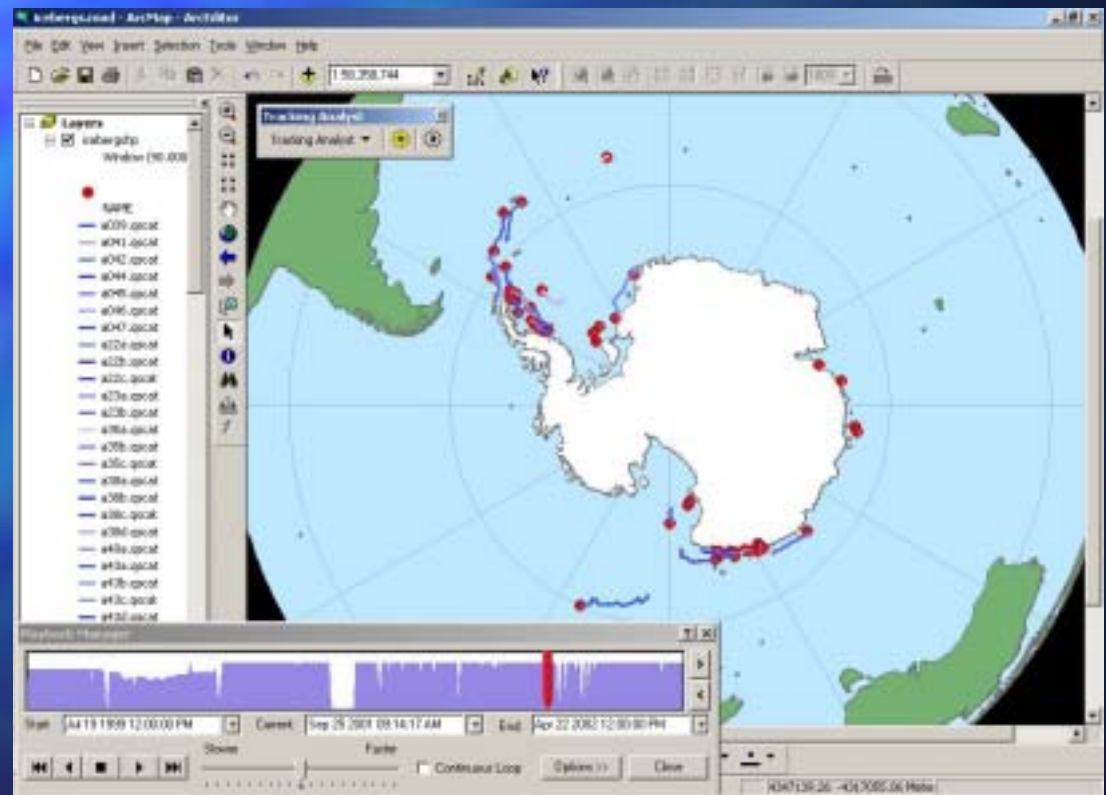


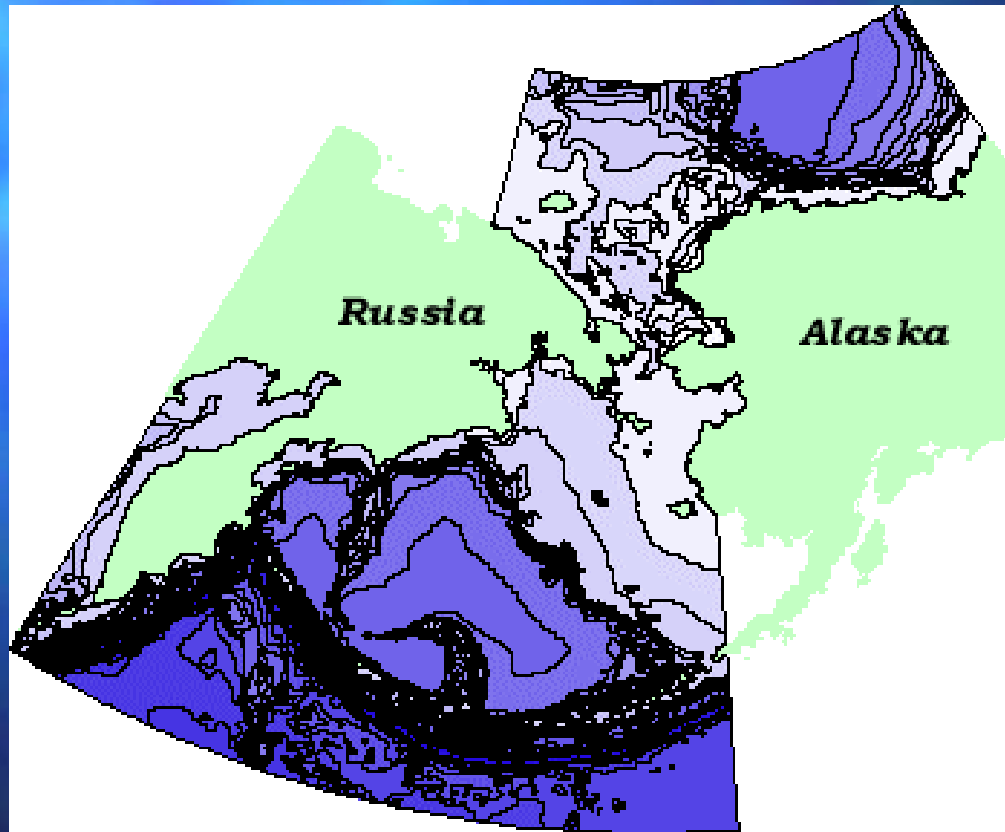
Geographic Information Systems (GIS) for Marine Biology



