NOAA Seafloor Mapping and Characterization in the Hawaiian Archipelago

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Since 2002 NOAA has implemented a major mapping program in the Hawaiian Archipelago in support of NOAA’s Coral Reef Conservation Program (CRCP), NOAA Fisheries, and the National Marine Sanctuaries Program (NMSP). Major goals of this work are to conduct benthic habitat mapping using seafloor bathymetry, acoustic backscatter, and optical data; to develop methods for determination of seafloor substrate type and habitat for priority areas in moderate depth (20-500 m) submarine environments; to provide information for development of Essential Fish Habitat (EFH); and to accurately map the NWHI Coral Reef Ecosystem Reserve (CRR) and other priority NMSP areas. To accomplish these goals the Hi’ialakai was outfitted with two sonar systems that provide multibeam data in water depths between 20 and 5000 m. The RV AH, a 25-ft survey launch also equipped with multibeam sonar, is deployed from the Hi’ialakai or independently from shore, to map near-shore regions.

Northwestern Hawaiian Islands

The Northwestern Hawaiian Islands (NWHI) stretch almost 2000 km from Nihoa Island to Kure Atoll. The south-ern boundary of the archipelago has been delineated on a mapping cruise between 2004 and 2005. As part of this work an ongoing syndynmic effort is underway to continuously update and make available to the public accurate and up-to-date multibeam grids. All NWHI bathymetric grids are available for download at http://www.soest.hawaii.edu/pibhmc.

Sand Dune

At Pearl and Hermes Reef (left), in addition to mapping the 150-fm boundary, a survey was done along the 150-fm isobath to the southeast of the reef. This survey was also used to create a 3-D model of the entire reef; these data have been developed into an alarming ground for the endangered Hawaiian monk seal, and the reef’s diversity is shown in the right image. The sand dune in the center of the figure was mapped at 60 m. This type of information is critical in analysis of previous stands of the sea and climate change.

Kure Atoll

A bathymetric complexity map was generated from the 2-m gridded depth data, following the method described in "A GIS Recipe for Determining Benthic Complexity: An Example from the Northwestern Hawaiian Islands." The second derivative (slope of the exaggerated slope) was then calculated, resulting in this complexity map (right). The value of this map is evident in the visualization of coastal and shelf environments.

Another promising habitat classification method is described in "A Benthic Terraine Classification Scheme for American Samoa," Lundblad, et al., Marine Geodesy, 2006, in press. Multibeam data were collected in 2002 and 2005 on the western bank and perimeter of FFS. In 2002 the Hi’ialakai and the NOAA Ship Ah’o‘o mapped the 150-fm boundary using Simrad EM120 and EM1002 (100 kHz) multibeam. In 2003 the R/V AHI’s EM3002 (300 kHz) and EM120 (12 kHz), and began multibeam surveying in Hawaii in early 2005. In 2005 the AHI surveyed on the perimeter of the bank at the 25- and 100-fm isobaths using Simrad EM1002 and EM120 sonars. In 2003 the R/V AHI’s Reson 8101ER and the EM3002D sonars in water depths ranging from 15 to 200 m. These high resolution data were then gridded using a 2-m grid cell size. Multibeam data have been incorporated into depth data shown above, including slope, complexity, and bathymetric position index/feature identification maps. These data will aid in interpretation of bathymetric data, as steps toward the seafloor characterization and benthic habitat mapping.

Hi’ialakai

The Hi’ialakai performed a bathymetric mapping cruise in late 2002, when UH’s R/V Kilo Moana surveyed over 38,000 sq. km. in the NWHI in support of defining boundaries for the CRER. Multibeam data were collected in 2002 and 2005 on the western bank and perimeter of FFS.

Hi’ialakai

University of Hawaii School of Ocean and Earth Science and Technology (SOEST) scientists, under the direction of Dr. Brian Taylor, have been collecting and integrating multibeam data in the Main Hawaiian Islands (MHI) for many years. Numerous UH investigators, including Dr. Taylor, Dr. Chris Kelley, Dr. John Smith, and Dr. Bruce Applegate have contributed significant amounts of multibeam data and have kindly permitted us to use this figure of their ongoing MHI bathymetric synthesis. In 2004 NOAA and UH/IMAR/CRCP formatted the Pacific Islands Benthic Habitat Mapping Center under a grant from the National Defense Center of Excellence in Ocean Research (CEROS). PIBHMC was formed to combine expertise at SOEST with that of NOAA scientists in collecting and analyzing acoustic and optical data. With the addition of the AH and the Hi’ialakai to the research fleet, NOAA joined the MHI mapping effort by surveying the shallow waters around Ni’ihau, Penguin Bank (east of Molokai), the north-shore of Molokai, and small shallow areas near Maui & Oahu in 2005. These surveys were planned and executed in response to the needs of managers from the Hawaii Division of Land and Natural Resources (DLNR), the Western Pacific Fisheries Management Council, and the NOAA/NMFS-Humpback Whale Sanctuary. In April 2006 a follow-up NOAA survey is planned at Penguin Bank to complete the survey of the last major unmapped areas in the MHI.

Main Hawaiian Islands

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WFNM

The bathymetry of the western bank reveals dozens of pinnacles, extensive sand wave fields in several areas, and spur and groove complexes. The bathymetric complexity map reveals a double terrace at the summit, canyons on the slope, and extensive evidence of mass wasting at the base of the seamount. This detailed morphological data is invaluable for interpretation of the geological and ecological history of the NWHI.

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