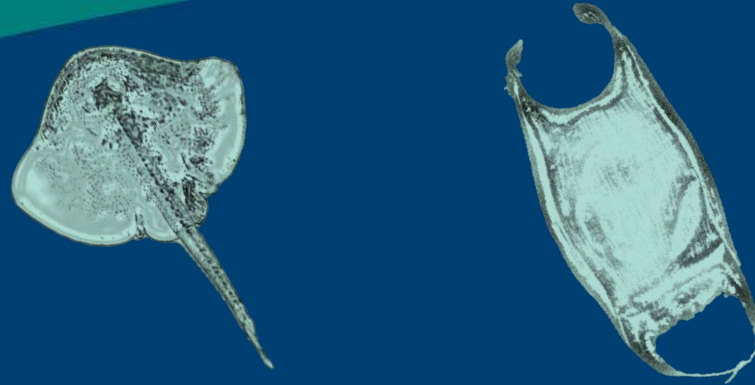


*Science, Service, Stewardship*



# 17 Years of Nursery Habitat Studies in the Eastern Bering Sea

**Gerald R. Hoff**  
Research Fisheries Biologists  
Alaska Fisheries Science Center  
Seattle Washington 98115

**NOAA  
FISHERIES  
SERVICE**

NOAA

# Outline

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★ Biology

★ Habitat

★ HAPC Designation

★ Recent Research

# Biology

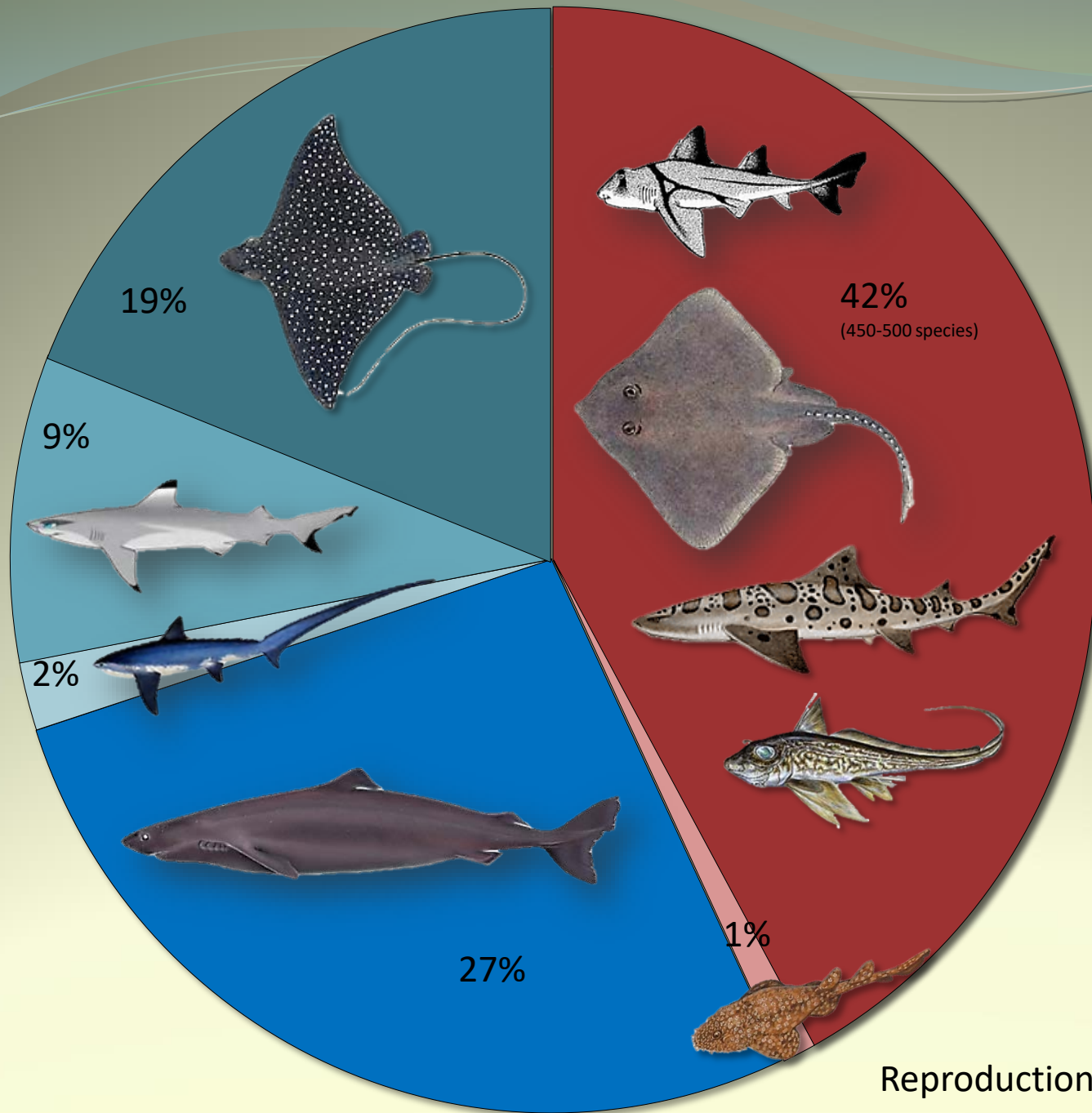
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★ Reproduction

★ Egg Cases

★ Predation

★ Development Timing



**Oviparity**

- extended
- retained

**Viviparity**

- uterine
- placental
- cannibal
- yolk sac

Reproduction in Chondrichthyes

## Egg Case Encounters

## Egg Cases of Alaska

# Egg cases of skates, sharks and chimeras from Alaska



*Bathynaja trachura*  
Roughtail Skate



*Bathynaja mini-spinosa*  
Whitebrow Skate



*Bathynaja interrupta*  
Bering Skate



*Bathynaja taranetzi*  
Mud Skate



*Bathynaja mariposa*  
Butterfly Skate



*Bathynaja abyssicola*  
Deepsea Skate



*Bathynaja maculata*  
Whiteblotched Skate



*Bathynaja aleutica*  
Aleutian Skate



*Raja rhina*  
Longnose Skate



*Raja binoculata*  
Big Skate



*Amblyraja badia*  
Roughshoulder Skate



*Bathynaja lindbergi*  
Commander Skate



*Bathynaja violacea*  
Okhotsk Skate



*Bathynaja parrifera*  
Alaska Skate



*Bathynaja panthera*  
Leopard Skate

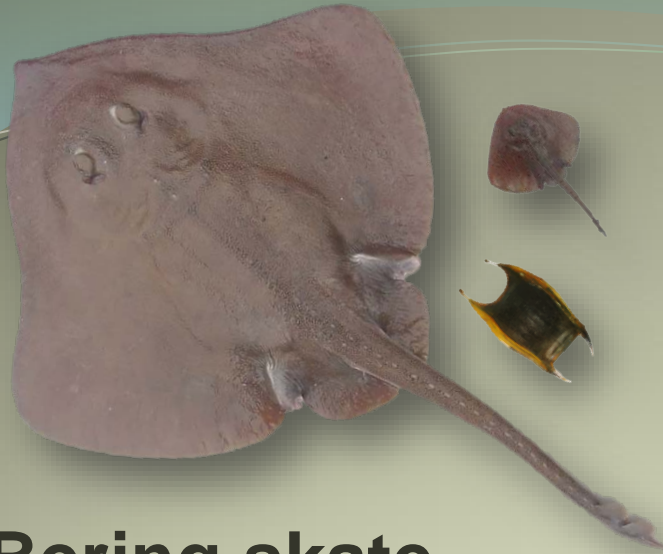


*Hydrolagus collicii*  
Spotted Ratfish



*Apristurus brunneus*  
Brown Cat Shark

IF YOU would like to help with an ongoing project documenting the location of skate egg cases washed up on beaches in Oregon, Washington, Canada, and Alaska please send an email to [jerry.hoff@noaa.gov](mailto:jerry.hoff@noaa.gov) with high resolution digital photos of the egg cases and the most accurate location and date of where you found them. I will email you back with an identification of the egg cases and include your data into our database.



**Bering skate**  
*Bathyraja interrupta*



**Aleutian skate**  
*Bathyraja aleutica*



**Alaska skate**  
*Bathyraja parmifera*



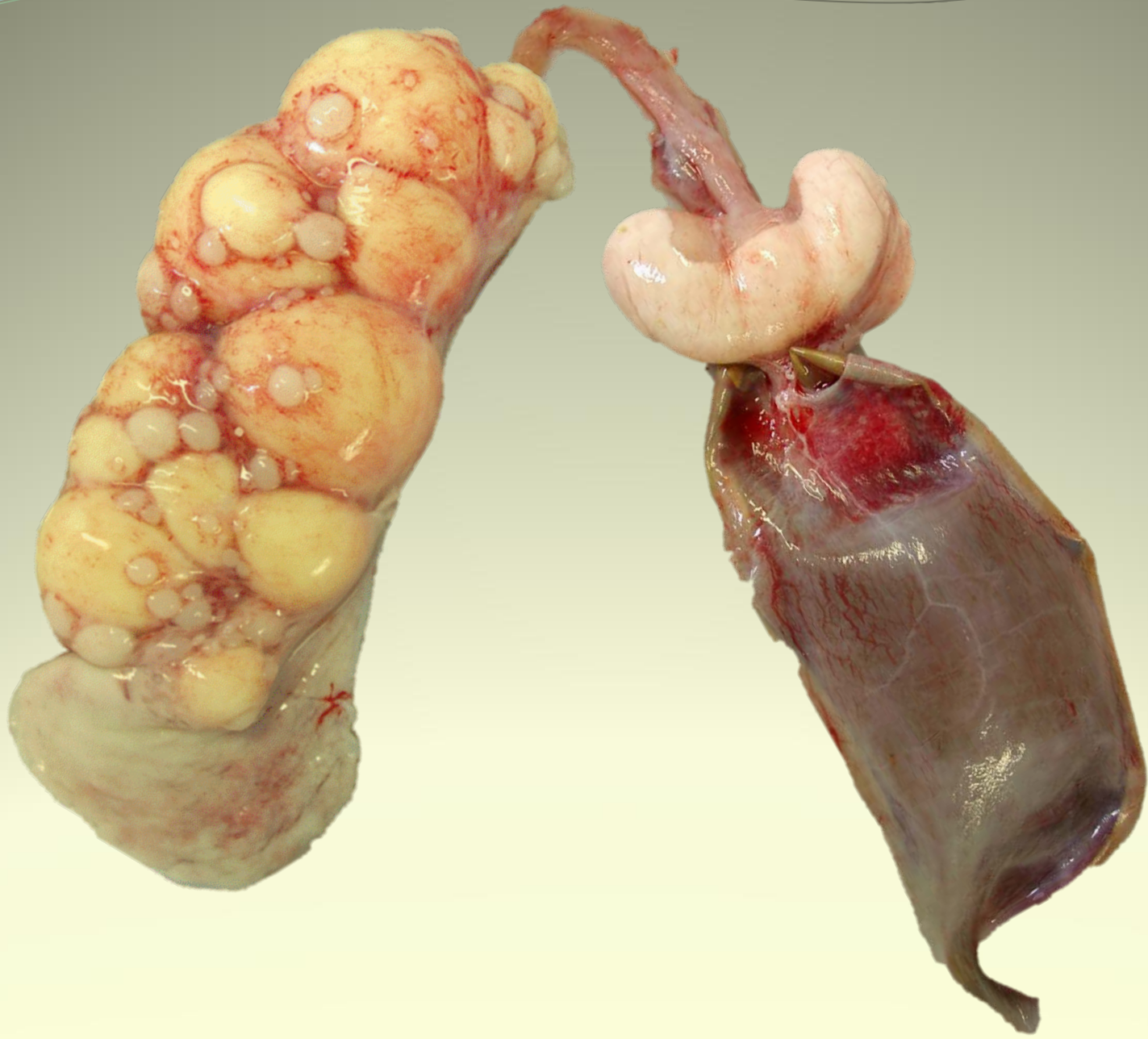
**Aleutian skate**  
*Bathyraja aleutica*