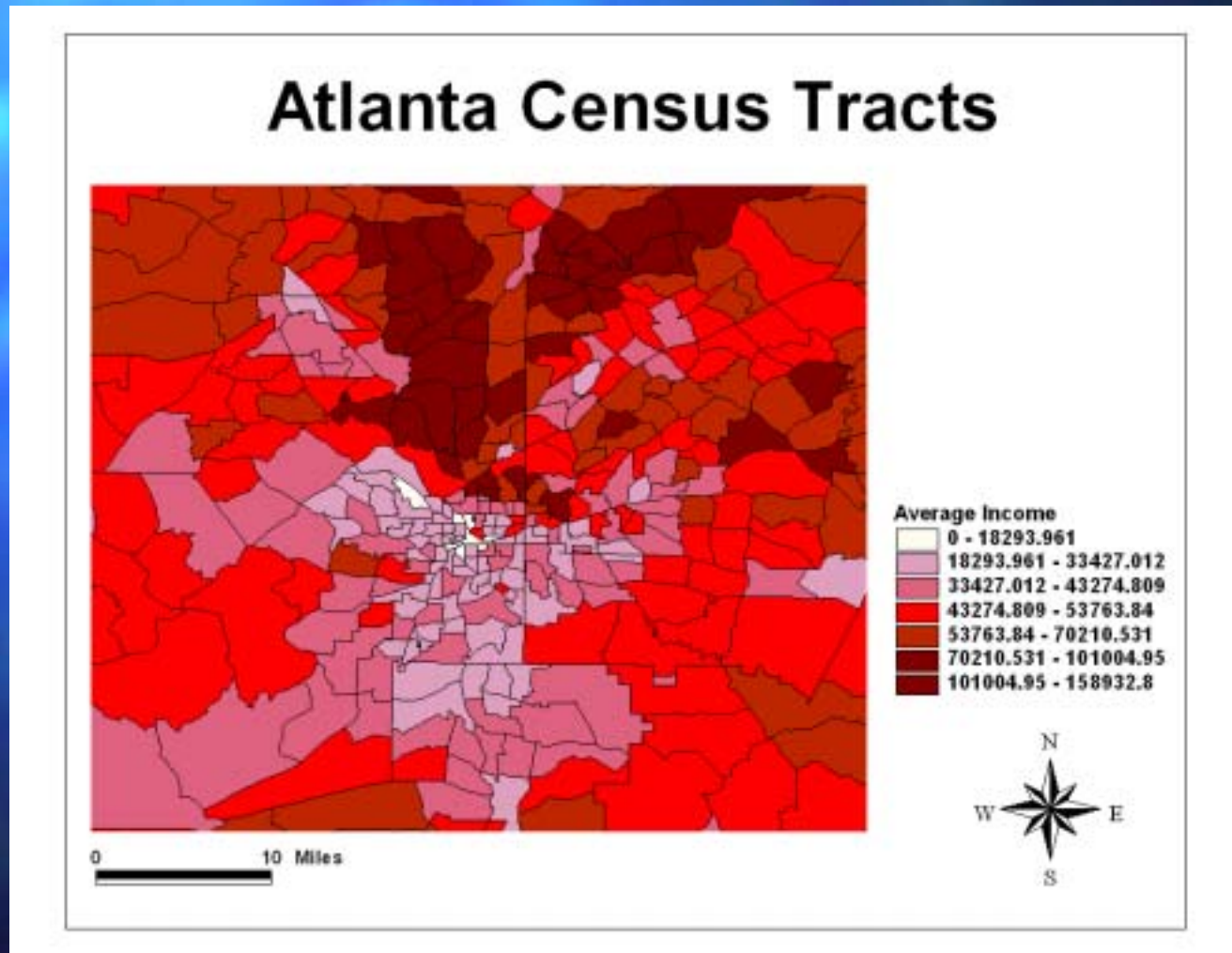
What are GIS?

- Geographic Information Systems are computer-based tools that facilitate mapping and spatial analysis of the Earth's features and events.
- GIS can reveal hidden patterns and relationships among data that aren't apparent in spreadsheets or statistical packages.

GIS enables you to better understand and evaluate your data by using cartographic tools to display information stored in your database.



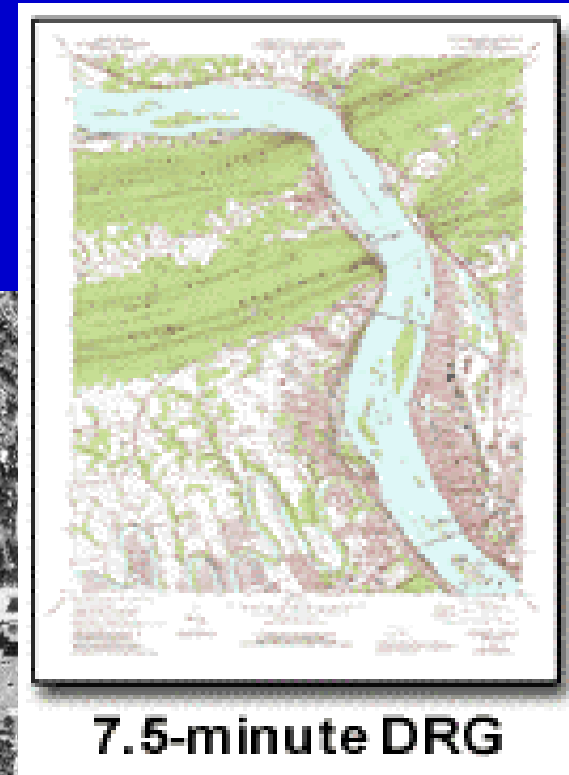
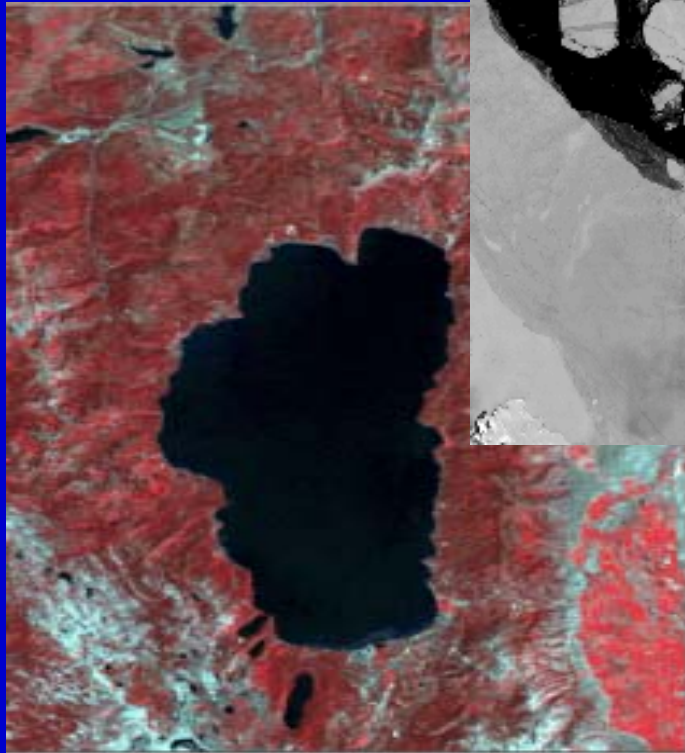
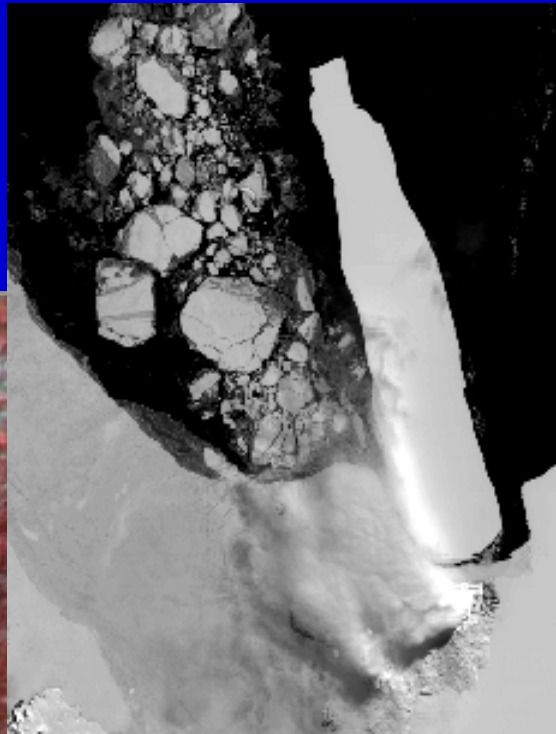
You can change the display of your data by changing the symbols, colors, or legend classifications.



