Essential Fish Habitat project status report

Reporting date: 10/15/2012

Project number: 7

Title: Identification of high relief living structures in the Gulf of Alaska slope areas

PIs: Rooper, Hoff, Wilkins

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Status: ☒ Complete ☐ Incomplete, on schedule ☐ Incomplete, behind schedule

Planned completion date if incomplete:

Reporting: Yes

Results: In August 2010, we conducted an eight day cruise aboard the chartered fishing vessel *Sea Storm* to investigate three slope areas in the western Gulf of Alaska (Figure 1). These slope areas were identified by fishers to potentially contain high relief, living structure such as coral and sponges (HAPC organisms) in virtually pristine states, as fishing has not typically occurred in these areas. As part of regulatory provisions enacted in 2005, these areas were closed to bottom contact mobile gear. The objective of our study was to use video to determine whether sponges and corals occurred in each of the three slope areas and to collect data that would allow predictive modeling of the distribution of sponges and corals in the three closed areas. This modeling could potentially be expanded to provide distributional maps for slope areas throughout the Gulf of Alaska.

The analysis was carried out using a generalized additive modeling methodology. We used presence or absence of coral or sponge observed in camera drops at the three sites as the dependent variable. At each of the Unalaska and Sanak areas, 30 random locations for camera drops were chosen at depths < 350 m. In the deeper Shumagin area, only 13 randomly selected locations were sampled using the camera (Figure 1). Camera drops consisted of three to nine minutes of video collected 1-2 m off the seafloor. The camera sled was drifted over the seafloor at a target rate of 1-2 knots. For each of these camera drops the presence or absence of coral and upright sponges (providing vertical relief off the seafloor) was recorded, the substrate type, as well as any other invertebrates or fishes. The number of individual corals or sponges was also recorded where possible, or the percentage of the seafloor covered by corals and sponges in cases where they were too numerous to count individually.

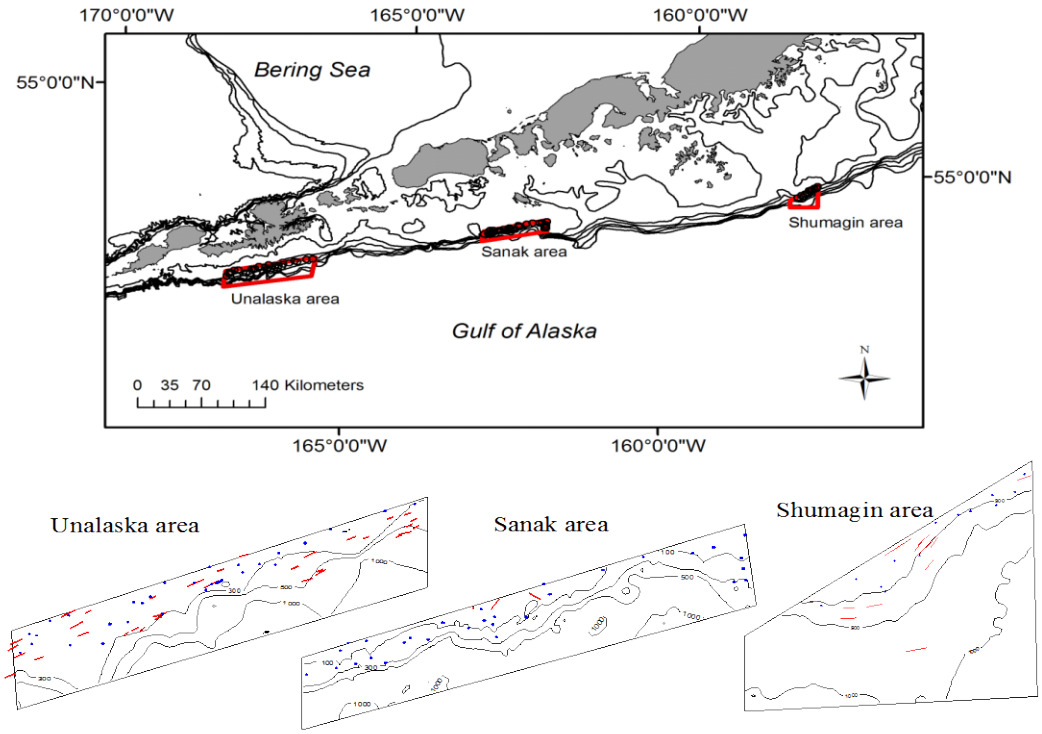

Figure 1. Map of the study areas showing the location of each of the three study sites (Unalaska, Shumagin and Sanak) and survey tows (red lines) and camera drops (blue lines).