**Bering skate**  
*Bathyraja interrupta*



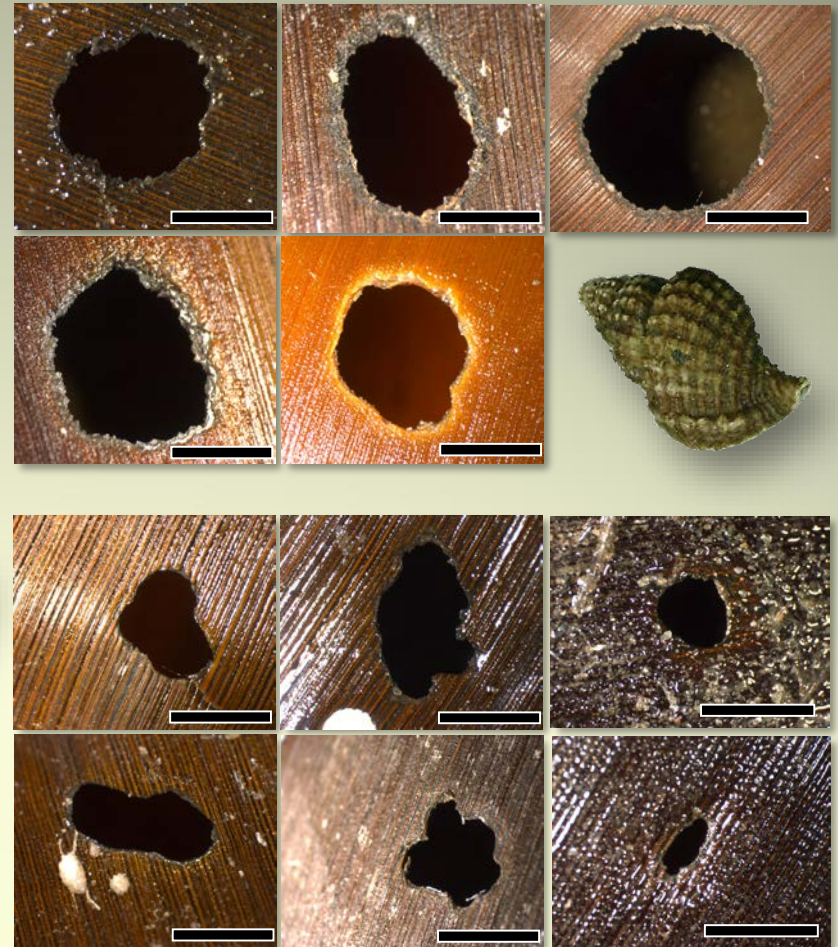
**Alaska skate**  
*Bathyraja parmifera*

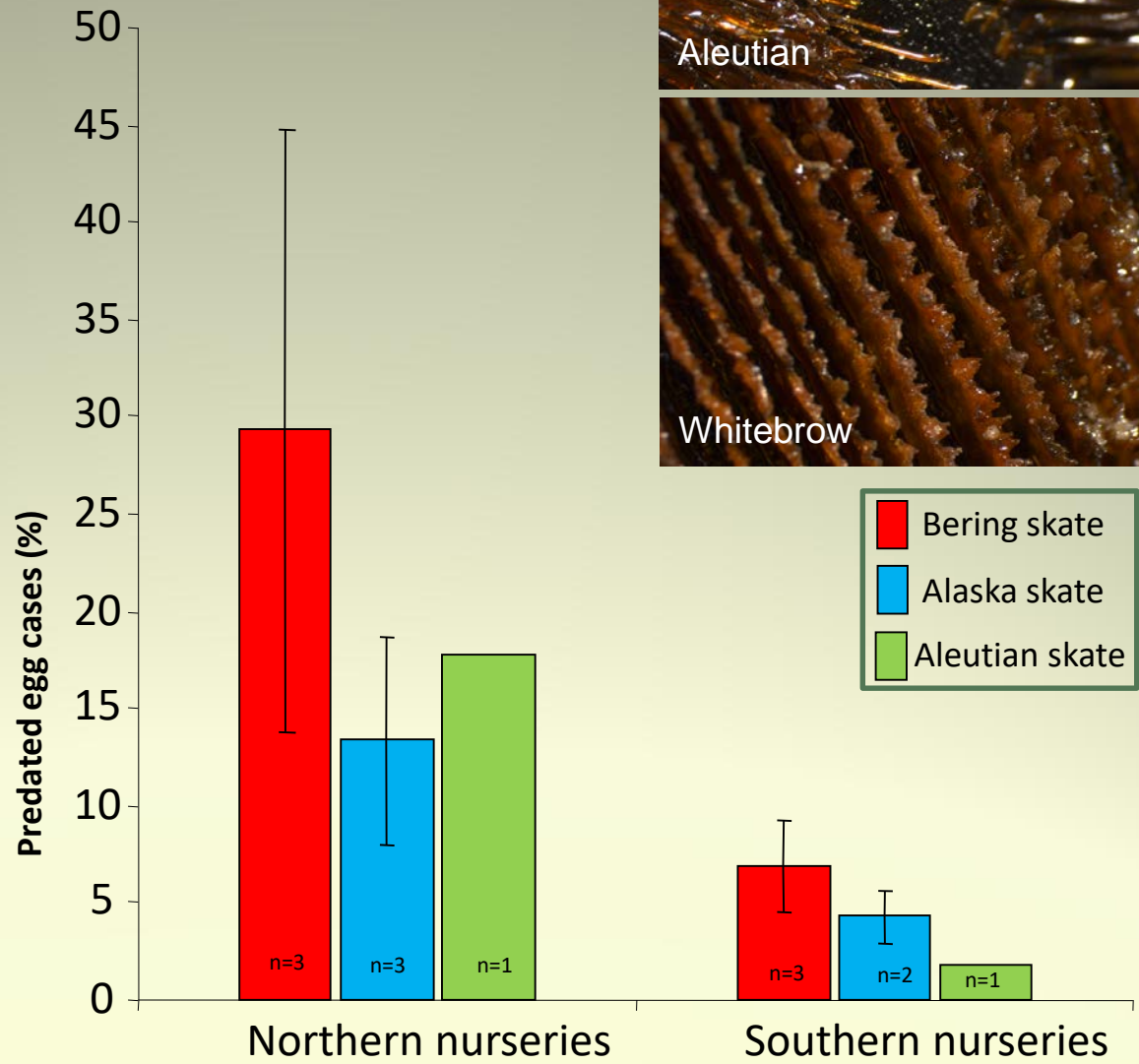
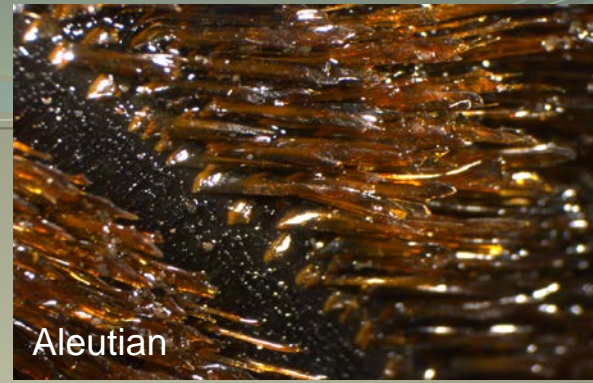
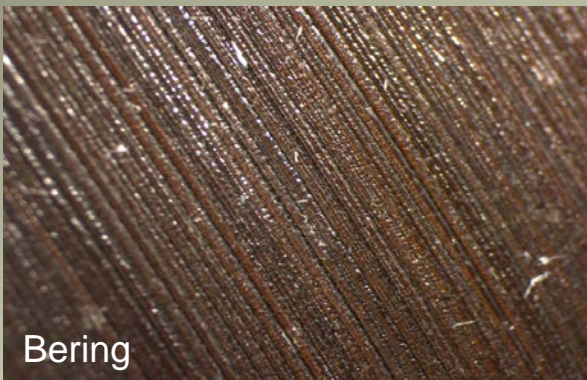
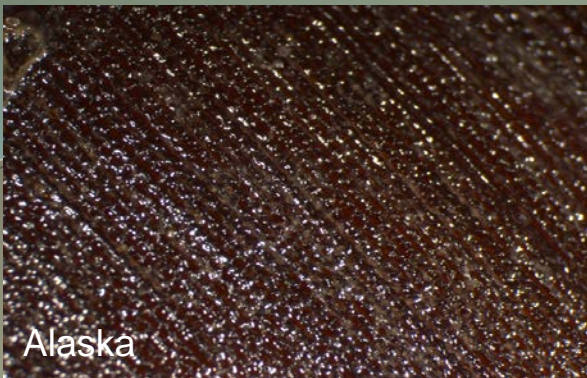


