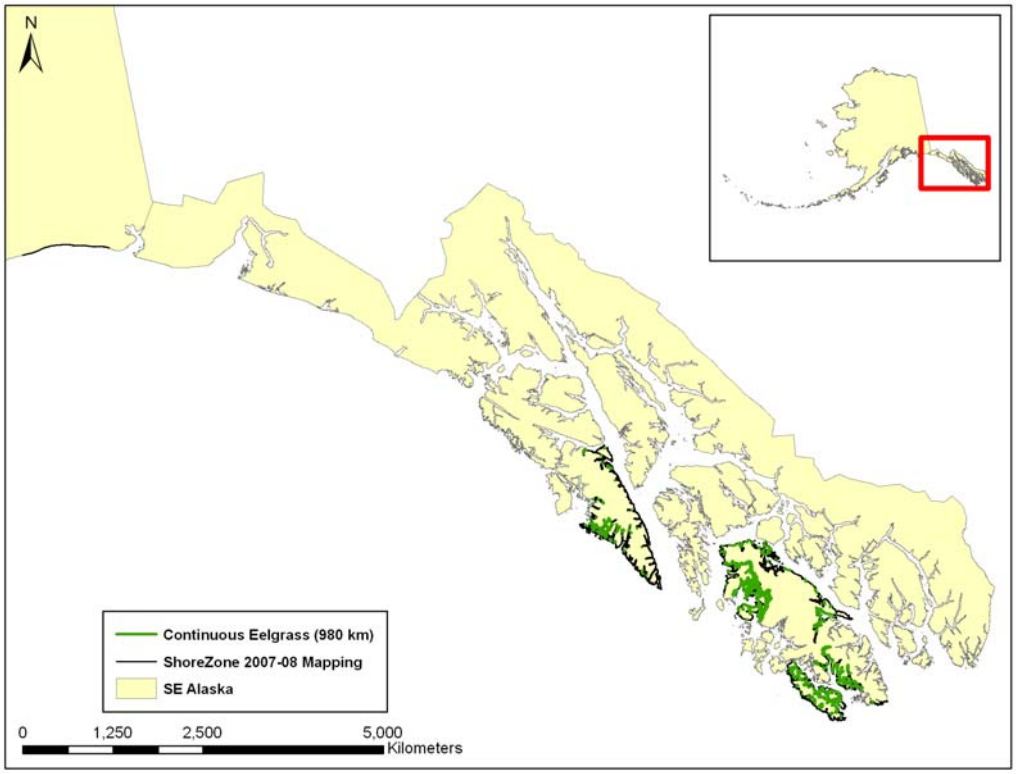
CORI Project: 2008-44 **30 June 2010**

Coastal Habitat Mapping Query Manual: A User's Guide to Querying ShoreZone Databases in ArcGIS and MS Access



Prepared for:
NOAA National Marine Fisheries Service, Alaska Region
Juneau, Alaska

Prepared by:

COASTAL & OCEAN RESOURCES INC
A-759 Vanalman Ave., Victoria BC V8Z 3B8 Canada
(250) 658-4050
www.coastalandoceans.com

Introduction

This "Query Manual" consists of step-by-step instructions on how to query the ShoreZone database in both ESRI **ArcGIS** and **Microsoft Access** software platforms. The directions are accompanied by screen captures to help the user navigate the various data tables and windows in each software platform. Basic approaches to querying are defined and illustrated, from simple to complex, and 10 examples are provided. Suggestions for troubleshooting and ways of ensuring the results are valid are also provided. The purpose of this guide is to empower a user who is familiar with the ShoreZone protocol and software platforms, so that the user can perform analytical queries of the database and can interpret the results.

Specific query examples provided in this manual include:

1. Determining the mapped distribution and shoreline length of the eelgrass (*Zostera)* bioband [ArcGIS Query].
2. Length summary of mapped shoreline types on the basis of BC Class [Microsoft Access Query].
3. Finding a digital still image that meets several criteria (BC Class, Shore Name, BioBand) [Microsoft Access Query].
4. Determining the mapped distribution of several shore types (BC Classes) [ArcGIS Query].
5. Determining the mapped distribution and shoreline length of the canopy kelps *Macrocystis* (giant kelp), *Nereocystis* (bull kelp), and *Alaria fistulosa* (dragon kelp) (MAC, NER, and ALF biobands) [ArcGIS Query].
6. Displaying multiple attributes: anthropogenic shorelines and shore modification features [ArcGIS Query].
7. Querying the Across-shore (Xshr) data to find shoreline with high marine debris potential [ArcGIS Query].
8. Querying multiple tables to find Salt Marsh that is not associated with an Estuary [ArcGIS Query].
9. Extracting data from multiple tables using sub-queries to find Sandlance spawning habitat [ArcGIS Query].
10. Using a definition query to display selected attributes and make a simple map [ArcGIS Query].

In the GIS environment, these queries can then be used to produce a data table, a map (exportable as a JPG), or a new shapefile. The methods to achieve each of these actions will be described in the query examples. A sample Access database, GIS geodatabase, and ArcMap project for Southeast Alaska are included on a data DVD for use with this manual.

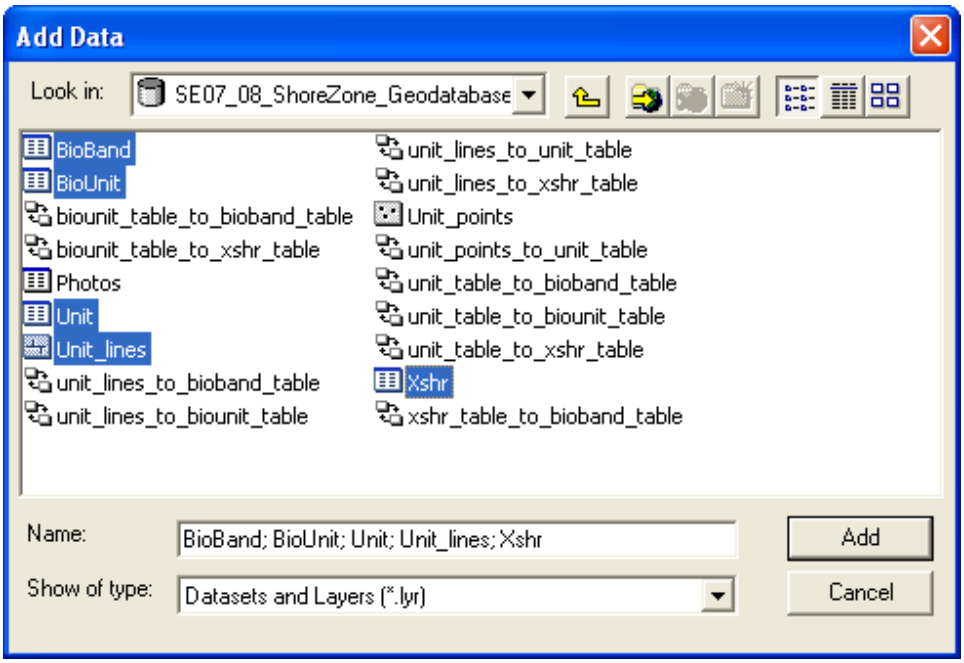
Note that FGDC-compliant metadata is included with the enclosed geodatabase. The metadata will define all tables and fields within tables, as well as briefly describe how the information was derived. Please refer to the ShoreZone Coastal Habitat Mapping Protocol (included on this Data DVD) for detailed information concerning methodology and definitions.

To access the most up-to-data ShoreZone info please visit:
http://alaskafisheries.noaa.gov/habitat/shorezone/szintro.htm

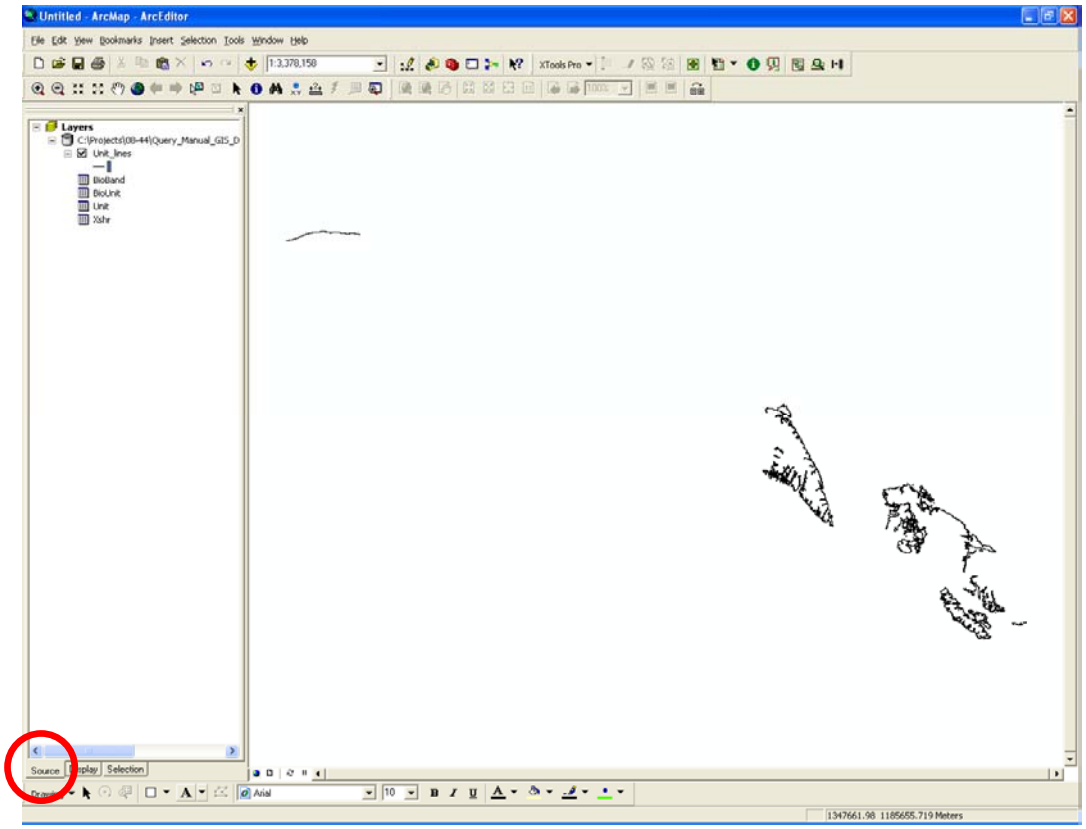
1. Determining the mapped distribution and shoreline length of the eelgrass (*Zostera)* bioband [ArcGIS Query]

This first example will utilize ShoreZone data for Southeast Alaska housed in ArcGIS. It will illustrate how to create a new project, add data and basemaps, change the appearance of layers, run a simple query, export a shapefile of query results, calculate lengths, and view metadata. Subsequent examples will build on the tools you learn in these steps.

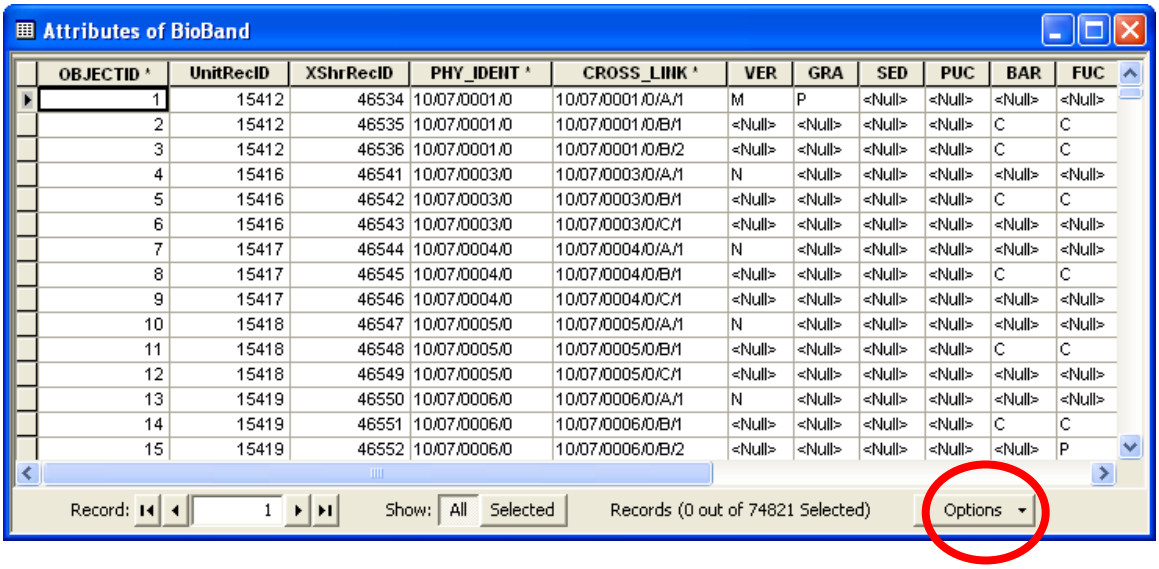
- Open a new blank project in ArcMap 9.x
- Click on the "File" menu and select "Add Data…"
- Navigate to the location of the ShoreZone Personal Geodatabase. In this case, it is on the included disk in the folder "Query_Manual_GIS_Data." Click once on the *.mdb file and select "Add."
- The "Add Data" window appears. Select the following data sets by holding down the CTRL key while clicking the file name with the mouse:
  - BioBand, BioUnit, Unit, and XShr data **tables**
  - Unit_lines **feature class**
- Click "Add"



- Ensure the “Source” tab is selected on the bottom left hand side (shown by the red circle below). The screen display should resemble this:

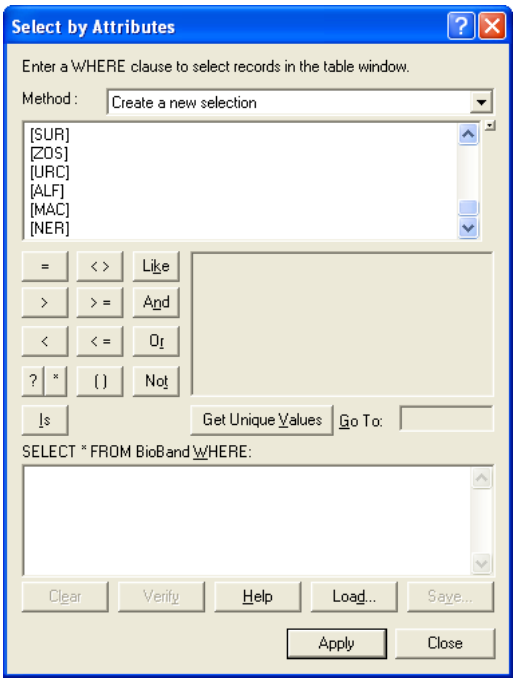


- Right click on the “BioBand” table and select “Open.” The “Attributes of BioBand” table will appear:



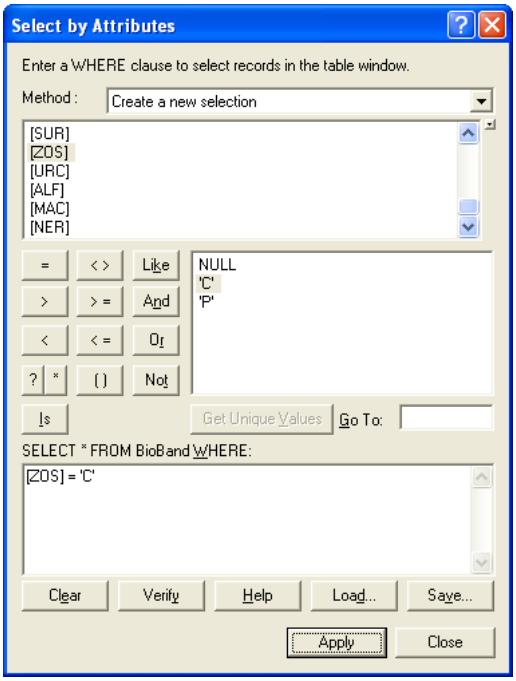
OBJECTID *	UnitRecID	XShrRecID	PHY_IDENT *	CROSS_LINK *	VER	GRA	SED	PUC	BAR	FUC
1	15412	46534	10/07/0001/0	10/07/0001/0/A/1	M	P	<Null>	<Null>	<Null>	<Null>
2	15412	46535	10/07/0001/0	10/07/0001/0/B/1	<Null>	<Null>	<Null>	<Null>	C	C
3	15412	46536	10/07/0001/0	10/07/0001/0/B/2	<Null>	<Null>	<Null>	<Null>	C	C
4	15416	46541	10/07/0003/0	10/07/0003/0/A/1	N	<Null>	<Null>	<Null>	<Null>	<Null>
5	15416	46542	10/07/0003/0	10/07/0003/0/B/1	<Null>	<Null>	<Null>	<Null>	C	C
6	15416	46543	10/07/0003/0	10/07/0003/0/C/1	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
7	15417	46544	10/07/0004/0	10/07/0004/0/A/1	N	<Null>	<Null>	<Null>	<Null>	<Null>
8	15417	46545	10/07/0004/0	10/07/0004/0/B/1	<Null>	<Null>	<Null>	<Null>	C	C
9	15417	46546	10/07/0004/0	10/07/0004/0/C/1	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
10	15418	46547	10/07/0005/0	10/07/0005/0/A/1	N	<Null>	<Null>	<Null>	<Null>	<Null>
11	15418	46548	10/07/0005/0	10/07/0005/0/B/1	<Null>	<Null>	<Null>	<Null>	C	C
12	15418	46549	10/07/0005/0	10/07/0005/0/C/1	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
13	15419	46550	10/07/0006/0	10/07/0006/0/A/1	N	<Null>	<Null>	<Null>	<Null>	<Null>
14	15419	46551	10/07/0006/0	10/07/0006/0/B/1	<Null>	<Null>	<Null>	<Null>	C	C
15	15419	46552	10/07/0006/0	10/07/0006/0/B/2	<Null>	<Null>	<Null>	<Null>	<Null>	P

- Click on the “Options” drop-down menu on the lower right of the table (circled in red above). Select “Select by Attributes…” and the following window will open:

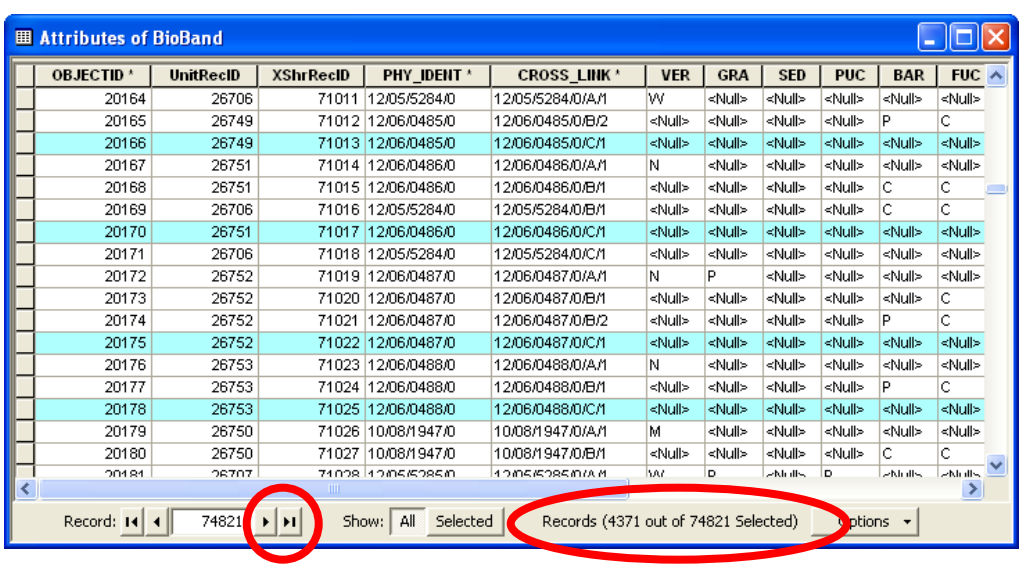


- Note that the “Method:” line at the top of the box defaults to “Create a new selection.” Leave that option selected for this example.
- Scroll down the list at the top of the table. The following steps will create query language in the SELECT FROM box:
  - Double click “ZOS” (the bioband that represents eelgrass)
  - Single-click “=”
  - Single-click the “Get Unique Values” button in the middle of the screen
- A list of values that occur in the ZOS field will appear in the box above that button. In this case, there should be three values that appear (NULL, C, and P). To find records that have <u>continuous</u> eelgrass (occurrence in >50% of the unit), double click on the “C”.
- Note that to find records with <u>patchy</u> eelgrass (occurrence in <50% of the unit), you would double click on the “P”. Continuous occurrence is used in this example.

