



**Alaska  
Fisheries Science  
Center**

National Marine  
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U.S. DEPARTMENT OF COMMERCE

## **AFSC PROCESSED REPORT 2009-01**

### Alaska Fisheries Science Center Essential Fish Habitat Data Inventory

January 2009

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**Alaska Fisheries Science Center  
Essential Fish Habitat Data Inventory**

by

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January 2009



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## **Introduction**

The Magnuson-Stevens Fishery Conservation and Management Act is the primary law regulating marine fisheries management in the United States. This Act includes a requirement to define the essential fish habitat (EFH) of all federally managed species. Since passage of the Act in 1996, scientists with the National Marine Fisheries Service's Alaska Fisheries Science Center (AFSC) have conducted diverse research projects that address this requirement. In many cases, these studies have been published in the peer-reviewed scientific literature. However much of the data have not been assembled in a readily accessible and centralized location, thereby limiting their overall utility.

In July 2005, the newly formed Habitat and Ecological Processes Research (HEPR) Program convened a meeting of AFSC staff to discuss EFH research in the Gulf of Alaska (GOA), Bering Sea (BS), and Aleutian Islands (AI) regions. Meeting participants identified creation of an AFSC habitat data inventory as a high priority. In particular, participants felt that a habitat data inventory would be useful for communicating AFSC habitat research and would also facilitate future data analyses and EFH research.

A workshop was held 20-21 September 2007 at the AFSC in Seattle, Washington. Workshop objectives were to: (1) inventory habitat data sets; (2) promote collaborative use of these data through greater awareness and accessibility; and (3) informally discuss EFH research and management issues. The workshop was attended by 27 individuals representing five AFSC Divisions, the Alaska Regional Office, the North Pacific Fishery Management Council, the Alaska Department of Fish and Game and the environmental group Oceana. The workshop conveners were Bob McConnaughey, John Olson and Jon Heifetz. The meeting agenda, participants and minutes are found in Appendix A.

Meeting participants presented summaries of the habitat data sets. Next, Eric Boerner of the AFSC's National Marine Mammal Laboratory presented lessons learned and practical insights from a similar exercise to catalog and share terrestrial environmental data among various scientific and public user groups (Appendix B). This presentation was followed by a structured group discussion that was specific to the needs for improved awareness of and accessibility to Alaska EFH data. Finally, participants discussed practical issues such as the need for more and better metadata, the desirability of greater research collaboration, and possible methods for integrating habitat studies conducted at substantially different spatial scales.

## **Habitat Data Inventory**

The habitat data sets were described following a standard format for this report. This inventory is the main product of the workshop and this report. The habitat data inventories begin on the next page.

**Name of Project:** Habitat Areas of Particular Concern: a case study of EFH habitat data.

**Region (GOA, BS, AI):** GOA.

**Specific Location:** Fairweather Grounds and Cape Ommaney.

**Data Types (Formats):** Point (latitude, longitude) data of coral locations.

**Instruments/Devices Used For Collection:** DSV *Delta*.

**Summary of Project/Data:** Concentrations of *Primnoa* sp. corals were documented during submersible groundfish surveys in the 1990s and subsequent directed research. Commercial fish species and *in situ* disturbances were observed in association with high relief corals. The 2004 Habitat Areas of Particular Concern (HAPC) selection process resulted in a closure of five discrete areas with known densities of *Primnoa* sp. Each area was considered as an HAPC based on the specific characteristics of each site. The *Primnoa* Coral Garden Marine Reserve prohibits any bottom contact fishing gear in a 13.5 nmi<sup>2</sup> area. A larger area was designated as HAPC for future research.

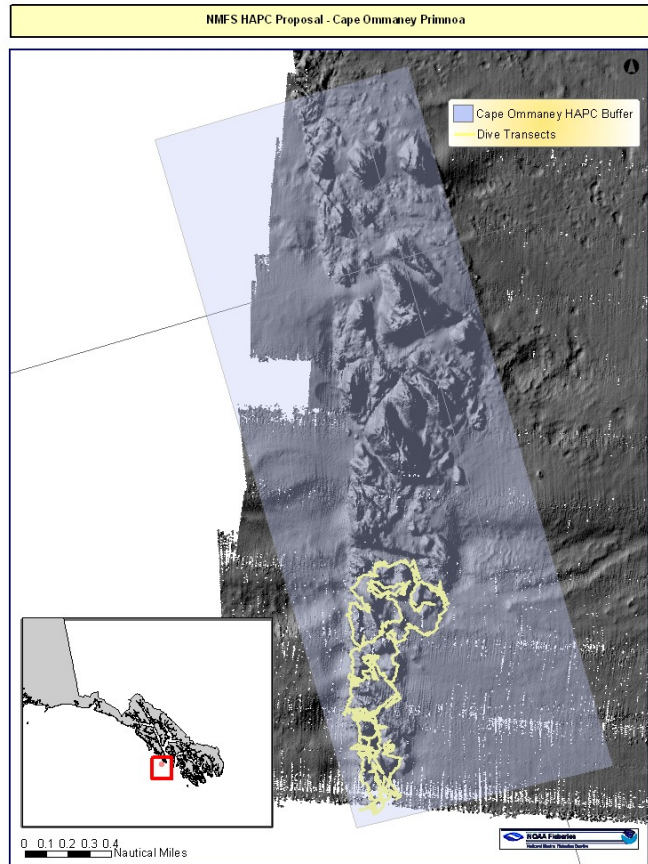
**Sampling Dates:** 2001.

**Status of Project/Data Processing:** Additional dives have occurred since the HAPC designation.

#### References/Publications:

- (1) Heifetz, J. 2002. Coral in Alaska: distribution, abundance, and species associations. *Hydrobiologia* 471: 19-27.
- (2) Krieger, K. J. 2001. Coral (*Primnoa*) impacted by fishing gear in the Gulf of Alaska. Pages 106-116 in J. H. M. Willison *et al.* (eds.). Proceedings of the first international symposium on deep-sea corals. Ecology Action Centre and Nova Scotia Museum, Halifax, Nova Scotia.
- (3) Krieger, K. J. and B. L. Wing. 2002. Megafauna associations with deepwater corals (*Primnoa* spp.) in the Gulf of Alaska. *Hydrobiologia* 471: 83-90.
- (4) Stone, R., J. Heifetz, and J. L. Freese. Unpublished HAPC proposals to the North Pacific Fishery Management Council for Cape Ommaney and Fairweather grounds. NOAA Fisheries, Alaska Fisheries Science Center, Auke Bay Laboratory, Juneau, Alaska.
- (5) Witherell, D. and C. Coon. 2001. Protecting gorgonian corals from fishing impacts. Pages 117-125 in J. H. M. Willison *et al.* (eds.). Proceedings of the first international symposium on deep-sea corals. Ecology Action Centre and Nova Scotia Museum, Halifax, Nova Scotia.

**Point of Contact:** Cathy Coon, North Pacific Fishery Management Council, 907-271-2809, [cathy.coon@noaa.gov](mailto:cathy.coon@noaa.gov).



**Name of Project:** Delta submarine video archiving.

**Region (GOA, BS, AI):** GOA, BS, AI.

**Specific Location:** Various.

**Data Types (Formats):** Video, \*.xls.

**Instruments/Devices Used For Collection:** *Delta* submarine.

**Summary of**

**Project/Data:** For about 20 years scientists at the Auke Bay Laboratories have been using the *Delta* submarine for a wide range of research projects.

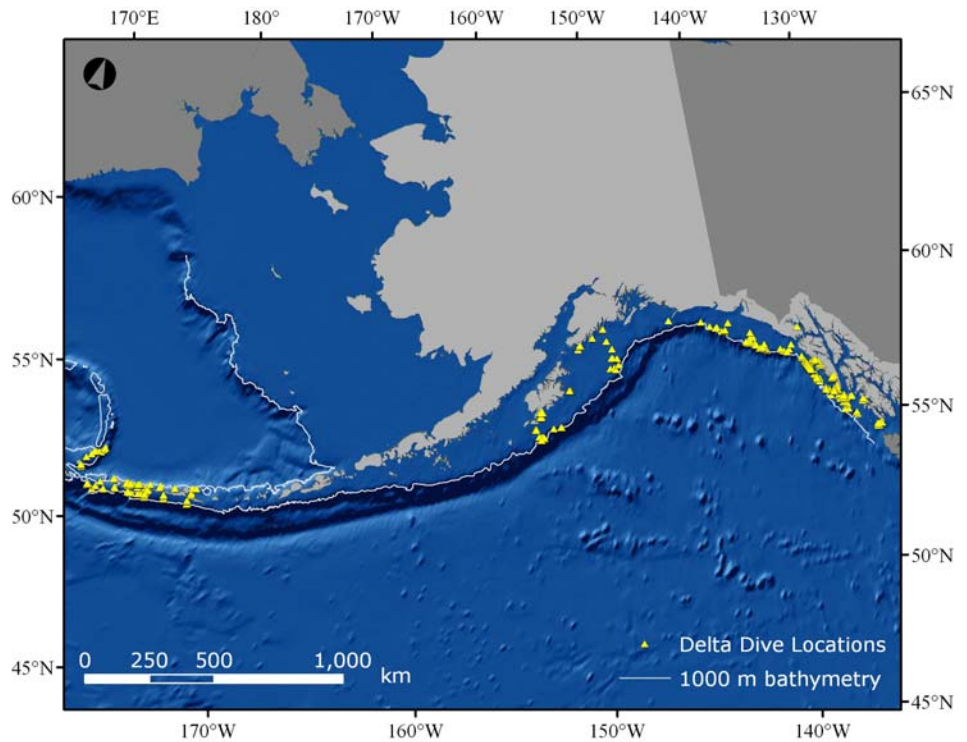
About 500 dives have been completed. The video collected during these projects provides valuable direct observations of seafloor habitat and biological attributes. This project is assembling a database that will include dive locations and basic biological and substrate information from each of the dives. To date, biological and substrate data have been processed for about 40% of the dives. If there is interest, the database may be expanded to include video collected from ROVs and/or video collected by other AFSC Divisions and programs.

**Sampling Dates:** 1988-2006.

**Status of Project/Data Processing:** In progress.

**References/Publications:** None.

**Point of Contact:** Jon Heifetz, ABL, 907-789-6054, [jon.heifetz@noaa.gov](mailto:jon.heifetz@noaa.gov).



**Name of Project:** Estuaries database.

**Region (GOA, BS, AI):** GOA.

**Specific Location:** Estuaries throughout southeast Alaska.

**Data Types (Formats):** ACCESS database.

**Instruments/Devices Used For Collection:** Fyke net, seine, trawl, and physical data devices.

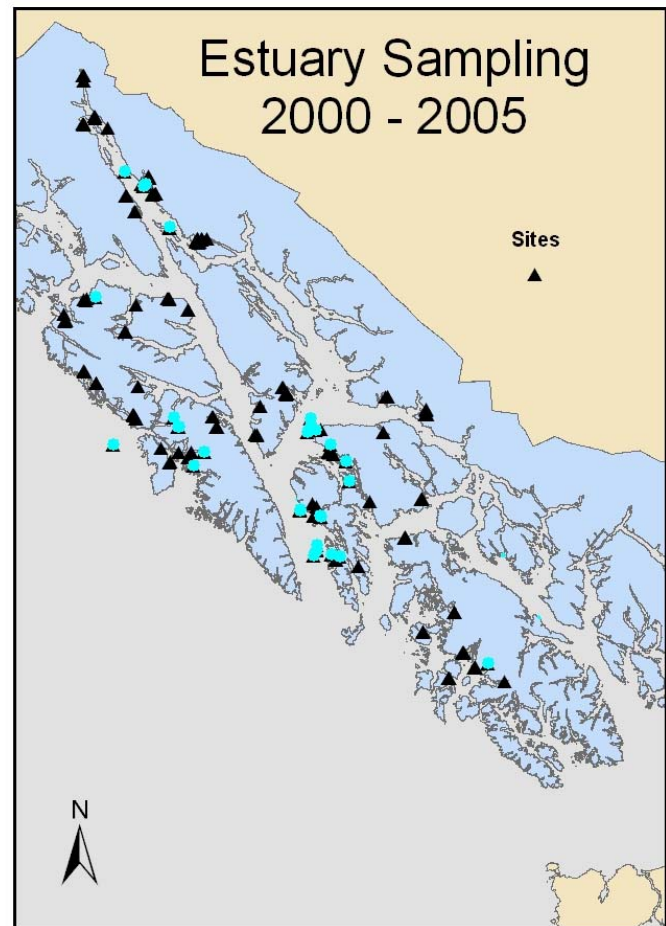
**Summary of Project/Data:** Since 1998 estuaries throughout southeast Alaska have been sampled with several gear types to assess fish habitat utilization. Some estuaries were sampled multiple times within a year and over multiple years to determine temporal patterns of habitat use. The most common fish species encountered were yellowfin sole, chum and pink salmon, starry flounder, and Pacific herring.

**Sampling Dates:** 1998 - present.

**Status of Project/Data Processing:** Ongoing.

**References/Publications:** None.

**Point of Contact:** Mitch Lorenz, ABL, 907-789-6036, [mitch.lorenz@noaa.gov](mailto:mitch.lorenz@noaa.gov).



**Name of Project:** Essential Fish Habitat requirements for skate nurseries.

**Region (GOA, BS, AI):** Eastern Bering Sea.

**Specific Location:** Shelf-slope interface.

**Data Types (Formats):** Biological data in Excel spreadsheets including depth, location, and bottom and sea-surface temperature. A single trackline through a nursery site recorded with digital video.

**Instruments/Devices Used For Collection:** Bottom trawl, Sea-bird SBE 39, bottom sounder.

**Summary of Project/Data:** Six skate nursery sites were located and mapped using bottom trawls during 2004-2006. All sites occurred along the shelf slope interface between 135 and 380 meters. The bottom was relatively flat sandy-muddy bottom with no evident relief or attached benthic invertebrates for all sites. Nursery sites were all small in area and possessed areas of highly concentrated egg cases. We collected egg case density, location (latitude and longitude), bottom depth, and temperature data, as well as species composition, length data and diet composition of selected predatory species. In summer of 2006, Craig Rose gathered digital video from a single camera-sled tow through an area of the Alaska Skate Nursery (AKS).

**Sampling Dates:** 1 June 2004 – 3 July 2006.

**Status of Project/Data Processing:** Initial process complete and analysis in progress.

**References/Publications:**

- (1) Hoff, G. R. 2007. Reproductive biology of the Alaska skate, *Bathyrāja parmifera*, with regard to nursery sites, embryo development and predation. Ph.D. dissertation, University of Washington, School of Aquatic and Fishery Sciences, Seattle. 160 p.
- (2) Hoff, G. R. 2008. A nursery site of the Alaska skate (*Bathyrāja parmifera*) in the eastern Bering Sea. Fish. Bull., U.S. 106: 233-244.
- (3) Hoff, G. R. In Press. Embryo developmental events and the egg case of the Aleutian skate *Bathyrāja aleutica* (Gilbert) and the Alaska skate *Bathyrāja parmifera* (Bean). Journal of Fish Biology. xx: xx-xx.
- (4) Hoff, G. R. 2009. Skate *Bathyrāja* spp. egg predation in the eastern Bering Sea. Journal of Fish Biology. 74:250-269.
- (5) Hoff, G. R. 2008. A nursery site of the Alaska skate (*Bathyrāja parmifera*) in the eastern Bering Sea. Fishery Bulletin. 106:233-244.

