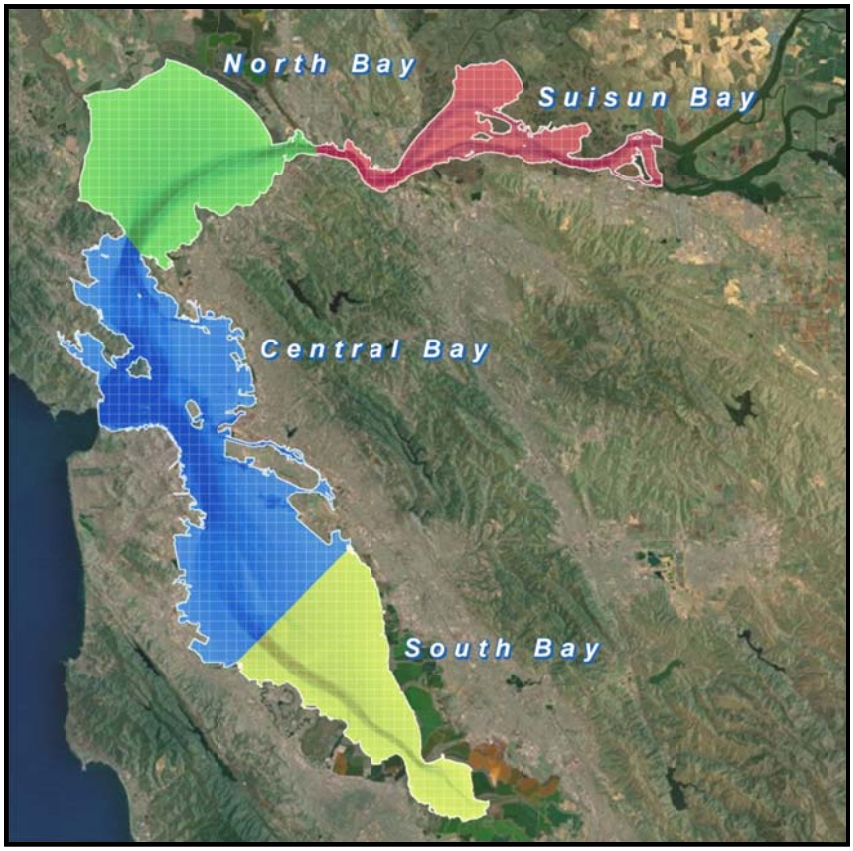
San Francisco Bay Benthic Macroinvertebrate Atlas – Help



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Database Information

Background

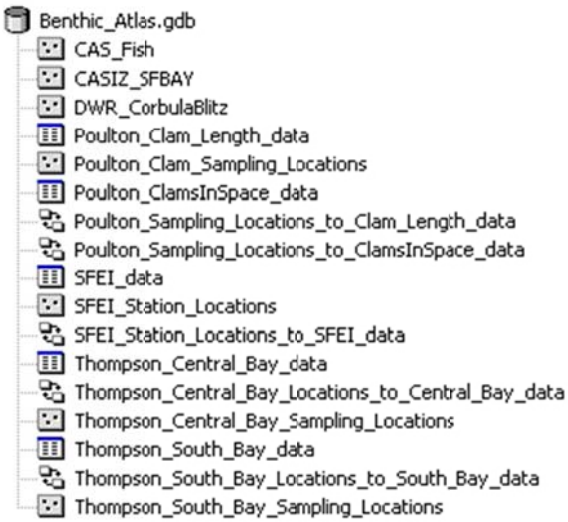
From 2007-2010, San Francisco State University and the U.S. Geological Survey gathered benthic macroinvertebrate distribution data from a number of different organizations in an attempt to document prey availability for San Francisco Bay benthic predators (including the greater and lesser scaup (*Aythya marila, Aythya affinis*), surf scoter (*Melanitta perspicillata*), and canvasback (*Aythya valisineria*). Local, state, and federal research agencies and non-profits contributed data for this analysis. Along with existing macroinvertebrate prey distribution data, we have also included information on the physical characteristics of the benthic environment (salinity, elevation, sediment composition).

