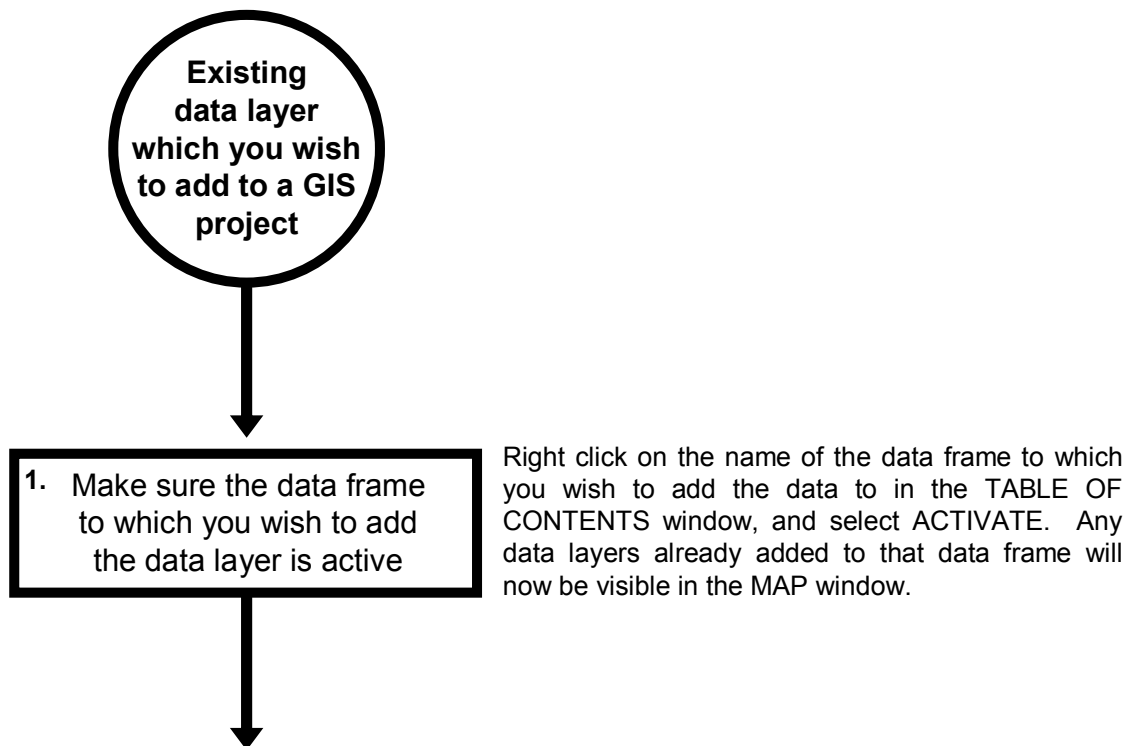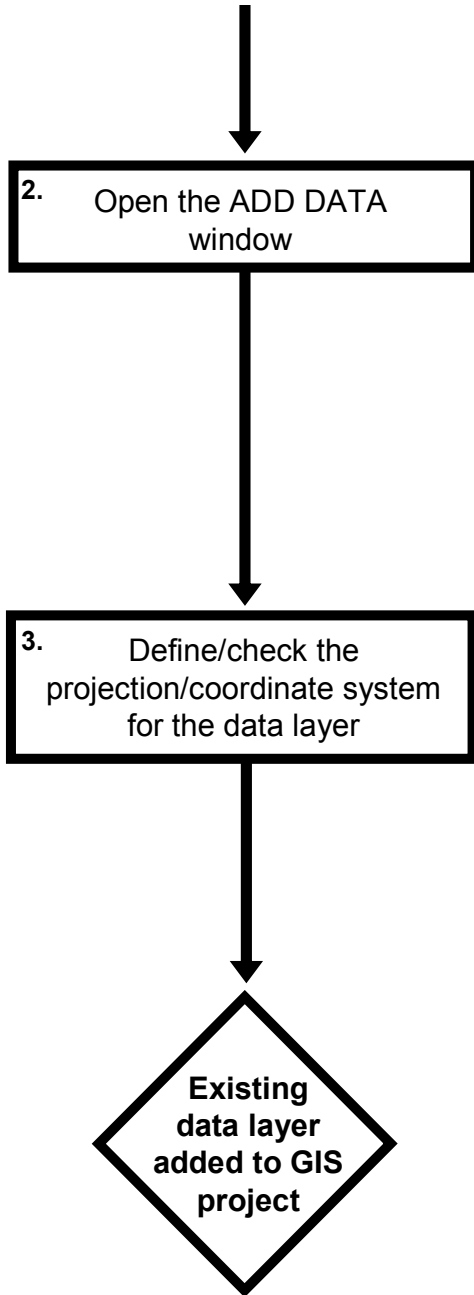# *How To Add Data To A GIS Project*

