Geologic Seafloor Mapping using the ArcMarine Data Model

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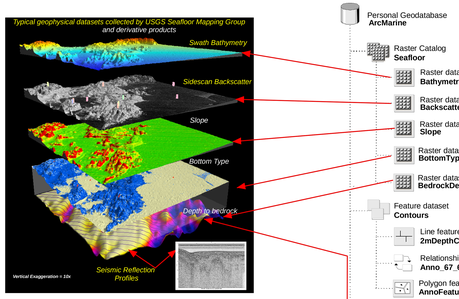
What is ArcMarine:The ArcGIS Marine Data Model?

The ArcGIS Marine Data Model represents a new approach to spatial modeling via improved integration of many important features of the ocean realm, both natural and manmade. The goal is to provide more accurate representations of location and spatial extent, along with a means for conducting more complex spatial analyses of marine and coastal data by capturing the behavior of real-world objects in a geodatabase. The model also considers how marine and coastal data might be more effectively integrated in 3-D space and time. Although currently limited to 2.5-D, the model includes "placeholders" meant to represent the fluidity of ocean data and processes.

For users, an ArcGIS data model provides a basic template for implementing GIS projects (i.e., inputting, formatting, geoprocessing, and sharing data, creating maps, performing analyses, etc.); for developers, it provides a basic framework for writing program code and maintaining applications. A key advantage of the data model is that it should help users to take fuller advantage of the most advanced manipulation and analysis capabilities of ArcGIS, particularly its support of more complex rules that can be built into its geodatabases, and of objects with not only attributes, but database rules (rudimentary behavior). ArcGIS data models also support existing data standards, so as to help simplify the integration of data at various jurisdictional levels (i.e., local, state/provincial, national, global) (ArcMarine Working Group website, 2005)

ArcMarine Data Model structure popluated with USGS geophysical data



Personal Geodatabase
ArcMarine

- Raster Catalog **Seafloor**
- Raster dataset **Bathymetry**
- Raster dataset **Backscatter**
- Raster dataset **Slope**
- Raster dataset **BottomType**
- Raster dataset **BedrockDepth**
- Feature dataset **Contours**
  - Line feature class **ZmDepthContours**
  - Relationship class **Anno_67_68**
  - Polygon feature class **AnnoFeatureOutlineMasks**
- Feature dataset **MarineFeatures**
  - Polygon feature class **SurveyBoundarys**
  - Polygon feature class **SanctuaryBoundarys**
- Feature dataset **Results**
  - Polygon feature class **PhysiographicZones**
  - Polygon feature class **PhysiographicZonesInshore**
  - Topology **PhysZoneTopology**
- Line feature class **SurveyLine**
- Relationship class **SurveyLineHASMeasuringDevice**
- Relationship class **SurveyLineHASSurveyInfo**
- Table **MeasuringDevice**
- Table **SurveyInfo**
- Raster dataset **NOAAChart**
- Point feature class **SedGrabs**
- Table **SedGrabResults**
- Relationship class **SedGrabHasResults**
- Point feature class **BottomPhotos**
- Relationship class **SurveyBoundaryHASSurveyInfo**

OVERVIEW

The USGS Coastal and Marine Geology Program in cooperation with the Massachusetts Office of Coastal Zone Management (CZM) is conducting geologic mapping of the sea floor to characterize the surface and subsurface geologic framework of near-shore environments in coastal Massachusetts. High resolution swath bathymetry, sidescan-sonar imagery, and seismic-reflection profiles were collected over the 128 km² survey area that covers a portion of the South Essex Ocean Sanctuary between Gloucester and Nahant. As part of this project the USGS worked with the ESRI Marine Data Model Working group to apply and tailor the existing model schema to the data collected in the South Essex Survey Area, which are typical geophysical data collected by the Woods Hole Science Center. Additional attributes were added to make custom objects representing specific data types.

The resulting USGS version of the data model not only simplified data management throughout the project, but more importantly facilitated geologic interpretation and modeling of the sea floor using the object-oriented relational database. Topology, relationship and domain rules with valid attribute domains, reduced errors during data entry and analysis phases of the project. In addition, using the standardized ArcMarine schema will simplify collaboration with other benthic scientists. Although the ArcMarine schema is still in draft form, this case study has proven valuable In the following areas:

1)Data Management- from survey planning to final publication
2)Geologic Interpretations-easier to interpret seafloor morphology because of existing relationship classes in Data Model and topological rules.
3)Marine Features- Data Model has specific feature attributes for certain data types.

METHODS

The development and application of the USGS ArcMarine data model has been an iterative process. Initial draft data model began in Microsoft Visio Professional 2002 and exported to ArcCatalog 9.0. Subsequent edits used ArcCatalog 9.0.

ACKNOWLEDGMENTS:

