IUCN Freshwater Mapping Application (FWMA) Help Manual

Version 2.1
(September 2019)

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Introduction

The Freshwater Mapping Application (FWMA) is a web based mapping application that can be used to produce distribution maps of freshwater species based on HydroBASIN layers, as part of assessments for The IUCN Red List of Threatened Species™. The FWMA provides an online platform to produce new distribution maps or update existing distribution maps for species with published IUCN Red List assessments. The FWMA is integrated with the existing Species Information Service (SIS) database, allowing users to edit the maps of species they have permission to edit in SIS. Users can upload external observation data (in the form of point, line or polygon data), which can be used to guide mapping. The application uses standardised base layers and follows the standard IUCN methods for mapping freshwater species, for calculating metrics such as extent of occurrence (EOO) and area of occupancy (AOO), and for listing countries of occurrence. The application can be used to create maps anywhere with reasonable internet bandwidth. The maps can also be reviewed online and either approved or rejected, which greatly improves the efficiency of the assessment review process.

Glossary

TERM	DESCRIPTION
IUCN	International Union for the Conservation of Nature (https://www.iucn.org/)
FWMA	Freshwater mapping application
GIS	Geographical Information System
SIS	Species Information Service (https://sis.iucnsis.org): An online database where data for IUCN Red List Assessments are stored and managed
HydroBASIN	HydroBASINS is a global river and lake catchment layer derived from HydroSHEDS (SHuttle Elevation Derivatives at multiple Scales) and the Global Lakes and Wetlands Database (GLWD). HydroBASINS provides the most accurate hydrographic information for river and lake catchments at the global scale in a consistent format (https://www.hydrosheds.org/pages/hydrobasins)
Working Set	A list of species within SIS. Users need permission to edit species assessments in Working Sets in SIS to edit the corresponding species maps in the FWMA

1 Getting started

1.1 Opening the tool

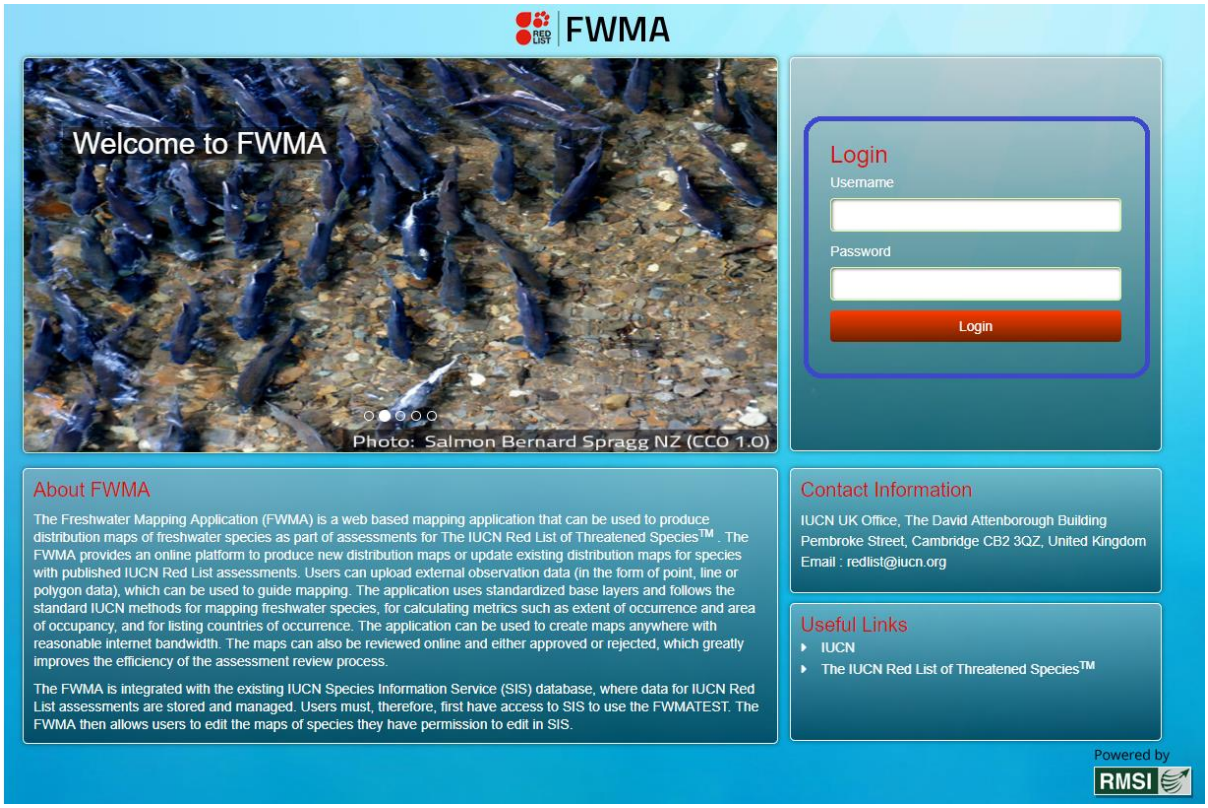
To log into the FWMA and start mapping, open an internet browser and entre the following URL:

⇨ **http://mappingfw.iucnredlist.org/FWMA**

The homepage of the FWMA will appear in the browser window.

To log into the application, enter your **SIS** username and password in the Login box in the top right corner of the screen.

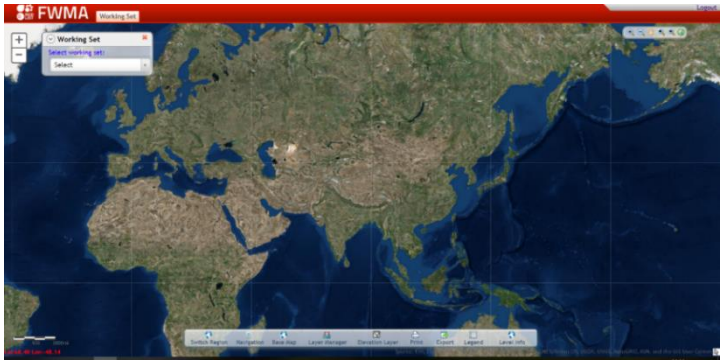
Google Chrome and Mozilla Firefox are the recommended internet browsers for the FWMA



If the password needs to be changed or reset, follow the links found on the SIS login page:

⇨ https://sis.iucnsis.org

The FWMA will then open to the select Working Set screen.



1.2 Logging out

To log out of the FWMA, click on 'Logout' at the top right of the screen, next to the username.

This will bring you back to the FWMA homepage.

2 Finding a species

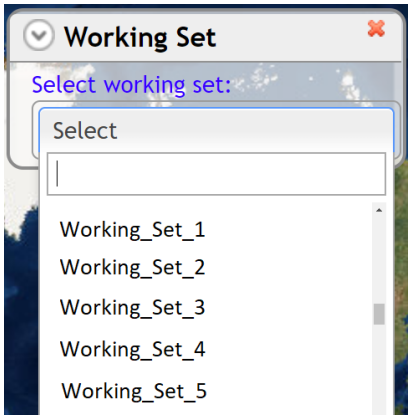
Once the FWMA is open, the next step is to find a species to map.

The Working Sets and species that appear in the Working Set window will depend on your level of permission in SIS. If you have assessor rights for a working set in SIS, it will appear here. If you cannot see a Working set in the drop down options, please contact the person who created or gave you access to the Working Set to check you have the correct permissions.

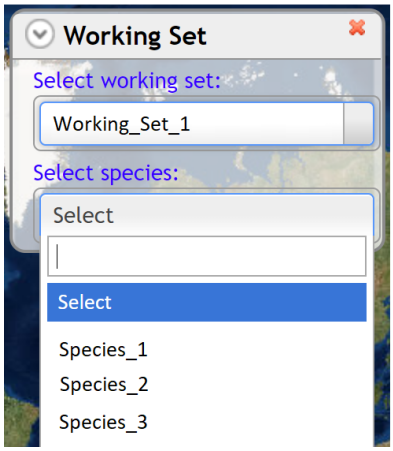
2.1 Selecting a species to map

To select a species to map:

- Navigate to the Working Set window, which will automatically appear in the top left of the screen after logging in to the FWMA. Click 'Select' on the 'Select working set' dropdown, and choose the appropriate working set from the given list.



- The 'Select species' dropdown will appear. In this, click on the name of the chosen species.



The next steps will depend on if the species has a previously published loaded map or draft map:

- If the species has a **previously published loaded map or draft map**, the 'Load Last Edit' box will appear. This box shows the username of the original creator of the species map and the date and time the map was last edited. Double click on this box to open the map.
- If the species **does not have a previously published loaded map or draft map**, click on 'Create New Map'.

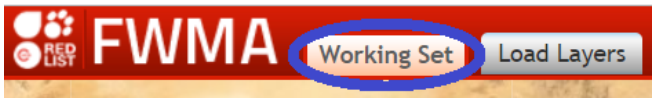
Common reasons why a species map cannot be opened:

- If another person is working on the draft species map. Only one person can edit a species map at any given time in the FWMA.
- If the map is submitted for review or publication.
- If you do not have permission to edit the assessment in SIS.

2.2 Switching to a different species

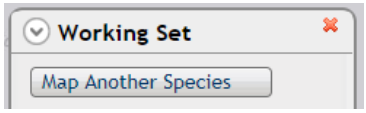
To switch to another species map in the FWMA:

- If not already displayed, open the Working Set window by clicking on 'Working set' on the toolbar located at the top of the screen.



Remember to save before switching to another species

- In the Working Set window, select 'Map another species'.



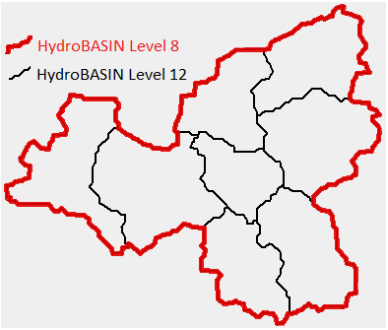
- This will close the current map and bring you back to the default Working Set selection screen where another species map can be selected.

3 Choosing the appropriate baselayer

Freshwater distribution maps are based on HydroBASIN layers. The FWMA allows users to load the appropriate HydroBASIN layer in addition to a number of different baselayers to assist in mapping.