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Four explanatory variables were utilized to predict the distribution of coral and sponge in the closed areas. These four variables were 1) bottom depth, 2) bottom slope, 3) seafloor roughness, and 4) seafloor hardness. Bottom depth was measured by a continuous depth recorder attached to the camera sled during deployment, the other three variables were all derived from the acoustic returns from the vessel echosounder. Each of these variables was interpolated onto a grid overlayed on the three closed areas.

The best-fitting model for both coral and sponge were used to make predictions of presence or absence on the 100 m^2 grid cell coverages of each of the closed areas. The model predictions were assessed by comparing them to the observed values where observations occurred. A second validation method used data collected in each of the closed areas during biennial bottom trawl surveys of the Gulf of Alaska. Tracklines for bottom trawl hauls occurring in each of the closed areas in the survey years since 1993

were overlayed on the model prediction grid. The model predictions of presence or absence integrated over the trawl path were compared to the bottom trawl catches to determine if presence of coral and sponge was accurately predicted in the bottom trawl survey catches.

The patterns in explanatory variables varied within each of the closed areas (Figure 2). For example, seafloor roughness was generally lower in the Unalaska area, while it was highest in the Shumagin area, where peak values were observed in deeper waters in the center of the closed area. Bottom hardness was observed to be higher in the Unalaska area, and harder areas generally occurred where depth was shallower.

