Exercise 4: Tracking Seal Movement[1]

Introduction:

There is a massive amount of digital data available on the web. Much of it exists as shapefiles, digital elevation models (DEMs) and images. There is even more data available as coordinate data. This data can be brought into MS Excel, manipulated, saved and brought into ArcGIS as an event theme. Then, if necessary, it can be exported as a shapefile. Sometimes the manipulation required can be **frustrating**. It may require **patience**, and a lot of time reading the Help files to get the format you want in the database file, and to behave the way it must in ArcGIS.

The purpose of this exercise is to give you some experience with this process. In this exercise you will obtain some coordinate data about the movement of a seal that has been rehabilitated and released into the Gulf of Maine by the Whalenet program of Wheelock College. Whalenet uses advanced satellite technology and telecommunications to monitor and research the actual migration patterns and movements of these animals. The satellite tracking data includes the seal ID, a location class code, a latitude and longitude obtained from the satellite fixes when the seal surfaces and a date and time. The dates and times have the following format: Date (dd.mm.yy): 22.08.96 and time 23:06:55 (hr:min:sec) in Greewich Mean Time (GMT). Location Classes indicate the quality of the satellite fix information. Codes of 0 and up are the best (derived from 4 or more messages)- a Class 0 is good to within between 1,000 and 5,000 meters. Classes 1,2,3 get consistently more accurate. The letter classes are given no estimate of error, but the A's are better than the B's etc. Some of the letter class locations are pretty good (i.e. several fixes over a short period are quite similar), but others vary wildly- especially the longitude.

You will copy the data from their website, bring it into ArcGIS, and explore it with the Tracking Analyst extension.

Procedures:

1. Copy the Ex_04 folder to your workspace.
2. Go to http://whale.wheelock.edu/whalenet-stuff/stop_cover.html and select the data sheet from an active harbor seal.
3. Copy the data and paste it into a new Notepad (or other plaintext) file and save it.
4. Open the file in MS Excel. It will be in fixed width format.
5. Verify that the information in each column is consistent.   Generally the first row is not. If not, delete it.
6. Insert a new row and add the following headings to the indicated columns:
   a. Column A: ID
   b. Column B:
   c. Column C:
   d. Column D: Date
   e. Column E: Time
   f. Column F:
   g. Column G:

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[1] . This exercise was modified from an exercise originally developed by Kate Beard as a demonstration project for visiting students.

h. Column H: Loc_Code (Location Class) – Format this column as text, so that the numbers and letters will have the same format.
i. Column I – Column M:
j. Column N: Latitude
k. Column O:
l. Column P
m. Column Q: Longitude

7. Delete all columns without headings.
8. Delete all rows having location code Z, as these rows have no coordinate data.
9. Remove the N from the Latitudes by using the Replace function.
10. Remove the W from the Longitudes.
    a. We need to make the longitudes negative. The easiest way to do this is to create a new column called Longitude and calculate its values as -1*Original. Next copy the new column and choose Paste Special ->Values and create a third Longitude column.
    b. Delete the first two longitude columns.
11. Format the Latitude and Longitude columns as numbers with 3 decimal places.
12. We need to create a combined Date_Time column, by concatenating the Date and Time columns
    a. Insert a new column after Time and name it Date_Time.
    b. Creating this new column is tricky. Excel will retain the date format, but it will convert the time to a decimal ranging from 0 (12:00:00 A.M.) to 0.9999999… (11:59:59 P.M.). To avoid this we need to save the time as a text string. To concatenate cells B2 and C2 to create D2, you need to do the following: =B2&" "&TEXT(C2, "hh:mm:ss")

|	A	B	C	D	E	F	G	H
1	ID	Date	Time	Date_Time	Loc_Code	Lat	Long	
2	91092	04.04.09	15:38:34	04.04.09 15:38:34:	3	39.395	-74.390	
3	91092	05.04.09	15:19:33	05.04.09 15:19:33:	B	39.665	-73.604	
4	91092	06.04.09	20:25:23	06.04.09 20:25:23:	3	39.855	-73.558	
5	91092	07.04.09	17:23:52	07.04.09 17:23:52:	0	39.968	-73.373	
6	91092	08.04.09	14:36:22	08.04.09 14:36:22:	3	39.969	-73.387	
7	91092	09.04.09	0:17:43	09.04.09 00:17:43:	A	39.969	-73.399	
8	91092	09.04.09	7:16:03	09.04.09 07:16:03:	A	39.966	-73.388	
9	91092	10.04.09	5:24:08	10.04.09 05:24:08:	B	39.963	-73.391	
10	91092	11.04.09	18:21:11	11.04.09 18:21:11:	1	39.996	-73.414	
11	91092	13.04.09	2:04:32	13.04.09 02:04:32:	2	40.007	-73.383	
12	91092	13.04.09	12:06:35	13.04.09 12:06:35:	1	40.000	-73.353	
13	91092	15.04.09	1:18:59	15.04.09 01:18:59:	3	39.951	-73.323	
14	91092	15.04.09	17:39:20	15.04.09 17:39:20:	0	39.920	-73.177	
15	91092	16.04.09	6:01:18	16.04.09 06:01:18:	2	39.927	-73.131	
16	91092	18.04.09	0:09:09	18.04.09 00:09:09:	2	39.891	-73.043	

