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

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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

Pribilof Canyon

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

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

~225,000 paired seafloor images

Stereo drop camera
15 minute tows
Each transect was about 450 m and 3-4 m wide.
Fieldwork results

- Validate model predictions
- Improve/refine predictions of coral presence
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Swiftia sp.  
Total number = 537

Plumarella sp.  
Total number = 811

Primnoidae  
Total number = 40

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 = 311 m
Min = 111 m
Max = 781 m
Halipteris
Total number = 29,435
Sea Whips Results

n = 105 (42%)
Median depth = 266 m
Min = 91 m
Max = 760 m
Fieldwork results

- Validate model predictions
- Improve/refine predictions of coral presence
- Acquire height and density data for coral
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- Improve data for vulnerability index
Probability coral present based on camera survey

Camera survey - Coral model

Probability of presence

Pribilof Canyon
Combine models

Trawl survey data

Camera survey data

Bottom trawl - Coral model

Camera survey - Coral model
Probability coral present, unified coral model, Pribilof Canyon
Fieldwork results

- Validate model predictions
- Improve/refine predictions of coral presence
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Observed densities
Camera survey

Sponge density > 0
n = 113 transects

Coral density > 0
n = 32 transects

Sea whip density > 0
n = 105 transects
Observed heights
Camera survey

- Coral
- Sponge
- Sea whips
Coral density and height models (preferred)
Coral density and height models (preferred)
Sponge density and height models (preferred)
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
- 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

<table>
<thead>
<tr>
<th>Species/group</th>
<th>Sponge</th>
<th>Coral</th>
<th>Whips</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rockfish (all Sebastes)</td>
<td>sig +</td>
<td>sig -</td>
<td>ns</td>
<td>sig</td>
</tr>
<tr>
<td>POP</td>
<td>sig +</td>
<td>ns</td>
<td>ns</td>
<td>sig</td>
</tr>
<tr>
<td>Shortraker</td>
<td>ns</td>
<td>sig +</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>SST</td>
<td>ns</td>
<td>ns</td>
<td>sig -</td>
<td>sig</td>
</tr>
<tr>
<td>Cod</td>
<td>ns</td>
<td>ns</td>
<td>sig -</td>
<td>sig</td>
</tr>
<tr>
<td>Sculpins</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>sig</td>
</tr>
<tr>
<td>Grenadier</td>
<td>sig -</td>
<td>sig -</td>
<td>sig -</td>
<td>sig</td>
</tr>
<tr>
<td>Flatfish</td>
<td>ns</td>
<td>ns</td>
<td>sig +</td>
<td>sig</td>
</tr>
<tr>
<td>Pollock</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>sig</td>
</tr>
<tr>
<td>Chionoecetes</td>
<td>sig -</td>
<td>sig -</td>
<td>ns</td>
<td>sig</td>
</tr>
<tr>
<td>King crabs</td>
<td>sig +</td>
<td>sig +</td>
<td>ns</td>
<td>sig</td>
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<tr>
<td>Skates</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>sig</td>
</tr>
<tr>
<td>Northern rockfish</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Rougheye/blackspotted</td>
<td>ns</td>
<td>sig +</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Sablefish</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
</tbody>
</table>
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)

Average depth = 237 m (111-394)
Longline or crab gear (n = 11 transects)

Average depth = 485 m (241-747)
Damaged invertebrates (n = 68 transects)

Average depth = 233 m (91-760)

- Damaged coral
- Abraded sea whip
- Tangled trawl
- Tangled longline
### Summary

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

<table>
<thead>
<tr>
<th>Classification</th>
<th>Number of transects</th>
<th>Percent of transects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damaged Isididae (coral)</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>Damaged Demosponge</td>
<td>7</td>
<td>3%</td>
</tr>
<tr>
<td>Damaged Halipteris (whip)</td>
<td>60</td>
<td>24%</td>
</tr>
<tr>
<td><strong>Damaged taxa subtotal</strong></td>
<td><strong>68</strong></td>
<td><strong>27%</strong></td>
</tr>
</tbody>
</table>

- 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
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- Improve data for vulnerability index
Vulnerability

Function of:

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

Denser

Taller

Coral

Sponge

Sea whips
Vulnerability: areas where organisms are dense or tall
Fishing effort (2003-2013)
Overlay fishing effort on vulnerability map

Pribilof Canyon

Zhemchug Canyon

Combined Vulnerability

Fishing effort (2003-2013)

Sea whip (upper quantiles)
Sponge (upper quantiles)
Coral (upper quantiles)
## Compare Bering Sea to other regions of U.S.

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

- **Coral**
  - Eastern Bering Sea
  - Aleutian Islands
  - Gulf of Alaska
  - Bowers Bank and Ridge

- **Seawhip**
  - Density (no./m²)

- **Sponge**
  - Density (no./m²)
Compare Bering Sea to other regions of Alaska

**Coral**
- Aleutians
- Bering

**Sponge (>20 cm)**
- Aleutians
- Bering
Why?

- **Region**
  - **Transects with rocky habitat**
  - **Transects with coral**

<table>
<thead>
<tr>
<th>Region</th>
<th>Transects with rocky habitat</th>
<th>Transects with coral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gulf of Alaska</td>
<td>35%</td>
<td>30%</td>
</tr>
<tr>
<td>Aleutian Islands</td>
<td>63%</td>
<td>60%</td>
</tr>
<tr>
<td>Bowers Bank</td>
<td>42%</td>
<td>47%</td>
</tr>
<tr>
<td>Eastern Bering Sea</td>
<td>19%</td>
<td>13%</td>
</tr>
</tbody>
</table>

- **Aleutian Islands (eastern and central)**
  - **Rocky**: 35.5%
  - **Unconsolidated**: 64.5%

- **Bowers Ridge and Bank**
  - **Rocky**: 32.3%
  - **Unconsolidated**: 67.7%
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