Northwest Atlantic
Marine Ecoregional Assessment

Ecological Marine Units and Benthic Habitat Mapping

First Iteration for the Mid-Atlantic Bight

The Nature Conservancy
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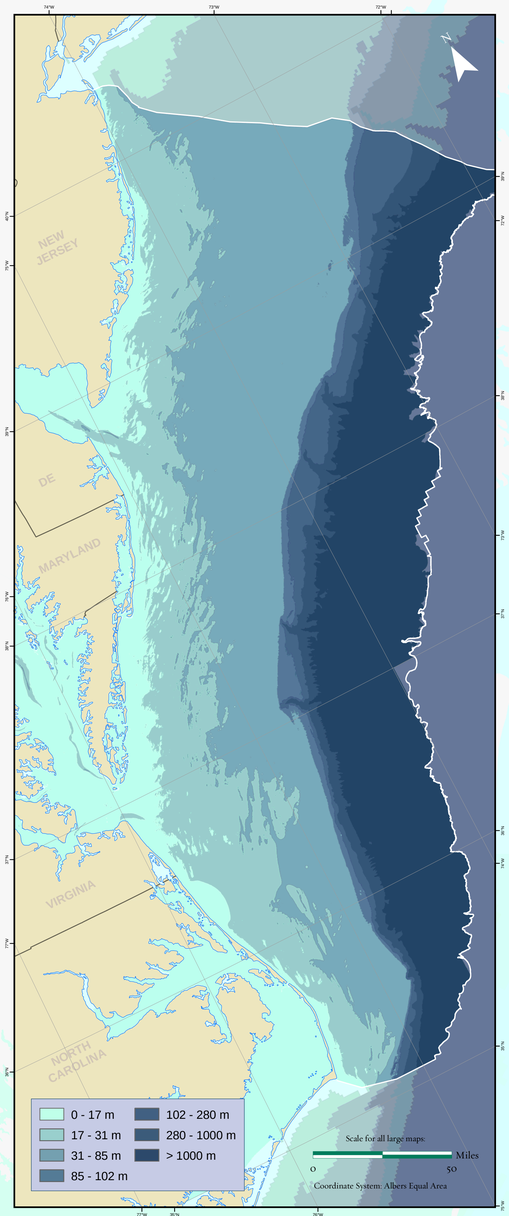
Virginia Coastal Zone
MANAGEMENT PROGRAM

Background: For decades, *terrestrial* conservation efforts have been guided by habitat classification systems and maps, most notably "natural community" typing developed by NatureServe and used in all 50 states. This system defines and maps ecosystems based on distinct habitats and their associated and obligate plant and animal communities. State and federal agencies and others use these maps to determine which community types are intrinsically rare or sensitive, to identify the best remaining occurrences of natural communities, and to inform conservation planning and permitting decisions at local, regional, and ecoregional scales. Development of effective *marine* conservation strategies is impeded by the lack of a robust system that pairs characteristic biological communities with physical habitat factors. With funding assistance from Virginia's Coastal Zone Program, The Nature Conservancy has been working closely with experts to develop such a system.

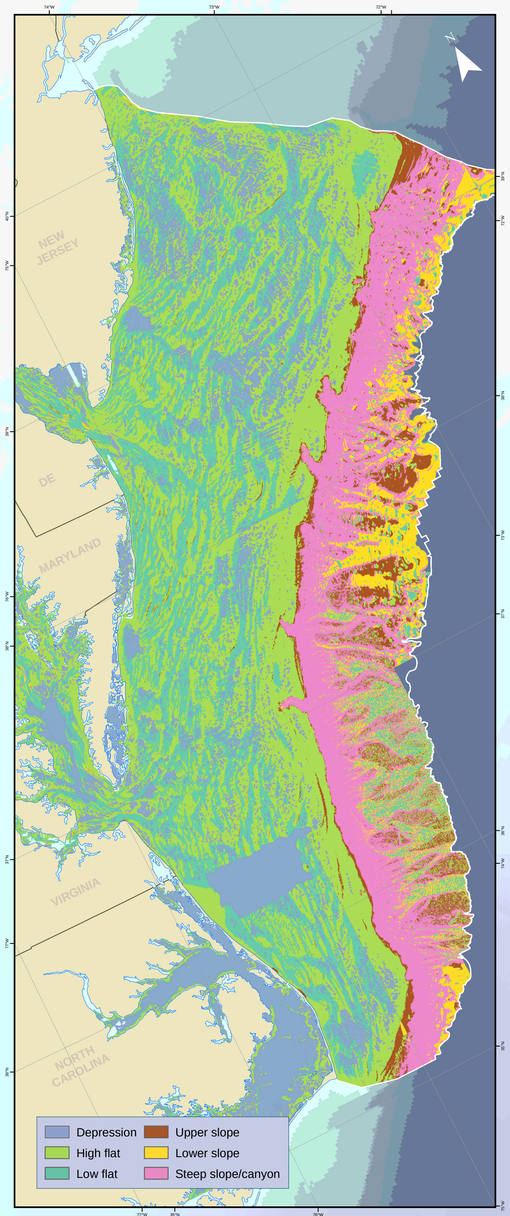
Method: Our method incorporates about one million spatially referenced records for diverse fish and invertebrate species, obtained from the National Marine Fisheries Service. We begin with a conventional habitat classification strategy, with classes constructed using combined physical factors—depth, seabed form, and substrate type. Biological data is then overlaid and analyzed using a quantitative cluster analysis to identify distinct species groups, followed by classification and regression tree analysis to identify the threshold values for each physical factor that best predict occurrences for all species groups. Finally, GIS analysis methods are used to produce maps showing Ecological Marine Units, marine analogues to the terrestrial natural communities described at left.