GIS Data

Thematic layers containing features

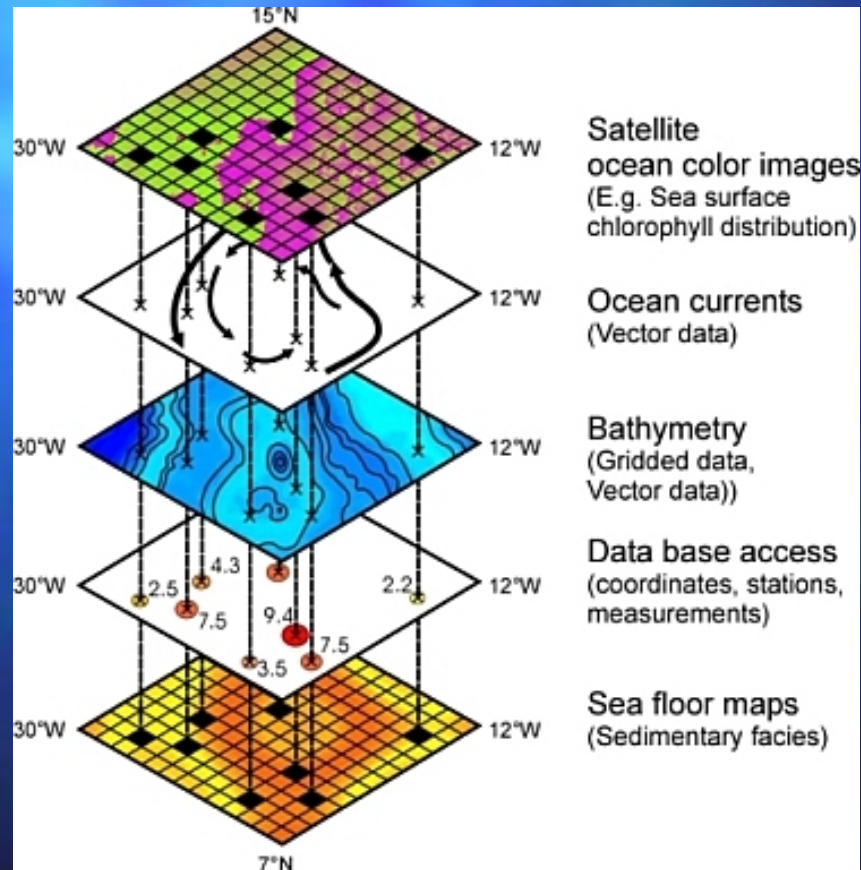
Imagery



7.5-minute DRG

GIS Data Structure

STACKED MAP LAYERS: Each layer represents a unique phenomenon. The data share a common location which allows the integration of data from all sources and types under a single platform. These “geo-referenced” layers are superimposed and can be queried.



ArcGIS

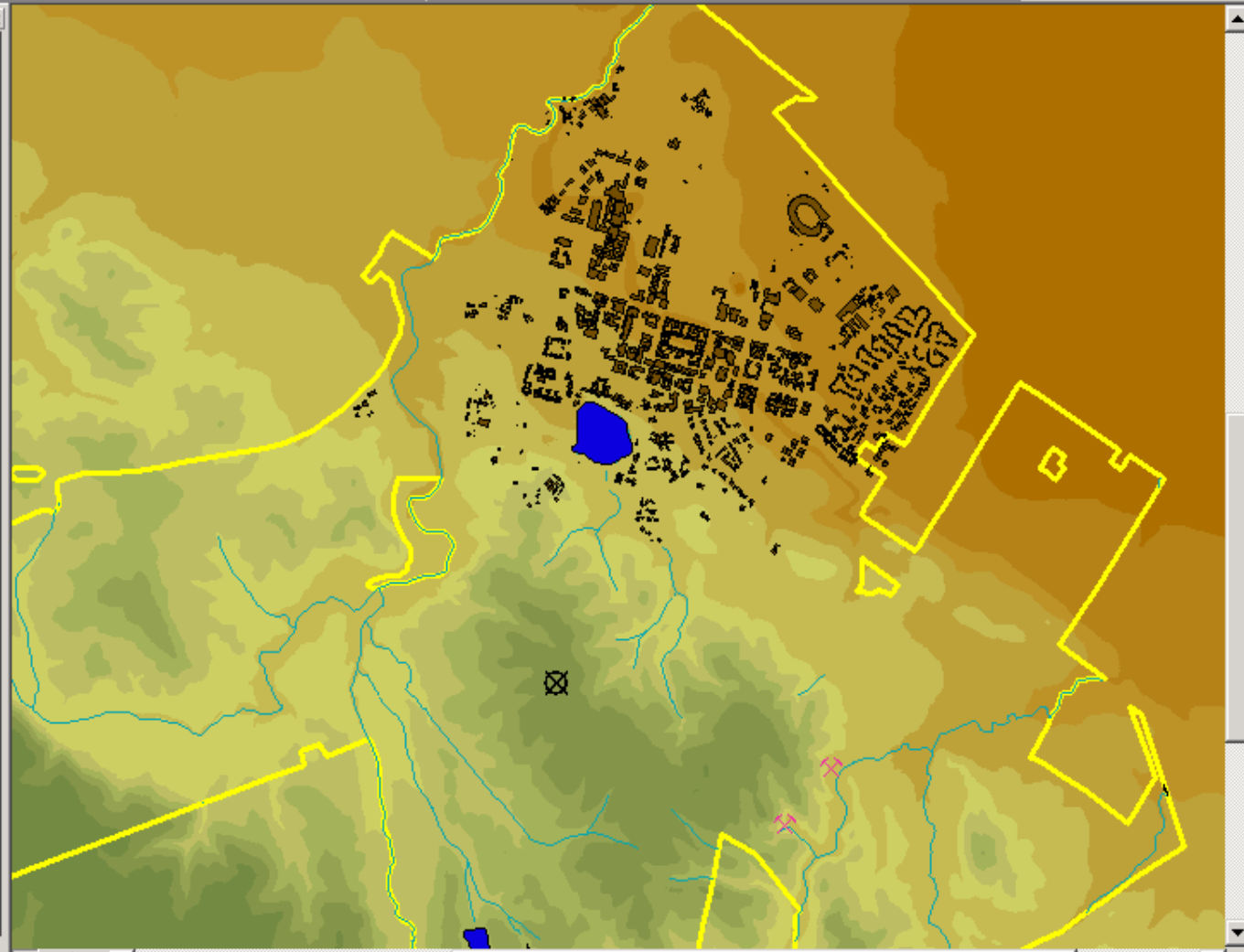
File Edit View Insert Selection Tools Window Help