11. How to add an existing data layer to a GIS project:

In many cases, you can use data layers that have already been created by someone else in your GIS project. This is much quicker than having to create all the data layers you might wish to use yourself, and anything which avoids having to do additional work is good. However, before you use pre-existing data layers, you need to find out a little about them. At a minimum, you need to know what projection/coordinate system they are in, what datum they are based on, what their resolution is and what units any values are in. It may also be useful to know who created it, when it was created and why it was created. This will avoid you using data layers that are inappropriate for your project, that are out-of-date or that are not of an appropriate resolution. **NOTE**: It is essential that you know the projection/coordinate system and datum in order to ensure that data from different data layers overlay each other properly.

To add an existing data layer to a GIS project, work through the following flow diagram:

Existing data layer which you wish to add to a GIS project

1. Make sure the data frame to which you wish to add the data layer is active

Right click on the name of the data frame to which you wish to add the data to in the TABLE OF CONTENTS window, and select ACTIVATE. Any data layers already added to that data frame will now be visible in the MAP window.

2. Open the ADD DATA window

3. Define/check the projection/coordinate system for the data layer

Existing data layer added to GIS project

Right click on the name of the data frame in the TABLE OF CONTENTS window, and select ADD DATA. Browse to the location of your data layer on your computer, select it and click ADD. In addition, at this point it may ask you whether you would like to build a pyramid. Select YES. **NOTE**: If the location where your data layer is not listed, you may need to add it to ArcCatalog before you add the data layer to your GIS project (see HOW TO ADD A NEW DISK DRIVE, DIRECTORY OR FOLDER TO ARCCATALOG on page 75 for more details).

If there is no projection/coordinate system already assigned to your data layer, a window will come up when you try to add it saying that the data are missing a spatial reference. In this case, you need to know the right projection/coordinate system and assign it yourself. First, click OK to close the warning window. Next, in the TOOLBOX window, go to DATA MANAGEMENT TOOLS> PROJECTIONS AND TRANSFORMATIONS> DEFINE PROJECTION. Select the data layer's name from the drop down menu in the top window. Next, select the appropriate projection/coordinate system in the lower window and click OK (see HOW TO SET THE PROJECTION/COORDINATE SYSTEM FOR A DATA LAYER SO THAT IT WILL PLOT PROPERLY OVER OTHER DATA LAYERS on page 95 for more details).

12. How to change whether the contents of a data layer are shown in the MAP window or not:

Once you have added a data layer to your GIS project, you can choose whether you want to turn it on (so that it is displayed in the MAP window), or whether you want to turn it off (so that it is not displayed in the MAP window). This is done by clicking on the box to the left of the data layer's name in the TABLE OF CONTENTS window. If there is a tick in this box, this means that it will be displayed in the MAP window. If there is not a tick in this box, it will not be displayed in the MAP window. Clicking on this box will change whether there is a tick there or not.