- The query window should appear as this:

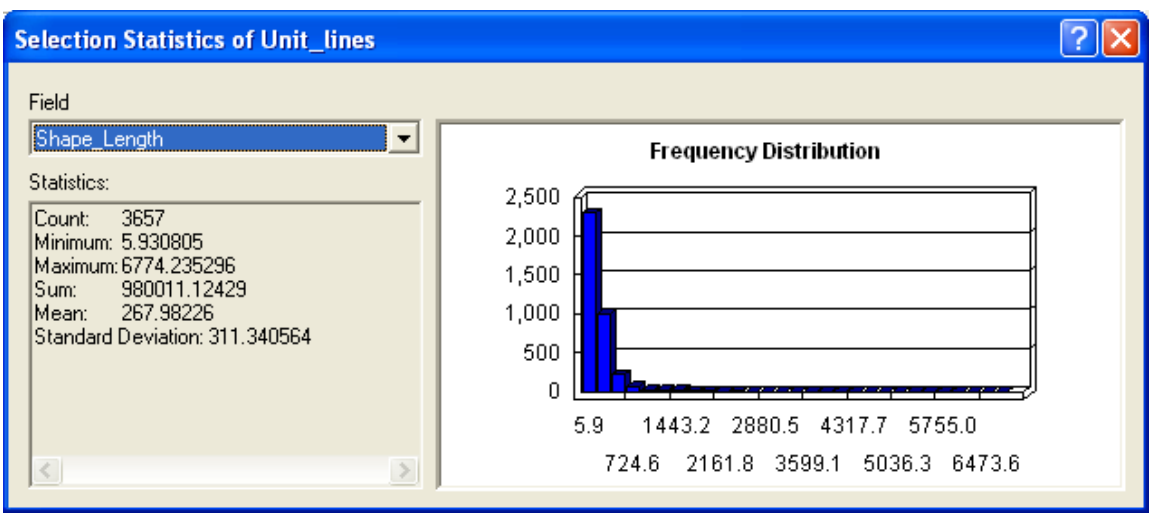


- Note that you may also expand the query to select records (units) that have either continuous or patchy eelgrass by typing **"ZOS" = 'C' or "ZOS" = 'P'** into the query box.
- Click "Apply" at the bottom of the window.
- Scroll down to see selected records highlighted in blue. The number of records selected by this query is shown at the bottom of the table. In this example, 4,371 out of 74,821 records have been selected. To see the total number of records in the table, click on the ">|" button (circled in red) at the bottom of the table.



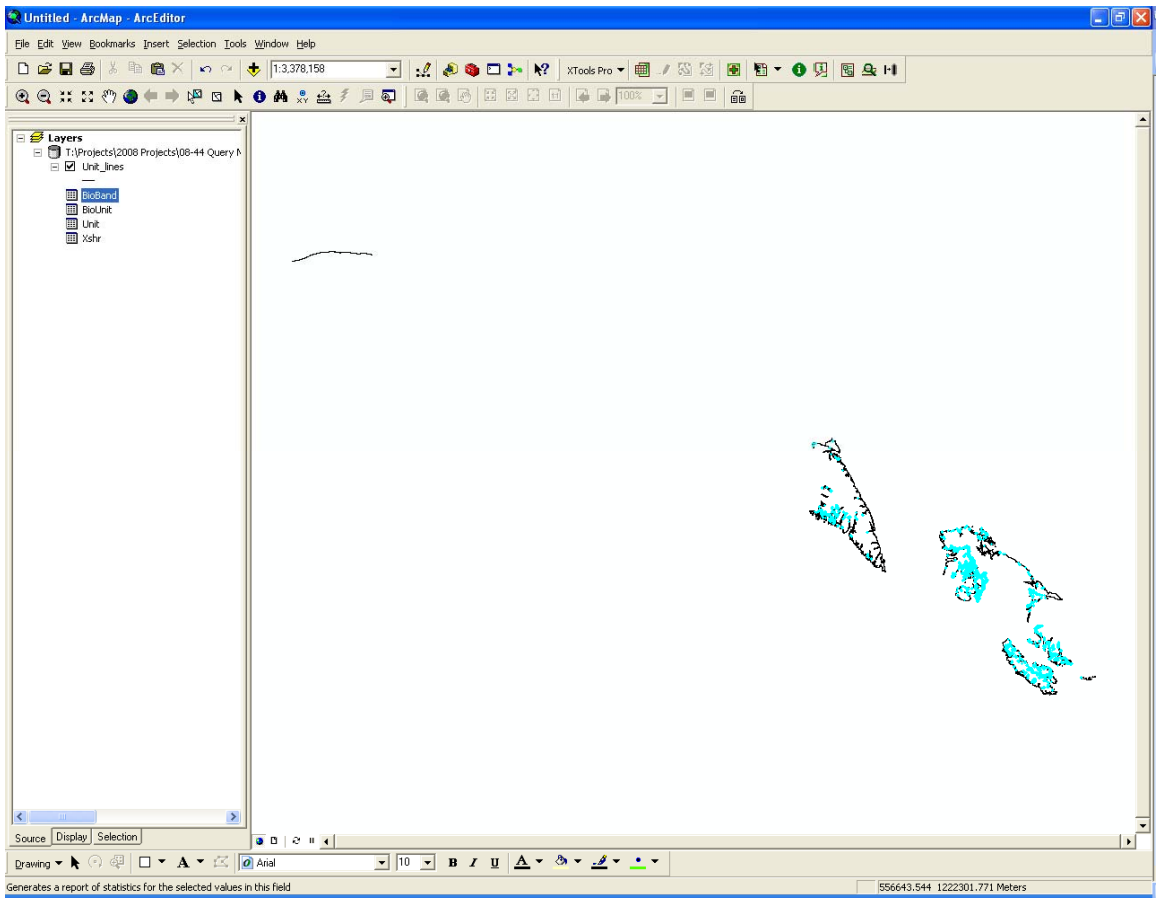
OBJECTID *	UnitRecID	XShrRecID	PHY_IDENT *	CROSS_LINK *	VER	GRA	SED	PUC	BAR	FUC
20164	26706	71011	12/05/5284/0	12/05/5284/0/A/1	W	<Null>	<Null>	<Null>	<Null>	<Null>
20165	26749	71012	12/06/0485/0	12/06/0485/0/B/2	<Null>	<Null>	<Null>	<Null>	P	C
20166	26749	71013	12/06/0485/0	12/06/0485/0/C/1	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
20167	26751	71014	12/06/0486/0	12/06/0486/0/A/1	N	<Null>	<Null>	<Null>	<Null>	<Null>
20168	26751	71015	12/06/0486/0	12/06/0486/0/B/1	<Null>	<Null>	<Null>	<Null>	C	C
20169	26706	71016	12/05/5284/0	12/05/5284/0/B/1	<Null>	<Null>	<Null>	<Null>	C	C
20170	26751	71017	12/06/0486/0	12/06/0486/0/C/1	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
20171	26706	71018	12/05/5284/0	12/05/5284/0/C/1	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
20172	26752	71019	12/06/0487/0	12/06/0487/0/A/1	N	P	<Null>	<Null>	<Null>	<Null>
20173	26752	71020	12/06/0487/0	12/06/0487/0/B/1	<Null>	<Null>	<Null>	<Null>	<Null>	C
20174	26752	71021	12/06/0487/0	12/06/0487/0/B/2	<Null>	<Null>	<Null>	<Null>	P	C
20175	26752	71022	12/06/0487/0	12/06/0487/0/C/1	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
20176	26753	71023	12/06/0488/0	12/06/0488/0/A/1	N	<Null>	<Null>	<Null>	<Null>	<Null>
20177	26753	71024	12/06/0488/0	12/06/0488/0/B/1	<Null>	<Null>	<Null>	<Null>	P	C
20178	26753	71025	12/06/0488/0	12/06/0488/0/C/1	<Null>	<Null>	<Null>	<Null>	<Null>	<Null>
20179	26750	71026	10/08/1947/0	10/08/1947/0/A/1	M	<Null>	<Null>	<Null>	<Null>	<Null>
20180	26750	71027	10/08/1947/0	10/08/1947/0/B/1	<Null>	<Null>	<Null>	<Null>	C	C
20181	26707	71028	12/05/5285/0	12/05/5285/0/A/1	W	P	<Null>	P	<Null>	<Null>

- To **calculate lengths or to view these records on the map**, we must "relate" the BioBand attribute table to the unit_lines feature class that contains the spatial information. The necessary relationships are already constructed within ShoreZone geodatabases. Follow these steps:
- Click on the "Options" drop-down menu at the bottom of the table and scroll up to "Related Tables". A box will appear that lists the data tables related to the BioBand table. Select the relationship called "**unit_lines_to_bioband_table**."
- The "unit_lines" attribute table will open up with the records that have continuous eelgrass already selected. Scroll down to see them highlighted in blue. In this example, 3,657 records out of 21,186 have been selected. Record the first number for use during a later step.
- Note that usually the number of selected records in the unit_lines feature class will be less than the selected records in the BioBand table. This is because a one-to-many relationship exists between them, in which each along-shore unit_lines (digitized shore segment) will have multiple across-shore "zones" associated with it (e.g. supratidal "A" zones, intertidal "B" zones or subtidal "C" zones).
- To calculate the **alongshore length** of the selected units, right-click on the Shape_Length column header and select "Statistics." The following box appears, showing the sum of the length of the selected features, along with other statistics:



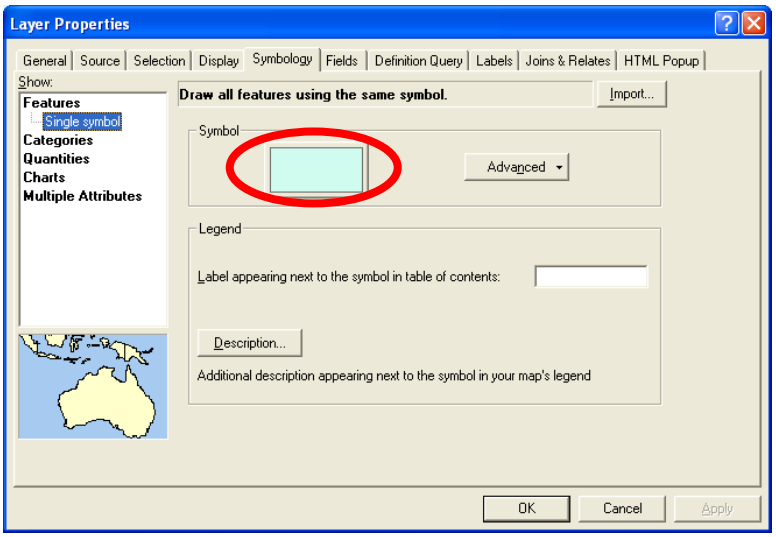
- The "Sum" is in meters. In this example, continuous eelgrass is mapped along 980.0 km of shoreline. Record this length for use during a later step.
- Note that when records are selected within a table (highlighted in blue), statistics are calculated for those **selected units only**. A subsequent step will illustrate how to calculate shoreline lengths for the entire table.

- Close or minimize the open windows and tables to view the spatial map with along-shore units having continuous eelgrass that have been highlighted by your query. Use the “Zoom” and “Pan” tools to investigate areas of interest. In the figure below, note that only mapped ShoreZone segments for the Southeast Alaska 2007 (and a small portion of the 2008) dataset is visible. A shoreline basemap is not shown.

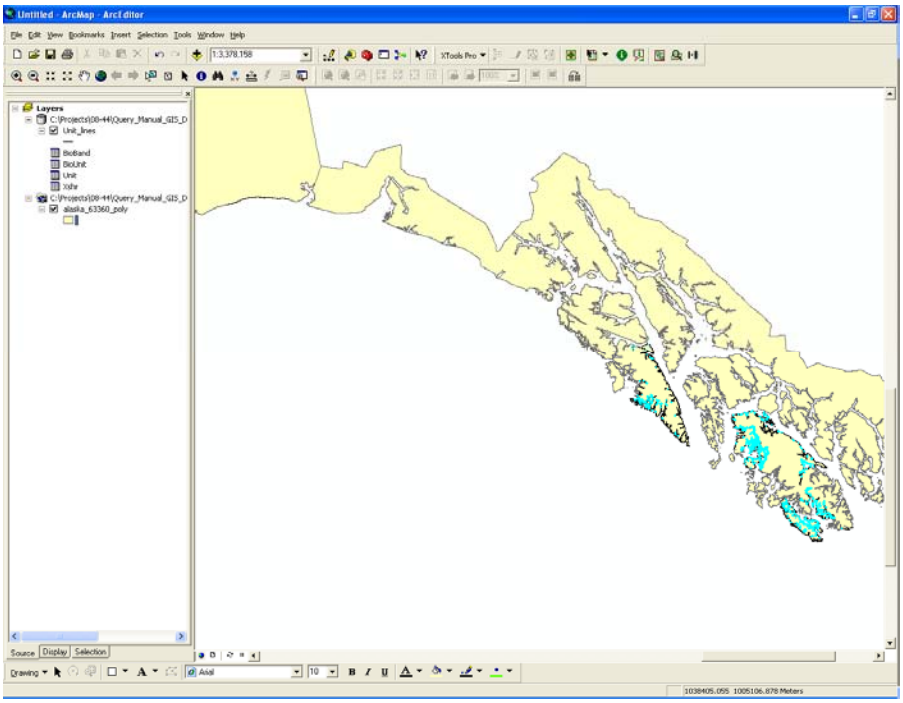


- To add a **shoreline basemap** as a layer in the view, select File>Add Data and navigate to the “alaska_63360_poly.shp” shapefile.
- Note that the Alaska polygon shapefile is added to the layer pane along the left side of the window, with the view box checked. The next step will show you how to change the appearance of this basemap.

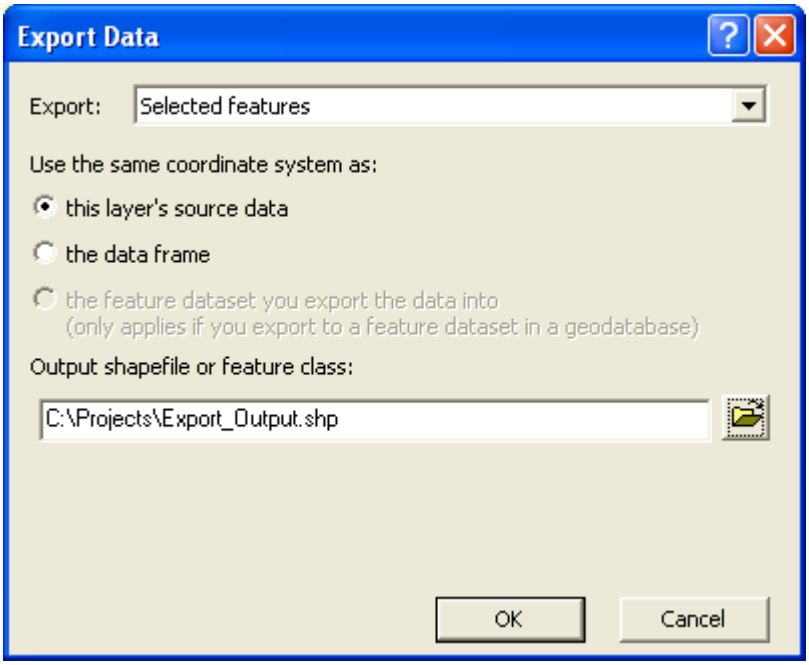
- To change the appearance of the basemap, double-click on the layer name to open the properties window (or right click on the layer name and select "Properties…" from the pop-up menu). Click on the "Symbology" tab. The following window appears:



- Double click on the colored box below "Symbol" to select fill and outline colors. Use the "Fill Color:" drop-down box to select a color to represent the land. Also set the outline width and color to represent the shoreline. Click "OK."
- In the example below, the fill color has been set to "Yucca Yellow," and the outline has been set to "Gray 50%" with a width of 0.40. Use the zoom tools to zoom in and out if you like.

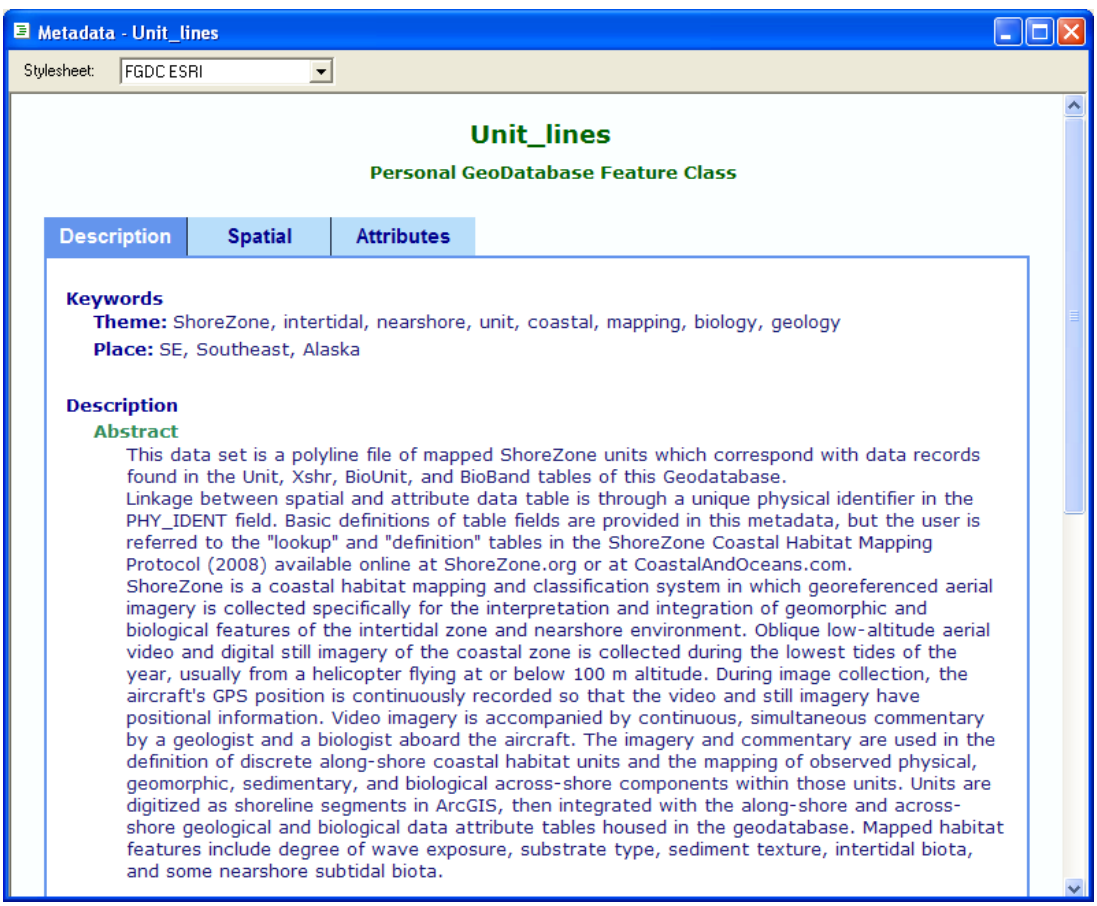


- To **create a shapefile** of the continuous eelgrass selection, right-click on the "unit_lines" layer, scroll to "Data" and select "Export Data..." The following window appears:



- Note that the "Export:" line at the top of the box defaults to "Selection features." Leave that option selected for this example.
- The "Use the same coordinate system as:" option defaults to "this layer's source data." Leave that option selected.
- In the "Output shapefile to feature class:" drop down menu, click on the browse button (folder icon just to the right of the filename box). Browse to the folder in which you want to save the shapefile. Name the shapefile appropriately (such as "se2007_08_continuous_eelgrass.shp").
- Leave the "Save as type:" drop down menu to its default setting of "Shapefile" and click "OK" twice.
- You will now be asked "Do you want to add the exported data to the map as a layer?" Click yes to add it.
- Right click on the new shapefile and select "Open Attribute Table." These are the attributes taken from the unit_lines shapefile for only the records you selected in your query. At the bottom of the table you will be able to see how many records have been exported to this new shapefile. Compare this number to the number you recorded after your selection query (3,657). If they match, the query and export steps were done correctly.
- Right click on the Shape_Length column header and select "**Statistics**." As long as no records are selected in the attribute table, the statistics returned will be for the entire attribute table. Compare the sum of the lengths to the number you recorded after your query to confirm they are the same (980.0 km).

- Note that the unit_lines feature class represents the digitized shoreline segments that have been “mapped” according to the ShoreZone Protocol. Click once on the unit_lines feature class to highlight it. Use the “Clear selected features” icon on the toolbar (or right click on unit_lines, scroll down to “Selection” and select “Clear selected features”). The highlighted blue segments will disappear from the map.
- To **calculate the total length** of all mapped data, right click on the unit_lines layer, open the attribute table, right click on the “Shape_Length” column header, and select “Statistics.” Because no records are selected, the statistics returned represent all the data that has been mapped in Southeast during the 2007 (and a small portion of 2008) project. In this case, the shoreline mapped is 6234.5 km. Close the tables.
- To **view the metadata** for the unit_lines feature class, right-click on the “unit_lines” layer, scroll to “Data” and select “View Metadata.” The following window appears with information concerning the feature class. The “Spatial” tab provides the coordinate system and projection information. The “Attributes” tab defines the fields (columns) within the attribute table.



- This example is saved in the “Answers” folder as an ArcGIS project (Query_Manual_Example_1.mxd), along with the continuous eelgrass shapefile (named “se2007_08_continuous_eelgrass.shp”). Compare these results to yours.