Spatial Analyst Layer: DRG-SureMap

3D Analyst Layer: DRG-SureMaps

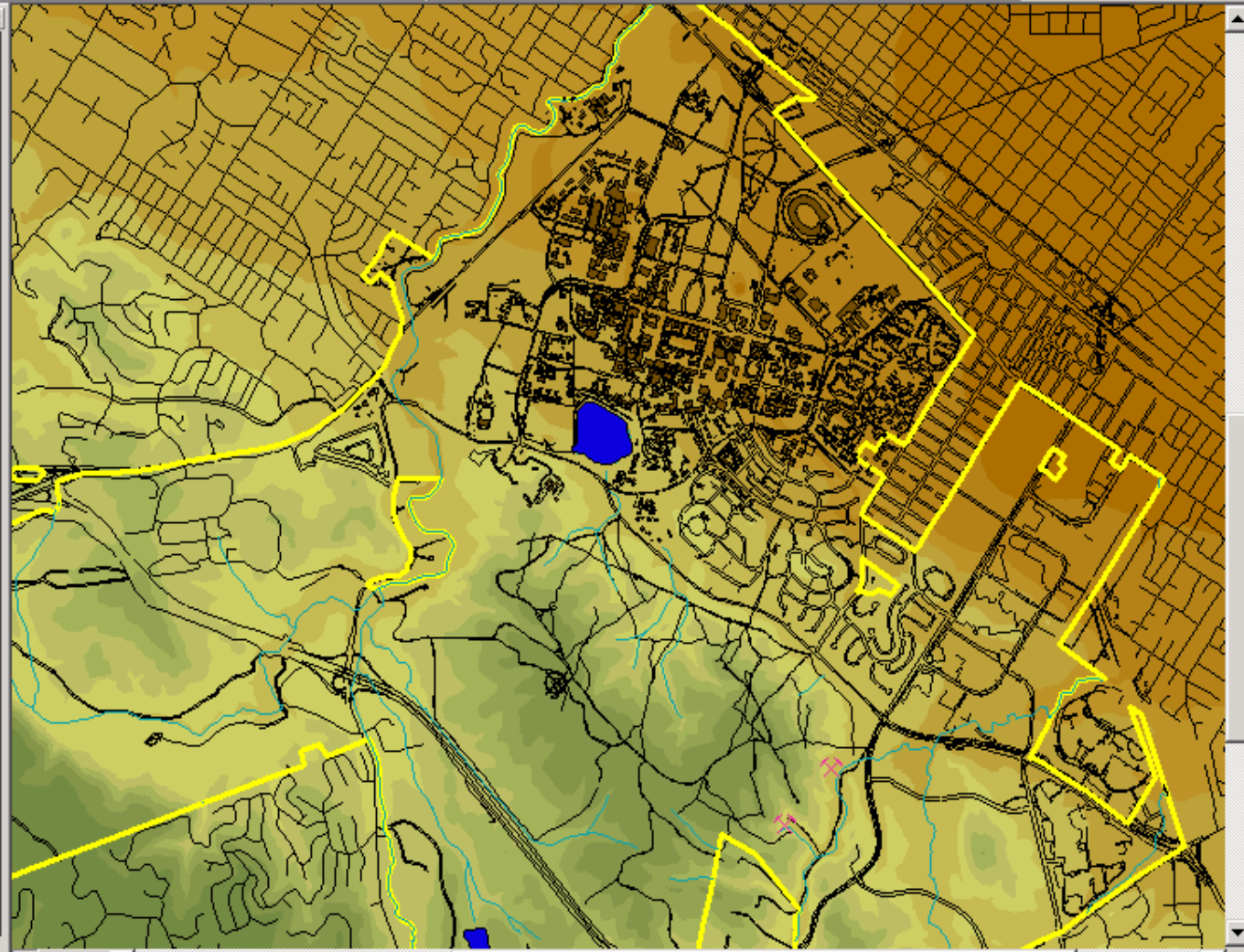
1:41,543 100%

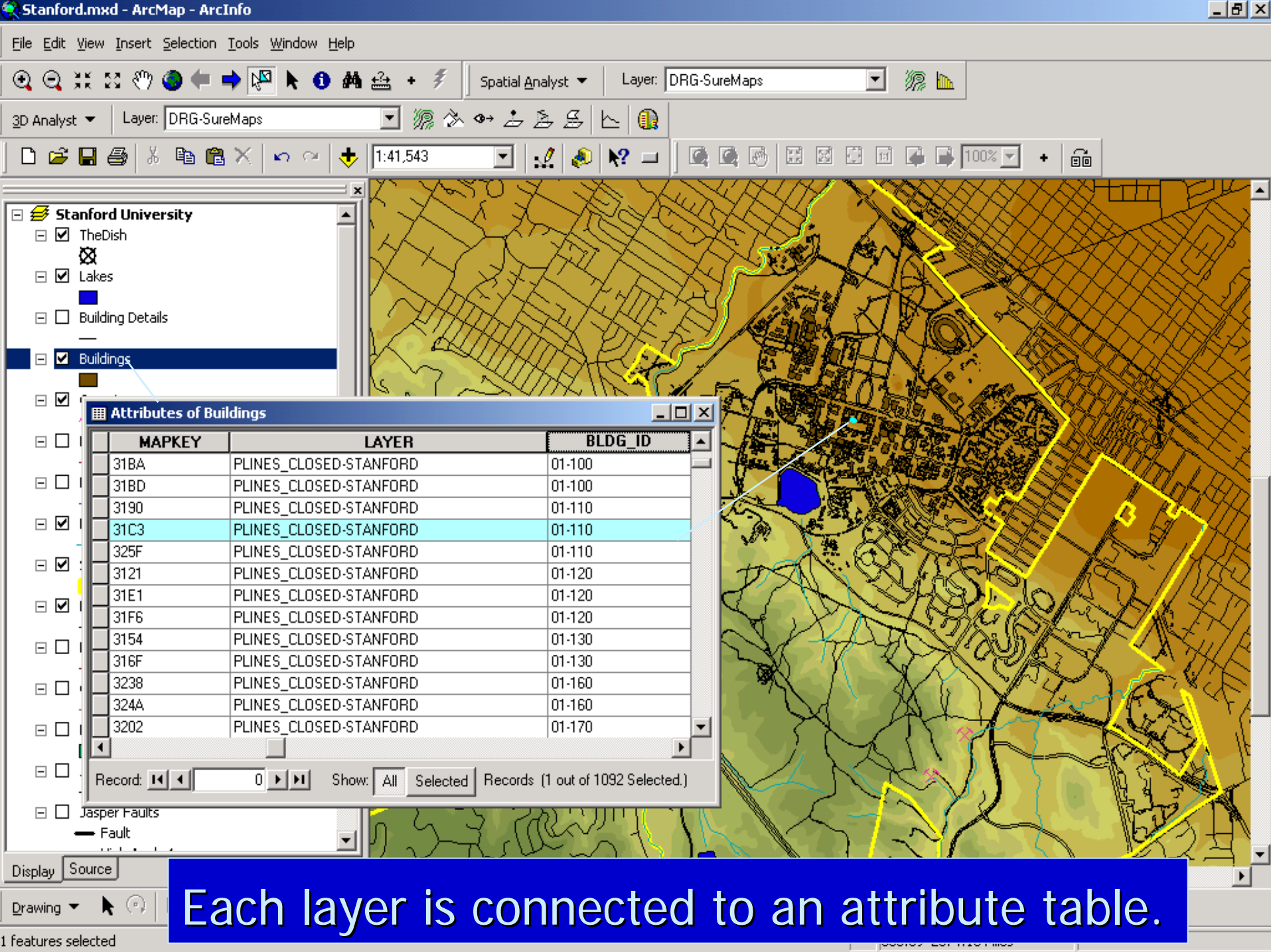
- Stanford University
 - TheDish
 - Lakes
 - Building Details
 - Buildings
 - Quarries
 - FHTrails
 - FHStructures
 - Hydrology
 - SU Boundaries
 - Roads