While compiling datasets used to calculate the carrying capacity of diving ducks in the San Francisco Bay, we realized that this collection could serve as a helpful resource for other researchers and resource managers. This GIS-based resource was modeled on an earlier summary of seabird and marine mammals off Southern California presented in 2009 (http://www.werc.usgs.gov/geospatial/seabird), and a summary of Pacific fisheries datasets released in 2010 (http://www.werc.usgs.gov/fisheriesgis).

Organization

Included in the Benthic Atlas geodatabase are macroinvertebrate (organisms greater than 0.5 mm) abundance, biomass and distribution information collected from the benthic zone of the San Francisco Bay as well as sediment, water quality, and bathymetry data from throughout the bay.

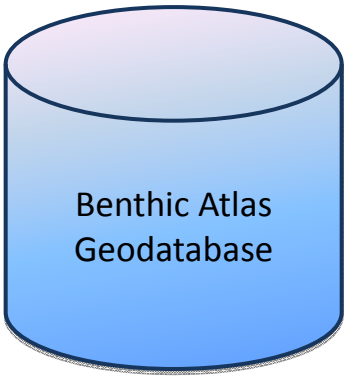
All of the spatial and tabular data for this project are stored inside of an ESRI® File Geodatabase. Biotic and physical data in the Benthic Atlas are embedded in the spatial features visible in the ArcMap document or associated with the features through relationship classes in the geodatabase. Relationship classes were used for datasets which had a Many-to-One relationship between the data and sampling locations (many records associated with a single sampling site).



For those datasets that participate in a relationship class, it is necessary to view related records in the data table through the attribute table of the feature class (see the **Viewing and Extracting Data** section below).

Installing the Benthic Atlas Geodatabase

The Benthic Atlas is available from http://www.werc.usgs.gov/benthicatlas as a zip file. After you have accepted the Terms of Use, you can save the zip file to your computer hard drive and extract it.



You will see that the unzipped files consist of:

- **Benthic_Atlas.gdb** folder: This is the Benthic Atlas geodatabase. Files in this folder should be viewed in ArcCatalog or ArcMap.
- **Benthic_Atlas.mxd**: The ArcMap document which contains the layers found in the Benthic Atlas geodatabase pre-loaded and symbolized for your convenience.
- **Benthic Atlas Help.pdf**: This help document.

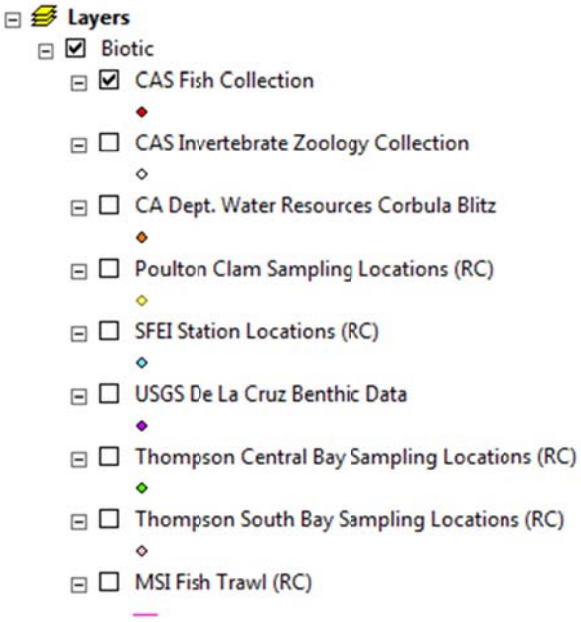
System Requirements:

- A PC running the Windows XP® operating system (or newer).
- ESRI ArcGIS Desktop® version 9.3 or 10.
- 40 MB of free hard disc space.
- 1 GB RAM memory
- 1.6 GHz processor

Note: All instructions given here are for ArcGIS Desktop version 9.3. Although the geodatabase and included ArcMap file should be compatible with ArcGIS Desktop version 10.x, the specific steps listed below may be different.