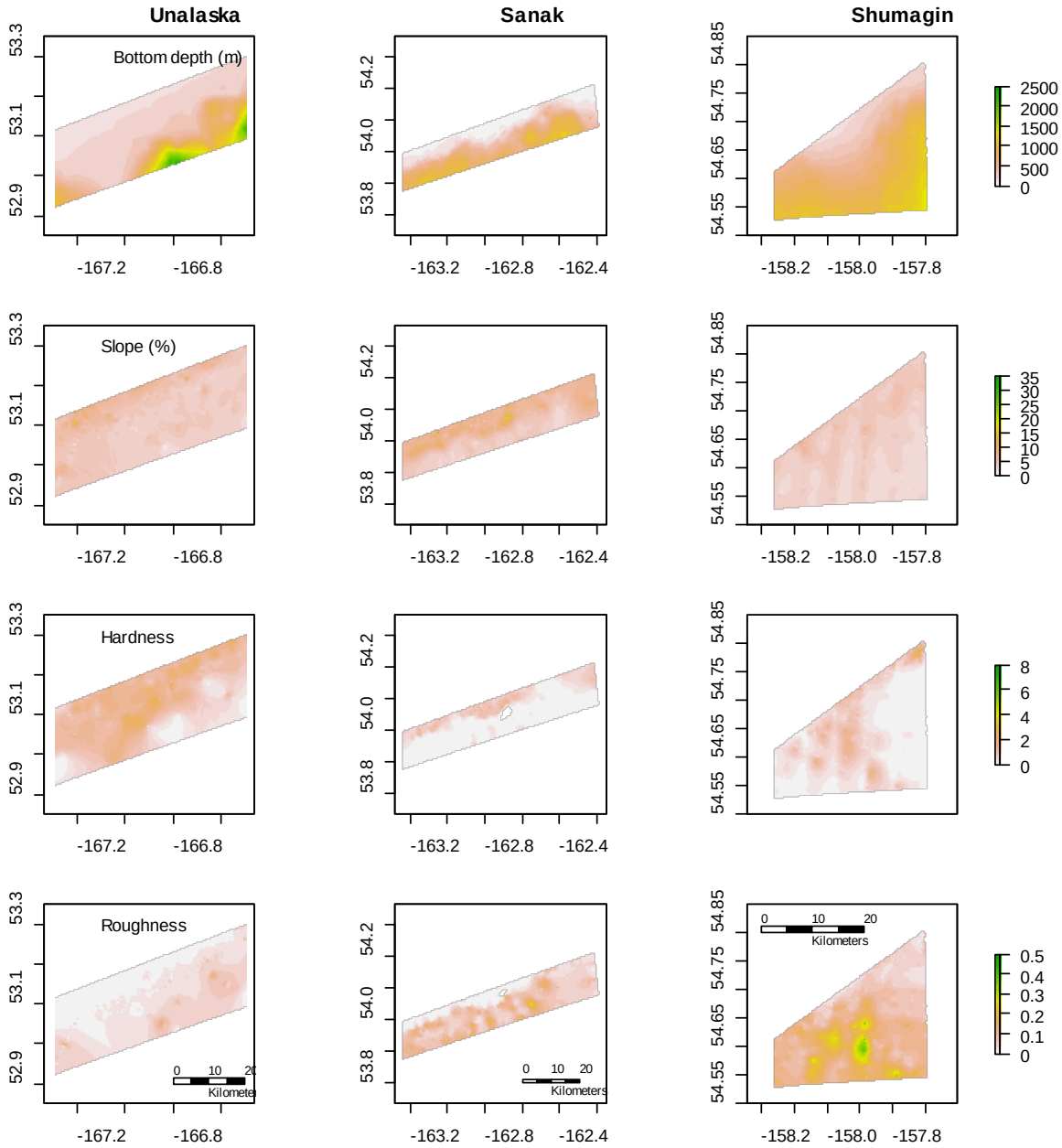

Figure 2. Distribution of explanatory variables, depth (m), slope (%), seafloor hardness and seafloor roughness from each of the three closed areas (Unalaska, Sanak, and Shumagin).

Upright sponges (vase or arborescent morphology) occurred at all three closed areas, although there were relatively few occurrences at the Unalaska and Shumagin areas Deepwater corals were not found in the Shumagin area and were observed only at one site in Unalaska. Coral occurred at 13 of 30 sites in the Sanak area. Sponges were distributed across all depths where video was recorded, while corals were distributed only at the shallowest locations (< 150 m) in the closed areas. The most common corals observed were gorgonians. *Fanellia fraseri* was the most abundant species, although a few other species such as *Calcigoria spiculifera* and some unidentified species were observed. All observed corals had an upright fan type morphology.

Table 1. Predicted and observed coral and sponge presence or absence from the model for camera drop transects (n=73) and bottom trawl survey hauls (n=30).

	Camera drop transects		**Bottom trawl survey trawls**	
Sponge	Predicted absent	Predicted present	Predicted absent	Predicted present
Observed absent	34	5	12	8
Observed present	5	29	6	4
Coral	Predicted absent	Predicted present	Predicted absent	Predicted present
Observed absent	57	2	21	5
Observed present	1	13	2	2

The best fitting model predicted coral presence or absence included depth, slope and seafloor hardness as explanatory variables. The probability of coral presence was highest at shallow depths and areas of flat seafloor (Figure 3). Probability of coral presence increased with increasing seafloor hardness as well. The model predictions agreed with the observed data for coral presence or absence in 96% of the 73 camera drops (Table 1).