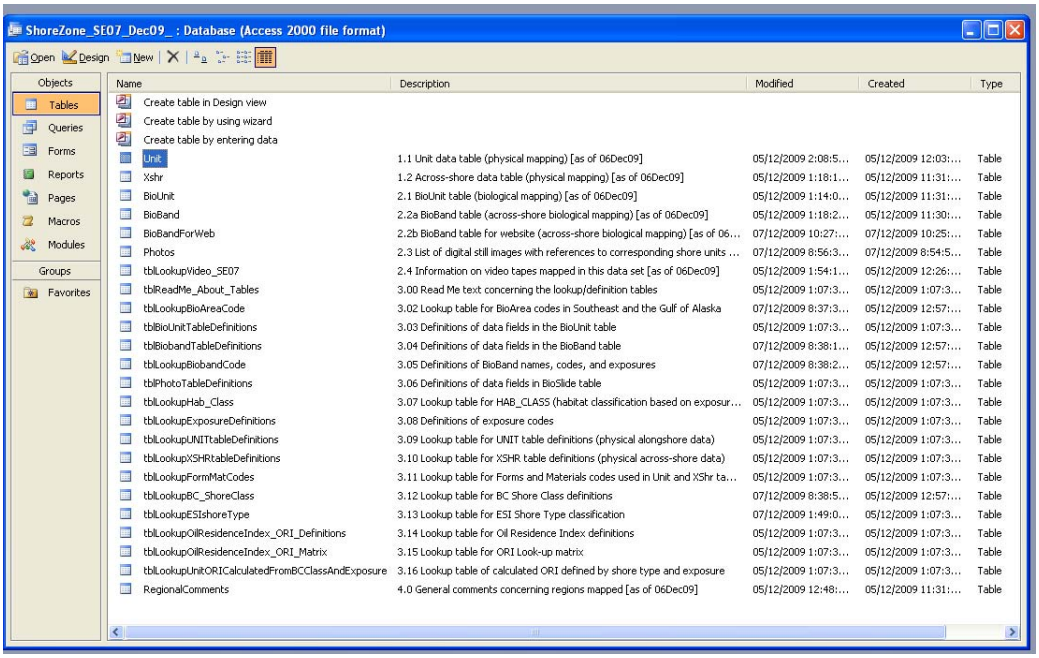
2. Length summary of mapped shoreline types on the basis of BC Class [Microsoft Access Query]

While ArcGIS geodatabases enable both spatial and quantitative analysis of ShoreZone data, it is also possible to perform simple, non-spatial queries of Microsoft Access databases to generate statistics for particular attributes of interest. Access databases house individual, regional projects such as the mapping of imagery collected in Southeast Alaska in 2007. The Access database for this region is included with this query manual.

This example will illustrate how to query the Access database for a summary of shoreline lengths by shore type (BC Class), and how to obtain a list of digital still photos that represent a particular class. See Table A-2 in the ShoreZone Protocol for the definitions of these 35 shore types.

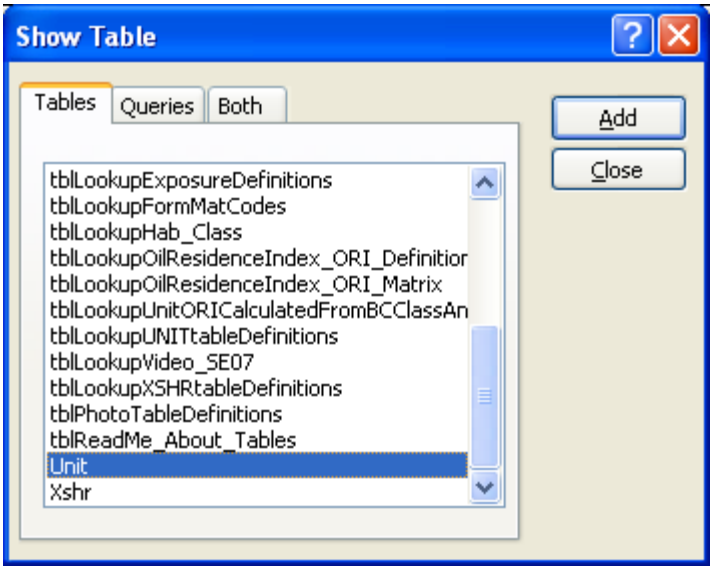
- Open the Microsoft Access database named: ShoreZone_SE07_Dec09.mdb inside the “Query_Manual_MS_Access_Data” folder.

- A list of “Tables” housed within the database appears:



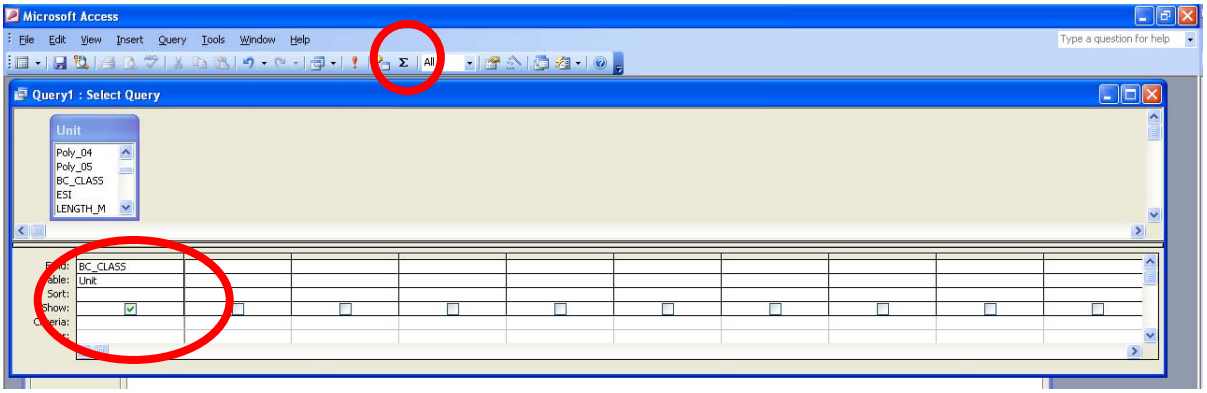
- Note that there are data tables and basic definition tables. Please refer to the **ShoreZone Coastal Habitat Mapping Protocol for the Gulf of Alaska 2008** for details regarding the tables and the fields within them. A PDF of this protocol is included on the Data DVD provided with this query manual.

- Click on the “Queries” option on the left sidebar. Double-click “**Create query in design view**.” A “Show Table” box will appear. Select the “Unit” table. The window should appear as this:

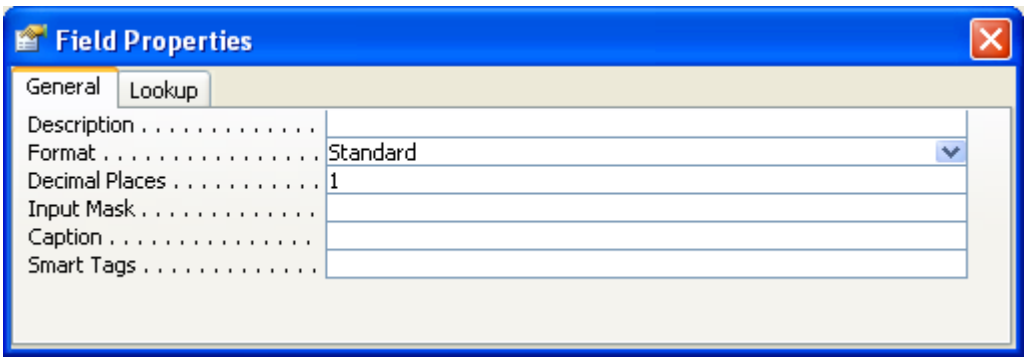


- Click “Add” and “Close.”
- The “Query1: Select Query” box will appear.

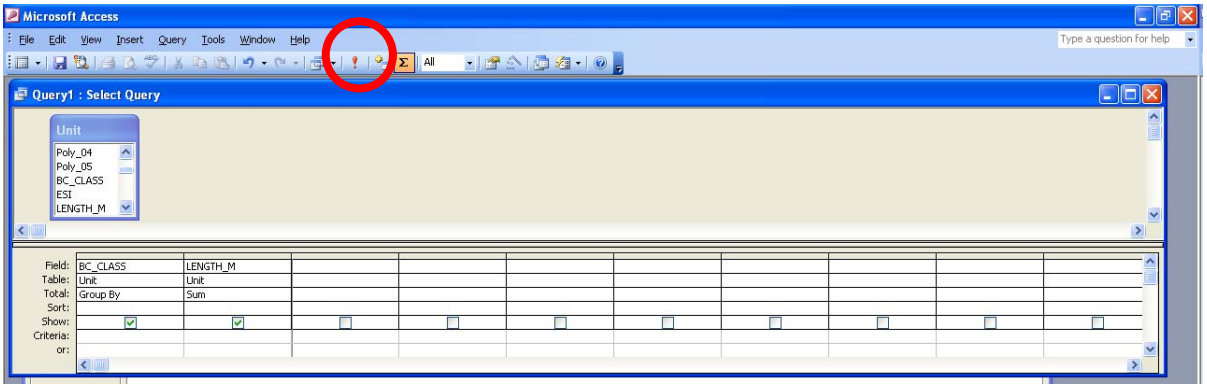
- In the “Query1: Select Query” box, click once on the “Unit” table and scroll down to “BC_CLASS.” Click and hold “BC_CLASS” and drag it into the first column of the query grid.



- In the query grid, the "**Field:**" row should read "BC_CLASS" and the "**Table:**" row should read "Unit" as shown in the red oval on the previous page.
- Click and hold "LENGTH_M" in the Unit table and drag it into the second column of the query grid.
- Once "LENGTH_M" is in the second column, right click on it and choose "Properties". The "**Field Properties**" window will open. To make the results easier to read use the drop-down menus to set the Format to "**Standard**" and the Decimal Places to "**1**".



- Close the Field Properties window and click the "Totals" button (**Σ** icon shown by the small red circle on the previous page). This adds a "**Total**: Group By" row to the query grid.
- Click in the "Group By" box under the LENGTH_M column to make it active. A downward arrow appears, indicating a drop-down menu is available. Click on the arrow and select "**Sum**" from the drop-down menu. The query window should appear as this:



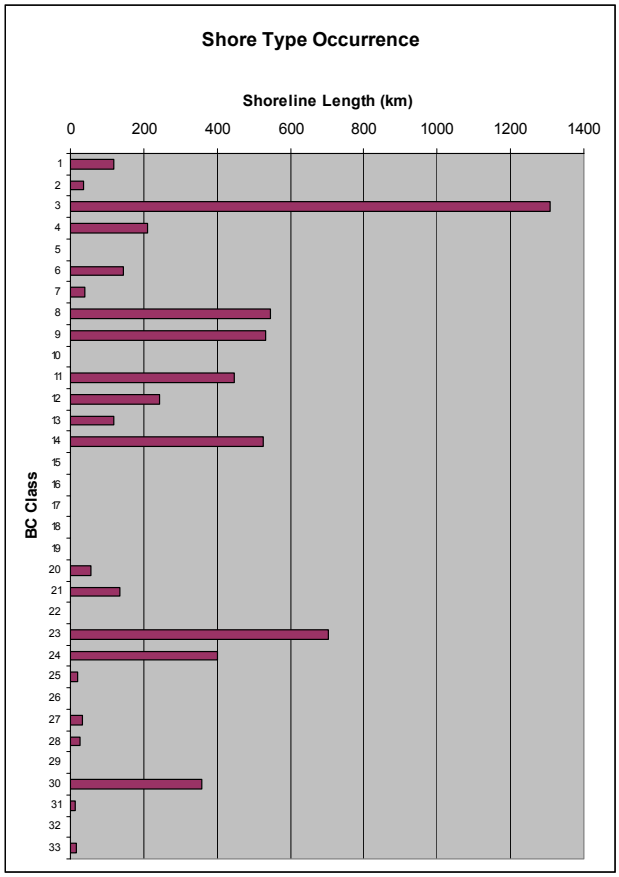
- Run the query by clicking on the "**Run**" icon in the tool bar (exclamation point shown by the red circle above).

- The result is a window that lists the BC Class from 1 to 35 (BC 20 and 35 are missing since they were not mapped in this dataset) and the sum of the shoreline length (in meters) for each of those classes.

Microsoft Access - [Query1 : Select

File Edit View Insert Format R

BC_CLASS	SumOfLENGTH_M
1	119,680.5
2	36,705.3
3	1,307,877.8
4	211,106.5
5	3,274.7
6	145,501.3
7	37,966.4
8	544,919.6
9	531,604.0
10	1,262.3
11	446,635.2
12	243,217.4
13	119,289.0
14	525,441.6
15	3,900.3
16	1,260.0
17	2,527.8
18	849.9
19	252.4
21	55,139.6
22	134,585.7
23	767.6
24	703,227.0
25	400,620.9
26	21,145.2
27	1,227.0
28	31,544.4
29	27,844.9
30	1,071.3
31	356,621.9
32	11,610.6
33	169.1
34	17,786.9



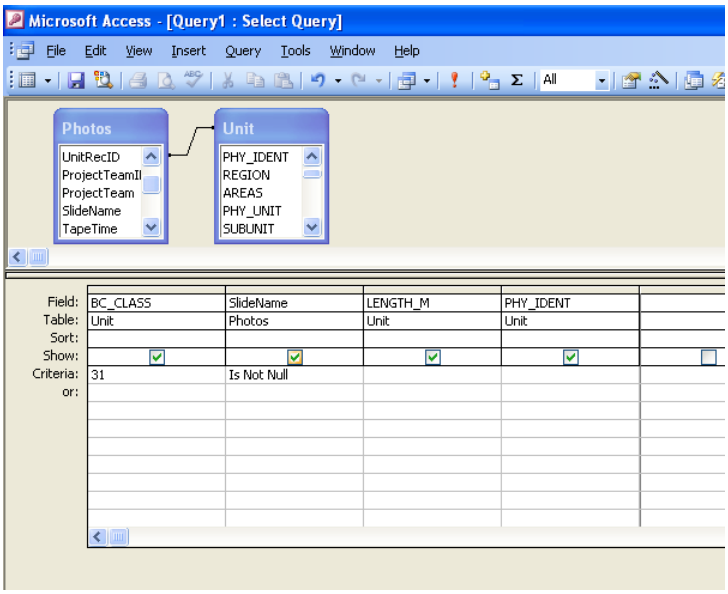
Graphic display of the same data using Excel

- Right click on the top of the window and select “Query Design” to return to the query grid. To save the query, choose File > Save as from the menu bar.
- In the “Answers” folder, you will find a query named “query_BC_Class_Length” to which you can compare your final query to check that you have done this correctly. To bring this query into your active database and compare them, select File>Get external data>Import and navigate to the database in the “Answers” folder. Click once on the file “ShoreZone_SE07_Dec09.mdb” and select “Import.”
- An “Import Objects” window will appear. Under the “Queries” tab, select the “query_BC_Class_Length” query and click “OK.” Use the design view to compare the two queries.
- Note: This data table could now be brought into Excel (example at right) and displayed using a Histogram which is a useful way to visualize the data.

3. Finding a digital still image that meets several criteria (BC Class, Shore Name, BioBand) [Microsoft Access Query]

This example will enable you to find the name and location of a digital still photo that meets criteria you specify in a query. It will build on what you learned in Microsoft Access from Example 2.

- Close the previous query, create a new blank one in design view, and add the Photos and Unit table.
- Drag “BC_CLASS” from the Unit table down into the first column of the query grid.
- Drag “SlideName” from the Photos table down to the second column of the query grid.
- Drag “LENGTH_M” from the Unit table down to the third column of the query grid.
- Drag “PHY_IDENT” from the Unit table down to the fourth column of the query grid.
- Click in the ”Criteria” box under the BC_CLASS heading, type “31” and press the tab key. Note that you do not need the quotation marks around 31. Including quotes will cause a “Data type mismatch” error.
- In the “Criteria:” box under the “SlideName” column, type “Is Not Null” and press the tab key. The “Query1: Select Query” window should appear as this:

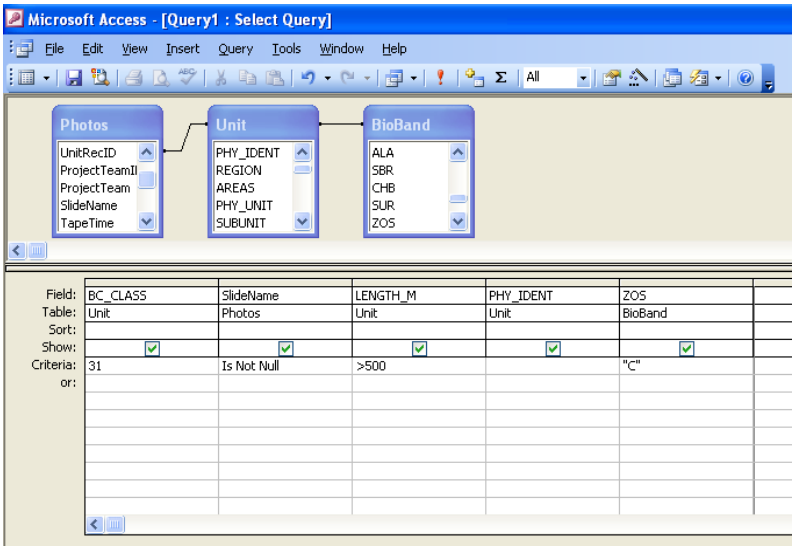


- Run the query by pressing the exclamation point icon on the menu bar. The result is a list of all the digital still photos that correspond to a shore unit mapped as a BC Class 31 (organic shorelines and estuaries). Note that there are **2,221 images** that meet these criteria!
- To become more selective in your search for a representative photo, right click on the top of the window and select "Design View" to return to the query grid. In the criteria box under LENGTH_M, type:

  >500

  and press the tab key.

- When you run this query, it will return just those units mapped as BC Class 31 that are over 500 meters in length. This query returns **1,718 records**.
- Out of these 1,718 photos, we want to find one of a unit that *also* has continuous eelgrass mapped in it (the ZOS band). Right click on the top of the window and select "Query Design" to return to the query grid.
- Click on the "Query" menu at top and select "Show Table…" and the "Show Table" window will open, select the BioBand table. Click "Add" and then "Close".
- From the BioBand table, click and drag the "ZOS" field down to the fifth column of the query grid. In the "Criteria:" box beneath ZOS, type "C" and press the tab key.
- The query box should resemble this:

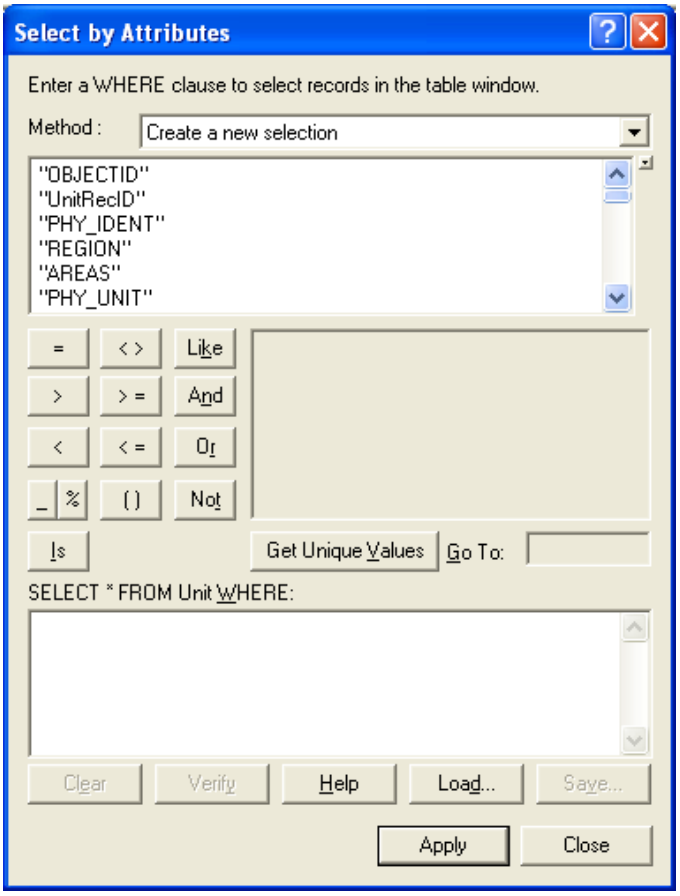


- Run the query. The result should be 421 records of *.jpg images that are mapped as BC Class 31, are over 500 meters in length and have continuous ("C") eelgrass mapped in them.
- The PHY_IDENT field enables you to identify the location of an image in ArcGIS.
- This query is saved as "query_Photo_Class31_>500meters_Eelgrass" in the "Answers" database. Compare the query to yours.

