window, click on the DATA FRAME tab and make sure that the extent is set to the FIXED EXTENT given at the end of step one.

STEP 3: TRANSFORM ALL DATA LAYERS INTO THE SAME PROJECTION/COORDINATE SYSTEM AS THE DATA FRAME:

At this stage, the contents of your MAP window will look very similar to how it looked at the end of exercise one, with the exception that you have locational records for more than one species and you also now have survey track data added to your GIS project. However, while you will not be able to see it by looking at the contents of your MAP window, your data layers are in one projection/coordinate system (the geographic projection), and your data frame is in another (the custom transverse mercator projection called North Sea). This is not necessarily an issue when creating maps and figures, but if you actually want to start comparing and using your data layers to create new information based on the relative spatial distributions of features within them, it is usually best to ensure that the data layers and the data frame are all in the same projection/coordinate system. This involves either transforming the data layers to the same projection/coordinate system of the data frame, or changing the projection/coordinate system of the data frame to that of the data layer.

In this exercise, you will need to measure the lengths of the survey tracks in order to be able to calculate the number of bottlenose dolphins per unit effort in each grid cell of a polygon grid. Therefore, you need to use a projection/coordinate system which is suitable for doing this. A geographic projection is not, while a transverse mercator projection centred on the middle of the study area is. As a result, you will transform the data layers from their current geographic projection to the same custom transverse mercator projection as the data frame.

When you transform your data layers into this projection/coordinate system, you will find that you need to create the custom transverse mercator projection/coordinate system from scratch. In this exercise this will be repeated for each data layer in order to keep things as simple as possible. However, after you have transformed the first data layer, it is possible to import the projection/coordinate system from it when transforming the other data layers, rather than having to make it from scratch again each time. This is done by

selecting IMPORT rather than NEW in the SPATIAL REFERENCE PROPERTIES window when transforming your data layer from one projection/coordinate system to another and selecting a data layer which is already in.

These instructions as based on instruction sets called *How to transform data layers between different projections* and *How to change the display symbols for a data layer* from pages 119 and 122 in *An Introduction To Using GIS In Marine Biology*. These instructions start on the next page.

Existing data layers which you wish to transform into a new projection/ coordinate system

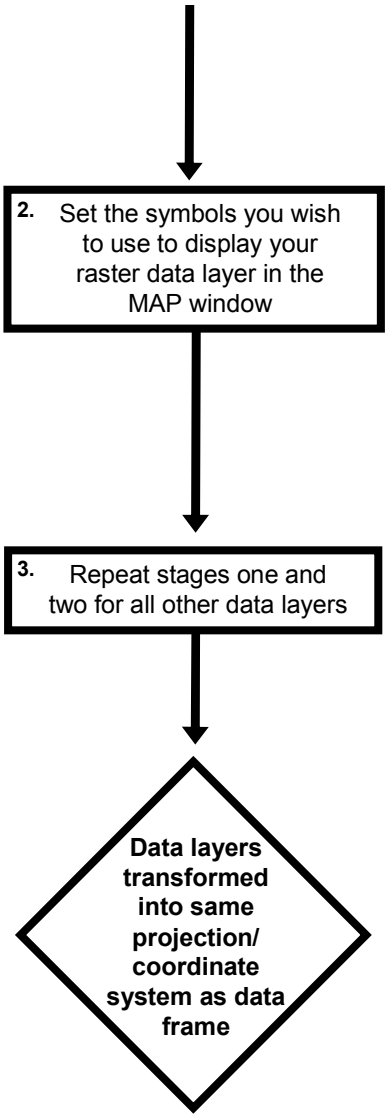
In this case the data layer you wish to transform are ALL_SPECIES, SURVEY_TRACKS_NORTH_SEA, LAND_NORTH_SEA and DEPTH_ NORTH_SEA. You will start with the data layer called ALL_SPECIES.

1. Transform your data layer to the same projection/ coordinate system as the data frame

In the TOOLBOX window, select DATA MANAGEMENT TOOLS> PROJECTIONS AND TRANSFORMATIONS> FEATURE> PROJECT. This will open the PROJECT window. Select ALL_SPECIES from the drop down menu in the INPUT DATASET OR FEATURE CLASS section of the window. In the OUTPUT DATASET OR FEATURE CLASS section enter C:\GIS_EXERCISES\ALL_SPECIES_ PROJECT_2.