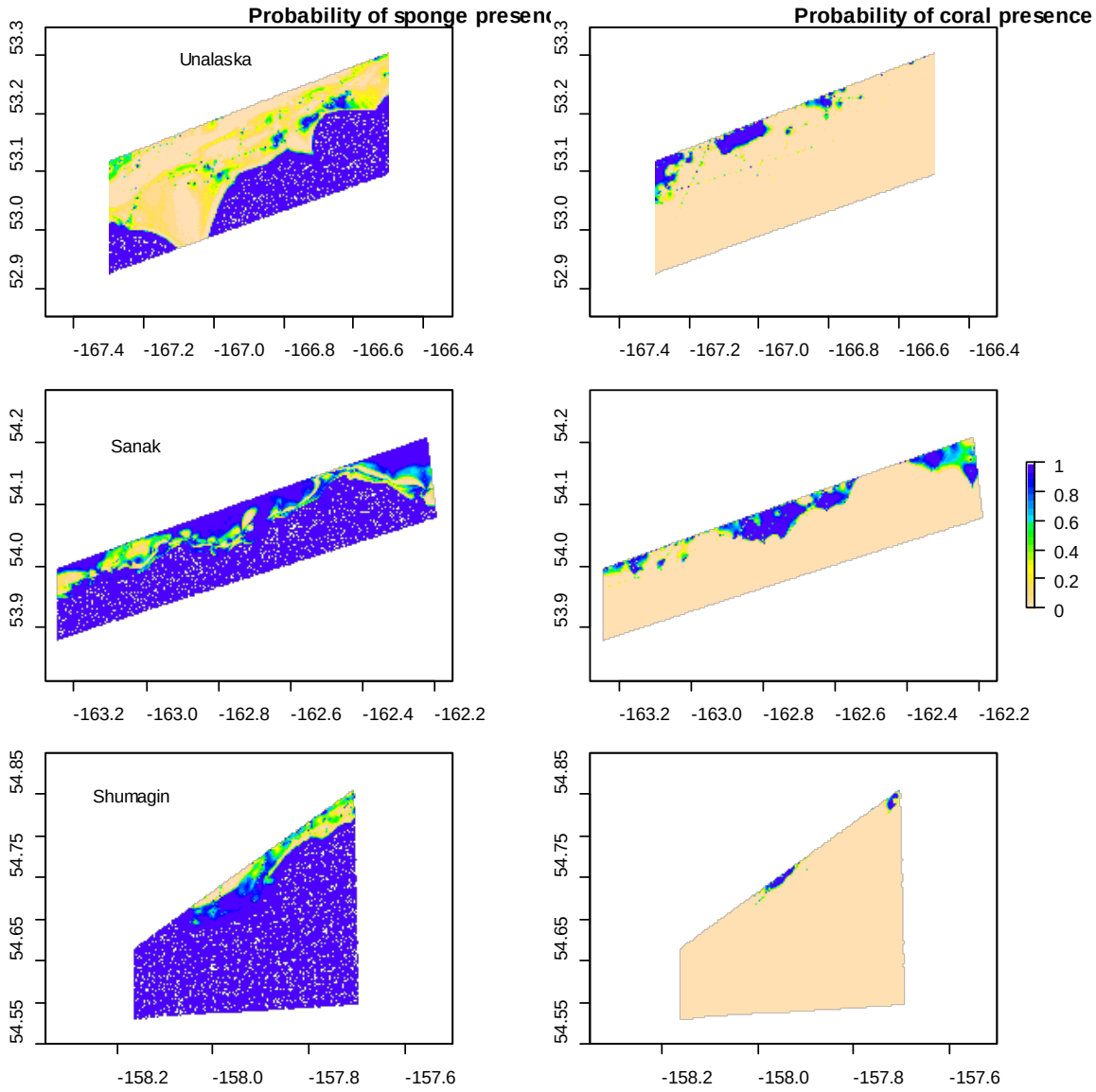

Figure 3. Model predictions for the probability of presence of sponge and coral for the three closed areas (Unalaska, Sanak and Shumagin).

The best fitting model for sponge included depth, slope and seafloor roughness. Similar to the coral model, the probability of sponge presence decreased sharply with depth to ~150 m. However, unlike for the coral model, there was an increase in the probability of sponge presence at depths > 300 m (Figure 3). The probability of sponge presence increased with increasing roughness and generally increased with increasing slope (greater than 4 %). The model predictions agreed with the observed data for sponge presence or absence at 86% of the camera drop locations. The mean probability of sponge absence at camera drop locations where sponge was observed to be absent was also below 0.5, however there were not the distinct differences in the mean probability between sites with observed sponge presence or absence as was seen for the case of coral.

When the best fitting coral GAM model was used to predict the presence of absence of coral across each of the three study areas, coral was predicted to occur in only a small fraction of the total area of the three sites In total 3.9%, 14.5%, and 1.2% of the Unalaska, Sanak and Shumagin areas respectively were predicted to have suitable coral habitat.

For sponge, the story was much different, as much of the area in the HAPC closures were predicted to have habitat suitable for sponge presence. However, much of the area predicted to have sponge present was at depths greater than 350 m. This was probably a result of the absence of samples from these depths. In total, 57% of the Unalaska site was predicted to have suitable sponge habitat while 88% and 94% of the Sanak and Shumagin areas were predicted to have suitable sponge habitat.

The best fitting coral model also performed reasonably well in predicting the occurrence of coral in the bottom trawl survey catch (Table 1). The model predicted the correct presence or absence in 77% of the cases. The best fitting model for sponge did not perform well at predicting the presence or absence of sponge in the bottom trawl hauls. The best fitting model was successful in only 16 of 30 cases (53% accuracy, Table 1).

A manuscript for peer-review is being prepared that describes these results. It is anticipated to go into the internal review process by October 31st, 2012.