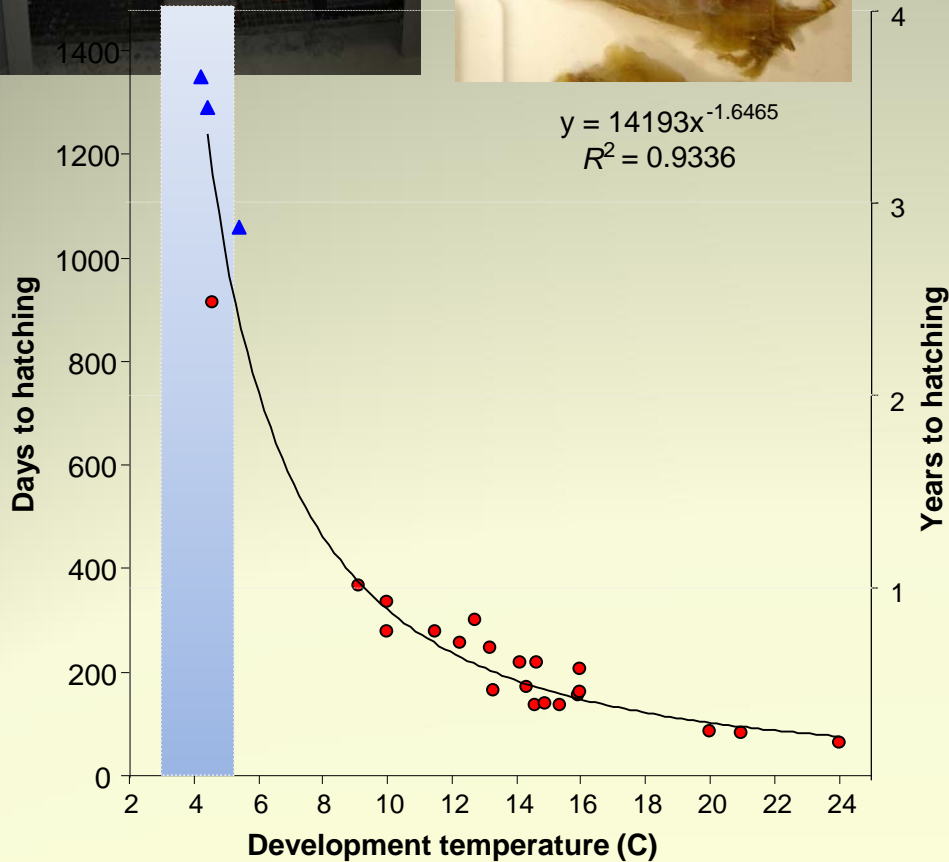




# Post-hatching Predation      Pre-hatching Predation







# Habitat

★ Location

★ Visualization

★ Quality

★ Use



Navarin Canyon

Pervenets Canyon

Zhemchug Canyon

Eastern  
Bering  
Sea

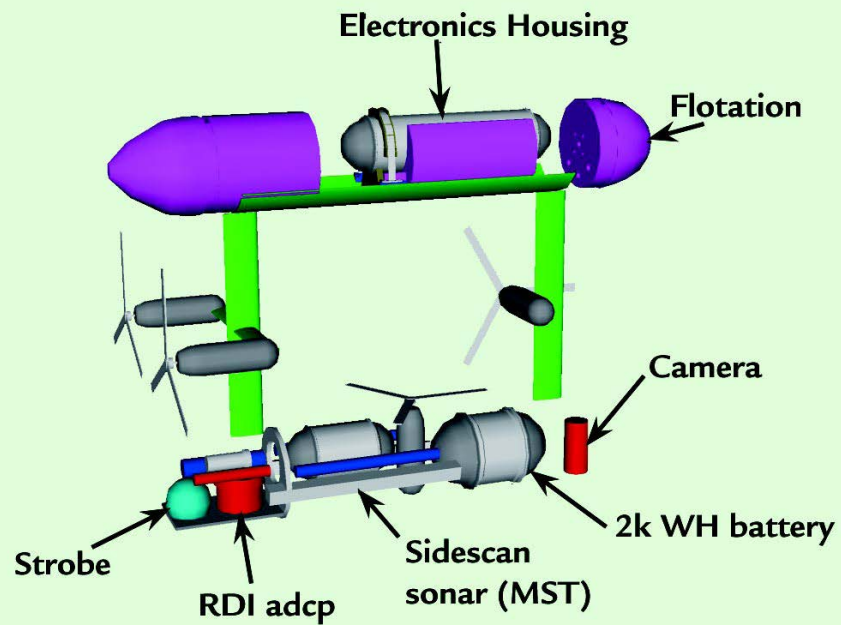
St. Matthew Canyon

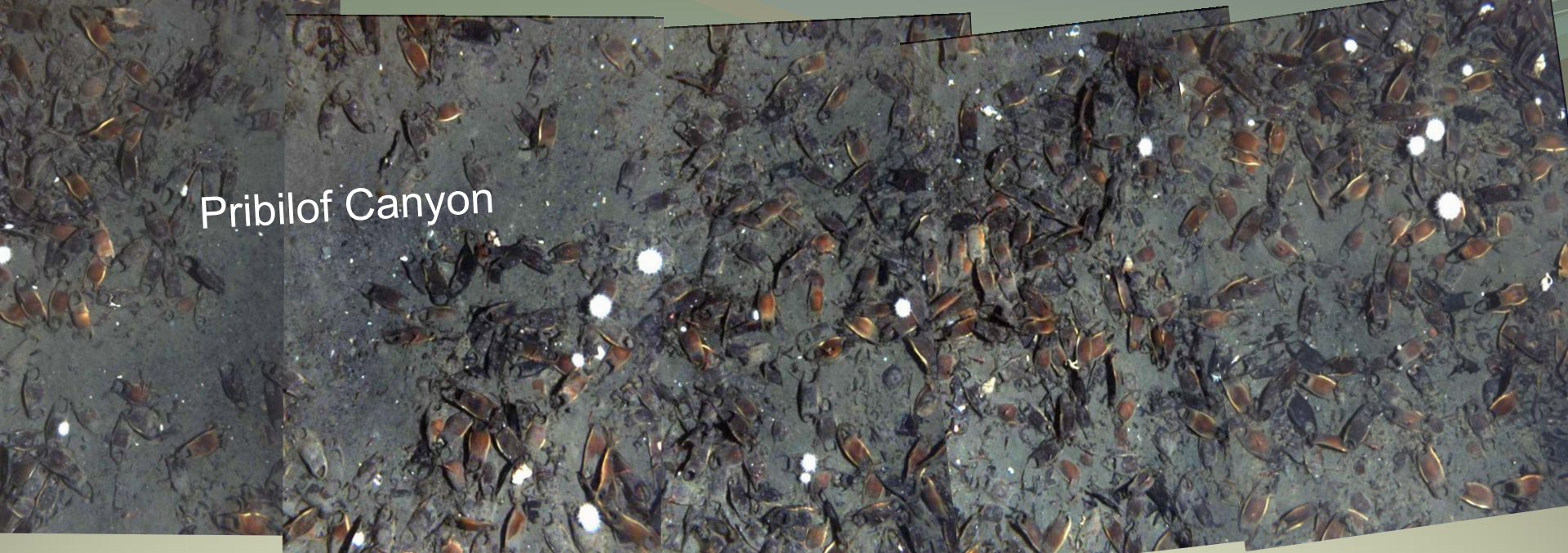
Middle Canyon

Pribilof Canyon

Bristol Canyon

Bering Canyon





Pribilof Canyon

This composite image shows the seafloor of Pribilof Canyon. The seabed is covered with a dense layer of dark, elongated, leaf-like organisms, likely sponges or similar invertebrates. Interspersed among these are numerous bright white, circular spots, which could be small shells or other biological features. The overall appearance is a dark, textured surface with high contrast between the dark organisms and the white spots.

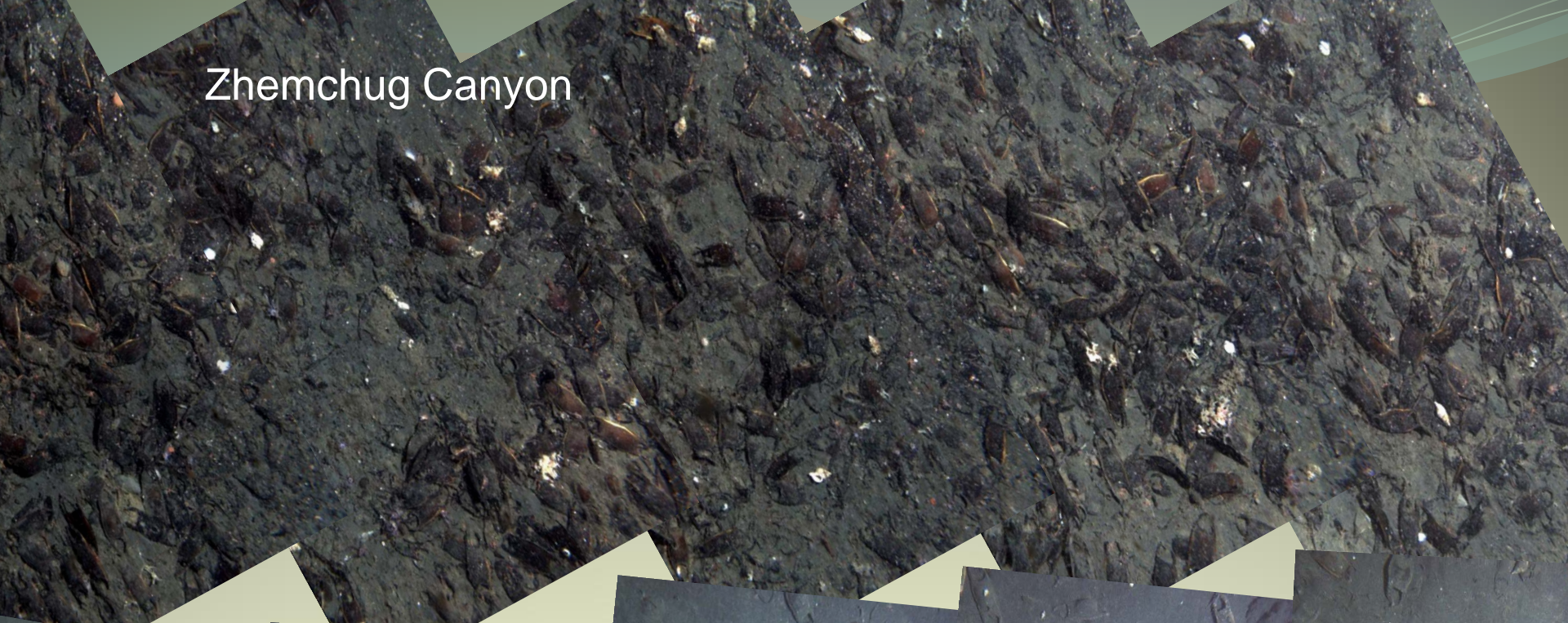


Pervenets Canyon

This composite image shows the seafloor of Pervenets Canyon. The seabed is covered with a dense layer of dark, elongated, leaf-like organisms, similar to those in the Pribilof Canyon image. In the center of the image, there is a prominent white, star-shaped organism. To its left, there are two small, reddish-pink circular spots. The overall appearance is a dark, textured surface with some distinct biological features.

