ALASKA CORAL AND SPONGE INITIATIVE: A 3-YEAR RESEARCH PLAN

Research Results from Year 1

Research Plan for Year 2

November 14, 2012

SECTION 1: OVERVIEW AND BACKGROUND FOR ALASKA RESEARCH PLAN

The U.S. EEZ in Alaska (3.3 million km^2) contains more than 70% of the nations' continental shelf. The marine waters of Alaska support a diverse collection of abundant fishes and invertebrates. Many of these fish and invertebrates are harvested by commercial fishing and comprise some of the largest fisheries (by landed weight and economic value) in the U.S. In addition the marine waters of the continental shelf in Alaska contain significant deposits of oil and precious minerals that support a large resource extraction segment of the U.S. and Alaskan economy. These activities and resources require significant investments in research to support management. Concerns over the future effects of global climate change and ocean acidification increase the need for adequate scientific research to answer questions regarding the response of marine resources to the effects of warming.

Deep sea coral and sponge ecosystems are widespread throughout most of Alaska's marine waters. In some places, such as the western Aleutian Islands, these may be the most abundant cold-water coral and sponge communities in the world. Deep sea coral and sponge communities are associated with many different species of fishes and invertebrates in Alaska. For example, the consistent association of sponges and corals with juvenile Pacific ocean perch (S*ebastes alutus*) may imply better growth or survival in these habitats.

The challenges facing management of deep coral and sponge ecosystems in Alaska begin with the lack of knowledge of where these organisms occur in high abundance and diversity. Because of the size and scope of Alaska's continental shelf and slope, the vast majority of the area has not been surveyed for the presence of coral and sponge communities. Since the spatial distribution of these communities is not known in Alaska, it is difficult to predict the locations and types of human activities that may be threats to the deep-sea coral and sponge ecosystems.

A September 2010 workshop on deep-sea coral research priorities identified a number of important research questions that need to be addressed for effective management of these ecosystems. In addition, the North Pacific Fishery Management Council has identified outstanding questions related to coral and sponge research. The Essential Fish Habitat-Environmental Impact Statement of 2005 and the Habitat and Ecological Processes Research Program have also identified important questions that should be addressed to effectively manage deep-coral and sponge resources in Alaska.

The Alaska Deep Sea Coral and Sponge Initiative (AKCSI) is a program funded by the Deep Sea Coral Research and Technology Program (DSCRTP), which will attempt to provide answers to some of these research questions. The project is entering the second year (FY13) of a three year funding cycle (FY12-14). Ten specific projects have been undertaken that will address the following objectives:

1. Identify areas of high abundance of *Primnoa* corals in the Gulf of Alaska
2. Determine the distribution and areas of high abundance and diversity of sponges and corals in the Gulf of Alaska and Aleutian Islands
3. Estimate the recovery rates and sustainable impact rate for *Primnoa* corals in the Gulf of Alaska
4. Determine the productivity increases in terms of fish abundance and condition in areas with and without corals and sponges
5. Estimate the effects of long-line fishing on coral and sponge communities in Alaska
6. Estimate the connectivity of populations of *Primnoa* in the Gulf of Alaska, British Columbia and the west coast of the U.S. through genetic studies
7. Collect long-term data sets of O2 and pH from summer bottom trawl surveys
8. Set up long-term monitoring of nearshore and unique populations of coral and sponge in SE Alaska fjords
9. Improve the taxonomy of sponges and corals through special collections of unidentified specimens and collect data and specimens for paleoclimatological, microbial, and marine natural product studies
10. Compile a geologically based substrate map for the Gulf of Alaska and Aleutian Islands

SECTION 2: OVERVIEW OF RESULTS FROM FY12 OF THE ALASKA RESEARCH

In FY12, three major cruises were conducted in by AKCSI researchers in Alaska. In June 2012, a multibeam mapping cruise was conducted to collect bathymetry and backscatter information for three study sites in the southeast and one site in the central Gulf of Alaska (Figure 1). This mapping was conducted to support FY13-14 research activities for projects 1, 3 and 6 which will explore the distribution and ecology of *Primnoa* thickets in the Gulf of Alaska. An additional site at Cape Ommaney (Figure 1) had previously been mapped using multibeam acoustics and will comprise the fifth study site for projects 1, 3 and 6.

A second research cruise in early August was conducted aboard a chartered fishing vessel out of Kodiak Alaska (Figure 1). This project was designed to look at the ecology and production of commercial fishes from coral and non-coral habitats (Project 4). Researchers collected

underwater video at 18 transects inside and outside coral habitat. They also collected rockfish from coral and sponge habitat in four bottom trawl hauls. Oceanographic information and zooplankton samples were also collected. The research found that dusky rockfish (*Sebastes variabilis*) and northern rockfish (*Sebastes polyspinis*) were the most commonly identified species of commercial fish in the area.

Finally, a third research cruise was conducted in mid-August aboard a chartered fishing vessel to groundtruth a coral and sponge distribution model (Project 2). This research cruise conducted underwater camera drops at 106 locations in the central and eastern Aleutian Islands from Unimak Pass to Petrel spur (Figure 1). In addition, a region north of the Aleutian chain, Bowers ridge and Bowers bank were also explored. This work resulted in the first underwater camera observations from this unexplored area that has been closed to fishing since2007. Corals were observed at 53 of the 106 sites and sponges were observed at 69 of 106 sites.

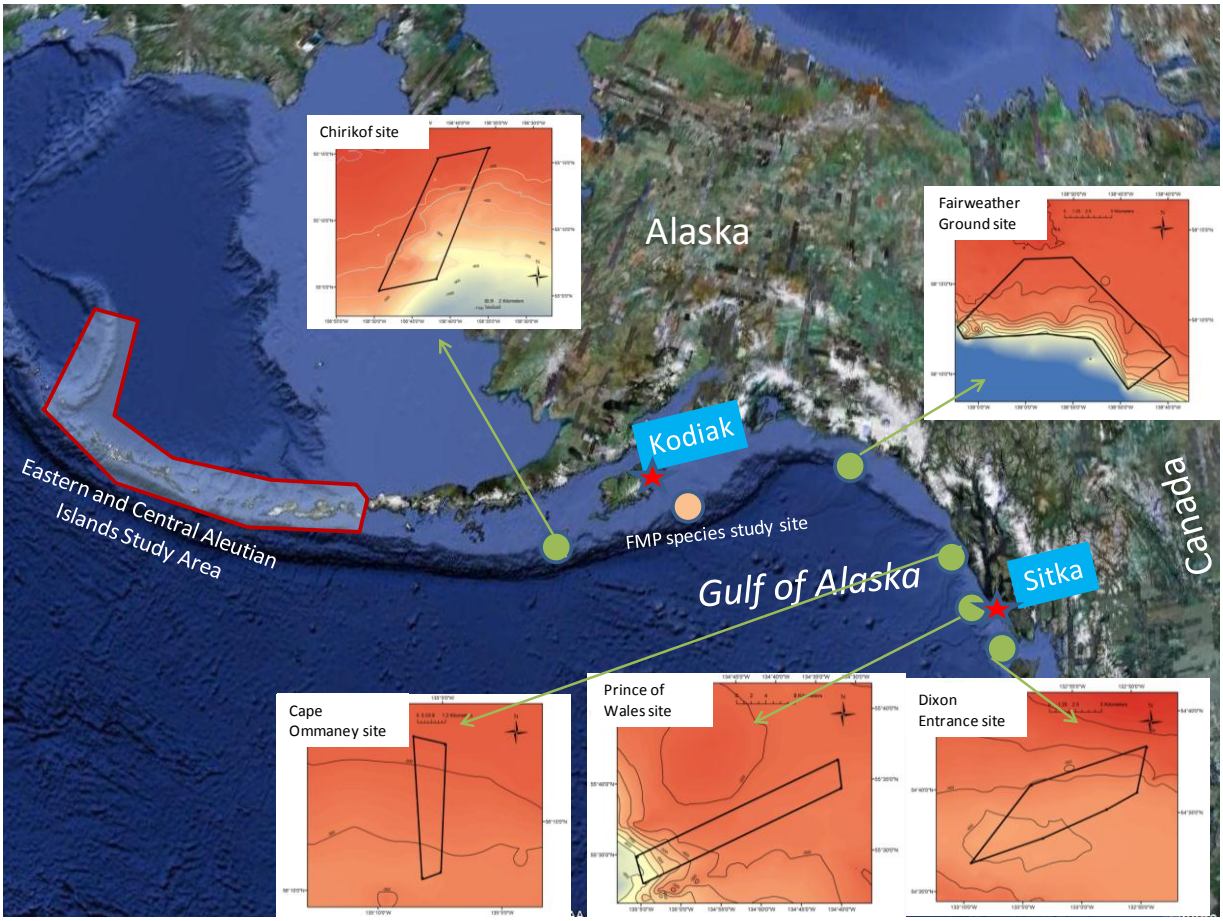

Figure 1. Locations of research cruises funded in FY12 by the DSCRTP.

In addition to these three cruises funded by AKCSI, there were also a number of field data collections carried out in partnership with other research activities in Alaska. In FY12, with partners in the AFSC RACE division (funded by the North Pacific Research Board) we purchased

two sensors to collect O2, salinity, turbidity and pH measurements on the headrope of bottom trawls used to conduct annual stock assessment surveys (Project 7). A deployment mechanism was constructed and tested during the 2012 eastern Bering Sea slope bottom trawl survey. Oceanographic data were collected on 168 tows along the Bering Sea slope from Bering Canyon to the U.S.-Russia border at depths to 1100 m.

Oceanographic equipment to measure O2, pH, salinity and temperature was also purchased to set up long-term monitoring stations in southeast Alaska and will be deployed this winter (Project 8).

In FY12 a pilot project was conducted to construct a camera system that could be attached to longline and pot fishing gear in Alaska to collect information on the impacts of these gears on benthic habitats (Project 5). A prototype camera system was constructed by research partners in the RACE division and was deployed off a vessel of opportunity in July 2012. Although the test revealed the difficulty of designing a deployment platform for the camera (the pot that it was attached to fell over upon reaching the seafloor), the design is relatively sound and testing will continue on this project through the winter with hopes of deploying the instrument again in FY13.

Field activities also included the collection of 120 sponge specimens for morphological taxonomic study and coral and sponge tissue samples for genetic analysis through collaboration with the Aleutian Islands bottom trawl survey (Project 9).

In anticipation of deploying settlement plates to serve as substrate for new *Primnoa* coral recruits (Project 3), a number of naturally occurring rocks were collected in southeast Alaska. These rocks were cut into regular squares and attachment points were inserted. The plates will be "cured" by holding them in flowing seawater tanks at the Auke Bay Labs wet laboratory during the winter. The arrays will then be deployed in *Primnoa* thickets at two sites in summer FY13.

Laboratory studies were also conducted to support the AKCSI program in FY12. Work on genetic markers for *Primnoa* corals (Project 6) was performed in our partner laboratory at the U.S. Geological Survey (Leetown Science Center, West Virginia). This work will support the analysis of genetic population connectivity among Alaska and west coast populations of *Primnoa* scheduled for FY13 and FY14.