**Point of Contact:** Gerald R. Hoff, RACE Division, 206-526-4580, [jerry.hoff@noaa.gov](mailto:jerry.hoff@noaa.gov).

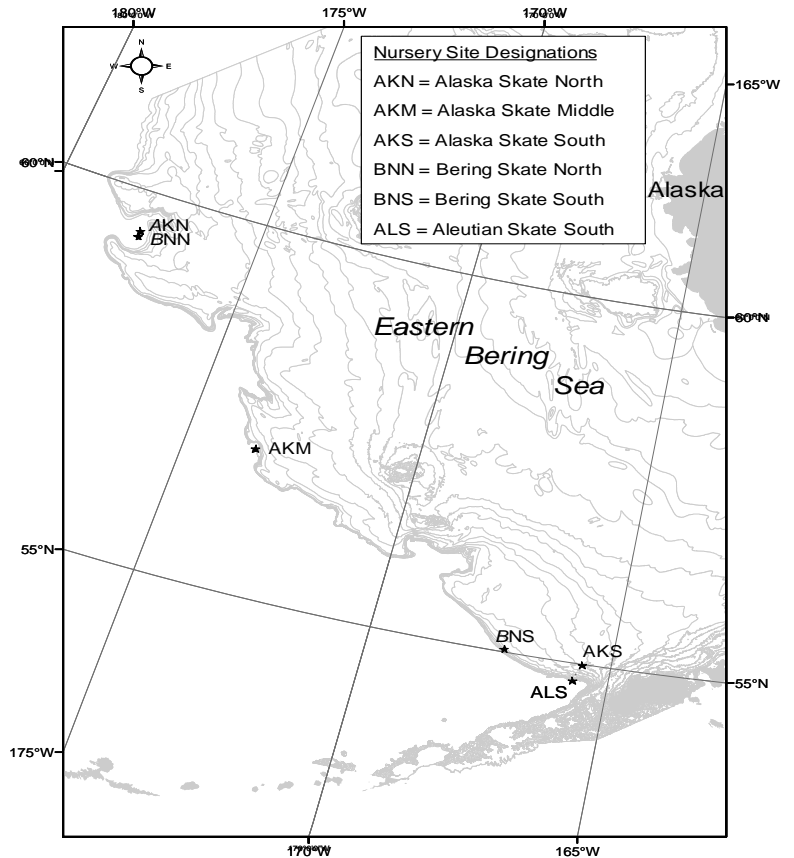


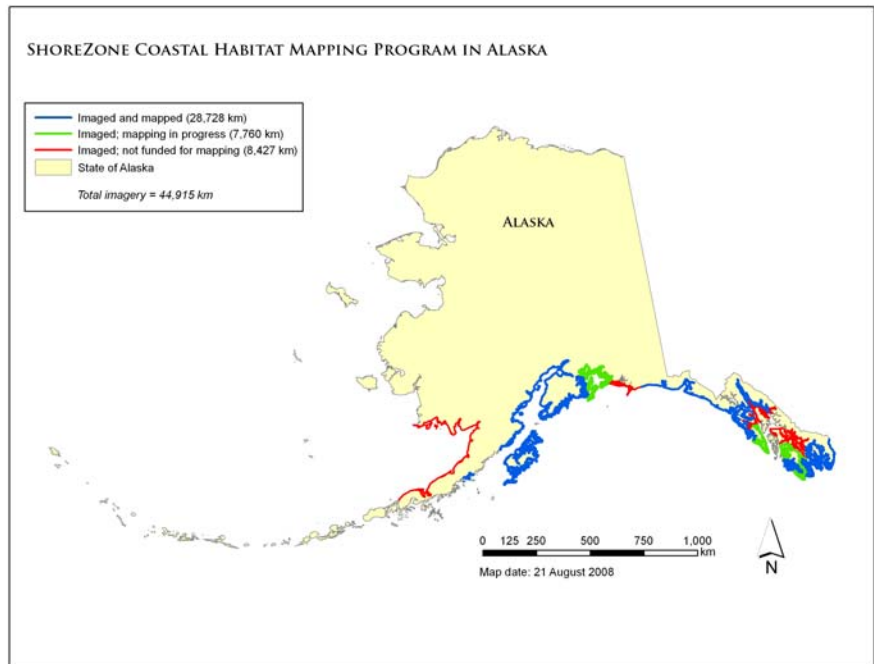
Figure 1.

**Name of Project:** Alaska coastal mapping / Nearshore Fish Atlas of Alaska.

**Region:** GOA, BS, AI, Arctic.

**Data Types (Formats):** Low-altitude, geo-referenced aerial video and still photography, biophysical habitat classifications, and beach seine catch data.

**Instruments/Devices Used For Collection:** Helicopter, fixed wing aircraft, differential GPS, digital cameras, standard beach seine.



**Summary of Project/Data:**

Alaska’s coastline is currently being mapped using the *ShoreZone* habitat classification system. The first phase of *ShoreZone* involves flying the coastline during minus tide windows and acquiring geo-referenced imagery. The second phase is the biophysical mapping where the imagery is analyzed for geomorphology and biological characteristics (e.g., eelgrass meadows, kelp beds). The third phase transfers the imagery and biophysical mapping data to an interactive online database for the public. The *ShoreZone* website is also used as a spatial platform for hosting additional datasets such as the Nearshore Fish Atlas of Alaska. The Fish Atlas database is linked to the *ShoreZone* website and contains 10 years of nearshore catch data (beach seine). Nearly 600,000 fish representing 98 species have been captured in over 800 seine hauls. Some of the most abundant species captured, mostly as juveniles, include walleye pollock, Pacific sand lance, Pacific herring, and salmon.

**Sampling Dates:** *ShoreZone* (2001 to present); Fish Atlas (1998 to present).

**Status of Project/Data Processing:** *ShoreZone* (see figure); Fish Atlas (up-to-date thru 2007).

**References/Publications:**

- (1) Johnson, S. W., A. D. Neff, and J. F. Thedinga. 2005. An atlas on the distribution and habitat of common fishes in shallow nearshore waters of southeastern Alaska. U. S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-157. 89 p.
- (2) <http://www.fakr.noaa.gov/maps/szintro.htm>
- (3) <http://www.fakr.noaa.gov/habitat/fishatlas/>

**Point of Contact:**

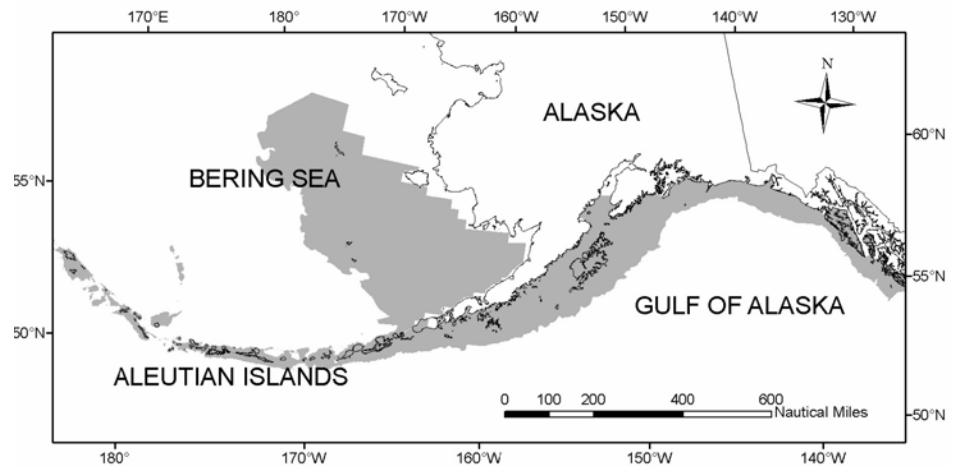
*ShoreZone*—Mandy Lindeberg, ABL, 907-789-6616, [mandy.lindeberg@noaa.gov](mailto:mandy.lindeberg@noaa.gov).  
Fish Atlas—Scott Johnson, ABL, 907-789-6063, [scott.johnson@noaa.gov](mailto:scott.johnson@noaa.gov).

**Name of Project:** Effect of light intensity on vertical and spatial distribution of fish and their availability to bottom trawl and acoustic surveys.

**Region (GOA, BS, AI):** GOA, BS, AI.

**Specific Location:** AFSC groundfish survey areas.

**Data Types (Formats):** Relative light intensity (in terms of downward irradiance) levels on scale from 0 – 255.



**Instruments/Devices Used For Collection:** MK-9 Wildlife Computer tag.

**Summary of Project/Data:** Project goals are assessment of the effects of light intensity and light penetration on the vertical and horizontal distributions of walleye pollock and their availability to bottom trawl and hydroacoustic surveys. Currently, these surveys are used as independent estimates of abundance, but our results may provide the means to integrate the results from these surveys and establish a relationship between light penetration and availability of walleye pollock to bottom trawls. If this relationship is established, it has the potential to reduce uncertainty in biomass estimates from the stock assessment model for walleye pollock in the EBS and to increase our understanding of pollock stock dynamics. In addition, the effect of light intensity and light penetration on the feeding success and degree of cannibalism (either through changes in horizontal or vertical distribution (prey availability), or through prey detection or selectivity (feeding behavior)), may affect the output of multi-species models that support management advice in the Ecosystem Considerations chapter of the Stock Assessment and Fisheries Evaluation Report provided to the North Pacific Fishery Management Council.

**Sampling Dates:** Summer 2004-2007.

**Status of Project/Data Processing:** EBS data from years 2004-2006 have been processed. GOA and AI data have not been processed and are stored in raw files.

**References/Publications:**

Kotwicki, S., A. De Robertis, P. von Szalay, and R. Towler. In press. The effect of light intensity on the availability of walleye pollock (*Theragra chalcogramma*) to bottom trawl and acoustic surveys. *Can. J. Fish. Aquat. Sci.*

**Point of Contact:** Stan Kotwicki, RACE Division, 206-526-6614, [stan.kotwicki@noaa.gov](mailto:stan.kotwicki@noaa.gov).



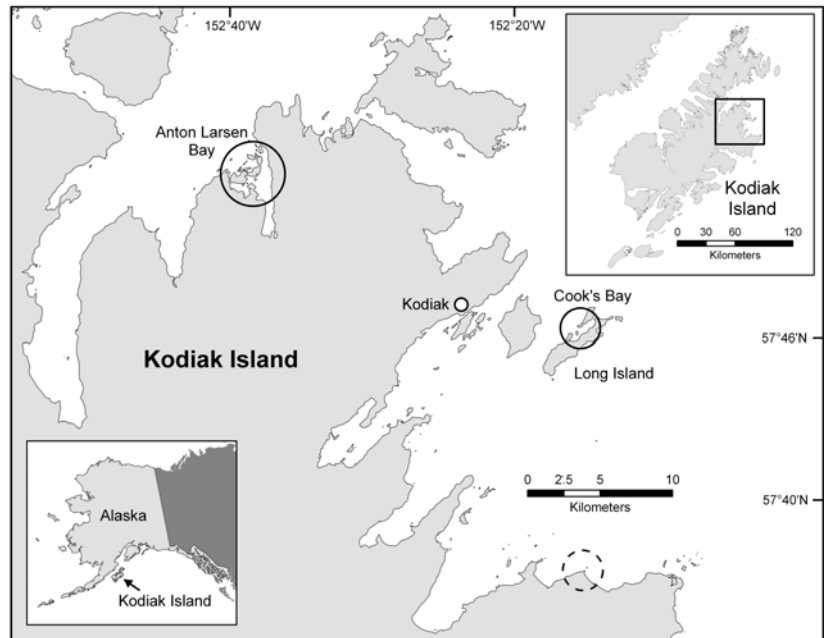
**Name of Project:** Nearshore habitat use in juvenile Pacific cod.

**Region (GOA, BS, AI):** GOA.

**Specific Location:** Kodiak Island nearshore and embayments.

**Data Types (Formats):** Monochrome video (digital tape), demersal beach seine and beam trawl (Excel). Other biological data include predator abundance, co-occurring juvenile gadid distribution and frozen specimens.

**Instruments/Devices Used For Collection:** Baited camera; demersal beach seine; beam trawl; temperature, salinity, oxygen probes.



**Summary of Project/Data:** Nearshore surveys of age-0 and -1 year old Pacific cod have been conducted over 2 years across multiple nearshore habitats and depths in coastal embayments around Kodiak Island. Seine surveys have 1) identified important habitats for age-0 cod in the nearshore; 2) provided a relative estimate of year-class strength; and 3) been an effective means of collecting juvenile cod for live transport to the Fisheries Behavior and Ecology Program laboratory at the Hatfield Marine Science Center in Newport, OR. Baited camera surveys have complemented these surveys by extending sampling into deep water and complex habitats that are not available to the seine. Baited camera video (DV tapes) is analyzed under several pre-established indices to provide a relative estimate of abundance stratified by depth zone and habitat type (e.g., *Laminaria*, eelgrass, etc.). In 2006, we were able to explain ontogenetic changes in habitat use of age-0 gadids (Pacific cod, saffron cod, and walleye pollock) on a categorical level. In 2007, we are analyzing field data on a diel, seasonal and annual basis. It is clear that this temporal component to juvenile cod habitat use is extremely dynamic, largely the consequence of year-class strength, ontogenetic changes in habitat preference and changes in the physical environment (e.g., temperature, light level).

**Sampling Dates:** Baited camera – July-August 2006 and July-October 2007; Seines – July-August 2006 and July-October 2007; Beam trawls – July-August 2006. Physical measures for same dates.

**Status of Project/Data Processing:** Seine and trawl samples are fully processed. Video records have been processed for 2006; 2007 records presently are being analyzed.

#### **References/Publications:**

- (1) Laurel, B. J., A. W. Stoner, C. H. Ryer, T. P. Hurst, and A. A. Abookire. 2007. Comparative habitat associations in juvenile Pacific cod and other gadids using seines, baited cameras and laboratory techniques. *J. Exp. Mar. Biol. Ecol.* 351: 42-55.
- (2) Stoner, A. W., B. J. Laurel, and T. P. Hurst. 2008. Using a baited camera to assess relative abundance of juvenile Pacific cod: field and laboratory trials. *J. Exp. Mar. Biol. Ecol.* 354: 202-211.

**Point of Contact:** Benjamin Laurel, RACE Division, 541-867-0197, [ben.laurel@noaa.gov](mailto:ben.laurel@noaa.gov).

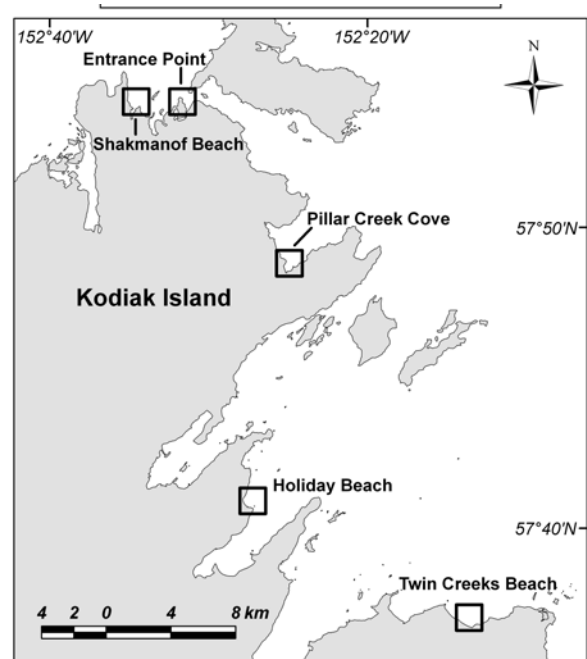
**Name of Project:** Flatfish nursery function.

