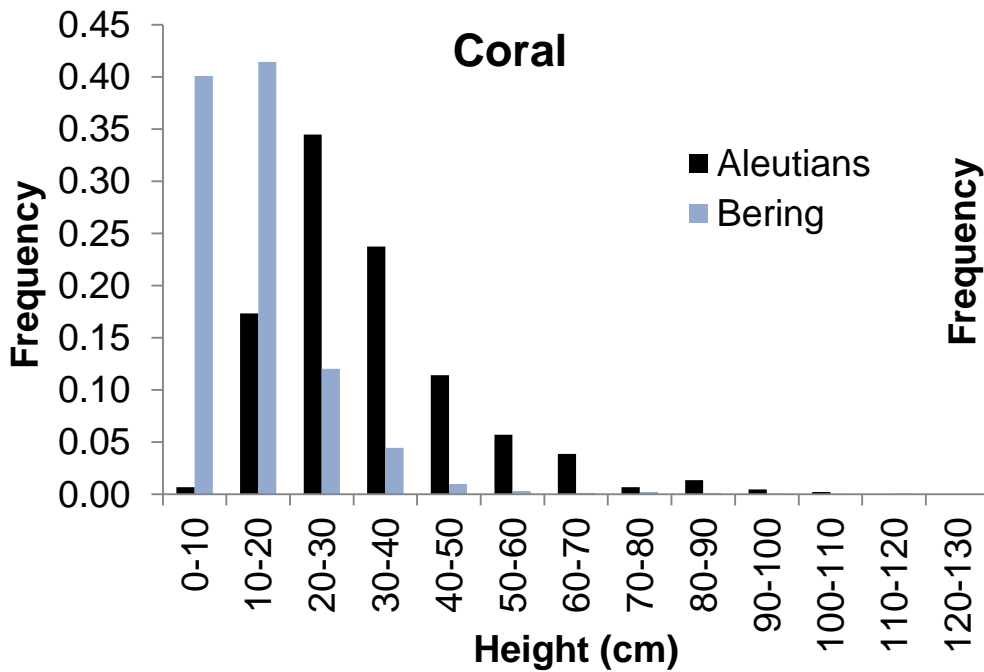
# Compare Bering Sea to other regions of U.S.

Location	Depth Range (m)	Coral density	Sponge density	Sea pen density	Investigator
Grays Reef, WA	120-300		0.600		Clarke
Astoria Canyon, OR	148-1358	0.064	0.600	0.100	Bianchi
Heceta Bank, OR	70-341	0.001	0.030		Rooney
Cordell Bank, CA	55-250		0.100		Pirtle
Canyons, Central CA	90-319	0.004-0.03	0.04-0.2		Bianchi
Offshore banks, Southern CA	40-600	0.070			Yoklavich
Offshore banks, Southern CA Bight	32-320	0.0003-0.08	0.010		Tissot et al. 2006
Oceanographer Canyon, Middle Atlantic	100-1400	0.054	0.065	0	Heckler et al. 1980
Lydonia Canyon, Middle Atlantic	400-1800	0.035	0.026	0	Heckler et al. 1980
Baltimore Canyon, Middle Atlantic	100-1100	0	0.004	0.019	Heckler et al. 1980
EBS Canyons	91-808	0.005	0.107	0.112	This study

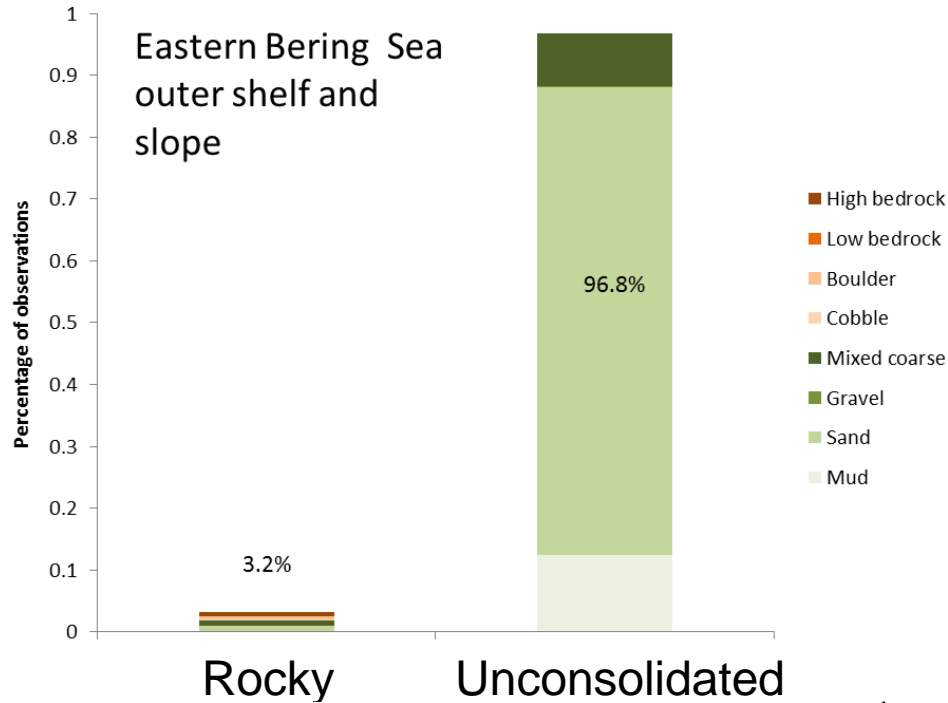
# Compare Bering Sea to other regions of Alaska