3.1 Loading HydroBASIN Levels and Regions on a new map

After creating a new map (see *2.1 Selecting a species to map*) the appropriate HydroBASIN Level and Region Level need to be loaded.



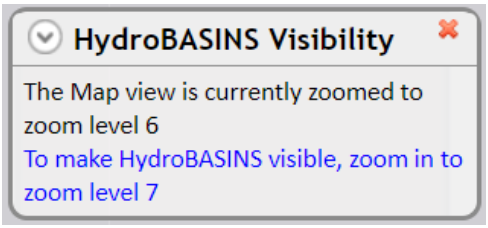
- **HydroBASIN Levels** differ in their scale, with 3 being the smallest and 12 the largest. For consistency, Level 8 is the recommended HydroBASIN Level. However, species with very restricted ranges (e.g. those found in a single small stream or cave) may be mapped down to Level 12. Species maps must include only one HydroBASIN Level.
- **HydroBASIN Regions** include all HydroBASINS of the chosen Level within a defined area. Because of the size of HydroBASIN layers, only one region can be loaded at any one time in the FWMA.

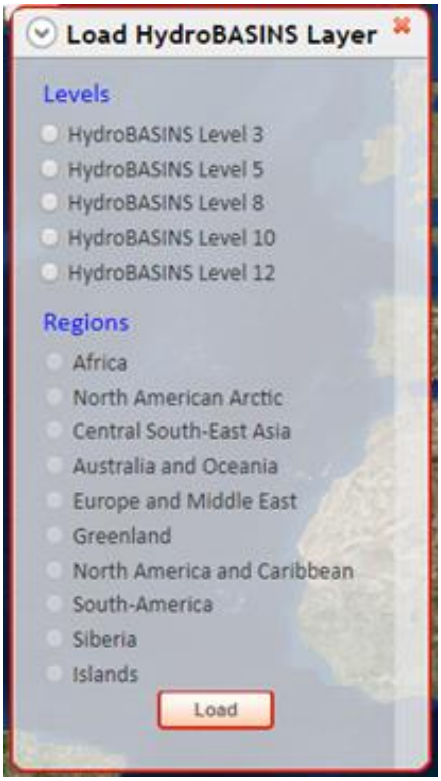
⇨ See '*0 Appendix 1: FWMA HydroBASIN Regions*' for a description of HydroBASIN regions.

It is important to choose the right region, as you will only be able to edit, add or delete HydroBASIN layers from the region that is currently loaded

To load these layers:

- After creating a species map, the 'Load HydroBASINS layer' window will appear. This window allows you to choose the appropriate level of HydroBASIN and the region in which to map.
- Select both a HydroBASIN Level and Region and click 'Load' to load the HydroBASIN baselayer.
- This layer will not be visible at a wide zoom. The HydroBASIN Visibility window will automatically appear to show the zoom level needed to view the loaded HydroBASIN layer.





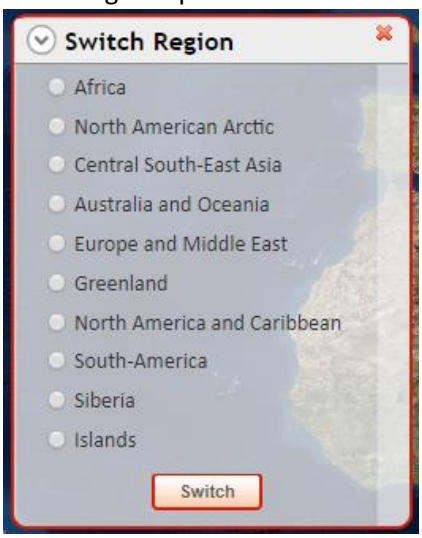
3.2 Switching Layers

While editing a species map you can switch between HydroBASIN Regions and Levels.

⇨ To switch between HydroBASIN Region layers:

- Click on the Switch Region tool located on the toolbar at the bottom of the screen.

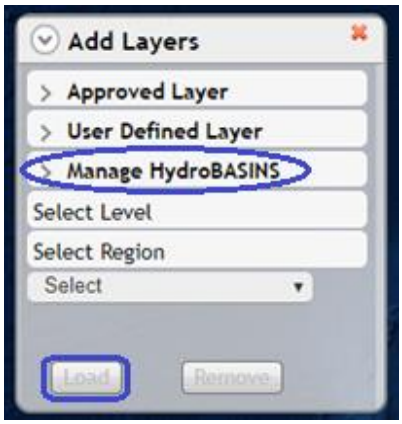
- The Switch Region window will appear. In this window, select the desired region to switch to from the 10 region options.



Switching regions in this way will not delete your mapped HydroBASIN layers, but you will only be able to edit, add to and delete HydroBASINS in the currently loaded region

⇨ To switch between HydroBASIN Level layers:

- Click on 'Load Layers' located at the top of the screen. This will open the Add Layers window.



- Open the 'Manage HydroBASINS' menu from the Add Layers window. Select the desired HydroBASIN Level and Region.
- Click the 'Load' button at the bottom of the Add Layers window to load the selected layers.

Switching HydroBASIN Levels while mapping will delete any currently saved HydroBASINS, as you cannot have a species map with more than one HydroBASIN Level.

3.3 Loading other Baselayers

There are a number of useful inbuilt baselayers that can be used to help map species within the FWMA. These are listed below.

- **Base Maps:** To switch the Base Map from the default (Satellite imagery), click on the 'Base Map' tool in the toolbox located at the bottom of the screen.

In the Base Maps window that appears, click on the desired Base Map from the given options to load the basemap in the application. This will not affect any saved HydroBASINS.

Base Maps in the FWMA: Grey, Streets, Topographic, Hybrid, Satellite, Oceans, Nat-Geo.

- **Rivers & Countries:** The FWMA has two approved layers; Rivers and Countries.

To load the Rivers or Countries layers, click on the 'Load Layers' tool located in the tool bar at the top of the screen. This will open the Add Layers window.

In the Add Layers window click on the 'Approved Layer' dropdown. Choose 'Rivers' or 'Countries' from the new dropdown selection and click Load. These layers will be visible at all zoom levels.

To remove these layers, follow the same steps as above but select Remove instead of Load on the final step.

❖ **Elevation:** Elevation information can be displayed by selecting the Elevation Layer tool from the bottom toolbar. This will also display the Elevation Layer Legend.

To turn this layer off, click on the Elevation Layer tool in the toolbar once more.

⇨ See 'Appendix 2: Baselayer resources' for information on useful external data layers not included in the FWMA.

4 Navigation

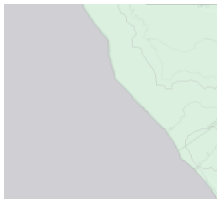
The Navigation tool can be used to help move around the FWMA. To open this tool, click on 'Navigation' located on the tool bar at the bottom of the screen.

This will open the Navigation window.

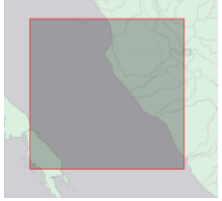
The Navigation window allows users to:

⇨ **Move around the map**: Select the 'Pan' tool from the Navigation window and use your cruiser to drag and move around the map.

⇨ **Zoom in**: Select the 'Zoom in' tool in the Navigation window, then draw the extent to zoom in to by drawing a rectangle on the map.

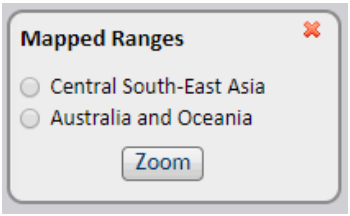


⇨ **Zoom out**: Select the Zoom out tool in the Navigation window, then draw the extent to zoom out to by drawing a rectangle on the map.



⇨ **Return to previous extent**: Click on the 'Zoom – previous' or 'Zoom – Next' icons to revert back to previous extents viewed in the FWMA.

⇨ **Zoom to a whole species mapped range**: Select the 'Zoomed to mapped ranges' tool in the Navigation window.



This will open the Mapped Ranges window, which will display each region that contains a saved HydroBASIN distribution for the current species. Select a region and click 'Zoom' to zoom to the whole extent of the HydroBASIN mapped range within that region.

5 Observation data

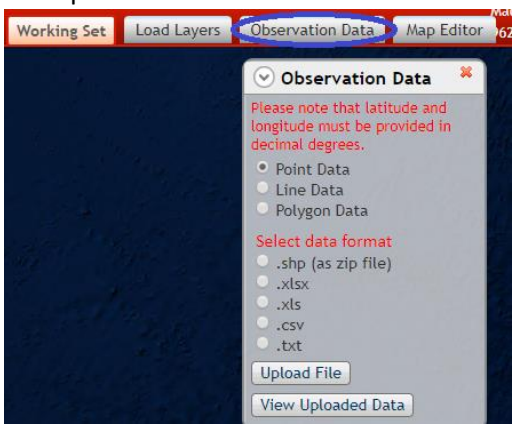
The FWMA allows users to import observation data and other useful layers to help inform species mapping.

⇨ See 'Appendix 2: Baselayer resources' for information on external data layers that can be uploaded to the FWMA.

5.1 Importing observation data

To import observation data and other useful layers:

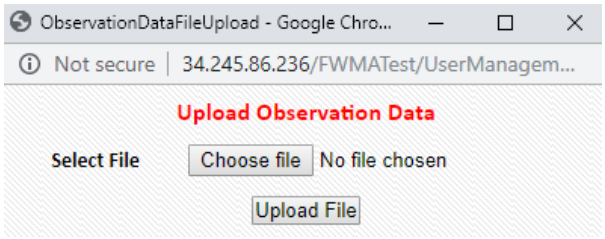
- Open the Observation Data window by clicking on 'Observation Data' located on the toolbar at the top of the screen.



- Select the kind of data to upload from point, line or polygon. Then select the data format to be imported (.shp, .xlsx, .xls, .csv, .txt). Once both are selected, click on 'Upload File'.