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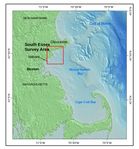
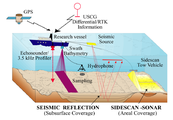
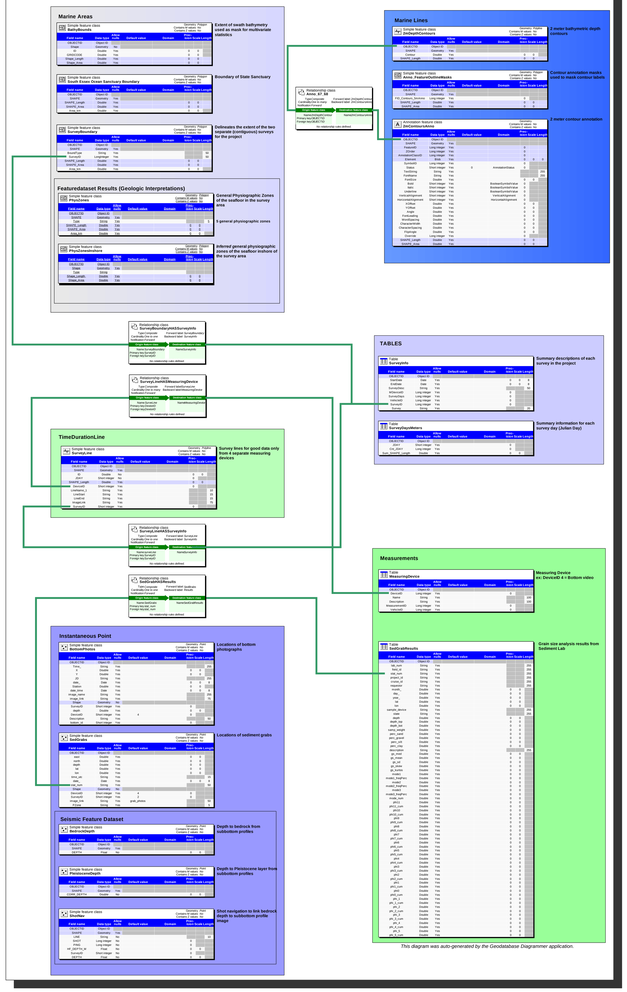
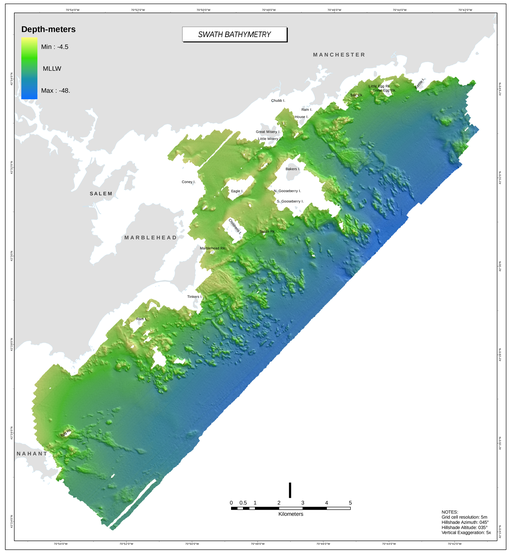
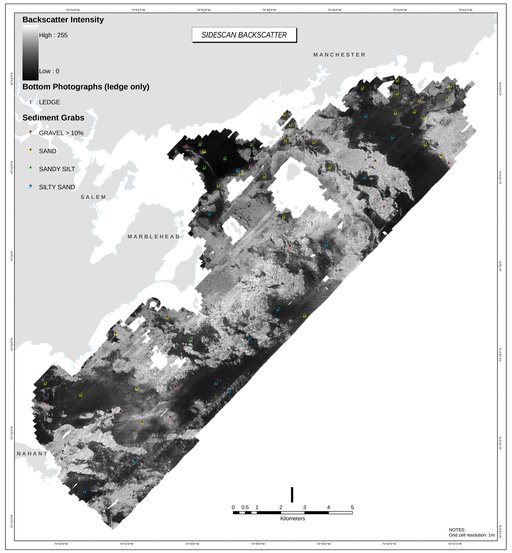
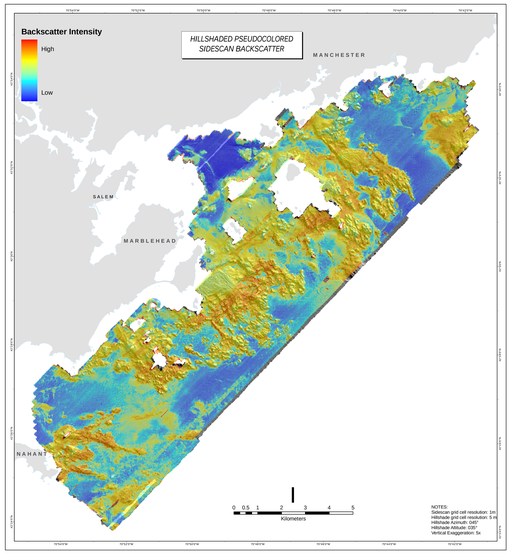
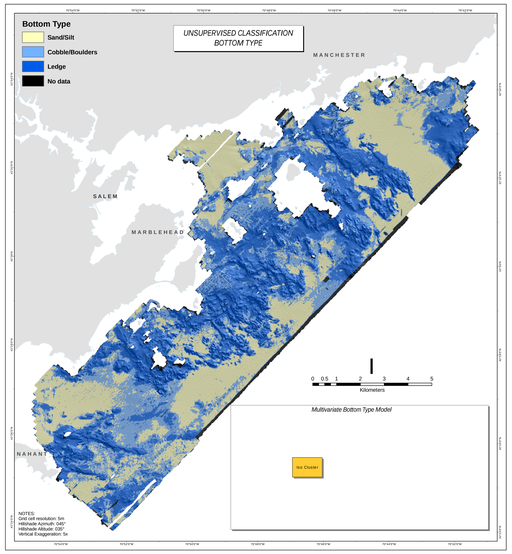
REFERENCES

ArcMarine Working Group, 2005, ArcMarine: The ArcGIS Marine Data Model. Website at http://dusk2.geo.orst.edu/djl/arcgis/about.html





USGS ArcMarine Data Model Diagram



This diagram was auto-generated by the Geodatabase Diagrammer application.