Additional work was conducted at the AFSC and U.S. Geological Survey to compile bathymetry and sediment maps for the Aleutian Islands and Gulf of Alaska in anticipation of completing a geologically interpreted substrate map for these regions in FY14 (Project 10). Some of the work on this project was funded through a small research grant from DSCRTP in FY11. Thus, the continuation of this work resulted in the completion of the Aleutian Islands region this year. Additionally, the data compilation in the Gulf of Alaska is proceeding at an accelerated pace thanks to collaboration with the NPRB-funded Gulf of Alaska-Integrated Ecosystem Research Program, which has similar needs for bathymetric data.

Detailed accounts of first year results for each project are reported in Appendix 1.

SECTION 2: RESEARCH ACTIVITIES TO BE FUNDED IN FY13 IN ALASKA

In FY13 three field programs will build on the 1st year's efforts to examine the distribution and abundance of coral and sponge ecosystems. First, the spatial distribution modeling project (Project 2) will focus its efforts on the eastern Aleutian Islands during another 15-day cruise.

Second, the FMP production project (Project 4) will also continue to collect fish and video data on the differences in production between sites with and without coral and sponge communities. This project will collect a second year of data at the same locations as in FY12. Additional funding to expand the sampling into winter and spring periods was obtained through a successful proposal to NPRB and this sampling will begin in winter FY14.

Third, the main field effort in FY13 will use a remotely operated vehicle (ROV) to conduct sampling and surveys for Projects 1, 3, and 6. The bulk of the field effort will focus on the project to examine areas of high *Primnoa* abundance (Project 1). With the new multibeam maps of the Dixon Entrance, Prince of Wales, Fairweather Grounds, plus the additional site that has previously been mapped (Cape Ommaney), field sampling will be conducted to map the distribution and species composition of corals and sponges within each site. The field sampling will be carried out with a remotely operated vehicle (ROV) that is capable of collecting specimens *in situ* and collecting visual data on species identification, abundance and habitat from strip transects. Because of the distance to the fifth site (Chirikof), it will be explored using a drop camera aboard a vessel of opportunity in FY13 with the plan to visit this site with the ROV in FY14.

Another component of this ROV cruise will use stereo video to examine the size structure of *Primnoa* communities in a landscape ecology framework (Project 3). The measurements will require additional ROV transects beyond those that map the distribution of *Primnoa* at each site. By measuring the size and biomass of *Primnoa* corals under different conditions of fishing pressure, estimates of population level growth, recovery and recruitment will be inferred. This research line will predict (using Ecosim modeling) the level of fishing disturbance that can be sustained by *Primnoa* thickets in Alaska. In addition, settlement plates will be deployed in *Primnoa* thickets at the Fairweather Grounds and Cape Ommaney sites and will be collected in future years (FY14 and beyond).

The final component of this cruise will use the ROV to collect tissue samples from up to 50 individual Primnoa colonies in order to examine the genetic connectivity of Alaska (and west coast) populations of Primnoa (Project 6). The collections will be made at all four study sites in the eastern Gulf of Alaska.

Other activities will also be continued in FY12. The pilot project to deploy a camera system on commercial longline and pot gear will continue gear development (Project 5). Some of this testing is ongoing through the fall and winter of FY13. It is expected that another vessel of opportunity (either through AFSC research activities or collaboration with industry) will be available for field testing in the summer of FY13.

In FY13, oceanographic data will be collected from the bottom trawl survey scheduled for the Gulf of Alaska (Project 7). The oceanographic instruments purchased and tested in FY12 will be deployed on the headrope of the AFSC research trawl during all three legs of the bottom trawl survey to collect O2, pH, turbidity and salinity from the Islands of Four Mountains to Dixon Entrance at depths to 1000 m.

The long-term monitoring site at a shallow population of *Primnoa* (30 m depth) in Tracy Arm, southeast Alaska will be instrumented in January 2013 and collect data throughout the year until collection and redeployment in January 2014 (Project 8).

New partnerships will be developed and existing partnerships continued to collect specimens of corals and sponges for taxonomic resolution and special studies of paleoclimatology and medicinal purposes (Project 9). These collections will occur both during the ROV fieldwork (Projects 1, 3 and 6) as well as during the 2013 Gulf of Alaska bottom trawl survey.

Finally, in FY13, researchers at the University of Alaska Fairbanks and the Tombolo Institute will continue to collaborate with NOAA and USGS researchers to compile an interpreted (from geology) substrate and sediment map for Alaskan waters based on existing multibeam bathymetry, sediment data, and available seafloor imagery (Project 10).

More detailed information on proposed activities for FY13 can be found in Appendix 1.

SECTION 3: PROPOSED BUDGET FOR AKCSI IN FY13

Below are two budget contingencies for FY13. The first assumes full funding of the AKCSI research ($900K), while the second scenario assumes reduced funding of the AKCSI research ($800K).

Budget Table (FY12-14)

Project #	Project title	Lead Investigator(s)	FY12	FY13	FY14
1	Habitat areas of particular concern in the GOA	Stone, Etnoyer, Reynolds	$324,352	$498,500	$301,815
2	Predictive modeling of coral and sponge	Rooper	$192,783	$118,413	$241,700
3	*Primnoa* Recovery	Etnoyer, Stone, Rooper	$5,000	$50,000	$50,000
4	FMP Production	Conrath, Knoth, Rooper	$150,340	$147,820	$147,820
5	Long-line and pot impacts	Raring, Rooper, Williams Lunsford	$1,689	$9,300	$9,300
6	Genetic connectivity of *Primnoa*	Stone, Morrison, Berntson	$13,000	$0	$3,000
7	O2 and pH monitoring	Hoff, Rooper	$58,816	$0	$0
8	Long term monitoring in SEAK	Stone, Etnoyer	$28,000	$3,000	$33,000
9	Improving sponge and coral taxonomy	Stone	$0	$0	$26,000
10	Geological substrate map for Alaska	Reynolds, Greene, Zimmermann, Reid	$111,260	$61,422	$75,820
	AM Travel		$14,760	$11,545	$11,545
	Total		**$900,000**	**$900,000**	**$900,000**

Budget Table (FY12-14)

Project #	Project title	Lead Investigator(s)	FY12	FY13	FY14
1	Habitat areas of particular concern in the GOA	Stone, Etnoyer, Reynolds	$324,352	$498,500	$137,240
2	Predictive modeling of coral and sponge	Rooper	$192,783	$18,613	$306,275
3	*Primnoa* Recovery	Etnoyer, Stone, Rooper	$5,000	$50,000	$50,000
4	FMP Production	Conrath, Knoth, Rooper	$150,340	$147,820	$147,820
5	Long-line and pot impacts	Raring, Rooper, Williams Lunsford	$1,689	$9,300	$9,300
6	Genetic connectivity of *Primnoa*	Stone, Morrison, Berntson	$13,000	$0	$3,000
7	O2 and pH monitoring	Hoff, Rooper	$58,816	$0	$0
8	Long term monitoring in SEAK	Stone, Etnoyer	$28,000	$3,000	$33,000
9	Improving sponge and coral taxonomy	Stone	$0	$0	$26,000
10	Geological substrate map for Alaska	Reynolds, Greene, Zimmermann, Reid	$111,260	$61,222	$75,820
	Annual Meeting Travel		$14,760	$11,545	$11,545
	Total		**$900,000**	**$800,000**	**$800,000**

APPENDIX 1: SUMMARY OF INDIVIDUAL RESULTS FROM FY12 PROJECTS AND PROPOSED ACTIVITY IN FY13

Project 1. Primnoa Habitat Areas in the Gulf of Alaska

Principal Investigators: Bob Stone (AFSC-ABL, bob.stone@noaa.gov), Jennifer Reynolds (UAF-WCNURP, jrreynolds@alaska.edu), Peter Etnoyer (NMFS-SEFSC, peter.etnoyer@noaa.gov), Gary Greene (Tombolo Institute, greene@mlml.calstate.edu) and Chris Rooper (AFSC-RACE, chris.rooper@noaa.gov)

Background and Justification: Deep-sea coral and sponge ecosystems are widespread throughout most of Alaska's marine waters. In some places, such as the western Aleutian Islands, these may be the most diverse and abundant deep-sea coral and sponge communities in the world. Deep-sea coral and sponge communities are associated with many different species of fishes and invertebrates in Alaska. Because of their biology, these benthic invertebrates are potentially impacted by climate change and ocean acidification. Deep-sea coral and sponge ecosystems are also vulnerable to the effects of commercial fishing activities in Alaska. Because of the size and scope of Alaska's continental shelf and slope, the vast majority of the area has not been surveyed for deep-sea coral and sponge abundance. Since the spatial distribution of these communities is not known in Alaska, it is difficult to predict the locations and types of human activities and climate impacts that may affect deep-sea coral and sponge ecosystems.

In 2012, NOAA's Deep Sea Coral Research and Technology Program began sponsoring a three year field research program in the Alaska region to better understand the location, distribution, ecosystem role, and status of deep-sea coral and sponge habitats. A project to be conducted in 2013-14 will use a deep-diving ROV or submersible to verify the location of red tree coral (*Primnoa pacifica*) thickets, black coral (*Chrysopathes speciosa*, *C. formosa*, *Bathypathes patula*, and *Lillipathes wingi*) groves, and bamboo coral (*Isidella tentaculum*) groves that are apparent from bycatch rates from the annual NMFS sablefish stock assessment survey. Two additional projects will deploy settlement plates in Primnoa thickets, estimate Primnoa population size structure, and collect samples for genetic analysis. The first stage of these projects was to produce maps of multibeam bathymetry and backscatter for the study locations where Primnoa coral thickets occur or are suspected to occur was conducted in 2012. This will allow safe and focused ROV/submersible operations during fieldwork in 2013-14.

Methods: From June 4, 2012 – June 15, 2012 and July 11-12, 2012 a research mapping cruise was conducted aboard the R/V *Pacific Star*. Fugro-Pelagos, Inc. was contracted to conduct the mapping of each of four study sites (Figure 1). Each of these sites was mapped (100 percent coverage) to ~800 m depth with a Reson Seabat7111 multibeam sonar operating at 110 kHz. The mapping was directed by Dr. Jennifer Reynolds (WCNURP/University of Alaska Fairbanks) who participated in the June portion of the cruise. The cruise began in Seattle, Washington and ended in Kodiak, Alaska.

Preliminary Results: Bathymetry and backscatter maps for each of the study areas were produced in August 2012 (Figures 2-5). In total 522.8 linear nautical miles were mapped over an area of 167.2 square nautical miles. Mapped areas were from approximately 100 m to 1287 m in depth. The initial attempt at mapping the Chirikof area in June was hampered by poor weather. Therefore, Fugro-Pelagos personnel performed an additional survey on July 11-12 that produced an acceptable backscatter map.