For point data, all latitude and longitude values must be in decimal degrees

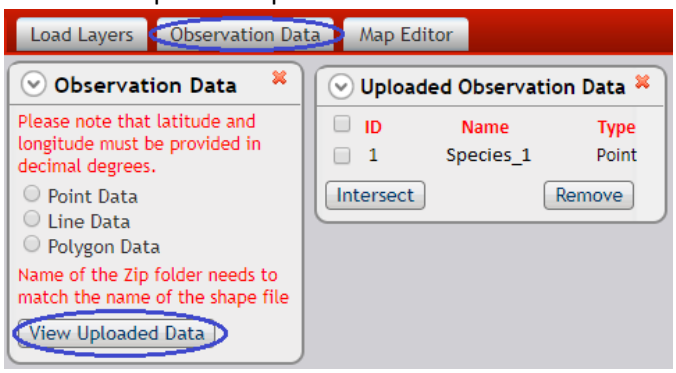
- The Upload Observation Data window will appear. Click on the 'Choose file' button and navigate to the file location.



The next step will depend on if **Shapefiles** (.shp) or **Excel/text files** (.xlsx, .xls, .csv, .txt) are being uploaded.

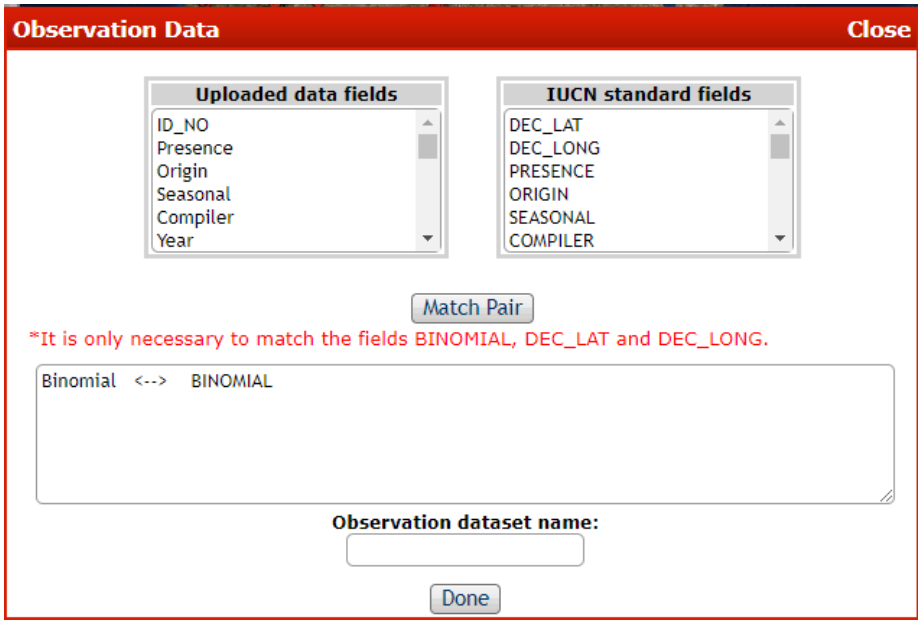
Shapefiles (.shp)

- Select the Shapefile from your folders. This must be in a single zip file, and the name of this file must match the name of the individual Shapefiles. Click 'Upload File' in the Upload Observation Data window.
- Go back to the Observation Data window and click 'Next'. The application will upload the files, but this may take a few moments. When the upload is complete, a popup window will appear to say 'Data uploaded successfully'. Press 'OK' and the data will be displayed in the application.
- To view all uploaded observation data, click on 'View Uploaded Data' in the Observation Data window to open the Uploaded Observation Data window.



Excel/text files (.csv, ,xlsx, .xls, .txt)

- Select the file from your folders and click 'Upload File'. Click 'Next' in the main Observation Data window. This will open a new window prompting you to match data fields in the uploaded data with the IUCN standard fields.



- Select a field from the 'Uploaded data fields' box in the top left of the window. Then select the corresponding IUCN standard field from the box in the top right of the window. Once both fields are selected click 'Match Pair'. The matched pair will appear in the output box below the data field tables
- Continue to match data fields, which will appear in the same box. It is only necessary to match the fields Binomial (species scientific name), Dec_Lat (Latitude in decimal degrees) and Dec_Long (Longitude in decimal degrees).

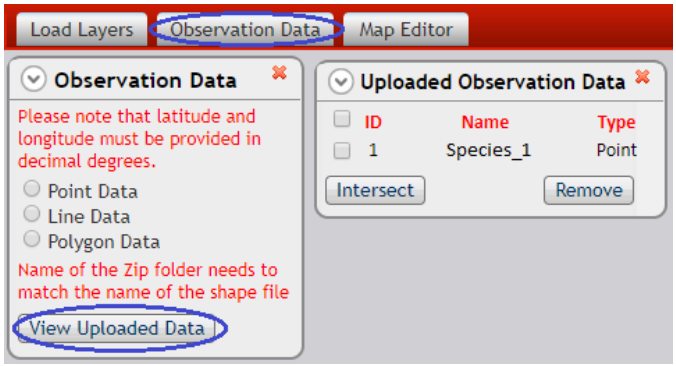
- When finished matching fields, name the dataset and click 'Done'. The data will appear in the application.
- To view all uploaded observation data, click on 'View Uploaded Data' in the Observation Data window to open the Uploaded Observation Data window.

For a list of data fields and their meaning, please see the IUCN Mapping Standards & Data Quality document:
⇨ https://nc.iucnredlist.org/redlist/resources/files/1539098236-Mapping_Standards_Version_1.16_2018.pdf

5.2 Removing observation data

⇨ To remove observation data:

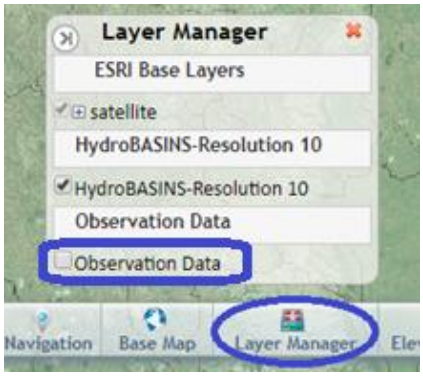
- Click on 'Observation Data' at the top of the screen to open the Observation Data window, then click on 'View Uploaded Data' to open the Uploaded Observation Data window.



- Select the data to be removed, then click 'Remove'.

⇨ To switch off the visibility of all observation data:

- Click on the 'Layer Manager' tool located at the bottom of the screen. This will open the Layer Manager window.
- On the Layer Manager window, uncheck the checkbox 'Observation Data' to turn off this layer. To make it reappear, check the checkbox once more.



5.3 Using observation data (Intersect tool)

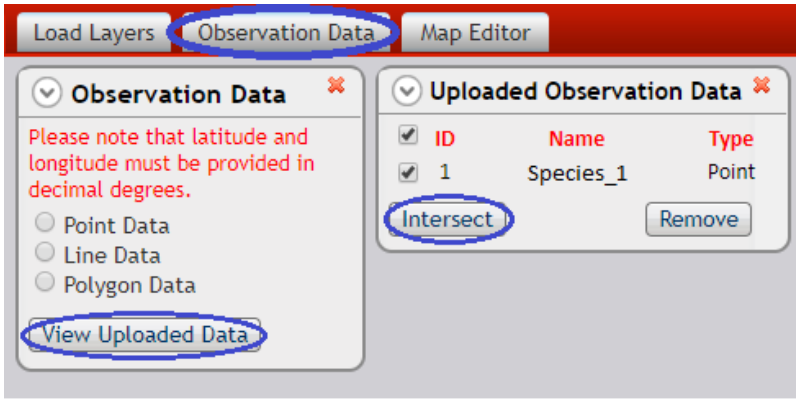
Once observation data has been successfully uploaded it can be used to help map a species range using the intersect tool.

The Intersect tool selects all HydroBASINS in the current Level and Region that intersect with the chosen observation data, which can then be saved as a species distribution map.

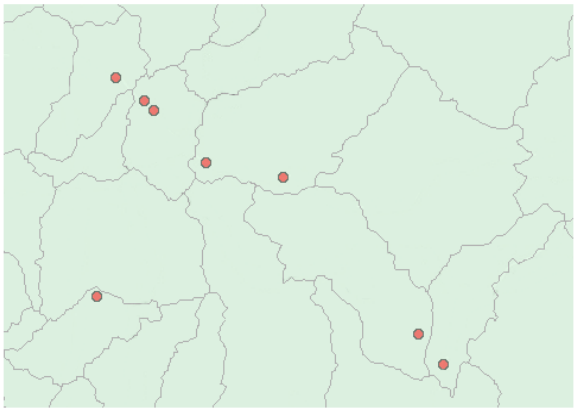
It's important to remember to load the correct HydroBASIN region. Only HydoBASINS in the loaded region will be selected when using the 'Intersect' tool.

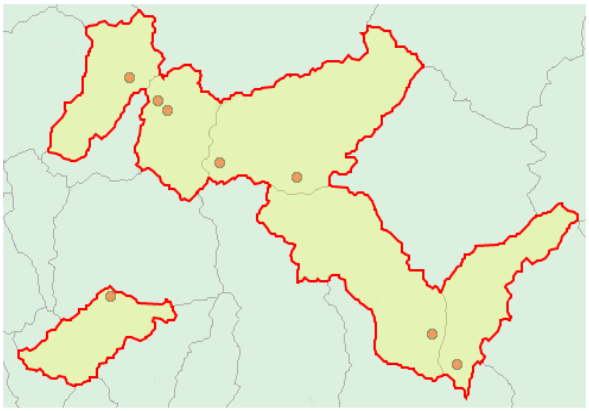
Using the Intersect tool:

- Click on 'Observation Data' at the top of the screen to open the Observation Data window, then click on 'View Uploaded Data' to open the Uploaded Observation Data window.
- In the Uploaded Observation Data window, select the observation data by clicking on its adjacent checkbox. Multiple observation data can be selected at once.
- Click 'Intersect' to start the tool.



The Intersect tool will select all HydroBASINS within the current region that intersect with the chosen observation data.





- To save the current HydroBASIN selection as a species distribution map, fill in the Attribute window that appears after intersecting your data. When the attribute table is complete, click 'Save Attributes'.

  ⇨ See section '*6. Mapping the species*' for details on how to fill in the attribute table and save a species map.
- To clear results of the intersect tool, click 'Esc' on your computer keyboard.

