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Hudson Canyon benthic habitats characterization and mapping by integrated analysis of multidisciplinary data

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Hudson Canyon, about 180 km SE of New York City, is the largest eastern U.S. submarine canyon and is under consideration for HAPC (Habitat Area of Particular Concern) status, representing a fisheries and biodiversity hot spot. Interest in the area, within the perspective of ecosystem based management, marine spatial planning, habitat and species conservation, led to a joint project between NOAA Northeast Fisheries, U.S. Geological Survey (USGS), Mississippi Mineral Research Institute (MMRI), National Institute for Undersea Science and Technology (NIUST), Stony Brook and Rutgers Universities for the study of benthic habitats, that includes the assembly of existing data with newly collected ones: acoustic mapping, visual ground-truthing, hydrographic, sedimentological, and trawl data collections. Acoustic mapping, performed using AUV-mounted multibeam sonar, provided ultra-high resolution bathymetric and backscatter imagery (3m and 1m respectively) at all water depths for identification of geomorphological features and for the characterization of surficial sediments along the two thirds of the shelf portion of the canyon. Identification of benthic and demersal communities was accomplished by visual ground thruthing with underwater vehicle video and still cameras, and from trawl catch data. A CTD-rosette sampler provided water column salinity-temperature profiles and water samples for dissolved methane analysis in the vicinity of suspected bottom sources. Analysis of data revealed a complex of topographic structures and hydrological patterns that provide a wide range of physical habitats in a relatively small area. A mosaic of sandy and muddy substrates, gravel beds, rock outcrops, and semilithified clay outcrops host rich and varied faunal assemblages, including deepwater corals and sponge communities. Pockmark fields, occurring below 300 m depth, suggest that methane-based chemosynthetic carbonate deposition contributes to creation of specific hard bottom habitats. Previously described hummocky terrain associated with extensive, long-term burrowing activity by golden tilefish (Lopholatilus chamaeleonticeps) was clearly delineated along the canyon rims. Bedform fields and potential current deposits observed along the upper portion of canyon walls suggest the presence of intense bottom currents flowing parallel to canyon axis. A benthic habitat map of Hudson Canyon head was produced by integration of the different datasets. The distribution of habitats was primarily inferred from geophysical data characteristics. Furthermore habitat characteristics can be related to sedimentary and oceanographic processes acting on the seafloor. Comparison and refinement of bathymetric and backscatter imagery with ground truth data enabled validation of acoustic classification of the seafloor, allowing the definition of morpho-acoustic classes corresponding to as many habitats, and to extend the predictive results over larger areas.