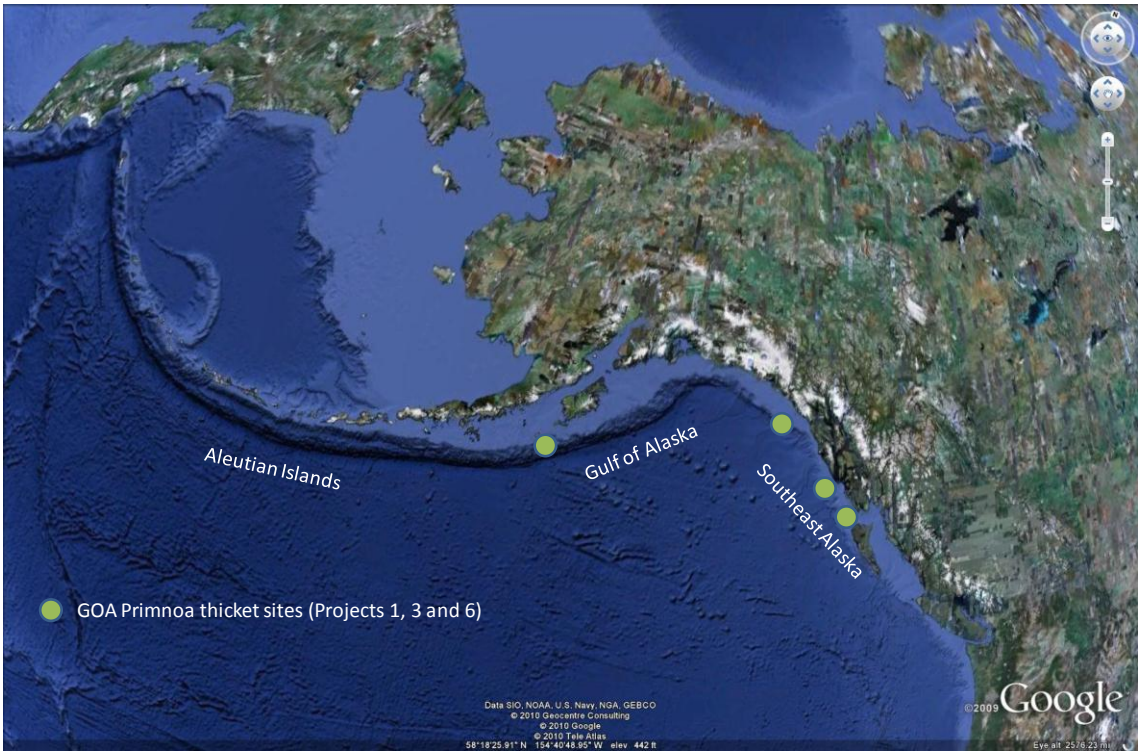

Figure 1. Gulf of Alaska map showing distribution of sites to be multibeamed (roughly positioned from left to right: Chirikof, Fairweather Grounds, Prince of Wales and Dixon entrance).

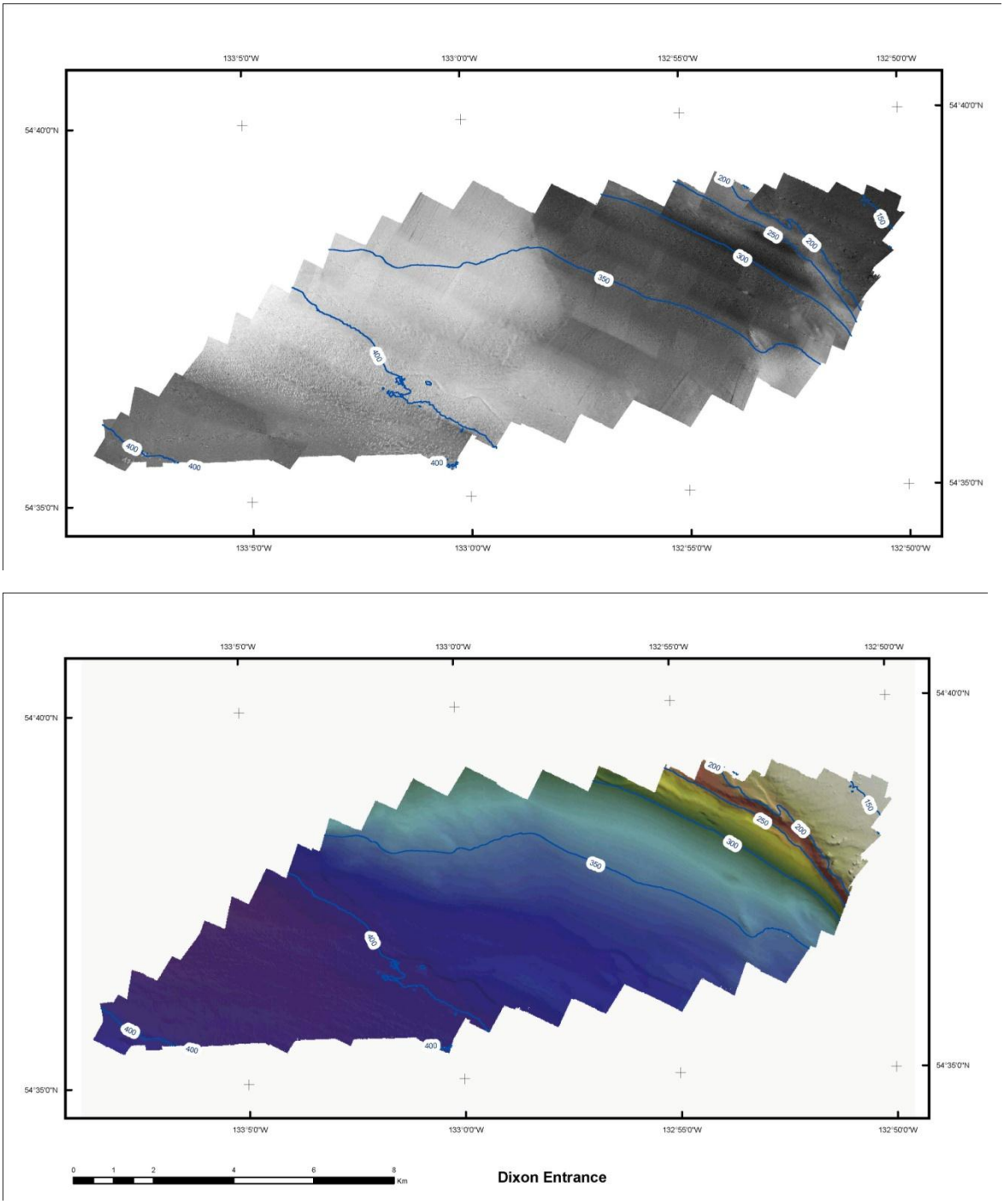

Figure 2. Preliminary multibeam backscatter (upper panel) and bathymetry (lower panel) from the Dixon Entrance study site. Blue contour lines are drawn at 50m intervals from 150m to 400m water depth.

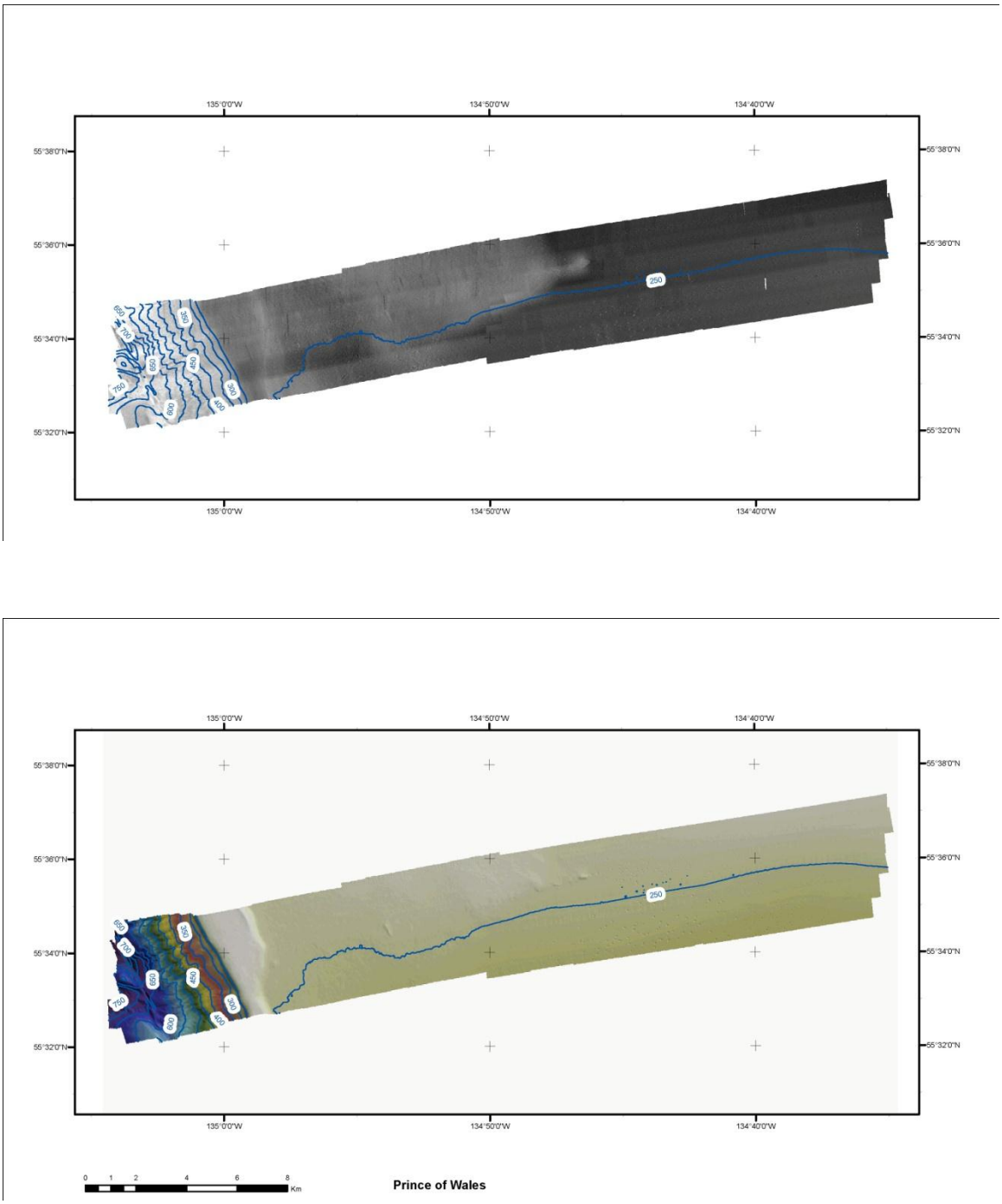

Figure 3. Preliminary multibeam backscatter (upper panel) and bathymetry (lower panel) from the Prince of Wales study site. The main contour line (blue) is drawn at 250m; deeper contours are shown at 50m intervals.

