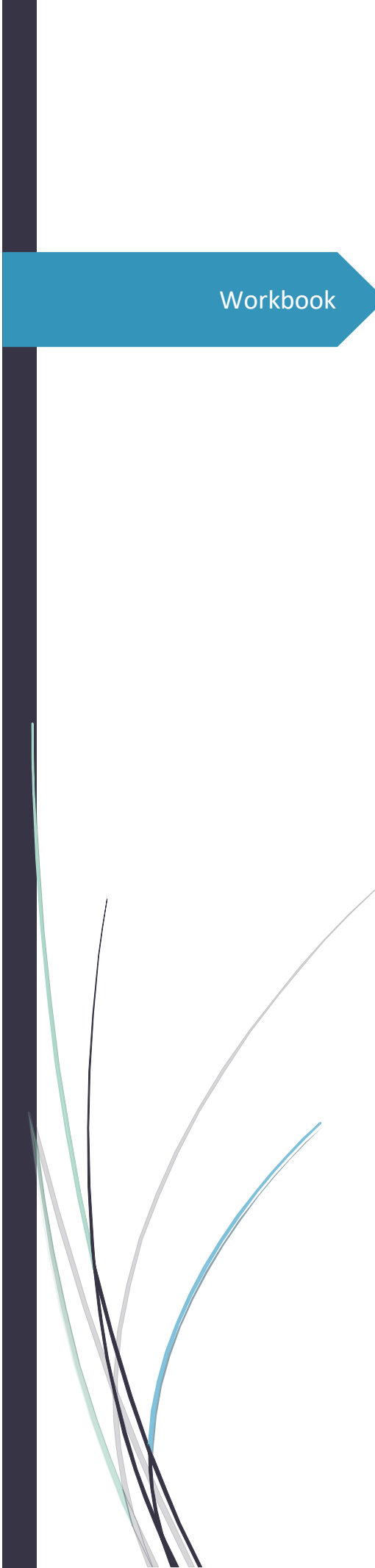


A thick dark blue vertical bar runs down the left side of the page. A teal arrow points right from this bar, containing the word 'Workbook'. In the bottom left corner, several thin, curved lines in teal, grey, and blue sweep upwards and to the right.

Workbook

Lab Practical – Thematic Mapping in QGIS

Coastal, Marine and Wildlife
Conservation

Elanor Alun
UWTSD

Section 1: A QGIS Introduction – Setting Up

Exercise 1.1: Setting Coordinate Reference Systems (CRS)

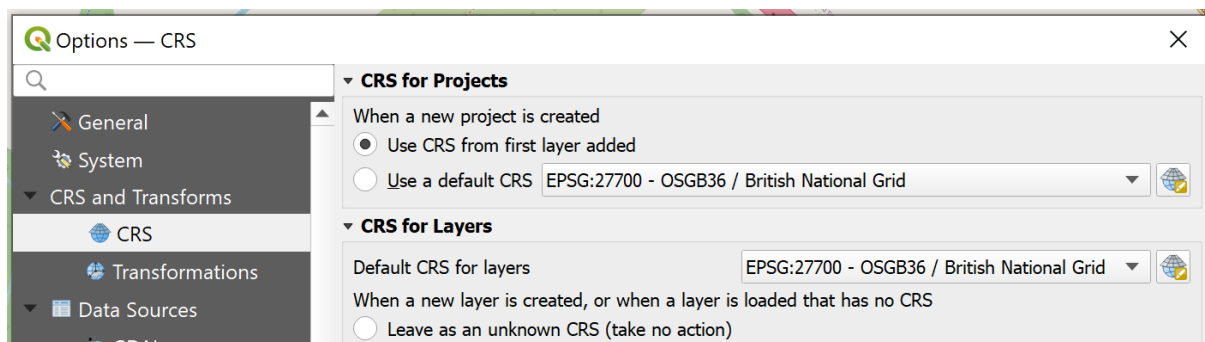
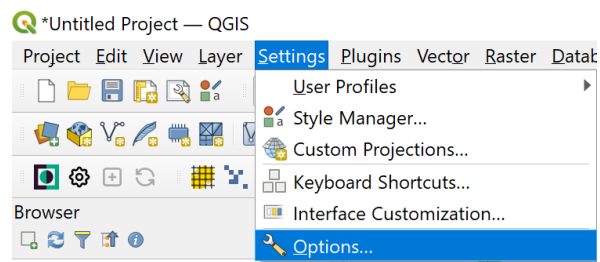
Video: <https://youtu.be/YZHWZ-7Hsiw>

Coordinate systems are critical for GIS. The Earth is a round ball, so when we try to flatten it out to make a map, there will be some distortion of land. To get around this, in QGIS you can select which location-specific reference system you want to use. This will centre the mapping on one location (e.g. the British Isles), minimising the distortion in that area – the further you then move away from that area, the wonkier everything will get.

In this exercise we will set the coordinate system for our project and ensure that any data being brought into our project will be projected “on-the-fly” to our desired coordinate reference system (CRS).

Note: On the fly re-projection is the default in QGIS 3 and there is no way to change this behaviour.

