Development of a Regional Seafloor Surficial Geologic (Habitat) Map for the Continental Margin of Oregon

Chris Romsos, Chris Goldfinger, Rondi Robison, and Randall Milstein

Active Tectonics and Seafloor Mapping Lab, College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, OR, 97331

ABSTRACT: At some level, contemporary marine fisheries management entails habitat management. On the West Coast of the United States this reality is manifest as the National Marine Fisheries Service and the Pacific Fisheries Management Council take responsibility under the Sustainable Fisheries Act to identify and protect habitats essential to commercially fished species. As large components of the species harvested along the West Coast are demersal or bottom dwelling, knowledge of benthic habitats fish (and fishermen) select, occupy, or utilize is essential prior to management actions. To address this problem we have mapped regional physiographic habitats and their surficial lithologies (Figure 1) along the continental margins of Washington and Oregon. Surficial map data bases were developed using an iterative interpretive method to integrate disparate geological and geophysical datasets including bathymetric grids, sidescan sonar images, seismic reflection profiles, sediment samples, geologic structure maps, and submersible observations. Each basic data type is comprised of multiple datasets that vary in age, quality, resolution, and spatial coverage, requiring an iterative approach to minimize mismatches between datasets and incorporate geologic interpretation into the process. The regional map developed from such disparate data differs from automated or semi-automated classifications, as those generally require relatively uniform spatial coverage of seafloor data. The map of geologic habitat is encapsulated as a thematic GIS layer having timely and direct application to modeling of Essential Fish Habitats of West Coast groundfish. Additionally, the geologic habitat maps are being used in local community marine resource management programs as well as in the ongoing fisheries research of our project cooperators.

METHOD: The method is a hybrid of physiographic and outcrop/lithologic interpretation (Figure 2). Physiographic habitats (landforms) are mapped using bathymetric imagery, seismic imagery, and structural maps. Surficial lithology is mapped by using all data types to locate or predict the occurrence of rock outcrop habitats and to show the distribution of sedimentary (unconsolidated) facies. As mentioned above, this general method is iterative in that several loops through the process are needed to minimize mismatches among datasets and faithfully represent all available geologic data in the final interpretation. ArcGIS software is used to display, interpret, and archive all habitat data and map products.

Figure 2. Generalized geologic habitat mapping method.

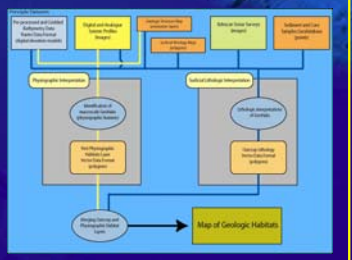
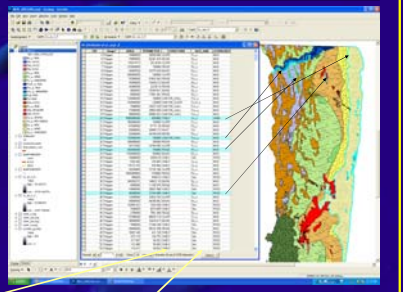


Table 1. Geologic habitat classes and their relationships to the original EFH composite habitats. Estuarine and neritic EFH habitats are not represented using this classification scheme.

Mega Habitat	Macro Habitat	EFH Composite	Attribute Code*
Continental Shelf	Rocky Shelf	Rocky Shelf	Shr
	Sedimentary Shelf	Non-Rocky Shelf	Ss_u
	Rocky Gullies & Channels	Not Represented	Shg
	Sedimentary Gullies & Channels	Not Represented	Ssg
	Rocky Glacial Deposit	Not Represented	Shi_ltrp
	Sedimentary Glacial Deposit	Not Represented	Ssi_o
Continental Slope	Rocky Ridge	Not Represented	Rhe
	Sedimentary Ridge	Not Represented	Rs_u
	Rocky Basin	Continental Slope Basin	Bhe
	Sedimentary Basin	Continental Slope Basin	Bs_u
	Rocky Slope	Not Represented	Rhe
	Sedimentary Slope	Not Represented	Rs_u
	Rocky Gullies & Channels	Not Represented	Rhg
	Sedimentary Gullies & Channels	Not Represented	Rsg
	Rocky Glacial Deposit	Not Represented	Rhi_ltrp
	Sedimentary Glacial Deposit	Not Represented	Rsi_o
Submarine Canyon	Rocky Canyon Wall	Submarine Canyon Habitat	Rhc
	Sedimentary Canyon Wall	Submarine Canyon Habitat	Rsc_u
	Rocky Canyon Floor	Submarine Canyon Habitat	Rscf/f
	Sedimentary Canyon Floor	Submarine Canyon Habitat	Rscf_u
Mass Wasting Zone	Unconsolidated Landslide	Not Represented	Rsl
	Rocky Landslide	Not Represented	Rhl

Figure 3. Arc MAP illustration showing the geologic habitat shapefile and associated attribute table.

