

Exercise One: Creating A Map Of Species Distribution For A Publication

One of the first, and most common, tasks you will want to do in using GIS is to produce maps for use in presentations, reports and publications. This is not as straight-forward as it first may seem and it may take you several attempts to get a map which looks exactly how you want it to. However, it is well worth the effort spent getting it right as a good map is extremely useful for getting information across to other people in an easy to understand format.

You will usually want your final map to have a number of key characteristics. Firstly, you will want it to display all the data layers you wish to show (and no other data layers). Secondly, you will want these to be displayed in a meaningful way. For example, you may want it to have different symbols marking the locations where each species was recorded in a specific study area so that you can tell them apart and compare the distributions of different species. Thirdly, you will want to provide additional information which helps put your data layers in context. For example, in a map of species locational records, you might also want to have information on water depth and the position of any land in the vicinity to make it easier to interpret how the distributions of different species vary in terms of their proximity to the coast or their preferred water depths. Fourthly, you will need to have some information which tells anyone who looks at the map what part of the world it represents. This can be done by putting a 'graticule' around it which show the latitude and longitude for your map around its edges. Finally, you will need to ensure that the projection used for your map is appropriate to the part of the world it represents and does not distort the shape or position of important features within it. This will ensure that the information presented in it can be easily understood. You also want your map to have an appropriate extent. That is, you do not want your map to be so 'zoomed in' that you cannot see all your features of interest, or so 'zoomed out' that the features you are interested in only occupy a very small portion of it and cannot be separated from each other.

You may also want to include a key which tells people what each symbol present on your map means. However, this is optional and you may choose to simply provide a description of the symbols and what they mean in the figure legend (for example, Red circles: Species 1; Blue circles: Species 2; etc). Other optional features include a scale bar so that people know how big features are in your map and an arrow which indicates the direction of North.

As with almost everything in GIS, thinking about what you need to include in your map, and how you are going to display it, before you start will benefit you in the long run. This is because if you rush in without thinking it through properly first, you will undoubtedly make mistakes. Of course, there is nothing wrong with making mistakes, and sometimes its the best way to learn how to do something, but a bit of thought in advance will save time and effort later.

In this exercise, you will make a map of the distribution of bottlenose dolphin records from surveys in the northern North Sea. Your final map will also include information on water depth and the position of land, so you can get an idea of how bottlenose dolphin are distributed in relation to these two features. While the locational records for bottlenose dolphin provided here are not real, they do represent an approximation of their real distribution in this region.

Before you start this exercise, you will first need to create a new folder on your C: drive called GIS_EXERCISES. To do this on a computer with the Windows 7 operating system, click on the START menu and select MY COMPUTER. In the window which opens, double-click on the icon for your C: drive (this may be called WINDOWS (C:)). This will open a window which displays the contents of your C: drive. To create a new folder, right click on this window and select NEW> FOLDER. This will create a new folder. Now call this folder GIS_EXERCISES by typing this into the folder name to replace what it is currently called (which will most likely be NEW FOLDER. This folder, which has the address C:\GIS_EXERCISES\ will be used to store all files and data for the exercises in this book.

Next, you need to download the source files for four data sets from www.gisinecology.com/books/data/marinebiologysupplementaryworkbook. When you

download these files, save them into the folder C:\GIS_EXERCISES\ which you have just created. These data sets are:

1. Bottlenose_Dolphin.xls: This is a spreadsheet file which has latitude and longitude for the positions of bottlenose dolphin sightings from a survey conducted in northeast Scotland. **NOTE:** The latitude and longitude have already been converted into decimal degrees. If you are doing this for your own data set, you would need to make sure that all your latitudes and longitudes values have been correctly converted into decimal degrees before you start.

2. Depth_North_Sea: This is a line data layer which contains information on water depth which you can use to create your map. You will need to download all the files called Depth_North_Sea (each with a different extension) in order to be able to use it. This data layer is in the geographic projection and uses the WGS 1984 datum. **NOTE:** The depth values are not accurate and is only provided here as an approximation for illustration purposes. As a result, it should not be used for any purpose other than these exercises.

