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Arc Marine: GIS for a Blue Planet—Case Studies in New Book Include USGS Sea-Floor Data

By Chris Polloni and Brendan Dwyer
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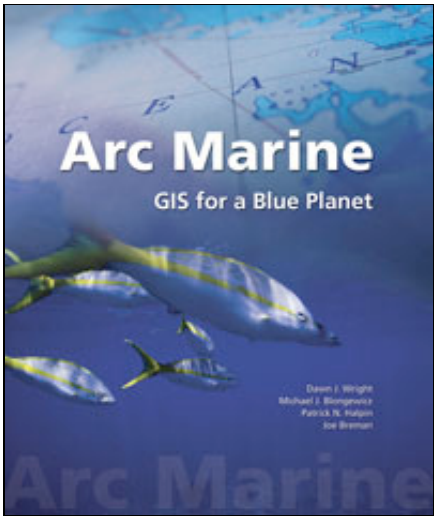

Data from two U.S. Geological Survey (USGS) coastal sea-floor mapping projects are showcased in *Arc Marine: GIS for a Blue Planet*, a new reference book published by ESRI Press that details the Arc Marine data model—an evolving database design for managing spatial data from various types of marine research, including sea-floor mapping, fisheries management, marine-mammal tracking, monitoring of shoreline change, and oceanographic measurements. In addition to facilitating data organization and analysis, the new data model helps users create maps and three-dimensional scenes of the marine environment to assist decision making. An online companion to the book contains PowerPoint presentations, posters, and downloadable datasets to help readers further explore the capabilities of the data model.

The book's authors are a multidisciplinary team of geographic-information-system (GIS) scientists: **Dawn Wright** (Oregon State University), **Michael Blongewicz** (DHI Water and Environment, Inc.), **Pat Halpin** (Duke University), and **Joe Breman** (ESRI). All have extensive experience in applying GIS science to the marine realm and an appreciation for the complexity of the task: "The dynamic nature of ocean and coastal systems and the three-dimensional nature of water volumes require a fundamental rethinking of the often static and planar representation of spatial features used in terrestrial applications." The Arc Marine data model is intended to serve a wide range of users in the marine community, including "academic, government, military, and private oceanographers, resource managers, conservationists, geographers, nautical archeologists," and more.

The book opens with an introduction (chap. 1) and an explanation of

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"Common Marine Data Types" (chap. 2), intentionally broad categories that can be adapted by users for specific databases. Subsequent chapters present a range of studies for which the Arc Marine data model can be used. Titles include "Marine Animal Data Applications," "Implementing Time Series and Measurements," and "Nearshore and Coastal/Shoreline Analysis." Chapters on "Model Meshes" and "Multidimensional GIS" address two interesting topics that push the limits for GIS systems.

The book's third chapter, "Marine Surveys," features two USGS projects as case studies: (1) sea-floor mapping and geologic sampling by the USGS Woods Hole Science Center in cooperation with the Massachusetts Office of Coastal Zone Management (CZM) and the National Oceanic and Atmospheric Administration (NOAA) to characterize the regional geologic framework of the Massachusetts inner continental shelf; and (2) a marine-survey geodatabase developed by Photo Science, Inc., for the USGS' Florida Integrated Science Center (FISC) office in St. Petersburg, Florida, from data collected to study land subsidence and sea-level rise in southeastern Louisiana.

The USGS/CZM/NOAA cooperative project serves as an Arc Marine case study for handling marine geophysical-survey data collected in nearshore environments. **Brian Andrews** (USGS) used the Arc Marine data model in collaboration with **Seth Ackerman** (CZM) and **Walter Barnhardt** (USGS) to manage, analyze, and publish marine geophysical-survey data from six research cruises conducted over 5 years offshore of Massachusetts.

The geodatabase case study from the USGS/Photo Science collaboration contains a description of a database structure for storing seismic tracks and survey points, using the Louisiana Sedimentary and Environmental Database, or LASED (lah-sed´), as an example. LASED (URL http://coastal.er.usgs.gov/lased/) is the result of combined efforts by the USGS and academic collaborators to manage decades of geologic data from the Louisiana coastal zone. The principal data in LASED are sediment-core locations and descriptions, and seismic tracklines, shotpoints, and profiles from various sources. Recently, the data in LASED were reorganized into the Arc Marine data model. Chapter 3 describes some of the challenges of incorporating existing data into the Arc Marine data model, including some of the drawbacks of using the data model.

The Arc Marine data model makes such tasks as loading and editing data easier for the data manager; however, data in an Arc Marine structure may be confusing to users who are unfamiliar with the Arc Marine data model or do not understand database relations. Users accustomed to seeing records in one form or table might not be able to make sense of the "cascading" relations in Arc Marine. Although the Arc Marine data model can make managing data easier and more consistent, data managers must make accessing the data simple and intuitive to users. To make LASED more user friendly, for example, data manager **Brendan**

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Dwyer plans to create tools in ArcMap that access the LASED database and allow users to easily select and view the records they want. These tools will present the user with a form that displays the parameters available to choose from and responds to their selections.

We recommend *Arc Marine: GIS for a Blue Planet* as an excellent treatise on database design and large-scale GIS solutions for the coastal- and marine-science community. Visit URL http://dusk2.geo.orst.edu/djl/arcgis/ to learn more about the new book and the Arc Marine data model.

Related Web Sites

The ArcGIS Marine Data Model
ESRI

LASED IMS
USGS (U.S. Geological Survey)

Massachusetts Office of Coastal Zone Management (CZM)-USGS Cooperative
USGS (U.S. Geological Survey)

ESRI
GIS software company

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