1. Open QGIS
2. From the main menu select: **Settings> Options**
3. In the left-hand Dialogue window select: **CRS**
4. Default CRS for new project options:
 - a. For “Default CRS for new projects:” choose **EPSG: 27700 – OSGB 1936 (British National Grid)**
 - b. Click **OK**

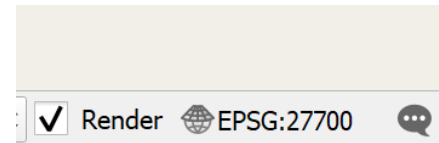


Be aware that this will set all future projects to begin in EPSG: 27700. If you are working on other projects not in the UK you should change this.

5. Note the CRS in the bottom right corner of the Status Bar at the bottom of the map canvas window should show **EPSG: 27700**

If it doesn't try starting a new project

6. Look at some of the other settings for your information, including map tools and digitising, and note the measurement units. Don't change any of the defaults for the exercises



In this exercise we have chosen a suitable CRS for our project. Any new project will default to this CRS. Project CRS can be changed using the project settings or the CRS widget in the bottom right of the main window.

Exercise 1.2: Base Maps

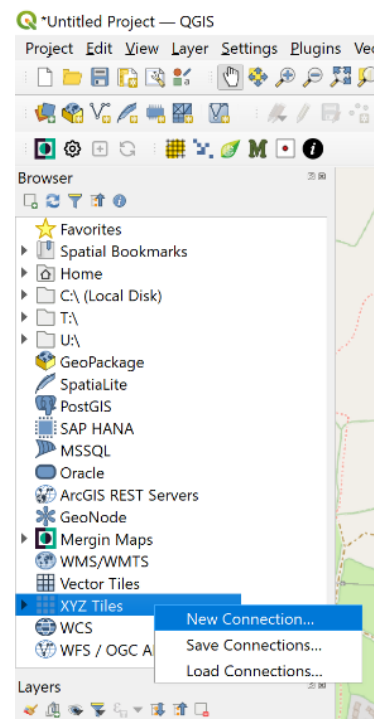
Currently, you probably still have a white screen and not much else. Time to change that!

Video: <https://www.youtube.com/watch?v=mVVcxtBFZkA>

There are various places you can get base maps from for QGIS, two of which are shown here. For this session we'll use Google Maps, and Ordnance Survey Maps.

Google Maps:

1. On the left of the screen, you should have two panels: Browser, and Layers. Go to **Browser > XYZ**.
2. Right click on XYZ Tiles, and choose **New Connection**.
3. **Name the connection** something appropriate (in this case, either Google Maps, Google Satellite, or Google Hybrid depending on which you're uploading), and then **paste in the corresponding URL**. These are listed below, and also on Moodle. Then click **OK**.

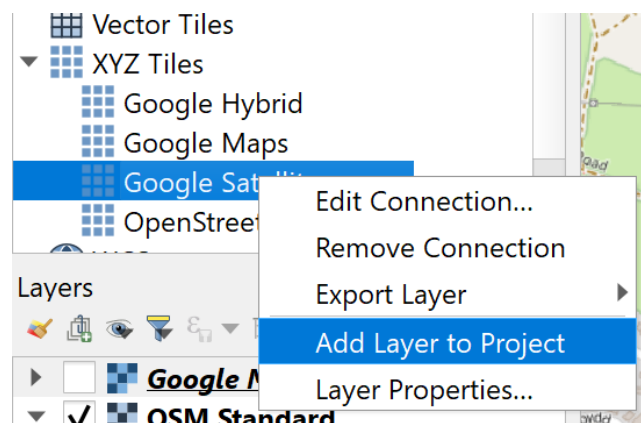


Map

URL

Google Maps	<code>https://mt1.google.com/vt/lyrs=r&x={x}&y={y}&z={z}</code>
Google Satellite	<code>http://www.google.cn/maps/vt?lyrs=s@189&gl=cn&x={x}&y={y}&z={z}</code>
Google Hybrid	<code>https://mt1.google.com/vt/lyrs=y&x={x}&y={y}&z={z}</code>

4. To add these, **click the little arrow** next to XYZ Tiles to get the drop down menu of possible layers. **Right-click** the one you want, and **select Add Layer to Project** (or click and drag into the Layers panel below it.)



Ordnance Survey Maps:

1. Go to **Plugins > Manage and Install Plugins**
2. Scroll down to – or search for – **QuickMapServices**. Click **Install Plugin**
3. This will give you access to the OSM. To use it, go to **Web > QuickMapServices > OSM**. This will load it into the workspace.