Viewing and Extracting Data

Using the included ArcMap document, you can easily view or extract data associated with selected features on the map. However, the method you use depends upon whether the data is embedded in a feature class or the feature class is tied to a separate data table through a relationship class in the geodatabase.

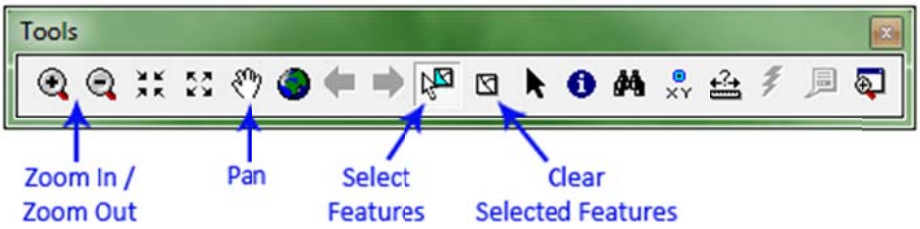


Layers that participate in a relationship class have been labeled with an "(RC)" in the ArcMap table of contents. The following chart also lists feature classes that have data embedded within them and those that participate in a relationship class with a data table:

Feature classes with embedded data	**Feature classes related to data tables**
CAS Fish Collection	MSI Fish Trawl Locations (to MSI Fish Trawl data)
CAS Invertebrate Zoology Collection	SFEI Station Locations (to SFEI data)
CA Dept. of Water Resources Corbula Blitz	Poulton Clam Sampling Locations (to Poulton Clam Length data AND Poulton ClamsInSpace data)
USGS De La Cruz Benthic Data	Thompson Central Bay Sampling Locations (to Thompson Central Bay data)
USGS Barnard Sediment Data	Thompson South Bay Sampling Locations (to Thompson South Bay data)
USGS Seabed datasets (clc, cmp, ext, fac, and prs)	USGS Water Quality Stations (to WQ 1997-2000 data AND WQ 2000-2002 data)

For more help on making selections and extracting data from feature classes or related data tables, please see the sections below.

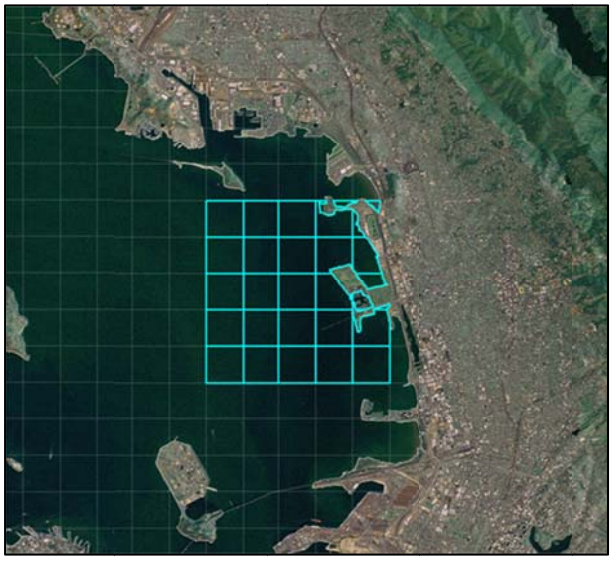
Making Spatial Selections (ArcMap 9.3):

