

Project Title: Evaluating a habitat restoration tool for nearshore Alaskan waters: Artificial reefs as Essential Fish Habitat.

FY06 Funding Requested: \$50 K

Divisions: Habitat Conservation Division (HCD) (Anchorage Field Office)

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FTEs: None requested

Project Description: Artificial reefs (AR) are man-made objects deployed on the seafloor with the effect of influencing biological and physical parameters in the marine environment. Worldwide, AR are used to restore or enhance productivity in marine ecosystems. In the United States, AR have been utilized in the coastal waters of Gulf of Mexico, Atlantic, and Pacific states. In the Gulf of Mexico and South Atlantic states AR are known to provide Essential Fish Habitat.

Artificial reef designs integrate biology and engineering to create specific habitats that mimic natural habitat. These artificial structures encourage settlement by marine plants and benthic invertebrates and provide shelter and a forage base for fish. Two AR structures used worldwide are pyramidal concrete structures called Fish Havens (©Artificial Reef, Inc.) and spherical concrete reef structures called Reef Balls (© Reefball Foundation). Both structures are designed for optimal colonization by marine plants and animals and have demonstrated increased biomass productivity for selected species and increased habitat complexity.

In spring 2006, NMFS will install Alaska's first artificial reef near Whittier in western Prince William Sound (PWS). The purpose of this pilot project is to evaluate the reef's potential as a fish habitat restoration tool in sub-Arctic marine waters. The NMFS reef will utilize pyramid-shaped Fish Havens. Concomitantly, Alaska Marine Lines will install the sphere-shaped Reef Balls in accordance with a mitigation settlement. The result will be a reef of 90 each Fish Havens and Reef Balls deployed in three paired patches on a declining slope (15-20m depth) over mixed soft and hard sediment substrates (Fig1). Three natural rocky reefs in the project area will be monitored as a control. The study is designed to assess the effectiveness of artificial reef structures in restoring natural fish habitat. This study has the following objectives:

- (1) document the marine community at the artificial reef
 - a. describe spatially and temporally the plant and invertebrate assemblages
 - b. document fish species diversity and abundance
 - c. determine if marine communities vary by reef structure (ball vs. pyramid)
- (2) assess if artificial reef communities enhance the immediate marine environment
- (3) assess artificial reefs as a fish habitat restoration tool

In addressing these objectives, two hypotheses will be tested:

H₁. Fish habitat is enhanced after deployment of artificial reefs; fish diversity and abundance at artificial reef sites is increased in comparison to natural hard bottom habitat.

H₂. Artificial reefs mimic the ecological structure and function of natural reefs such as rock outcroppings.

The study will rely on surveys using scuba diving, underwater camera, hook and line, and fish traps. Sampling methodologies stem from previous work on AR (Powers et. al. 2003, Conley et. al. 2000). Intensive monitoring will be conducted in the first 2 years of the project to effectively describe colonization time of objective (1) a. and b. After 2 years, monitoring will be limited to quarterly scuba dives and monthly fish traps to fully address objective (1) c., (2) and (3). The project will be conducted as a cooperative effort between NMFS HCD (Anchorage field office), the Prince William Sound Science Center (PWSCC), Cordova, Alaska; Dauphin Island Sea Lab, University of South Alabama; the NOAA Restoration Center; and the USFWS (Anchorage field office). PWS is an important site for commercial, subsistence, and sport fish harvest, as well as a

port destination for oil tankers, cargo vessels, cruise ships, and recreational vessels. As economic growth and development continues in communities along the PWS the ability of fisheries managers to restore damaged and stressed fish habitat may be vital to a sustainable fishery. Marine coastal habitat is altered by a variety of development activities such as harbor development, dredge and fill operations, sheet-pile dock structures, and log transfer facilities. These development activities alter the function of pristine marine coastal habitats, principally by the removal, alteration or elimination of existing living habitat structure, including rocky reefs and aquatic vegetation. A study of the efficacy of artificial reefs to restore natural fish habitat loss will provide knowledge and direction for management of future restoration efforts in Alaskan coastal waters. To date development projects in Valdez, False Pass and Kodiak have shown interest in using artificial reefs as mitigation. Knowledge about the effectiveness of artificial reefs in providing fish habitat is necessary to evaluate these proposals and is currently unavailable. This project represents the only known research on use of artificial reefs in Alaskan waters.

Budget Justification: NMFS HCD (Anchorage Field Office) is the lead on the project and will contract with the PWSSC for the majority of the monitoring effort in years 1 and 2. PWSSC will provide a biologist who will adopt the project for a masters thesis at the University of Alabama, Dauphin Island Sea Lab. Dr. Shawn Powers, an expert in AR, will serve as faculty advisor (http://www.southalabama.edu/marinesciences/fac_powers.html). The project is seeking additional funding from the USFWS Coastal Program, NOAA Undersea Research (NURP) and NOAA's Restoration Research Program. All funds applied for are anticipated in the monitoring plan. However, if partially funded a scaled-down monitoring project will be devised with less frequent sampling. This will yield adequate data for habitat created by the AR and the timeline with which this habitat is created. Data on fish use will also be captured although with less frequent sampling some fish that use the AR temporarily may be missed.