*Note: occasionally, you might be prompted to ‘convert’ some of these into your project CRS. If this happens, simply make sure the ‘destination CRS’ is the one you’re using in your project – in this case, **EPSG: 27700 – OSGB 1936 (British National Grid)**. The conversion method is not relevant at this level.*

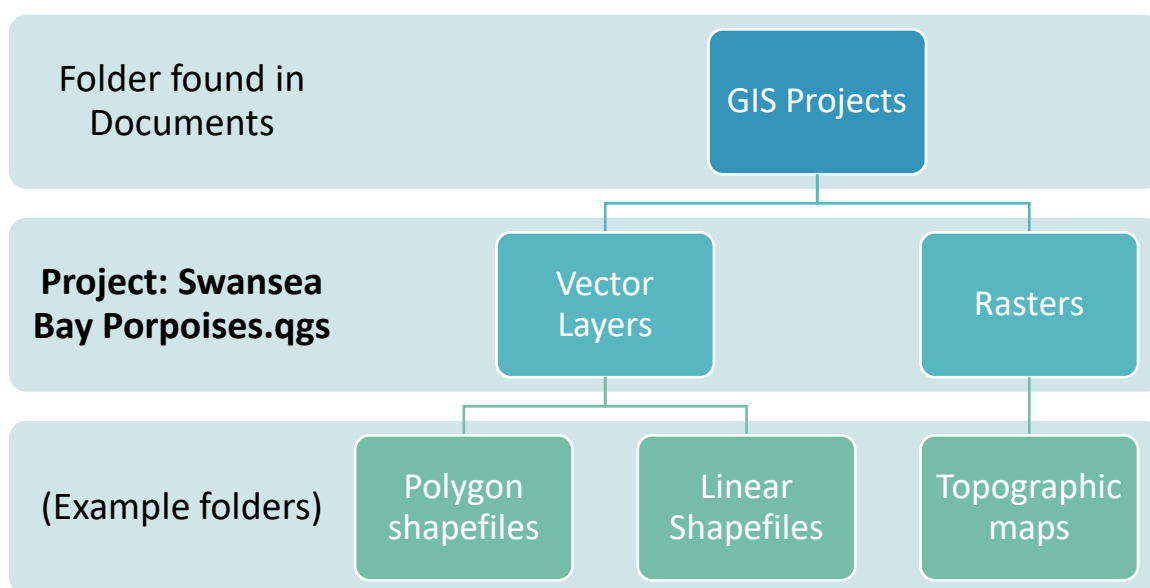
Exercise 1.3: Saving Your Project

GIS softwares are all very weird when it comes to saving, so it's important to get this right early doors.

Firstly, you'll need to choose an accessible place to save to. This place **cannot be moved** once chosen, or you will not be able to open the project again. So, in this case, choose your OneDrive; this will let you access it from any computer with QGIS installed and an internet connection. An alternative would be a memory stick.

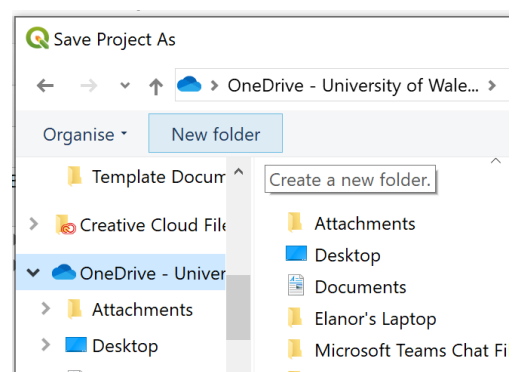
Once that is done, and the project is saved, all subsequent layers will need to be saved **below** the workspace in the file directory. So, if you save the overall project into a folder called GIS, you then need to make a new folder **next to** the project – in the same GIS folder as it – and then save all subsequent data that will be uploaded into that.

You will need to practice good folder hygiene for this. Many people have a set up like this:



In this case:

1. Go to **Project > Save As**
2. In the left hand panel, **select your OneDrive**, and click **New Folder**. Call it GIS Projects.
3. **Click into** this new folder. Name the Project "Swansea Bay Porpoises."
4. Click **Save**.