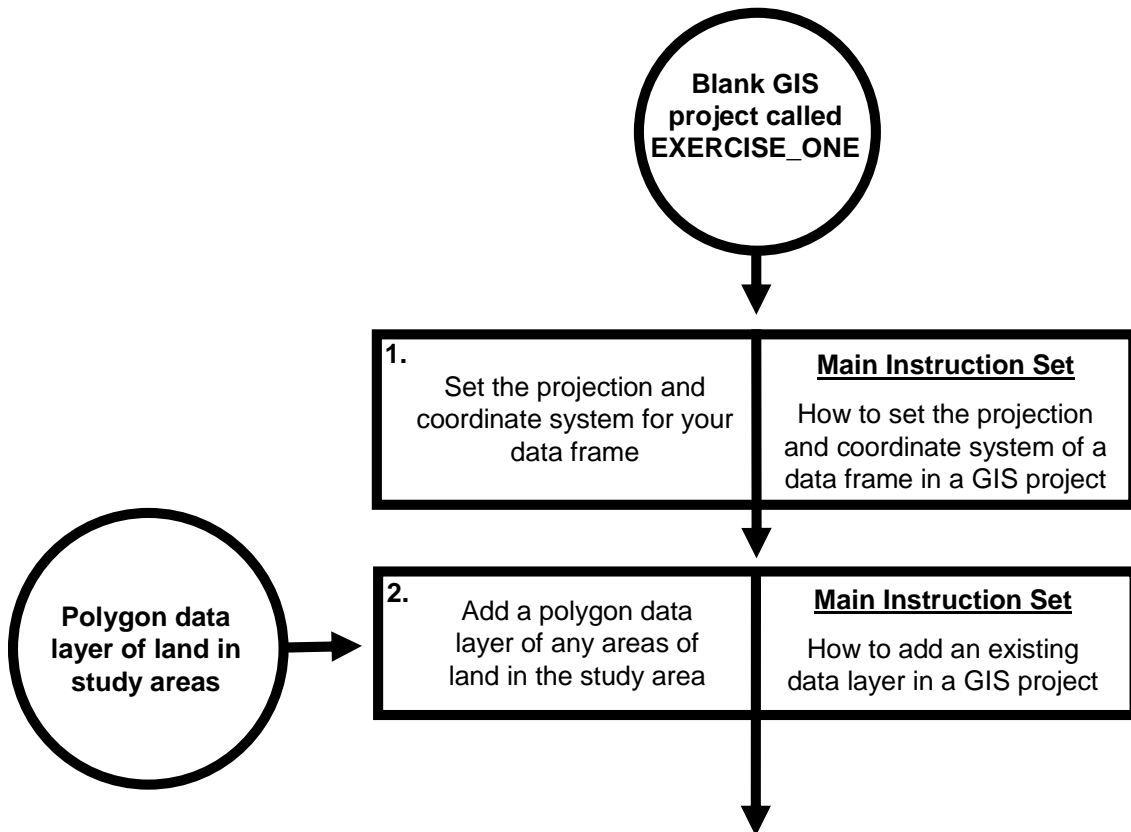
3. Land_North_Sea: This is a polygon data layer which contains information on land in this region which you can use to create your map. You will need to download all the files called Land_North_Sea (each with a different extension) in order to be able to use it. This data layer is in the geographic projection and uses the WGS 1984 datum. **NOTE:** The land information is not accurate and are only provided here as an approximation for illustration purposes. As a result, it should not be used for any purpose other than these exercises.