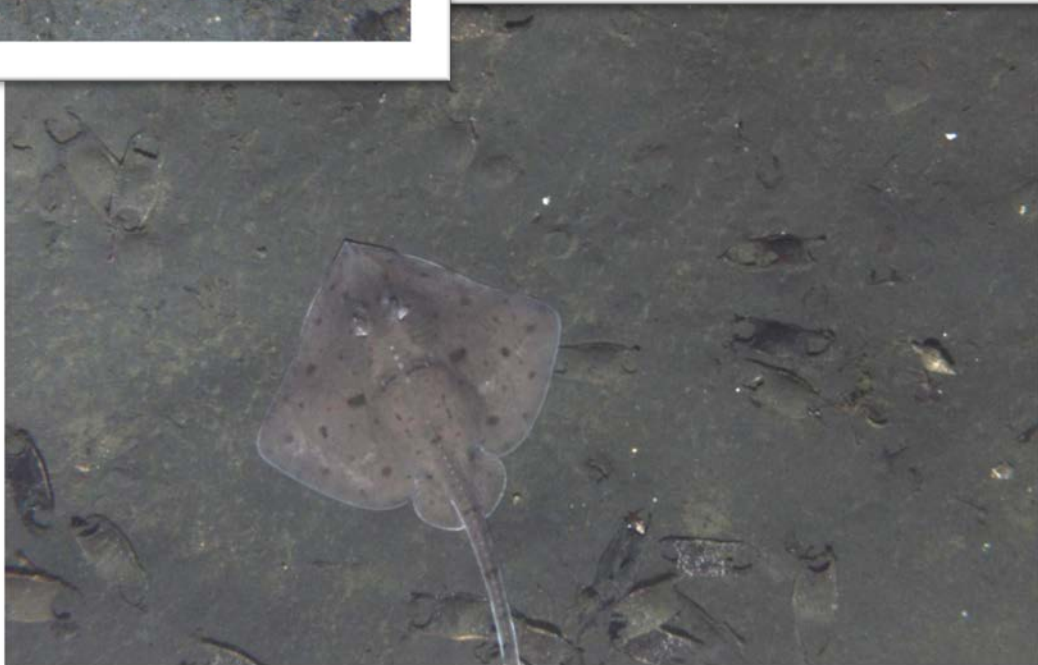


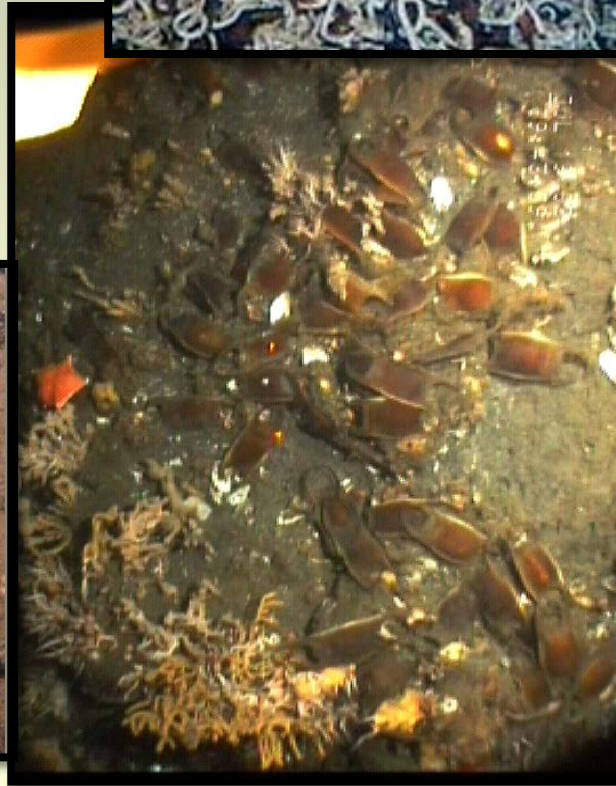
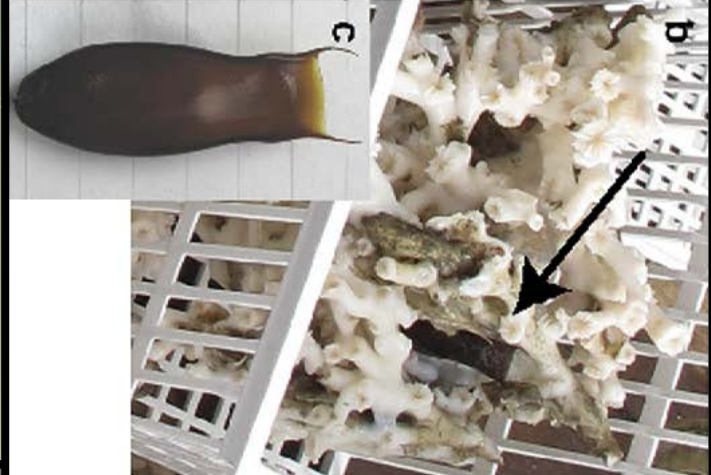
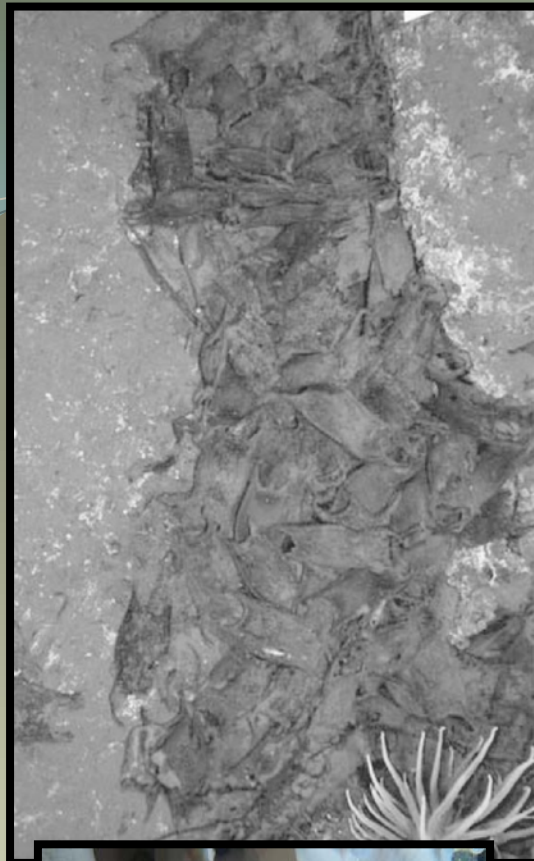
Zhemchug Canyon

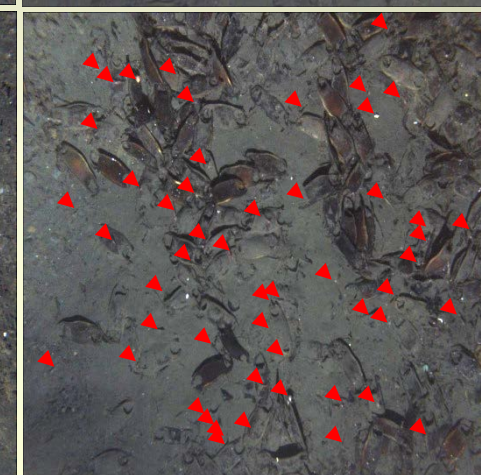
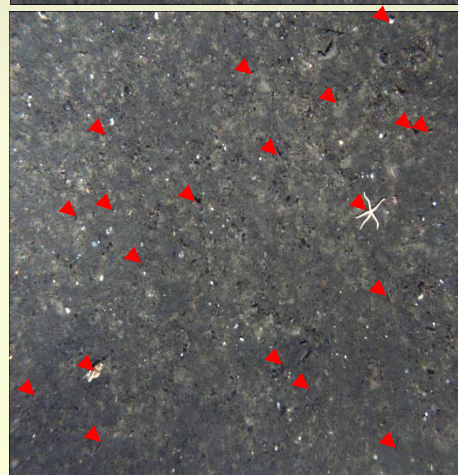
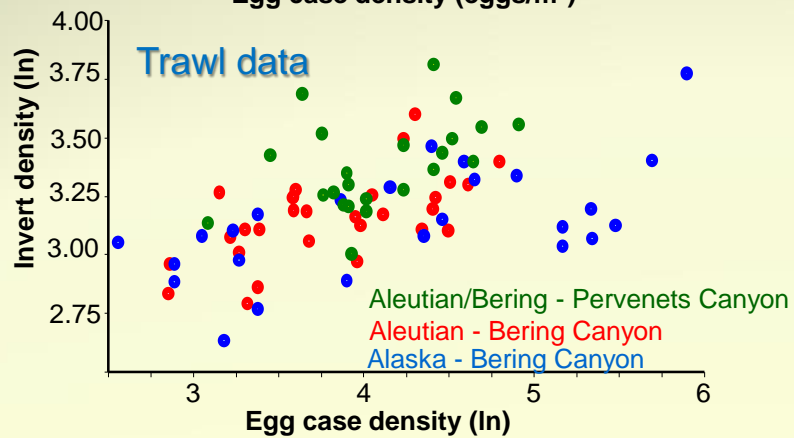
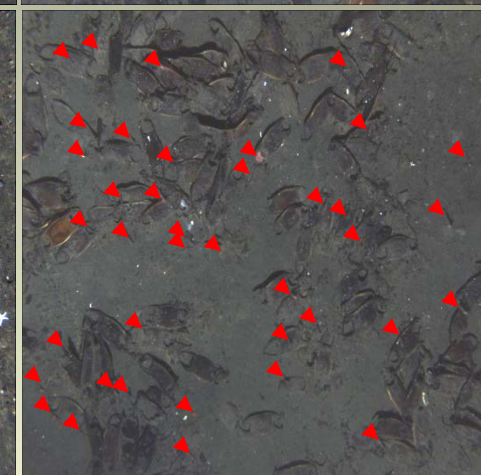
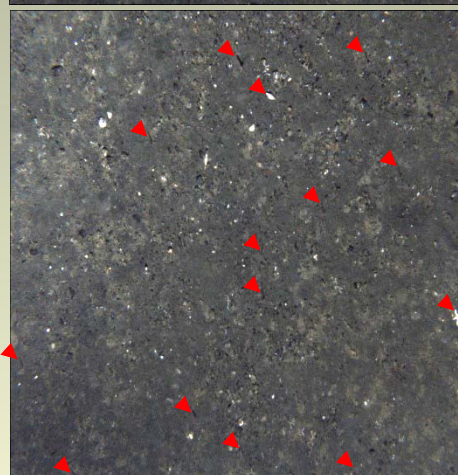
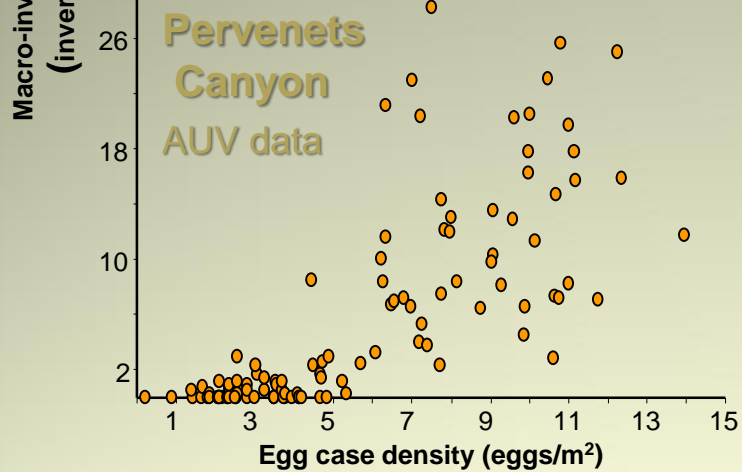
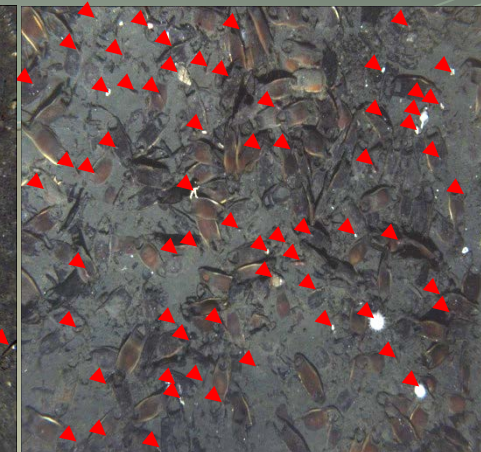
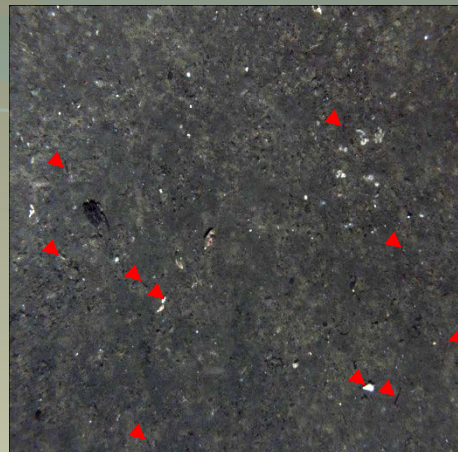
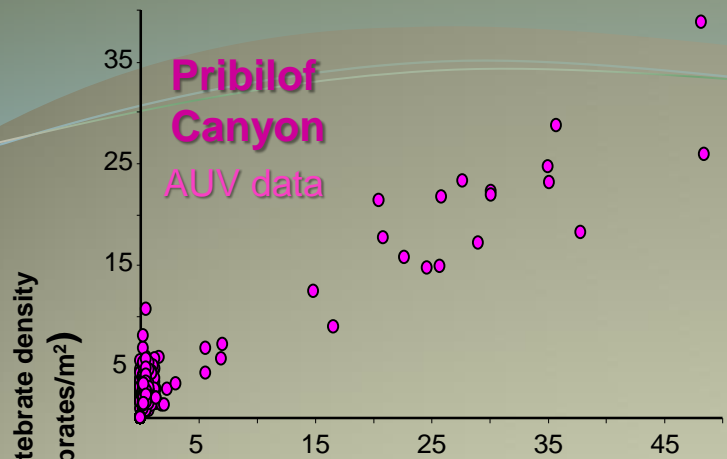