 - FH5ft.contour
 - Contours20ft.
 - Parcels
 - Jasper StrikeDips
 - Jasper Faults
 - Fault



Display Source Drawing Arial 10 B I U

- Stanford University
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 - Jasper Faults
 - Fault





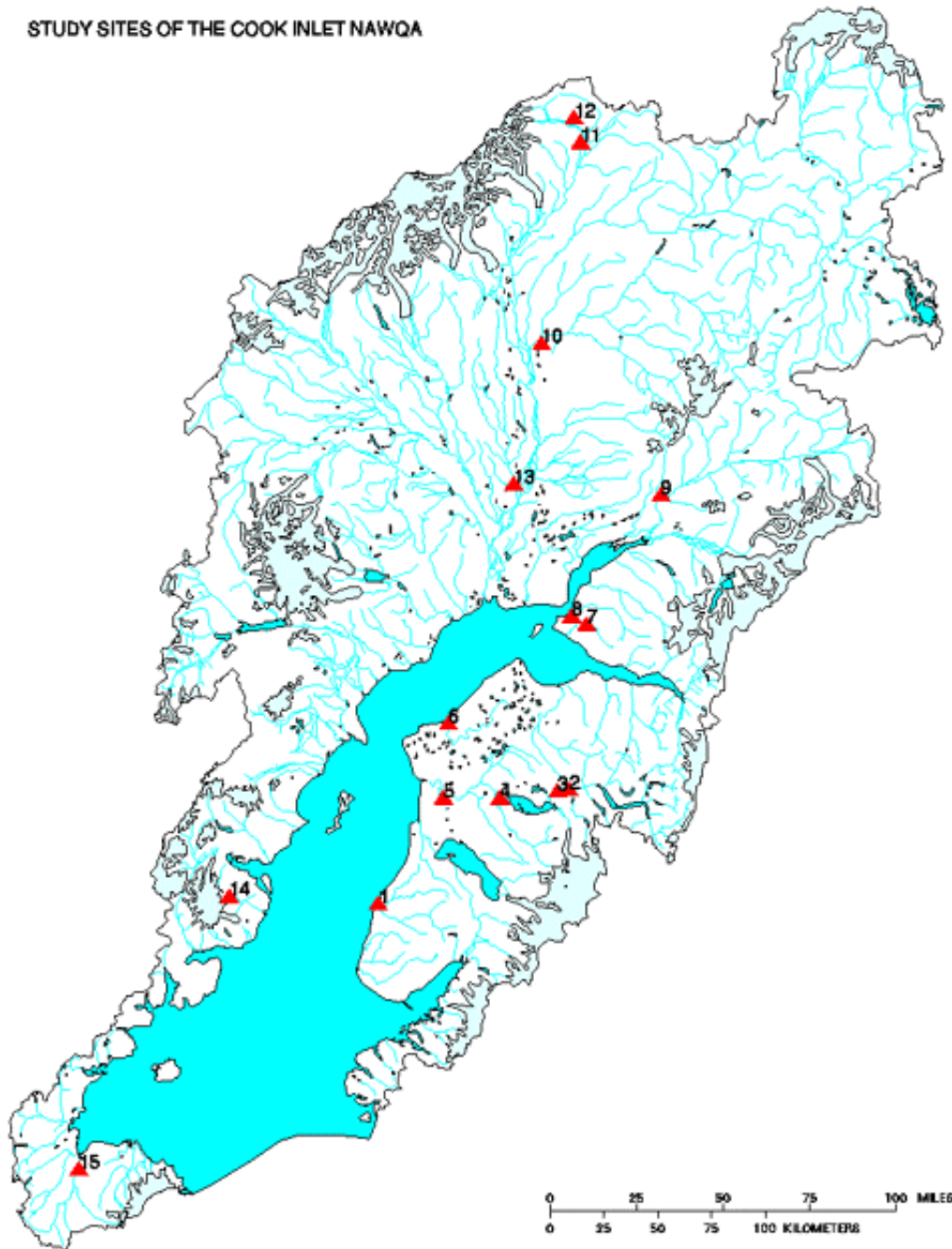
Each layer is connected to an attribute table.