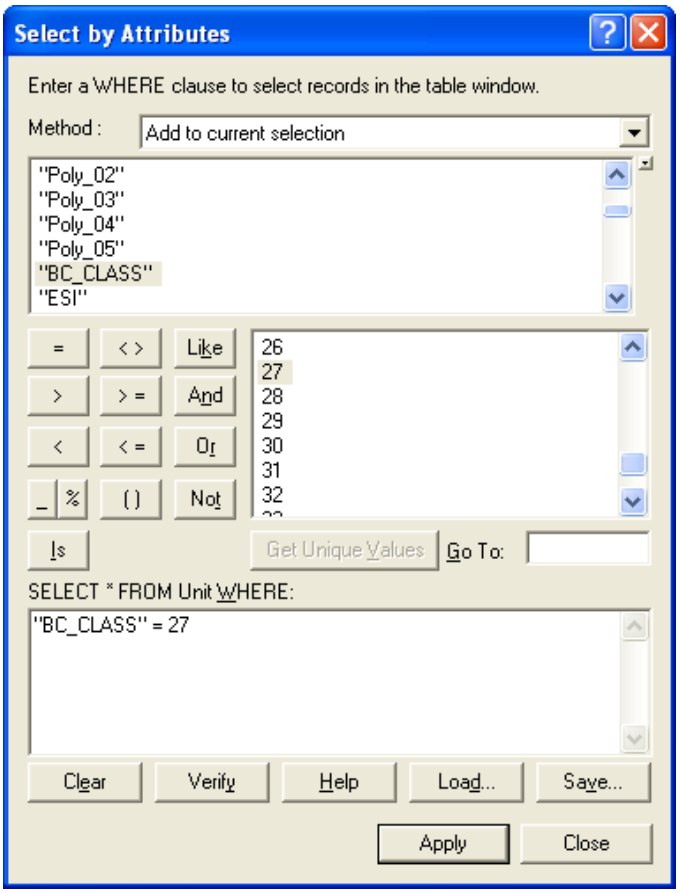
4. Determining the mapped distribution of several shore types (BC Classes) [ArcGIS Query]

This example will use ArcGIS to illustrate how to add to perform a series of nested queries that *add to*, *select from*, or *remove from* the current selection. This example involves selecting all wide sediment-dominated flats by querying for BC Class 24, 27, 28 and 29. It then illustrates how to remove certain records from the selection.

- Open your ArcGIS project file from Example 1 (or the "Query_Manual_Example_1.mxd" file provided in the "Answers" folder).
- Click on the "Source" tab on the lower left to display the tables within the file geodatabase.
- Right click on the "Unit" table and select "Open." The "Attributes of Unit" table will appear.
- Click on the "Options" drop-down menu on the lower right of the table and choose "Select by Attributes." The following window will open:

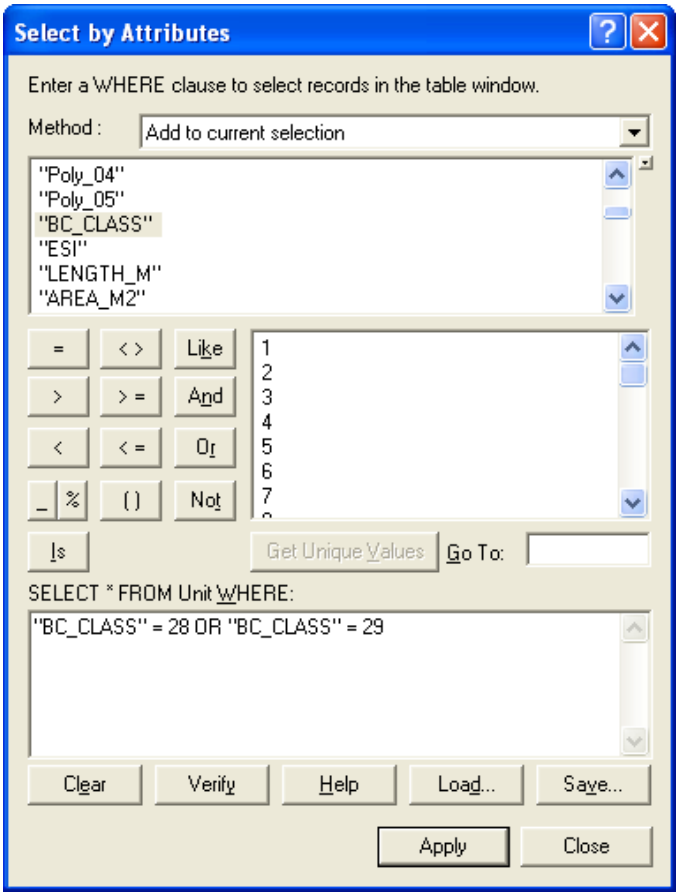


- The “Method:” line at the top of the “Select by Attributes” box defaults to “Create a new selection.” Leave that option selected for this step.
- The following steps will create query language in the SELECT FROM box:
  - Scroll down the list at the top of the table to see all the fields.
  - Double click “BC_CLASS”
  - Single-click “=”
  - Single-click the “Get Unique Values” button in the middle of the screen
- A list of values that occur in the BC_CLASS field will appear in the box above that button. In this case, there should be numbers from 1 to 35 (Refer to table A-2 in the ShoreZone Coastal Habitat Mapping Protocol for the Gulf of Alaska 2008). Double click on “24.”
- Click “Apply” at the bottom of the window.
- Scroll down to see selected records highlighted in blue. The number of records selected by this query is shown at the bottom of the table. These are units that have been mapped as BC Class 24, or wide sand and gravel flats (3,975 units out of 24,682 are selected).
- To **view these records on the map**, we must “relate” the Unit attribute table to the unit_lines feature class that contains the spatial information. The necessary relationships are already constructed within ShoreZone geodatabases. Follow these steps:
- Click on the “Options” drop-down menu at the bottom of the table and scroll up to “Related Tables”. A box will appear that lists the data tables related to the Unit table. Select the relationship called “**unit_lines_to_unit_table**.”
- The “unit_lines” attribute table will open, with the records that have been mapped as BC Class 24 already selected (2,292 out of 21,186).
- Note that the number of selected records in the unit_lines feature class will usually be less than the selected records in the Unit table. This is because the query performed on the Unit table also selected variants (point features such as streams) that were mapped as BC Class 24. (Point features have no length.)
- If you minimize the attribute table you will be able to see the selected shoreline. Use the zoom tools to zoom in and out of areas of interest.
- Right click on the “Unit” table and open the “Attributes of Unit” table again. It should still have the 3,975 records that we queried for BC Class 24 selected.
- We would also like to add BC Class 27 (wide sand beaches) to this selection. Click on the “Options” drop-down menu on the lower right of the table. Choose “Select by Attributes…” again.
- This time click on the drop down list beside the “Method:” line at the top of the window and select “**Add to current selection**.”
- This time we want to enter:
  "BC_CLASS" = 27



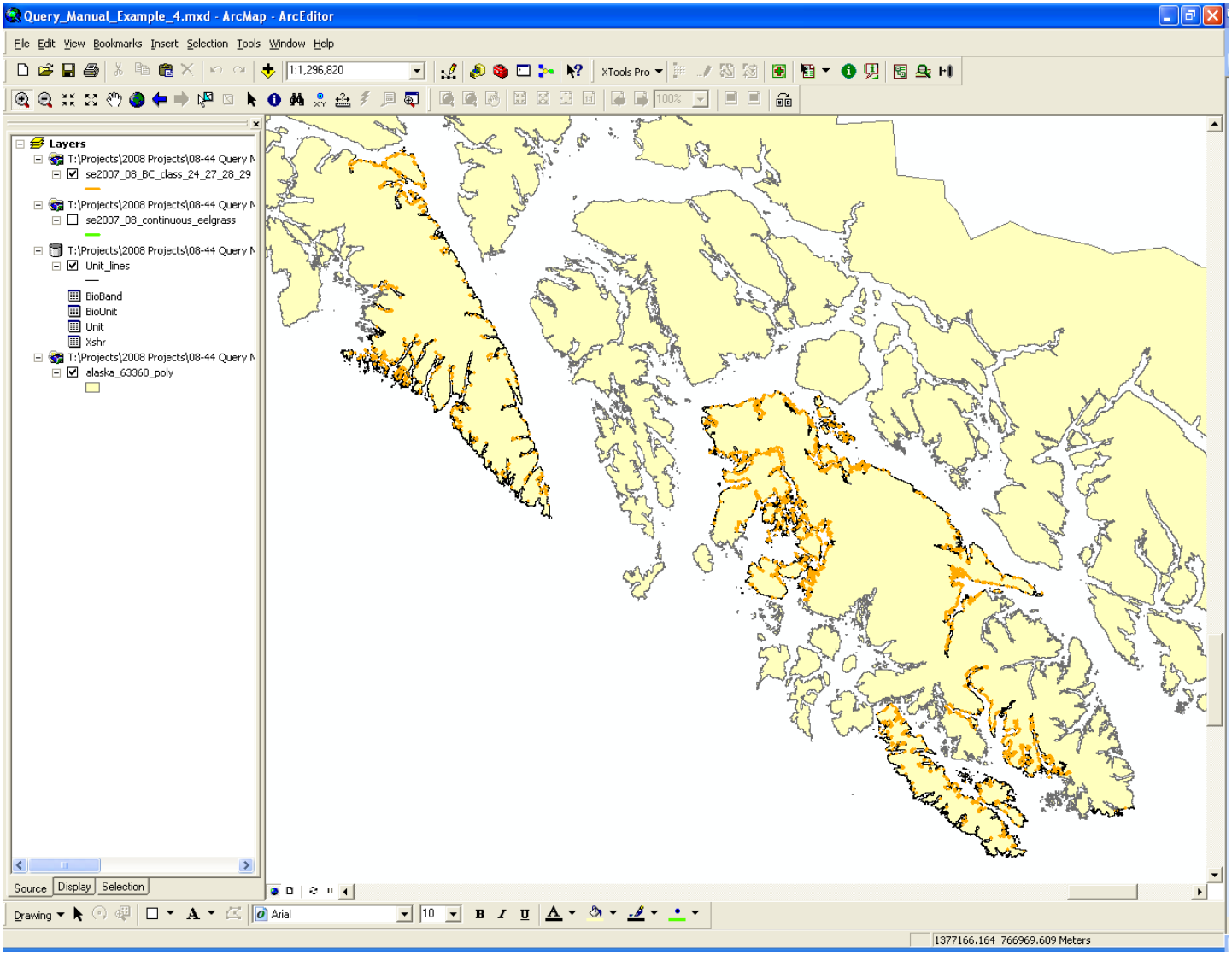
- Click “Apply” at the bottom of the window.
- The “Attributes of Unit” table now shows all units that are classified as BC Class 24 or 27 (4,023 out of 24,682).
- To **view these records on the map**, choose Options>Related Tables> “**unit_lines_to_unit_table**” as you did above. Minimize the windows to see the selections on the map.
- We also wish to add wide sand flats and wide mud flats to this selection (BC Classes 28 and 29). Open the Unit attribute table and click on the “Options” drop-down menu on the lower right of the table. Choose “Select by Attributes…” to see the “Select by Attribute” window.
- Ensure the drop-down list beside the “Method:” line at the top of the window shows “Add to current selection.”

- Click on the “Clear” button to clear the text in the SELECT box in order to write a fresh query. Then do the following:
  - Double-click “BC_CLASS”
  - Single-click “=”
  - Type “28” (without the quotation marks)
  - Single-click “Or”
  - Double-click “BC_CLASS”
  - Single-click “=”
  - Type “29” (without the quotation marks)
- This example illustrates that you can use the “Get Unique Values” button just or simply type your selection in the box. Your query window should resemble this:



- Click “Apply” at the bottom of the window.
- The “Attributes of “Unit” table appears, with the units mapped as BC Class 24, 27, 28, or 29 selected (4,190 out of 24,682).
- Relate the **Unit table** to the **unit_lines feature class** to view the spatial locations of these units. The unit_lines table should show *fewer* units selected (2,375 units out of 21,186). Recall that this is because “point features” are contained in the Unit table but not in the unit_lines feature class.

- To test that this is the reason for the difference, we will *remove* the point features from the Unit table selection and see if it then matches the unit_lines selection. Minimize the unit_lines attribute table.
- At the bottom of the “Attributes of Unit” table, click “Options,” choose “Select by attributes.” Change the “Method:” line at the top of the table to read “**Remove from current selection**.”
- Highlight and clear the query script in the SELECT window and do the following:
  - Double-click “TYPE”
  - Single-click ”=”
  - Single-click “Get Unique Values” (note that the choices are ‘L’ and ‘P’)
  - Double-click ‘P’
  - Click “Apply”
- The “Attributes of Unit” table now shows only the “Line” features, not the “Point” features (2,375 out of 24,682 are selected).
- Maximize the unit_lines attribute table again, and note that there are 2,375 records selected.
- Right-click on the Shape_Length field of the unit_lines table and choose “Statistics.” The sum of the lengths of these wide sediment flats is 840.2 km.
- This example is saved in the “Answers” folder as an ArcGIS project (Query_Manual_Example_4.mxd), along with the sediment flats shapefile (named “se2007_08_BC_class_24_27_28_29.shp”). Compare these results to yours.
- Try running a query on the Unit table to “*select from current selection*” only those records that have a SHORENAME like ‘Edna*’ Hint: You should end up with the following script in the query box (noting the use of single quotes and the star sign to indicate a wild card):
  "SHORENAME" LIKE 'Edna*'
- The query should show 16 records out of 24,682 selected and when viewed should highlight shore units in Edna Bay on Kosciusko Island.



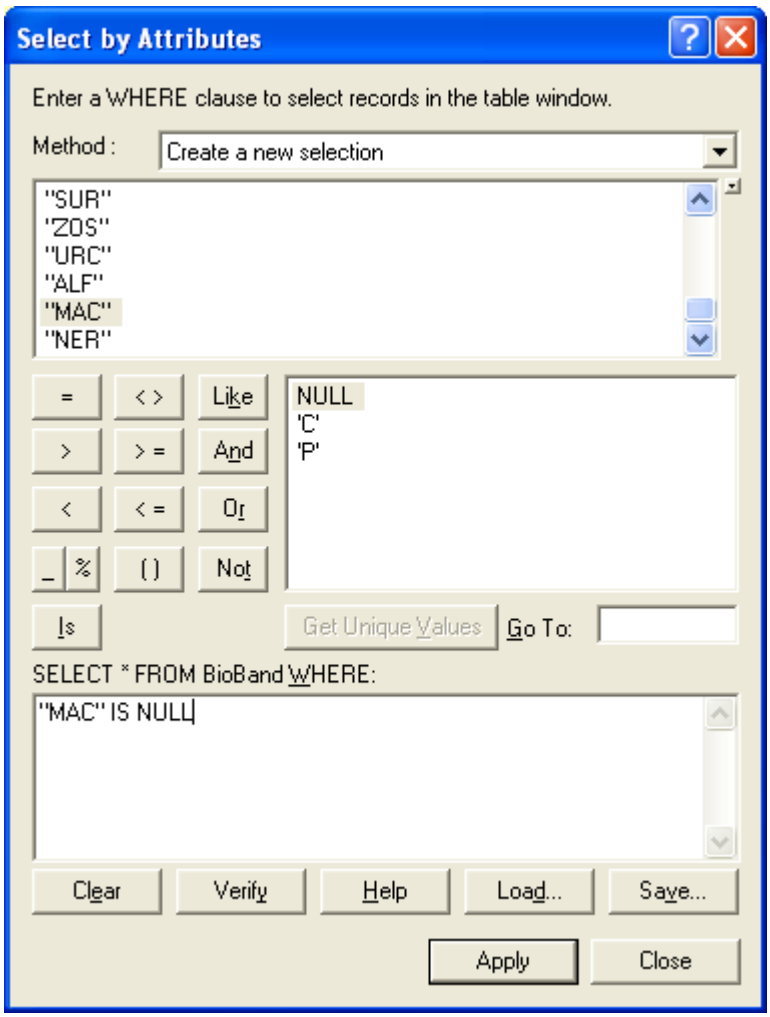
Map showing locations of “wide sediment-dominated flats” (BC Class 24, 27, 28 and 29).

5. Determining the mapped distribution and shoreline length of the canopy kelps *Macrocystis* (giant kelp), *Nereocystis* (bull kelp), and *Alaria fistulosa* (dragon kelp) (MAC, NER, and ALF biobands) [ArcGIS Query]

This example will use ArcGIS to illustrate how to select continuous and patchy mapped *Macrocystis*, *Nereocystis*, and *Alaria fistulosa.* Most BioBands are mapped as either null, continuous or patchy (NULL, C, and P). This example will explore using all these values in the query language to get the results.

- Open your ArcGIS project file from Example 4 (or the "Query_Manual_Example_4.mxd" file provided in the "Answers" folder).
- Click on the "Source" tab on the lower left to display the tables within the file geodatabase.
- Right click on the "BioBand" table and select "Open." The "Attributes of BioBand" table will appear.
- All BioBands (with the exception of VER) are mapped as either null, continuous or patchy (NULL, C, and P). Biobands can be queried by either looking for continuous and patchy occurrences or by utilizing the null values in the query; we will do both in this example.
- Click on the "Options" drop-down menu on the lower right of the table and choose "Select by Attributes." The query window will open with the "Method" line defaulting to "Create a new selection". Leave that option selected for this example.
- The following steps will create query language in the SELECT FROM box:
  - Scroll down the list at the top of the table to see all the fields.
  - Double click "MAC"
  - Single-click "IS"
  - Single-click the "Get Unique Values" button in the middle of the screen
- A list of values that occur in the MAC field will appear in the box above that button. In this case, there will be the values "NULL", 'C' and 'P'.

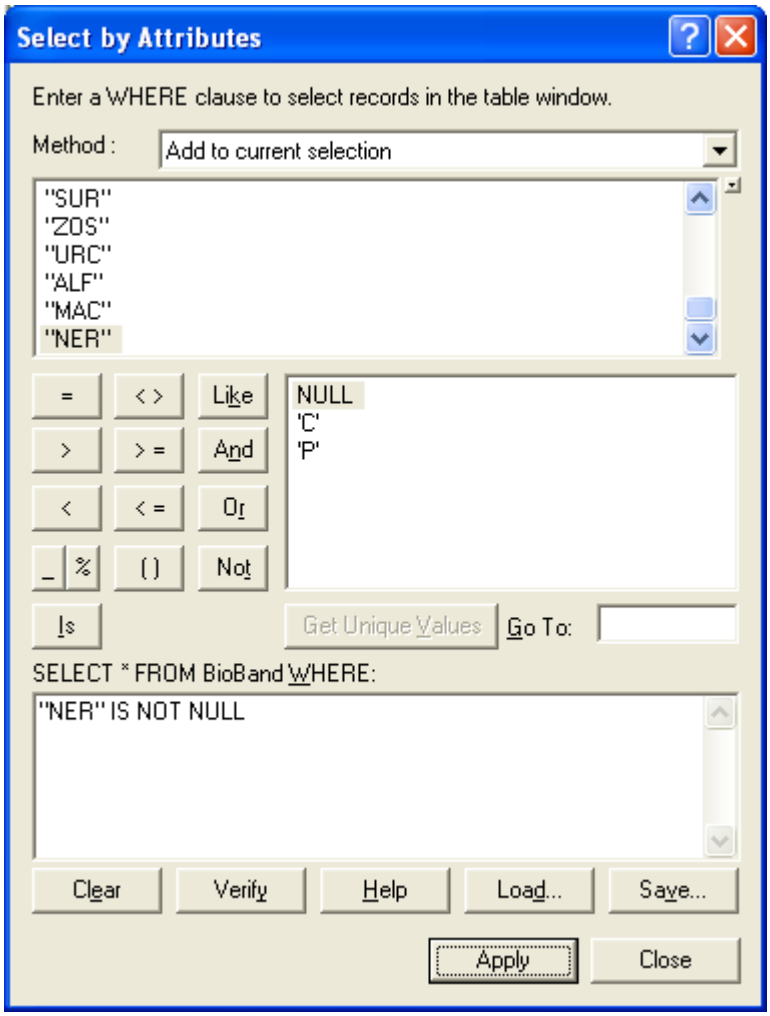
- Double click “NULL” , your query should look like this:



- Click “Apply” at the bottom of the window.
- All records that **do not** have MAC mapped have been selected. There should be 70,358 out of 74,821 selected.
- Close the “Select by attribute” window and click on the “Options” tab at the bottom of the Bioband table. Scroll up and select “Switch Selection”. This will switch the selection and choose all the records that were not chosen before so that now all records with continuous (“C”) or patchy (“P”) MAC will now be selected. There should be 4,463 out of 74,821 records selected.
- We now have all records with continuous or patchy MAC selected but we also wish to add records that have continuous or patchy NER mapped.
- Click on the “Options” drop-down menu on the lower right of the table and choose “Select by Attributes. The query window will open with the previous query still in the “Select *FROM BioBand Where:” box. Click on the “Clear” tab to get rid of this previous query.