**Region (GOA, BS, AI):** GOA.

**Specific Location:** Kodiak nearshore and embayments.

**Data Types (Formats):** (1) Monochrome video (digital tape and DVD), sediment grain size, bathymetry, trawl results (Excel and GIS coverages) (all high spatial resolution). (2) Other biological data – predator abundance, flatfish growth and predation rates (northern rock sole).

**Instruments/Devices Used For Collection:** Towed camera sled; beam trawl; sediment grab; temperature, salinity, oxygen probes or recorders.



**Summary of Project/Data:** Beam trawling has been conducted during the summer season for 7 years at five sites believed to be representative for northern rock sole, Pacific halibut and other flatfish species in the GOA. To evaluate qualitative characteristics of the habitat, intensive video-camera coverages were acquired for three nurseries, with coarser-scale coverage for the surrounding shelf areas. Video tapes are analyzed for bed formations, sediment characteristics, and structural elements of the habitat (e.g., pits, algae, invertebrates). Spatially-explicit models were developed for the first year of the descriptive study. Seasonal and interannual variation in habitat utilization is now under analysis. The descriptive investigation is being supplemented by field experiments to evaluate spatial variation in flatfish growth and mortality. We believe that nursery function is best defined by the intersection of physical habitat characteristics, with larval supply and the biological processes affecting high growth and survival – and not by simple nominal descriptors of bottom type.

**Sampling Dates:** Trawl samples - June through October 2002 to 2007; Towed camera – July 2002; July 2003; June, July, August, September 2004; August 2005; July 2006; Physical measures for same dates; Field experiments for growth, mortality, etc. - summer 2005, 2006, 2007.

**Status of Project/Data Processing:** Trawl samples, sediment and depth coverages fully processed. Video records processed for 2002, 2003; subsequent years under analysis.

#### **References/Publications:**

- (1) Hurst, T. P. and A. A. Abookire. 2006. Temporal and spatial variation in potential and realized growth rates of age-0 northern rock sole. *J. Fish Biol.* 68: 905-919.
- (2) Spencer, M. L., A. W. Stoner, C. H. Ryer, and J. E. Munk. 2005. A towed camera sled for estimating abundance of juvenile flatfishes and habitat characteristics: comparison with beam trawls and divers. *Estuar. Coast. Shelf Sci.* 64: 497-503.
- (3) Stoner, A. W., M. L. Spencer, and C. H. Ryer. 2007. Flatfish-habitat associations in Alaska nursery grounds: use of continuous video records for multi-scale spatial analysis. *J. Sea Res.* 57: 137-150.

**Point of Contact:** Allan Stoner, RACE Division, 541-867-0165, [al.stoner@noaa.gov](mailto:al.stoner@noaa.gov).

**Name of Project:** Atka mackerel EFH.

**Region (GOA, BS, AI):** AI, GOA.

**Specific Location:** Various locations along AI and GOA continental shelf.

**Data Types (Formats):** Mini-DV video with time and GPS overlays, depth, and temperature. High-resolution multibeam bathymetry and backscatter snippets (.xtf) are also available for a single spawning and nesting ground near Dutch Harbor, AK.

**Instruments/Devices Used For Collection:** Towed video drop camera (various camera and light combinations depending on light conditions) with real-time video feed and variable-speed electronic winch, SONY DVG300 mini-DV recorder, Sea-bird SBE-39, Intuitive Circuits GeoStamp, Garmin GPS, and Globe plotting software.

**Summary of Project/Data:** The objectives of this research were to locate and characterize the general spawning and nesting habitat of Atka mackerel (*Pleurogrammus monopterygius*) in Alaska and determine the geographic distribution and depth range of spawning and nesting sites.

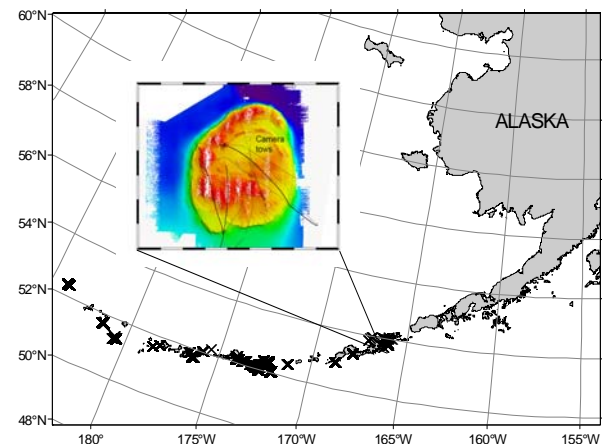
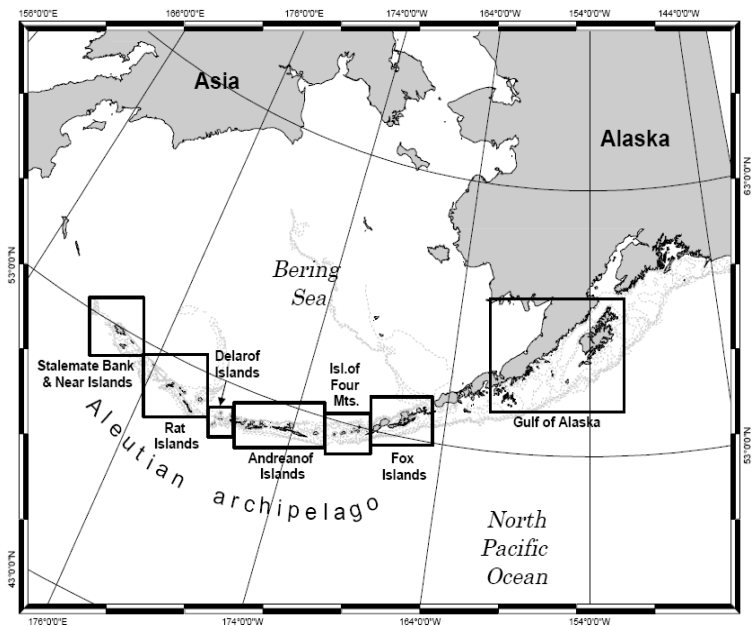
**Sampling Dates:** June to October 2004.

**Status of Project/Data Processing:** Initial processing completed. Further analysis of habitat from videotapes is in progress.

#### References/Publications:

- (1) Lauth, R. R., S. W. McEntire, and H. H. Zenger. 2007. Geographic distribution, depth range, and description of Atka mackerel (*Pleurogrammus monopterygius*) nesting habitat in Alaska. Alaska Fish. Res. Bull. 12: 164-185.
- (2) Lauth, R. R. and D. M. Blood. 2007. Description of embryonic development of Atka mackerel (*Pleurogrammus monopterygius*). Fish. Bull., U.S. 105: 571-576.
- (3) Lauth, R. R., J. Guthridge, D. Nichol, S. W. McEntire, and N. Hillgruber. 2007. Timing and duration of mating and brooding periods of Atka mackerel (*Pleurogrammus monopterygius*) in the North Pacific Ocean. Fish. Bull., U.S. 105: 560-570.
- (4) [http://doc.nprb.org/web/04\\_prjs/f0417\\_final\\_report.pdf](http://doc.nprb.org/web/04_prjs/f0417_final_report.pdf).

**Point of Contact:** Robert R. Lauth, RACE Division, 206-526-4121, [bob.lauth@noaa.gov](mailto:bob.lauth@noaa.gov).



**Name of Project:** Habitat influence on rearing condition and overwinter survival of juvenile capelin (*Mallotus villosus*).

**Region (GOA, BS, AI):** GOA.

**Specific Location:** Berners Bay, Auke Bay and Glacier Bay in southeastern Alaska.

**Data Types (Formats):** Fish abundance from acoustic backscatter along predefined survey tracks. Oceanographic data collected by CTD. Zooplankton with a single net.

**Instruments/Devices Used For Collection:** Acoustic data collected with 38 kHz Simrad EK60 echosounder system, targets identified with midwater trawl. Physical oceanographic data collected with a CTD equipped with temperature, salinity, turbidity, light, pH and fluorometry sensors.



**Summary of Project/Data:** We are collecting data describing the relative abundance, size (length, wet mass) and proximate composition (protein, lipid, water, ash and energy) of juvenile capelin and eulachon. In addition we are collecting physical (temperature, conductivity, turbidity, pH, light) and biological oceanographic (chlorophyll-a, relative zooplankton abundance) data. Matched data sets are being collected from different bays in southeastern Alaska. Ultimately the data describing oceanographic conditions will be compared with measures of abundance, growth and energetic condition to evaluate habitat characteristics conducive to increased recruitment. Oceanographic data are collected along a stratified grid.

**Sampling Dates:** 1 October 2007 – 1 April 2009.

**Status of Project/Data Processing:** Data and samples have been collected, samples are being processed. Oceanographic data have been downloaded from the CTD.

**References/Publications:** None, project is still underway.

**Point of Contact:** Johanna Vollenweider, ABL, 907-789-6612, [johanna.vollenweider@noaa.gov](mailto:johanna.vollenweider@noaa.gov).

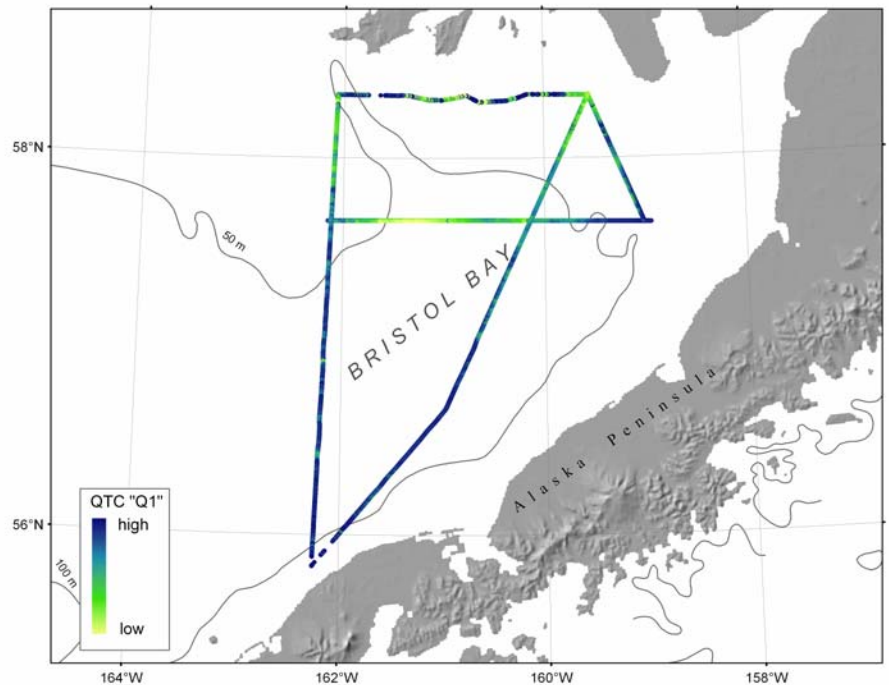
**Name of Project:** Bristol Bay reconnaissance.

**Region (GOA, BS, AI):** BS.

**Specific Location:** Bristol Bay, eastern Bering Sea continental shelf.

**Data Types (Formats):** (1) High-resolution digital sidescan sonar data (.xtf) and geo-referenced backscatter images (GeoTIFF); (2) sediment grain size (.xls); (3) analog video (Hi-8); (4) CTD (.cap ASCII text).

**Instruments/Devices Used For Collection:** (1) Klein 5410; (2) van Veen grab sampler; (3) drop camera; (4) Sea-bird SBE 19 Plus.



**Summary of Project/Data:** Seafloor habitats in the eastern Bering Sea were surveyed in June-July 2002 using a high-resolution sidescan sonar deployed from the *F/V Ocean Explorer*. The reconnaissance effort was centered on an uncharted 2,750 km<sup>2</sup> area of central Bristol Bay. A 150 m swath of backscatter and bathymetric data were collected along survey lines totaling nearly 1,110 km. Imagery was systematically groundtruthed using an underwater video camera (8 sites) and van Veen grab sampler (22 sites). The backscatter data have been processed using *QTC Sideview* software and were also classified by a marine geologist.

**Sampling Dates:** 28 June 2002 – 4 July 2002.

**Status of Project/Data Processing:** Fully processed.

#### **References/Publications:**

- (1) Yeung, C. and McConnaughey, R. A. 2008. Using acoustic backscatter from a sidescan sonar to explain fish and invertebrate distributions: a case study in Bristol Bay, Alaska. *ICES J. Mar. Sci.* 65: 242–254.
- (2) Bornhold, B. D., C. V. Jay, R. A. McConnaughey, G. Rathwell, K. Rhynas, and W. Collins. 2006. Walrus foraging marks on the seafloor in Bristol Bay, Alaska – a reconnaissance survey. *Geo-Marine Letters* 25: 293-299.
- (3) <http://www.afsc.noaa.gov/RACE/groundfish/hrt/sonar.htm>.
- (4) <http://oceanexplorer.noaa.gov/projects/alaskatools01/alaskatools01.html>.

**Point of Contact:** Bob McConnaughey, RACE Division, 206-526-4150, [bob.mcconnaughey@noaa.gov](mailto:bob.mcconnaughey@noaa.gov).

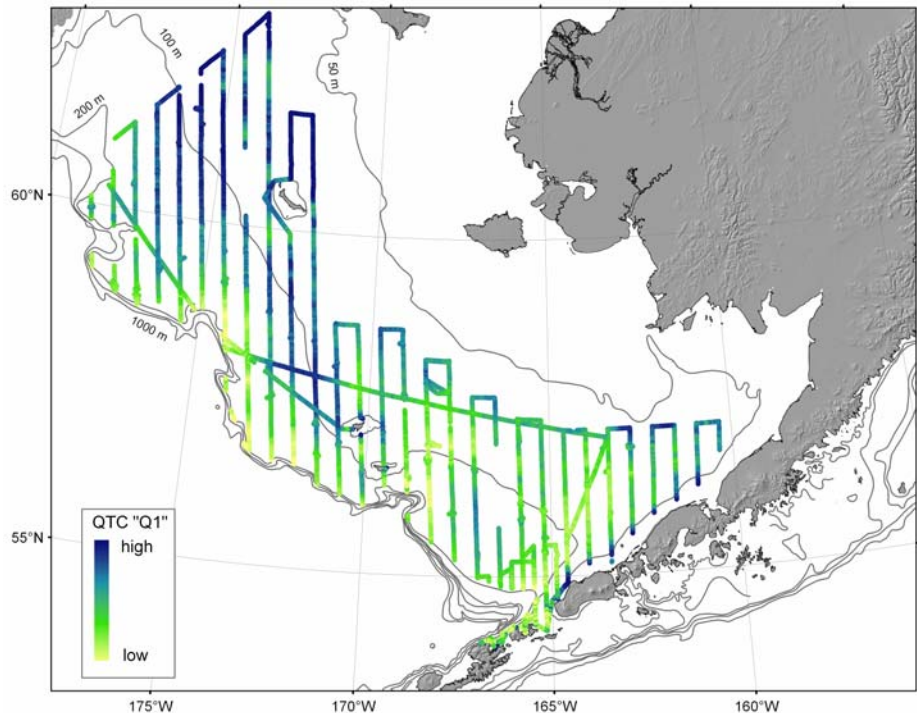
**Name of Project:** Bering Sea echosounder survey.