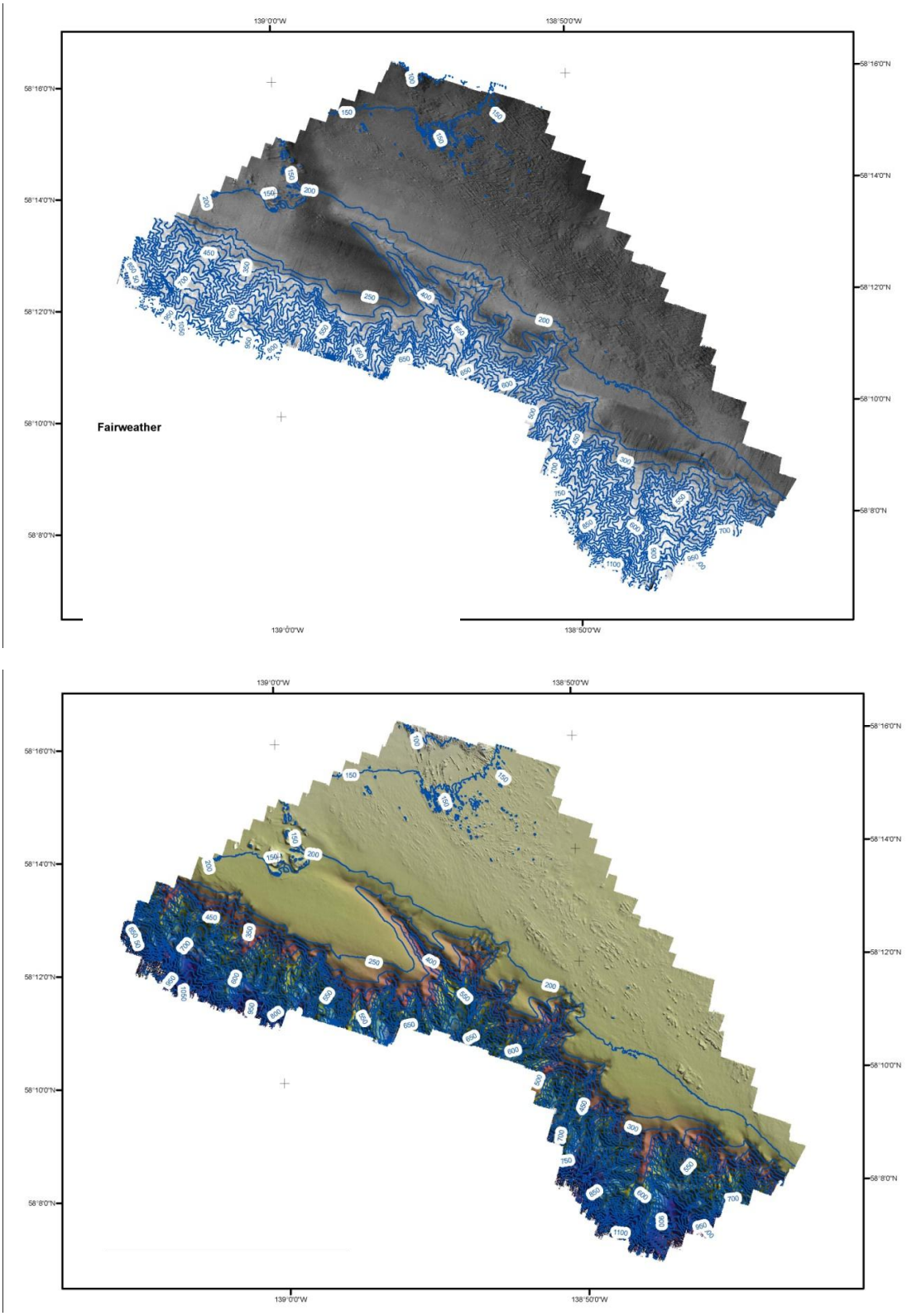

Figure 4. Preliminary multibeam backscatter (upper panel) and bathymetry (lower panel) from the Fairweather Grounds study site. Blue contour lines are drawn at 50m intervals from 100m to 1100m water depth.

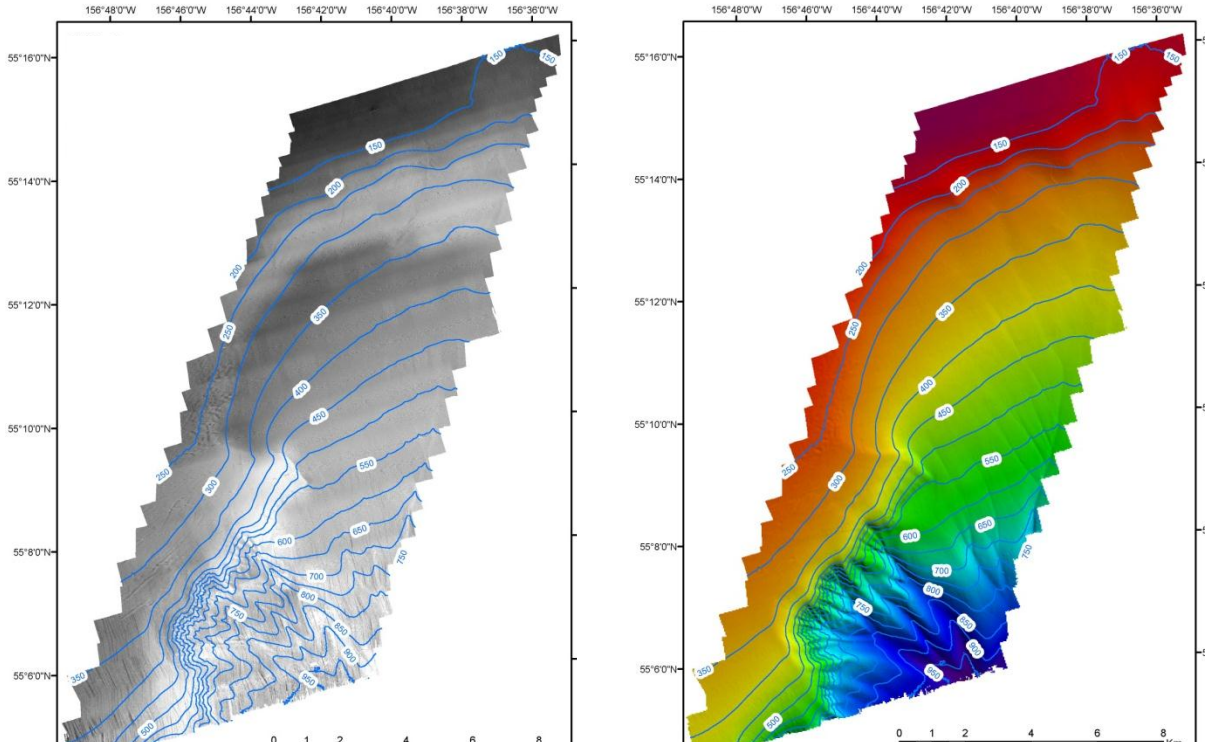

Figure 5. Preliminary multibeam backscatter (upper left panel) and bathymetry (lower right panel) from the Chirikof study site. Contour lines (blue) are drawn at 50m intervals from 150m to 950m water depth.

Proposed Activities in FY13: In FY13, this is the highest priority project for completion. There will be an 11 day cruise aboard a research vessel equipped with an ROV capable to diving depths of 800 m during July or August 2013. The ROV will be used to conduct 4-8 strip transects at each site (Project 1) and 2 sampling dives per site (Projects 3 and 6).

Strip transects (Project 1): The location and number of transects needed at each site will be determined by interpretation of the multibeam bathymetry data collected in 2012. Transects will be chosen at random within the drop stone or bedrock habitat that comprises suitable substrate for red tree corals. We anticipate that 4-8 transects lasting up to three hours each will be needed to survey each site. Transects will cover the entire depth range (generally 150 to 800 m) at each site. The ROV will follow a predetermined bearing along each transect generally oriented perpendicular to the slope or from deep to shallow water, and its course will be modified when necessary. ROV speed will be maintained near 0.50 m s-1 depending on seafloor terrain and near-bottom currents. Video footage of the seafloor will be collected with at least two cameras. The primary camera will be mounted with the imaging plane directed near perpendicular to the seafloor so as to provide a fixed-width image area delineated by mounted lasers from

which counts of biota will be made. A stereo-image camera system will be mounted forward with the imaging plane directed at a 45º angle to the seafloor. This camera system will be used to provide a landscape-view forward of the transect area from which coral colony size will be measured. Stereo images of corals will be continuously recorded. In addition, all video cameras will record two parallel laser marks 10 cm apart projected onto the seafloor to provide calibration for measurements of the dimensions of the image area (i.e. transect width and length), and size of fauna. The ROV will be equipped with an Oceanographic Profiler used to collect depth, temperature, salinity, and density profiles of the water column. Additional oceanographic data and samples will be collected with a CTD rosette and pH and O2 sensor (provided by the AFSC).

In the laboratory, all corals, sponges, fish and identifiable invertebrates within the strip transect video will be identified to species and counted. Corals and sponges will be classified as damaged if they have missing or broken branches, are detached from the seafloor, or are attached but overturned and lying in contact with the seafloor. Broken skeletons and those with evidence of an injury caused by physical disturbance will also be classified as damaged. Any evidence for the nature of the disturbance, e.g., natural disturbance by slumps, landslides, earthquake events, anthropogenic disturbance by fishing gear, or predation will be noted. Mobile fauna (fish and crabs) will be enumerated from the video. Each organism's distance from and interaction with (such as hiding behavior) red tree coral will be recorded. Densities of fish and crabs observed inside and outside of red tree coral habitat will be recorded and compared. Habitat variables will be recorded using established criteria for the region (Stone and Alcorn, in review), and both sets of video recordings will be used to groundtruth substrate maps prepared from the multibeam data.

Voucher specimens will be collected at intermittent stops along transects to confirm species identifications. A 5 function or 7 function hydraulic manipulator arm will be used to collect the coral, symbiotic fauna, and geological samples. Samples will be stored in a bio-box and science basket assembly attached to the ROV. Coral and sponge samples will be prepared and preserved appropriately for morphological taxonomic identification, mitochondrial DNA analysis, and for paleoclimatological and age analyses.

ROV activities will be conducted on a 24 hour basis and will require 8-10 scientists. The ROV operations outlined in the budget below include additional time for Project 3 transects and Project 6 genetics collections.

Contingencies:

1) Based on our preliminary estimates, this project will cost more than previously expected in FY13. If there are any savings under the ROV contracts, these funds will be used to make up the current reduction in Project 2, and reductions in Projects 8, 9 and 10.
2) Additionally, if funds beyond what is expected here are necessary, these will be taken from Project 2 in FY13 and corresponding increases in Project 2 will be made in FY14.

Budget Table and Narrative:

	Description	Amount FY12	Amount FY13	Amount FY14
1100	Direct Labor:			
1150	Overtime and Hazard Pay			
	4 NOAA Employees		$10,000	
1200	Benefits:			
2100	Travel			
	8-10 Scientists to Sitka		$20,000	
2200	Transportation			
	Sample shipping		$500	
2300	Rents et al.			
2400	Printing			
2500	Contracts:			
	Multibeam mapping contract	$324,352		
	Mob/Demob of ROV (3 days)		$22,500	
	Ship transit to and from Sitka (6 days)		$108,000	
	Fieldwork (Ship + ROV, 24 hrs, 11 days)		$335,500	
	Fieldwork in FY14			$112,040
2600	Supplies and Materials:		$2,000	
3100	Equipment:			
4100	Grants			
	Total	$324,352	$498,500	$112,040

Project 2: Groundtruthing areas of predicted high diversity-high abundance coral and sponge in the Aleutian Islands

Principal Investigators: Chris Rooper AFSC-RACE (chris.rooper@noaa.gov), Bob Stone AFSC-ABL (bob.stone@noaa.gov)

Background and Justification: Effective management of deep coral and sponge ecosystems in Alaska requires knowledge of where these organisms occur and where they are absent. Effective management also requires knowledge of areas of high diversity and high abundance. The immensity of Alaska's marine waters necessitates the development of predictive models to best determine where sponges and corals are located, since not every site can be explored given our available time and resources. Therefore a systematic and analytical approach to determining where coral and sponge ecosystems are present is needed. This approach needs to accurately predict the presence or absence of corals and sponges, the diversity of the community and the abundance of the organisms. Although preliminary modeling and data-mining has proved useful for generating a starting point for these analyses, data to support and groundtruth a systematic modeling approach is not currently available for most areas of Alaska. In FY12-14 a major component of analysis and fieldwork is designed to address this informational need.

