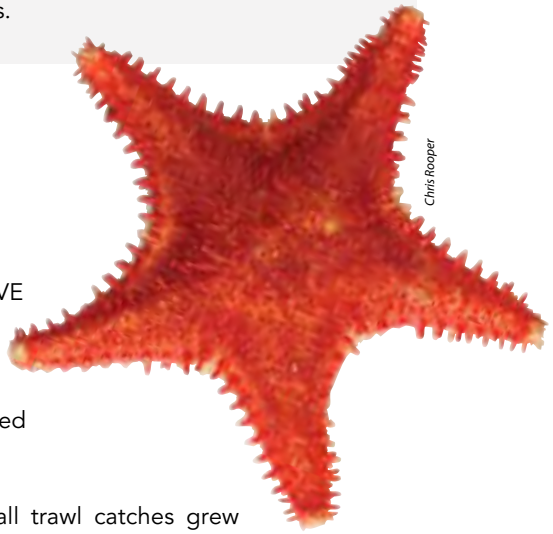
# Habitat Mapping

MAPPING NORTHERN MARINE ECOSYSTEMS FOR ESSENTIAL FISH HABITAT.

Once we know that an undersea habitat is important for biodiversity or fish production, we need to know its location and extent for delineating truly essential fish habitat.

Much of Alaska's continental shelf, especially in the Bering Sea, is characterized by broad regions of sand and silt, with little topographic relief. Resource managers include these areas in EFH designations under "fish presence/absence criteria," and we know that large populations of walleye pollock, Pacific cod, and other pan-shelf species reside there. But often the more critical habitat areas have harder substrates that support epifaunal structures where fish hide, feed, grow, and reproduce. Hard substrates also may support coldwater coral and sponge gardens that not only provide refuges for fish, but contribute to the biodiversity of these northern marine ecosystems.

Ship time and fuel costs are so high when mapping bottom habitat that very limited fish habitat mapping has been accomplished in the Bering Sea, the Aleutians, or the Gulf of Alaska. NPRB has helped in that regard by supporting several mapping studies.



Chris Rooper

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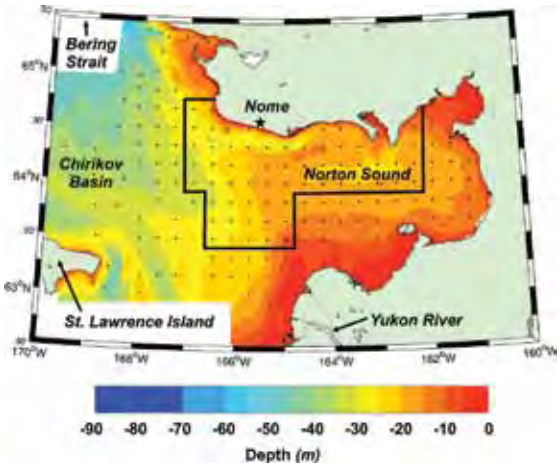
## Seafloor Habitat Changes in Norton Sound

Project 604

TO THE NORTH IN NORTON SOUND, PROJECT 604 INVOLVED A RETROSPECTIVE analysis of trawl survey data from 1976 to 2006 to examine changes in distribution and abundance of benthic fauna and demersal fishes in response to climate change. Instead of collecting new data, the investigators constructed a geographical information system database and used it to analyze changes in abundance and distribution of selected dominant benthic species, species richness, and diversity.




**Locations of trawl survey stations in Norton Sound. Stations in the boxed area were continuously surveyed from 1976 to 2006 by NMFS (1976-1991) and ADF&G (1996-2006). Stations outside the boxed area were surveyed when additional time was available.**

Over the study period, overall trawl catches grew exponentially by 370%, driven primarily by one sea star, *Asterias amurensis*, which accounted for 70% of the total catch. Catches increased for some 13 other species as well, although the composition of dominant species remained unchanged. Researchers looked at a variety of environmental factors to explain the variability in species biomasses. Significant correlations were identified with east-west gradients across Norton Sound, incident solar radiation, duration of ice-free waters, and a large-scale climate index called the Pacific-North American Index.