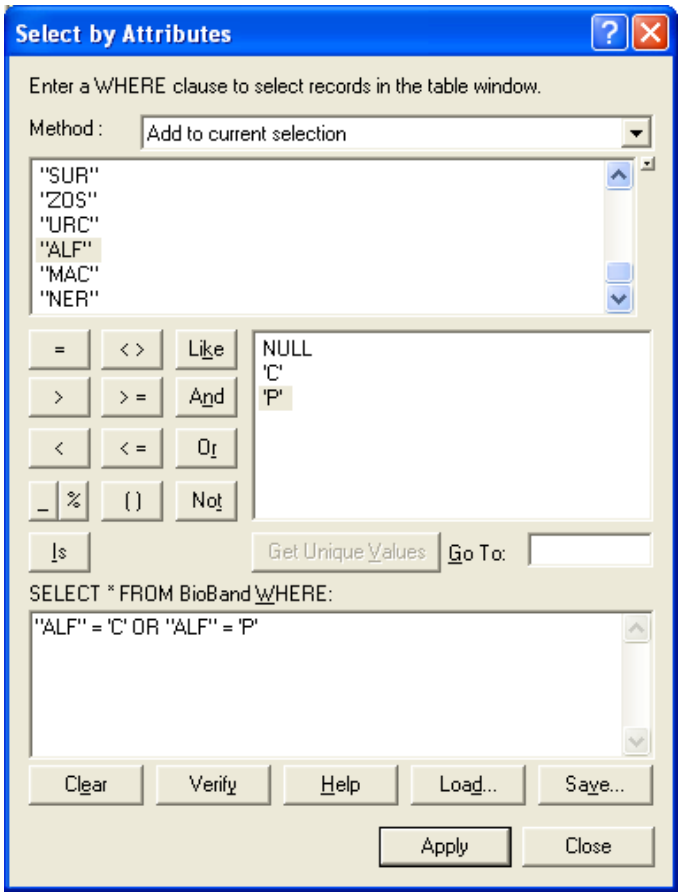
- Click on the drop down list beside the “Method:” line at the top of the window and select “**Add to current selection**.”

- The following steps will create query language in the SELECT FROM box:
  - Scroll down the list at the top of the table to see all the fields.
  - Double click “NER”
  - Single-click “IS”
  - Single-click “NOT”
  - Single-click the “Get Unique Values” button in the middle of the screen
- A list of values that occur in the NER field will appear in the box above that button. In this case, there will be the values “NULL”, ‘C’ and ‘P’.
- Double click “NULL”, your query should look like this:

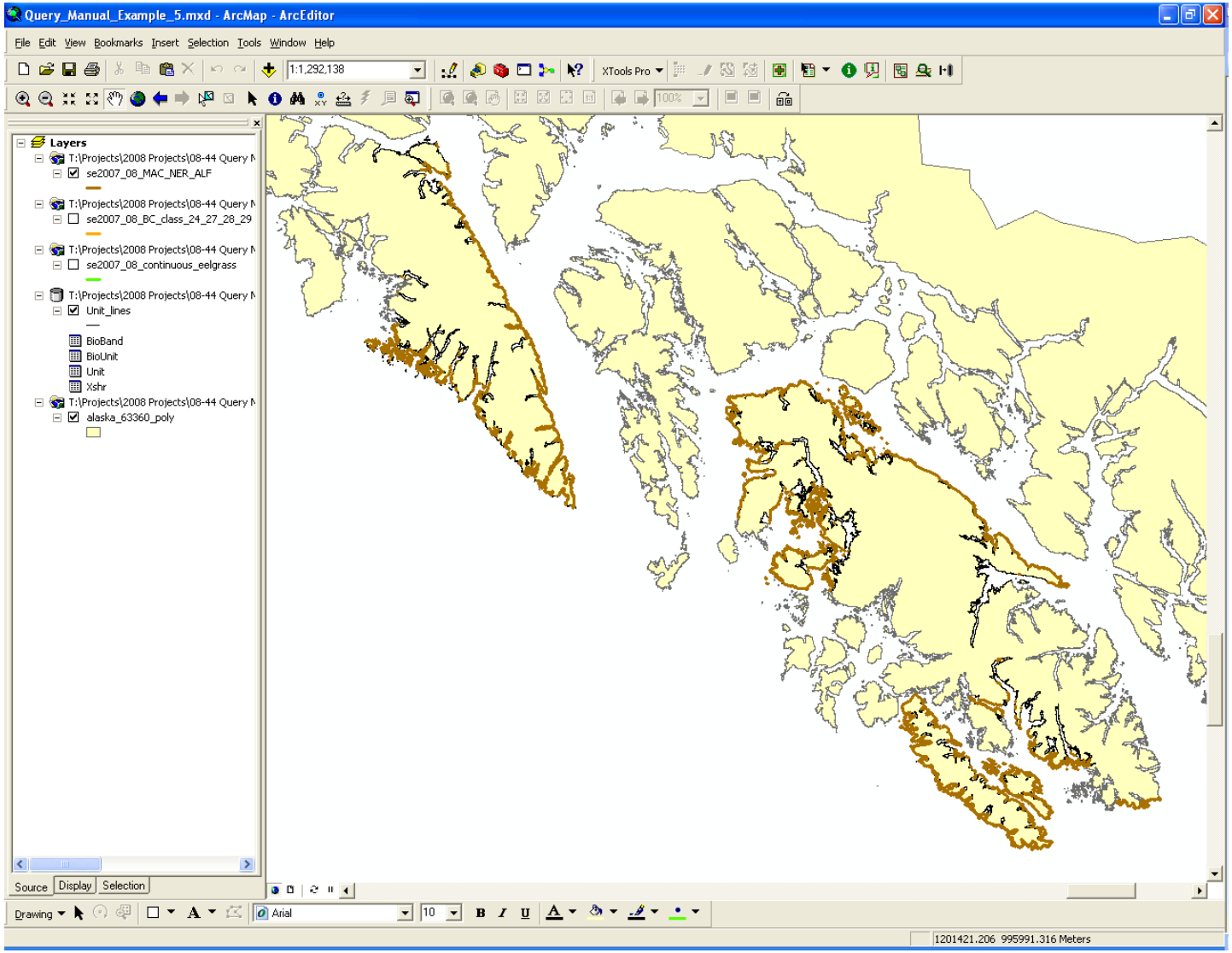


- Click “Apply” at the bottom of the window.
- By using the query “NER” IS NOT NULL, all other records have been selected. All records with a “C” or a “P” in the NER field have been added to our selection. There should be 8,459 out or 74,821 records selected.

- Note that some selected records will now have a NULL value in either the MAC or NER field. However the other field of interest (MAC or NER) should have a C or P in it. This query has now selected units that have either continuous or patchy MAC, or units that have continuous or patchy NER. A unit does not need to have both of MAC and NER to be selected in this query.
- We now have all records with continuous or patchy MAC and continuous or patchy NER selected but we finally wish to add records that have continuous or patchy ALF mapped.
- Open the "Select by Attributes" window again by clicking on the "Options" tab at the bottom of the BioBand table. Once this window is open click on the "Clear" tab to get rid of the previous query from the "SELECT *FROM BioBand WHERE:"
- Ensure that "**Add to current selection**" is selected in the "Method" drop-down list at the top.
- The following steps will create query language in the SELECT FROM box:
  - Scroll down the list at the top of the table to see all the fields.
  - Double click "ALF"
  - Single-click "="
  - Single-click the "Get Unique Values" button in the middle of the screen
- A list of values that occur in the ALF field will appear in the box above that button. In this case, there will be the values "NULL", 'C' and 'P'.
- - Double click "C"
  - Single click "OR"
  - Double click on "ALF"
  - Single-click "="
  - Double click "P", your query should look like this:



- Click “Apply” at the bottom of the window.
- The query has now selected all records that have continuous or patchy MAC, continuous or patchy NER and continuous or patchy ALF. There should be 8,970 out of 74,821 records selected.
- To **view these records on the map**, choose Options>Related Tables> “**unit_lines_to_bioband_table**” as you did above. Minimize the windows to see the selections on the map.
- Maximize the unit_lines attribute table again and note that there should be 8,970 records out of 21,186 selected.
- Right-click on the Shape_Length field of the unit_lines table and choose “Statistics.” The sum of the lengths of these canopy kelps is 2,591.8 km.
- This example is saved in the “Answers” folder as an ArcGIS project (Query_Manual_Example_5.mxd), along with the canopy kelps shapefile (named “se2007_08_MAC_NER_ALF.shp”). Compare these results to yours.
- This query can be run in one step, try the following expression or a combination of the following expressions. You should come up with the same answer.
    - **"MAC"** IS NOT NULL OR **"NER"** IS NOT NULL OR **"ALF"** IS NOT NULL
    - **"MAC"** = 'C' OR **"MAC"** = 'P' OR **"NER"** = 'C' OR **"NER"** = 'P' OR **"ALF"** = 'C' OR **"ALF"** = 'P'
    - **"MAC"** IS NOT NULL OR **"NER"** = 'C' OR **"NER"** = 'P' OR **"ALF"** IS NOT NULL

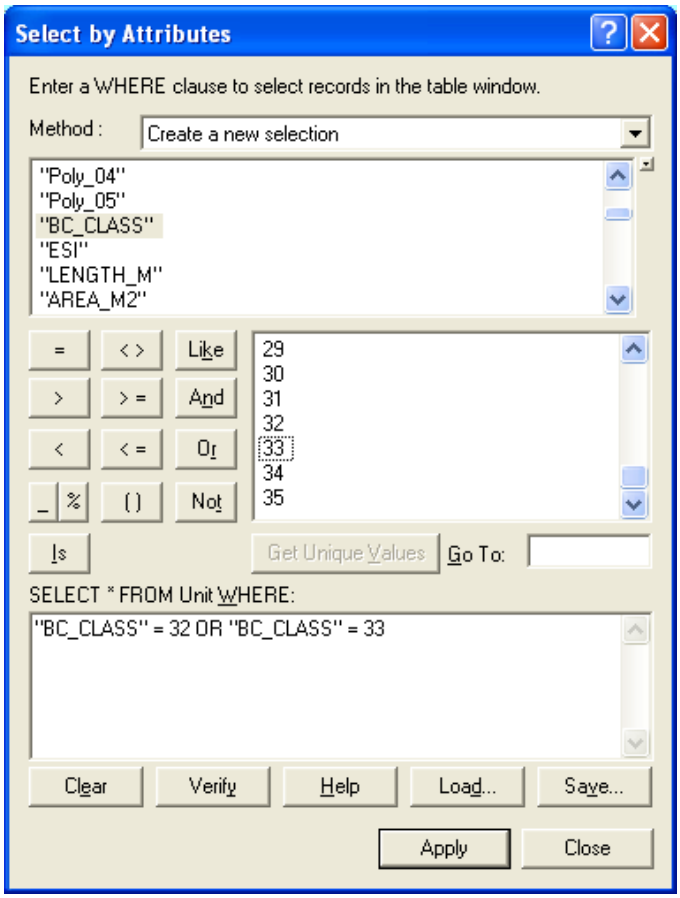


Map showing distribution of Giant Kelp, Bull Kelp and Dragon Kelp (BioBands MAC, NER and ALF).

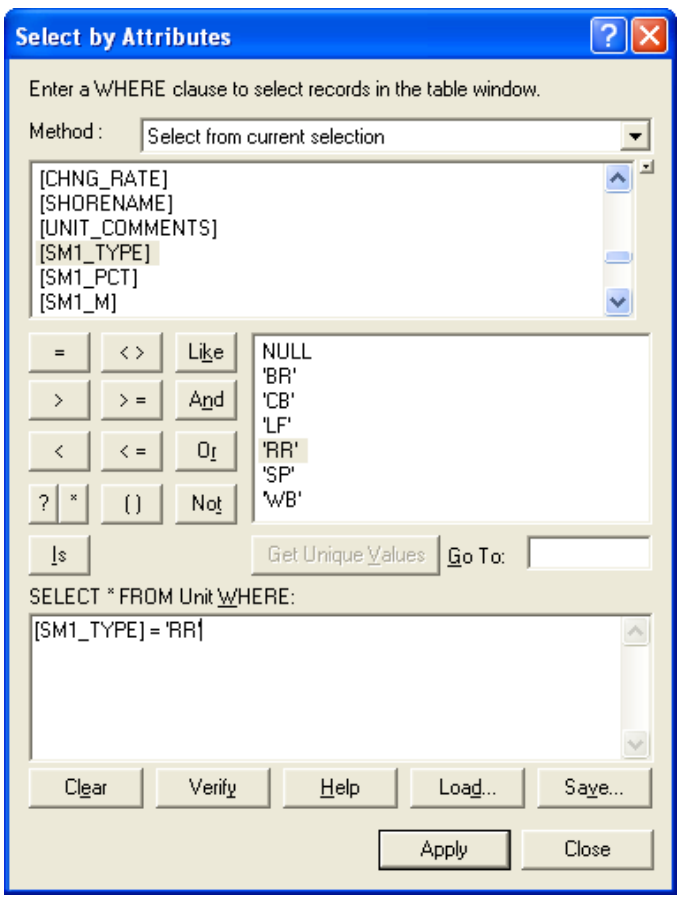
6. Displaying multiple attributes: anthropogenic shorelines and shore modification features [ArcGIS Query]

This example will use ArcGIS to illustrate how to select anthropogenic manmade shoreline. Once manmade shoreline is selected it will also illustrate how to select shore modification features such as riprap or concrete bulkheads.

- Open your ArcGIS project file from Example 5 (or the "Query_Manual_Example_5.mxd" file provided in the "Answers" folder).
- Click on the "Source" tab on the lower left to display the tables within the file geodatabase.
- Right click on the "Unit" table and select "Open." The "Attributes of Unit" table will appear.
- Click on the "Options" drop-down menu on the lower right of the table and choose "Select by Attributes." The query window will open with the "Method" line defaulting to "Create a new selection". Leave that option selected for this example.
- The following steps will create query language in the SELECT FROM box:
  - Scroll down the list at the top of the table to see all the fields and enter the following query:
  "BC_CLASS" = 32 OR "BC_CLASS" = 33

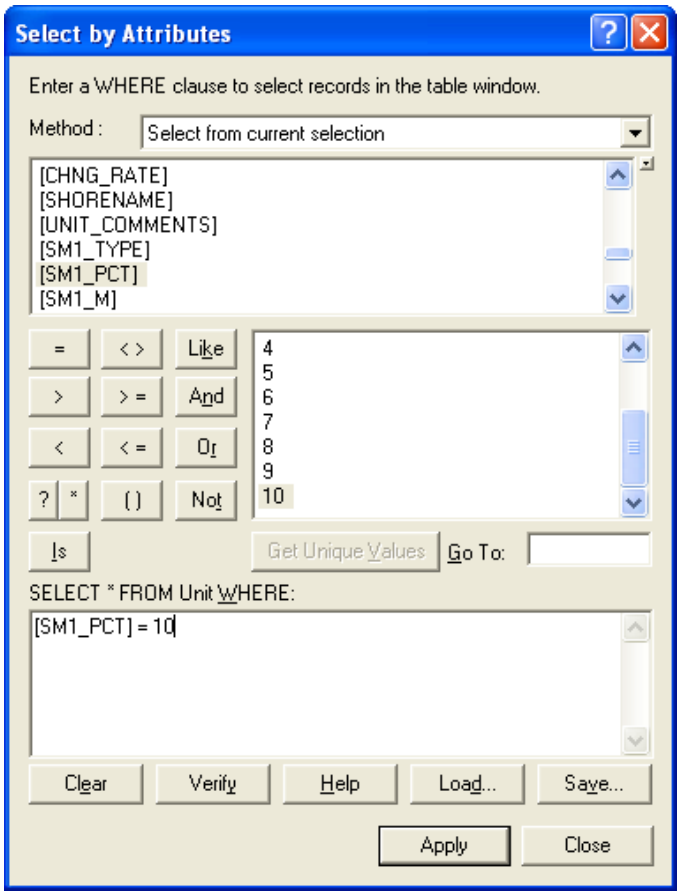


- BC Class 32 indicates that the unit was mapped as anthropogenic man-made (permeable shoreline) and BC Class 33 indicates that the unit was mapped as anthropogenic man-made (impermeable) shoreline. The intertidal zone must exhibit >50% human alteration in the intertidal zone.
- To view only the selected records click on the “Selected” tab at the bottom of the “Attributes of Unit” table. This will hide all the records that weren’t selected in the query. There should be 60 out of 24,682 units selected.
- The field “SM1_TYPE” contains a 2 letter code indicating the primary type of shore modification occurring within the unit: BR = boat ramp; CB = concrete bulkhead; LF = landfill; SP = sheet pile; RR = riprap and WB = wooden bulkhead. The field ‘SM2_TYPE” indicates the secondary type of shore modification while the field “SM3_TYPE” indicates the tertiary type.
- One of the most common shoreline modifications is Riprap. To find the units that have riprap mapped as their primary shoreline modification click on the “Options” tab and open the “Select by Attribute” window.
- This time we want to set the “Method” line at the top to “Select from current selection” and enter the following query: "SM1_TYPE" = 'RR'
  Your query should look like this:



- There should now be 20 out of 24,682 records selected.

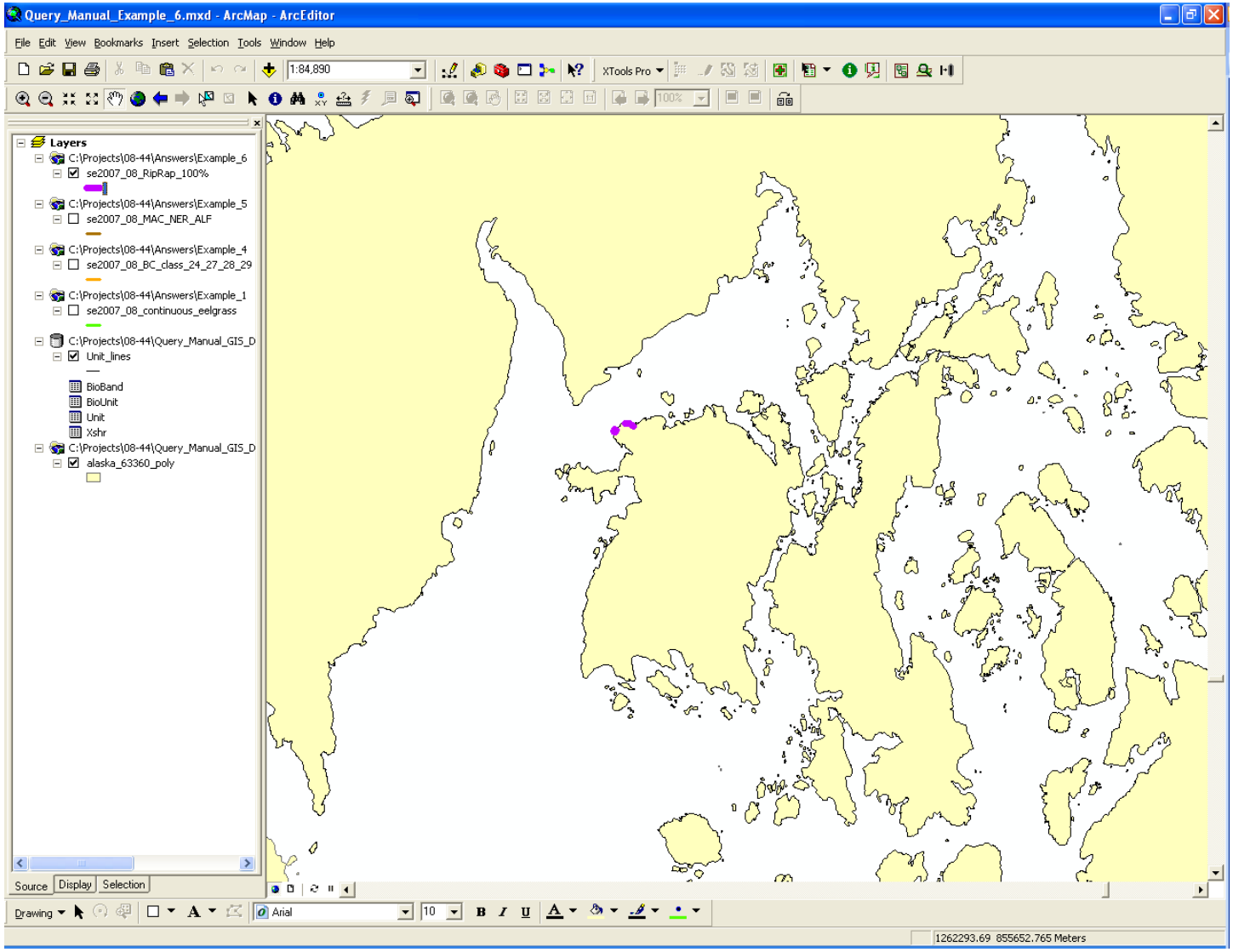
- The estimated percent occurrence of the primary shore modification is indicated in the field “SM1_PCT”. The data in this field is entered in tenths (i.e. “2” = 20% occurrence within the unit. We might be interested in ShoreZone units where the alongshore is completely comprised of riprap, so we could query this field for the number 10. That would mean that the unit is 100% riprap alongshore.
- Open the “Select by Attribute” window again and “Clear” the previous query.
- Again we want to set the “Method” line at the top to “Select from current selection” and enter the following query: "SM1_PCT" = 10
  Your query should look like this:



Note: A ShoreZone unit can be mapped as having a 100% Shore Modification but not be classified as a BC Class 32 or 33. The Shore Modification Percentage field refers to the “alongshore length” of the modification while the BC Class field refers to the “intertidal area” of man-made modification within a unit.