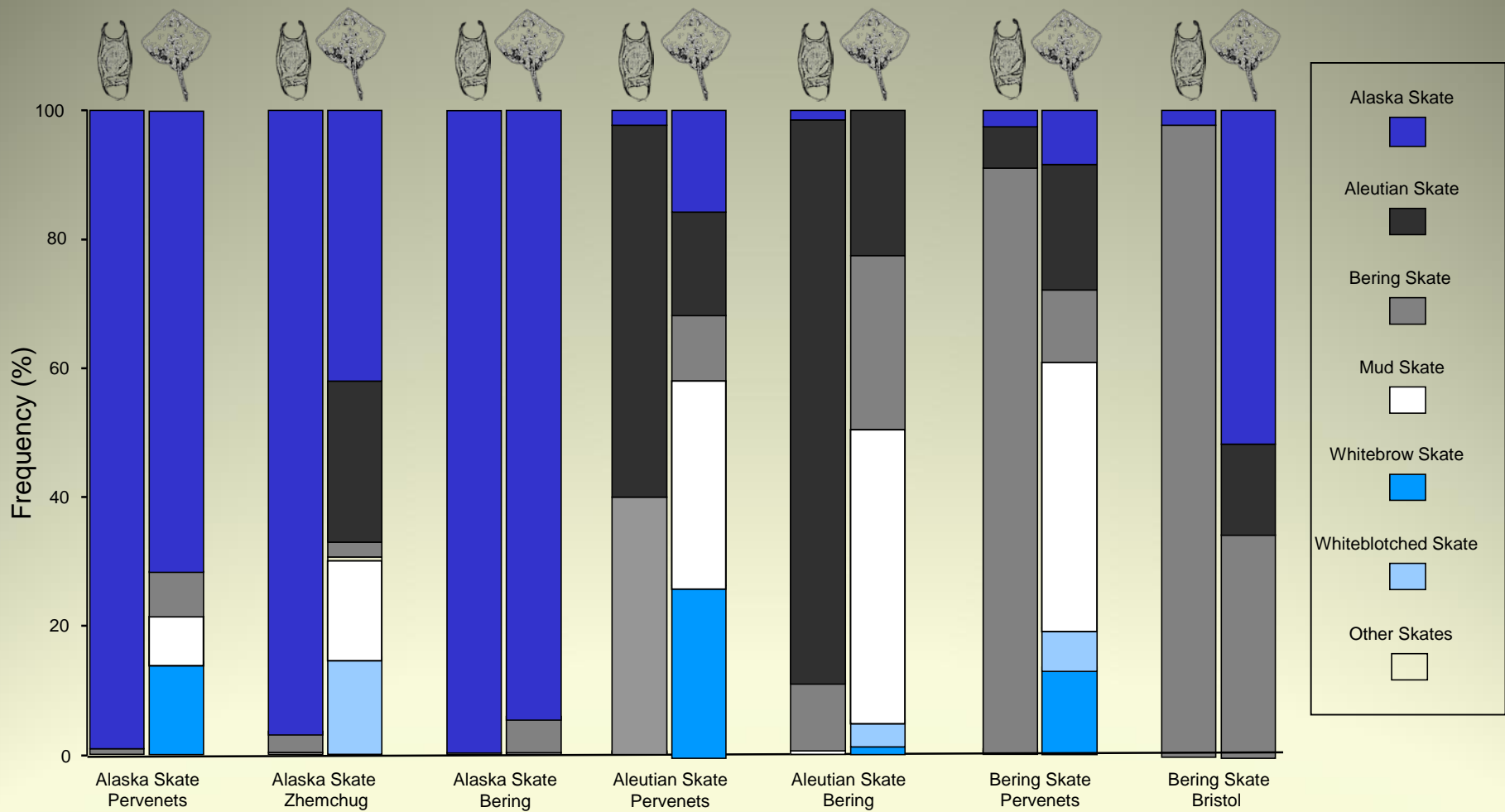
Bering Canyon

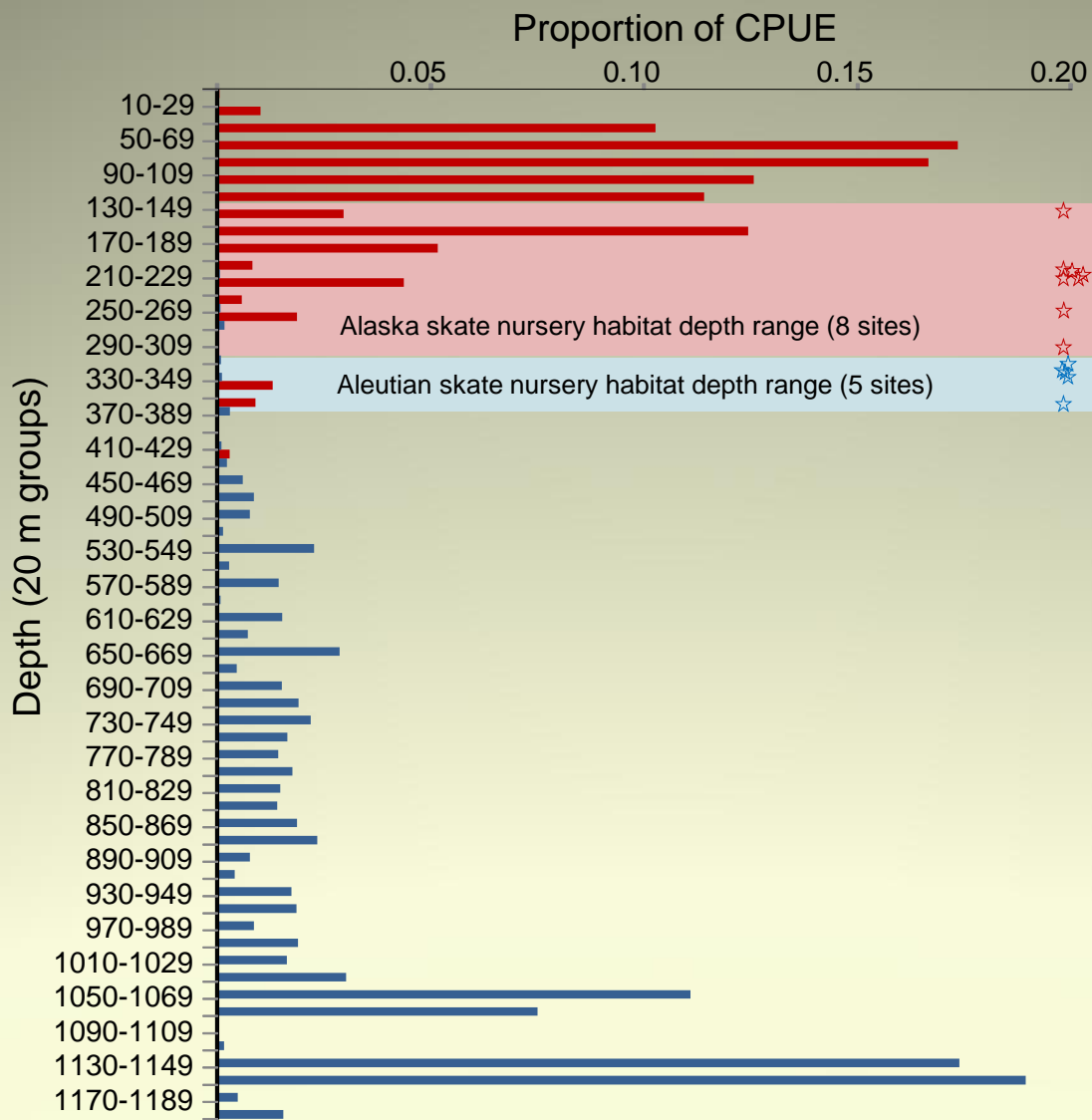


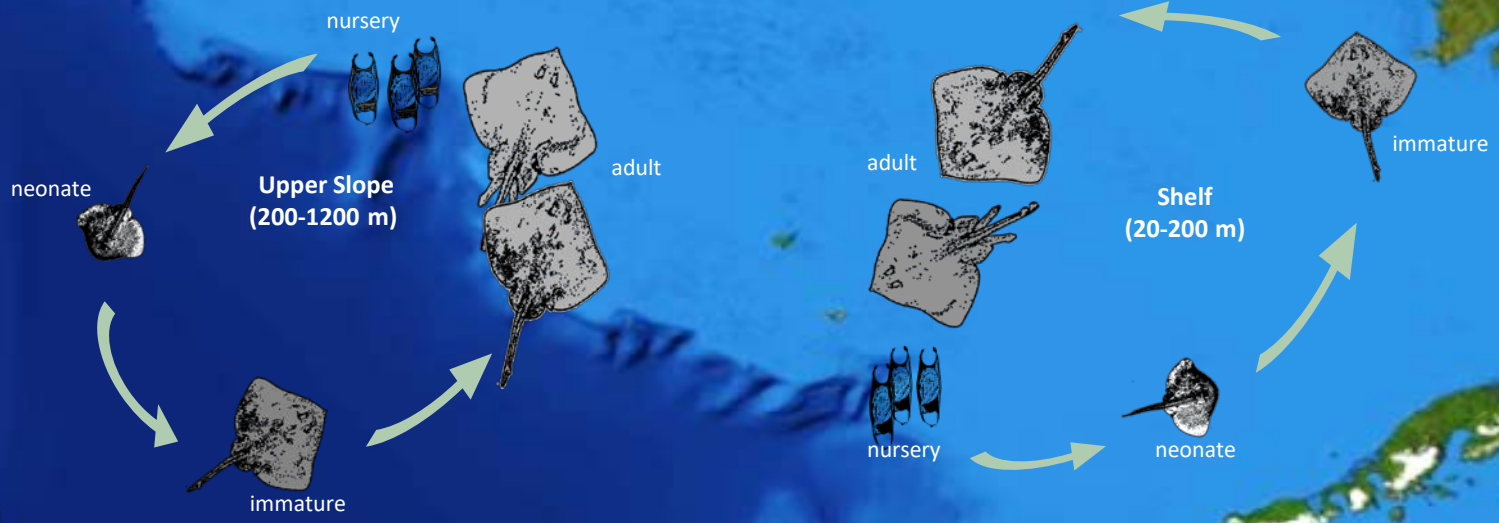












# HAPC

★ Designation



# HAPC Designation

The purpose of HAPCs is to focus conservation, management, and research efforts on subsets of EFH that are vulnerable to degradation or are especially important ecologically for federally managed fish. The HAPC designation alone does not confer additional protection or restrictions to an area, but helps to focus EFH conservation, management, and research priorities. HAPC designation is a valuable way to acknowledge areas where we have detailed information on ecological

function and habitat vulnerability, indicating a greater need for conservation and management. In some instances the

Council and NMFS may develop fishery management measures to conserve the habitat within the HAPC. **HAPCs are a subset of**

**EFH that deserve special attention because they provide extremely important ecological functions and/or are especially vulnerable to degradation.**

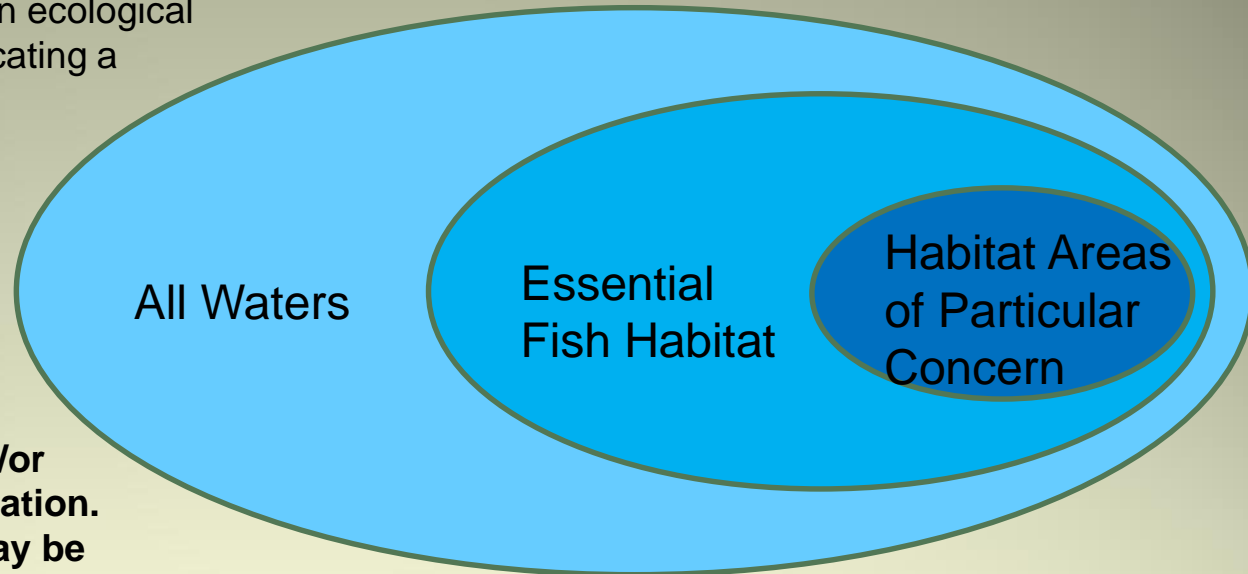
**For instance, HAPC designation may be warranted for areas that play a vital role in**

**the reproductive cycle of a managed species (e.g., grouper spawning sites) or areas that contain a rare habitat type (e.g., corals) that may be sensitive to disturbance from fishing or other human activities.** A

Council may designate an area as a HAPC for one or more of the following reasons: The habitat provides important ecological functions. The habitat is sensitive to human-induced environmental degradation.

Development activities are, or will be, stressing the habitat. The habitat type is rare. Additionally, a Council may establish HAPC priorities based on concerns for any particular habitat area, i.e. Areas of Skate Egg

Concentration.