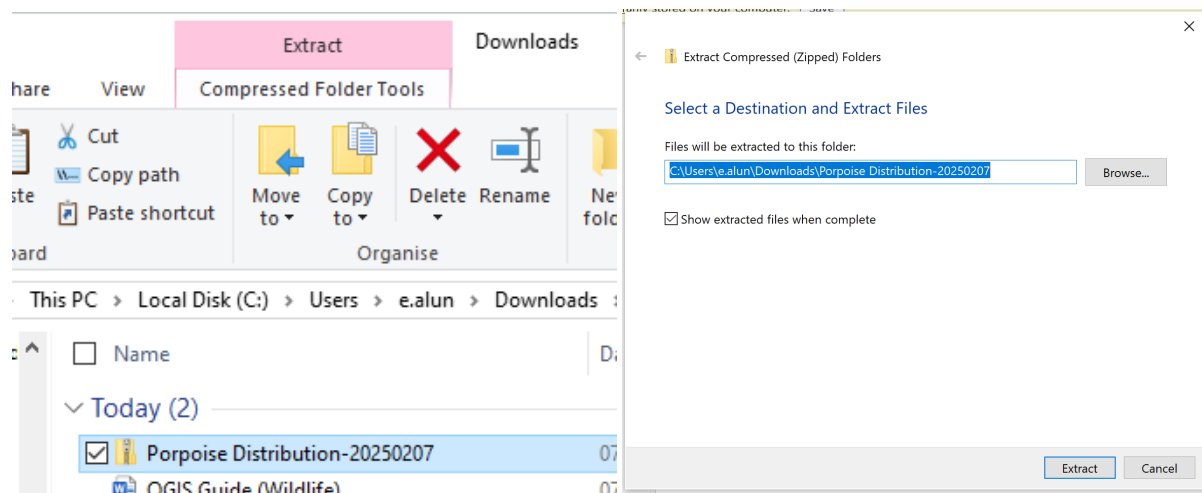


Section 2: Adding Map Features

Exercise 2.1: Getting Data Layers

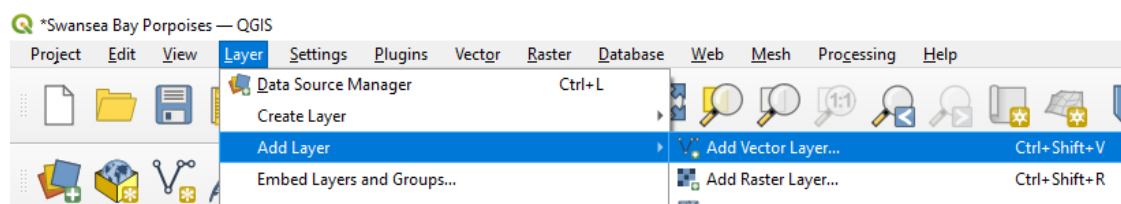
First thing's first: let's get some data to play with!

Go to the folder on Moodle named **Porpoise Distribution**, and download all five files within. You can simply click "**Download Folder**"; if so, extract them from their zip file by **selecting the folder in Downloads**, clicking **Extract**, then **Extract All**, and then selecting **Browse** to navigate to their intended new home.



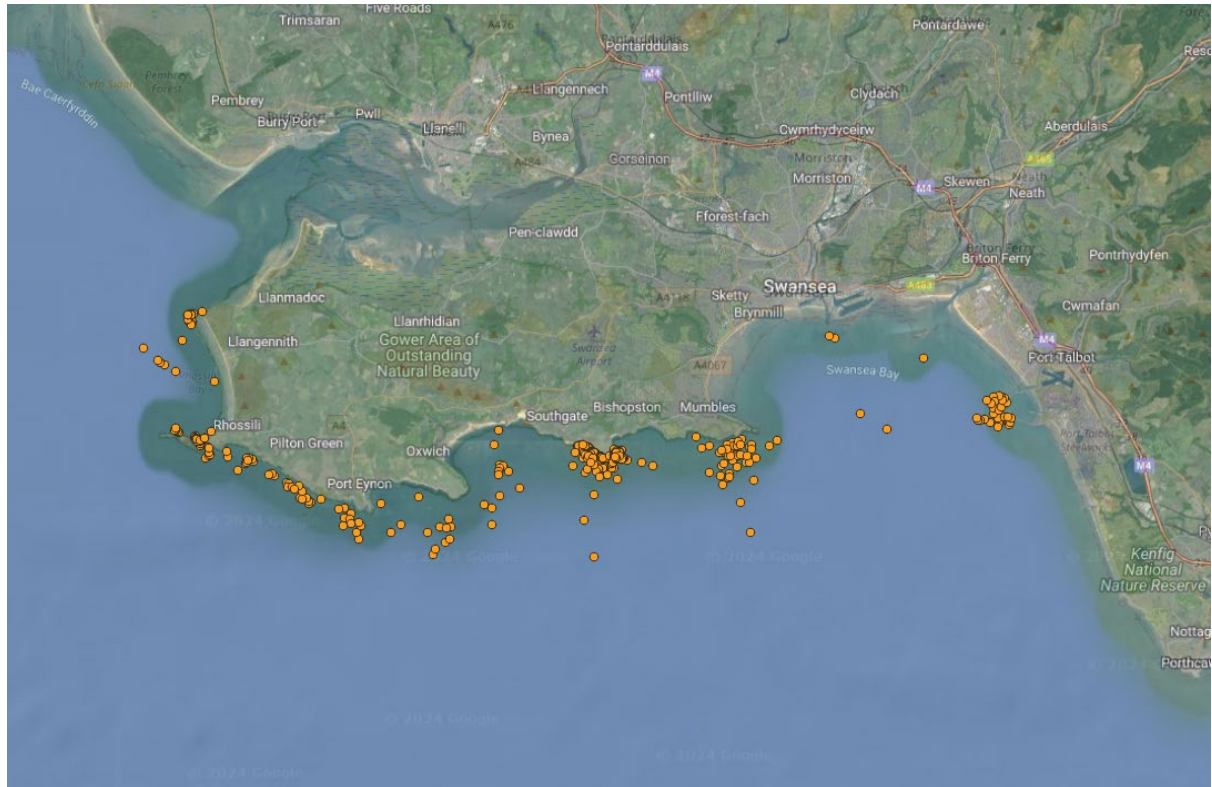
Save them either adjacent to your QGIS project, or in their own folder below it in the file directory.

1. From the main menu select: **Layer> Add Layer> Add Vector Layer**



2. In the dialogue window click the **ellipsis button** (three dots) on the right side of the Source box.
3. Navigate to your **QGIS Swansea Bay Porpoise** folder where you have saved your data
4. To the right of the file name box make sure the "**ESRI Shapefile**" filter is selected
5. Choose the file ending with **.shp** and click **Open**.