MAPKEY	LAYER	BLDG_ID
31BA	PLINES_CLOSED-STANFORD	01-100
31BD	PLINES_CLOSED-STANFORD	01-100
3190	PLINES_CLOSED-STANFORD	01-110
31C3	PLINES_CLOSED-STANFORD	01-110
325F	PLINES_CLOSED-STANFORD	01-110
3121	PLINES_CLOSED-STANFORD	01-120
31E1	PLINES_CLOSED-STANFORD	01-120
31F6	PLINES_CLOSED-STANFORD	01-120
3154	PLINES_CLOSED-STANFORD	01-130
316F	PLINES_CLOSED-STANFORD	01-130
3238	PLINES_CLOSED-STANFORD	01-160
324A	PLINES_CLOSED-STANFORD	01-160
3202	PLINES_CLOSED-STANFORD	01-170

A Few Applications of GIS in the Marine Environment

- Store, map and analyze data from seafloor mapping expeditions
- Marine life and habitat conservation
- Monitor species distribution, abundance, and migration patterns
- Coastal zone management
- Map sources and paths of pollutants in marine environments
- Study the impact of fisheries on marine mammals
- Multi-dimensional visualization of marine environments

STUDY SITES OF THE COOK INLET NAWQA



**USGS: National
Water Quality
Assessment
(NAWQA)
–Cook Inlet Basin
Study Unit**

Internet Map Server Software Provides GIS through Web Sites

USGS Geology: Monterey Bay National Marine Sanctuary GIS

Tools
Help

Map Server Intro

More Info
Download Data

Refresh Map

Layers

Visible Active

- Latlon labels
- net60minp
- quad75p
- eqreloc (relocation vector)
- eqreloc (befaft)
- seismicity: nceq7500 (mag)
- mbgeolse - faults
- isopach
- mbgeolsep
- ccalbatc
- National Marine Sanctuaries
- places
- mcculstruc.tif

Refresh Map

USGS/Coastal and Marine Geology Program

0 31 km

Zoom In

Coastal and Marine Geology Program

CMGP Field Centers:

Regional Map Sites:

MBNMS Map View Selection:

CMGP Internet Map Server

Go to

Go to

Go to

Protected Areas Geographic Information System (PAGIS)

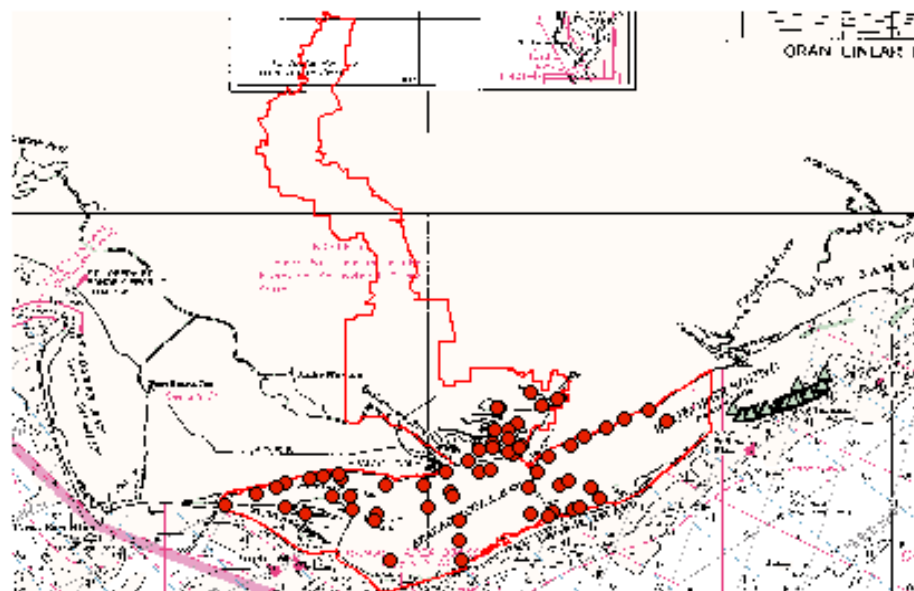
Navigate Current Map: (Click map to submit request)

Zoom In Zoom Out Scale Factor Pan

Attribute Information: (Click on map to submit request)

Identify Feature

Apalachicola NERR



Protected Areas
GIS

[HELP](#)