**Region (GOA, BS, AI):** BS.

**Specific Location:** Continental shelf of the eastern Bering Sea.

**Data Types (Formats):** (1) georeferenced soundings (ASCII text); (2) *QTC View* - processed echo returns from the seabed (Q-values and classes in ASCII text).

**Instruments/Devices Used For Collection:** Simrad EK-500 split-beam calibrated echosounder (38 kHz, 120 kHz) connected to a Qester Tangent Corporation ISAH-S waveform recorder.



**Summary of Project/Data:** Seafloor habitats in the eastern Bering Sea were surveyed in June-August 1999 using a calibrated split-beam echosounder deployed by the NOAA ship *Miller Freeman*. Approximately 6 million echo returns from the seafloor were simultaneously collected at two frequencies (38 and 120 kHz) during a routine hydroacoustic fishery survey. A total of 16,700 km of EBS seabed was sampled. Numerical parameters were extracted from the digitized echo returns using *QTC View* software and then reduced to principal components (Q-values). A new application of the Bayesian Information Criterion identified 14 distinct acoustic bottom types in the 38 kHz data.

**Sampling Dates:** 14 June – 3 August 1999.

**Status of Project/Data Processing:** Fully processed.

#### **References/Publications:**

- (1) Preston, J. M., A. C. Christney, W. T. Collins, R. A. McConnaughey, and S. E. Syrjala. 2004. Considerations in large-scale acoustic seabed characterization for mapping benthic habitats. ICES CM 2004/T:13, 8 p.
- (2) McConnaughey, R. A. and S. E. Syrjala. 2009. Statistical relationships between the distributions of groundfish and crabs in the eastern Bering Sea and processed returns from a single-beam echosounder. ICES J. Mar. Sci. 66.
- (3) <http://www.afsc.noaa.gov/RACE/groundfish/hrt/echosounder.htm>.
- (4) [http://www.afsc.noaa.gov/RACE/surveys/cruise\\_archives/cruises1999/results\\_MF1999-09.pdf](http://www.afsc.noaa.gov/RACE/surveys/cruise_archives/cruises1999/results_MF1999-09.pdf).
- (5) Qester Tangent Corporation. June 2004. Revised final report: QTC VIEW™ acoustic seabed classification, Bering Sea, Miller Freeman 1999. Document Number: DRP NOAA 0005.R00. 148 p.

**Point of Contact:** Bob McConnaughey, RACE Division, 206-526-4150, [bob.mcconnaughey@noaa.gov](mailto:bob.mcconnaughey@noaa.gov).

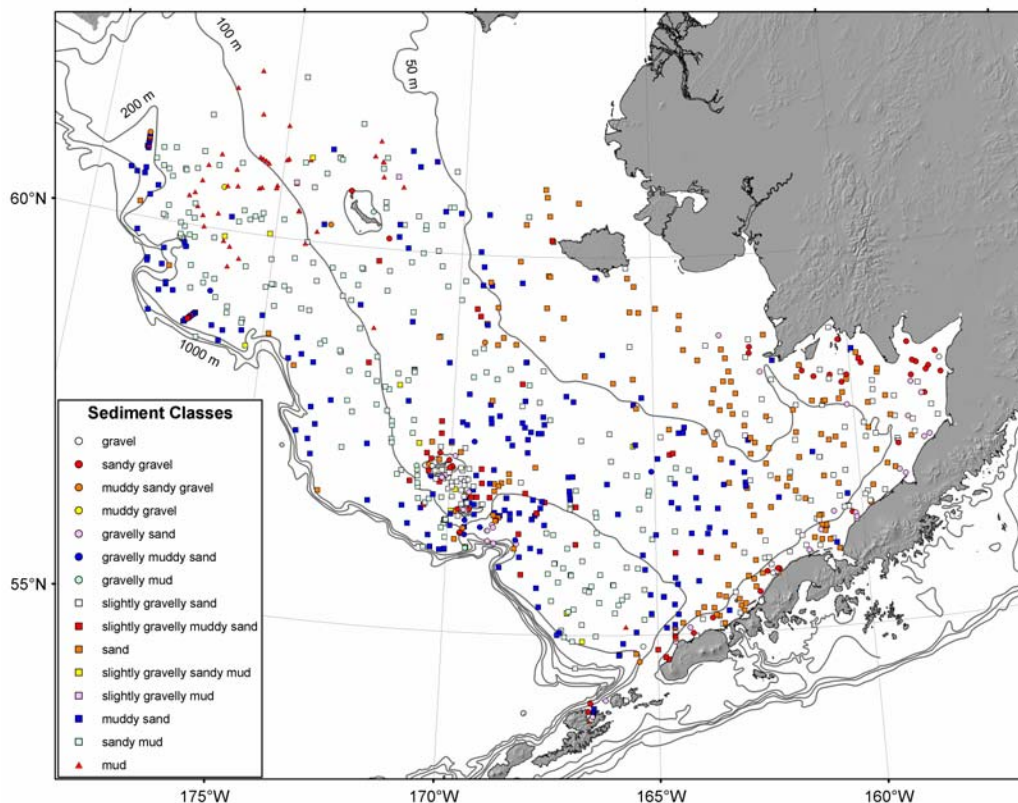
**Name of Project:**  
EBSSSED sediment  
database.

**Region (GOA, BS,  
AD):** BS.

**Specific Location:**  
Continental shelf of  
the eastern Bering Sea,  
delimited by the  
boundaries of the  
annual RACE bottom  
trawl survey.

**Data Types  
(Formats):**  
Granulometric data  
and categorical  
textures (.dbf).

**Instruments/Devices  
Used For Collection:**  
Miscellaneous grab  
samplers and corers.



**Summary of Project/Data:** EBSSSED is a compilation of historical point-sample sediment data (n=2,587) from all available sources at the time of publication. Textural data in the database are of two main types: (1) standardized statistics characterizing sample grain size distribution based on laboratory measurements (granulometric data), including percent composition by size grades (e.g., gravel, sand, mud) and size distribution parameters (e.g., mean size); and (2) sample descriptions from less exacting, more subjective visual/tactile observations, usually made in the field, establishing size-grade constituents. Each record includes information about the original samples, including location, water depth and sampling gear used.

**Sampling Dates:** 1934 – 1997.

**Status of Project/Data Processing:** Currently 2,587 samples. New samples added when available.

**References/Publications:**

- (1) Smith, K. R. and R. A. McConnaughey. 1999. Surficial sediments of the eastern Bering Sea continental shelf: EBSSSED database documentation. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-104, 41 p. (<http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-104.pdf>).
- (2) McConnaughey, R. A. and K. R. Smith. 2000. Associations between flatfish abundance and surficial sediments in the eastern Bering Sea. *Can. J. Fish. Aquat. Sci.* 57: 2410-2419.

**Point of Contact:** Bob McConnaughey, RACE Division, 206-526-4150, [bob.mcconnaughey@noaa.gov](mailto:bob.mcconnaughey@noaa.gov).

**Name of Project:** 2006 FISHPAC experiment.

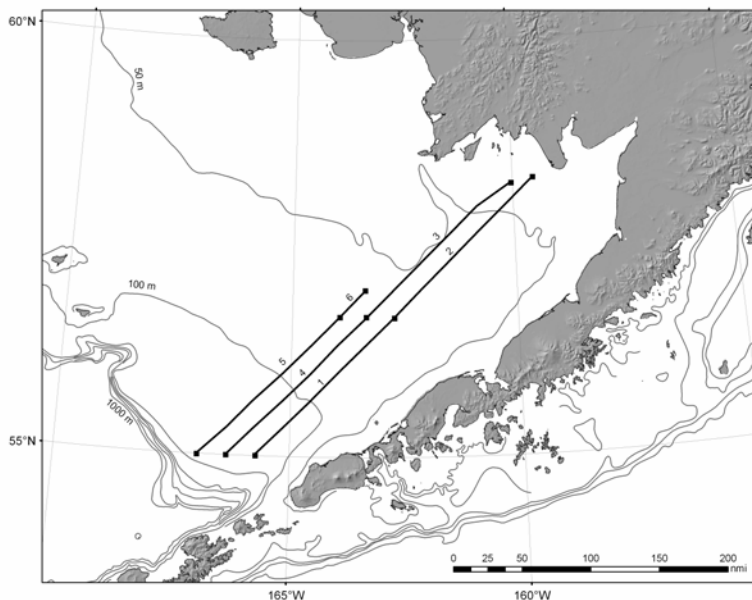
**Region (GOA, BS, AI):** BS.

**Specific Location:** Bristol Bay, eastern Bering Sea continental shelf.

**Data Types (Formats):** (1) multibeam bathymetry and backscatter snippets (.xtf and Caris); (2) high-resolution sidescan sonar backscatter (.xtf); (3) optical backscatter data (.xtf); (4) sound velocity profiles (.svp ASCII text); (5) light levels (proprietary hexadecimal).

**Instruments/Devices Used For**

**Collection:** (1) Reson 8111-ER multibeam echosounder (50 kHz); (2) Reson 8160 multibeam echosounder (100 kHz); (3) Klein 5410 sidescan sonar (455 kHz); (4) Klein 7180 long-range sidescan sonar with integrated multibeam echosounder (180 kHz); (5) 38 kHz vertical incidence echosounder (on Klein 7180 towfish); (6) SEABOSS sediment grab/camera system; (7) TACOS towed video sled; (8) FFCPT sediment probe with sound velocity profiler; (9) MVP sound velocity profiler; (10) ECO triplet backscattering meter; (11) Mk9 light-level logger.



**Summary of Project/Data:** NOAA ship *Fairweather* surveyed six 260 km tracklines on the Bering Sea shelf during July-August 2006. Five different sonar systems were used to acquire acoustic backscatter and bathymetry data at depths ranging from 20 to 160 m. The five systems included two hull-mounted multibeam echosounders, a high-resolution interferometric sidescan sonar, and a prototype long-range sidescan sonar with an independent single beam echosounder. Groundtruth samples of sediment, infauna, and still/video images were collected during one of three passes along each trackline. Additional sensors provided continuous measurements of dissolved organics, chlorophyll-a, total particulate concentrations, and light levels in the study area.

**Sampling Dates:** 13 July 2006 – 23 August 2006.

**Status of Project/Data Processing:** Fully processed – Reson 8111 bathymetry, Klein 5410 backscatter, sediment granulometrics, infauna, sound velocity profiles. Processing ongoing – bathymetry and backscatter from Reson 8160 and Klein 7180; optical backscatter; light levels.

**References/Publications:**

- (1) Lomnicky, J., R. A. McConnaughey, C. Yeung, K. R. Smith, and M. Amend. 2008. Hydrography through the eyes of a fish – can acoustic backscatter be used to classify benthic fish habitat? Proceedings of the U.S. Hydro 2007 Conference, The Hydrographic Society of America.
- (2) Lomnicky, J. and R. A. McConnaughey. 2008. Integrating charting and acoustic habitat research. *Sea Tech.* 49(8): 10-15.
- (3) Yeung, C., M-S. Yang, and R. A. McConnaughey. In review. Polychaete community in southeastern Bering Sea in relation to groundfish distribution and diet.
- (4) [http://www.afsc.noaa.gov/RACE/surveys/cruise\\_archives/cruises2006/results\\_FW-FISHPAC2006.pdf](http://www.afsc.noaa.gov/RACE/surveys/cruise_archives/cruises2006/results_FW-FISHPAC2006.pdf).
- (5) <http://www.afsc.noaa.gov/RACE/groundfish/hrt/fishpac.php>.

**Point of Contact:** Bob McConnaughey, RACE Division, 206-526-4150, [bob.mcconnaughey@noaa.gov](mailto:bob.mcconnaughey@noaa.gov).



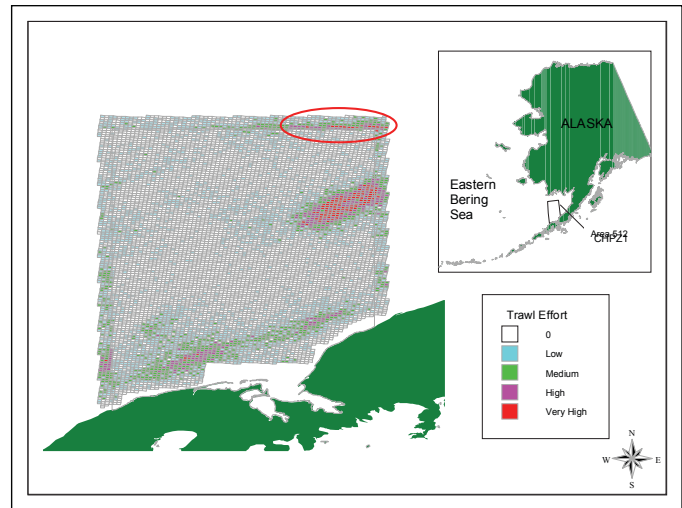
**Name of Project:** 1996 TRAWLEX experiment.

**Region (GOA, BS, AI):** BS.

**Specific Location:** Bristol Bay, eastern Bering Sea continental shelf.

**Data Types (Formats):** (1) Standardized epifauna catches, temperatures, depths (RACEBASE), (2) Hi-8 analog video (tapes digitized to DVD).

**Instruments/Devices Used For Collection:** (1) Eastern 83-112 bottom trawl modified with tickler chain and liner, (2) net-mounted MBT, (3) Osprey model OE1373 low-light analog video camera.



**Summary of Project/Data:** In 1996, epifauna populations were characterized in heavily fished and unfished areas in northern Bristol Bay during a July-August 1996 cruise involving the *FV Aldebaran* and the *FV Arcturus*. Quantitative estimates for 92 invertebrate taxa were obtained at 84 1-nmi<sup>2</sup> stations (n=42 pairs) straddling the northeastern boundary of the Crab and Halibut Protection Zone 1 (management area 512, which is now contained within the Bristol Bay Nearshore Closure Area). This area is relatively shallow (41-49 m), sandy and has strong tidal currents. Stations within the closed area had never been fished with commercial bottom trawls based on a review of historical fishing effort and foreign/domestic fishery regulations. A self-contained color video camera was attached to the top bridle of the trawl and provided landscape imagery of the seabed (5 sites).

**Sampling Dates:** 30 July – 6 August 2006.

**Status of Project/Data Processing:** Fully processed epifauna samples and archived video.

#### References/Publications:

- (1) [http://www.afsc.noaa.gov/RACE/surveys/cruise\\_archives/docs1996.htm](http://www.afsc.noaa.gov/RACE/surveys/cruise_archives/docs1996.htm)
- (2) McConnaughey, R. A., K. Mier, and C. B. Dew. 2000. An examination of chronic trawling effects on soft-bottom benthos of the eastern Bering Sea. *ICES J. Mar. Sci.* 57: 1377-1388.
- (3) McConnaughey, R. A., S. E. Syrjala, and C. B. Dew. 2005. Effects of chronic bottom trawling on the size structure of soft-bottom benthic invertebrates. Pages 425-437 in P. W. Barnes and J. P. Thomas (eds.). *Benthic habitats and the effects of fishing*. American Fisheries Society, Symposium 41, Bethesda, Maryland.