Your map should look something like this:



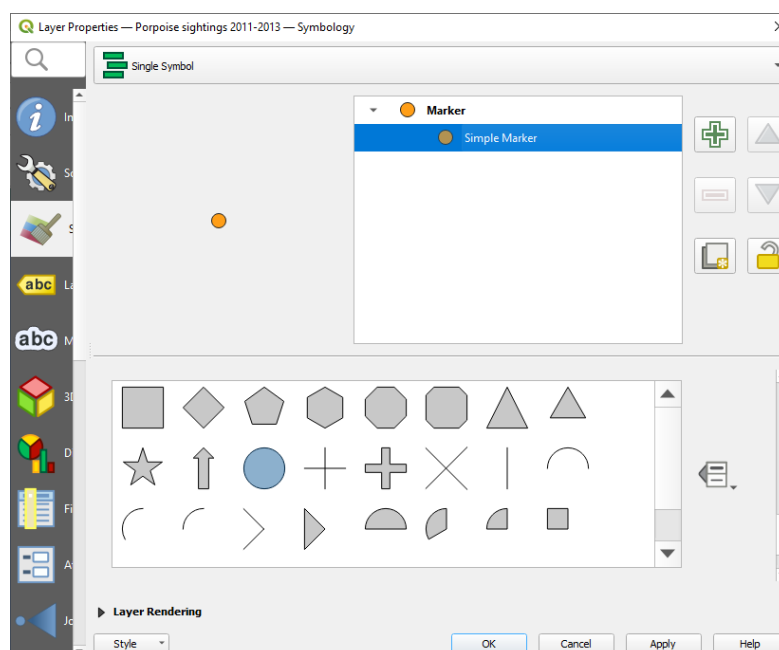
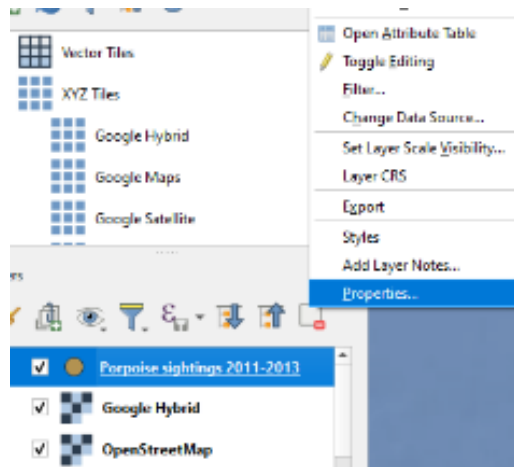
Exercise 2.2: Simple Styles

Video: <https://youtu.be/uuF4T8ThoxI>

Currently our map does not look particularly pretty. QGIS allows us to change the style of any layer through the layer's properties. It is important to remember that a shapefile only contains information about a layer's data. A layer's style is not saved with the shapefile. However, QGIS allows us to save style files that do contain style information.

So! Let's make this look nicer.

1. Select and highlight the **"Porpoise Sightings 2011-2013"** layer in the **Layers Panel**
2. Right click the layer and select **Properties** from the context box
3. In the Layer Properties window select the **Symbology** tab
4. Change the colour, size and/or pattern of the layer to anything you like. Experiment!
5. By clicking the words **Simple Marker**, you can change the symbol itself.
6. To see what each option looks like, you can click **Apply** rather than **OK**, and this will show you the effect without closing the Symbology window.



A faster alternative to open the Symbology window is to simply double click the layer.

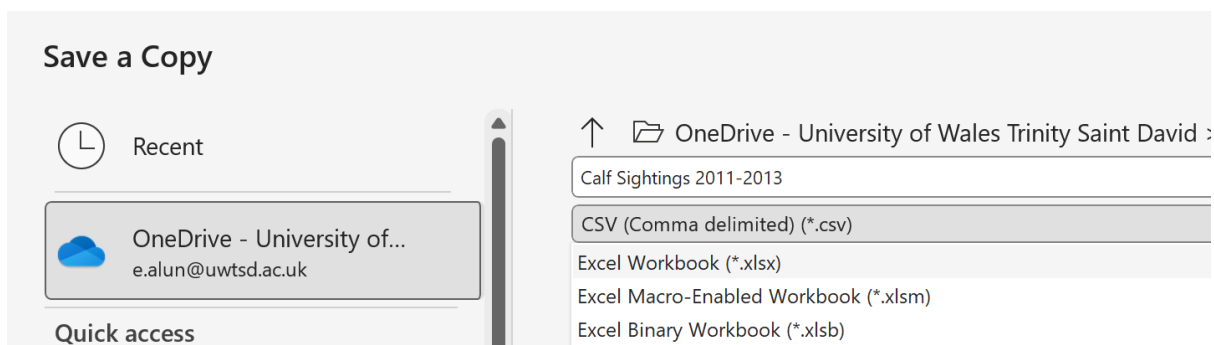
In this exercise we have looked at how we can change the style of any given layer in QGIS. There are many options in the style tab and you should explore these in your own time.