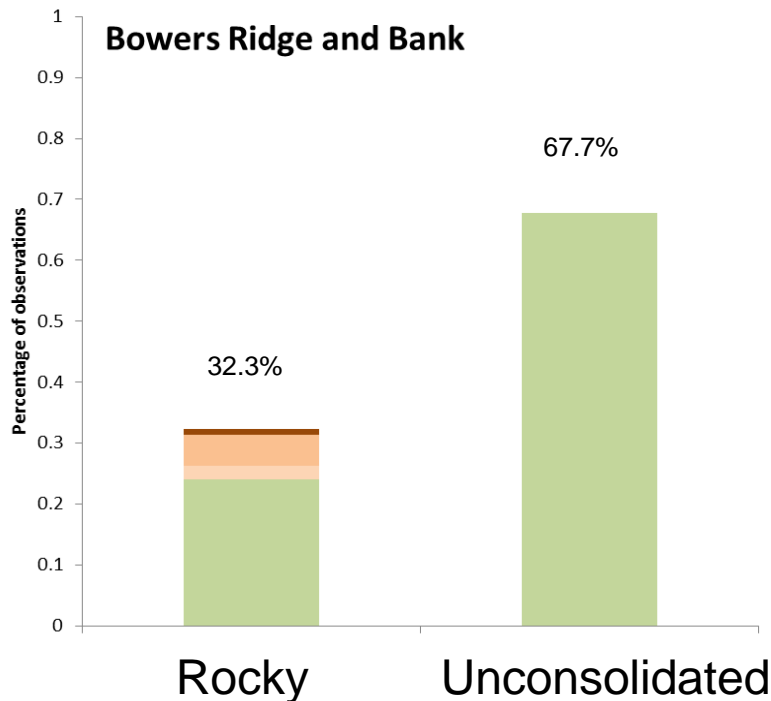
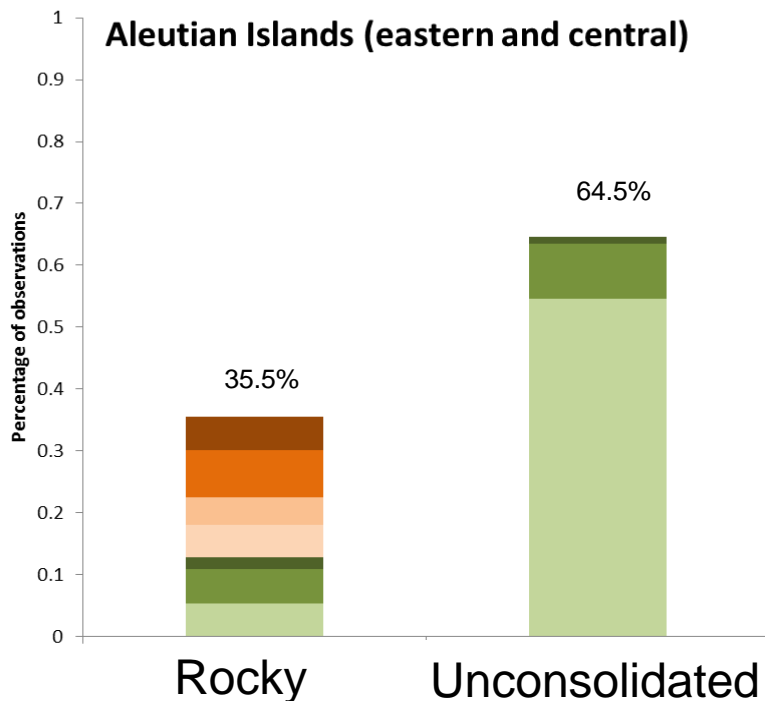
# Compare Bering Sea to other regions of Alaska



# Why?



Region	Transects with rocky habitat	Transects with coral
Gulf of Alaska	35%	30%
Aleutian Islands	63%	60%
Bowers Bank	42%	47%
Eastern Bering Sea	19%	13%



# Conclusions

- Coral occurrence was low throughout
  - Concentrated around Pribilof Canyon and to the northwest
  - Consistent with model results and other data (trawl, observer)
  - Densities were low even where they occurred
- Sponge & Sea Whips distributed more broadly
  - Consistent with model results and other data
  - Sponge and sea whip densities were high in some locations
- Some associations of rockfish and king crab with corals and sponges
- About 9% of sea whips observed were damaged



## *FV Vesteraalen*

Tim Cosgrove, Landon Mavar,  
Al Mavar, Gordy Mendez



- Steve MacLean
- Rick Towler
- Kresimir Williams
- Rachel Wilborn
- Bob Stone
- Jerry Hoff
- Mark Zimmermann
- Megan Prescott