Results to Date: We first developed a distribution model for coral and sponge that utilizes data from bottom trawl surveys in the Aleutian Islands. The predictor variables were limited to variables collected during the bottom trawl survey (i.e. water temperature, depth, position) and gross bathymetric features (i.e. slope, rugosity, aspect). The predicted variables were the presence or absence, abundance and family diversity of corals and sponges. The objective of the modeling was to develop and parameterize a spatially explicit model to predict coral and sponge presence, abundance and diversity using existing data on a 100 m by 100 m grid in the Aleutian Islands (this effort is mostly completed, see Figure 1 for example). The model provided a basis for fieldwork examining where corals and sponges are most abundant and diverse in the existing data. It also pointed out the areas where corals and sponges are likely to be present in high diversity or abundance, but where no previous information exists.

We conducted fieldwork from August 16-28th in the eastern and central Aleutian Islands designed to provide an assessment of the accuracy of the distribution model of coral and sponge in the eastern and central Aleutian Islands. The fieldwork was carried out at 106 randomly selected sites in the eastern and central Aleutian Islands from Unimak pass to Bowers Ridge (Figure 2). At each of these locations a 15 minute camera drop was conducted from the random starting point, drifting with the prevailing current. A stereo drop camera system was used as the primary tool for determining the presence or absence of sponges and corals, the species identification and the abundance. Average depths of camera drops ranged from 49.5 to 866 m (Figure 3). Additionally, ES60 data (acoustic data) that may be used to infer seafloor characteristics, water temperature data, and vessel trackline depth and position data were collected.

Initial observations made at the time the image data was collected during the survey indicated that sponges were observed at 69 of the 106 sites and hydrocorals or gorgonians were found at 53 of the 106 sites. However, further detailed analysis of the image data will

be conducted in the next 6 months to produce accurate numbers for coral and sponge species presence, abundance and diversity.

A prolonged stretch of good weather allowed us to conduct 17 camera drops along Bowers Ridge and Bowers Bank. This is the first ever (that we are aware of) underwater exploration of this area that is currently closed to mobile bottom contacting fishing. The initial video analysis indicated much of the Bowers Ridge feature was composed of sand substrates in deep waters (500-800 m) with a seamount like feature at the north end which had some hard substrate with sponges and corals. Bowers Bank had large areas of sand substrate with sponges and corals attached to harder substrates at the summit of the bank. In these areas there was a mix of sand and cobble substrate principally dominated by demosponges, hexactinellid sponges, and hydrocorals. There were low numbers of gorgonians (*Plumarella*, *Muriceides*, *Paragorgia*, *Isidella* sp. and *Keratoisis* sp.) Fishes included Pacific ocean perch, Pacific cod and golden king crab.

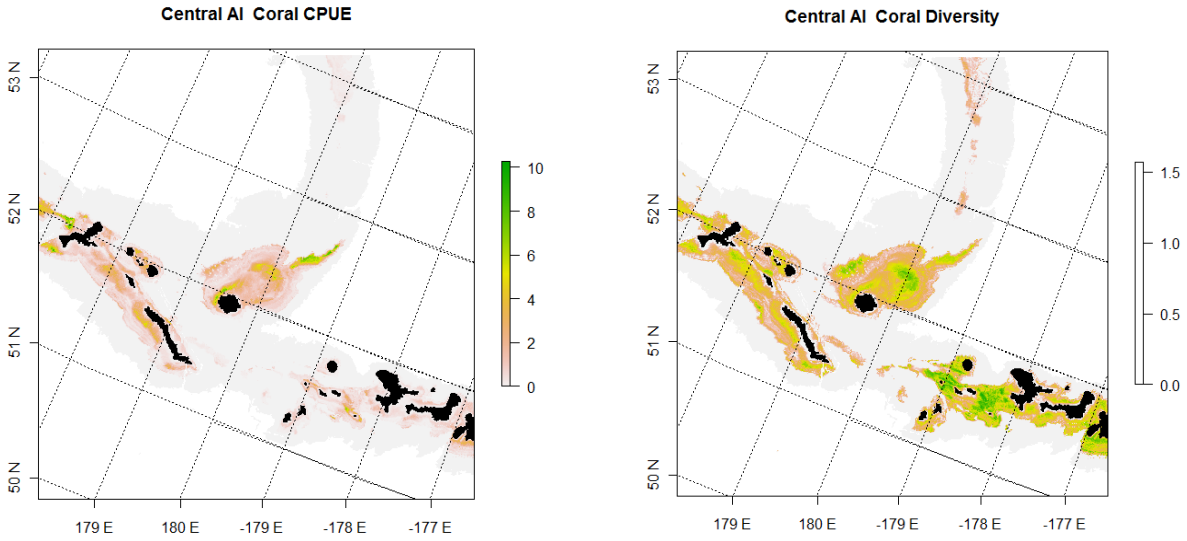

Figure 1. Predicted abundance and diversity of coral families in the central Aleutian Islands from a model based on bottom trawl survey data from 1991-2010.

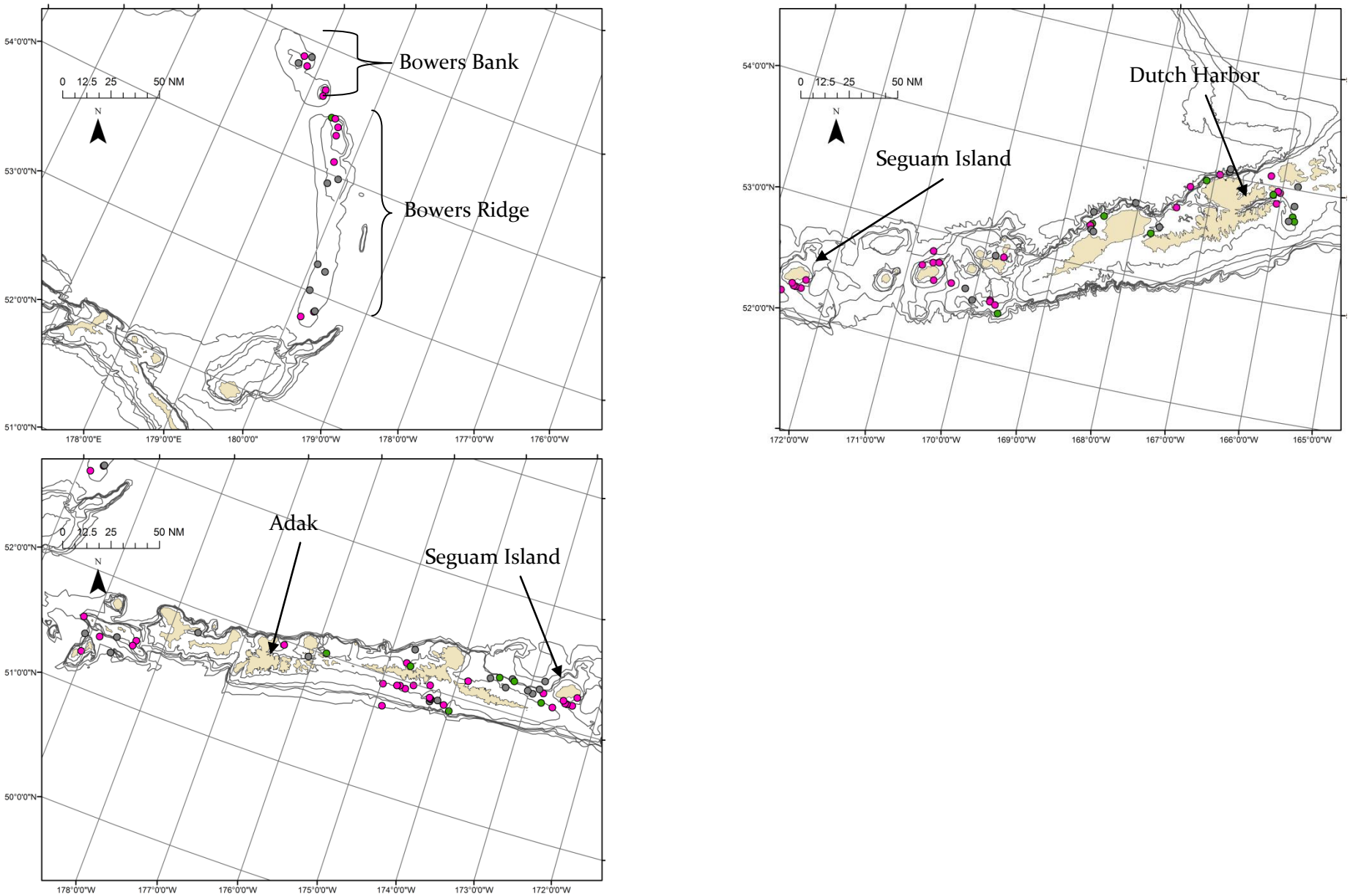

Figure 2. Random locations where sampling with a stereo drop camera system was conducted during the August 16-28th cruise at Bowers Ridge and Bank (top left), in the eastern (top right) and central (bottom left) Aleutian Islands. Pink circles indicated sites where both sponge and coral were observed, green circles indicate sites where only sponge was observed and grey circles indicate sites where neither sponge nor coral was observed