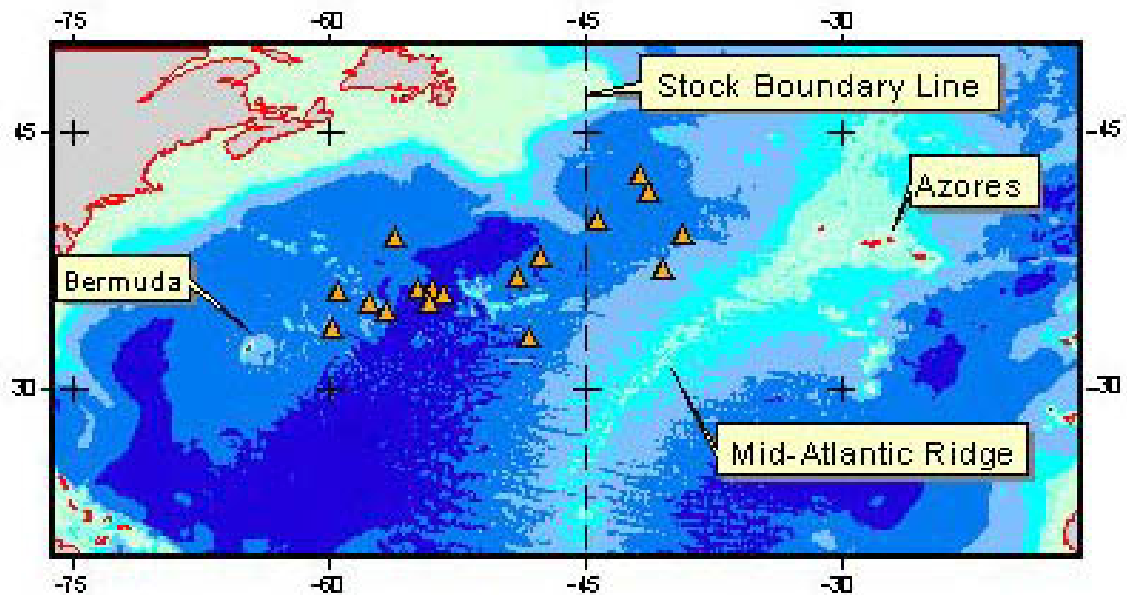
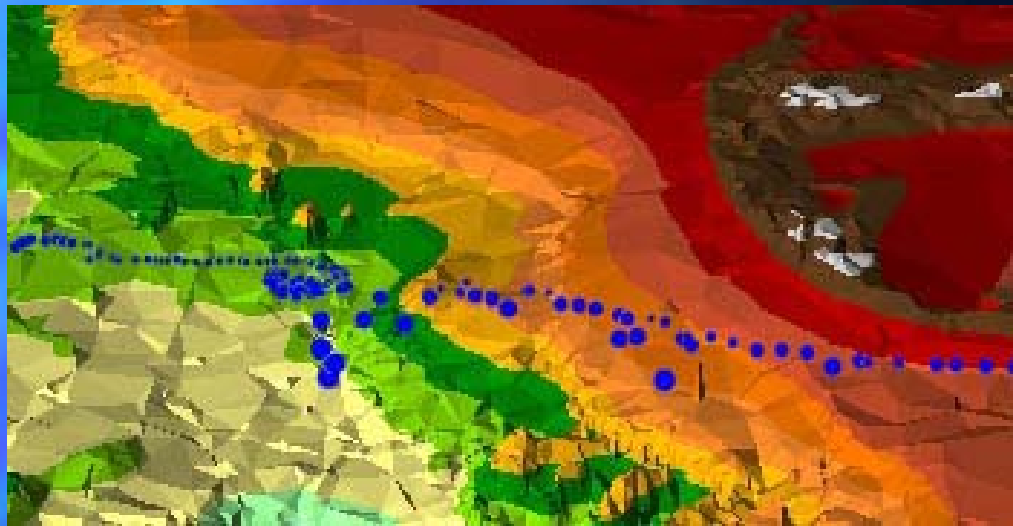
[HOME](#)

- St. George Island Sea Turtle Nests, 1998
- St. George Island Sea Turtle Nests, 1997
- St. George Island Sea Turtle Nests, 1996
- St. George Island Sea Turtle Nests, 1995
- Coliform Sampling Stations ●
- Apalachicola River Discharge - Blountstown, 1941-1991
- Shorebird Nesting Sites, 1985-1998
- Manatee Sightings, 1995-1998
- Dog Island Sea Turtle Nests, 1998 ▲
- Dog Island Sea Turtle Nests, 1997
- Dog Island Sea Turtle Nests, 1996
- Apalachicola NERR □
- Nautical Chart - Tampa to Cape San Blas

Bluefin Tuna Research

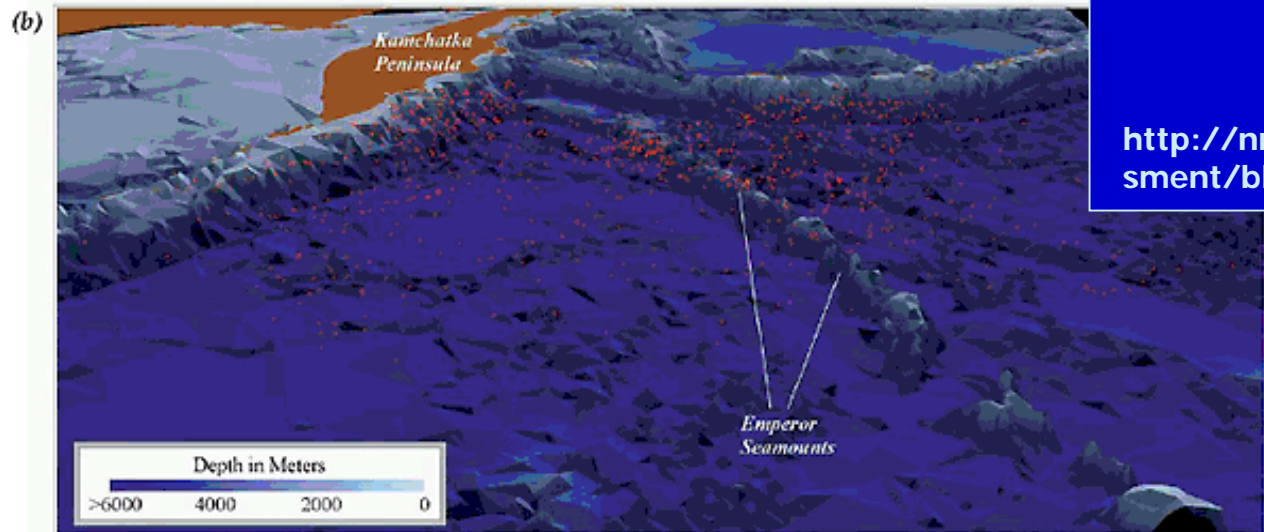
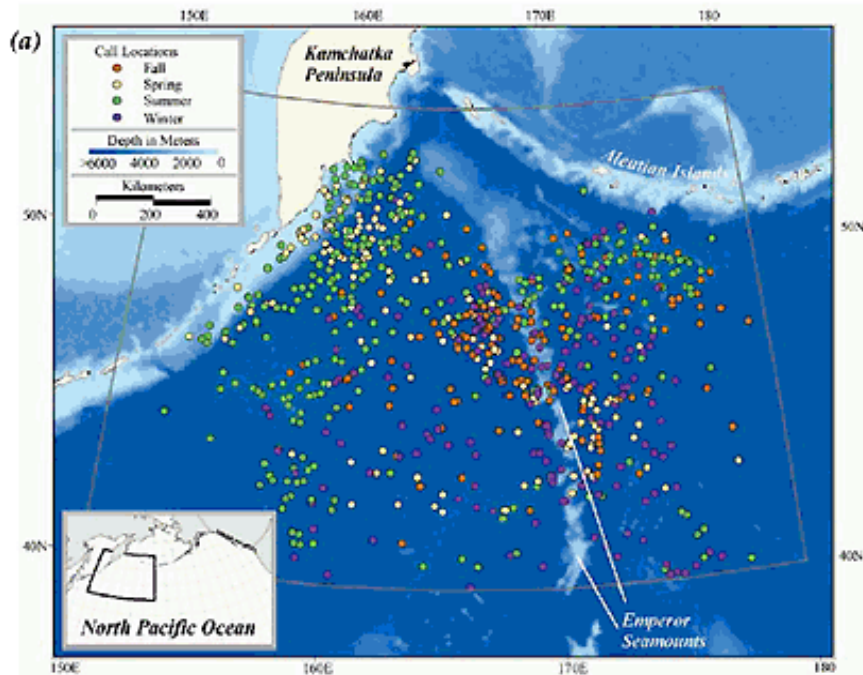
Pelagic GIS Group, New England Aquarium