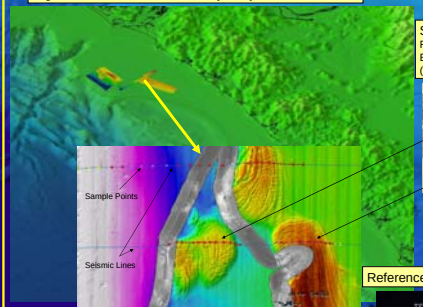


Geologic Habitat Type

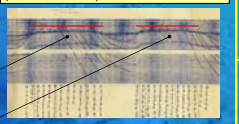
Habitat Code

RESULTS/IMPLICATIONS: Surficial geologic habitats (Table 1.) are mapped in ArcGIS coverage data structure. Habitats are represented as polygons (categorical data). Each polygon contains information including habitat type, surficial lithology, and map area (m^2, calculated in 2-dimensions). The map provides data essential to identifying and protecting EFH for federally managed groundfish. It also finds application in the CIMRS supported research of Marlene Bellman (Shifting groundfish trawl effort: regulatory impacts on habitat conservation, OSU Fisheries and Wildlife masters thesis research) and Vicki Wedell (Port Orford Ocean Resources Team, COAS, Marine Resource Management masters project).

High Resolution Multibeam Bathymetry at Nehalem Bank



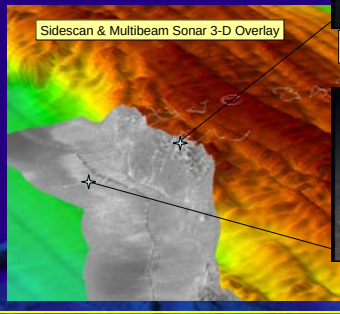
Seismic Profile over Nehalem Bank: Rock outcrop is predicted in the areas where Eroded stratigraphy contacts the seafloor (under the red lines).



Reference observations from submersible video

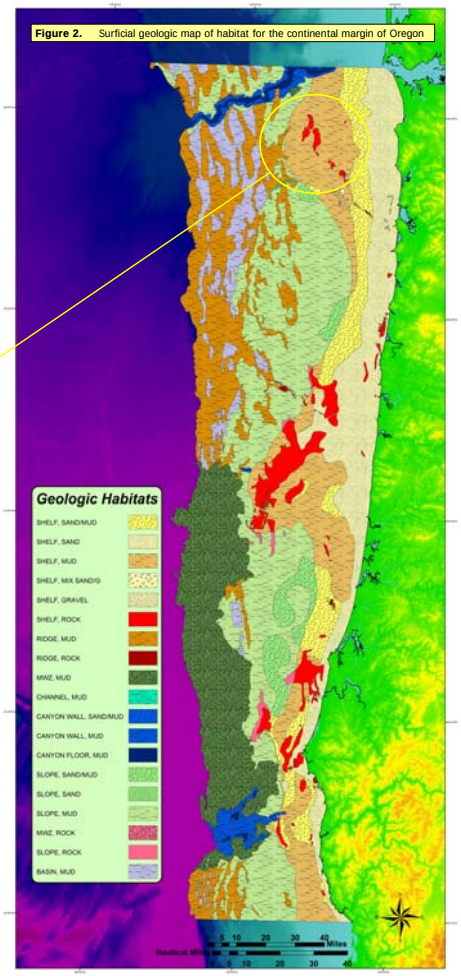
Strike ridges at top of bank, "rough" pattern in sidescan image

Sidescan & Multibeam Sonar 3-D Overlay



Soft unconsolidated sediments are found seaward of the bank.

Figure 2. Surficial geologic map of habitat for the continental margin of Oregon



Support for this project is provided by: CIMRS, NOAA, Pacific Fishery Management Council, MCBI, Sea Grant