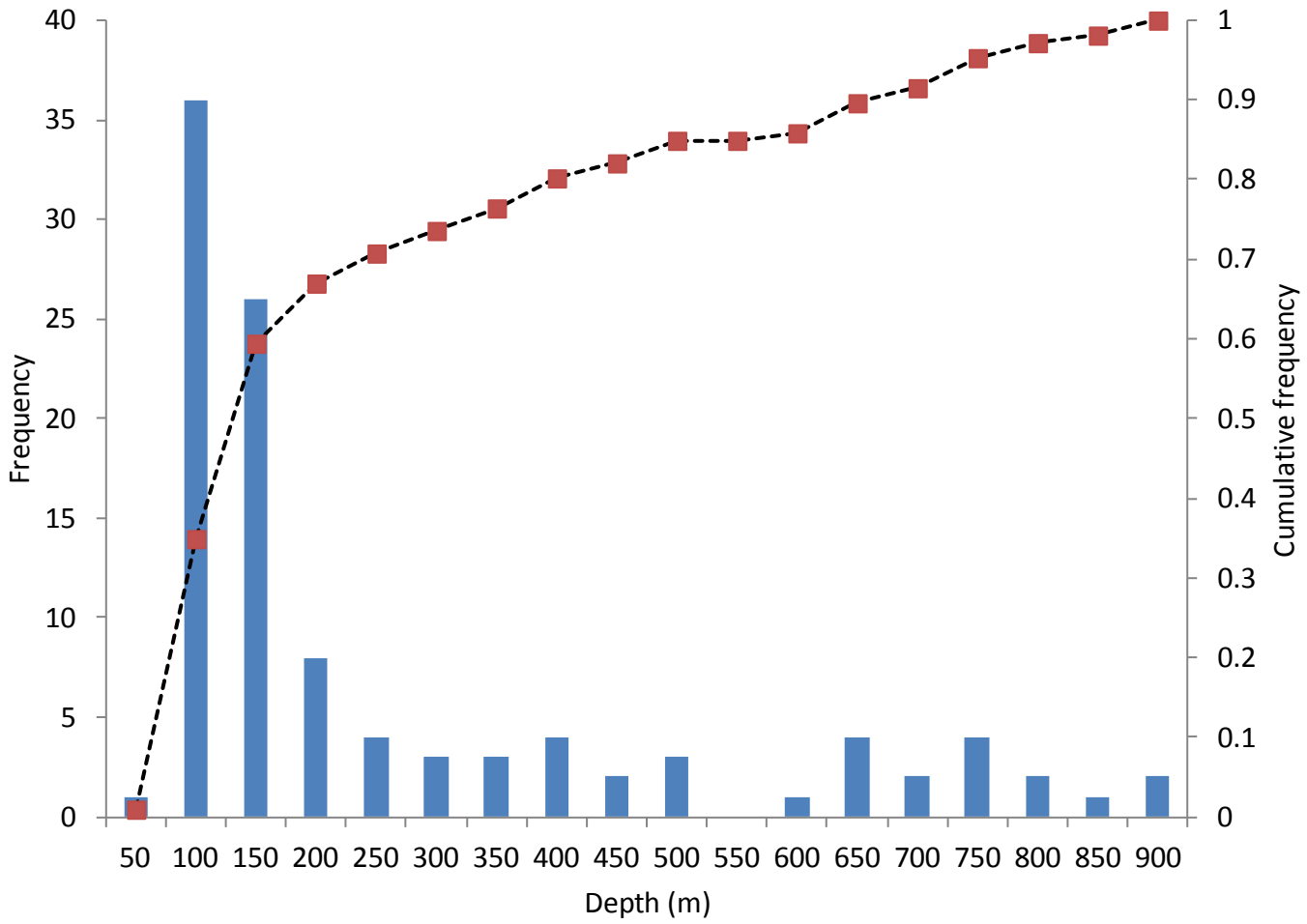

Figure 3 Sampling distribution by depth for sites occupied during August 2012 field sampling (August 16-28).

Proposed Activities in FY13: In FY13, this project was scheduled to conduct an additional 15 days of fieldwork in the eastern and central Aleutian Islands at 100-150 additional randomly selected stations. This would complete the drop camera sampling in those two regions. Due to budget constraints imposed by the ROV activities, we anticipate this number of days will be reduced in FY13 (see contingencies below), but the days will be added on to FY14.

Contingencies:

1) This project has been reduced from 15 days to 11 days of fieldwork in FY13 to accommodate the anticipated $900K budget. In order to offset this reduction a proposal for funding under the Co-operative research program ($70K) has been submitted.
2) Under an $800K budget scenario, the fieldwork for this project will be eliminated in FY13 and expanded (from 15 days to 30 days) in FY14 to make up the difference.

Budget Table and Narrative:

	Description	Amount FY12	Amount FY13*	Amount FY14
1100	Direct Labor:			
1150	Overtime and Hazard Pay	$10,589	$2,530	$4,960
1200	Benefits:			
2100	Travel	$5,638	$2,800	$5,640
2200	Transportation	$2,483	$1,700	$1,700
2300	Rents et al.			
	Sea Storm (11 days in FY13, 19 in FY14)	$102,450	$76,450	$152,900
2400	Printing			
2500	Contracts:			
2600	Supplies and Materials:		$2,325	$5,000
	Boat Fuel	$31,730	$22,750	$50,050
3100	Equipment:	$39,893	$9,858	$21,450
4100	Grants			
	Total	$192,783	$118,413	$241,700

*under $800K budget the fieldwork for this project would be eliminated in FY13 and $18,613 would be used to purchase equipment and supplies for an expanded FY14 effort

Project 3. Red tree coral growth, recruitment, and recovery from fishing disturbance

Principal Investigators: Peter Etnoyer NCCOS-CCEHBR- (Peter.Etnoyer@noaa.gov), Robert Stone (AFSC-ABL), Chris Rooper (AFSC-RACE)

Background and Justification: One of the most important priorities identified for coral research in Alaska in the September 2010 DSC Workshop, the North Pacific Fisheries Management Council and the EFH-EIS is to determine the growth and recovery rates of coral populations in the presence of fishing activity. This project seeks to understand the resilience of *Primnoa pacifica* thickets to bottom contact fishing gear in order to answer the question "what is a sustainable level of mortality for *Primnoa pacifica* in Alaska?"

Results to Date: In FY12, this project used $5K to issue a contract for building settlement plates from local rock sources. After consultations with geologists familiar with the substrates that will most likely be present in Primnoa thickets, a local source of these rock species were obtained. The rocks were then cut into 16 regular shaped (12 X 12) settlement plates with an attachment point. The settlement plates will be deployed in Auke Bay, Alaska for "seasoning" prior to deployment in Primnoa thickets in FY13 at Cape Ommanney and Fairweather Grounds study areas.

Proposed Activities in FY13: There will be two activities occurring for this project in FY13. During the ROV operations in all four study sites to be surveyed in Project 1 (above), additional dives and transects will be conducted using a stereo image system (either attached to the ROV or attached to a drop camera frame). These stereo image pairs will be used to obtain size information from individual Primnoa colonies in the thickets. This will allow simulation modeling of the size structure of the populations using growth rates known from the literature. This simulation modeling will provide the framework for population modeling of sustainable removal and mortality rates for Primnoa corals. We anticipate the additional dives at the four sites will add two days to the ROV operations in Project 1 (these costs have been added into the budget for project 1 for simplicity). A contract for image processing and statistical analysis and modeling to support this project, as well as Project 1 will be set up in FY13 through the College of Charleston.

The second activity in FY13 will be the deployment of settlement plates. To measure naturally occurring recruitment, 4 paired settlement plate arrays will be deployed in Primnoa thickets at both the Cape Ommaney and Fairweather Grounds study sites. The arrays will be deployed using the ROV and will be recovered in FY14 and FY16 or later.

Contingencies:

1) A proposal to the Alaska Essential Fish Habitat for $50K has been submitted to provide additional funds for this project. If this proposal is funded, the additional funds will be used to offset cuts to Project 2 in FY13.

Budget Table and Narrative:

	Description	Amount FY12	Amount FY13	Amount FY14
1100	Direct Labor:			
1150	Overtime and Hazard Pay			

1200	Benefits:			
2100	Travel			
2200	Transportation			
2300	Rents et al.			
2400	Printing			
2500	Contracts:			
	Data and video analysis		$50,000	$50,000
	ROV/Charter vessel contract (2 days)			
2600	Supplies and Materials:	$5,000		
3100	Equipment:			
4100	Grants			
	Total	$5,000	$50,000	$50,000

Project 4: FMP Production from coral and sponge ecosystems

Principal Investigators: Christina Conrath AFSC-RACE (christina.conrath@noaa.gov), Brian Knoth AFSC-RACE (brian.knoth@noaa.gov), and Chris Rooper AFSC-RACE (chris.rooper@noaa.gov)

Background and Justification: The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 included a requirement to establish a deep sea coral research program. Identified data needs to improve management of coral and sponge ecosystems include a better understanding of both the biodiversity and ecology of coral communities as well as the impacts caused by fishing and human activities. In Alaska waters, many commercially important species have been found to be associated with coral and sponge habitats and survey data indicate rockfish and Atka mackerel are associated with gorgonian, cup, and hydrocorals, whereas; flatfish and gadids are more commonly associated with soft corals (Heifetz 2002). In the Aleutian Islands, previous research using fine scale video monitoring of the seafloor found that a significant fraction of the commercially important fish and crabs were associated with corals and other biotic structures, including rockfish, which were highly associated with corals (Stone 2006). Coral and sponge habitats may be particularly important for both juvenile and adult rockfish. In NMFS trawl surveys, the CPUE of juvenile Pacific ocean perch in the Gulf of Alaska is positively correlated to the CPUE of sponge and coral (Rooper and Boldt 2005). In southeast Alaska juvenile rockfish have been shown to be associated with sponges (primarily *Aphrocallistes*) (Freese and Wing 2003) and adult rockfish have been shown to be associated with coral of the genera *Primnoa* (Krieger and Wing 2002). It is speculated that these complex habitats provide both protection from predators and increased prey availability; however, the relative importance of coral and sponge habitat as compared to other non-biotic complex structure (*e.g.* boulders) for rockfish and other FMP species remains unknown. The overarching goal of this project is to examine the productivity of FMP species within coral and sponge habitats in the Gulf of Alaska.

We conducted field work from August 15th-21st in the central GOA offshore of Kodiak Island, AK to examine the productivity of FMP species found within biotic (coral/sponge) and non-biotic habitats. The study site was located at the 49 fathom pinnacle on the continental slope offshore of Albatross Bank (Figure 1). Utilizing a stereo drop camera system, we identified three habitat regions, including a coral site on the northeast corner of the pinnacle, a low relief site on the northwest corner of the pinnacle, and a boulder site to the south and throughout the middle of the pinnacle. At each location, three to five camera drops were made to examine the density and diversity of biotic structure (coral/sponge) as well as to assess the abundance and composition of FMP species (Figure 1). Additional camera drops were made outside of these areas to examine the bottom habitat throughout the pinnacle. Briefly, each camera drop lasted 30 minutes and was conducted at a random starting point, drifting with the prevailing current. Initial observations made at the time the image data was collected indicated that the coral habitat was dominated principally by stylaster corals. In addition, hexactinellid sponges were frequently observed. However, further detailed analysis of the image data will produce accurate numbers for coral and sponge species presence, abundance and diversity. At each site, a CTD was deployed and a temperature profile of the water column was generated for each habitat site. In addition, bongo tows were conducted to obtain samples of the pelagic prey field at each site. At the coral and low relief sites, two bottom trawl tows were conducted within each site to obtain samples for energetic, diet, and age and growth analysis. Trawl catches consisted predominately of dusky and northern rockfish. A total of 96 dusky rockfish and 83 northern rockfish were sampled for diet and energetic analysis.