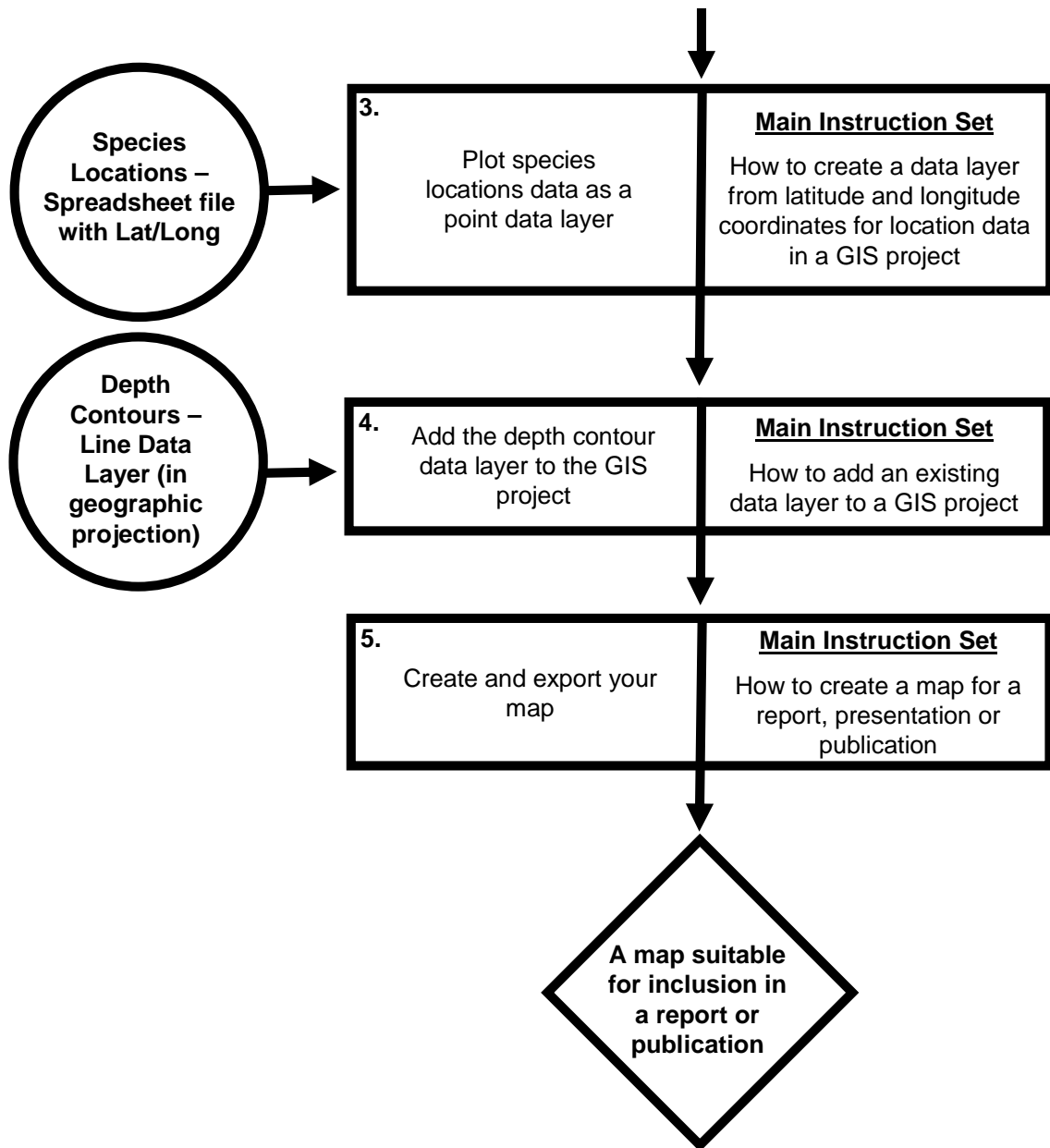
Once you have all these files downloaded into the correct folder on your computer, and understand what is contained within each file, you can move onto creating your map. The starting point for this is a blank GIS project. To create a blank GIS project, first, open the ArcView 9.3 software by opening the ArcMap module. When it opens, you will be presented with a window which asks: START USING ARCMAP WITH. Select A NEW EMPTY MAP. Now, click OK at the bottom of this window. This will open a new blank GIS project. (**NOTE:** If this window does not appear, you can start a new project by clicking on FILE from the main menu bar area, and selecting NEW. When the NEW window opens, select BLANK DOCUMENT and click OK.)

Once you have opened your new GIS project, the first thing you need to do is save it under a new, and meaningful, name. To do this, click on FILE from the main menu bar area, and select SAVE AS. Save it as EXERCISE_ONE in the folder C:\GIS_EXERCISES\.

The next step is to read over the summary flow chart for this exercise. This will help you identify all major steps you need to carry out and the individual instruction sets you will need to follow to do them. The summary flow diagram for this exercise is provided on the next two pages.

Summary Flow Diagram For Creating A Map Of Species Distribution





Once you have familiarised yourself with the summary flow diagram outlining the major steps you will need to complete and which instruction sets can be used to complete them, you need to read through the instruction set for the first step in the flow diagram in its entirety (see below), before working through it step by step. Once you have completed the first step, read through the instructions again to check that you have completed it properly. It is important to do at this stage as you need to use the results of one step as the starting point for the next. It is much easier to spot where you have gone wrong at the end of an individual step, rather trying to work it out later when you get stuck as a

result of a mistake made at this stage. Once you have completed the first step, move onto the second step and repeat this process, and so on until you have completed all the steps in the summary flow diagram.