If you find that the names of your data layers are not listed for a given data frame, you may need to expand the contents for that data frame. This is done by clicking on the + sign next to the name of the data frame in the TABLE OF CONTENTS window. This will expand its contents and show you a list of the data layers present in that data frame. When this list is expanded, you can click on the – sign beside the name of the data frame to hide the list of data layers.
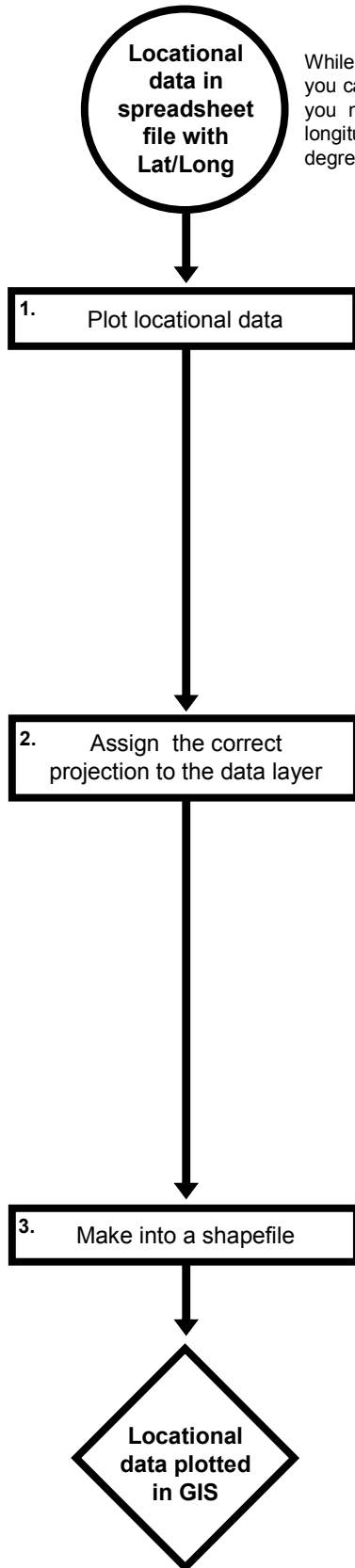
Similarly, for an individual data layer, you can change whether you see the categories, colours and symbols used to display its contents or not. If there is a + sign to the left of the name of the data layer in the TABLE OF CONTENTS window, this information is hidden. If there is a – sign here, this information will be shown. By clicking on the box containing one of these symbols next to the name of the data layer in the TABLE OF CONTENTS window, you can change between whether this information is displayed or not.

13. How to create a data layer from latitude and longitude coordinates for locational data in a GIS project:

Undoubtedly, one of the most common things that you, as a marine biologist, will want to do is to add locational data to a GIS project. That is, you will have data which represent points in space. These will usually, but not always, be recorded in latitude and longitude. These may represent locational records where a species was recorded, sampling locations or other similar data that are linked with discrete points in space. Since the widespread use of GPS receivers, it has become very easy to record large amounts of such data for use in GIS projects. However, in order to be able to use such data in GIS projects, you need to know how the GPS receiver is set up, what datum it is recording positions in and what units the coordinates are in. For example, you need to know whether your data are recorded to the WGS 1984 datum (which is the default for most GPS receivers), or whether it has been set to another datum (see chapter nine for more details).

Similarly, you need to know whether the latitude and longitude values are recorded in decimal degrees; degrees, minutes and seconds; degrees and decimal minutes; or some other format. Specifically, to plot locational data in a GIS which has been recorded in latitude and longitude, you will need to convert it into decimal degrees. If this is not done correctly, the data will not plot in the right places. Converting data into decimal degrees incorrectly is one of the most common errors that marine biologists make when trying to use such data in a GIS project. The relevant conversion formulae for degrees, minutes and seconds, and degrees and decimal minutes are provided in the section on HOW TO CONVERT LATITUDE AND LONGITUDE LOCATIONAL DATA INTO DECIMAL DEGREES (page 90). Once the correct conversion has been applied to the latitude and longitude data (which can be done quickly and easily in a spreadsheet programme), the data can be added into a GIS as outlined in the flow diagram on the next page.

NOTE: If you are using a computer which is not set to use a decimal point (.) as the symbol to mark the division between whole numbers and decimal fractions (as in 12.345), this may cause problems. If you find you are having problems, you may need to change the settings on your computer to use a decimal point as the decimal separator. In Windows 7 and Windows 8, this can be changed by going to CONTROL PANEL> CLOCK, LANGUAGE AND REGION> CHANGE THE DATE, TIME, OR NUMBER FORMAT> ADDITIONAL SETTINGS.