Milestones: April 2006 - Collection of baseline data prior to deployment
May-September 2006 – Post-deployment monitoring
December 2006 – Progress report on year 1 monitoring
May-September 2007 – Post-deployment monitoring, Conference Presentation
May-September 2008 – Post-deployment monitoring at reduced level (NMFS)
Fall 2008 – refereed publication agency info-share on use of AR for mitigation
May-September 2009 – Post-deployment monitoring at reduced level (NMFS)
May-September 2010 – Post-deployment monitoring at reduced level (NMFS)

EFH Research Priorities met by this proposal: This project addresses “Characterization, census, and mapping of habitat features, including offshore habitats that may be susceptible to disturbance from fishing gear (e.g. corals) and coastal habitats that may be susceptible to disturbance from non-fishing activities. Highest Priority: Coastal habitats near population centers that may face threats from development.” Project site is the nearest marine access (Whittier) for the largest population center in Alaska (Anchorage).

Status Report: Phase 1 of this project was funded with Alaska Regional EFH monies, for \$37 K in FY05. An additional \$10K was awarded to the project in FY05 from the NOAA Restoration Center. A contract has been awarded to Artificial Reefs Inc. for construction and delivery of 90 artificial reef structures to Whittier, Alaska by April 30, 2006. A second contract was awarded to Bering Marine Corporation for deployment of 90 artificial reef structures into the sub-tidal waters of Smitty's Cove (project site), scheduled for May 2006. Existing funds cover design, procurement, transportation, and deployment of the reef structures. Phase 2 will cover monitoring and assessment.

Budget
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Object Class*	Description	Amount (\$)
2500	Contracts: Prince William Sound Science Center, a private, non-profit, Marine Research organization	\$50 K
*Object classes: 1100, 1150, 1200, 2100, 2200, 2300, 2400, 2600, 3100 and 4100 will be covered within the contract.		
	Total	\$50 K

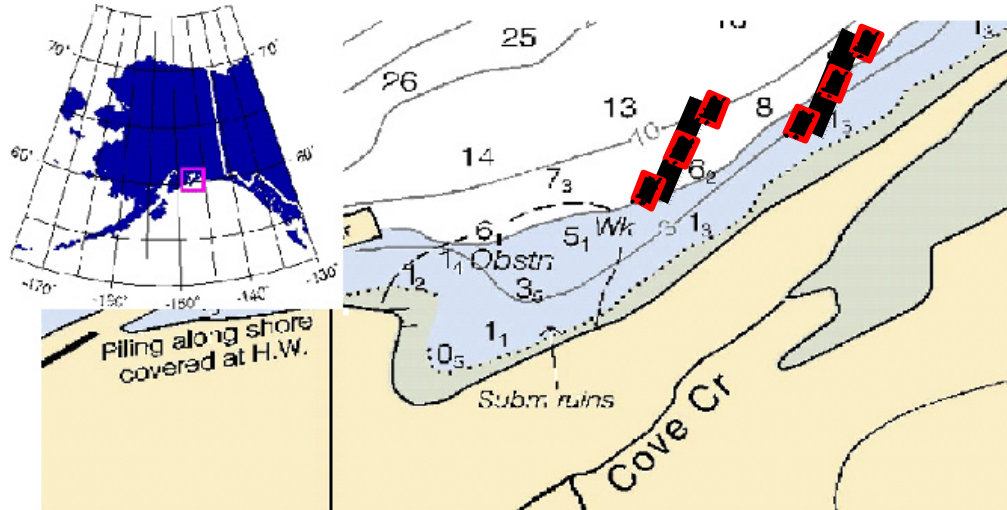


Figure 1: General location of Artificial Reef project in Smitty's Cove Whittier. Locations of rocky reef controls still to be determined. * Exact locations of reefs subject to change as precise mapping of depths still needs to be conducted prior to deployment. However, reefs will be deployed in a manner that allows for replication in comparison to the rocky reef controls and a nested design for comparison of Reef Ball and Fish Haven structures.

Citations:

- Conley, K.W., Cosgrove, J.A., Lambert, P., and Smiley, B.D. 2000. The Reefkeeper's Guide for Monitoring Subtidal Habitats of Canada's Pacific Waters. Fisheries and Oceans Canada Pacific Region. Modules 1,2,3,4 and 5.
- Powers, S. P., J. Grabowski, C. H. Peterson and W. J. Lindberg. 2003. Estimating enhancement of fish production by offshore artificial reefs: uncertainty exhibited by divergent scenarios. Marine Ecology Progress Series, *In press*.