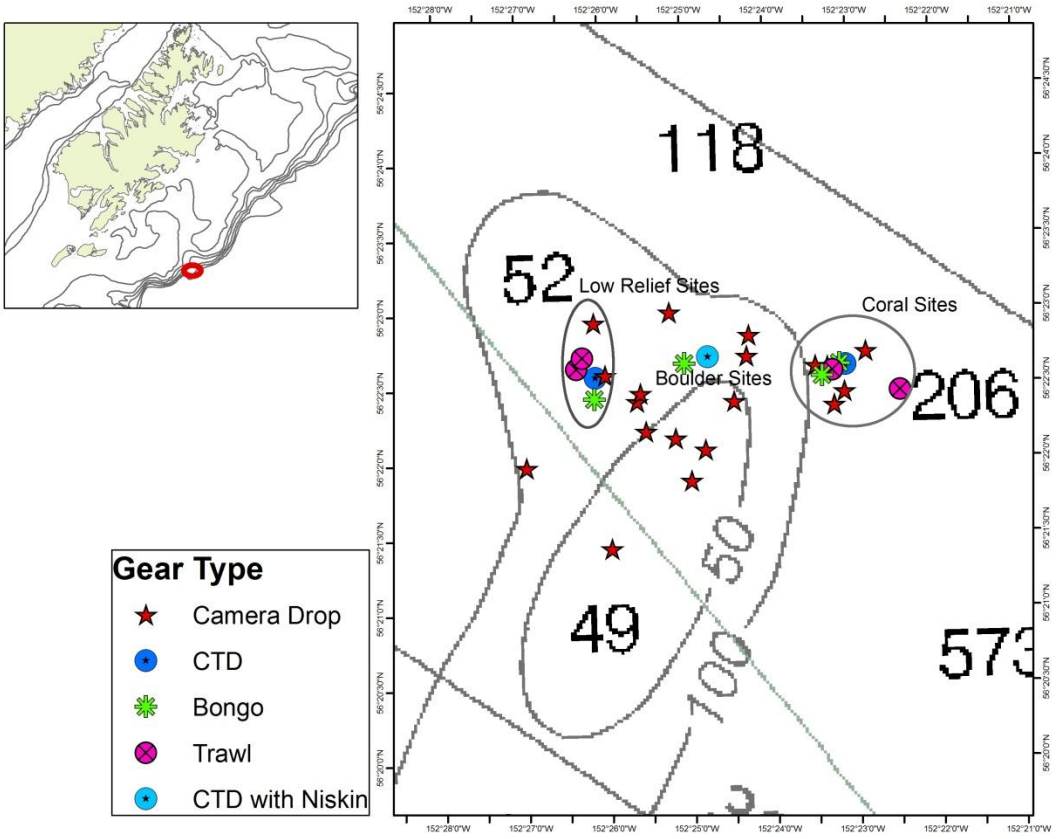

Figure 1. Map of 49 fathom pinnacle study site off of Albatross Bank, near Kodiak Island, Alaska.

Proposed Activities in FY13: In FY13, the same sampling plan will be carried out at the study sites in the Gulf of Alaska. A second year of data and samples for laboratory analyses will be collected. If time and funding allows, an additional sites nearby will be sampled for rockfish and coral. Beginning in fall-winter of 2013, funding from a successful proposal to the North Pacific Research Board will allow 2 additional cruises to be conducted to collect samples for analysis. These collections will be made during the winter and spring periods, adding a seasonality component to the knowledge of coral and sponge habitat use by commercially important species of fishes in the Gulf of Alaska.

Contingencies:

1) A proposal to fund the laboratory analyses for this project has been submitted to the AFSC Essential Fish Habitat Program ($31,820). If successful, this funding will be used to offset reductions made to Project 2.

Budget Table and Narrative:

	Description	Amount FY12	Amount FY13	Amount FY14
1100	Direct Labor:			

1150	Overtime and Hazard Pay	$10,020	$8,000	$8,000
1200	Benefits:			
2100	Travel	$6,500	$2,500	$2,500
2200	Transportation	$10,000	$3,500	$3,500
2300	Rents et al.			
	Vessel Fuel		$16,000	$16,000
2400	Printing			
2500	Contracts:			
	Charter vessel contract	$82,500	$82,500	$82,500
	Sample processing	$31,820	$31,820	$31,820
2600	Supplies and Materials:	$7,500	$3,500	$3,500
3100	Equipment:	$2,000		
4100	Grants			
	Total	$150,340	$147,820	$147,820

Project 5: Effects of Longline Fishing on Coral Habitat in Alaska

Principal Investigators: Nate Raring (AFSC-RACE), Chris Rooper (AFSC-RACE), Kresimir Williams (AFSC-RACE), Chris Lunsford (AFSC-ABL) and Pat Malecha (AFSC-ABL)

Background and Justification: Disturbance from longline fishing to sensitive coral and sponge habitats has been documented in Alaska but the extent of and mechanisms of disturbance have not been well studied compared to bottom trawling. Observations in red tree coral thickets in the eastern Gulf of Alaska indicate that 17% and 20% of the "standing stock" of corals and sponges, respectively, have been damaged by longlines (Stone et al., in preparation). Corals and sponges are common bycatch in both commercial fisheries and stock assessment surveys using longlines clearly indicating interactions between the gear and sensitive habitats. The goal of this project is to examine the behavior of longline gear *in situ* in coral and sponge habitat. These observations will assist researchers in identifying longline disturbance *in situ*, provide additional estimates of damage rates, and provide insights regarding possible gear modifications to minimize interaction.

Results to Date: In FY12 a pilot project was conducted to construct a camera system that could be attached to longline and pot fishing gear in Alaska to collect information on the impacts of these gears on benthic habitats. A prototype camera system was constructed by research partners in the RACE division and was deployed off a vessel of opportunity in July 2012. Although the test revealed the difficulty of designing a deployment platform for the camera (the pot that it was attached to fell over upon reaching the seafloor), the design is relatively sound and testing will continue on this project through the winter with hopes of deploying the instrument again in FY13.

Proposed Activities in FY13: The pilot project to deploy a camera system on commercial longline and pot gear will continue gear development. Some of this testing is ongoing through the fall and winter of FY13. It is expected that another vessel of opportunity (either through AFSC research activities or industry collaboration) will be available for field testing in summer FY13.

Budget Table and Narrative:

	Description	Amount FY12	Amount FY13	Amount FY14
1100	Direct Labor:			
1150	Overtime and Hazard Pay		$1,000	$1,000
1200	Benefits:			
2100	Travel		$1,800	$1,800
2200	Transportation		$500	$500
2300	Rents et al.			
2400	Printing			
2500	Contracts:			
2600	Supplies and Materials:		$1,000	$1,000
3100	Equipment:	$1,689	$5,000	$5,000
4100	Grants			
	Total	$1,689	$9,300	$9,300

Project 6: Genetic Connectivity among Regional Populations of red tree corals (*Primnoa pacifica*) in the North Pacific Ocean

Principal Investigators: Robert Stone AFSC-ABL (bob.stone@noaa.gov), Cheryl Morrison (USGS, WV), Ewann Berntson (NOAA AFSC)

Background and Justification: Knowledge of the degree to which populations are connected through larval dispersal is imperative to effective management, yet little is known about larval dispersal capability or population connectivity in *Primnoa pacifica*, the dominant structure forming coral on the outer continental shelf and upper slope between the Alaska Peninsula and the Olympic Coast Marine Sanctuary (OCMS) off the Washington Coast. This study will build on an ongoing study using microsatellite DNA markers to generate data on the spatial scale and pattern of genetic connectivity across a large portion of the range of *P. pacifica* in the North Pacific Ocean. These data will provide important insights regarding the most appropriate tools available to resource managers to protect sensitive coral habitats and the ecosystem services they provide.

As part of ongoing studies on shallow-water populations of *Primnoa pacifica* in the glacial fjords of Southeast Alaska we have done much of the preliminary work developing microsatellite DNA markers for that population. This project would expand that work to six other populations of *P. pacifica* in the North Pacific Ocean–four populations on the continental slope in the Gulf of Alaska, one on Bowie Seamount off British Columbia (Canada), and one in the Olympic Coast Marine Sanctuary off Washington State. Samples from 50 individual colonies will be collected with an ROV (or submersible) as a piggy-back project to Project 1. Collaborating scientists from DFO-Canada and NOAA-OCMS would be asked to support the collection of genetic samples contributed to this project.

Results to Date: In FY12, funds were used to purchase supplies and laboratory equipment for the USGS laboratory that allowed researchers to identify genetic markers for *Primnoa pacifica*. This research is onging.

Proposed Activities in FY13: In FY13, tissue samples will be collected from 50 individual Primnoa colonies at each of the four sites surveyed by the ROV cruise (Project 1). These samples will be analyzed in the laboratory during FY14 and added to the samples that have already been acquired from ABL research and anticipated to be acquired by DFO and Olympic Marine Sanctuary collaborators. A geneticist (or possibly two) will participate in the ROV cruise to collect the samples in the field. The costs of the travel and the additional ROV time needed to complete the collections have been added into the budget for Project 1 in FY13.

Budget Table and Narrative: No additional funds are being requested for this project in FY13.

Project 7: Long-term monitoring of O_2 and pH in Alaska waters; a sentinel for global climate change and ocean acidification

Principal Investigators: Jerry Hoff (AFSC-RACE), Chris Rooper (AFSC-RACE)

Background and Justification: The effects of global climate change and ocean acidification loom large in Alaska. These environmental changes are expected to have larger impacts at high latitudes, and in fact many effects of climate change are already being observed in Alaska. Deep-coral and sponge ecosystems are especially susceptible to ocean acidification through reductions in calcification rates due to reduction in the available carbonate ions. Deep corals in other systems have also been found to be more abundant at O_2 minimum zones than in other areas (although this phenomenon has not been explained. Thus it is important to determine the rates of ocean acidification through monitoring pH and to determine changes in the distribution of the O_2 minimum zones in order to predict and understand the effects of climate change on deep coral and sponge ecosystems.

Results to Date: In FY12, with partners in the AFSC RACE division (funded by the North Pacific Research Board) we purchased two sensors to collect O2, salinity, turbidity and pH measurements on the headrope of bottom trawls used to conduct annual stock assessment surveys. A deployment mechanism was constructed and tested during the 2012 eastern Bering Sea slope bottom trawl survey. Oceanographic data were collected on 168 tows along the Bering Sea slope from Bering Canyon to the U.S.-Russia border at depths to 1100 m

Proposed Activities in FY13: In FY13, oceanographic data will be collected from the bottom trawl survey scheduled for the Gulf of Alaska. The oceanographic instruments purchased and tested in FY12 will be deployed on the headrope of the AFSC research trawl during all three legs of the bottom trawl survey to collect O2, pH, turbidity and salinity from the Islands of Four Mountains to Dixon Entrance at depths to 1000 m.

Budget Table and Narrative: No additional funds are being requested for this project in FY13.

Project 8: Long-term Monitoring of Oceanographic Conditions

Principal Investigators: Robert Stone AFSC-ABL (bob.stone@noaa.gov), Peter Etnoyer NCCOS-CCEHBR (peter.etnoyer@noaa.gov)

Background and Justification: Access with scuba diving to red tree corals (*Primnoa pacifica*) that have emerged into shallow water in several glacial fjords of Southeast Alaska have been studied year-round since 2004. These coral populations may prove to be sentinel populations for studies on the effects of global climate change and ocean acidification on marine processes in the North Pacific Ocean. This project will establish a long-term program of oceanographic observations in these systems.

Results to Date: In FY12, oceanographic equipment was purchased to deploy at the Tracy Arm Study site.

Proposed Activities in FY13: We will establish several long-term oceanographic stations in Tracy Arm, Holkham Bay and Muir Inlet, Glacier Bay were studies on the biology of red tree corals have been ongoing since 2004. Remote oceanographic sensors that measure temperature, salinity, pH, and current speed and direction will be deployed at each site and routinely maintained from the Auke Bay Laboratory in Juneau. In January 2013, the first oceanographic sensor will be deployed in Tracy Arm. FY13 funds will be used for this deployment. If savings can be realized in other projects in FY13, the additional sensor ($28K) for Glacier Bay will be purchased in FY13.