Exercise 2.3: Adding Data from Spreadsheets

Video: <https://youtu.be/bQ15OmFVsgc>

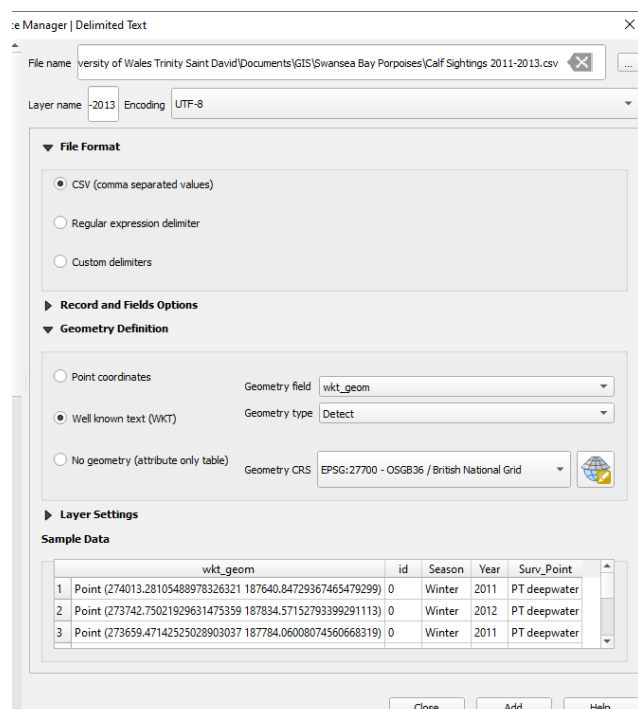
Let's say, though, you went out in the field and gathered your own GPS data. You need to upload this into QGIS – how might you do this?

For this exercise we will use the Excel files on Moodle called “**Calf Sightings 2011-2013**”, and “**Fresh Strandings 2000-2013**”. Download and save these as previously instructed. Once done, for each Excel file go to **File > Save a Copy** and save in CSV (Comma delimited) format.



These are now ready for upload into QGIS!

1. From the main menu go to **Layer> Add Layer> Add Delimited Text Layer**
2. Browse to the “**Calf Sightings 2011-2013.csv**” file
3. Use the following settings in the dialogue window
 - a. File Format: CSV
 - b. Encoding: UTF-8
4. Set the **Geometry definition** to **Well known text (WKT)** and make sure the Geometry field is set to the **wkt_geom** column from the spreadsheet.
5. Make sure you specify the CRS as **EPSG 27700 British National Grid**



6. Once the settings are correct, click **Add**
7. Your points will appear on the map
8. Repeat the process for the **Fresh Strandings** file

Note: *if your spreadsheet uses more traditional X and Y (or lat/long) coordinates for your GPS locations, at step 4 select “Point coordinates” and make sure the X and Y fields are correct.*

At this point the data is being read directly from the CSV. This means we can browse the data points and overlay them with other layers but they cannot be changed or edited. In order to make the CSV layer editable we need to convert it to a shapefile or geopackage.

9. Select the layer in the layers panel
10. Right click and choose **“Export> Save features as...”**
11. Save the shapefile or geopackage somewhere sensible with a meaningful name;
remember, it will need to be adjacent or below the QGIS project file
12. The new shapefile is now ready for editing

Note for Mac users: Importing text files like CSV, TAB, TXT or ASC into QGIS

In general the difference between all these files is the delimiter character. That is the character separating each entry. For CSV it is a comma, for a TAB file it is a 'tab', for a TXT or ASC file it could be either a tab, comma or single or double quotes.

It is important to note that if you create a table of data in Excel then to import it as a CSV file to QGIS you must make sure that it is saved-as in the correct Unicode (UTF-8) style and not a DOS type CSV style. (The difference is DOS uses ASCII characters CR+LF and Unix/Linux just LF for new lines.)

Alternatively: Prepare the data in Excel, then copy to 'numeric' then export from this to CSV and to XLS files. Use these exported files and then the delimited text file import will work.

In this exercise we have taken data from a file in the CSV format which is very widely used. We imported the data to QGIS and then to make the data editable exported the data to a new shapefile.

