Ecological Marine Units

Terrestrial conservation efforts have long been guided by habitat classification systems and maps that are used by land use planners and agencies to identify the natural communities (plant and animal groups) associated with specific habitats. Knowing which community types are intrinsically rare or sensitive helps to guide conservation planning and permitting decisions at local, regional, and ecoregional scales. Similar marine habitat classification currently lags behind terrestrial progress in the terrestrial realm. These maps showing Ecological Marine Units and Benthic Habitat Types are the first draft of a new system to identify natural community types in the Ocean.

Status of the data
This data is current as of November 2008. An update to be added to Coastal Gems is anticipated in June 2009.

Data Sources
NOAA
National Marine Fisheries Service
U.S. Geological Survey
The Nature Conservancy

Why should we care?
Understanding the location and rarity of sea-bottom habitat types and their associated marine life can help inform the development of plans and actions to foster sustainable use of coastal and ocean waters.

How is this resource managed?
Human uses that affect marine habitats are managed by many different State and Federal agencies. Federal agencies include the U.S. Fish and Wildlife Service, the Minerals Management Service, the Environmental Protection Agency, the U.S. Army Corps of Engineers, several agencies within the National Oceanic and Atmospheric Administration, and others. State agencies include the Virginia Coastal Zone Program and the Virginia Marine Resources Commission, and others. Increasingly, these groups work in collaboration to establish and manage for diverse ecological and economic goals.

Why was the GIS data created?
These data were developed by The Nature Conservancy under a grant from the Virginia Coastal Zone Management Program, to increase public access to information to the first iteration of a new approach for mapping the sea bottom to reveal natural marine community types.

How was the GIS data created?
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 and their paired Benthic Habitat types.

Future directions?
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 the biases associated with different choices for survey data time periods.

This layer currently includes 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 under construction and will be added in June, 2009. Preliminary results suggest incorporation of fish community data will increase the accuracy and spatial resolution of final project results.

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.

Frequently Asked Questions?

Why don't these maps show habitat for pelagic species like menhaden, bluefish, and tunas?
Many marine species are pelagic (typically live in the water column well above the sea floor). Additional work is needed to develop a pelagic classification system that links hydrographic factors (*e.g.* currents, water temperature, and salinity) and pelagic marine biodiversity and subsequently identifies dynamic three-dimensional water column EMUs. Progress towards this goal will likely depend on funding for new pelagic species survey data collected over large geographic extents.

Marine Species Importance

This data layer indicates relative importance for eight marine species within the entire Northwest Atlantic Marine Ecoregion (Virginian and Acadian provinces, from Cape Hatteras, NC, to Bay of Fundy). Importance is defined as a measure that ranks how often a given species is regularly found in large numbers. These maps display important areas for 8 species of particular interest to marine resource stakeholders in Virginia: American shad, Atlantic menhaden, black sea bass, Atlantic croaker, horseshoe crab, sea scallop, summer flounder and weakfish.

Status of the data
This data is current as of November 2008. Updates to include additional species will be posted in the future.

Data Sources
National Marine Fisheries Service
The Nature Conservancy

Why should we care?
Understanding where sensitive and valuable resources are located can help inform the development of plans and actions to foster sustainable use of coastal and ocean waters.

How is this resource managed?
These species are all harvested by recreational and/or commercial fishers. Management of fisheries for American shad, Atlantic menhaden, Atlantic croaker, horseshoe crab, and weakfish is the responsibility of the Atlantic States Marine Fisheries Commission (ASMFC), and fisheries for summer flounder and black sea bass are jointly managed by ASMFC and the Mid-Atlantic Fisheries Management Council (MAFMC). The sea scallop fishery is jointly managed by MAFMC and the New England Fishery Management Council. These three management entities each conduct a variety of stock assessment, fishery monitoring and enforcement activities, and each provides substantial opportunity for public input as regulations are developed.

Why was the GIS data created?
These data were developed by The Nature Conservancy under a grant from the Virginia Coastal Zone Management Program, to increase public access to information about the location of ecologically and economically important marine habitats.

How was the GIS data created?
TNC received NMFS trawl survey data in an ASCII file and generated points representing the start point of each trawl from lat/long values provided. These points were related to a trawl catch database and catch per tow for each species was calculated. Catch per tow values were summarized (binned) into a standard grid (10 minute squares) for each species of interest. Squares where a survey was not conducted at least 3 times per decade were not included in this analysis. Finally, importance values for each square and species were calculated by multiplying the relative abundance by the relative frequency.

Future directions?
Additional importance maps for a suite of representative species are being created. Next steps include simultaneously analyzing importance levels for many species to create generalized ecological importance scores with finer spatial resolution.

Frequently Asked Questions?

Will these maps show me where to go fishing?
Only in a general sense, as the data is grouped into squares approximately 10 miles across.

Can these maps help inform sea use planning?
Yes. The maps indicate that not all places in the Ocean are equally important to all species. In combination with other data under development, these maps may help indicate areas where additional care may be needed to avoid unnecessary impacts to the marine ecosystem.

Why don't the maps cover Chesapeake Bay and other inshore areas?
These maps were created using NMFS data from trawl surveys which are primarily conducted in offshore waters. Additional analysis using data from inshore surveys collected by other agencies will be required to create maps that extend to nearshore estuarine and marine areas.