**Point of Contact:** Bob McConnaughey, RACE Division, 206-526-4150, [bob.mcconnaughey@noaa.gov](mailto:bob.mcconnaughey@noaa.gov).

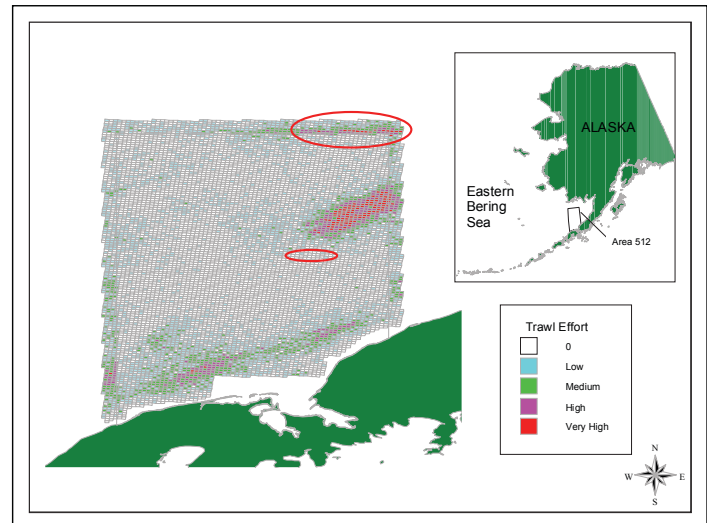
**Name of Project:** 1997 TRAWLEX experiment.

**Region (GOA, BS, AI):** BS.

**Specific Location:** Bristol Bay, eastern Bering Sea continental shelf.

**Data Types (Formats):** (1) Infauna abundance (.xls); (2) sidescan sonar imagery (*ArcView* project).

**Instruments/Devices Used For Collection:** (1) 0.05 m<sup>2</sup> Sutar van Veen grab sampler; (2) Klein 2000 sidescan sonar (100/500 kHz) with 3.5 kHz sub-bottom profiler.



**Summary of Project/Data:** AFSC and U.S. Geological Survey (USGS) scientists characterized benthic habitats in northern Bristol Bay during a July-August 1997 cruise on the *FV Golden Dawn*. The primary study area straddled the northeast boundary of management area 512, a relatively shallow (41-49 m), sandy and high-current area closed to bottom trawling. Infauna were collected from adjacent untrawled and heavily trawled stations using a Sutar van Veen grab sampler (n=25 pairs). Sidescan (188 line-km) and video (22 line-km) transects oriented across the boundary explored seabed features. Additional infauna sampling (n=28) and sidescan/video surveys were conducted farther south in the closed area (depths 59-72 m).

**Sampling Dates:** 28 July – 15 August 2007.

**Status of Project/Data Processing:** Fully processed infauna samples and sidescan images.

#### References/Publications:

- (1) [http://www.afsc.noaa.gov/RACE/surveys/cruise\\_archives/cruises1997/results\\_GD1997-02.pdf](http://www.afsc.noaa.gov/RACE/surveys/cruise_archives/cruises1997/results_GD1997-02.pdf)
- (2) McConnaughey, R. A., K. Mier, and C. B. Dew. 2000. An examination of chronic trawling effects on soft-bottom benthos of the eastern Bering Sea. *ICES J. Mar. Sci.* 57: 1377-1388.
- (3) McConnaughey, R. A., S. E. Syrjala, and C. B. Dew. 2005. Effects of chronic bottom trawling on the size structure of soft-bottom benthic invertebrates. Pages 425-437 in P. W. Barnes and J. P. Thomas (eds.). *Benthic habitats and the effects of fishing*. American Fisheries Society, Symposium 41, Bethesda, Maryland.
- (4) Marlow, M. S., A. J. Stevenson, H. Chezar, and R. A. McConnaughey. 1999. Tidally generated sea-floor lineations in Bristol Bay, Alaska. *Geo-Marine Letters* 19: 219-226.

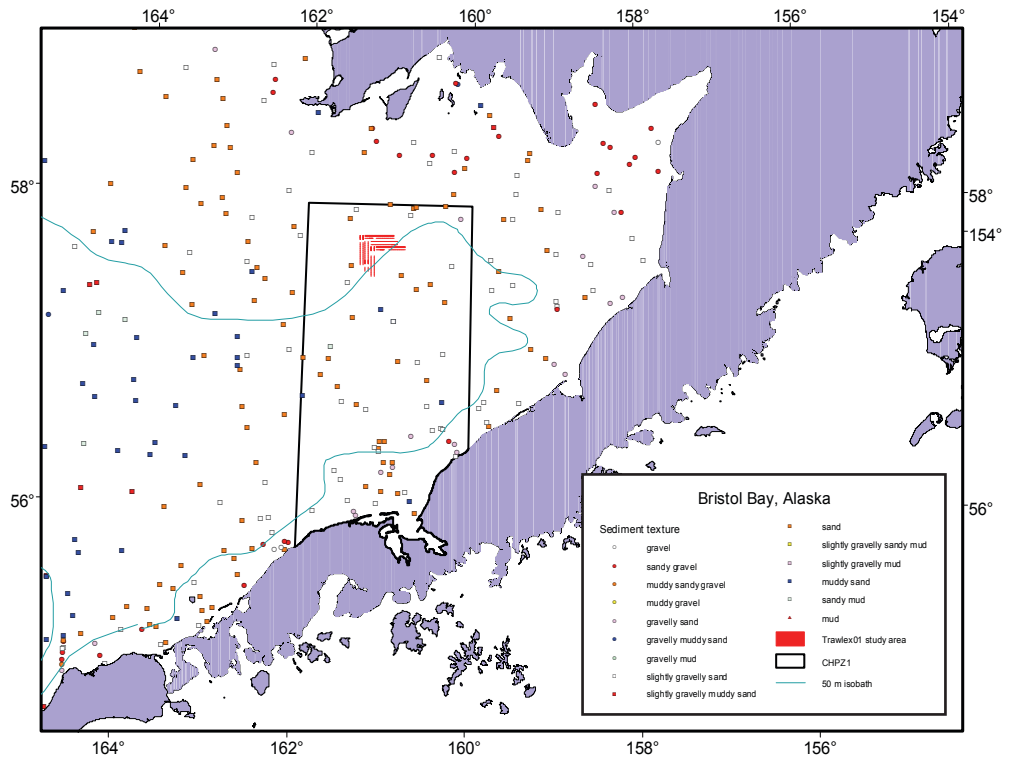
**Point of Contact:** Bob McConnaughey, RACE Division, 206-526-4150, [bob.mcconnaughey@noaa.gov](mailto:bob.mcconnaughey@noaa.gov).

**Name of Project:**  
TRAWLEX BACI  
experiment.

**Region (GOA, BS,  
AI):** BS.

**Specific Location:**  
Bristol Bay, eastern  
Bering Sea  
continental shelf.

**Data Types  
(Formats):** (1)  
standardized  
epifauna catches,  
temperatures,  
depths  
(RACEBASE), (2)  
infauna (.xls), (3)  
sediment  
granulometrics and  
chemistry (.xls), (4)  
sidescan sonar  
backscatter (.xtf), (5) CTD.



**Instruments/Devices Used For Collection:** (1) Eastern 83-112 bottom trawl modified with tickler chain and liner, (2) net-mounted MBT, (3) 0.1 m<sup>2</sup> van Veen grab sampler, (4) Klein 5410 sidescan sonar, (5) Sea-bird SBE 19 Plus.

**Summary of Project/Data:** In 2001, six pairs of 10-mi long research corridors were sampled from the *FV Ocean Explorer* to investigate the effects of an experimental disturbance with a commercial bottom trawl. Quantitative assessments of epifauna and infauna populations were undertaken before and after trawling. Sediment samples were collected and processed for possible changes in grain size and chemical characteristics (organic carbon, nitrogen). Sidescan sonar surveys were also conducted before and after trawling. All corridors were revisited in 2002 to monitor recovery. The experimental design will accommodate one additional sampling event.

**Sampling Dates:** (1) 15 June – 15 July 2001, (2) 18 June – 6 July 2002.

**Status of Project/Data Processing:** All processing completed.

**References/Publications:**

- (1) [http://www.afsc.noaa.gov/RACE/surveys/cruise\\_archives/cruises2001/results\\_OE2001-01.pdf](http://www.afsc.noaa.gov/RACE/surveys/cruise_archives/cruises2001/results_OE2001-01.pdf).
- (2) <http://www.afsc.noaa.gov/RACE/groundfish/hrt/impact.htm>.

**Point of Contact:** Bob McConnaughey, RACE Division, 206- 526-4150, [bob.mcconnaughey@noaa.gov](mailto:bob.mcconnaughey@noaa.gov).

**Name of Project:** Trawl-effect reduction tests.

**Region (GOA, BS, AI):** BS.

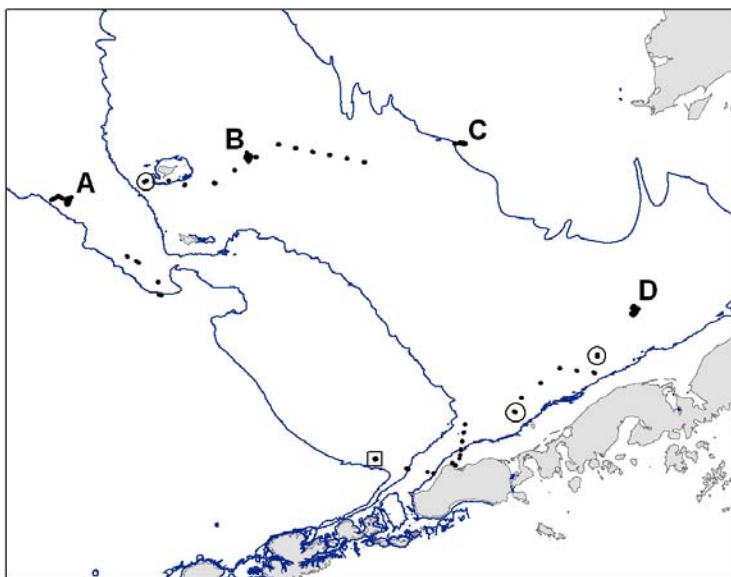
**Specific Location:** Eastern Bering Sea shelf.

**Data Types (Formats):** Video, DIDSON (sonar imagery).

**Instruments/Devices Used For Collection:** Strobe-lighted video camera and DIDSON sonar mounted on a towed benthic sled.

**Summary of Project/Data:**

Benthic sled observations of trawl tracks. Trawl sweeps modified to test whether sweep modification reduces seafloor effects. Four test locations (letters on figure) plus opportunistic sled tows at survey sites, boundaries of fishing closures (circles) and a skate nursery (square). Site A had sled tows 1–2 days, 1 week, 1 month and 1 year after trawl tows.



**Sampling Dates:** 23 May - 7 June 2005 (all sites on figure); 19 June - 3 July 2006 (site A only).

**Status of Project/Data Processing:** DIDSON processing to determine location of trawl component tracks (doors, sweeps, footrope) and video counts of animals in different conditions by component. Video processing complete for 2005 sites A and D and partial for 2006 site A.

**References/Publications:** Reports to North Pacific Fishery Management Council.

**Point of Contact:** Craig Rose, RACE Division, 206-526-4128, [craig.rose@noaa.gov](mailto:craig.rose@noaa.gov).

**Name of Project:** Multibeam habitat mapping in the Alaska region.

**Region (GOA, BS, AI):** GOA, BS, AI.

**Specific Location:** Various.

**Data Types (Formats):** NA.

**Instruments/Devices Used For Collection:** Multibeam sonar.

**Summary of Project/Data:** Seafloor habitat maps have been created using high-resolution multibeam bathymetry with co-registered backscatter at various locations throughout the Alaska Region. Most of the mapping in the GOA is in the form of “postage stamps” ranging in size from 27 km<sup>2</sup> to 790 km<sup>2</sup>. Some of this mapping was in cooperation with the Alaska Department of Fish and Game and the University of Alaska Fairbanks. Such mapped sites in the GOA were generally selected in the areas of fisheries for rockfish (*Sebastes* spp.). The selection of specific sites to map was influenced by budget and logistical constraints that in some cases limited the fishery-habitat mapping to areas near concurrent areas being mapped by NOAA’s Office of Coast Survey. In contrast for the Aleutian Islands, a systematic design was used to select sites to map that enabled a relatively substantial area of seafloor to be characterized. In theory such a systematic design allows extrapolation to unmapped areas.

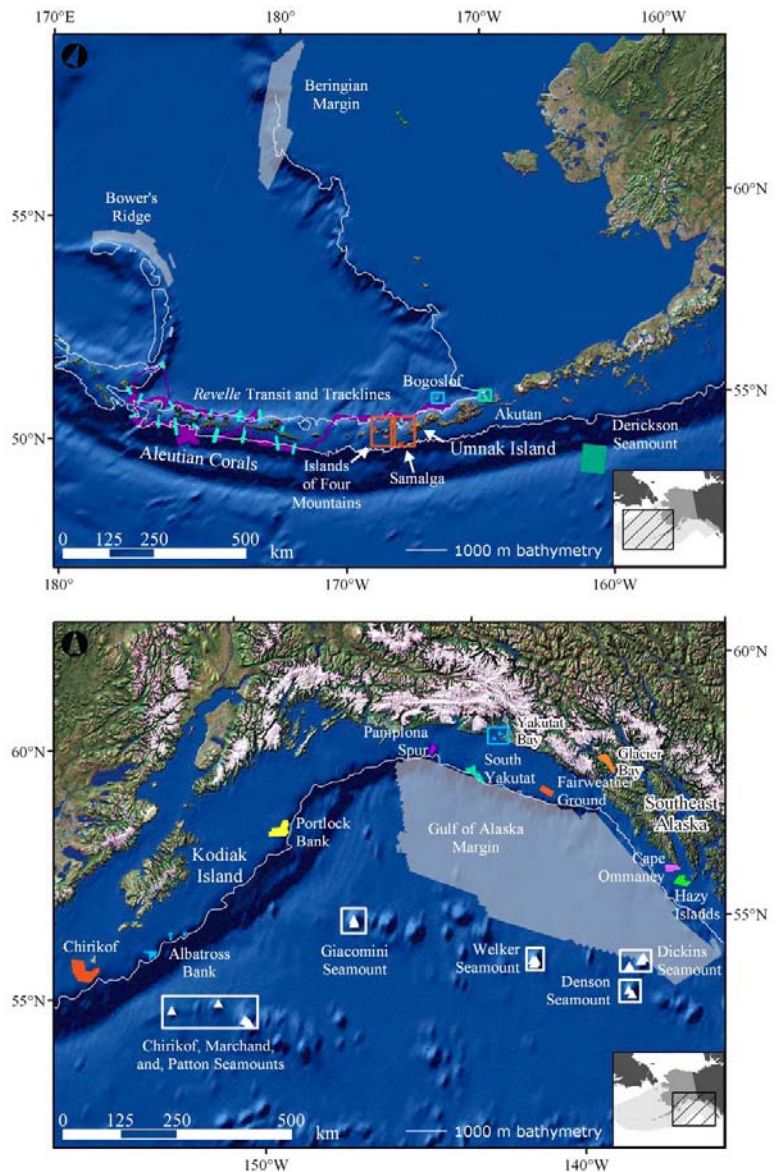
**Sampling Dates:** 2001-2003.