## **NPFMC MEETING Minutes June 2012**

### **C-2 HAPC Areas of Skate Egg Concentration**

2010-Council set a habitat priority type—“skate nurseries”—and issued an RFP in conjunction with completion of its EFH five-year review. The Council selected a HAPC proposal from the Alaska Fisheries Science Center (AFSC) for further analysis.

2012- the Council made initial reviews of an analysis of alternatives and options to identify and conserve six areas of skate egg concentration as HAPCs in the eastern Bering Sea.

The Council adopts Alternative 2-Identify skate egg concentration HAPC(s)

Option a: NMFS would monitor HAPCs for changes in egg density and other potential effects of fishing, and the Council would request that industry support collection of data in evaluation of monitoring and management efforts relative to those HAPCs.

Option d: Suggest adding research and monitoring of areas of skate egg concentration to the Council’s research priority list.

# HAPC

The Council made an initial review of the analysis to identify areas of skate egg concentration as Habitat Areas of Particular Concern (HAPC); the Enforcement Committee also reviewed the analysis. The Council selected Alternative 2 and Options a, d, and e as its Preferred Preliminary Alternative (PPA), and released the document for public review.

The Council moved to strike from Alternative 2 its intent to "discourage fishing in these areas" of skate egg concentration with gear that makes contact with the sea floor. The Council adopted a revised statement of Purpose and Need, based on public comments. The motion is available on the Council's website.

Under Option a, NMFS would monitor HAPC

for changes in egg density and other potential effects of fishing, and the Council would request that industry support collection of data in evaluation of monitoring and management efforts relative to those HAPC. Under Option d, the Council would suggest adding research and monitoring of areas of skate egg concentration to the Council's research priority list. The intent of its PPA is to monitor the potential impacts of fishing activities in the proposed HAPCs primarily at the population level and if practicable to develop additional information on fishery interactions with areas of skate egg concentrations.

Finally, under Option e, the Council would adopt the formatting standards as stated in the final rule implementing Amendment 89 to the BSAI Groundfish FMP, which establishes Bering Sea habitat conservation

measures. This option is a housekeeping amendment to consolidate figures and tables that describe the Bering Sea Habitat Conservation Area (HCA), the Northern Bering Sea Research Area and Saint Lawrence Island HCA, and the Nunivak Island, Etolin Strait, and Kuskokwim Bay HCA. Staff contact is David Witherell.



Photo: Jeff DiCosimo, NPFMC



Photo: Peggy Kircher, NPFMC

Above: Whale watching on the boat ride to Ouzinkie. Left: Hermann Squartsoff addresses the community and guests of Ouzinkie at a reception during the Council meeting. Below: The Coast Guard cutter Munro.



Photo: Mark Fine, NPFMC

**DEPARTMENT OF COMMERCE**

**National Oceanic and Atmospheric  
Administration**

**50 CFR Part 679**

**RIN 0648–XD287**

**Fisheries of the Exclusive Economic  
Zone Off Alaska; Skates Management  
in the Bering Sea and Aleutian Islands  
Management Area; Habitat Areas of  
Particular Concern**

**AGENCY:** National Marine Fisheries  
Service (NMFS), National Oceanic and  
Atmospheric Administration (NOAA),  
Commerce.

**ACTION:** Notice of Agency decision.

---

**SUMMARY:** The National Marine  
Fisheries Service (NMFS) announces the  
approval of Amendment 104 to the  
Fishery Management Plan for  
Groundfish of the Bering Sea and  
Aleutian Islands Management Area  
(FMP). Amendment 104 to the FMP  
designates six areas of skate egg  
concentration as Habitat Areas of  
Particular Concern (HAPC). The HAPC  
designations for the six areas of skate  
egg concentration in the Bering Sea and  
Aleutian Islands Management Area  
(BSAI) are intended to highlight the  
importance of this essential fish habitat  
for conservation. This action promotes  
the goals and objectives of the  
Magnuson-Stevens Fishery  
Conservation and Management Act, the  
FMP, and other applicable laws.

**DATES:** The amendment was approved  
on January 5, 2015.

**ADDRESSES:** Electronic copies of  
Amendment 104 to the FMP and the  
Environmental Assessment (EA)  
prepared for this action are available  
from the Alaska Region NMFS Web site  
at [http://www.alaskafisheries.noaa.gov/  
analyses/default.htm](http://www.alaskafisheries.noaa.gov/analyses/default.htm).

**FOR FURTHER INFORMATION CONTACT:**  
Seanbob Kelly, 907–271–5195.

**SUPPLEMENTARY INFORMATION:** The  
Magnuson-Stevens Fishery

***“Amendment 104 to the FMP  
designates six areas of skate egg  
concentration as Habitat Areas of  
Particular Concern (HAPC).”***

**Federal Register/ volume 80, no 6 January 9, 2015**

-180° -178° W -176° W

- ★ Alaska Skate
- ★ Aleutian Skate
- ★ Bering Skate

Navarin Canyon

Pervenets Canyon

Zhemchug Canyon

Skate Nursery Sites  
Designated HAPC 2015  
6 areas 8 nursery sites  
3 species

60° N

58° N

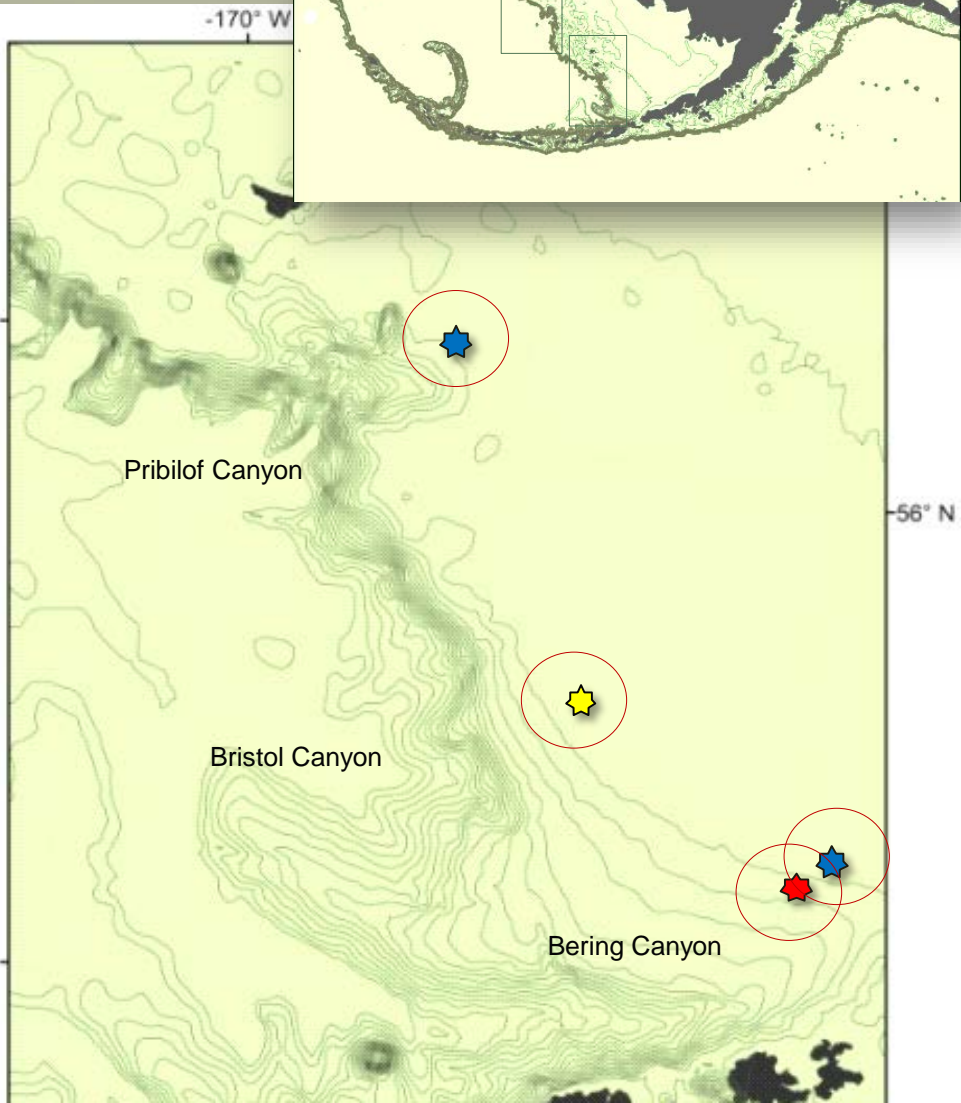
-170° W

Pribilof Canyon

Bristol Canyon

Bering Canyon

56° N



# Research



## **Nursery Site Genetic Conductivity**

genetics of embryos



## **Predictive Nursery Modeling**

modeling physical & biological data



## **Fisheries Interactions**

observer program

# Research



## **Nursery Site Genetic Conductivity**

genetics of embryos



## **Predictive Nursery Modeling**

modeling physical & biological data



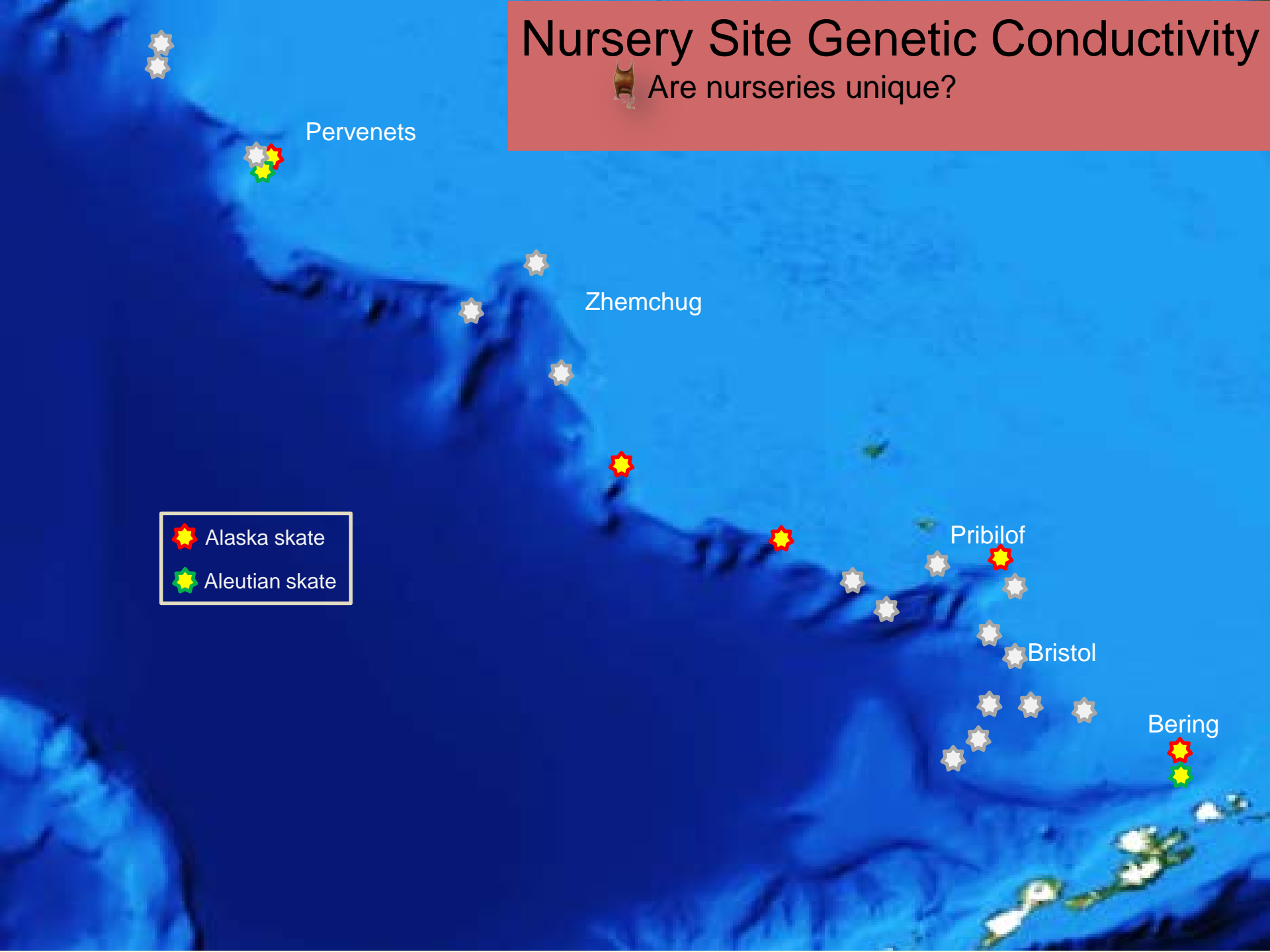
## **Fisheries Interactions**

observer program

# Nursery Site Genetic Conductivity



Are nurseries unique?