- There should be 5 out of 24,682 units selected.
- To **view these u**nits click on the “Options” tab, scroll up to “Related tables” and choose the “**unit_lines_to_unit_table**” relationship.
- In the “Attributes of unit_lines” right click on the field name “Shape_Length” and scroll down to “Statistics”. There is 1.6km of shoreline classified as anthropogenic man-made and comprised of 100% riprap in Southeast Alaska 2007 mapping.
- Try another query looking for units that are comprised of Concrete Bulkheads (CB) or Wooden Bulkheads (WB).

- The above query can also be written in one step, paying attention to the brackets.
  ([BC_CLASS] = 32 OR [BC_CLASS] = 33**)** AND [SM1_TYPE] = 'RR' AND [SM1_PCT] = 10
- This example is saved in the “Answers” folder as an ArcGIS project (Query_Manual_Example_6.mxd), along with the riprap shapefile (named “se2007_08_RipRap_100%.shp”). Compare these results to yours.



Map showing ShoreZone units classified as having 100% RipRap. (Marble Island, Sea Otter Sound)

7. Querying the Across-shore (Xshr) data to find shoreline with high marine debris potential [ArcGIS Query].

This example will use ArcGIS to find areas where marine debris tends to concentrate. A good indication of this is to look for cut log deposits in the supratidal zone. Areas with larger concentrations of cut logs are considered to have a higher potential of containing marine debris than areas with fewer or no cut logs.

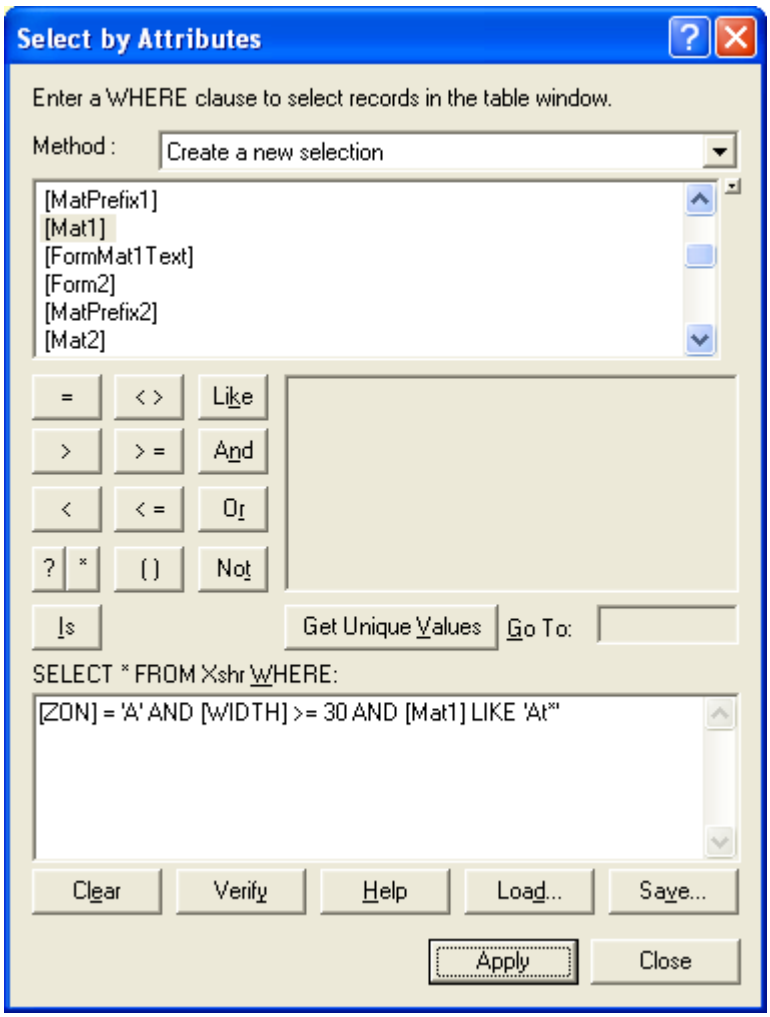
- Open your ArcGIS project file from Example 6 (or the "Query_Manual_Example_6.mxd" file provided in the "Answers" folder).
- Click on the "Source" tab on the lower left to display the tables within the file geodatabase.
- Right click on the "Xshr" table and select "Open." The "Attributes of Xshr" table will appear.
- Click on the "Options" drop-down menu on the lower right of the table and choose "Select by Attributes." The query window will open with the "Method" line defaulting to "Create a new selection". Leave that option selected for this example.
- First, we are interest in supratidal zones that are 30 meters or more in width. The different zones, supratidal (A), intertidal (B) and subtidal (C) are found by querying the ZON field (Refer to table A-10 in the ShoreZone Coastal Habitat Mapping Protocol for the Gulf of Alaska 2008). In this case we are looking for zone A, so the following steps will create query language in the SELECT FROM box for this:
    - From the list at the top of the table enter the following query:

  "ZON" = 'A' AND "WIDTH" >= 30.

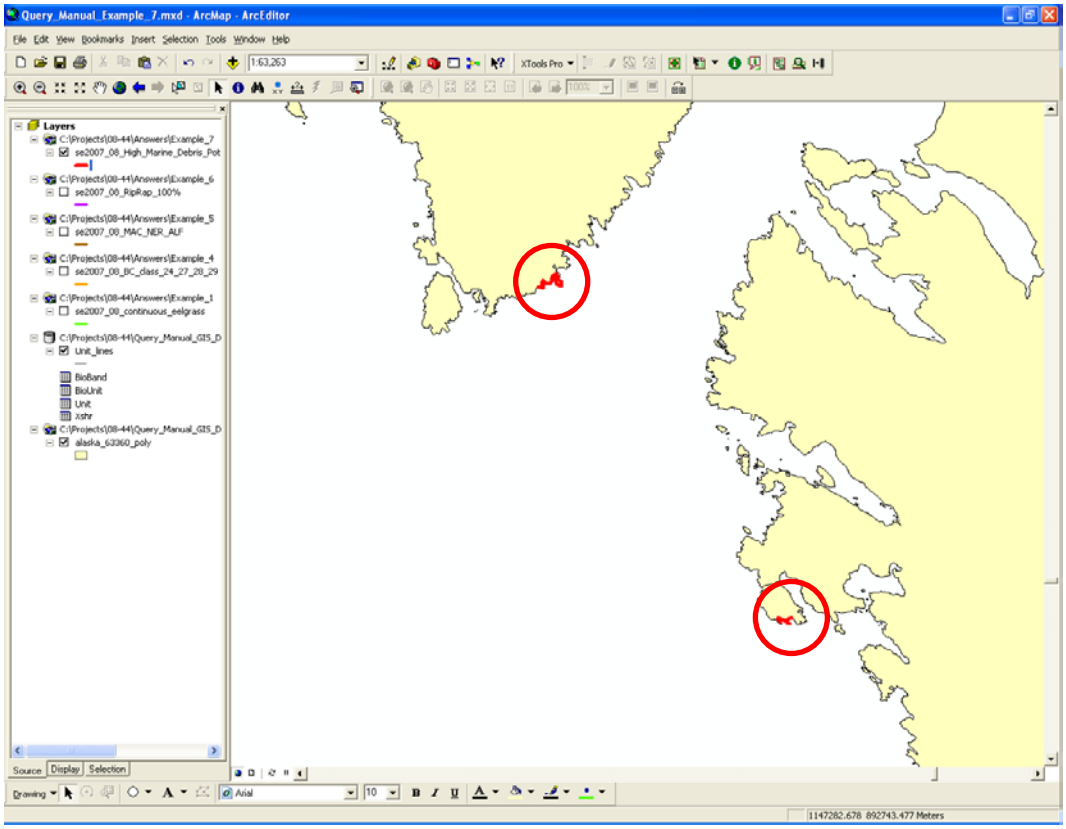
- Click on apply and there should be 3,623 out of 74,821 units selected.
- This is a good start, but many of these units will not have cut logs in them. The materials code for cut logs is 'At'. They are usually thrown into the supratidal zone during storm events and are consequently mapped as being on top of or overlaying the sediment and vegetation. For example they might show up in the database as 'At/Cbc' which translate to "Anthropogenic logs overlying Clastic boulder and cobble.
- To search for cut logs we can simple add to our above query. Remembering that the * sign is a wildcard we can and the following to our query:

  AND [Mat1] LIKE 'At*'

- The query should now look like this:



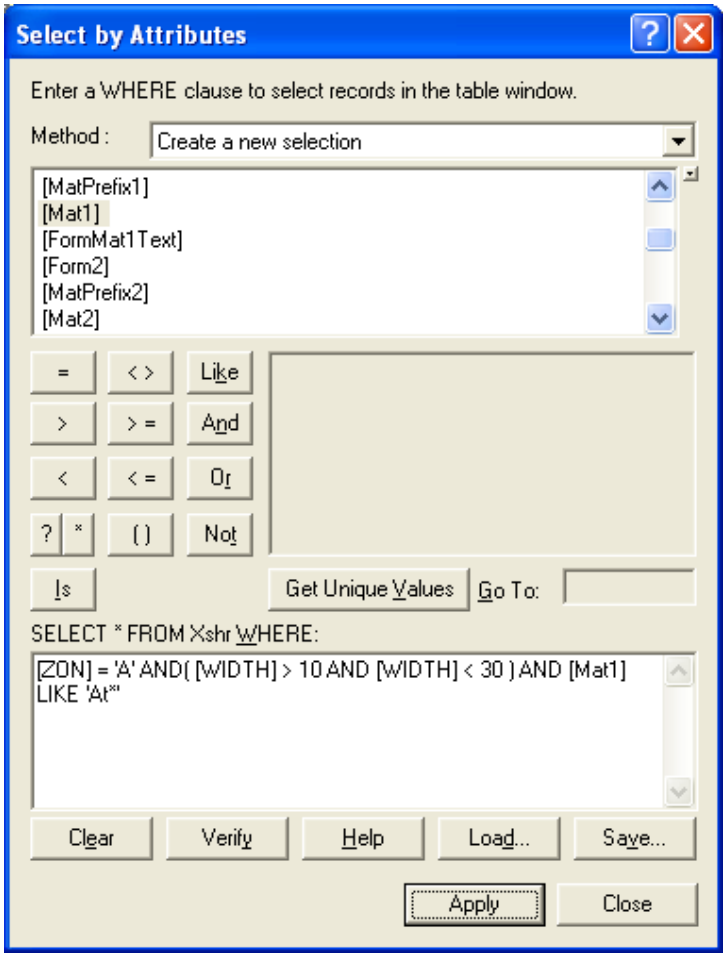
- This should now return **11 out of 74,821 records**. To view these units click on the "Options" tab, scroll up to "Related tables" and choose the "**unit_lines_to_xshr_table**" relationship.
- Use the zoom tools to zoom into the map. As expected, many of them are south facing units as indicated by the highlighted segments.



- 11 areas with high potential for marine debris is a good start, but we might also be interested in areas with moderate potential for marine debris. A supratidal zone with cut logs and a width between 10 and 30 meters is considered to have moderate potential for catching marine debris. To search for these records we need to alter the widths in our query.
- Entering the following query will find supratidal zones greater than 10 meters but less than 30 meters in width.

  [ZON] = 'A' AND **(**[WIDTH] > 10 AND [WIDTH] < 30**)**

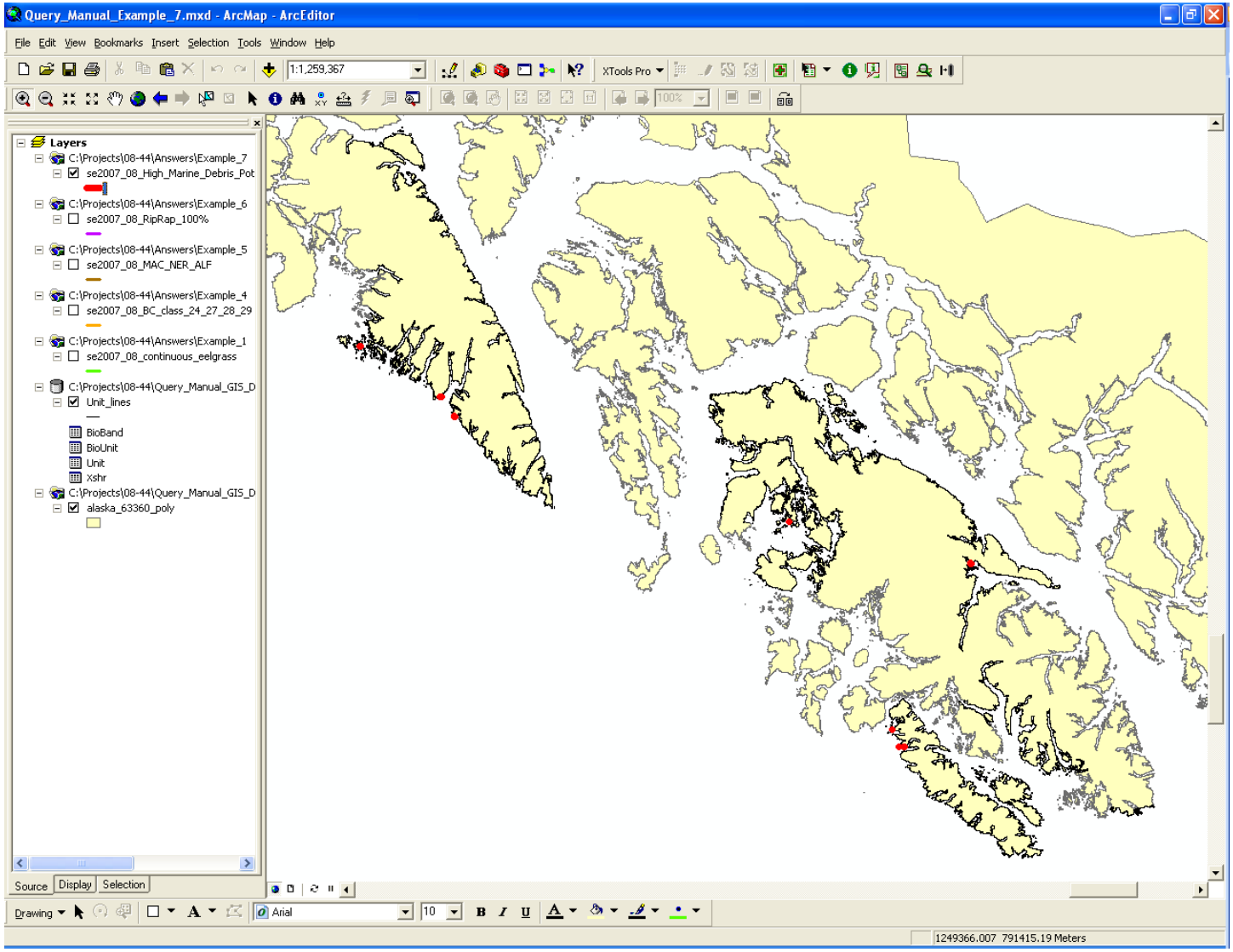
  Paying attention to the placement of the brackets is important, as is the fact that an "**AND**" is used between the widths instead of an "**OR**". If ("WIDTH" > 10 OR "WIDTH" < 30) had been used then all A zone records in the table would be selected because every A zone is over 10 meters in width (10 meters and up) yet every A zone is also below 30 meters in width (0 to 30 meters). Using an **AND** picks out the width that are only between 10 and 30 meters.
- The above query should select 2,530 out of 74,821 records.
- Now add the language asking for cut logs:



- The above query should select 166 out of 74,821 records. To view these units click on the "Options" tab, scroll up to "Related tables" and choose the "**unit_lines_to_xshr_table**" relationship. Again many, but not all, of them appear to be south facing pockets.
- You can also search for areas with low potential for marine debris by searching for supratidal zones that are less than or equal to 10 meters in width.

  [ZON] = 'A' AND [WIDTH] <= 10 AND [Mat1] LIKE 'At*'

- The above query should return 915 out of 74,821 records of low marine debris potential.
- This example is saved in the "Answers" folder as an ArcGIS project (Query_Manual_Example_7.mxd), along with the high marine debris potential shapefile (named "se2007_08_High_Marine_Debris_Potential.shp"). Compare these results to yours.



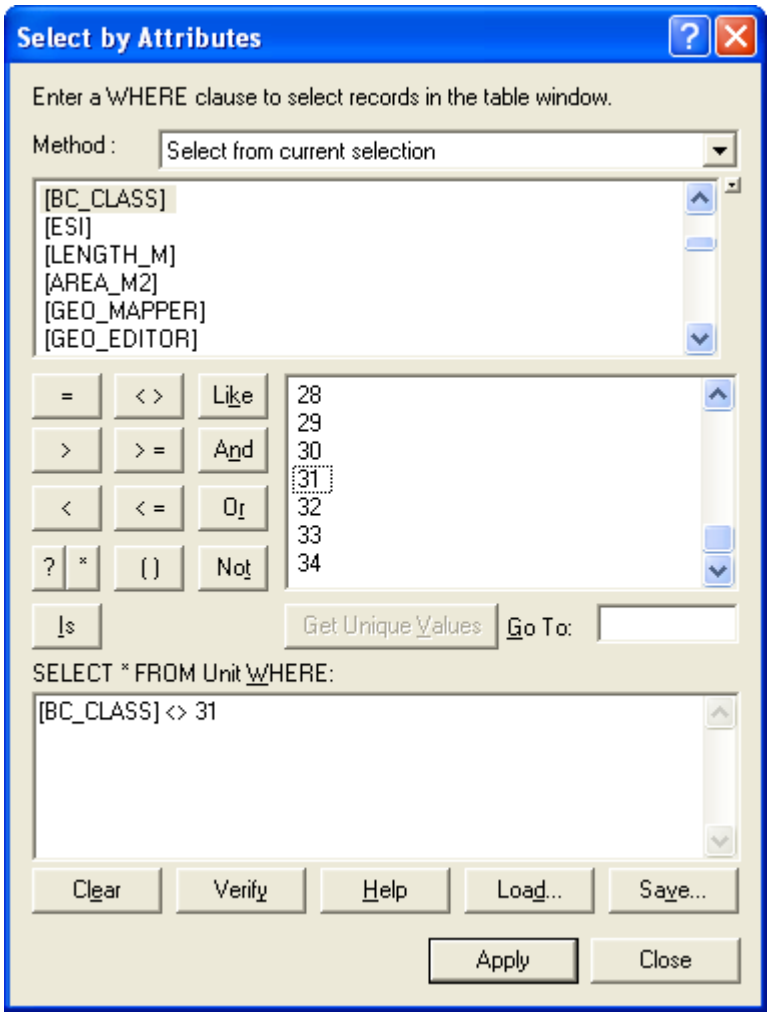
Map showing ShoreZone units with High Marine Debris Potential.

8. Querying multiple tables to find Salt Marsh that is not associated with an Estuary [ArcGIS Query]

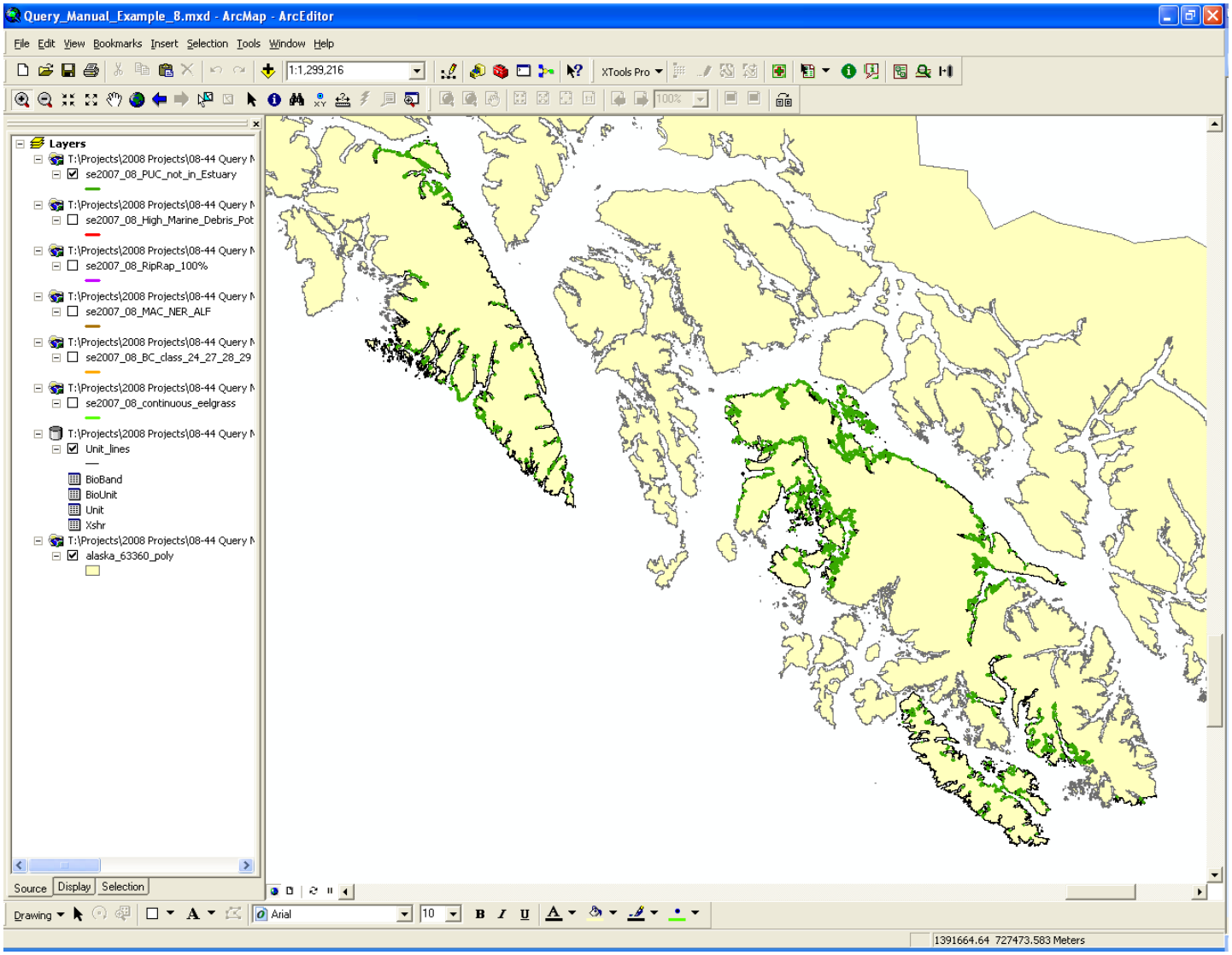
This example will use ArcGIS to find Salt Marsh occurrence that is not associated with an estuary. The data of interest for this query exists in both the BioBand and Unit tables, so this example will show how to access the data to get the required results.