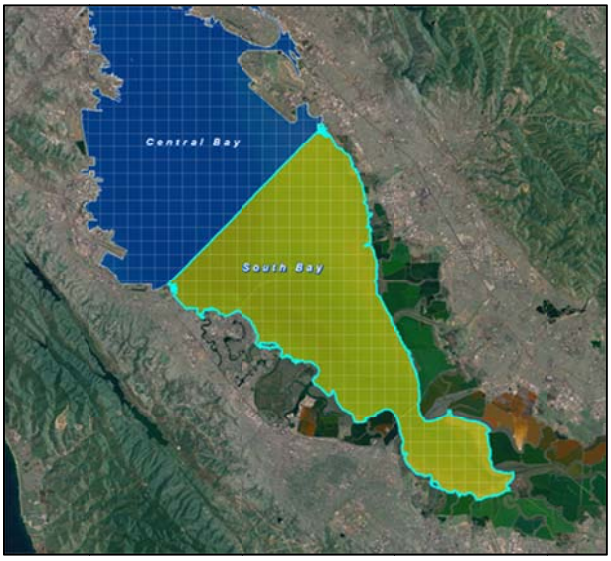


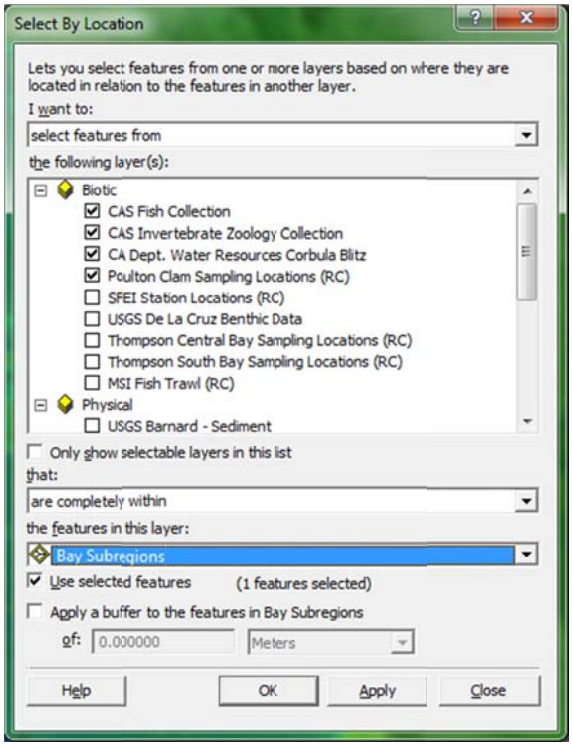
If you would like to see data associated with a specific location, you will need to make a selection on the map. The easiest way to do this is to turn on one or more layers you are interested in on the Table of Contents, and then use the Select Features tool. This tool should be on the "Tools" toolbar in ArcMap. If you do not see it, go to View > Toolbars and make sure there is a check next to Tools. Once you have chosen the Select Features tool, you can use it to click on or drag a box around associated locations on the map. Selected features should appear highlighted in blue. If you would like to clear selections you've made, simply click the Clear Selected Features icon on the toolbar (see above).

By default, only layers associated with Benthic, Fish Trawl, Sediment, and Water Quality data are selectable on the map. However, you could also use the 1 km x 1 km UTM Grid and Bay Subregions layers to make broader selections. If you would like to make these layers selectable, you will need to choose Selection > Set Selectable Layers on the main menu. In the Set Selectable Layers dialog, you can scroll through the list of layers and add a check box next to UTM Grid, Bay Subregions, or any other available layer you would like.

To make a broader selection within the UTM Grid or Bay Subregions layers, use the Select Features tool to select one or more UTM grid cells, or one or more Bay Subregions.