13. Save your workheet as an Excel (97-2007) Workbook, so that it has the .xls extension..
14. Close Excel.

15. Start ArcMap and open Atlantic_Coast.mdx.

16. Add the table to ArcMap and open it. Verify that the Date_Time, Latitude and Longitude columns look correct. If not, remove the table from the project and return to Excel correct any errors.
17. When the table imports correctly, go to the File menu -> Add Data and select Add X,Y Data, the default values will probably be correct, but if not set the X field to Longitude and the Y field to Latitude.
    a. Click on the Edit button and Select a Geographic Coordinate System>North American Datum 1983, click OK.
    b. You have just created an Event Theme, but you will need a shapefile. Right-click on the Event Theme and choose Data>Export Data and save it in your folder with the appropriate name.
    c. You can remove your Event Theme.
18. From the Layer Properties menu, select the General tab and set the Display Units to miles.
19. From the Customize menu, select Extensions and place a checkmark next to Tracking Analyst to add the extension to your project.
    a. From the Customize menu select Toolbars and click on Tracking Analyst to add the toolbar to your project.
    b. Click the Add Temporal Data Wizard button on the Tracking Analyst toolbar.
    c. For the Data Source, browse to your seal's shapefile
    d. For the date/time field use DATE_TIME.
    e. For tracks use ID
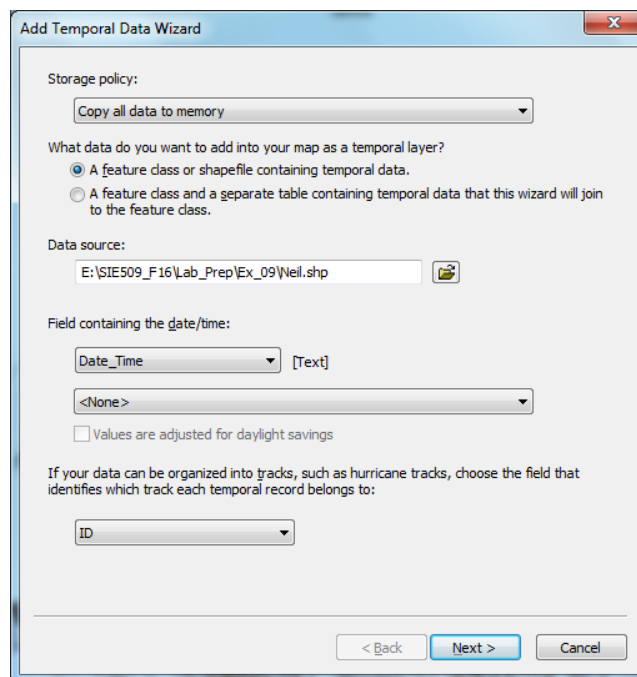
20. Click Next. You will see the window that lets you specify the date time formats of your data (See the window below).
    a. **Type** in the date format as shown (dd.mm.yy).
    b. **Select** the time format as shown (HH:mm:ss).