Hydro-Acoustic Tracking



Satellite Popup Tags

<http://www.marinegis.org/bluefin.html>



Blue Whale Habitat Associations in the Northwest Pacific

<http://nmml.afsc.noaa.gov/CetaceanAssessment/bluwhale/bluhabitat.htm>

Figure 1. Locations of calling blue whales in the NW Pacific region in relation to bathymetry in planar projection (a); and in 3-D projection (b). Whale call locations are associated with the Emperor Seamounts and the steep slopes off Kamchatka Peninsula.

Specific Concerns for Marine GIS

- Data are in motion, often unpredictably
 - Boundaries are difficult to define
 - How frequently should one map an area?
 - At which scale?
- A true 3D environment
- Matching vertical datums between land and sea in coastal zones
- Data
 - Can be expensive and time-consuming to collect
 - Existing data may be of uncertain reliability

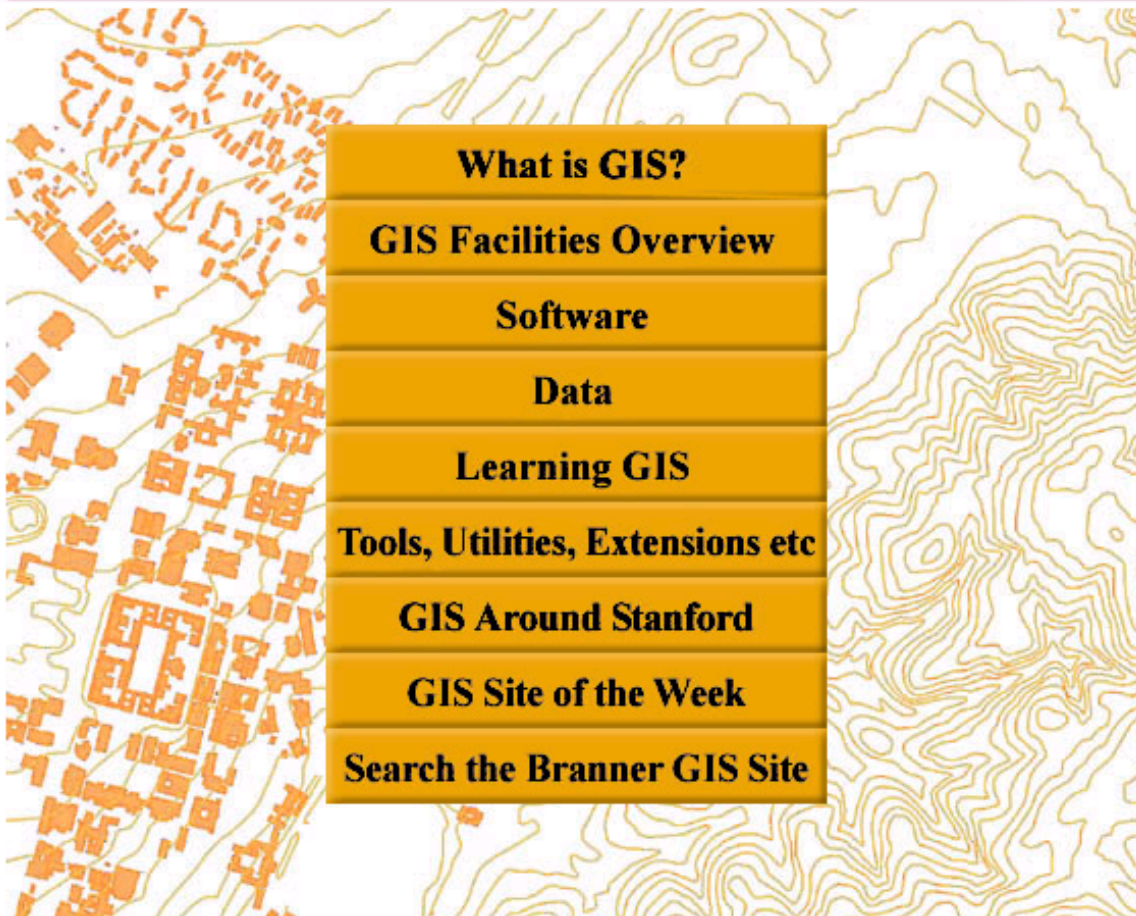
Components of Stanford's GIS

- Hardware
 - 4 networked Windows 2000 workstations
 - Student project storage space
 - Color and B/W printers, 36" plotter
 - 40" Scanner
- Software
 - ESRI campus site license
 - ENVI license for remote sensing analysis
- Data
 - Most important for a meaningful GIS project

GIS Support in Branner Library

- Training: Virtual Campus, tutorials
- GIS Books: Reference, Software Manuals, Journals
- Technical Support Contacts :
 - Meredith Williams, GIS Manager
mjwilliams@stanford.edu
 - Julie Sweetkind-Singer, GIS and Map Librarian
sweetkind@stanford.edu
- Learn more about GIS and our facilities at:
<http://gis.stanford.edu>

Geographic Information Systems (GIS) at Branner Library



<http://gis.stanford.edu>

Where to find GIS Data

- Stanford owned data.
 - ESRI Data & Maps CDs – rivers, lakes, water bodies, generalized drainage systems
- Data from commercial vendors
 - NGDC coastal relief model – gridded bathymetric data
- Data from government agencies/research groups
 - On CD-ROMs or over the Web
- Data you've collected
 - Sonar, tagging, GPS, species migration, habitat distribution

Data Considerations

- Are the data in a format you can use?
- What are the scale of the data?
- Are the spatial files in a projection and if so, which one?
- How recent are the data?
- What were the sources of the data?
- Are there copyright restrictions?

The Hunt for Existing Data

- Search Socrates
- Search the Internet
 - Look at the starting points on the GIS & Marine Biology page
 - <http://gis.stanford.edu/MarineBioGIS.html>
- See if there are paper maps that can be digitized.
 - Branner has a large format scanner.
 - NOAA bathymetric charts for the US are downloadable from the Web, but are not georeferenced.