Pervenets

Zhemchug

Pribilof

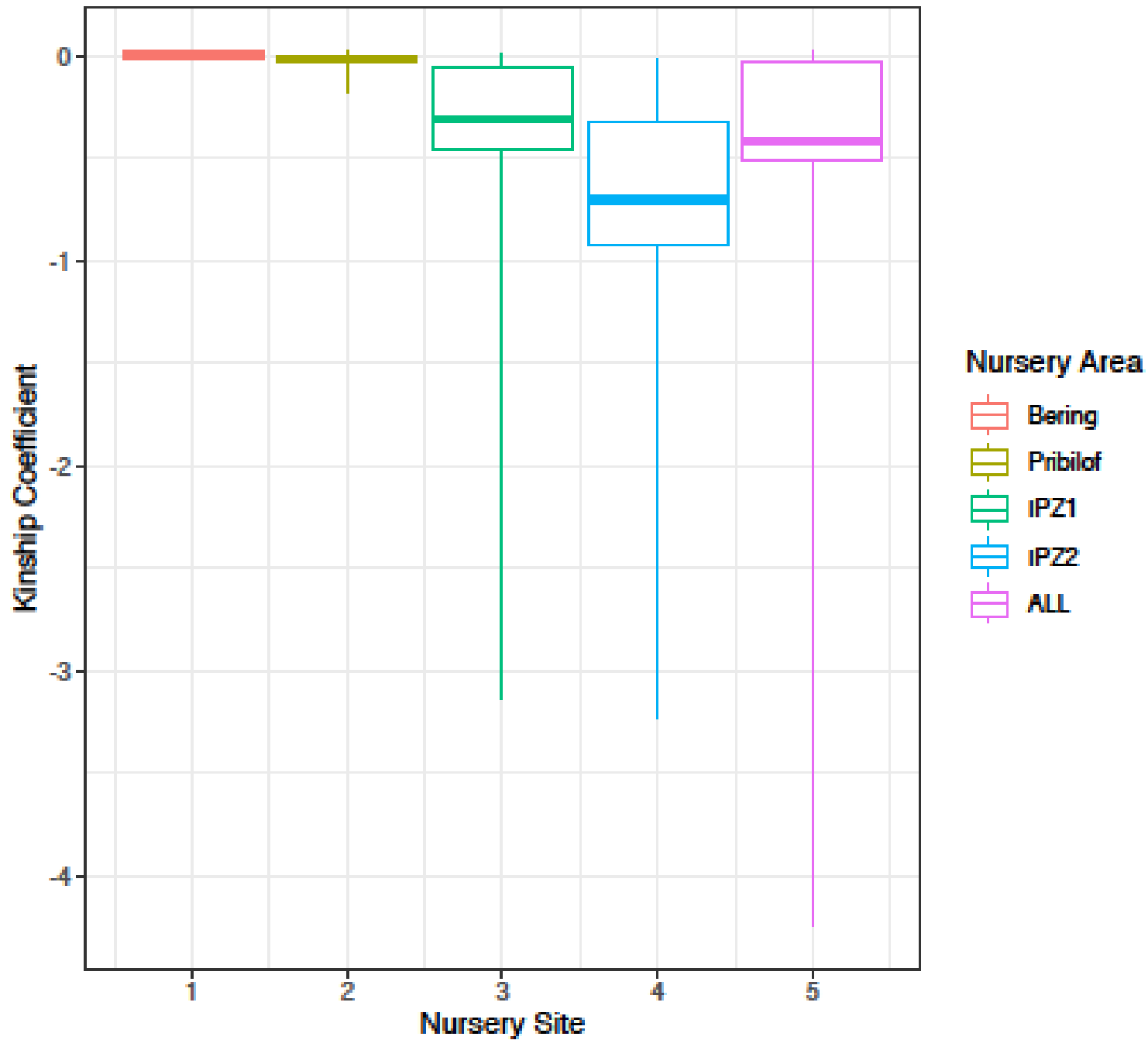
Bristol

Bering

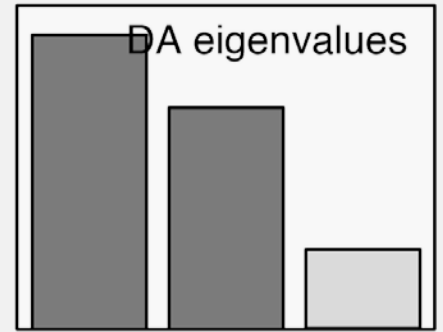
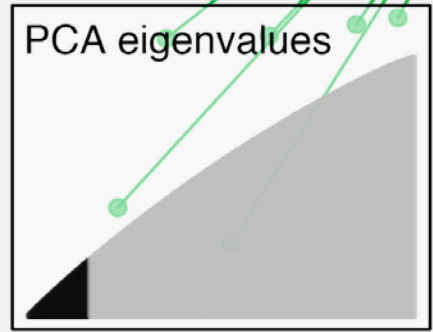
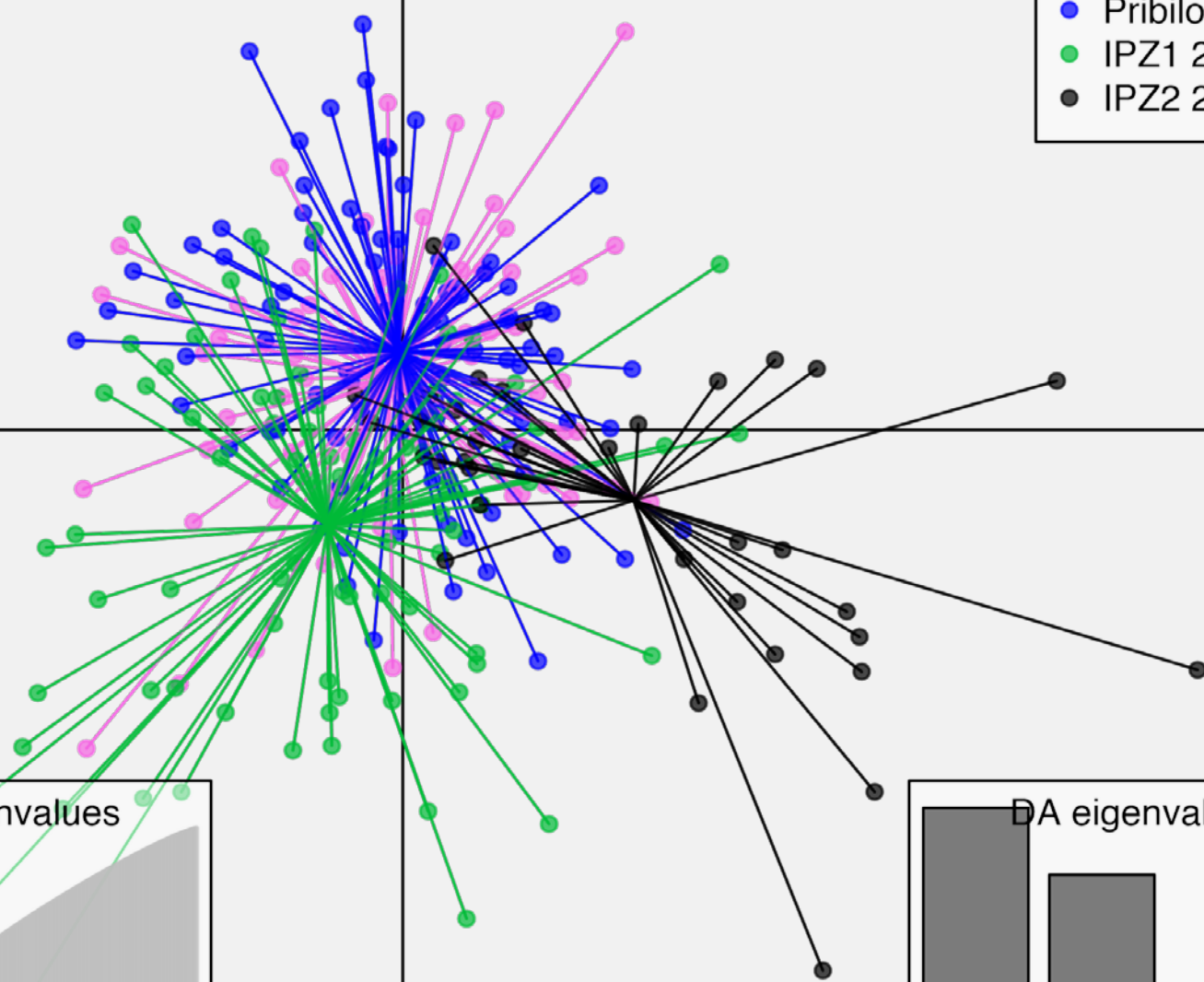
Alaska skate

Aleutian skate





- Bering 2016
- Pribilof 2016
- IPZ1 2016
- IPZ2 2016



# Research



**Nursery Site Genetic Conductivity**  
genetics of embryos



**Predictive Nursery Modeling**  
modeling physical & biological data



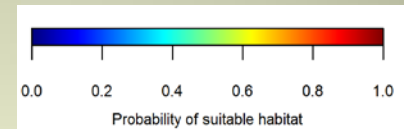
**Fisheries Interactions**  
observer program

## MaxEnt Presence/Absence Model

- ★ 26 nursery sites presences
- ★ 3,278 observations absences
- ★ 10 environmental/habitat variables