6 Mapping the species

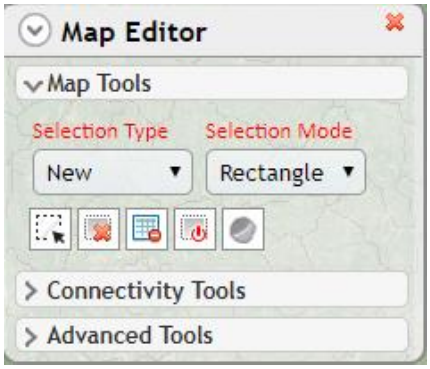
The Map Editor tool can be used to create a new map or edit an existing map.

To open the Map Editor window, click on the 'Map Editor' tool at the top of the screen.

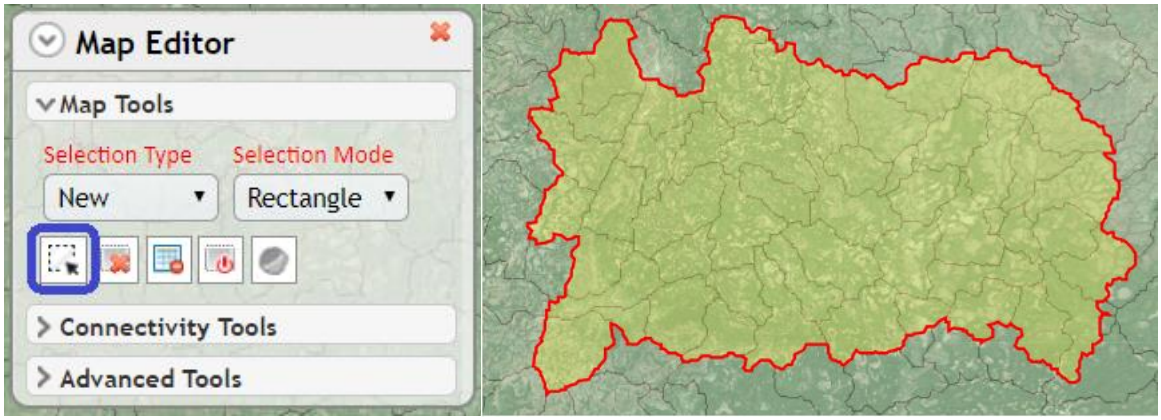
6.1 New selection

To add a new selection of HydroBASINS to a species map:

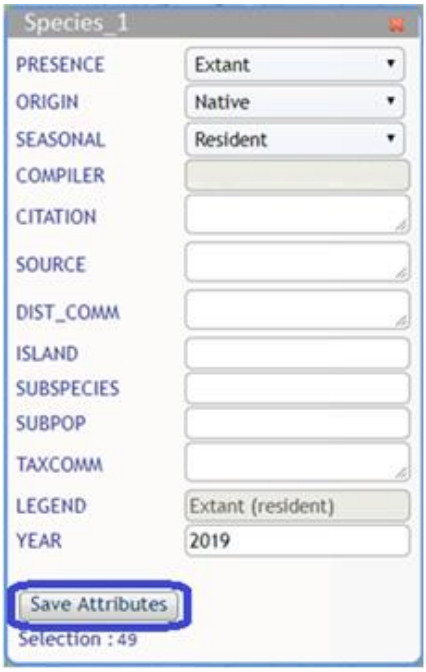
- Click on 'Map Editor' located at the top of the screen to open the Map Editor window. On this window, click on the 'Map Tools' dropdown.



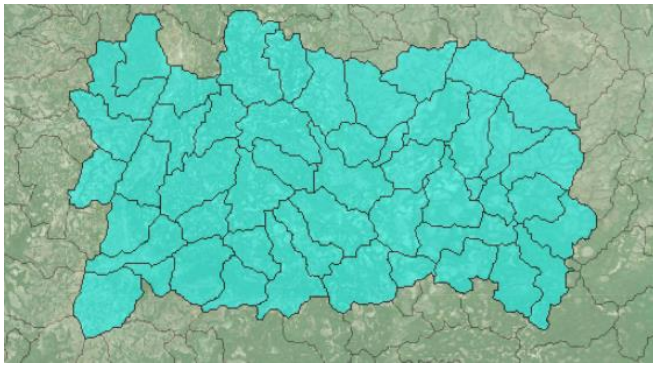
- On the Selection Type dropdown, select 'New'.
- Use the 'Selection Mode' dropdown to choose the method of selection (rectangle, polygon, freehand polygon or point).
- Click on the 'Selection' tool located in the 'Map Tools' toolbar. Draw or drop a point on the map to select the desired HydroBASIN range. The selection will be displayed in the application.



- The Attribute Editor window will appear. Enter the relevant values in the fields and click on 'Save Attributes'. This will save the selected HydroBASINS as a mapped range.



To read more on the attribute fields, see the mapping standards document:
https://nc.iucnredlist.org/redlist/resources/files/1539098236-Mapping_Standards_Version_1.16_2018.pdf



The Attribute Editor shows the required information for all IUCN Red List species maps.

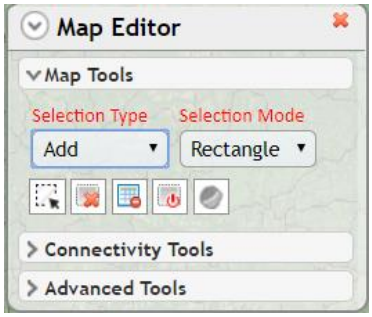
- All maps require the PRESENCE, ORIGIN, SEASONAL, CITATION and YEAR fields.
- The PRESENCE, ORIGIN, and SEASONAL values are default on Extant, Native, and Resident in the FWMA. These fields can be changed by clicking on the values and selecting from the drop down options.
- The BINOMIAL, HydroBASIN ID, and COMPILER fields are also required, but are automatically added to HydroBASINS in the application.
- The SUBSPECIES and SUBPOP are only required if a species is assessed at the subspecies or subpopulation level. The SOURCE, DIST_COMM, ISLAND, and TAXCOMM values are optional.

6.2 Editing Selection

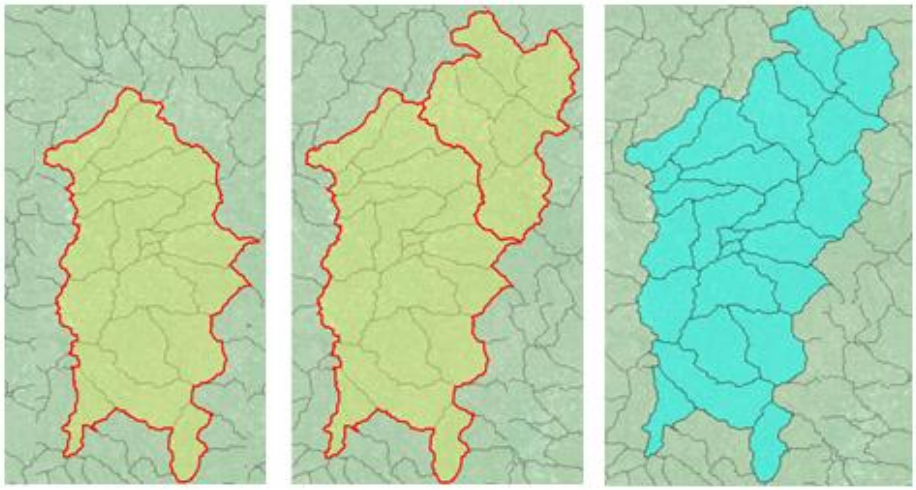
A selected range of HydroBASINS can be edited before it is saved as a species map.

To add to an existing selection:

- Click on 'Map Editor' located at the top of the screen to open the Map Editor window. On this window, click on the 'Map Tools' dropdown.
- On the Selection Type dropdown, choose 'Add'. Then choose an option from the Selection Mode dropdown list (rectangle, polygon, free hand polygon, point).

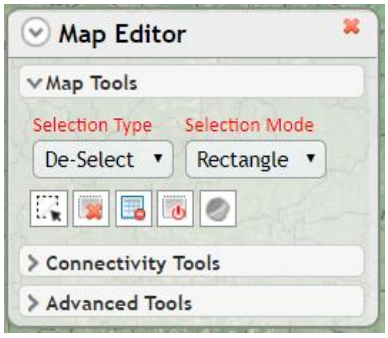


- Draw or drop a point on the map to select the desired HydroBASIN range. Fill in the Attribute Editor window and click 'Save Attributes' to save the new selection as a species map.



To de-select specific HydroBASINS within a selection:

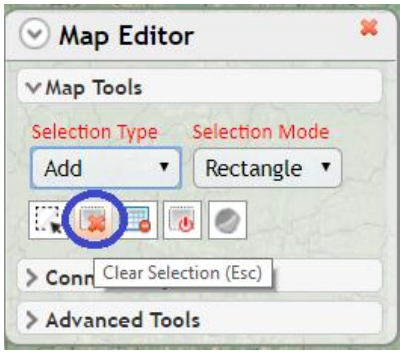
- Click on 'Map Editor' located at the top of the screen to open the Map Editor window. On this window, click on the 'Map Tools' dropdown.
- Choose 'De-Select' from the Selection Type dropdown list. Then choose a Selection Mode from the dropdown list (rectangle, polygon, freehand polygon, point).



- Draw a range within the current selection to be de-selected. This will automatically deselect the range.

To de-select the entire selected range:

- On the Map Editor Window, select the 'Clear Selection' tool from the Map Tools toolbar. This will clear all HydroBASINS currently selected.

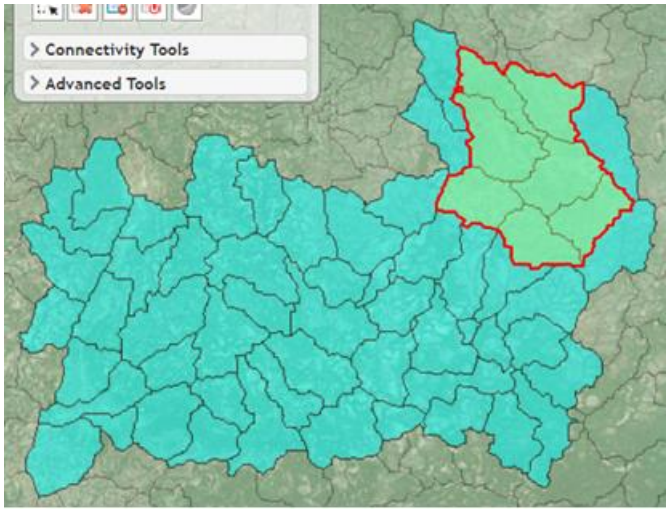


Alternatively, press the escape key (Esc) on the keyboard to de-select all HydroBASINS.