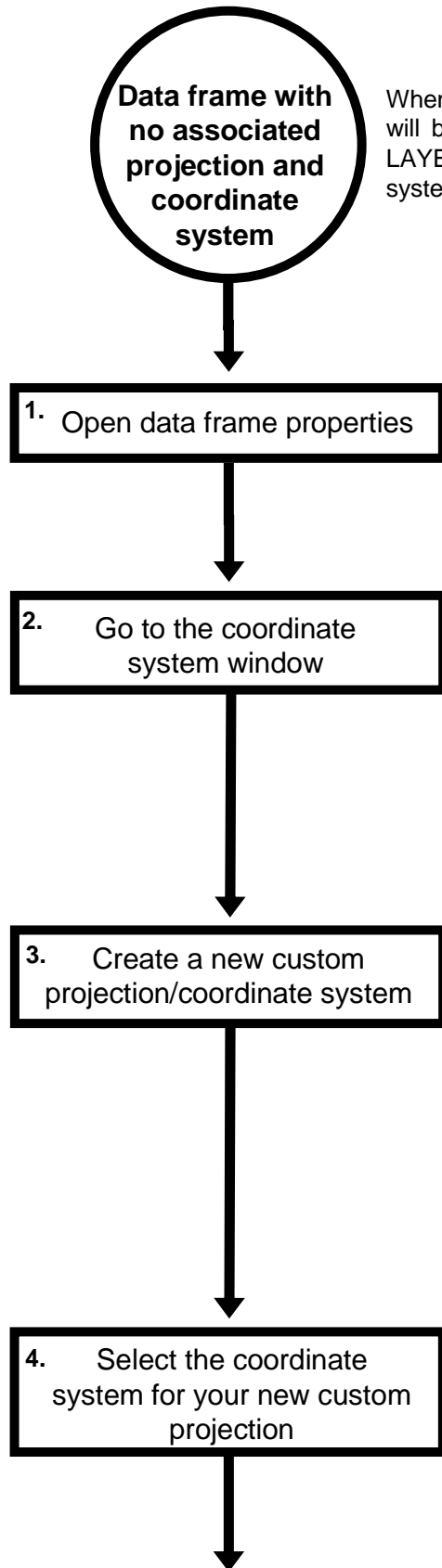
At various points through out the exercise, images of contents of the MAP window, the LAYOUT window, the TABLE OF CONTENTS window and/or the ATTRIBUTE TABLE window will be provided so that you have an idea of what your project should look like at that specific point. Check your GIS project against these images. If they do not match up, you will need to go back and work out where you have gone wrong.

NOTE: It is important that you save your GIS project after you complete each step. This can be done by going to the FILE menu on the main menu bar and selecting SAVE.

Instruction Sets For The Individual Steps Identified In The Summary Flow Diagram:

STEP 1: SET THE PROJECTION AND COORDINATE SYSTEM OF YOUR DATA FRAME:

These instructions are based the instructions set *How to set the projection and coordinate system for a data frame in a GIS project* (from page 89 in *An Introduction To Using GIS In Marine Biology*). For this exercise, the projection and coordinate system that will be set to a custom transverse mercator centred on the middle of the area of data collection. This central position is latitude 56.5°N and longitude 1.0°W (or latitude 56.5° and longitude -1.0° in decimal degrees). This projection was chosen as it provides an accurate representation of the shape and relative positions of features in the study area. In addition, it can also be used to accurately measure distances and areas in real world units, which will be important for later exercises. This custom transverse mercator projection will use the WGS 1984 datum. This datum is used because it is the same as that used during data collection and for the existing data layers.