Locational data in spreadsheet file with Lat/Long

While this example is based on having data in a spreadsheet file, you can also use data from other sources. However, in all cases, you need to have a discrete column for latitude and one for longitude. The values in these columns need to be in decimal degrees, with negative values for south and west.

1. Plot locational data

Click on the FILE menu on the main menu bar and select ADD DATA> ADD XY DATA. Once the ADD XY DATA tool window is open, you need to browse to select the file which contains the data you wish to plot in the top section of the window. Next, select the field with longitude values from the drop down menu in the X FIELD window, and the latitude value from the drop down menu in the Y FIELD window. Do not close the tool window, but rather move on to step two.

2. Assign the correct projection to the data layer

When you open the ADD XY DATA tool, it will automatically assume that the projection/coordinate system for your XY data is the same as that for your data frame. This is shown in the lower half of the ADD XY DATA window. If this projection/coordinate system is correct, you can click the OK button and run the tool. If it is not correct, you need to set the projection/coordinate system to the correct one before you run the tool. To do this, click on the EDIT button at the bottom right corner of the ADD XY DATA tool window. This will open the SPATIAL REFERENCE PROPERTIES window. In this example, you will need to use a geographic projection/coordinate system since your data are in latitude and longitude, and select the right datum. If you have used a GPS receiver to collect your data the chances are that it is WGS 1984 (**NOTE**: Do not assume that this is correct – you need to check that it is). This is done by selecting: GEOGRAPHIC COORDINATE SYSTEM> WORLD> WGS 1984.PRJ in the upper section of the SPATIAL REFERENCE PROPERTIES window. Next, click OK to close this window. Finally, click on OK in the ADD XY DATA window. Other projections/coordinate systems can be selected in a similar manner. When a window asking about object ID fields appears, do not worry and just click OK (you will sort this out in the next step).

3. Make into a shapefile

The event data layer created in step one is temporary and may disappear when you close your GIS project. In order to make a permanent version of your data layer, you need to convert it into a shapefile. This can be done using the EXPORT DATA tool. To access this tool, right click on the name of the data layer you just created in the TABLE OF CONTENTS window, and select DATA> EXPORT DATA. In the OUTPUT FEATURE CLASS window, type location and the name which you wish to use to save the data layer. When asked if you want to add the exported layer to the map as a layer, click YES. Finally, in the TABLE OF CONTENTS window right click on the name of the data layer created in steps one and two, and select REMOVE.
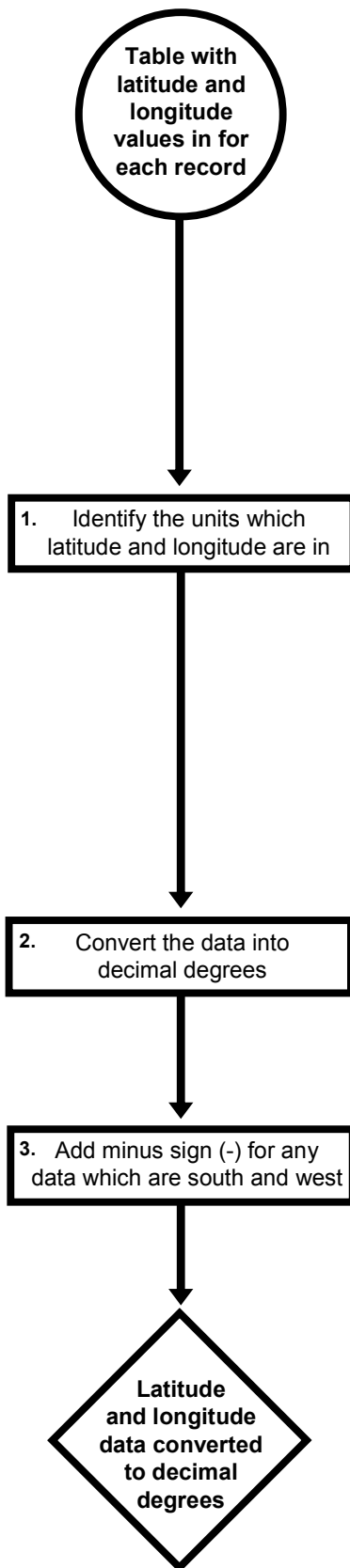
Locational data plotted in GIS

14. How to convert latitude and longitude locational data into decimal degrees:

In order to plot locational records in a GIS project, your latitude and longitude values need to be in decimal degrees. As long as you know the format which these values are in, it is relatively straight-forward to convert your data into deecimal degrees. Details of how to do this for two common formats which latitude and longitude values are recorded in (degrees minutes and seconds, and degrees and decimal minutes) are provided below. However, if you do not know what format your latitude and longitude values are in, you cannot convert them to decimal degrees and so cannot use them in a GIS project. Therefore, it is essential that you record this information correctly and clearly.