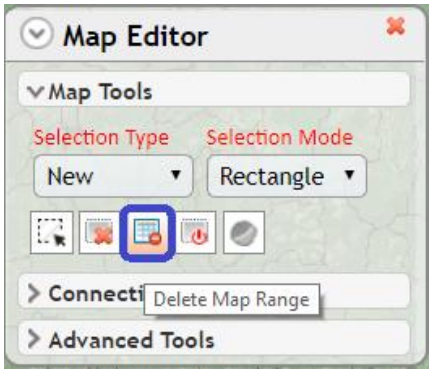
6.3 Delete mapped range

To delete a part of the mapped range:

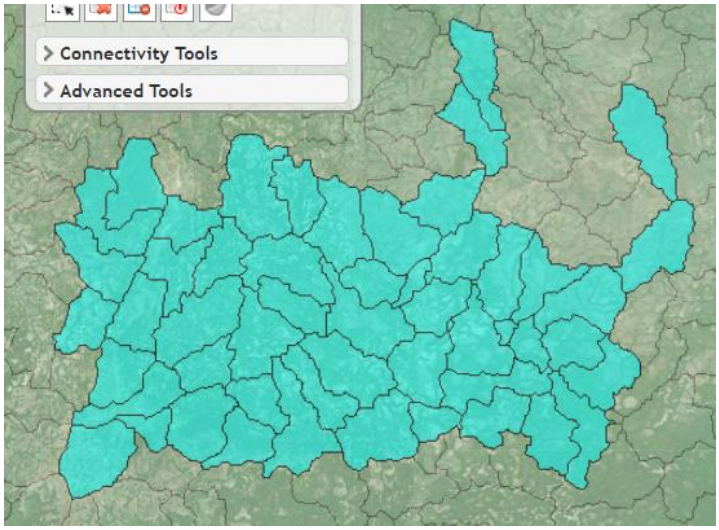
- Click on 'Map Editor' located at the top of the screen to open the Map Editor window. On this window, click on the 'Map Tools' dropdown.
- Choose 'New' on the Selection Type dropdown. Then choose a Selection Mode from the options (rectangle, polygon, free hand polygon or point).
- Drawn the extent to be deleted on the map. The attribute window pop-up can be ignored.



- Select 'Delete Map Range' in the Map Tools tool bar.

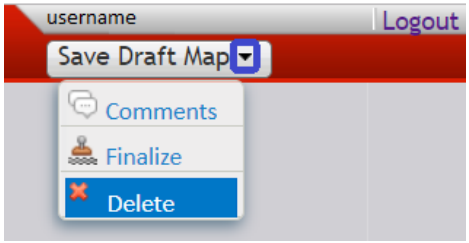


- On the Confirmation Message pop-up, click yes. The selected range will then be deleted.



To delete the entire mapped range:

- Click on the drop down option next to 'Save Draft Map' located at the top right of the screen. Do not click on 'Save Draft Map' directly, as this will save and close the current map.



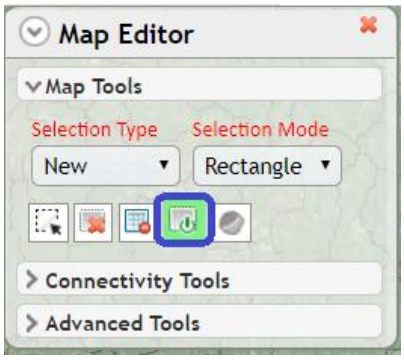
- Choose 'Delete' from the drop down options.
- Click 'Yes' in the confirmation window. This will delete the entire species map and exit to the Working Set menu.

6.4 Viewing and editing attributes

Once a species range has been mapped the HydroBASIN attributes can be viewed and edited.

Viewing Attributes of selected mapped HydroBASINS:

- Click on 'Map Editor' located at the top of the screen to open the Map Editor window. On this window, click on the 'Map Tools' dropdown.
- Select the 'Attribute Viewer' tool from the 'Map tool' toolbar. When active the tool icon will turn green.



- While the icon is green, click on a mapped HydroBASIN to open the Attribute View window. This will display the attributes for the chosen HydroBASIN.

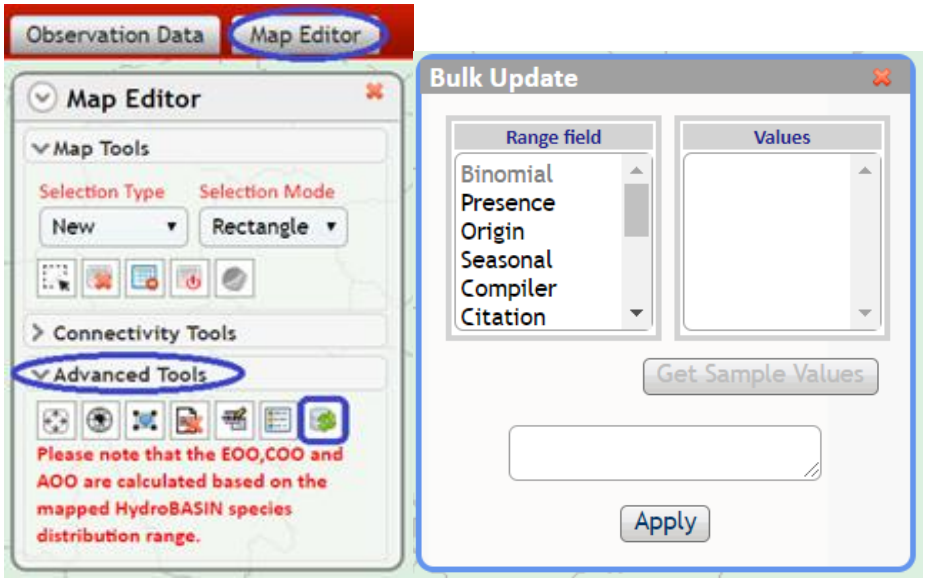
Attributes cannot be edited using the 'Attribute Viewer' tool, and any changes made will be reverted once the Attribute view tool is deactivated.

Editing attributes of selected mapped HydroBASINS:

- Click on 'Map Editor' located at the top of the screen to open the Map Editor window. On this window, click on the 'Map Tools' dropdown.
- Choose 'New' on the Selection Type dropdown, and the Selection Mode of rectangle, polygon, free hand polygon or point.
- Select the mapped HydroBASINS to be edited using the chosen selection mode. The Attribute View window will then appear.
- In the Attribute Viewer window, edit the required attributes. When complete select 'Save Attributes'. This will update the attributes of the selected HydroBASINS.

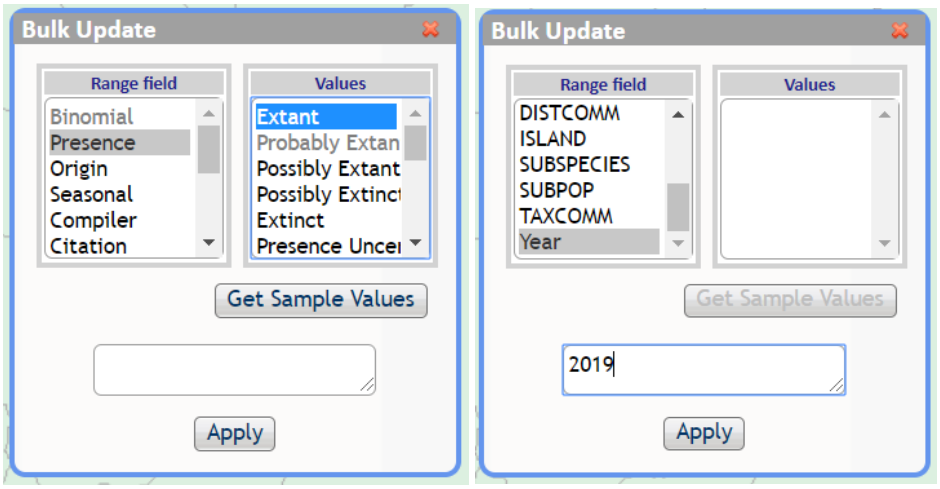
Editing the attributes of all mapped HydroBASINS:

- Click on 'Map Editor' located at the top of the screen to open the Map Editor window. Open the 'Advanced Tools' dropdown to view the Advanced Tools toolbar.
- Click on the 'Bulk Attribute Update' tool in the Advanced Tools toolbar. This will open the Bulk Update window.

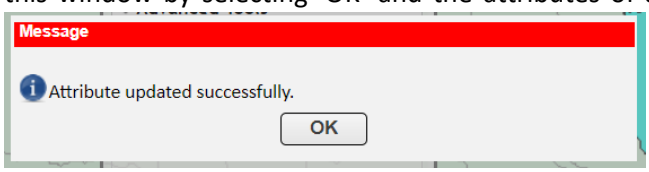


- In the Bulk Update window, select the attribute field to be updated from the Range field list on the left.
- If updating **Presence, Origin**, or **Seasonal** fields click 'Get Sample Values' and select from the list of attributes in the 'Values' list on the right of the window. Click 'Apply' once a value has been selected.

  If updating **all other fields**, click on the chosen field and enter the updated value in the text box below the Range field and Values boxes. Click 'Apply' once the value has been entered.



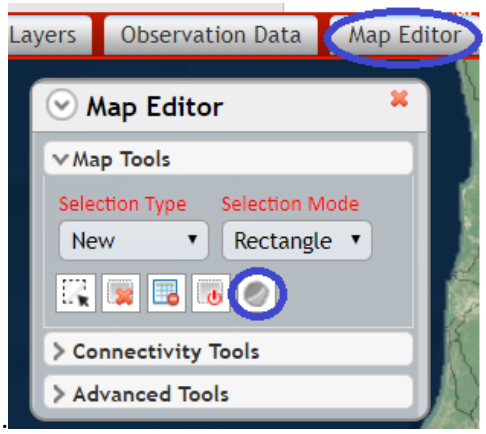
- A message window will appear to say that the attributes have been updated successfully. Close this window by selecting 'OK' and the attributes of all mapped HydroBASINS will be updated.