- Open your ArcGIS project file from Example 7 (or the "Query_Manual_Example_7.mxd" file provided in the "Answers" folder).
- Click on the "Source" tab on the lower left to display the tables within the file geodatabase.
- Salt Marsh is a bioband and is mapped in the "BioBand" table in the field PUC (*Puccinellia*) as either null, continuous or patchy (NULL, C, and P).
- Right click on the "BioBand" table and select "Open." The "Attributes of BioBand" table will appear.
- Click on the "Options" drop-down menu on the lower right of the table and choose "Select by Attributes." The query window will open with the "Method" line defaulting to "Create a new selection". Leave that option selected for this example.
- The simple query of **[PUC] = 'C'** will return all the records that have a continuous occurrence of PUC.
- There should be **5,818 out of 74,821 records** selected after executing the above query.
- Next we would like to query the BC Class to find which of these above selected units are not associated with an estuary; however the BC_CLASS field is located in a different table.
- The field of interest is "BC_CLASS" and it is located in the Unit table.
- To open the Unit table click on the "Options" tab, scroll up to "Related tables" and choose the "**unit_table_to_bioband_table**" relationship. The Unit table will open with 5,608 out of 24,682 records selected. These selected records are records that have continuous PUC mapped in them. Note that the number of selected records in the Unit table is less than the selected records in the BioBand table because of a one-to-many relationship mentioned earlier in this manual.
- Scrolling down the table by using the slider bar at the right and looking at the "**BC_CLASS**" field it shows that units with continuous PUC occur in a wide range of BC Classes, but a lot of them occur in units classified as BC Class 31 which indicates the salt marsh is occurring in an estuary. (Refer to table A-2 in the ShoreZone Coastal Habitat Mapping Protocol for the Gulf of Alaska 2008).
- To select those units where **continuous PUC does not occur in an Estuary** click on the "Options" drop-down menu on the lower right of the table and choose "Select by Attributes." The query window will open and at the top change the "Method" line to "Select from current selection".
- Next enter the query:
  [BC_CLASS] <> 31
  Noting that "**<>**" is the sign for "does not equal".

- The “Select by Attribute” window should look like this:



- Click the “Apply” button and the results should show 4,857 out of 24,682 records selected. These are 4,857 records where continuous Salt Marsh (PUC) occurs along the open coastline rather than in an estuary. To view these units click on the “Options” tab, scroll up to “Related tables” and choose the “**unit_lines_to_unit_table**” relationship.
- There should now be **3,264 out of 21,186 records** selected in the Unit_lines attribute table, the number of records dropped from 4,857 to 3,264 records because 1,593 of the records were point features and are not located in the unit_lines table.
- Closing the tables we can observe where these selected features occur. Use the Zoom and Pan tools to investigate areas of interest.
- This example is saved in the “Answers” folder as an ArcGIS project (Query_Manual_Example_8.mxd), along with the Salt Marsh that is not associated with an Estuary shapefile (named “se2007_08_PUC_not_in_Estuary.shp”). Compare these results to yours.



Map showing Salt Marsh (PUC) that is not associated with an Estuary (BC Class 31)

9. Extracting data from multiple tables using sub-queries to find Sandlance spawning habitat [ArcGIS Query]

This example will use ArcGIS to show how to use a sub-query (a query nested inside another query) to extract data stored in another table. The last example showed how to query data that was in both the BioBand and BioUnit tables but it involved multiple queries and steps. A sub-query will allow us to find potential Sandlance spawning beaches using one query to access data stored in multiple tables.

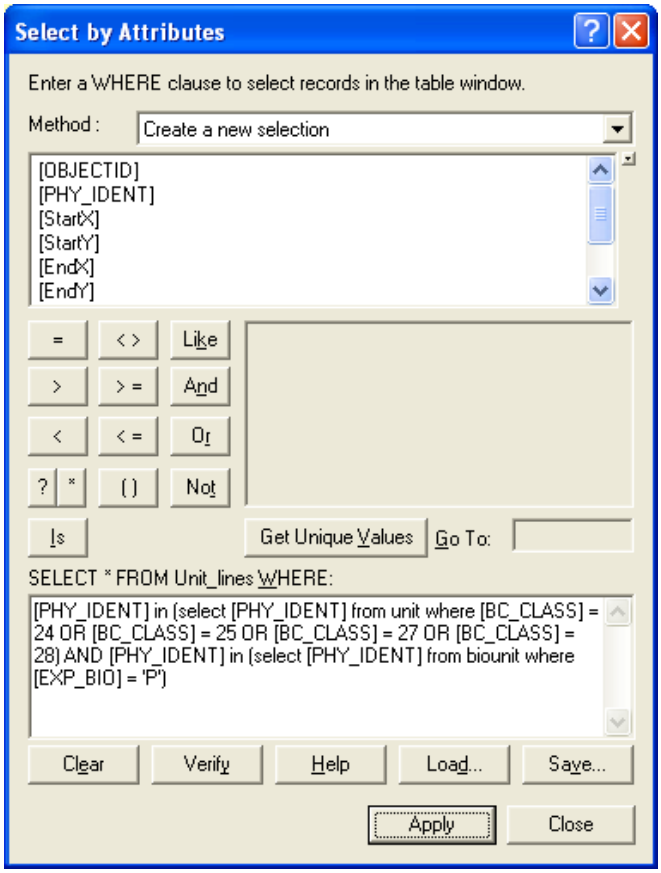
- Open your ArcGIS project file from Example 8 (or the "Query_Manual_Example_8.mxd" file provided in the "Answers" folder).
- Click on the "Source" tab on the lower left to display the tables within the file geodatabase.
- Sandlance spawning habitat can be divided into five different classes of potential. *low*, *moderately low*, *moderate*, *moderately high* and *high potential*. For simplicity sake we will start by finding *low potential* habitat and work our way up to *high potential*.
- Low potential of Sandlance spawning is shoreline designated as BC Class 24, 25, 27 and 28. (Refer to table A-2 in the ShoreZone Coastal Habitat Mapping Protocol for the Gulf of Alaska 2008 for details). This info is found in the Unit table in the field BC_Class.
- As previous examples showed, the Unit table can be queried for this info and then the Unit table could be related to the Unit_lines feature class to spatial view the results. However it is possible to query the Unit_lines feature class for this info by using a sub-query that will extract this info from the Unit table through the built in geodatabase relationships. This allows the data to be spatially viewed in one step.
- All four tables (BioBand, BioUnit, Unit and Xshr) are related to the Unit_lines feature class through the field "**Phy_Ident**"; we will use this field in our query to extract the required data from these four tables while querying the Unit_lines feature class.
- Right click on the "**Unit_lines**" feature class and select "Open." The "Attributes of Unit_lines" table will appear.
- Click on the "Options" drop-down menu on the lower right of the table and choose "Select by Attributes" and the query window will open.
- Enter the following query **paying close attention to the placement of brackets**:

  [PHY_IDENT] in (select [PHY_IDENT] from unit where [BC_CLASS] = 24 OR [BC_CLASS] = 25 OR [BC_CLASS] = 27 OR [BC_CLASS] = 28)

- The above query might initially seem a little confusing to start with but it can easily be deciphered. Looking inside the brackets or the sub-query, it is simply asking to select the "**Phy_Ident**" from the "**unit**" table where BC_Class equals 24, 25, 27 or 28. Outside the brackets (at the start of the query) it is simply calling on the relationship between the Unit table and Unit_lines feature class that is based on the field Phy_Ident.
- Click "Apply" at the bottom of the query window and **4,001 out of 21,186 records** should be selected and we can already spatially view them on the screen.
- We can test that this query did what we expected by clicking on the "Options" tab at the bottom of the unit_lines attribute table and scrolling up to "Related tables" and choose the "**unit_lines_to_unit_table**" relationship. The Unit table should open with 4,001 records selected. Scrolling down the table we can see only records that are classified as BC_Class 24, 25, 27 or 28 are selected. Note that there might be additional records classified as BC_Class 24, 25, 27 or 28 that are not selected, but they will all be "Type P" (point features) and we are only interested in "Type L" (line features) for this query.
- 4,001 records or 1,213 km of *low potential* Sandlance spawning habitat. We can narrow our search by searching for how many of the above 4,001 records occur in **Protected** areas. This will then give us *moderately low* Sandlance spawning potential.
- The following needs to be added to the above query:

  AND [PHY_IDENT] in (select [PHY_IDENT] from biounit where [EXP_BIO] = 'P')

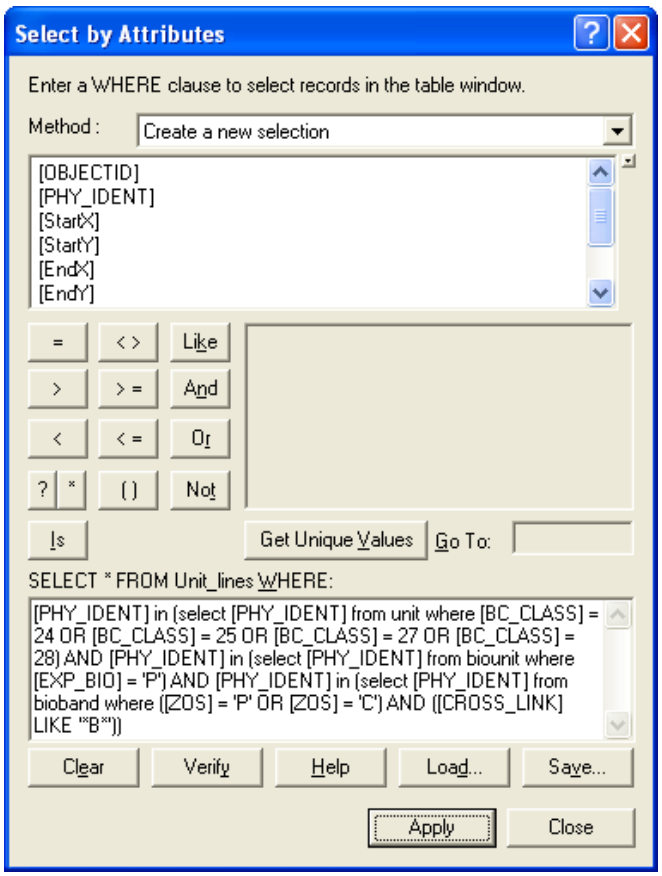
- Your query should look like this, **paying close attention to the placement of brackets and quotation marks:**



- Click on “Apply” and there should now be **2,494 out of 21,186 records** selected.
- Again we can test that this query did what we expected it to by clicking on the “Options” tab at the bottom of the Unit_lines attribute table and relating back to the BioUnit table. The BioUnit table should open with 2,494 records selected, all of them with an “Exp_Bio” of “P”.
- Click on the “Options” tab at the bottom of the **BioUnit** attribute table and relate back to the **Unit** table. The Unit table should open with 2,494 out of 24,682 records selected, all of them with a “BC_Class” of 24, 25, 27 or 28.
- The next step to narrow our query is to search for *moderate* Sandlance spawning potential. This is defined by adding eelgrass (*zostera* or ZOS) in the intertidal (B zone) zone to the search. This data is found in the BioBand table.
- Add the following to your query **paying very close attention to the placement of brackets and quotation marks**:

  AND [PHY_IDENT] in (select [PHY_IDENT] from bioband where ([ZOS] = 'P' OR [ZOS] = 'C') AND ([CROSS_LINK] LIKE '*B*'))

- Of note in this query is that we are using the field “Cross_Link” to define that we are only interested in the “B” (intertidal) zone. You will notice the values in the field “Cross_Link” all have an A, B or C in them. A wildcard (*) is used to help us search for “B” (intertidal) zones.
- Your query should look like this and it should now return **631 out of 21,186 records**.



- You can test this third part of the query by querying the BioBand table with the following:
  ([ZOS] = 'P' OR [ZOS] = 'C') AND ([CROSS_LINK] LIKE '*B*')
  You should get 1,824 out of 74,821 records.
  Note that you can not test the third part of this query by simply relating the Unit_lines feature class back to the BioBand table. This is because it is a one-to-many relationship based on the field Phy_Ident. Every record that is selected in the Unit_lines table with relate to **many** records in the BioBand table and those records in the BioBand table will also include the A (supratidal) and C (subtidal) zones (remembering that we are only interested in the B zone).

- *moderately high* Sandlance spawning potential is found by adding shorelines with **sand/pebble, pebble/sand, or sand** listed as the primary material in the upper intertidal (B1 zone) zone. This data is in the Xshr table and can be found by adding the following to your query. Again **paying close attention to the placement of brackets and quotation marks**.

  AND [PHY_IDENT] in (select [PHY_IDENT] from xshr where [ZON] = 'B' AND [COMPONENT] = '1' AND ([MAT1] = 'Csp/' OR [MAT1] = 'Cps/' OR [MAT1] = 'Cs/'))

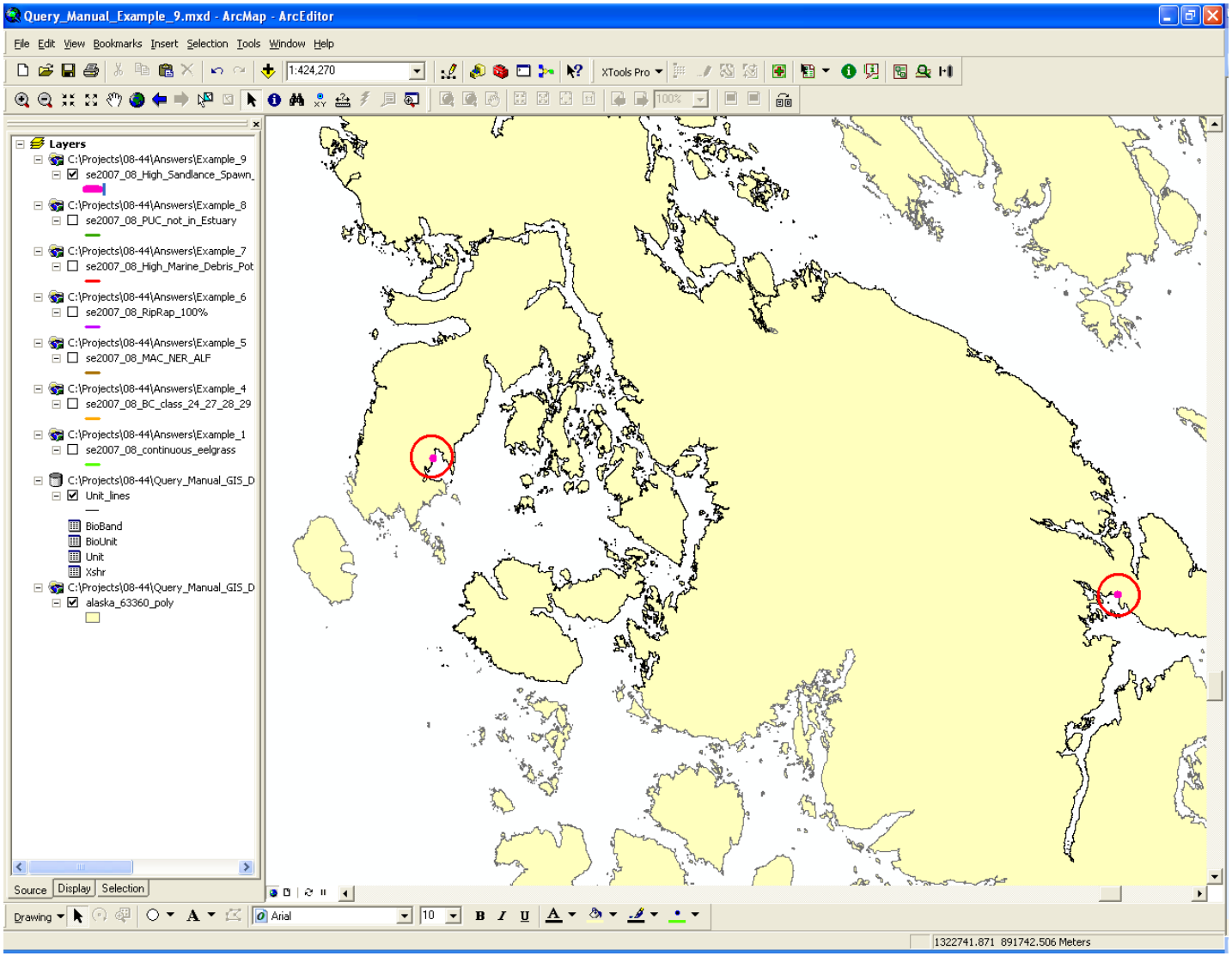
  There should now be **18 out of 21,186 records** selected.
- *high* Sandlance spawning potential is found by adding shoreline with cut logs in the supratidal (A zone) zone to the query. This data is also in the Xshr table and can be found by adding the following to your query:

  AND [PHY_IDENT] in (select [PHY_IDENT] from xshr where [ZON] = 'A' AND [MAT1] LIKE 'At/*')

- Your final query should look like this, **paying extremely close attention to the placement of brackets and quotation marks:**

  [PHY_IDENT] in (select [PHY_IDENT] from unit where [BC_CLASS] = 24 OR [BC_CLASS] = 25 OR [BC_CLASS] = 27 OR [BC_CLASS] = 28) AND [PHY_IDENT] in (select [PHY_IDENT] from biounit where [EXP_BIO] = 'P') AND [PHY_IDENT] in (select [PHY_IDENT] from bioband where ([ZOS] = 'P' OR [ZOS] = 'C') AND ([CROSS_LINK] LIKE '*B*')) AND [PHY_IDENT] in (select [PHY_IDENT] from xshr where [ZON] = 'B' AND [COMPONENT] = '1' AND ([MAT1] = 'Csp/' OR [MAT1] = 'Cps/' OR [MAT1] = 'Cs/')) AND [PHY_IDENT] in (select [PHY_IDENT] from xshr where [ZON] = 'A' AND [MAT1] LIKE 'At/*')

- There should now be a total of **2 out of 21,186 records** that have ***high Sandlance spawning potential***. One in Edna Bay on Kosciusko Island and one in Karta Bay on the east side of Prince of Wales Island as noted by the red circles on the map below.
- This example is saved in the “Answers” folder as an ArcGIS project (Query_Manual_Example_9.mxd), along with the High Sandlance Spawning Potential shapefile (“se2007_08_High_Sandlance_Spawn_Potential.shp”). Compare these results to yours.



Map showing High Potential Sandlance Spawning habitat.