Results: Ecological Marine Units (EMUs), are the three-way combination of depth, sediment grain size and seabed forms based on the ecological thresholds revealed by the organism relationships. Benthic Habitats are EMUs considered with their diagnostic species assemblage. In some cases, an organism group is widespread and occurs across several EMUs. In other cases, the diagnostic species group for an EMU remains unclear or unknown. Examples of EMUs and their characteristic species and indicator values are shown below. These preliminary results are currently being analyzed and refined.

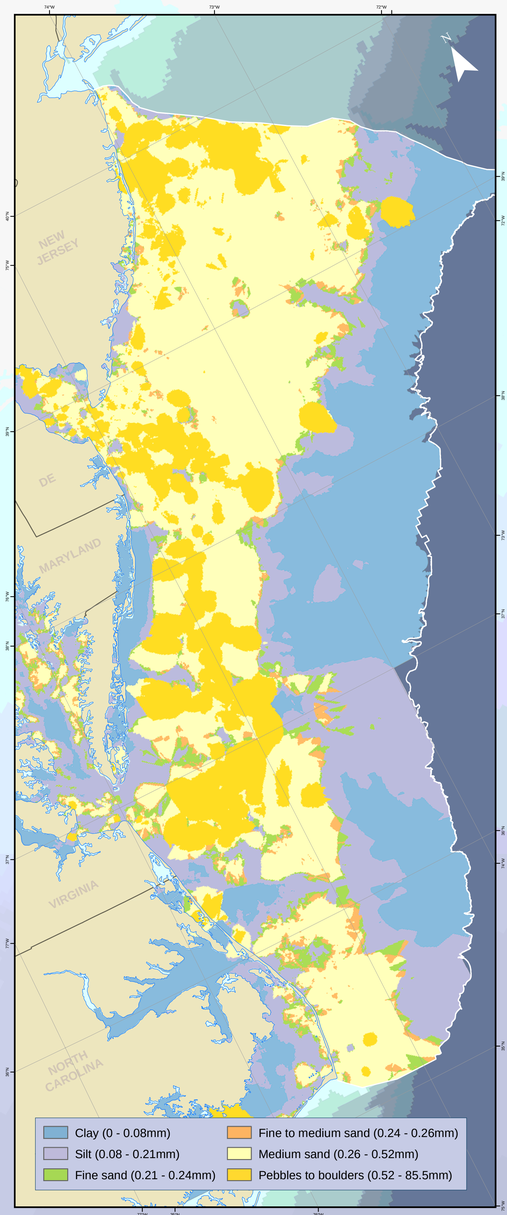
Depth



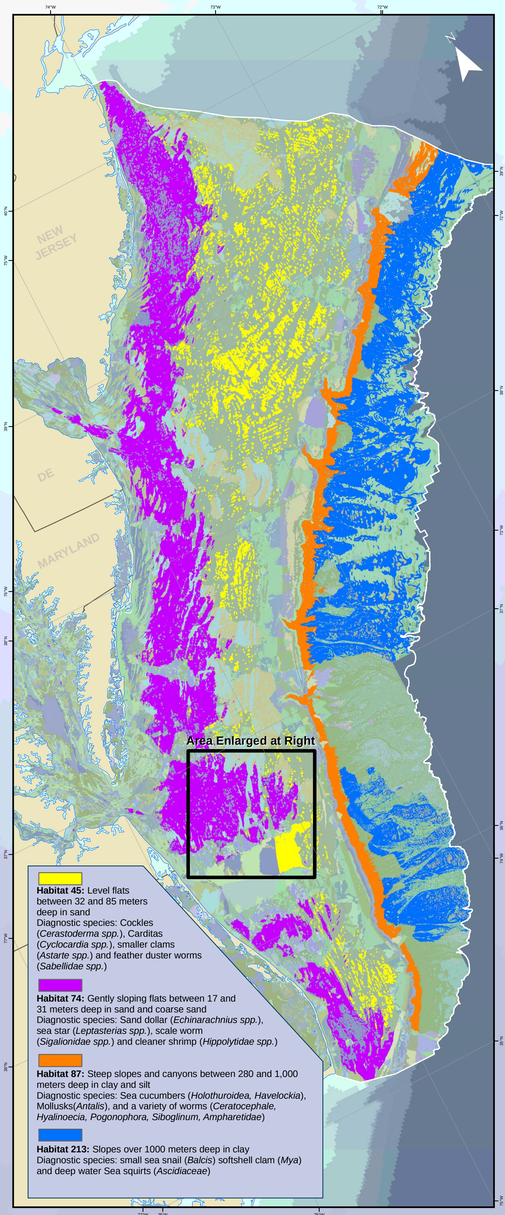
Seabed Form



Grain Size

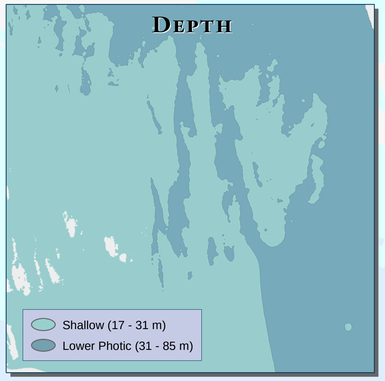


Ecological Marine Units and Benthic Habitats (Draft Example)

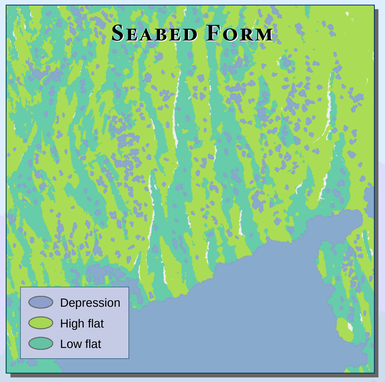


Area of Detail

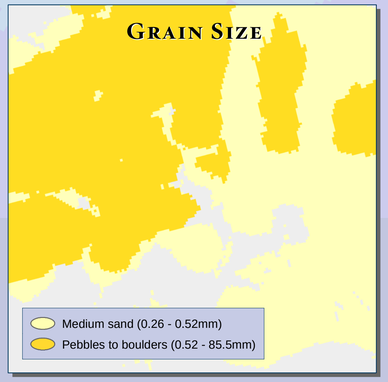
Depth



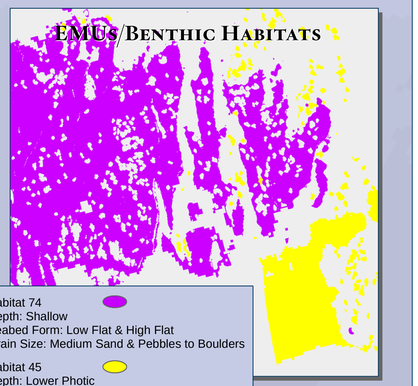
Seabed Form



Grain Size



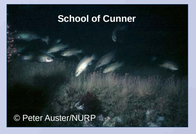
EMUs/Benthic Habitats

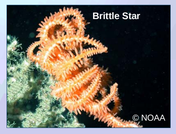


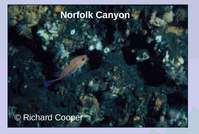
Habitat 74
Depth: Shallow
Seabed Form: Low Flat & High Flat
Grain Size: Medium Sand & Pebbles to Boulders

Habitat 45
Depth: Lower Photic
Seabed Form: Depression
Grain Size: Medium Sand

Vicinity Map







Next Steps: The methods and results described above are currently being reviewed by a group of marine habitat experts, external to The Nature Conservancy. With guidance from our external peer review team we are ground truthing and measuring error by superimposing and analyzing local scale species data from additional surveys and evaluating bias associated with various choices for survey data time periods.