Data in degrees, minutes and seconds should be recorded clearly as XX° XX' XX" with N after it for latitudes which are north of the equator or an S after it for latitudes which are south of the equator or XXX° XX' XX" followed by E for longitudes which are east of the Greenwich Meridian or W for longitudes which are west of the Greenwich Meridian. These must include the unit markers which tell you that it is in degrees(°), minutes (') and seconds ("). Data in degrees and decimal minutes should be recorded as XX° XX.XXX' with N after it for latitudes which are north of the equator or an S after it for latitudes which are south of the equator or XXX° XX.XXX' followed by E for longitudes which are east of the Greenwich Meridian or W for longitudes which are west of the Greenwich Meridian, using a decimal point to clearly separate out the minutes from the decimal fractions of a minute.

If you are working with a data set which contains records that you have not collected, it may be difficult to tell what units have been used, and indeed whether the same units have been used in every case. For example, in distributional data sets, it is quite common for some people to have submitted locational records in degrees, minutes and seconds and others in degrees and decimal minutes, but for all of them to have been entered as if they were in the same format. Such data sets are virtually useless for GIS analyses since it will be impossible to separate out which records have been recorded in which format. Therefore, if you are collating records from a wide range of sources pay particular attention to whether different people have used different units (despite any requests to use a specific format) when pulling the data together as this saves spending the time building a data set which you cannot analyse because you have positions recorded in mixed formats.

NOTE: While ArcGIS 10.1 does have a tool to convert positional data between different notations (see DATA MANAGEMENT TOOLS> PROJECTIONS AND TRANSFORMATIONS> CONVERT COORDINATE NOTATIONS), it is often much easier to do this in a spreadsheet software package before you bring your data into your GIS project in the first place using the instructions which start on the next page.

Table with latitude and longitude values in for each record

↓

1. Identify the units which latitude and longitude are in

↓

2. Convert the data into decimal degrees

↓

3. Add minus sign (-) for any data which are south and west

↓

Latitude and longitude data converted to decimal degrees

In order to be able to convert latitude and longitude values into decimal degrees, you must first know what units they are in. There are two common formats. These are degrees, minutes and seconds, and degrees and decimal minutes. In general, when data are in degrees, minutes and second, they will be written down as XX° XX' XX'' with an N (north) or S (south) after it for latitude and XXX° XX' XX'' with an E (east) or W (west) after it for longitude. For degrees and decimal minutes, they will generally be written down as XX° XX.XXX' with an N (north) or S (south) after it for latitude and XXX° XX.XXX' with an E (east) or W (west) after it for longitude.

If you are unsure which format some data are in, often the quickest way is to look at the last two or three digits (which will either be seconds or decimal minutes). If the lead digit for some of these is greater than 5, then it is most likely the data are in degrees and decimal minutes (since the value for seconds cannot go above 59). However, you need to make sure that you have this correct before proceeding. **NOTE**: This assumes that data have been recorded and entered in a consistent format, which is not always the case, and is something which needs to be ascertained and corrected, if required, before you do anything else with your data set.

If your data are in degrees, minutes and seconds, they can be converted into decimal degrees using the following formula: Degrees + (minutes/60) + (seconds/3600). If your data are in degrees and decimal minutes, they can be converted into decimal degrees using the following formula: Degrees + (minutes/60).

In decimal degrees, locations which are south of the equator are negative, while those north of it are positive. Similarly, locations which are west of the Greenwich Meridian are negative, while those to the east are positive. It is best to add any required minus signs after converting to decimal degrees as adding a negative sign can affect the calculation of the formula if it is not added correctly.