**Status of Project/Data Processing:** Habitat typing of all maps except for AI has been completed.

**References/Publications:**

Shotwell, S. K., J. Heifetz, D. L. Courtney, and H. G. Greene. 2008. Mapping marine benthic habitat in the Gulf of Alaska: Geological habitat, fish distributions, and fishing intensity. Pages 349-368 in B. J. Todd and H.G. Greene (eds.). Mapping the seafloor for habitat characterization. Geological Association of Canada. Special Publication 47.

**Point of Contact:** Jon Heifetz, ABL, 907-789-6054, [jon.heifetz@noaa.gov](mailto:jon.heifetz@noaa.gov).



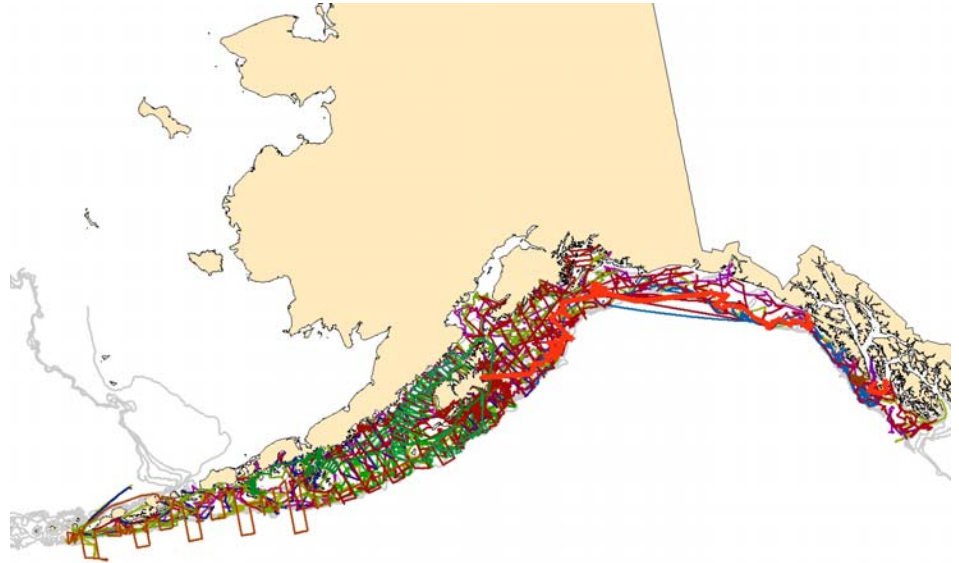
**Name of Project:** Trawlability  
- AFSC survey single-beams.

**Region (GOA, BS, AI):**  
GOA.

**Specific Location:** GOA  
bottom trawl survey area.

**Data Types (Formats):** ES60  
and EK60 single-beam files  
(\* .raw), EK-60 split-beam  
files.

**Instruments/Devices Used  
For Collection:** Simrad ES60,  
EK60 single-beam  
echosounders. EK60 split-  
beam echosounder.



**Summary of Project/Data:**

The map shows approximately 100,000 km of single-beam acoustic vessel tracks for the 2002 NOAA ship *John N. Cobb* survey, the 2003 and 2005 Gulf of Alaska bottom trawl vessels, four MACE cruises, 2 FOCI cruises, and the 2007 split-beam cruise on the NOAA ship *Oscar Dyson*. Quality varies widely but depth can usually be discerned. Data need to be smoothed to eliminate vessel motion and then integrated with the slope map for more complete coverage. There are also other single-beam transect data sets available from the NOAA National Geophysical Data Center (NGDC) and the USGS but they have not been proofed.

**Sampling Dates:** 2002-present.

**Status of Project/Data Processing:** Attempting to locate and acquire data. Editing and analysis has not begun.

**References/Publications:** None.

**Point of Contact:** Mark Zimmermann, RACE Division, 206-526-4119, [mark.zimmermann@noaa.gov](mailto:mark.zimmermann@noaa.gov)

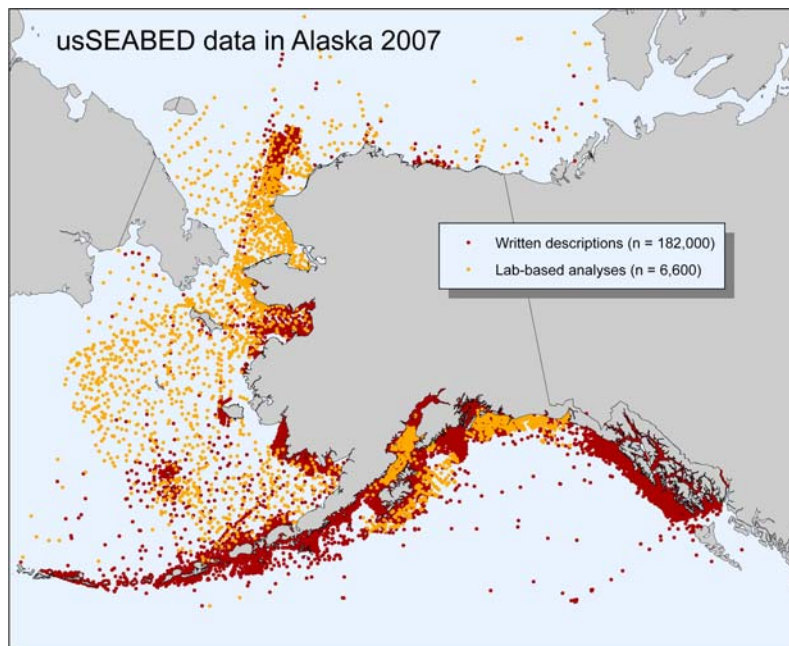
**Name of Project:** usSEABED.

**Region (GOA, BS, AI):** All.

**Specific Location:** Alaskan EEZ.

**Data Types (Formats):** Comma-delimited text files and shapefiles on CD and web-based USGS publication; also searchable online ArcIMS database. Full FGDC-compliant metadata provided for usSEABED data files and all source data sets.

**Instruments/Devices Used For Collection:** Lead-lines, grabs, cores, dredges, trawls, video and other groundtruthing methods.



**Summary of Project/Data:** USGS-led initiative to collate all seafloor surficial groundtruthing information into a data-mined relational database. Numeric values for verbal descriptions are provided through the application of fuzzy set theory to geologic language; these data can be combined with more typical lab-based analytical data to increase seafloor coverage. Information provided includes: texture (GSSC), color, grain-size, geochemical or geophysical parameters, constituents (geologic and biologic); that is, whatever data were collected or can be inferred from the samples themselves. On map, brown dots are locations with verbal descriptions and orange dots are locations with numeric, laboratory-derived descriptions.

**Sampling Dates:** 19 July 1888 to present.

**Status of Project/Data Processing:** USGS Data Series publication "usSEABED: Pacific Coast (Alaska, Hawaii) Offshore Surficial-Sediment Data Release." 2008. For sediment contributions contact Jane Reid, USGS, [jareid@usgs.gov](mailto:jareid@usgs.gov).

**References/Publications:**

- (1) For viewing seabed datasets see: <http://coastalmap.marine.usgs.gov/regional/contusa/index.html>.
- (2) For a description of the usSEABED database as currently published for the US. Pacific coast (2006), Atlantic coast (2005), and Gulf of Mexico and Caribbean (2006) see: <http://walrus.wr.usgs.gov/usseabed/>.
- (3) For a description of the seabed software see: Jenkins, C. J. 1997. Building offshore soils databases. Sea Tech. 38(12): 25-28.

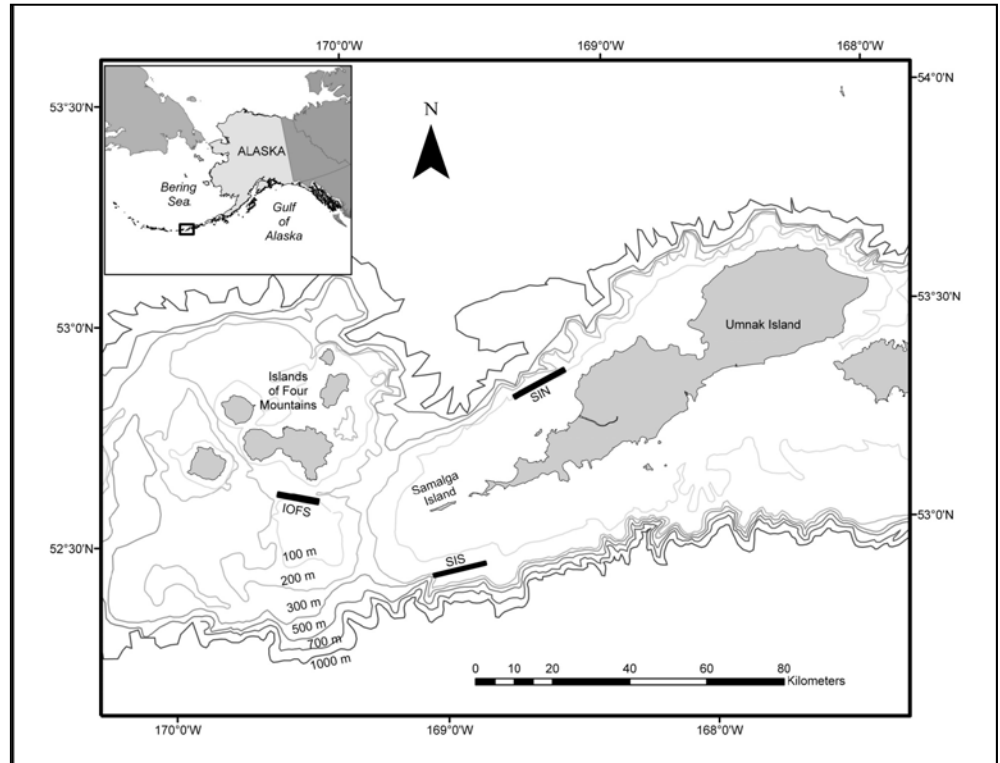
**Point of Contact:** Mark Zimmermann, RACE Division, 206-526-4119, [mark.zimmermann@noaa.gov](mailto:mark.zimmermann@noaa.gov)

**Name of Project:** Pacific ocean perch (*Sebastes alutus*) habitats.

**Region (GOA, BS, AI):** AI.

**Specific Location:** Islands of Four Mountains and Samalga Pass, continental shelf.

**Data Types (Formats):** High resolution multibeam sonar data (.xtf) and georeferenced bathymetry images (.tiff); digital sidescan sonar data (.xtf) and georeferenced backscatter images (.tiff); analog and HD video (all in digital format – DVD).



**Instruments/Devices Used For Collection:** Simrad SM2000, Klein 3000.

**Summary of Project/Data:** This study examined a nursery area for juvenile Pacific ocean perch (POP, *Sebastes alutus*) in the Aleutian Islands. Five study sites were mapped using sidescan and multibeam sonar, and three were groundtruthed using underwater video. The video images were used to classify the seafloor into substrate types. Juvenile POP were found predominantly in mixed sand and boulder substrate within one body length of complex structure such as boulders, coral or sponges. The distribution of juvenile POP also suggest their essential habitats may be relatively easily identified and managed from large-scale mapping studies that can discriminate mixed boulders and habitat.

**Sampling Dates:** 1 June – 24 August 2004.

**Status of Project/Data Processing:** Completed.

**References/Publications:**

- (1) Rooper, C. N., J. L. Boldt, and M. Zimmermann. 2007. An assessment of juvenile Pacific ocean perch (*Sebastes alutus*) habitat use in a deepwater nursery. *Estuar. Coast. Shelf Sci.* 75:371-380.
- (2) Boldt, J. L., and C. N. Rooper. In review. An examination of links between feeding conditions and energetic content of juvenile Pacific ocean perch in the Aleutian Islands. *Fish. Oceanogr.*
- (3) Rooper, C. N. and M. Zimmermann. 2007. A bottom-up methodology for integrating underwater video and acoustic mapping for seafloor substrate classification. *Cont. Shelf Res.* 27: 947-957.
- (4) [http://www.afsc.noaa.gov/race/groundfish/habitat/POP/pop\\_intro.htm](http://www.afsc.noaa.gov/race/groundfish/habitat/POP/pop_intro.htm).
- (5) <http://project.nprb.org/view.jsp?id=cb4ac4f5-390c-44fb-953e-c466816cd30c>.

**Point of Contact:** Chris Rooper, RACE Division, 206-526-4689, [chris.rooper@noaa.gov](mailto:chris.rooper@noaa.gov).



**Name of Project:** Aleutian Islands cooperative acoustic survey study.

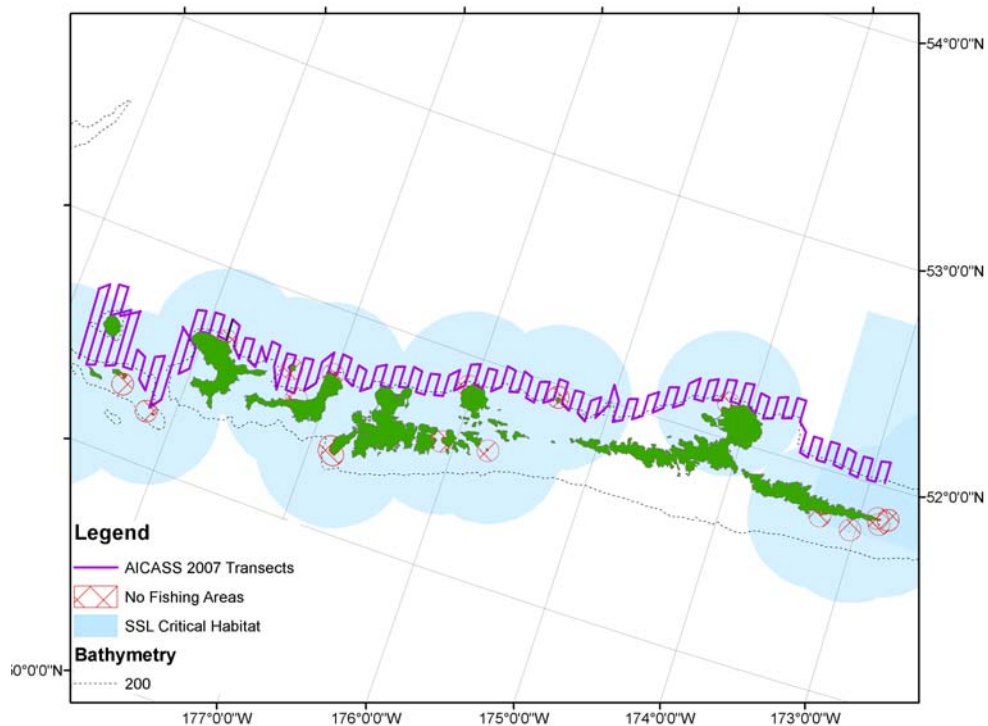
**Region (GOA, BS, AI):** AI.