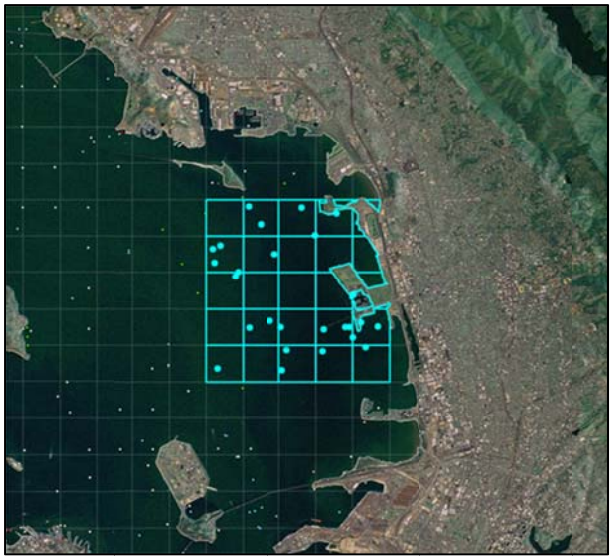


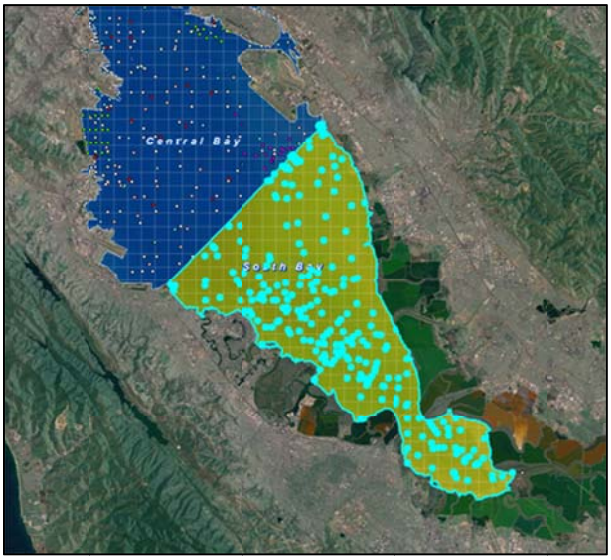




After you've made your grid or subregion selection, choose Selection > Select by Location from the main menu. In the Select By Location dialog, choose the layers you would like to be selected that "are completely within" the features in the UTM or Subregion layer. Make sure "Use selected features" is checked and click OK.

If the layers you've chosen are turned on in the Table of Contents, you will see the features within the larger area are now selected.