Red king crab, the species of greatest interest, were negatively related to near-bottom water temperatures. Neither the crab population nor the average bottom temperatures showed any trend during the study. The study concluded that physical forcings are transmitted unevenly through the benthic community and other higher-order interactions need to be considered to explain red king crab population dynamics.

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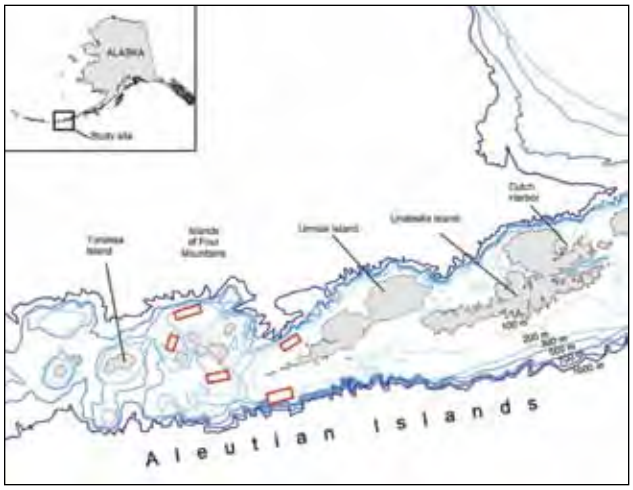
## Which Habitats Do Pacific Ocean Perch Prefer?

**Project 416**

A SECOND MAPPING PROJECT IN THE ALEUTIANS examined preferred substrate characteristics for Pacific ocean perch. Project 416 mapped five sites using sidescan and multibeam sonar, groundtruthed by video observations. Indices of reflectivity, complexity, roughness, slope, and relative height were related to fish densities. A substrate classification tree was used to classify bottom types from acoustic data.

The study found that bottom reflectivity and roughness were the most important features of the acoustic data for determining correct substrate classification. One of the most important findings identified characteristics of nursery habitats utilized by juveniles. Isolated from adult populations, young ocean perch used only specific habitat types within the nurseries, with most found in mixed sand and boulder fields. Juveniles appeared to be using these complex habitats and the associated epibenthic invertebrates for shelter. Sponge and coral were common on all hard substrates and prevalent on boulders in areas occupied by juvenile ocean perch.

Researchers drew two important conclusions from the mapping study: all substrate types must be groundtruthed, for example, using underwater video or by sediment grab; and they need a relatively large sample size of more than 100 observations to correctly parameterize the classification tree and get accurate maps of the seafloor.




**Proposed study areas in the western Gulf of Alaska/eastern Aleutian Islands.**

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## Identifying Nearshore Habitat in Northern Bristol Bay

**Project 201**

PROJECT 201 DEMONSTRATED THE EFFICACY OF COMBINING SIDESCAN SONAR WITH TOWED SEABED VIDEO IMAGERY to delineate three different habitat associations close to shore in northern Bristol Bay. Researchers identified the following habitats:

- eelgrass with sandy gravels
- bladed kelps and filamentous red algae with sandy gravels
- coralline algae, green urchins and bryozoans with bouldery/cobbly sandy gravel

High-frequency (390 kHz) sidescan sonar worked best in mapping eelgrass beds, with sufficient precision, groundtruthed by visual data, to monitor longer-term changes in eelgrass distribution. The approach did not work all that well in other habitats, especially those that were particularly heterogeneous.