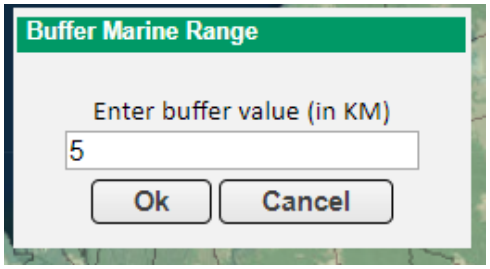
6.5 Buffer marine range

Some species occur in both marine and freshwater systems. The 'Buffer Marine Range' tool can be used to map around coastlines:

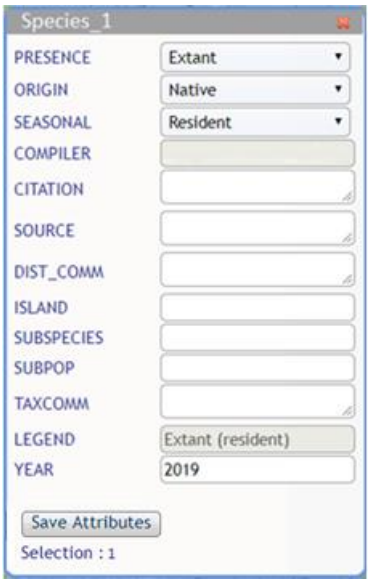
- Click on 'Map Editor' located at the top of the screen to open the Map Editor window. On this window, click on the 'Map Tools' dropdown.
- Select the 'Buffer Marine Range' tool.



- When prompted, enter the needed buffer value in kilometres (km). The example below uses 5 km.



- Draw a freehand polygon along the coastal area to be buffered. This will then select the entered distance from the coastline (as determined by the HydroBASIN layer) within that freehand polygon.
- Enter the attribute values in the Attribute viewer window that appears. Unlike standard HydroBASINS, a marine polygon does not require a HYBAS_ID field (which is automatically added to HydroBASIN polygons). Once completed, click 'Save Attributes' to save the coastal range as a polygon, which can be edited in the same way as HydroBASIN polygons.

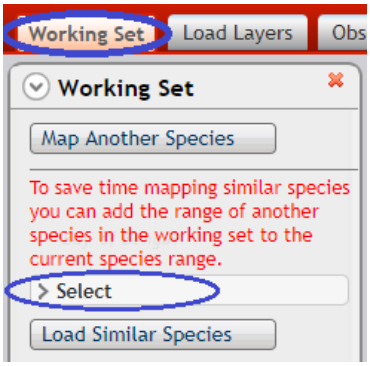


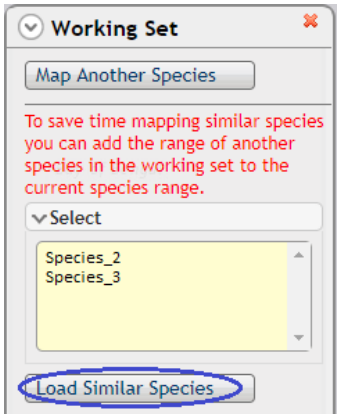
⇨ See '*6.1 New selection*' for details on how to fill in the attribute table and save a selected range.

6.6 Loading a map from a similar species

To save time mapping species with similar distributions, the range of a species with a saved map in the FWMA and in the same working set can be copied to the current species map:

- After selecting a species to map, open the Working Set window by clicking on 'Working Set' located at the top of the screen.
- Click on 'Select' to open a list of species. This will comprise of all species within the current working set that have maps saved within the FWMA.
- Select the species with the map to be copied and click 'Load Similar Species'. The HydroBASIN range and attributes will be copied over and can be edited in the same way as any other HydroBASIN range.





When copying maps from similar species, make sure to update the HydroBASIN range and Attribute table to reflect the current species being worked on.

6.7 Saving the map

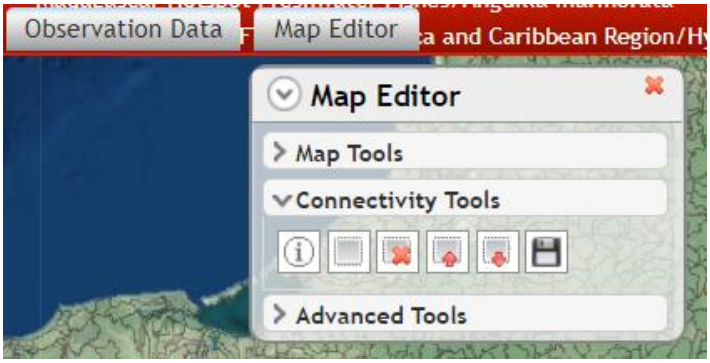
To save the current species map, click 'Save Draft Map' at the top right of the screen. Clicking the dropdown icon next to 'Save Draft Map' will not save the map, but will bring up an additional option list.

Clicking 'Save Draft Map' will save and exit the current map and return you to the Working Set selection screen.

7 Connectivity Tools: Using hydrology

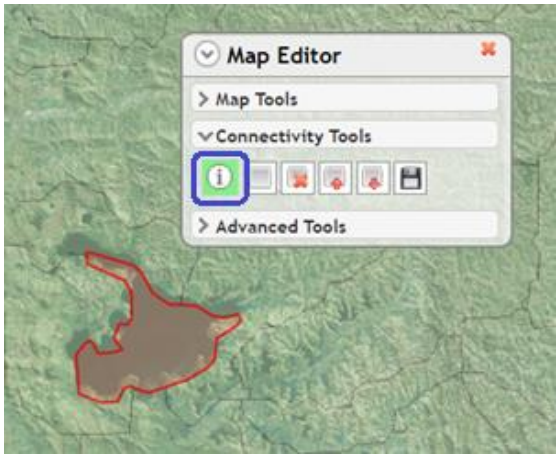
The FWMA has a number of functions that allows users to harness hydrological connectivity information from HydroBASIN layers.

These tools can be found in the Map Editor Window under the 'Connectivity Tools' drop down.

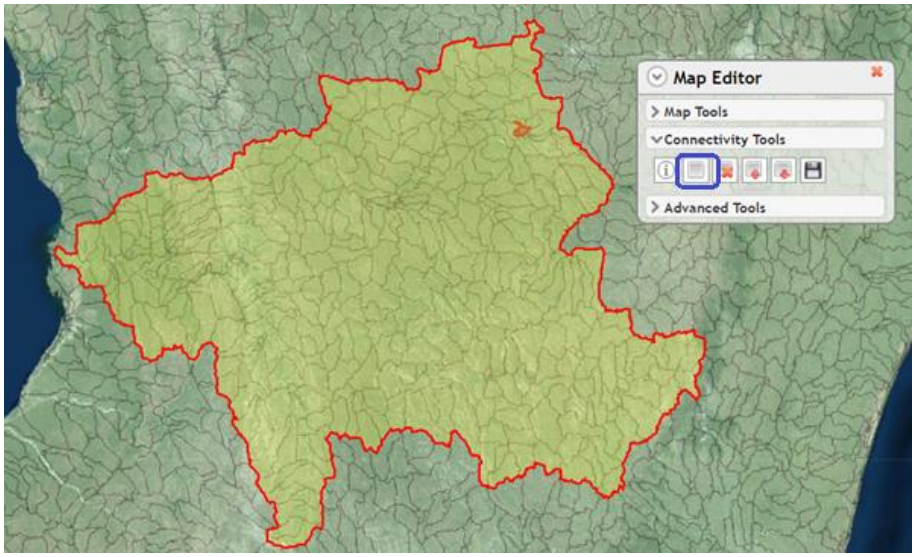


7.1 View and map entire catchments

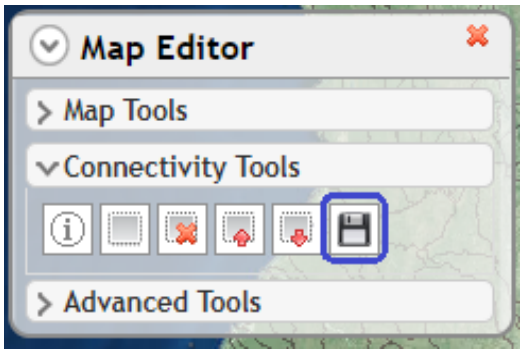
- Click on 'Select HydroBASIN for Connectivity' in the 'Connectivity Tools' toolbar in the Map Editor window. When activated this icon will turn green. Click on the desired HydroBASIN to select it.

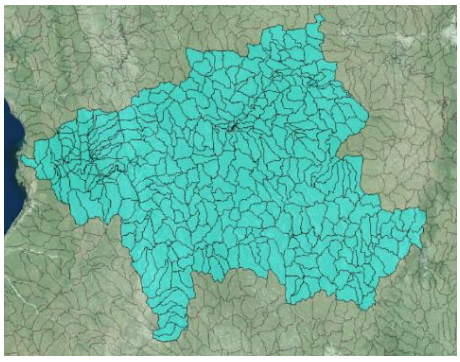


- Click on the 'Catchment' tool in the Connectivity Tools toolbar to display the entire catchment of a HydroBASIN. For HydroBASINS with large catchments this may take some time to load.



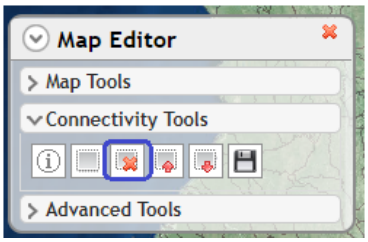
- To save the current HydroBASIN selection as a species distribution map, click on 'Save Catchment as Mapped Range' in the Connectivity Tools toolbar. This will bring up the Attribute window. Fill in this window with the correct attributes and click 'Save Attributes' to save the selected range.