**Specific Location:** Central Aleutians; Atka Island (2006); 173°W longitude to 179°W longitude (2007).

**Data Types (Formats):**  
Text files; Excel.

**Instruments/Devices Used For Collection:** CTD.

**Summary of Project/Data:**  
Temperature, salinity and depth data were collected at sites throughout the study area.



**Sampling Dates:**

- (1) 10 March – 5 April 2006.
- (2) 19 March – 21 April 2007.

**Status of Project/Data Processing:** Project is on-going. 2006 data report is in review and 2007 data are being processed.

**References/Publications:** None at this time.

**Point of Contact:**

Libby Logerwell, REFM Division, 206-526-4231, [libby.logerwell@noaa.gov](mailto:libby.logerwell@noaa.gov).  
Steve Barbeaux, REFM Division, 206-526-4211, [steve.barbeaux@noaa.gov](mailto:steve.barbeaux@noaa.gov).

**Name of Project:** Kodiak fishery interactions and fisheries oceanography studies.

**Region (GOA, BS, AI):** GOA.

**Specific Location:** East coast of Kodiak Island.

**Data Types (Formats):** Text, Excel, Access.

**Instruments/Devices Used For Collection:** Sea-bird SBE 9 Plus, MBT, XBT (expendable bathythermograph), continuous “sea chest” sampling, drifters, Tucker trawl (2005 only).

**Summary of Project/Data:** Oceanographic data were collected near Kodiak Island from the NOAA ship *Miller Freeman*. Depth, temperature and salinity (SBE only) data were collected at numerous sites. Water samples were taken for chlorophyll and nutrient analysis. Continuous sea surface temperature, salinity and fluorescence data were also collected (with water samples for chlorophyll and nutrient analysis). Drifters were also released.

**Sampling Dates:**

- (1) 9-17 August 2000.
- (2) 9-30 August 2001.
- (3) 16 August – 4 September 2002.
- (4) 15 August – 4 September 2004.
- (5) 5 August – 14 September 2005.
- (6) 13 August – 6 September 2006.

**Status of Project/Data Processing:** Projects are complete. Data from 2000-2004 have been published in peer-reviewed journals. 2005 and 2006 data have undergone preliminary analyses.

**References/Publications:**

- (1) Hollowed, A. B., C. D. Wilson, P. J. Stabeno, and S. A. Salo. 2007. Effect of ocean conditions on the cross-shelf distribution of walleye pollock (*Theragra chalcogramma*) and capelin (*Mallotus villosus*). *Fish. Oceanogr.* 16: 142-154.
- (2) Logerwell, E. A., P. J. Stabeno, C. D. Wilson, and A. B. Hollowed. 2007. The effect of oceanographic variability and interspecific competition on juvenile pollock (*Theragra chalcogramma*) and capelin (*Mallotus villosus*) distributions on the Gulf of Alaska shelf. *Deep Sea Res. II* 54: 2849-2868.

**Point of Contact:**

Libby Logerwell, REFM Division, 206-526-4231, [libby.logerwell@noaa.gov](mailto:libby.logerwell@noaa.gov).  
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**Name of Project:** Atka mackerel tag release and recovery.

**Region (GOA, BS, AI):** AI.

**Specific Location:** Seguam Pass, Tanaga Pass, Amchitka Island, Kiska Island.

**Data Types (Formats):** Text files, Excel files.

**Instruments/Devices Used For Collection:** Net-mounted MBT, SBE45, SCUFA (Self-Contained Underwater Fluorescence Apparatus).

**Summary of Project/Data:**

Oceanographic data were collected at several locations along the Aleutian Islands from chartered fishing vessels. Temperature-depth data were collected with a MBT on nearly all tag release and recovery hauls. Temperature, salinity and fluorescence were collected continuously from surface water during tag release cruises only. Water samples were filtered and analyzed for chlorophyll to convert fluorescence data into chlorophyll biomass.

**Sampling Dates:** Tag release cruises: (1) 10 June - 15 July 2002; (2) 12-26 July 2003; (3) 8-24 July 2006. Tag recovery cruises: (1) 23-28 August 2002; (2) 30 September – 12 October 2002; (3) 5-31 October 2003; (4) 7-23 October 2004; (5) 11 October - 1 November 2006.

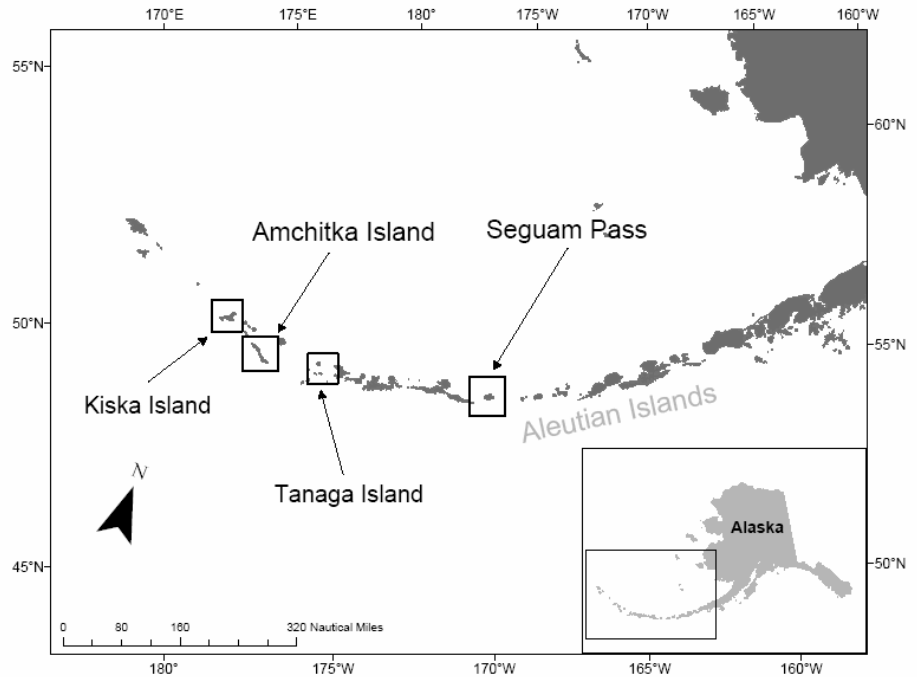
**Status of Project/Data Processing:** Project is on-going. Most data are in raw (text file) format. Some have been organized into Excel spreadsheets.

**References/Publications:**

McDermott, S. F., L. W. Fritz, and V. Haist. 2005. Estimative movement and abundance of Atka mackerel (*Pleurogrammus monopterygius*) with tag-release-recapture data. *Fish. Oceanogr.* 14 (Suppl. 1): 113-130.

**Point of Contact:**

Libby Logerwell, REFM Division, 206-526-4231, [libby.logerwell@noaa.gov](mailto:libby.logerwell@noaa.gov).  
Susanne McDermott, REFM Division, 206-526-4417, [susanne.mcdermott@noaa.gov](mailto:susanne.mcdermott@noaa.gov).



**Name of Project:** Pacific cod Cape Sarichef localized depletion experiment.

**Region (GOA, BS, AI):** BS.

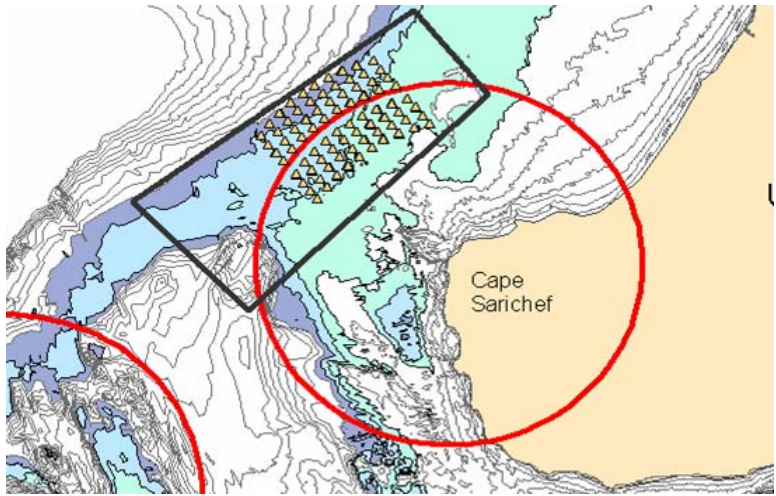
**Specific Location:** Cape Sarichef.

**Data Types (Formats):** Text files.

**Instruments/Devices Used For Collection:** CTD (with dissolved oxygen, turbidity and light sensors), current meter.

**Summary of Project/Data:**

Oceanographic data were collected nearby Unimak Pass. A CTD and current meter were deployed in a small “mooring cage” to collect near bottom data continuously throughout the study dates.



**Sampling Dates:**

- (1) 27 December 2002 – 10 January 2003.
- (2) 15-31 March 2003.
- (3) 27 December 2003 – 10 January 2004.
- (4) 15-31 March 2004.
- (5) 5-19 January 2005.
- (6) 15-31 March 2005.

**Status of Project/Data Processing:** Project is complete. Data have undergone preliminary analysis.

**References/Publications:**

Conners, M. E., and P. Munro. 2008. Effects of commercial fishing on local abundance of Pacific cod (*Gadus macrocephalus*) in the Bering Sea. Fish. Bull., U.S. 106:281-292.

**Point of Contact:**

Libby Logerwell, REFM Division, 206-526-4231, [libby.logerwell@noaa.gov](mailto:libby.logerwell@noaa.gov).  
Peter Munro, REFM Division, 206-526-4292, [peter.munro@noaa.gov](mailto:peter.munro@noaa.gov).

**Name of Project:** Down to 50 m bathymetry.

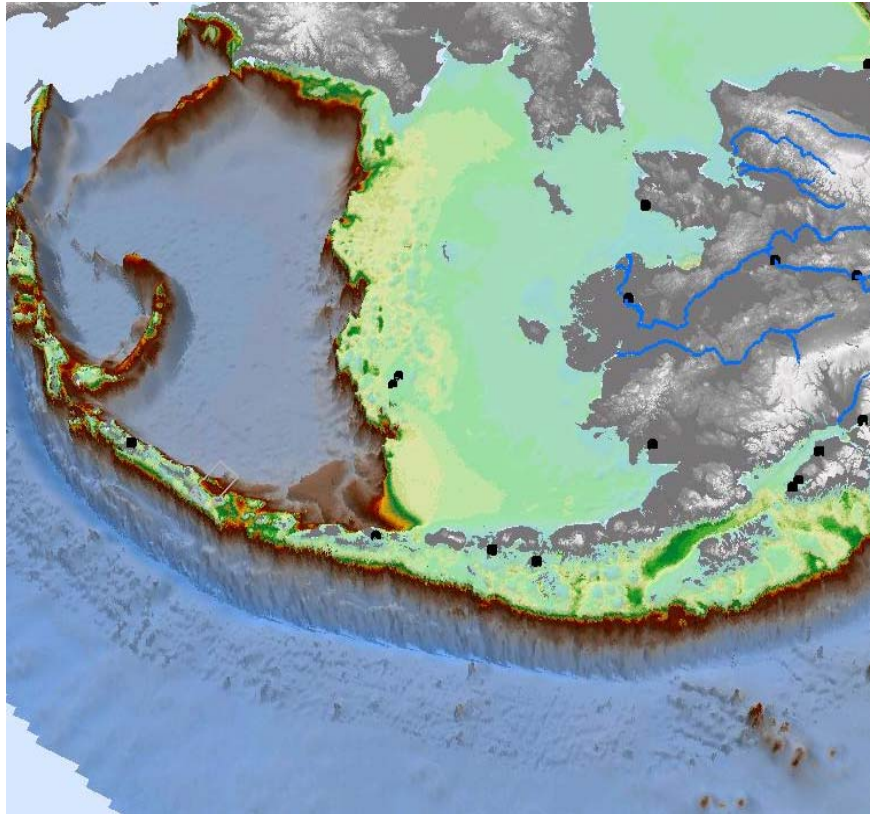
**Region (GOA, BS, AI):** GOA, BS, AI.

**Specific Location:** Alaska and surrounding areas.

**Data Types (Formats):** Polygon – shapefile and geodatabase.

**Instruments/Devices Used For Collection:** Off-the-shelf base data. Hydrographic survey. Trackline Geophysics.

**Summary of Project/Data:** This Alaska bathymetric dataset was built using base data from Trackline Geophysics, hydrographic surveys, and filled in with ETOPO2 data. The process included creating higher resolution polygons where the trackline and hydrographic data supported it.



The final data product has two main attributes: the spatial resolution of the data (incrementally from 50 – 1500 meters) and the depth by 1/10 of a meter. The Trackline Geophysics data remained uncorrected in this process. This dataset was last updated in June 2005. We have plans to update this dataset with the additional Trackline and hydrographic data that has become available.

**Sampling Dates:** Data through March 2005.

**Status of Project/Data Processing:** Complete.

**References/Publications:** None.

**Point of Contact:** Steve G. Lewis, National Marine Fisheries Service, Alaska Region, 907-586-7858, [steve.lewis@noaa.gov](mailto:steve.lewis@noaa.gov)



**Appendix A.** Meeting agenda, participants, and workshop minutes.

**AGENDA**

<b>Day</b>	<b>Time</b>	<b>Activity</b>	<b>Facilitator</b>
Thursday	08:30	Coffee	
20 September	09:00	Welcome / Plan for the day	Bob McConnaughey
	09:10	Workshop objectives	Mike Sigler
	09:30	Oral presentations of data worksheets	Bob McConnaughey
	12:30	Lunch	
	13:30	Workshop products overview	Bob McConnaughey
	13:40	Lessons learned about centralizing data	Eric Boerner
	14:10	Product-related discussions	Mike Sigler
	17:00	Wrap-up / Friday overview	Bob McConnaughey
Friday	08:30	Coffee	
21 September	09:00	Welcome / Plan for the day	Bob McConnaughey
	09:10	Round table discussions	Bob McConnaughey
		Lunch (1 hour)	
	14:00	Wrap-up and Assignments	Bob McConnaughey
Time Permitting		ShoreZone presentation (15 min)	Scott Johnson

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## PARTICIPANTS

Name	Affiliation
Steve Barbeaux	AFSC, REFM, Seattle, WA
Jan Benson	AFSC, OMI, Seattle, WA
Eric Boerner	AFSC, NMML, Seattle, WA
Cleo Brylinsky	ADF&G, Sitka, AK
Liz Chilton	AFSC, RACE, Kodiak, AK
Liz Conners	AFSC, REFM, Seattle, WA
Cathy Coon	NPFMC, Anchorage, AK
Guy Fleischer	AFSC, RACE, Seattle, WA
Angie Greig	AFSC, REFM, Seattle, WA
Jon Heifetz	AFSC, ABL, Juneau, AK
Jerry Hoff	AFSC, RACE, Seattle, WA
Scott Johnson	AFSC, ABL, Juneau, AK
Stan Kotwicki	AFSC, RACE, Seattle, WA
Jon Kurland	AKRO, HCD, Juneau, AK
Ben Laurel	AFSC, RACE, Newport, OR
Bob Lauth	AFSC, RACE, Seattle, WA
Steve Lewis	AKRO, Juneau, AK
Mandy Lindeberg	AFSC, ABL, Juneau, AK
Bob McConnaughey	AFSC, RACE, Seattle, WA
John Olson	AKRO, HCD, Anchorage, AK
Jeep Rice	AFSC, ABL, Juneau, AK
Phil Rigby	AFSC, ABL, Juneau, AK
Kalei Shotwell	AFSC, ABL, Juneau, AK
Mike Sigler	AFSC, HEPR, Juneau, AK
Jon Warrenchuk	Oceana, Juneau, AK
Cynthia Yeung	AFSC, RACE, Seattle, WA
Mark Zimmermann	AFSC, RACE, Seattle, WA

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Abbreviations: Alaska Fisheries Science Center (AFSC), Alaska Department of Fish and Game (ADF&G), Alaska Regional Office (AKRO), Auke Bay Laboratories (ABL), Habitat and Ecological Processes Research Program (HEPR), Habitat Conservation Division (HCD), National Marine Mammal Laboratory (NMML), North Pacific Fishery Management Council (NPFMC), Operations Management and Information Division (OMI), Resource Assessment and Conservation Engineering Division (RACE), Resource Ecology and Fisheries Management Division (REFM).