Budget Table and Narrative:

	Description	Amount FY12	Amount FY13	Amount FY14
1100	Direct Labor:			
1150	Overtime and Hazard Pay		$2,000	$2,000
1200	Benefits:			
2100	Travel		$1,000	$3,000
2200	Transportation			
2300	Rents et al.			
2400	Printing			
2500	Contracts:			
2600	Supplies and Materials:			
	Sensors	$28,000		$28,000
3100	Equipment:			
4100	Grants			
	Total	$28,000	$3,000	$33,000

Project 9: Improving coral and sponge taxonomy, and collections for paleoclimatological, microbial, and marine natural products studies

Principal Investigators: Robert Stone (AFSC-ABL), Jim Stark (AFSC-ABL)

Background and Justification: We have made considerable progress with the taxonomy of both corals and sponges in Alaska during the past decade but some corals and quite a few sponges have not been collected or properly identified. Taxonomic studies are critical for accurate measures of biodiversity that are often used to gauge the importance of habitats. Proper taxonomic identifications are also important for constructing identification guides to be used in the fisheries and surveys to record the location of coral and sponge taxa. These data can be used by resource managers to identify the locations of high biodiversity and abundance that might indicate the location of vulnerable marine ecosystems. We anticipate that Project 1 would generate the majority of specimens for taxonomic work but all specimens collected during the 3-year initiative would be properly preserved and sent to collaborating taxonomists for identification.

Opportunistic collections from past expeditions in Alaska have provided samples for important studies of paleoclimatology, and microbial communities and marine natural products associated with deep-sea corals. Some corals, particularly *Primnoa pacifica*, can record oceanic productivity and nutrient dynamics in their skeletons providing important historical information. Many corals harbor unique microbial communities that may be performing important ecosystem functions such as cycling carbon, fixing nitrogen, chelating iron, and producing antibiotics. Corals and particularly some sponges have evolved the ability to produce or accumulate from associated microorganisms a diversity of unique chemical compounds or secondary metabolites that they utilize in predator defense, competition for resources, and as physiological adaptations to living in extreme environments. Many of the compounds are currently in early clinical or late preclinical development for use as treatments for cancer, tuberculosis, HIV, asthma, and many other diseases and ailments. Deep-water sponges show particular promise in this emerging research area, and several species collected from the Aleutian Islands as part of a pilot program in 2004 exhibited near 100% inhibition during primary screening for M. tuberculosis. Only a handful of sponge species from the Aleutian Islands have been examined for the presence of secondary metabolites, but so far "hit rates" for biomedically active compounds are on the order of 10% rather than 1% which is typical for samples collected elsewhere.

Results to Date: In FY13, tissue collections for genetic analysis of a hexactinellid sponge (*Aphrocallistes vastus*)were made throughout the Aleutian Islands in response to a request from a collaborator. These collections (~100 tissue samples) were coordinated with the RACE Division Aleutian Islands bottom trawl survey. Collections were also made for a collaborator of Bigmouth sculpin eggs found in hexactinellid sponges. Additionally, genetic samples for bar-coding corals were collected during the bottom trawl survey and 120 sponge specimens were collected for morphological taxonomic study.

Proposed Activities in FY13: In FY13, unknown coral and sponge specimens will be collected for taxonomic study during the ROV cruise in the Gulf of Alaska (Project 1). Collections of select sponge taxa will also be made for studies of marine natural biomedicines as part of an ongoing collaboration with the University of Mississippi. Additionally, collections will be made for collaborating scientists by the AFSC-RACE Division upon request and approval during the Gulf of Alaska bottom trawl survey inFY13.

Budget Table and Narrative: No additional funds are being allocated to this project in FY13, although if substantial savings from other projects are realized, these could be used to fund a a small taxonomic contract in FY13 to augment the FY14 contract and expedite the work.

Project 10: Geological substrate and potential habitat map for deep sea corals and sponges in the Gulf of Alaska margin and the Aleutian shelf and slope regions.

Principal Investigators: Jennifer Reynolds – NURP and University of Alaska Fairbanks (jrreynolds@alaska.edu), Gary Greene – Tombolo Institute (tombolo@centurytel.net) and Moss Landing Marine Laboratories (greene@mlml.calstate.edu), Mark Zimmermann – AFSC (mark.zimmermann@noaa.gov), Jane Reid – U.S. Geological Survey, Pacific Coastal & Marine Science Center (jareid@usgs.gov)

Background and Justification: The distribution of deep-sea corals and sponges is strongly tied to substrate characteristics. Geology and oceanography control the distribution of substrates, and therefore the geology and oceanography of the seabed can be used to construct potential habitat maps for these species. These maps may then be combined with other types of information, e.g., bycatch in bottom trawls, for predictive modeling of species distribution.

Specific sites in the Alaska region have been surveyed and high-resolution potential habitat (substrate) maps have been constructed, such as at Fairweather Ground and the offshore Edgecumbe Volcanic Field. These maps have contributed to our understanding of ecological patterns. However, at a regional scale this data compilation and interpretation has not been done.

Existing seafloor data sets for the Gulf of Alaska and Aleutian Ridge are adequate for creation of a broad-scale substrate and potential deep-sea coral and sponge habitat map at a resolution of 1-5 km. Data sets identified for this purpose include multibeam seafloor surveys for bathymetry and backscatter, side-scan surveys, single beam profiles, NOAA smooth sheet records, sediment data, existing seafloor imagery, and geological studies of the seafloor and adjacent areas on land.

Results to Date: In FY12, funds were used to provide a GIS technician to compile the smooth sheet and sonar data for the Aleutian Islands and western Gulf of Alaska. Funds were also provided for students at the USGS laboratory to perform parallel data compilations for the central Gulf of Alaska. Details of these ongoing efforts are provided below. In addition a contract for a geologist (Dr. Gary Greene) to analyze these data in FY13 was exercised using FY12 funds

Proposed Activities in FY13: This is a laboratory-based project for data mining and interpretation. Compilation of sonar data will be done at the AFSC and compilation of surficial sediment data will be done at the USGS. Metadata for seafloor video and still photo imagery in the relevant regions will be collected. While the imagery itself will not be included in the georeferenced database, characteristic images may be identified and linked to it during this project. Because the investigators are based in different locations, it will be necessary to transfer working copies of the database and products to multiple locations.

A potential habitat map for deep-sea coral and sponge, based primarily on substrate, will be constructed covering the depth range 50 – 1500 m or deeper. Because this map is intended as input for probabilistic distribution models, the target resolution is that of the models, i.e., 1-5 km. The potential habitat map will be based on the compiled and georeferenced data layers; groundtruth from any available seafloor imagery; and geological interpretation that takes into account the bedrock and tectonic patterns, sediment type and depth, oceanography, and seafloor morphology at the highest resolution available. Geologic interpretation is used to understand a suite of seabed characteristics in terms of the processes that create them, and to use this understanding to extrapolate seabed characteristics in poorly sampled areas.

The project will build on recent and ongoing efforts to compile georeferenced, quality-controlled bathymetric and seabed data in a usable format. First, at the AFSC, Mark Zimmermann is leading an effort to extract bathymetric soundings from NOAA smooth sheets at the resolution of the original data and to compile this information into edited, datum-shifted GIS layers in a modern projection. In regions lacking multibeam surveys, these soundings are the highest-resolution information available on the shape of the seafloor. Current efforts cover the Aleutian Islands to 500m depth and the central and eastern Gulf of Alaska to 1000m depth, the lower depth boundaries for NMFS trawl surveys in these areas. As part of the Alaska Deep-Sea Coral and Sponge Initiative, this work will be expanded to include the remaining target areas in the Gulf of Alaska. We will start the substrate interpretation with GIS layers already compiled by Zimmermann, but, as his work is still incomplete, we will also refer to the bathymetry compilation from Steve Lewis (IT Specialist, NMFS Regional Office, Juneau) which is currently available and provides broad coverage for the study area. We will use these bathymetry data in construction of a potential habitat map.

Second, the usSEABED project at the U.S. Geological Survey, led by Jane Reid, has constructed a quality-controlled, georeferenced database of marine sediment data for regions around the U.S. Data sets are publicly available for the Gulf of Mexico, Caribbean, Atlantic and Pacific margins. For the Alaska region, the usSEABED database contains data from all known sediment samples, but for many areas the only available sediment data are from NOAA smooth sheets. These groundtruth data will be important for construction of a substrate map and prediction of deep-sea coral and sponge distribution. This project will include further work on digitizing sediment records from the smooth sheets, under Jane Reid's supervision.

Because this will be the first effort to construct regional-scale potential habitat maps for Alaska, using this suite of data sets, large uncertainty exists around the time and effort required to cover the full area at the desired resolution. Furthermore, some of the data sets are not yet in place and will be developed as part of this project. Thus, in years 1 and 2 (FY12 and FY13) the bathymetry and sediment maps will be compiled for the entire Gulf of Alaska and Aleutian Islands regions (some of this work is currently underway and some already completed). During FY13, the initial analysis of substrate types will begin using data from the central Gulf of Alaska. This analysis will continue as more sediment and bathymetry data layers become available in FY13. It is unclear whether the geological interpretation for the entire state can be completed by FY14, but the underlying bathymetry and sediment data sets and development of protocols for completing a geologically interpreted layer for the Gulf of Alaska and Aleutian Islands will be finished at a target resolution of 1-5 km.

An initial trial of the approach and the utility of the various data sets will be conducted for Albatross Bank and Portlock Bank, on the outer shelf near Kodiak Island. These sites have similar bedrock geology but different current regimes and sediment cover, and accordingly they have very different habitat potential for deep-sea corals and sponges. Extensive groundtruth information exists, primarily from sediment samples collected in the 1980s and submersible dives in 2007. Albatross Bank has also been a focus of usSEABED data analysis and quality control. The results of this trial will be used to guide subsequent work and estimate the total effort necessary to complete this task for the entire Gulf of Alaska and Aleutian Islands.

For consistency with existing seafloor habitat maps in the Alaska region, the classification scheme of Greene et al. will be used. This classification is compatible with NOAA's Coastal and Marine Ecological Classification Standard (CMECS), but is designed for the deeper environments that are

the focus of the Alaska Deep Sea Coral and Sponge Initiative. The classifications accommodate multiple substrate characteristics, but may easily be queried to show simple categories such as hard, mixed, or soft bottom.

Budget Table and Narrative:

	Description	Amount FY12	Amount FY13	Amount FY14
1100	Direct Labor:			
1150	Overtime and Hazard Pay			
1200	Benefits:			
2100	Travel		$7,980	$7,980
2200	Transportation			
2300	Rents et al.			
2400	Printing			
2500	Contracts:			
	Contract to Greene	$44,100		$42,840
	Jennifer Reynolds		$25,000	$25,000
	Contract to AFSC or USGS GIS Technician	$41,960	$25,200	
2600	Supplies and Materials:		$3,242	
3100	Equipment:			
4100	Grants			
	Total	$111,260	$61,422	$75,820