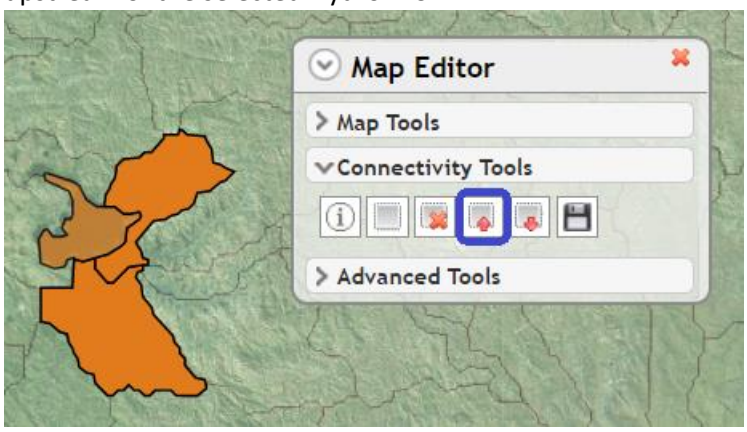
⇨ See section '*6. Mapping the species*' for details on how to fill in the attribute table and save a species map.

- To clear results, click 'Esc' on your computer keyboard, or select 'Clear Catchment' from the Connectivity tools toolbar. The results need to be cleared before using another connectivity tool.



7.2 View and map upstream catchments

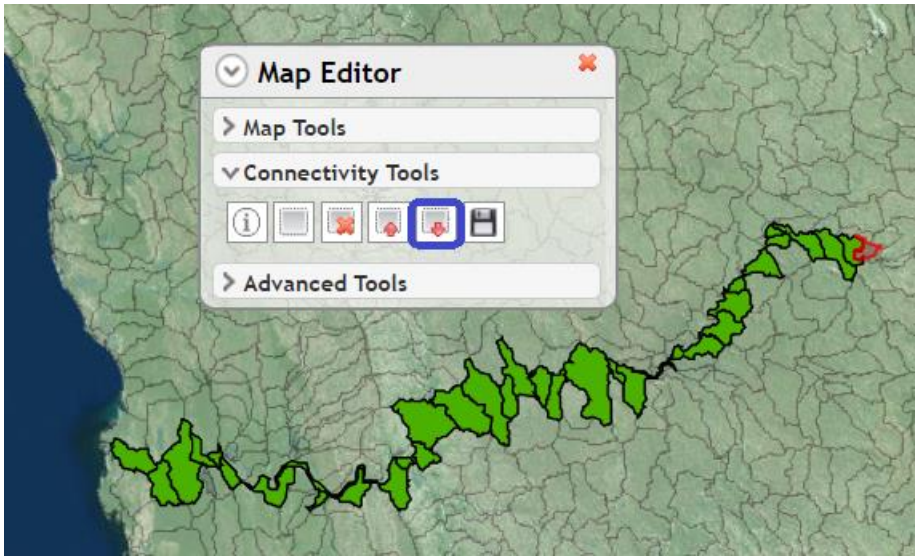
- Click on 'Select HydroBASIN for Connectivity' in the 'Connectivity Tools' toolbar. When activated this icon will turn green. When this icon is green, click on the desired HydroBASIN to select it.
- Click the 'View Next-Up Catchment' tool on the Connectivity Tools toolbar to view all HydroBASINS upstream of the selected HydroBASIN.



- Save or clear the connectivity result by clicking on 'Save Catchment as Mapped Range' or 'Clear Catchment' tools in the Connectivity Tools toolbar.

7.3 View and map downstream catchments

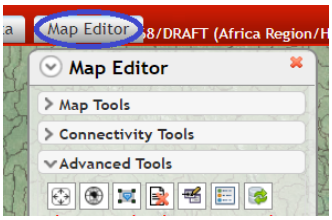
- Click on 'Select HydroBASIN for Connectivity' in the 'Connectivity Tools' toolbar. When activated this icon will turn green. When this icon is green, click on the desired HydroBASIN to select it.
- Click on 'View Next-Down Catchment' on the Connectivity Tools toolbar to view all HydroBASINS upstream of the selected HydroBASIN.



- Save or clear the connectivity result by clicking on 'Save Catchment as Mapped Range' or 'Clear Catchment' tools in the Connectivity Tools toolbar.

8 Advanced Tools

There are a number of advanced tools that can be used to assist in analysing maps and assessing a species for the IUCN Red List. Advanced tools can be found in the Map Editor Window under the 'Advanced Tools' dropdown.



Using the advanced tools to calculate the Extent of Occurrence (EOO), Area of Occupancy (AOO) or Countries of Occurrence (COO) will not automatically fill in the corresponding fields in SIS, so make sure to manually enter these values for each species assessment.

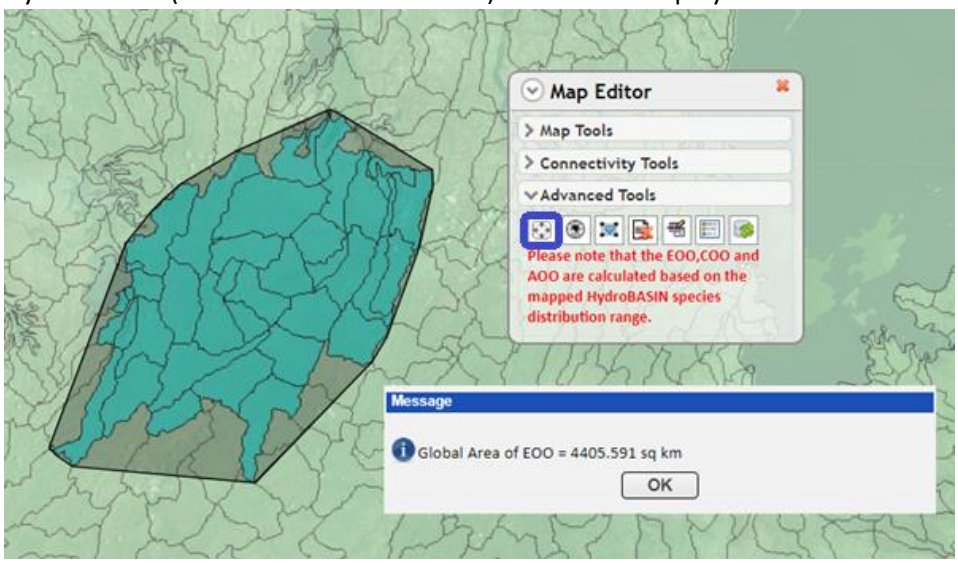
To find more information on the terms used in this section, please refer to the IUCN Guidelines:
https://www.iucnredlist.org/resources/redlistguidelines

8.1 Extent of Occurrence (EOO)

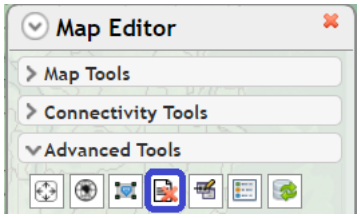
The Extent of Occurrence (EOO) is the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy. The EOO is used in the IUCN Red List Criterion B.

To calculate EOO in the FWMA:

- Click on the 'EOO' tool in the 'Advanced Tools' toolbar within the Map Editor Window.
- Wait for the EOO to load. For wide ranging species, this may take some time to load.
- The results will appear in a Message box in sq km. The minimum convex polygon around all HydroBASINS (used to calculate the EOO) will also be displayed.



- To clear all results, click 'Clear Results' located in the 'Advanced Tools' toolbar.

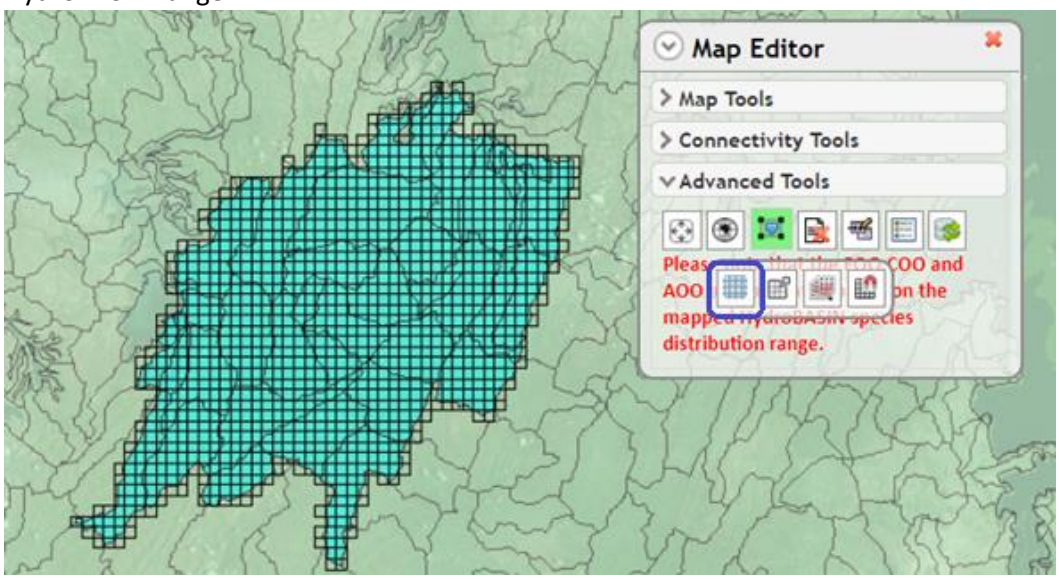


8.2 Area of Occupancy (AOO)

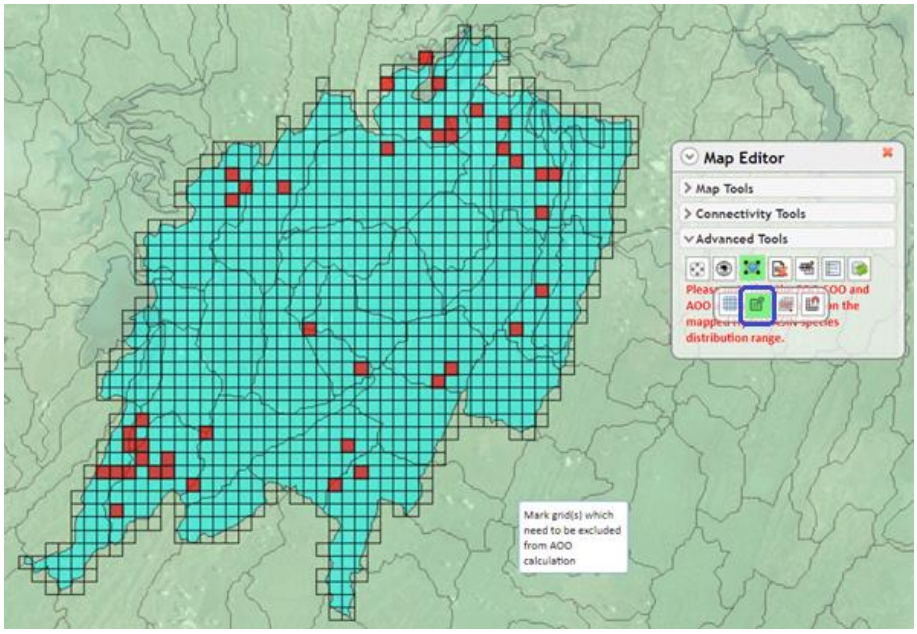
The Area of Occupancy (AOO) is the area within the Extent of Occurrence (EOO) that the species actually occurs in, measured in standard 2 x 2 km grid cells. The AOO is used in the IUCN Red List Criteria B and D.