## MINUTES

Bob McConnaughey opened the workshop by addressing the plan for the day. The overall goal of the workshop is to discuss how to derive the maximum benefit from any data that may be collected, and the stated workshop objectives. We want to promote a discussion of where we've been, where we are, and where we go from here. Bringing this group of scientists together should enable three things: (1) to learn about the datasets provided by attendees and catalog other datasets that may be available; (2) to develop a plan for promoting collaborative use of data through greater awareness; and (3) to bring scientists involved in habitat research together to get to know one another.

Mike Sigler stated that the purpose of the workshop is to communicate to each other what databases are available or that are used by scientists in the Alaska Region to support habitat research. The outcome of the workshop will be a Processed Report published through the AFSC, available both in hardcopy and online.

The participants described 23 habitat data sets. The presentations are listed below in the order presented. The title of the data set is followed by the presenter. In addition, this information is described in the "Habitat Data Inventory" section of this workshop report following a standard format. Included in each section are questions raised during the ensuing group discussion.

### **1. Habitat Areas of Particular Concern – a Case Study of EFH Habitat Data Cathy Coon, NPFMC**

This presentation was based on the use of coral and habitat data collected by Bob Stone, Ken Krieger, and Jon Heifetz in dives in SE Alaska. Working with the North Pacific Fishery Management Council and NMFS, three areas in SE Alaska were closed to bottom contact fishing gear to protect sensitive coral habitat. This closure was based on *in situ* observation of *Primnoa* thickets and rockfish from submersibles and also utilized multibeam data. These closures were a result of management actions taken by NMFS and NPFMC during the Essential Fish Habitat Environmental Impact Statement and illustrate how scientific datasets are utilized by managers.

Q: How to keep management (NMFS, NPFMC) and AFSC aware of what each is doing?

### **2. Delta Submarine Video Archiving Jon Heifetz, ABL**

Since 1988, 373 *Delta* dives have been conducted in Alaska, predominately in SE Alaska (260) but also in Kodiak (50) and the Aleutian Islands (63). The dives presented are those conducted by the Marine Fish section at ABL. A contractor was hired to analyze the video data and collect information such as start/end times, scientist name, purpose of dive, camera angle, navigation, depth min/max, stock assessment, slope, dominant habitat type, species table, abundance category, and navigation files. Data formats are VHS, Hi8 analog, and Hi8 digital. 40% of the tapes have been completed, but approximately \$15k and 6 months of time is required to finish the remaining 60%. It has proven difficult to find someone to process video files, as it is very time intensive and tedious.

Q: Could these data be added to Fish Atlas?

Q: Could locations/status be added to data sheets, even for unprocessed data?

Q: Could datasets include image captures?

Q: How much public access should be granted to these data?

### **3. Multibeam Habitat Mapping in the Alaska Region** **Kalei Shotwell, ABL**

A multibeam database collaboration between AFSC, UAF, OSU, ADFG, and NMFS containing imagery and backscatter; organized into Point of Contact, region, depth range, area, XYZ, and including information about how the data were produced. For AFSC data, approximately 16,000 km<sup>2</sup> of 390,000 km<sup>2</sup> of the data have already been processed. AFSC data will be incorporated into NOS/NGDC data sets. Extrapolating processed data into unsurveyed areas is a goal of the program.

Q: Have extrapolated data been groundtruthed at this time?

Q: Does backscatter and bathymetry actually give you good habitat maps?

### **4. Habitat Influence on Rearing Condition and Overwinter Survival of Juvenile Capelin (*Mallotus villosus*)** **Mandy Lindeberg, ABL**

A 2-year project studying juvenile capelin, utilizing acoustics, plankton tows, and surveys. Energetics and physiological studies are included. There are three study sites: Glacier Bay, Berners Bay, and Fritz Cove. Data collected will eventually be compared with measures of abundance, growth and energetic condition to evaluate habitat characteristics conducive to increased recruitment of capelin.

Q: Studies of capelin don't deal with hard (physical) boundaries, which is required for EFH designation.

Q: Is there a way to designate habitat for the water column?

Q: Acoustic files are huge and storage is a problem – how to solve?

### **5. Essential Fish Habitat Requirements for Skate Nurseries** **Jerry Hoff, RACE**

Six skate nurseries in the Bering Sea were identified and mapped using bottom trawl survey data. Nurseries generally occur along the 200 m contour, usually in flat sandy-muddy bottom with little relief. Nursery sites tended to be small and contained large numbers of egg cases.

Q: If the data exists in Excel format now, is it possible to put into RACEBASE format?

Q: Are nursery sites discrete?

Q: Are they vulnerable to fishing?

### **6. Effect of Light Intensity on Vertical and Spatial Distribution of Fish and Their Availability to Bottom Trawl and Acoustic Surveys** **Stan Kotwicki, RACE**

Assess the effect of light intensity and penetration on the distribution of walleye pollock. Data are mainly from the Bering Sea, less from the Gulf of Alaska. The objective of this work is to establish a relationship between light penetration and the availability of pollock to trawls, which could allow scientists to reduce uncertainty in pollock biomass estimates.

### **7. Nearshore Habitat Use in Juvenile Pacific Cod** **Benjamin Laurel, RACE**

This HEPR-funded project looks at smaller nearshore sites sampled with beach seines and baited cameras. Age-0 and -1 Pacific cod have been collected for 2 years at several sites around Kodiak Island. Data have been analyzed on a diel, season, and annual basis, leading to conclusions relating habitat use to year class-strength, ontogenetic changes in habitat preference and changes in the physical environment.

Q: Sampling in rough bottoms is difficult – how do you standardize?

Q: How do you archive tapes?

## **8. Atka Mackerel EFH**

**Bob Lauth, RACE**

Towed video drop camera to locate and characterize the general spawning and nesting habitat of Atka mackerel in the AI. Research supported with EFH and NPRB funds. The drop cameras being used are designed for extremely rugged bottoms. 125 drops have been performed. Issues are storage – 1 hour of footage is 15GB.

Q. How do you process and present data to the public?

## **9. Estuaries Database**

**Jon Heifetz, ABL**

Visit nearshore sites several times over scales of seasons and years to index variability. The most common fish species sampled have been yellowfin sole, chum and pink salmon, starry flounder, and Pacific herring.

Q: Links between this project and ShoreZone and Fish Atlas?

## **10. Alaska Coastal Mapping / Nearshore Fish Atlas**

**Mandy Lindeberg/Scott Johnson, ABL**

ShoreZone is a biophysical mapping protocol for intertidal areas. Washington and British Columbia are done. 30,000 km of Alaska have been mapped. Integrated with Fish Atlas. First phase involved flying coastline during a minus tide window and acquiring georeferenced images. The second phase is the biophysical mapping. The third phase involves an online website.

Q: How much duplicative information from ESI maps, NOS, etc?

Q: Can this type of project contain data on marine mammals as well?

## **11. Trawlability – AFSC Survey Single-Beams**

**Mark Zimmermann, RACE**

5 by 5 km grid cells have been marked good/bad trawls since 1990. 20,000-22,000 total grid cells, ~1,300 are bad, ~1,400 good, and the rest are presently unknown. Once a cell is designated as “bad” it is taken off the list of trawlable locations. Slope, rockiness, and snags are recorded. Midrange (100-200 m) strata were generally more trawlable than shallow (<100 m) or deeper (>300 m) strata. Overall strata are 75% trawlable on average.

Q: Part of RACEBASE?

Q: How often do they get to new grid cells?

## **12. Bristol Bay Reconnaissance**

**Bob McConnaughey, RACE**

Seafloor habitats in central Bristol Bay were surveyed with sidescan sonar. Imagery was groundtruthed using video camera and van Veen grab sampler. Acoustic data compared to AFSC bottom trawl survey data. Processed acoustics explained between 9-54% of variability in miscellaneous groundfish and benthic invertebrate species found in the study area.

Q: How are data stored? Digital tape, DVDs, georeferenced TIFFs.

**13. Bering Sea Echosounder Survey**  
**Bob McConnaughey, RACE**

Seafloor habitat in the eastern Bering Sea surveyed using a split-beam echosounder. Total of 9,000 nautical miles (16,700 km) of EBS seabed was sampled. Acoustic and other habitat data were compared to AFSC bottom trawl survey data. Overall, Generalized Additive Models explained 28-77% of variability in abundance for a variety of groundfish and benthic invertebrate species over a 23-year period, including a marginal contribution of 2–13% by the acoustic predictors.

**14. EBSSSED Sediment Database**  
**Bob McConnaughey, RACE**

A compilation of historical point-sample sediment data (2,587 samples). Samples were reduced to broad textural categories but all original data were retained within records.

Q: Can we use sediment/acoustic data to identify EFH? Acoustic data are easier to collect than sediments over large areas. This sediment database is assembled from many different sources.

**15. 2006 FISHPAC Experiment**  
**Bob McConnaughey, RACE**

Experimental comparison of various acoustic systems for quantitative characterization of groundfish habitat. Prototype long-range sidescan was designed for broader coverage at lower resolution. More tests to follow.

Q: Have you been getting repeatable results from single/multibeam?

Q: Are acoustic data affected by directionality?

**16. 1997 TRAWLEX Experiment**  
**Bob McConnaughey, RACE**

AFSC/USGS characterized benthic habitats in northern Bristol Bay. Heavily trawled areas compared to untrawled areas. Infauna sampling from 1 nmi<sup>2</sup> grid.

**17. Trawlex BACI Experiment**  
**Bob McConnaughey, RACE**

Investigated effects of experimental disturbance with commercial bottom trawl in six pairs of experimental-control corridors each 10-mile (18.5 km) long. Experiment may continue in 2009.

**18. Pacific ocean perch (*Sebastes alutus*) habitats**  
**Mark Zimmermann, RACE**

Looked at high- versus low-relief habitat for juvenile POP at five 1 km by 10 km sites. Utilized grab samples, plankton nets, fishtraps as well as video.

**19. Trawl Effort Reduction Tests**  
**Bob McConnaughey, RACE**

Disks on trawl sweeps studied with video sled for habitat impact reduction.

**20. Flatfish Nursery Function**  
**Al Stoner, RACE**

Beam trawl sampling at five sites over 7 years, video sampling as well. Augmented with lab work.

Q: How do you use O<sub>2</sub> and salinity? Not much variability.

Q: How do you use nesting models? Run the models in different bins.

**21. Trawlability – AFSC Survey with Single-Beam**  
**Mark Zimmermann, RACE**

Attempting to utilize vessel track data in GOA. Pitch and roll corrections needed for data quality.

Q: Talk with MACE?

Q: Calibrations with bottom trawl survey?

**22. usSEABED**  
**Mark Zimmermann, RACE**

Collaborating with USGS for 10 years. 200,000 data points overall. Converting database - can take video data. ArcIMS interface.

**23. Down to 50 m Bathymetry**  
**Steve Lewis, AKRO**

Tracklines, hydrographic, and ETOPO data assembled into one nested database. Resolutions are from 50 to 1,500 m. Project is integrating all possible data sources.



## **Appendix B.** Data management system example from the Mojave Desert.

### Summary of Eric Boerner's presentation describing the data management system developed for the Mojave Desert Ecosystem Program (MDEP).

The objective of the MDEP was to use GIS and the internet to gather and share data dynamically and region-wide through an interactive database with real-time data capabilities. Temporal and spatial analysis could be completed at an ecosystem scale.

The basic intention was to get data organized and centralized. This was a regional collaboration by six agencies – Department of the Interior, National Park Service, State of California, U.S. Fish and Wildlife Service, United States Geological Survey, and the Department of Defense – to gather data in the Mojave region. However, a method to assemble and condense vast amounts of data into a streamlined, usable system was necessary.

Another concern was the ability to allow various levels of access to different user groups. Some of the data collected was proprietary or could be disseminated only to other agencies rather than the public. Database programs allow you to restrict access in many ways. Eric's suggestion for the AFSC's EFH data was to use SQL rather than Oracle as the database because many of the required administrative issues are simpler in SQL.

The Mojave project had a staff of 6 people for 3 years, funded at approximately \$1,000,000 per year. Creating a comprehensive ecosystem database is not cheap.

The steps in this process were as follows:

1. Identify available data and data types.

The collaborating agencies provided data to the MDEP, which cataloged and checked the quality of the data. Standards were set for accuracy and completeness of the data, and metadata were required. Data included GIS files, databases, spreadsheets, documents, imagery, and photos.

2. Find complementary data sets from outside sources.

Partner agencies were queried to determine data needs. These data were gathered gratis or through data grants, and in rare cases, purchased with joint MDEP funds.

3. Determine data collaboration roles.

It was important to establish data collaboration roles before the MDEP was developed. Questions regarding who contributed, used, and administered the system were answered.

4. Evaluate server, storage, and database requirements.

Forward thinking is important in planning a large database. The MDEP outgrew the data storage capabilities within 2 years, effectively doubling storage. Overbuild your data storage capacity.

5. Consider methods of distribution.

The original intent was to distribute the MDEP on 15 CDs. Hard copies of the data quickly became outdated, however. A centralized website was developed to provide data directly to users.

6. Build the data portal interface.

The database contained two components. Non-spatial data (web pages, images, photos, documents) were housed in a MySQL database, and spatial data were accessed through an ArcSDE/Oracle database.

7. Create data visualization tools.

Allowing users to simply access the data required the creation of visualization tools. These tools allow pre-viewing of large data sets. The use of a GIS frontend allowed the viewing of spatial data in the web interface.

8. Assign user and group policies.

Some data contained within the MDEP is considered sensitive, so access restrictions were required. Individual and group policies were implemented, allowing data to be restricted or shared within or between groups.

Since coming to AFSC-NMML, Eric has been working on the Polar Ecosystem Program Seal Telemetry Database. The emphasis of this project is to centralize data to increase effectiveness and analysis speed and reduce data errors and redundant data.

NMML houses many diverse collections of data, both spatially and multi-species. Much of this data is housed either on an AFSC server or individual workstations as Access or Excel files. Multiple copies are created by scientists, creating data versioning issues.

With the use of a centralized database, it is possible for a field scientist to upload data collected from field computers through MS Infopath to that database at some interval. Those data are available to scientists as a single “cleaned” dataset, but the original data remain intact. Those original data are imported into the database with the use of scripting, which automates the process. Users query the database through SQL 2005.