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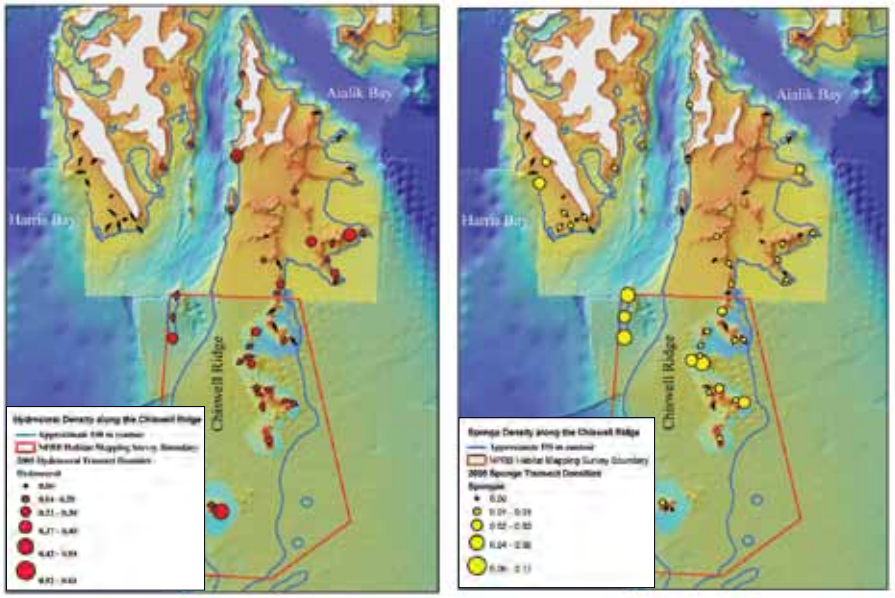
# Mapping the Chiswell Ridge in the Gulf of Alaska

**Project 616**

MOVING AROUND TO THE GULF OF Alaska, the Board supported Project 616, which produced high-resolution rocky reef substrate data using side-scan and multibeam sonar for the Chiswell Ridge along the north Gulf coast of the Kenai Peninsula, a biologically important area for commercially important, structure-oriented species such as lingcod and yelloweye rockfish. The sonar data, collected in the fall of 2006, were groundtruthed with visual observations from a previous ROV survey and the resulting substrate maps were used with habitat-specific fish density estimates to obtain new abundance estimates for lingcod and yelloweye on the Chiswell Ridge.




**Hydrocoral and sponge distribution and density from the 2005 Chiswell Ridge ROV survey.**

The results of the study revealed a 47.5% decrease in estimated fish abundance based on a much lower estimate of rocky reef area than shown previously in historical NOAA data. With the decrease in available habitat, the estimated abundance of lingcod remained higher on the southern Chiswell Ridge, but yelloweye rockfish were estimated to be more abundant in the northern ridge area. Given the low inherent productivity of yelloweye rockfish populations, it is important that management remains conservative, and that population estimates are as accurate as possible. (For more about the ecosystem function aspect of this study, see page 44: Rocky reef habitat for yelloweye and lingcod)

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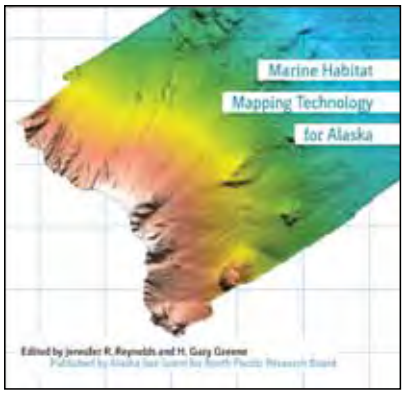
# Habitat Mapping Workshop

**Project 615**




SINCE HABITAT MAPPING IS VERY EXPENSIVE, THE BOARD WANTED TO UNDERstand which technologies would be most effective and affordable for a given purpose. Project 615 gathered together experts in various aspects of marine habitat mapping to identify key issues, evaluate available technologies and techniques as well as those in development, and present results in a form that could be used to educate managers and other interested parties.

The workshop produced a comprehensive report discussing available technologies, their capabilities, and how they might be used in the development of effective mapping programs. Researchers reviewed remote sensing technologies and their applications, including a variety of sonar mapping systems, mapping AUVs, small-boat surveys in shallow water, airborne LIDAR (light detection and ranging) bathymetry, and sub-bottom profiling. Visual scale technologies included towed video sleds, small ROVs, the imaging AUV SeaBED, manned submersible Delta, and methods of quantitative video analysis. Participants discussed habitat classification schemes and provided case histories for major habitat mapping programs in other regions. Workshop results were summarized in a CD available through Sea Grant and NPRB.