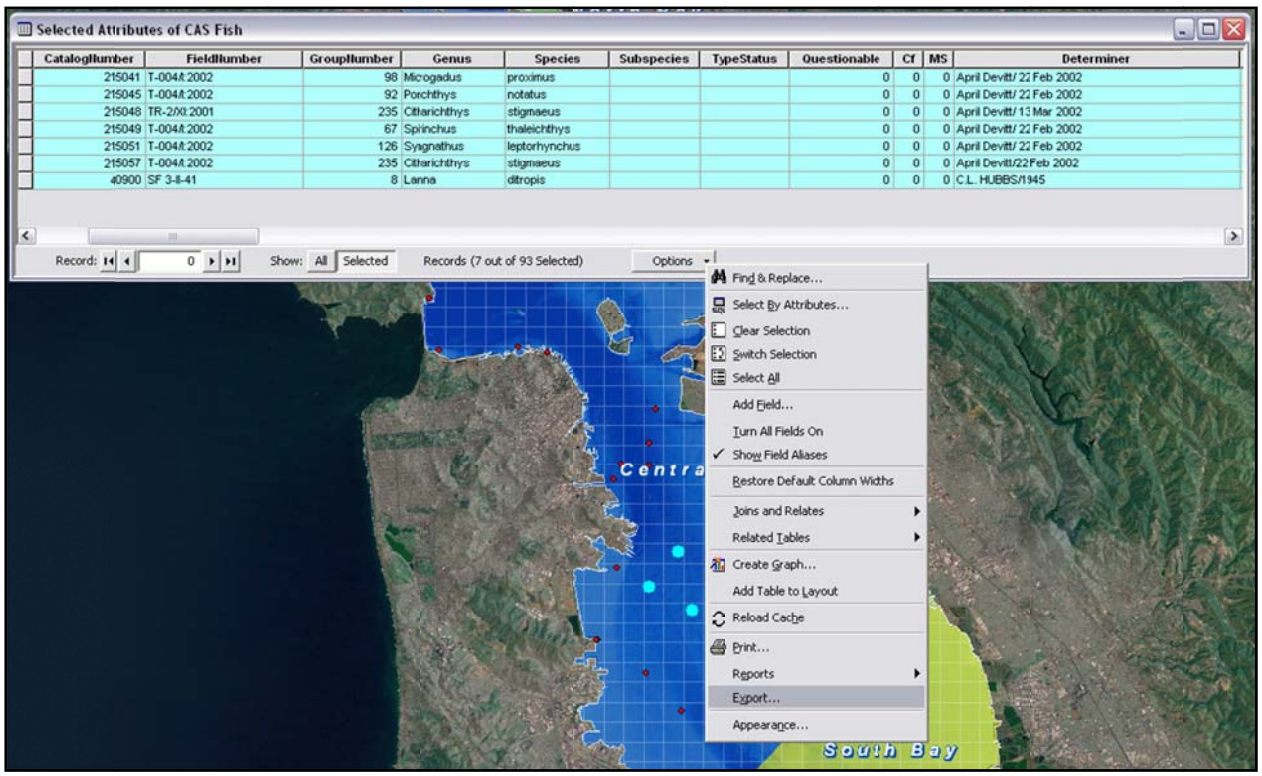




To view or extract records from locations with embedded data (ArcMap 9.3):

Right click on the layer name in the table of contents and choose “Open Attribute Table.” If you have made a selection on the map from the same layer, records associated with that selection will appear highlighted in blue. You can click on the “Selected” button near the bottom of the attribute table window to see only those records associated with selected features. Additionally, you can sort and select records in this window.

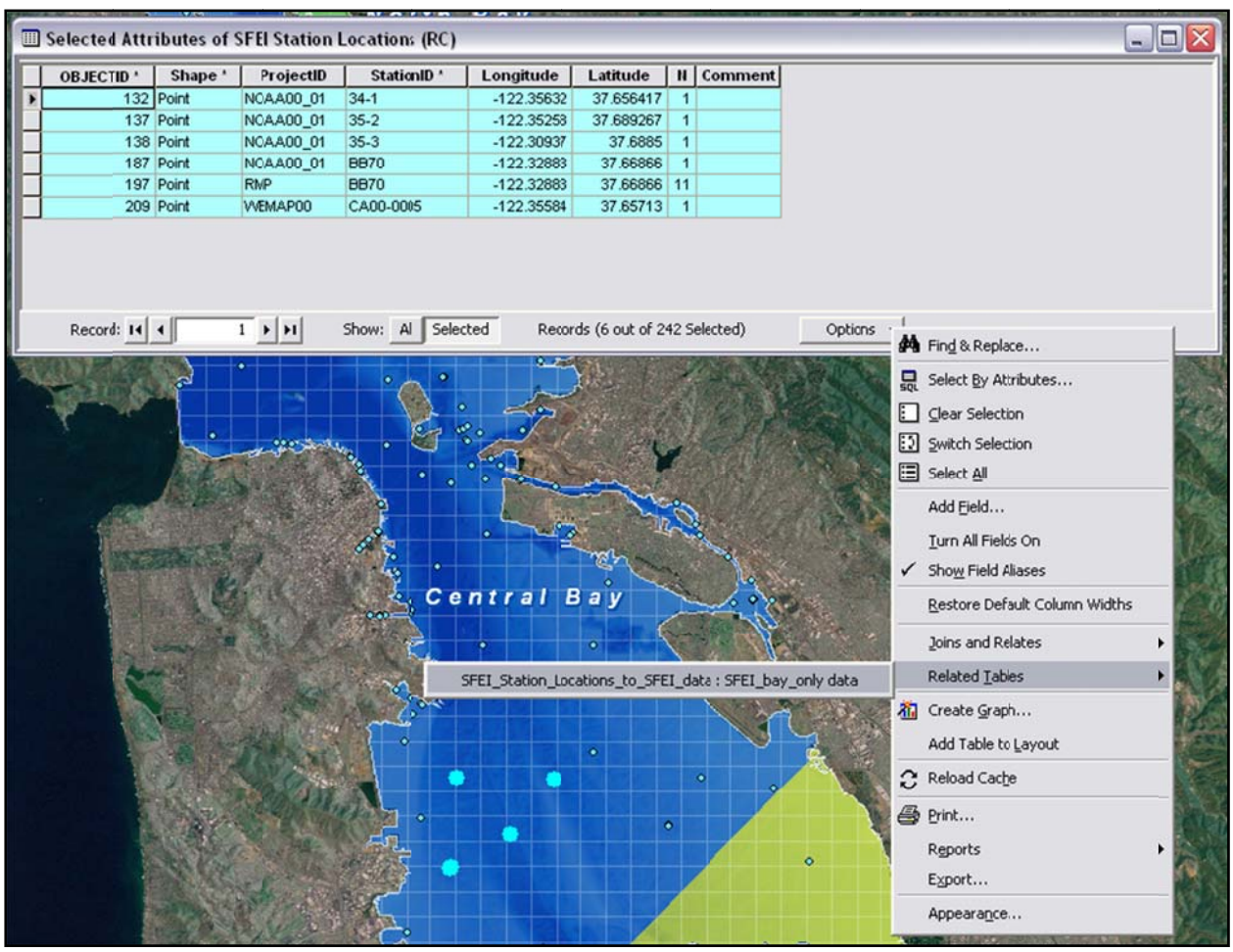
To export selected records, click on the “Options” button in the attribute table and choose “Export.” An Export Data window will appear allowing you to choose an output location and file type (File and Personal Geodatabase tables, dBASE Table, Info tables, Text File and SDE tables).