c. Click Next.
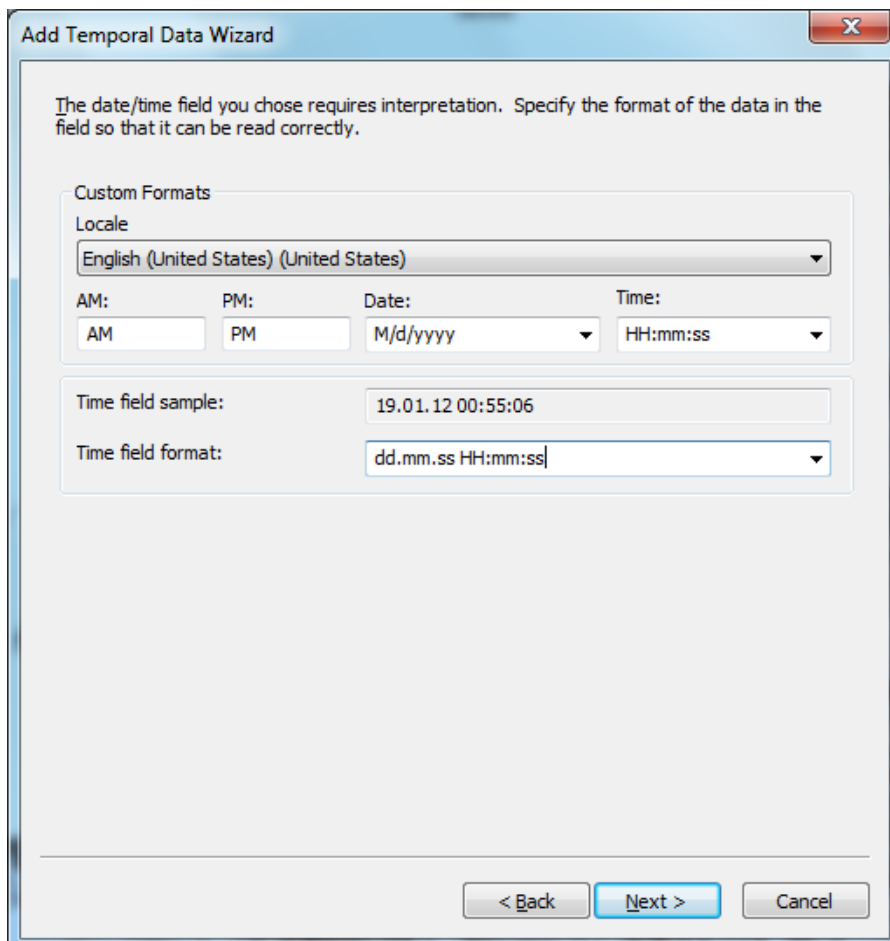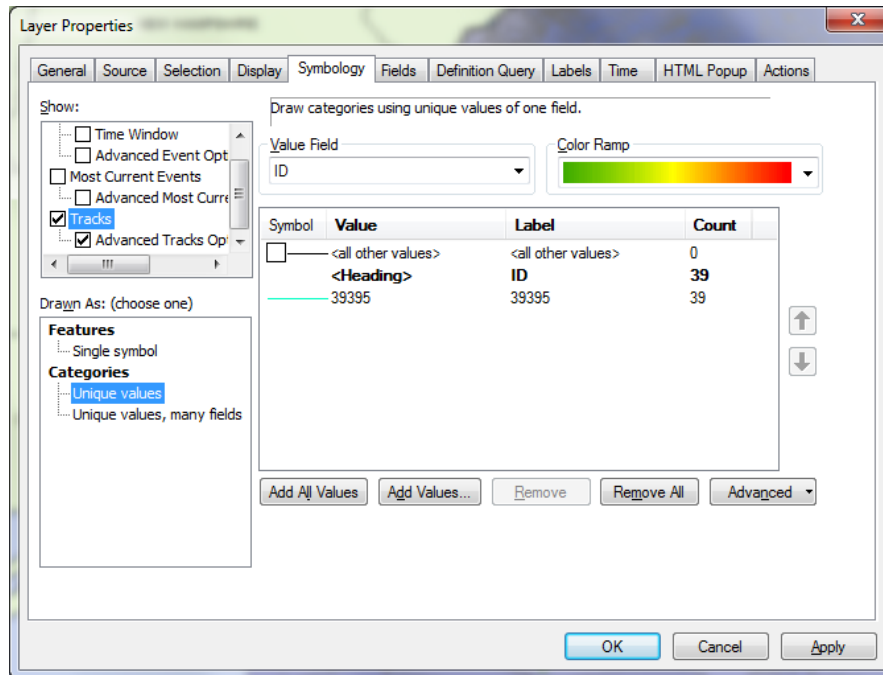
21. Click Finish to add this layer to ArcMap. Your seal's layer appears in the table of contents with a default symbol.
22. Make the seal's tracks an appropriate color and size.
    a. In the seal's Properties, select the Symbology tab. Check the Tracks check box in the Show panel.
    b. In the Drawn As panel select unique value and select ID as the Value Field.
    c. Select the Advanced Tracks Option and Choose Smooth Curve.
23. Select properties and the symbology tab for your seal again. This time select the Time Window under events.
    a. In the Time Window set the period to 60 and the units to days. Under the Drawn As window select Color.
    b. Select a color ramp and set the number of classes to 8.
    c. Click OK. The color range and classes will appear in the table of contents but you will no longer see the tracks on the map. To see them you will use the Playback Manager.
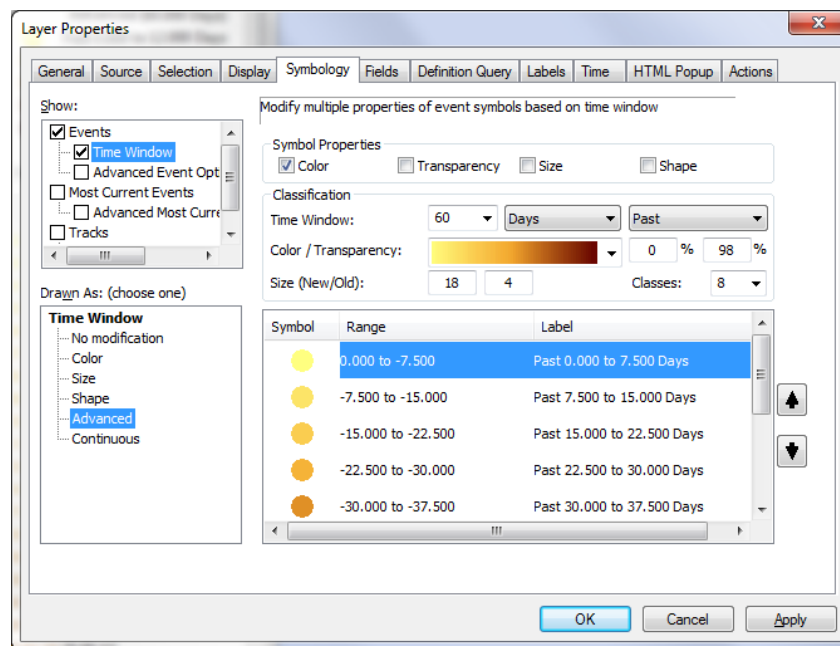
Using the Playback Manager
24. Select the Playback Manager from the Tracking Analyst toolbar.   The Playback Manager helps to monitor changes in your data. Because your seal's data has time stamps for locations where he was tracked, you can use the Play Back Manager to indicate time passing in the time window as his movements are displayed on the map.
25. Click the options button and under the Set playback window to temporal extent of: select the your seal. Set the playback rate to Days.
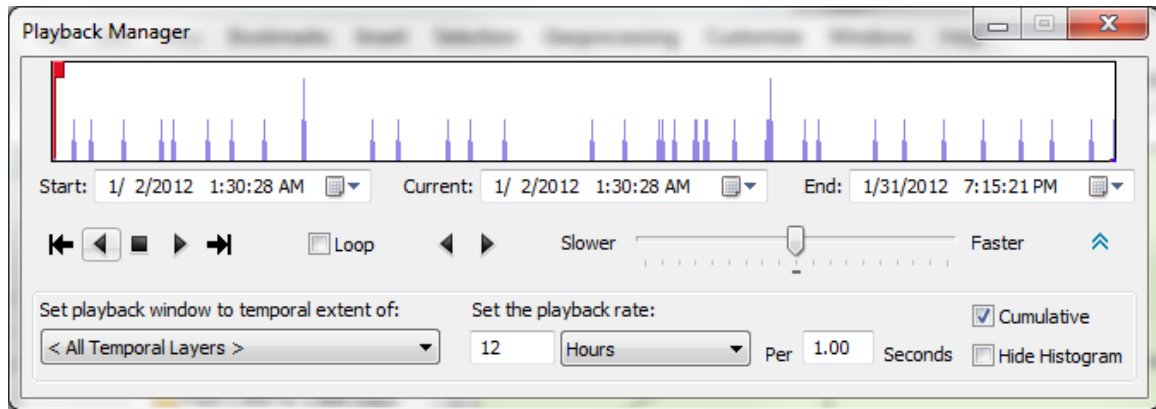
Figure showing the Playback Manager. It includes play, stop, replay, end and beginning buttons, start, current and end times for the data file you select and other options. The top panel shows the histogram of data available for the file you select.

Using the playback histogram
You can use the play button, the time indicator, and the Next and Previous buttons to the right of the histogram to change the point in time that will display on the map. The Next and Previous buttons can only be used when you're not playing data. If you're playing data, click the Stop button before using these buttons.

You can also click a point on the histogram to move the time indicator to that point in time. As with the Next and Previous buttons, this method works only when not playing data using the play button.

If you adjust the time by clicking and dragging the time indicator on the histogram, any labels you have applied to the layer will not appear on the map for performance reasons. Labels will reappear after you have released the mouse button.

The first time the Playback Manager is opened, the start time defaults to the earliest time of the temporal layers in your view, and the end time defaults to the latest time of the tracking layers in your view. When you select Your seal, the times are set to her start and end times.

26. Play the track for your seal by using the play button or by dragging the time indicator in the histogram. You may want to zoom in and out as on the map as you adjust the play back to see more or less detail on the tracks.
27. When you are finished, create an attractive layout for your seal that shows his tracks.