You will need to create the custom projection/coordinate system you are going to transform the data layers into. This is done by clicking on the button at the end of the OUTPUT COORDINATE SYSTEM section of the window to open the SPATIAL REFERENCE PROPERTIES window. Next, click on the NEW button. Select PROJECTED COORDINATE SYSTEM from the drop down menu that appears. This will open the NEW PROJECTED COORDINATE SYSTEM window. In the NAME window, type in NORTH SEA. In the PROJECTION section of the window, select TRANSVERSE MERCATOR from the drop down menu. Next type in 56.5 for LATITUDE_OF_ORIGIN and -1.0 for CENTRAL_MERIDIAN. Leave all other fields with their default settings.

Next, 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. Next click on FINISH in the PROJECTED COORDINATE SYSTEM window. Now click on the OK button at the bottom of the SPATIAL REFERENCE PROPERTIES window. The OUTPUT COORDINATE SYSTEM section of the PROJECT window should now say NORTH SEA. Finally, click OK in the PROJECT window.



Right click on the name of your newly created data layer (ALL_SPECIES_PROJECT_2) in the TABLE OF CONTENTS window and select PROPERTIES. Next, click on the SYMBOLOGY tab of the LAYER PROPERTIES window. In the left hand portion of the LAYER PROPERTIES window, select CATEGORIES> UNIQUE VALUES. You will want to use the same symbols as you used for the ALL_SPECIES data layer. These can be loaded in by clicking on the IMPORT button on the right hand side of the LAYER PROPERTIES window. In the IMPORT SYMBOLOGY window select ALL_SPECIES from the drop down menu and click OK.. In the IMPORT SYMBOLOGY MATCHING DIALOG window which will open, select SPECIES as the VALUE FIELD Finally, click OK to close the LAYER PROPERTIES window.

Repeat stages one and two for SURVEY_TRACKS_ NORTH_SEA, LAND_NORTH _SEA and DEPTH_ NORTH_SEA to create data layers called SURVEY_TRACKS_NORTH_SEA_ PROJECT_2, LAND_NORTH_SEA_PROJECT_2 and DEPTH_ NORTH_SEA_PROJECT_2

To check that you have done this step properly, right click on the name of each new data layer (e.g. ALL_SPECIES_PROJECT_2) in the TABLE OF CONTENTS window and select properties. Click on the SOURCE tab and make sure that contents of the DATA

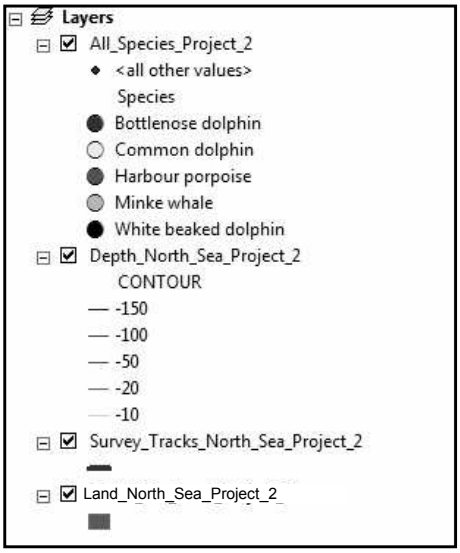
SOURCE section of the window should have the following text in it (you may have to scroll down to see it all):

Data Type: Shapefile Feature Class
Shapefile: C:\GIS_EXERCISES\ALL_SPECIES_PROJECT_2.SHP
Geometry Type: Point
Projected Coordinate System: NORTH SEA
Projection: Transverse_Mercator
False_Easting: 0.00000000
False_Northing: 0.00000000
Central_Meridian: -1.00000000
Scale_Factor: 1.00000000
Latitude_Of_Origin: 56.50000000
Linear Unit: Meter

Geographic Coordinate System: GCS_WGS_1984
Datum: D_WGS_1984
Prime Meridian: Greenwich
Angular Unit: Degree

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

Next, remove the data layers ALL_SPECIES, SURVEY_TRACKS_NORTH_SEA LAND_NORTH_SEA and DEPTH_NORTH_SEA from your GIS project by right-clicking on their name in the TABLE OF CONTENTS window and selecting REMOVE. Finally, re-arrange the order of the remaining data layers (by clicking on a data layer's name in the TABLE OF CONTENTS window and, while holding down the mouse button, dragging it up or down until it is in the desired position) so that your TABLE OF CONTENTS window looks like the one at the top of the next page.



The contents of your MAP window should look the same as before. This is because you have the same information in all your data layers, you have simply transformed the projection/coordinate system of the data layers to a different one.