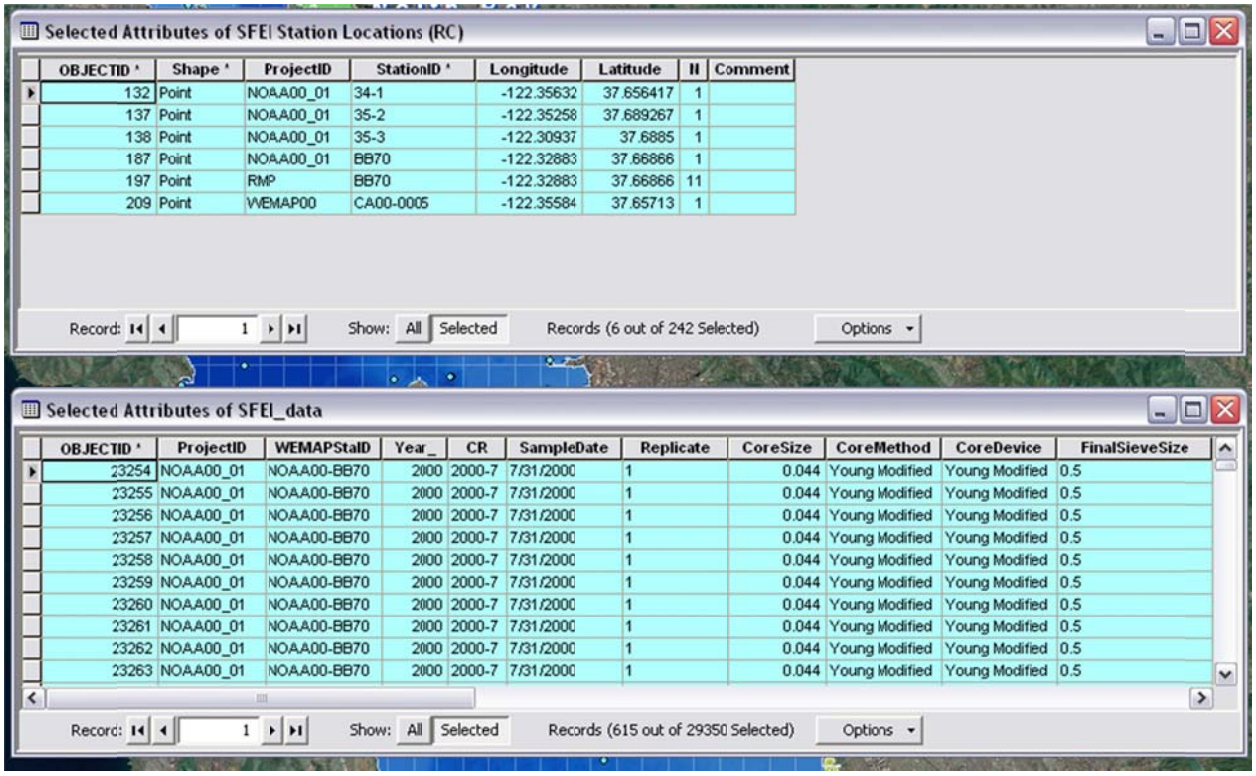
To view or extract records from locations related to data tables (ArcMap 9.3):