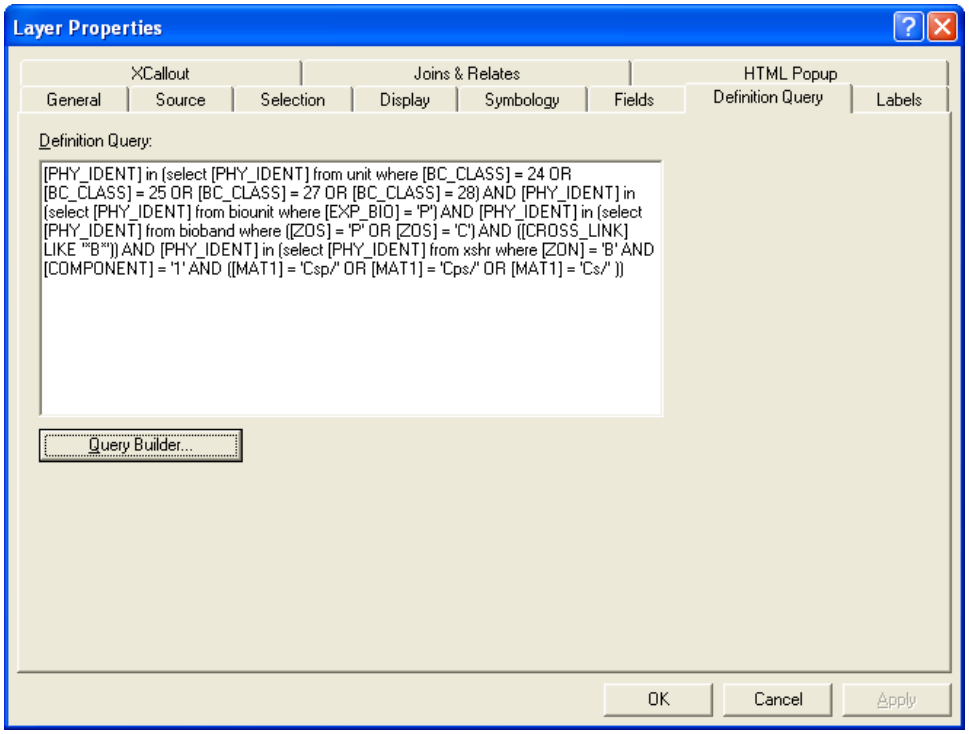
10. Using a definition query to display selected attributes and make a simple map [ArcGIS Query]

This example will use ArcGIS to show how to use a definition query on a layer and allow only a selected subset of a layer to be displayed. Once the definition query is constructed, simple instructions on how to compose and export a map for use in a report or presentation will be explored.

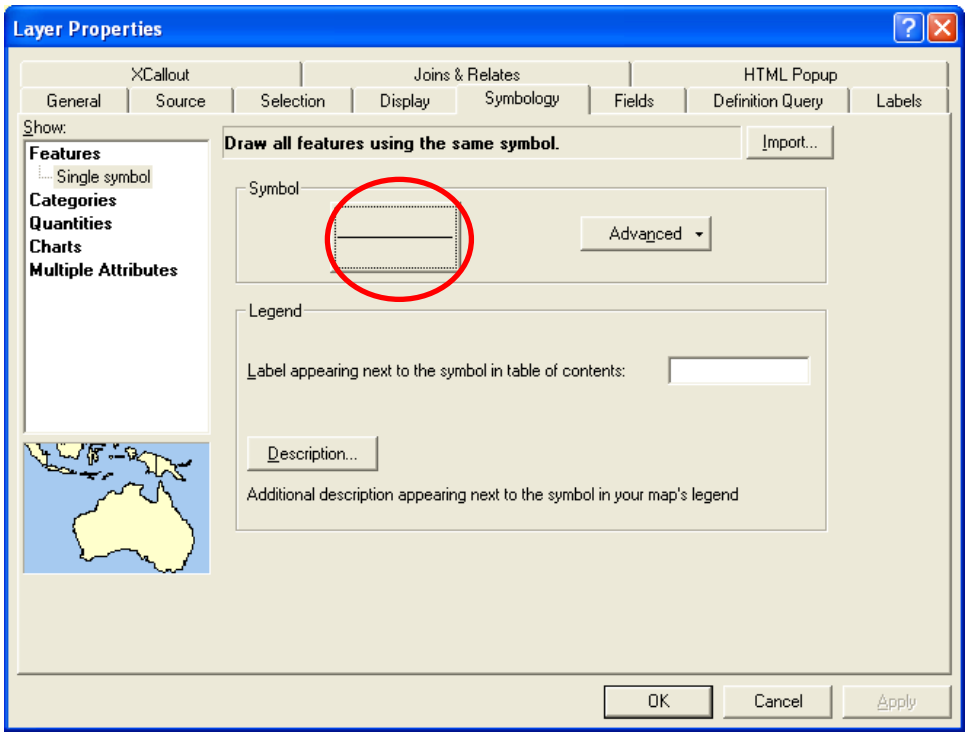
- Open your ArcGIS project file from Example 9 (or the "Query_Manual_Example_9.mxd" file provided in the "Answers" folder).
- Click on the "Source" tab on the lower left to display the tables within the file geodatabase.
- Right click on the Unit_lines feature class and then scroll and click on "Properties…" (Or simply double-click on the Unit_lines layer name).
- The "**Layer Properties**" window will open. This window has eleven different tabs and allows for many different options to be explored. For example, clicking on the "**Source**" tab give us valuable information about the projection of the layer. We can see that this layer is projected in an "Alaska Albers NAD 1983" projection.
- The tab of interest to start this exercise is the "**Definition Query**" tab, so click on that one. This window only gives one option, so click the "**Query Builder…**" tab and a familiar "Query Builder" window will open.
- Revisiting query number 9 in this manual we'll look for areas with Moderately High Sandlance Spawning potential.
- Referring back to the previous example enter the query for looking for Moderately High Sandlance Spawning potential into the query box:

  [PHY_IDENT] in (select [PHY_IDENT] from unit where [BC_CLASS] = 24 OR [BC_CLASS] = 25 OR [BC_CLASS] = 27 OR [BC_CLASS] = 28) AND [PHY_IDENT] in (select [PHY_IDENT] from biounit where [EXP_BIO] = 'P') AND [PHY_IDENT] in (select [PHY_IDENT] from bioband where ([ZOS] = 'P' OR [ZOS] = 'C') AND ([CROSS_LINK] LIKE '*B*')) AND [PHY_IDENT] in (select [PHY_IDENT] from xshr where [ZON] = 'B' AND [COMPONENT] = '1' AND ([MAT1] = 'Csp/' OR [MAT1] = 'Cps/' OR [MAT1] = 'Cs/'))

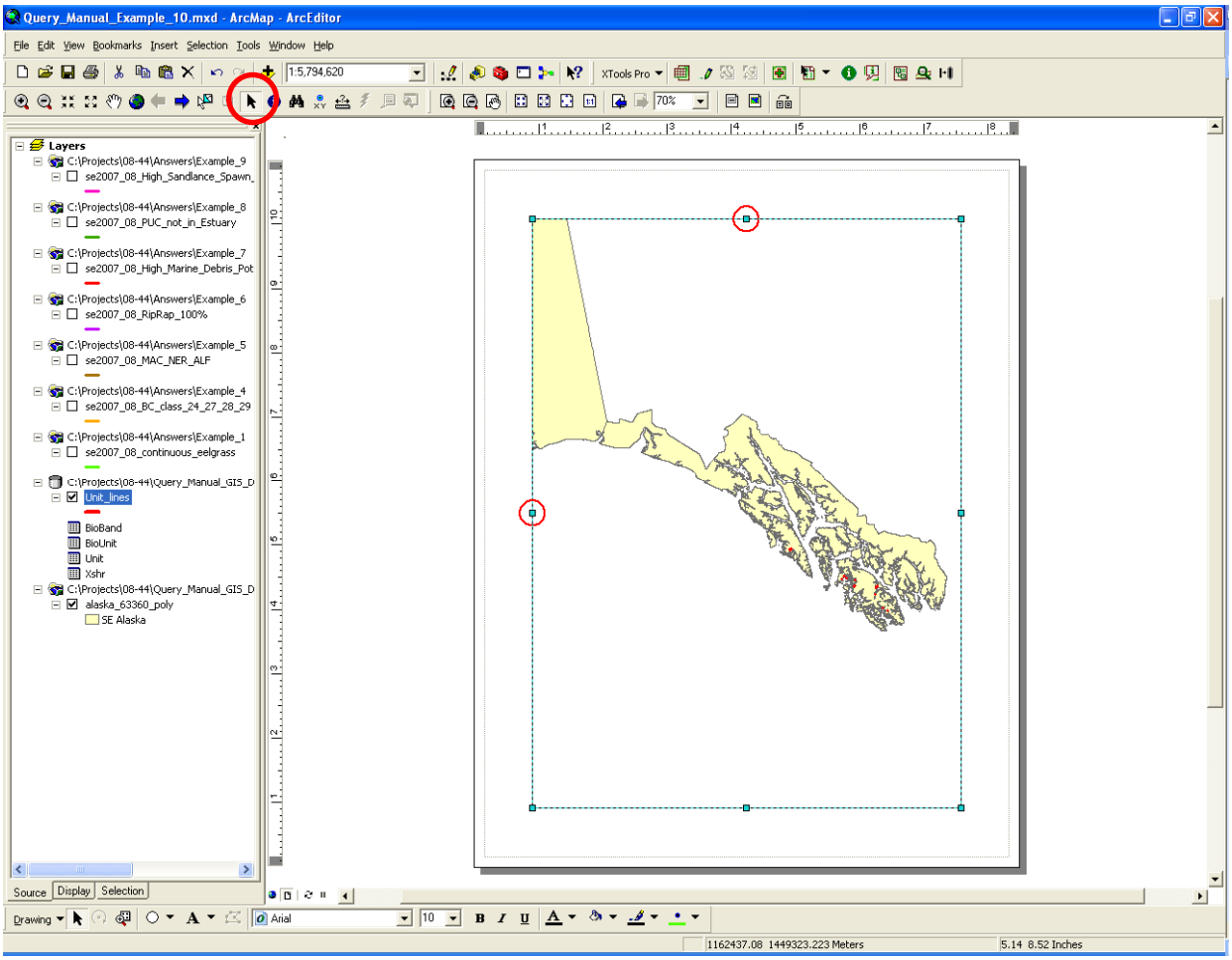
- Click on “OK” and the “Layer Properties” box should now look like this:



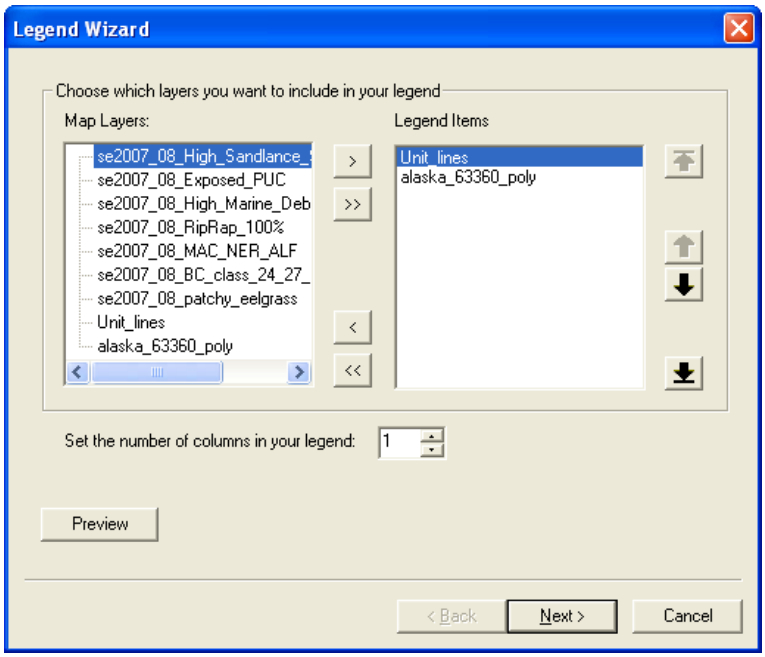
- Before closing this window, click on the “**Symbology**” tab and then click on the large tab with the line running through it under the word “**Symbol**”.



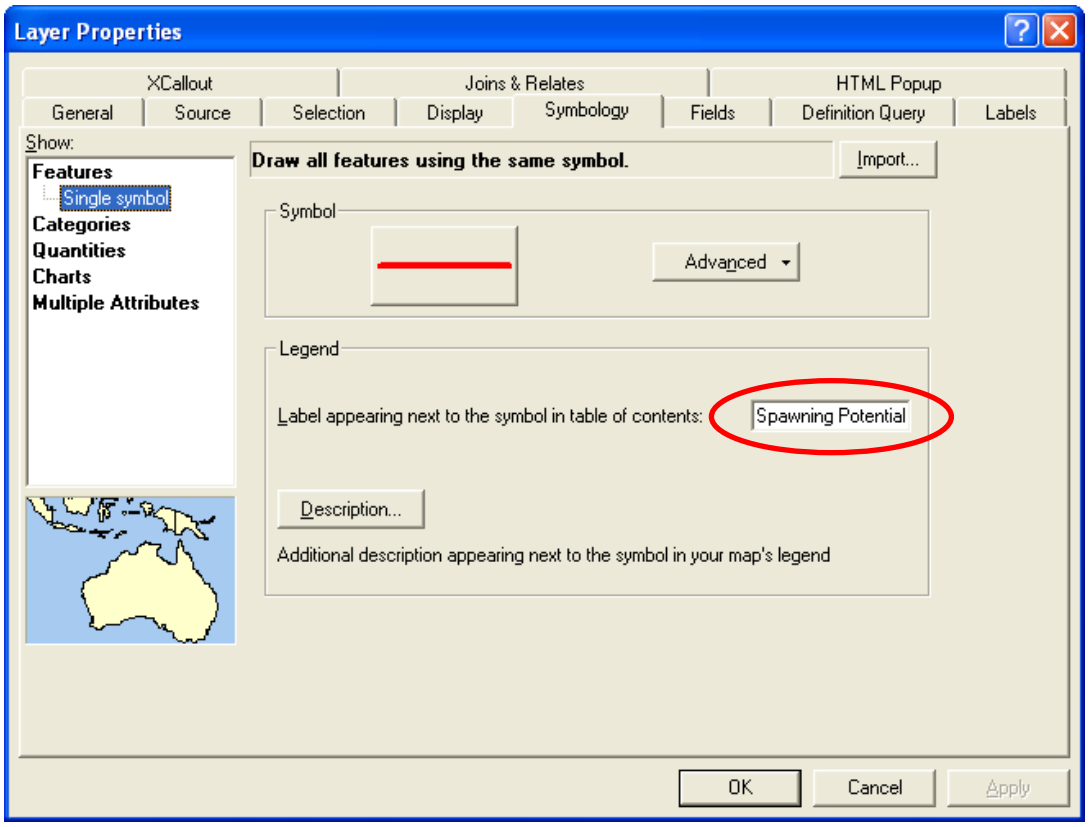
- The "**Symbol Selector**" window that was seen back in Example 1 in this manual will open. Change the line color to red and increase the line width to 3.
- Click "OK" twice to close both windows and we should see a familiar result that was also seen back in Example 9.
- To check that this query worked, right click on the Unit_lines feature class and open the attribute table. There should be **0 out of 18 records** selected. Looking back to Example 9, the query for Moderately High Sandlance spawning potential also came up with 18 out of 21,186 records. This query has come up with the exact same answer, except now it only shows the 18 records of interest on the map while the other records are hidden from view.
- To make a simple map, close the attribute table and click on the **View menu** at the top and scroll down and click on "Layout View". The view will change to the map laid out on a page that is ready to be printed. For simplicity sake we will continue with the page in the "Portrait" orientation but note that the page can be changed to the "Landscape" orientation though the File menu and the "Page and Print Setup…" option.
- The screen should look like the one below, with the red circles noting which tool to use (the Select Elements tool) and where to click and "drag" the data frame to a different size to fit a Landscape orientation if you so choose.



- This is a good start but it is a bit hard to see the areas of interest so use the "Zoom" tool to zoom into an area of interest to you. Also, all good maps should have a north arrow, scale bar, title and legend.
- Click on the **Insert menu** at the top and select "North Arrow". The "**North Arrow Selector**" window will open; select an arrow on the left and click "OK". That arrow will be placed on the map, use the "Select Elements" tool to "drag" the arrow into the top right corner of the map.
- Again click on the Insert menu and select "**Insert Scale Bar**". The "**Scale Bar Selector**" window will open; select a scale bar on the left and click "OK". The scale bar will be placed on the map. It might appear a bit confusing to start with so right click on it and choose "Properties" (or simply double click on the scale bar). The "**Alternating Scale Bar Properties**" window will open. The "**Scale and Units"** tab will let you adjust the scale and units to something that makes sense to you. Also note that you can "drag" the edges of the scale bar to increase or decrease the distance it represents. You can also add a border and a background in this window. When you are happy, "drag" the scale bar into the bottom right corner of the map.
- Again click on the **Insert menu** and click on "**Insert Title**." A text box will appear on the map, type something like "Moderately High Sandlance Spawning Potential" into it. Then "drag" it to a position on the map that suits you, usually near the top. Note that the "Properties" of this text box (accessed by double-clicking on it) allows plenty more options including an option to add a border and background color.
- Final click on the **Insert menu** and choose "Legend". The '**Legend Wizard**" will open. If the "Unit_lines" and "Alaska_63360_poly" are the only layers that you have "checked" on the left side of you map, then they should be the only ones that show up in the "**Legend Items**" box on the right side of the Legend Wizard.

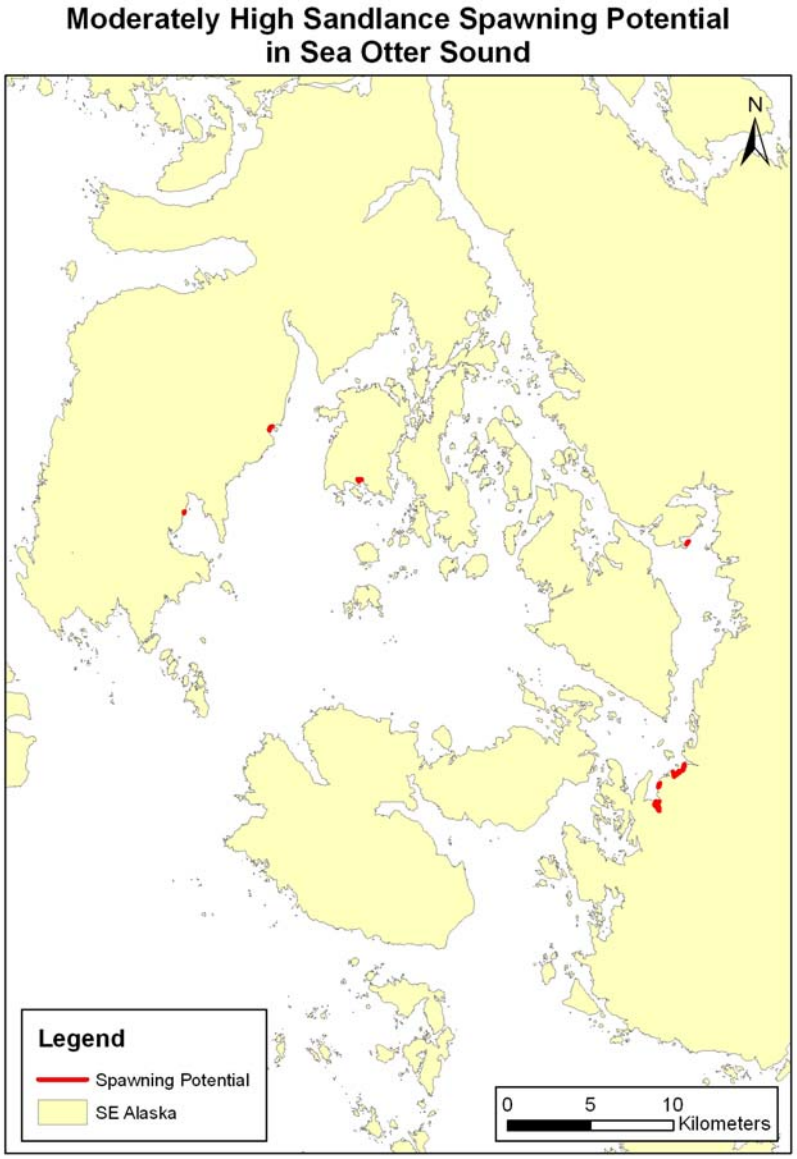


- Click “Next” and now we can add a title of your choice to the legend, leave the title as “Legend”, or simple delete it and have no title. In this case we can leave the title as “Legend”.
- Click “Next” and we can now add a border and background color to the legend which if often nice when making maps.
- The next few options we won’t worry about in this example because they are very detailed options, so click “Next” twice more and then “Finish”.
- The legend is now placed on the map; drag it down into the bottom left corner.
- Finally, double click on the Unit_lines feature class and then on the “**Symbology**” tab. In the box next to the words “**Label appearing next to the symbol in table of contents**:” type “Spawning Potential” and click “OK”.



- Double-click on the “Alaska_63360_poly” feature class and do the same as above, typing “**SE Alaska**” into the box.

- The map should now look something like this:



- To print the map click on the **File menu** and scroll down to "Print".
- To **export the map to a .jpg**, .tif or .pdf among other options, click on the File menu and scrolling down to "**Export Map**". Now choose what folder to save the map in, what "File name" to call it, what file format to save it as and finally the resolution you would like to save it as before clicking on the "Save" button.
- This example is saved in the "Answers" folder as an ArcGIS project (Query_Manual_Example_10.mxd), along with a .jpg of the Spawning Potential map (named "Moderately_High_Spawning_Potential_in_Sea_Otter_Sound.jpg"). Compare these results to yours.

References

Harney, J.N., Morris, M., and Harper, J.R. 2008. ShoreZone Coastal Habitat Mapping Protocol for the Gulf of Alaska. Report prepared for The Nature Conservancy, NOAA National Marine Fisheries Service, and the Alaska State Department of Natural Resources (Juneau, AK). 153 p.

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- Prince William Sound Regional Citizens' Advisory Council
- The Nature Conservancy
- University of Alaska
- U.S. Forest Service
- U.S. Fish and Wildlife Service
- U.S. National Park Service

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