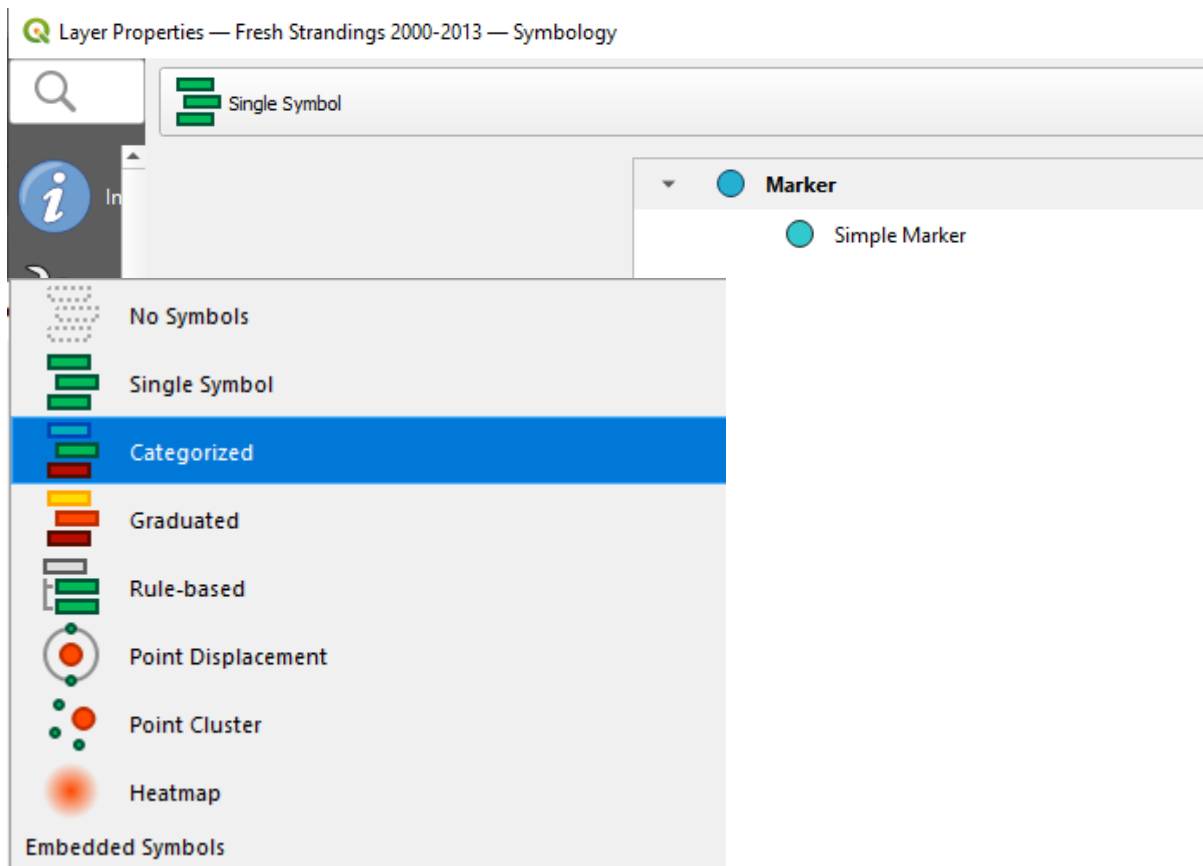
Exercise 2.4: Thematic Mapping

Video: <https://youtu.be/bNBewUIZTxQ>

A thematic map is where we style the features of the layer according to the values in one of the columns (or fields) – essentially, a map that is colour-coded to show the differences between different datapoints, based on their attributes. For example, if you have a bunch of datapoints showing the locations of trees, you could colour code them to show different species.

In this case, we want to look at the fresh stranding data and see the different ages/life stages of each porpoise found stranded.

1. Open the layer properties for the Fresh Strandings 2000-2013 layer
2. Click on the **Symbology** tab
3. Use the drop down at the top of the window to choose “**categorized**”



4. For the Value choose “**Age**”
5. Click the “**Classify**” button
6. Click “**Apply**” to see your changes take effect

You may notice that empty or null values are shown. See if you can work out how to delete the extra category that has no text next to it!

7. Order the layers in your map and try changing the transparency of layers (found in **Style**) to make a more appealing map

This is now showing you the various ages of the stranded porpoises. Repeat this process with the Calf Sightings file. Try to create maps that display:

- The season the porpoises were spotted
- The year they were spotted
- The survey points on land from which they were spotted

In this exercise we have learned how to thematically style a layer based on its attribute data. This is a very powerful way to convey complex information efficiently. Be aware that using more than 5 – 7 different shades of the same colour can make it difficult for the human eye to separate different shades.

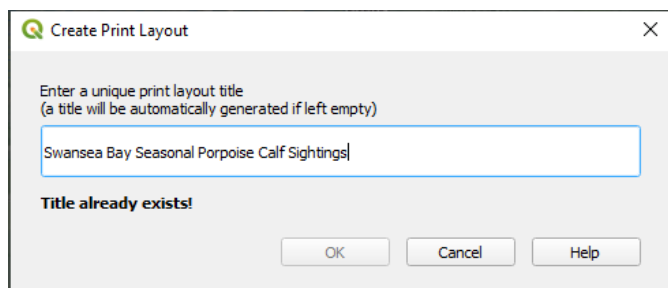
Section 3: The Final Map

Video: <https://youtu.be/UBpz7Z3Hy-s>

Now that we have made several awesome maps it would be nice to share them! QGIS' Print Layout allows us to output our maps in many different formats so we can share them with others, insert them into word documents etc.

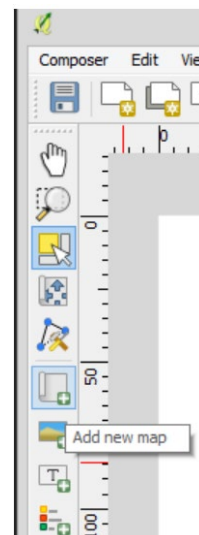
In this exercise we'll look at creating a new print layout, adding some cartographic elements and outputting the result to a jpeg/png image. Keep in mind that print layout can be quirky; it is always a good idea to build in extra time to your projects to allow for print layout issues.