This poster only presents the EMU and benthic habitat typing work derived from analysis of benthic grab samples. An additional component, the analysis and integration of fishery independent ground fish trawl survey data is also underway. Preliminary results suggest incorporation of fish community data will increase the accuracy and spatial resolution of final project results.

We assume that the sensitivity and resilience of the sea bottom to specific human disturbance (e.g. coastal sand mining, increased water temperature, bottom trawling, etc.) will vary based on EMU type. The next phase of this project will include literature review and consultation with experts (including marine resource user groups) to begin to identify disturbance type specific scores for sensitivity and resilience for each EMU.

Over time, we are hopeful that this approach can produce maps that inform sea use planning approaches by indicating the suites of human uses that are most compatible with the underlying ecological identity of places. In other words, to provide appropriate protection for critical habitats without unnecessarily restricting specific human uses.

Ultimately, we would like to contribute to the development of a pelagic classification system that links hydrographic factors and pelagic marine biodiversity and subsequently identifies dynamic water column EMUs and pelagic habitat types. Progress towards this goal will likely depend on acquisition of new species level pelagic survey data collected over large geographic extents.

Data Sources: National Marine Fisheries Service, TNC, USGS, NOAA

Produced by TNC-VA (C. Bruce, J. Odell), Oct-08
EMU data developed by TNC-ERO (M. Anderson, D. Morse)