Poster 27

Improving the accuracy of benthic habitat maps in the Gulf of Mexico

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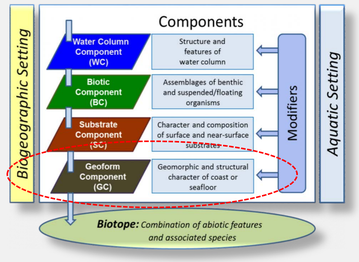
Introduction

Comprehensive deep-sea habitat characterizations are key components of ecosystem and resource assessments, and provide necessary information for management of energy and natural resources sector impacts on those ecosystems. This information, however, is scarce, especially at regional scales and useful resolutions. Although many datasets for the Gulf of Mexico exist, most are local or sub-regional in extent, and integrating data collected by different institutions, programs, and instruments can be difficult. This project uses the **Coastal and Marine Ecological Classification Standard (CMECS) Geoform Component (GC)**[1] to identify, classify, and integrate geomorphic features from existing datasets into a single map describing deep water structural habitat in the Gulf of Mexico.

Why CMECS?

CMECS, endorsed by the Federal Geographic Data Committee (FGDC), is a vocabulary for describing ecological data that employs a hierarchical framework of **settings**, **components**, **units**, and **modifiers**.

- Application of the CMECS structured vocabulary translates quantitative data into descriptive information that can be used for comparisons of ecosystem characteristics across geographic settings.
- The nested hierarchical framework allows the classification to be applied at various spatial scales, as determined by source data.
- Integration of data occurs post-classification, so is independent of collection method, instrument type.



Objectives

- Enhance the utility and application of high-resolution US Bureau of Ocean Energy Management (BOEM) datasets toward comprehensive Gulf of Mexico habitat mapping.
- Demonstrate application of the CMECS Geoform Component (GC) and identify potential improvements to the GC vocabulary.
- Integrate BOEM data with an existing, lower-resolution geoform map of greater geographical extent, yielding a map of varying spatial resolution and descriptive detail.
- Use the resulting Gulf of Mexico CMECS GC basemap and associated products to encourage other data collectors and mappers to contribute their data to the ongoing refinement of the map.

Future Work

- Expand the CMECS GC classification to global extent and continue integration of more detailed hi-resolution data where available.
- Combine the CMECS GC classified data with other CMECS component data towards development of full biotope characterization.

References

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6. Seismic Water Bottom Anomalies- Gulf of Mexico. BOEM, Regional Analysis Unit. US Bureau of Ocean Energy Management, New Orleans, LA, 03 August, 2016. Web. 29 April, 2018. BOEM, Regional Analysis Unit. US Bureau of Ocean Energy Management, New Orleans, LA, 03 August, 2016. Web. 29 April, 2018.

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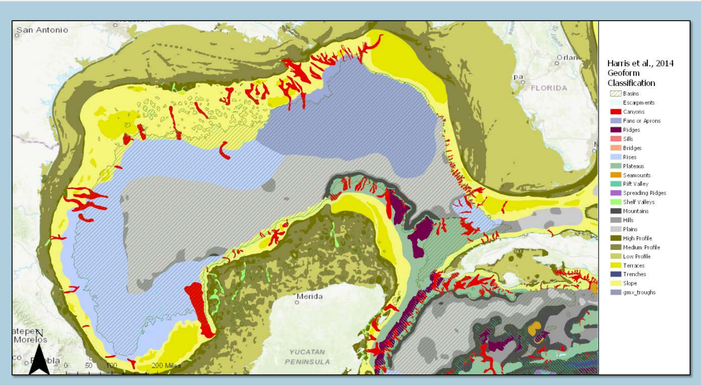
Dataset 1: Global Seafloor Geomorphic Features Map (GSFM)[2]

The GSFM consists of GIS polygons, derived primarily from 30-arc second NASA JPL-NGA Shuttle Radar Topography Mission (SRTM) data[3], representing discrete geomorphic features. The upper-level (i.e., the most spatially general) shelf and abyssal unit polygons will serve as the framework for nesting individual lower-level geomorphic features.

- Subset GSFM GIS to Gulf of Mexico extent.
- Crosswalk geomorphic feature descriptions to CMECS GC.
- Assign CMECS unit codes[4] to the re-classified polygons



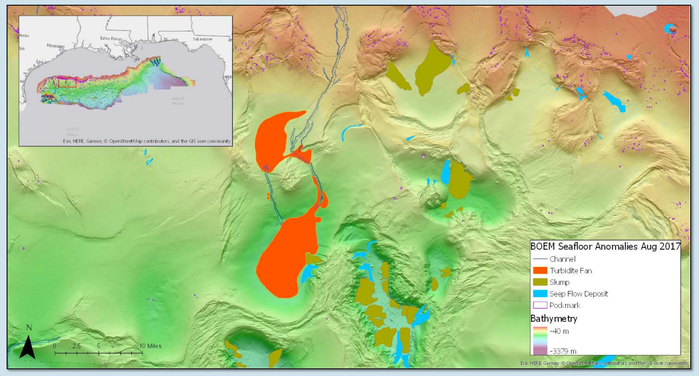
Original GSFM with geomorphic classification, Gulf of Mexico subset

Dataset 2: BOEM Northern Gulf of Mexico Deepwater Bathymetry Grid[5]

The BOEM bathymetry raster (40 ft x 40 ft grid cell resolution) was generated by mosaicking interpreted time-migrated seafloor returns in 3-D seismic data from over 100 surveys conducted by energy industry researchers. Geographic coverage extends over 90,000 mi2 over the Northern Gulf of Mexico slope, abyssal plain, Mississippi Fan, and part of the West Florida Escarpment. Geomorphic features, such as relict channel levees, ridges, dunes, mounds, and craters are visible in the bathymetry surface, and many have not been identified in previous datasets, or at this level of spatial definition[5].

Dataset 3: Seismic Water Bottom Anomalies- Gulf of Mexico[6]

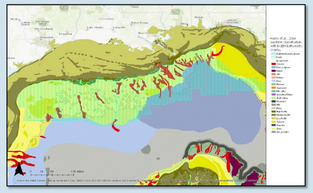
Seafloor acoustic amplitude anomalies, also mapped by BOEM from 3-D seismic data, indicate potential locations of geomorphic features associated with subsurface hydrocarbon seeps and carbonate hard grounds[7]. These GIS polygon data will be used to help identify surficial features.



BOEM seismic water bottom anomalies overlying the Northern Gulf of Mexico Deepwater Bathymetry grid

- Identify and digitize geomorphic features in the BOEM bathymetry raster using mapping and image analysis software (ArcGIS and ENVI).
- Merge with BOEM seismic anomalies GIS- derived features where appropriate.
- Apply CMECS GC classification to geomorphic feature polygons.

- Import CMECS-classified features into a single ArcGIS geodatabase.
- Merge BOEM geomorphic feature polygons with the GSFM using ArcGIS tools. Discrete features will either be nested within existing GSFM polygons of larger scale features, or will be used to revise boundaries of less-accurate GSFM polygons.



- The resulting Gulf of Mexico CMECS Geoform Component (GC) basemap will comprise a region of highly detailed features classified to the lower levels of the CMECS hierarchy, within more generally described features classified to the higher CMECS levels.
- A reference publication to assist other mappers and data collectors in CMECS application and a web application to encourage further integration of data will be produced.