1. Save your Swansea Bay Porpoise Map to the GIS folder giving it a suitable name if you haven't already (it is always a good idea to save a project again before starting a print layout; but, you should have saved it many times by now)
2. In the main menu go to **Project> New Print Layout**
3. For the layout title, use **whatever feature this map will show** (calves by season, strandings by age, etc) and hit **OK**

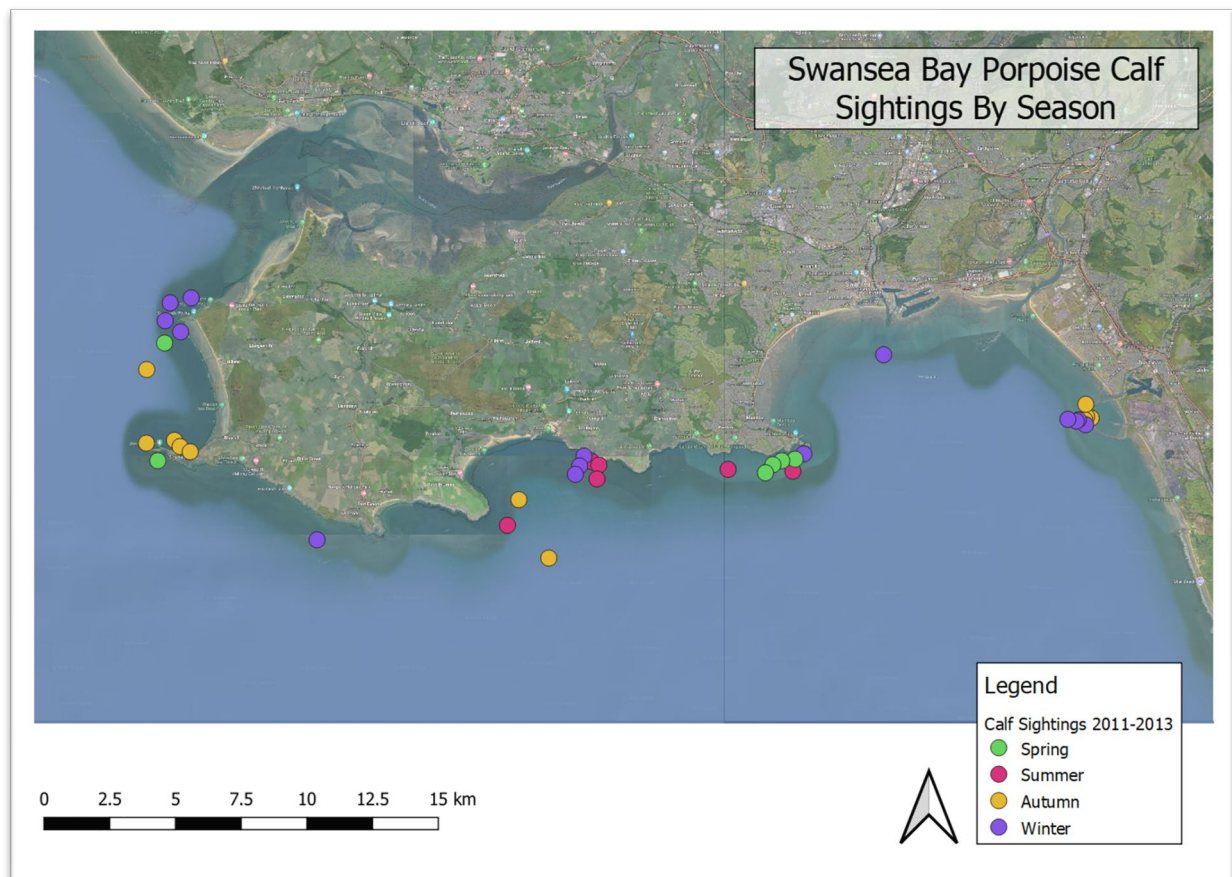


This will open a new print layout window which looks similar to the normal QGIS window. The large white space is equivalent to a sheet of paper and we will lay our map out on this sheet.

4. Start by adding a new map to the print layout window (*Left click and drag a rectangle to specify the map area*)
5. Your Porpoise map should appear in the layout window
6. Using the buttons to the left of the layout screen add the following
 - a. Title (label text)
 - b. Scalebar
 - c. Legend
 - d. North arrow (see if you can find preloaded north arrows!)



7. These elements can all be altered on the right. You will probably have to remove some legend entries. Once done, your map should look something like this:



Now you can save and export using **Layout> Save project** or **Layout> Export as**. This will save your map as an image (.png) that can now be inserted in Word, etc.

Print layout has other options that should be taken into consideration. Page set up allows you to select paper size and orientation. Export resolution (dpi) may also be of importance especially if printing very detailed data or printing at larger page sizes (such as A1 or A2 for posters).

Print layouts can also be saved as templates for future maps using **Layout> Save as template**. This is helpful if you need to produce multiple maps for one assignment, and you want them to have a unified “look.”