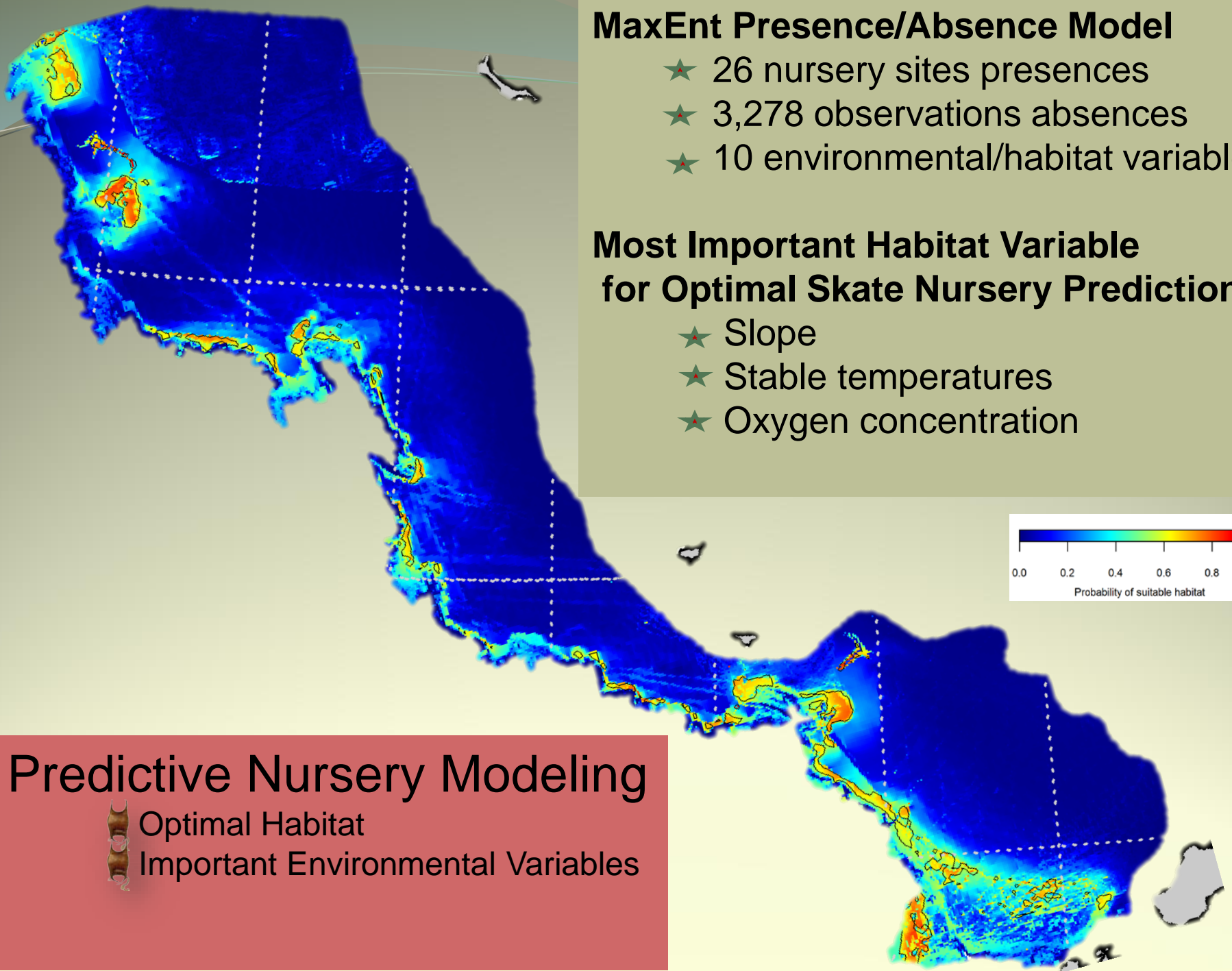
## Most Important Habitat Variable for Optimal Skate Nursery Prediction

- ★ Slope
- ★ Stable temperatures
- ★ Oxygen concentration



## Predictive Nursery Modeling

- Optimal Habitat
- Important Environmental Variables



# Research



**Nursery Site Genetic Conductivity**  
genetics of embryos



**Predictive Nursery Modeling**  
modeling physical & biological data



**Fisheries Interactions**  
observer program

# Fisheries Interactions

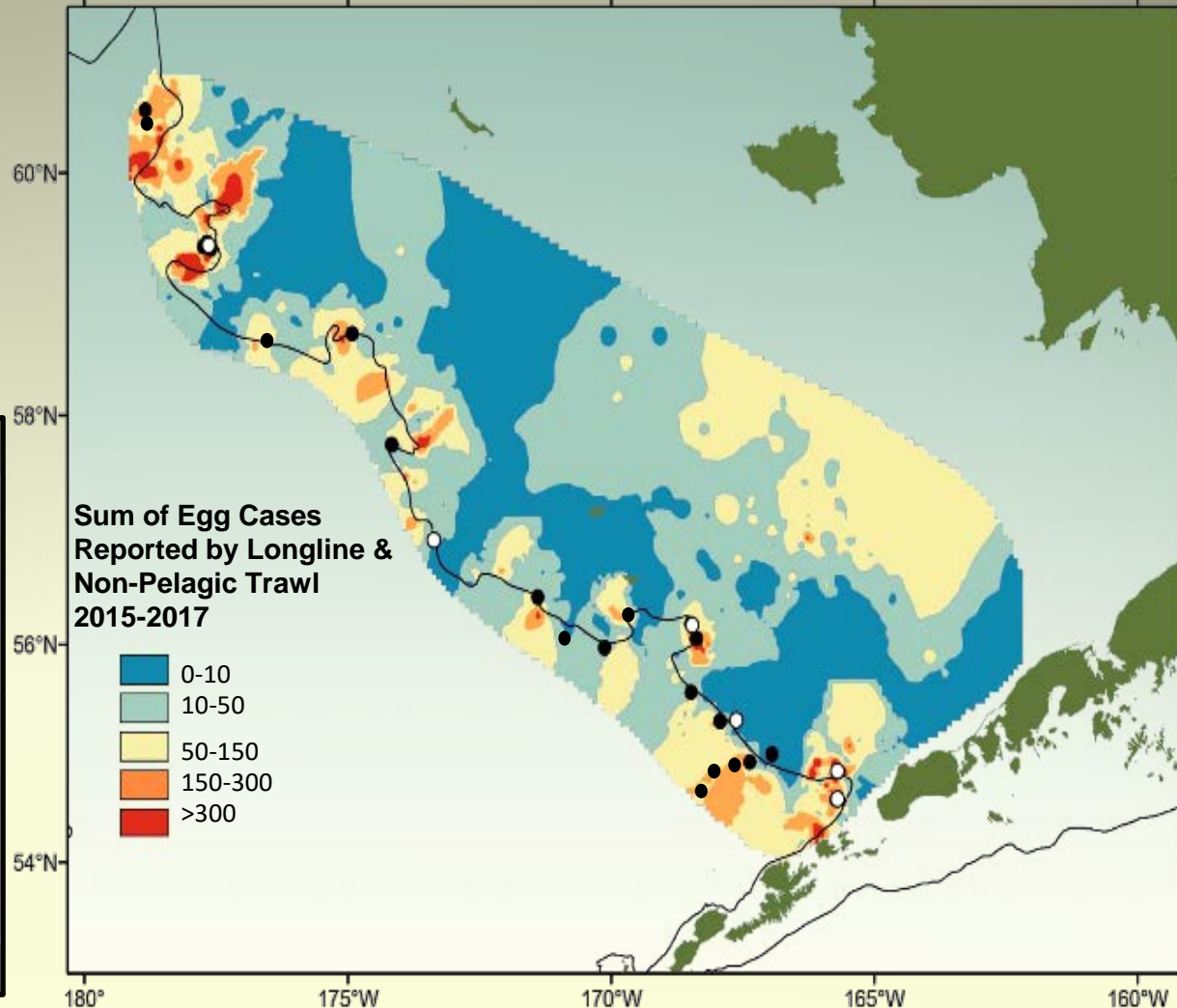
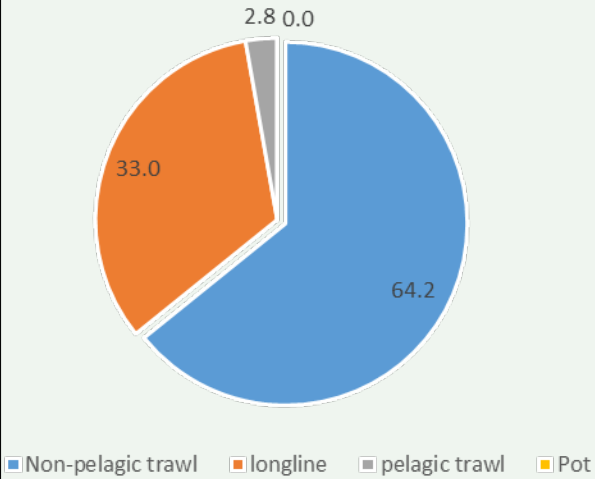


What Fisheries?

Viability?

Where Encountered?

Skate egg case encounter by fisheries



SPECIES	Viable	Non-Viable	Total
Alaska skate	48.7%	51.2%	2,099
Aleutian skate	21.3%	78.6%	478
Bering skate	19.8%	80.1%	302
Commander whiteblotched	26.0%	73.9%	276
whitebrow skate	27.4%	72.5%	131
mud skate	14.9%	85.1%	47
deepsea skate	27.6%	72.4%	29
longnose skate	30%	70%	10
big skate	0.0%	100%	5
rougtail skate	40%	60%	5
<b>TOTAL</b>	<b>38.8%</b>	<b>61.2%</b>	<b>3,382</b>

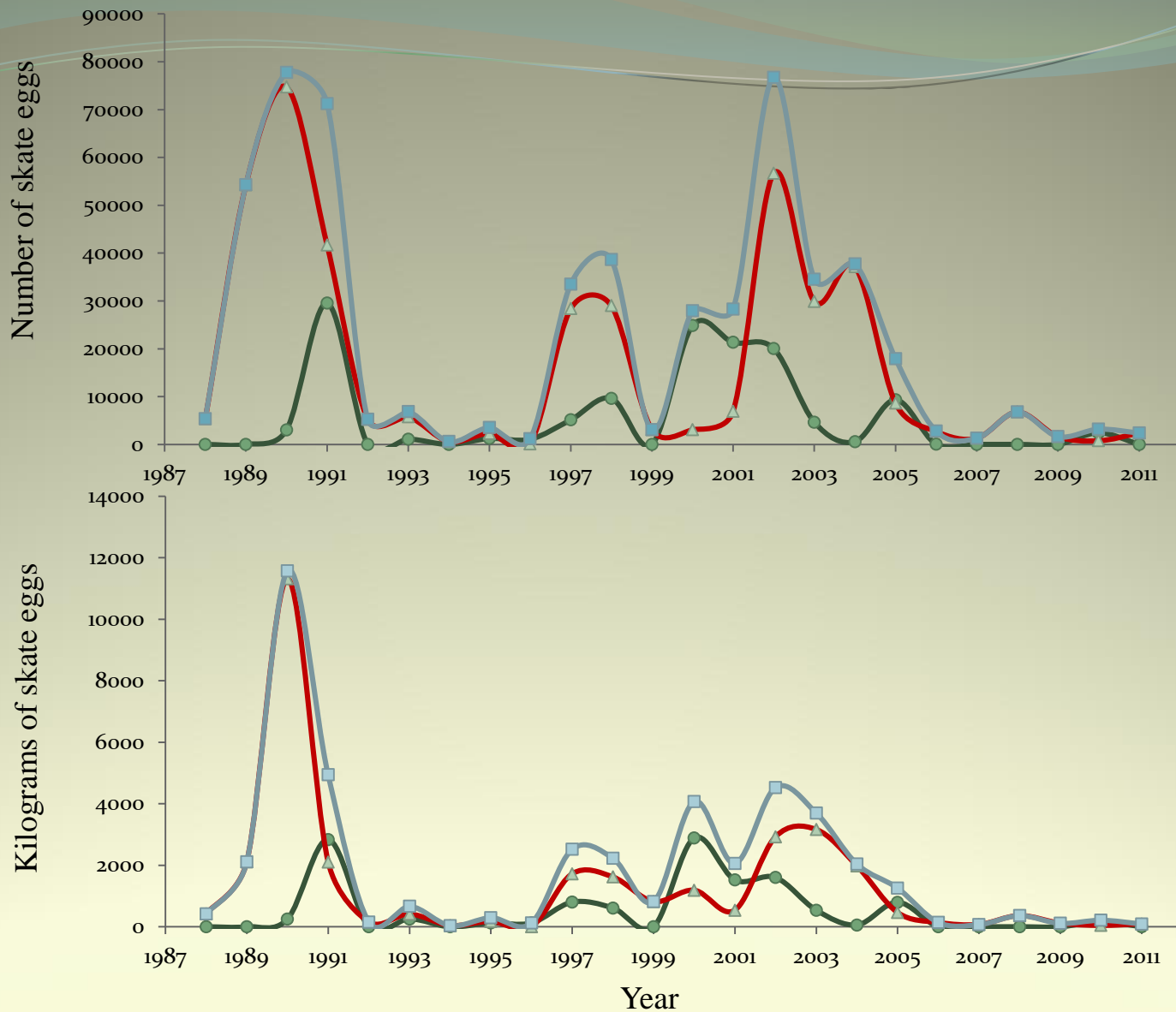


Figure xx. Estimated skate egg numbers and weight taken by year from the Bering canyon skate nursery sites for observed fisheries hauls only. Longline (green); bottom trawl (red); longline and trawl combined (blue).



Nursery of the Alaska Skate  
Pribilof Canyon  
Gerald R. Hoff  
AFSC