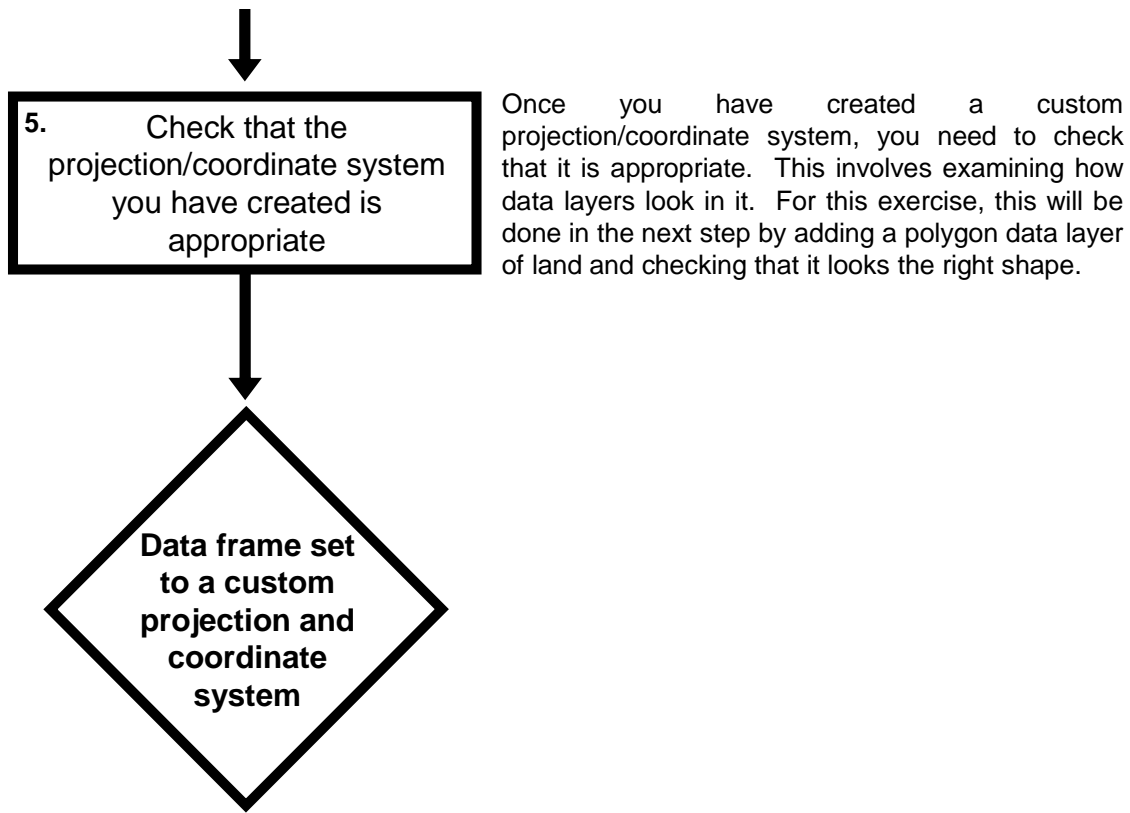
When you open a new GIS project in ArcView 9.3, there will be an empty data frame (called, rather confusingly, LAYERS). It will not have a projection or coordinate system associated with it

To open the properties of a data frame, right click on its name (in this case LAYERS) in the TABLE OF CONTENTS window, and select the PROPERTIES option. If this is not visible, go to the WINDOWS menus and click on the TABLE OF CONTENTS option.

Select the COORDIANTE SYSTEM tab in the DATA FRAME PROPERTIES window. The top section of this window will tell you which projection and coordinate system are set for the data frame you are currently using. This should currently say 'No Projection'.

To create a new custom projection/coordinate system, press the NEW button in the COORDINATE SYSTEM window. Select PROJECTED COORDINATE SYSTEM from the drop down menu that appears. This will open the NEW PROJECTED COORDINATE SYSTEM window. In the upper NAME window, type in NORTH SEA. In the PROJECTION portion of the window, select the name of the appropriate type of coordinate system from the drop down menu (in the lower NAME window). For this exercise, select TRANSVERSE MERCATOR. Next type in the values you wish to use for the parameters. LATITUDE_OF_ORIGIN enter 56.5 and for CENTRAL_MERIDIAN enter -1.0. Leave all other sections of the window with their default settings.

In the GEOGRAPHIC COORDINATE SYSTEM section of the PROJECTED COORDINATE SYSTEM window, click on the SELECT button. This will open a window where you can select the datum you wish to use for the coordinates in your projection. For this exercise, select WORLD> WGS 1984, and then click on the ADD button. Now click the FINISH button in the PROJECTED COORDINATE SYSTEM window. Finally, click OK in the DATA FRAME PROPERTIES window.



To check that you have done this step properly, right click on the name of your data frame (LAYERS) in the TABLE OF CONTENTS window and select PROPERTIES. Click on the COORDINATE SYSTEM tab of the DATA FRAME PROPERTIES window and make sure that contents of the CURRENT COORDINATE SYSTEM section of the window has the following text in it:

North Sea
Projection: Transverse_Mercator
False_Easting: 0.000000
False_Northing: 0.000000
Central_Meridian: -1.000000
Scale_Factor: 1.000000
Latitude_Of_Origin: 56.500000
Linear Unit: Meter

GCS_WGS_1984
Datum: D_WGS_1984

If it does not, you will need to repeat this step until you have assigned the correct projection/coordinate system to your data frame.