Right click on the layer name in the table of contents that has an "(RC)" in its title and choose "Open Attribute Table." If you have made a selection on the map from the same layer, records associated with that selection will appear highlighted in blue. You can click on the "Selected" button near the bottom of the attribute table window to see only those records associated with selected features.

It's important to remember that the records that appear in the attribute table of a feature class that is associated with a separate data table pertain to the spatial location only (site name, coordinates, etc.). To view the additional data associated with the locations, you must click on the "Options" button of the feature class attribute table and choose Related Tables > [Related Table Name]. Once you have chosen the related table you wish to view, it will open with any associated records highlighted. Again, you can click on the "Selected" button near the bottom of the table window to see only those records associated with the selected feature class locations. Conversely, you can make attribute selections in the table window and view locations associated with those data by following the same steps (Options > Related Records > [Feature Class Name]).



Once you have chosen the related table you wish to view, it will open with any associated records highlighted. Again, you can click on the “Selected” button near the bottom of the table window to see only those records associated with the selected feature class locations. Conversely, you can make attribute selections in the table window and view locations associated with those data by following the same steps (Options > Related Records > [Feature Class Name]).



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137	Point	NOAA00_01	35-2	-122.35258	37.689267	1	
138	Point	NOAA00_01	35-3	-122.30937	37.6885	1	
187	Point	NOAA00_01	BB70	-122.32883	37.66866	1	
197	Point	RMP	BB70	-122.32883	37.66866	11	
209	Point	WEMAP00	CA00-0005	-122.35584	37.65713	1	

OBJECTID *	ProjectID	WEMAPStaID	Year_	CR	SampleDate	Replicate	CoreSize	CoreMethod	CoreDevice	FinalSieveSize
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23255	NOAA00_01	NOAA00-BB70	2000	2000-7	7/31/2000	1	0.044	Young Modified	Young Modified	0.5
23256	NOAA00_01	NOAA00-BB70	2000	2000-7	7/31/2000	1	0.044	Young Modified	Young Modified	0.5
23257	NOAA00_01	NOAA00-BB70	2000	2000-7	7/31/2000	1	0.044	Young Modified	Young Modified	0.5
23258	NOAA00_01	NOAA00-BB70	2000	2000-7	7/31/2000	1	0.044	Young Modified	Young Modified	0.5
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23263	NOAA00_01	NOAA00-BB70	2000	2000-7	7/31/2000	1	0.044	Young Modified	Young Modified	0.5

To export data associated with selected records in either the feature class or the data table, click on the “Options” button in the table window and choose “Export…” An Export Data window will appear allowing you to choose an output location and file type (File and Personal Geodatabase tables, dBASE Table, Info tables, Text File and SDE tables).