To calculate AOO in the FWMA:

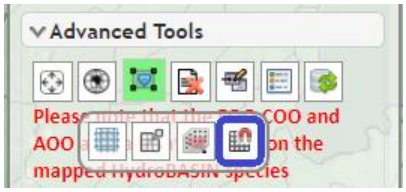
- Click on the 'AOO' tool in the Advanced Tools toolbar. This will open up a subset of options to calculate the AOO.
- Click on the 'Generate Grid Cells' tool from the options to generate 2 x 2 km^2 grid cells. A confirmation message will appear with a warning that large ranges will be time consuming to run. Click 'Yes' if the species has a relatively restricted range. When the tool has finished, the created grid cells will appear across the mapped HydroBASIN range.



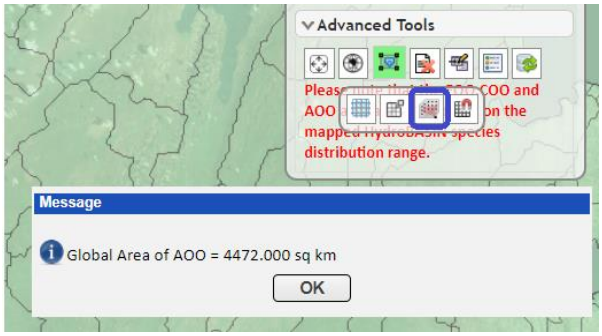
- The grid cells can be edited to exclude cells in which a species does not occur. To do this, click on 'Manual Grid Selection' tool, which will display as green when active. Click on individual grid cells to **exclude** them from the AOO calculation. Cells in red will **not** be counted towards the total AOO.



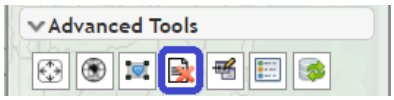
- If a mistake has been made the current grid selection can be fully reverted by clicking 'Clear Grid Selections' from the AOO options.



- Once the correct grid has been selected click 'Calculate AOO' for the global AOO to be displayed in a pop-up message.



- To clear all results, click 'Clear Results'.

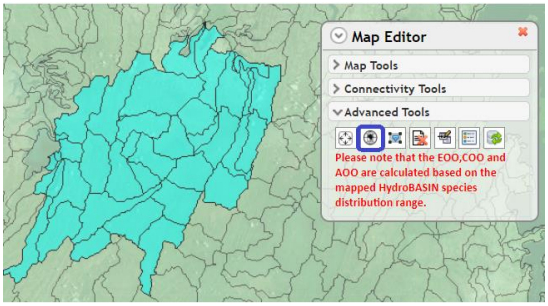


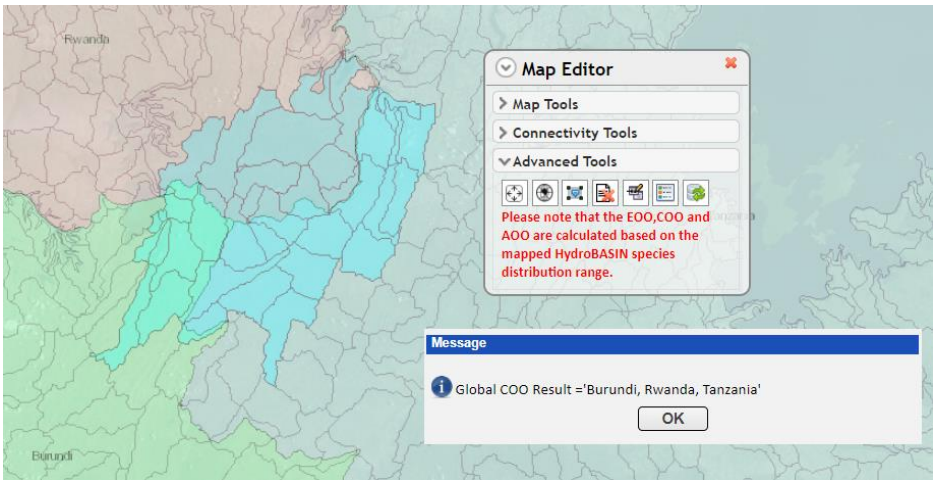
8.3 Countries of Occurrence (COO)

The Countries of Occurrence (COO) tool produces a list of countries the HydroBASIN range map intersects.

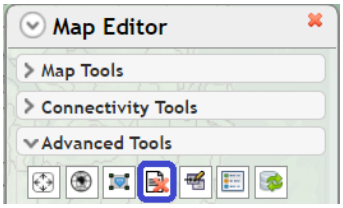
To use the COO tool:

- In the Map Editor window, click on the Advanced Tools dropdown to open the Advanced Tools toolbar. Click on 'COO' from this toolbar to load the tool. This may take some time for very wide ranging species.
- Once the tool has completed its search, a popup message window will appear which will list the COO. Close this window by clicking 'OK'. The tool will also highlight each COO in a different colour.





- To clear all results, including the colour coding of the countries, click 'Clear Results' in the Advanced Tools toolbar.



8.4 Symbology

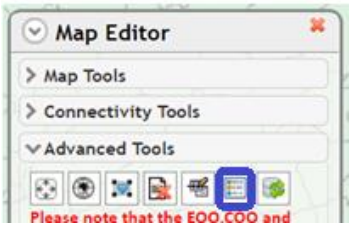
The are two tools in the FWMA that can be used to visualise the Presence, Origin and Seasonal attributes of saved HydroBASINS within a species distribution map.

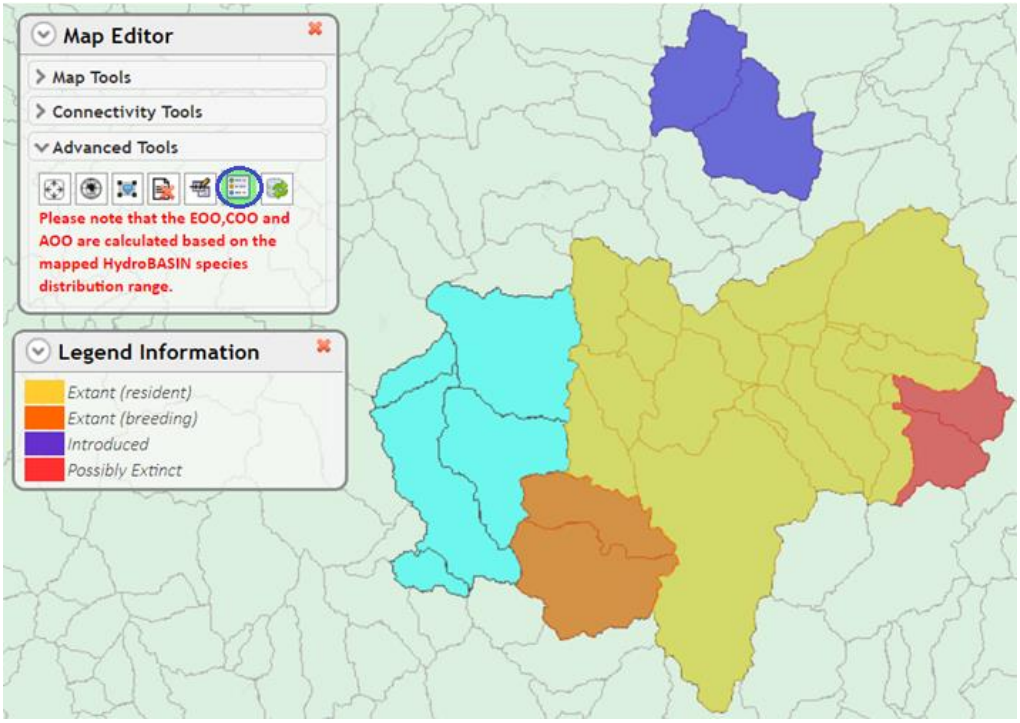
8.4.1 Quick Symbology

The Quick Symbology tool will automatically colour code the different Presence, Seasonal and Origin attributes for saved HydroBASINS.

To use this tool:

- In the Map Editor window, click on the Advanced Tools dropdown to open the Advanced Tools toolbar. Click on 'Quick Symbology' in this toolbar. The Quick Symbology tool will then colour code the Presence, Seasonal and Origin attributes and will produce a legend window.
- To clear all results, click 'Clear Results' in the Advanced Tools toolbar.





Some attribute values will not be specifically coded for or included in the Legend box, and instead will appear as the default blue HydroBASINS. These values are:

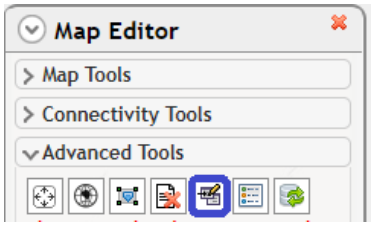
Presence: *Possibly Extant, Presence Uncertain*

Origin: *Passage, Seasonal Occurrence Unknown*

8.4.2 Symbolize

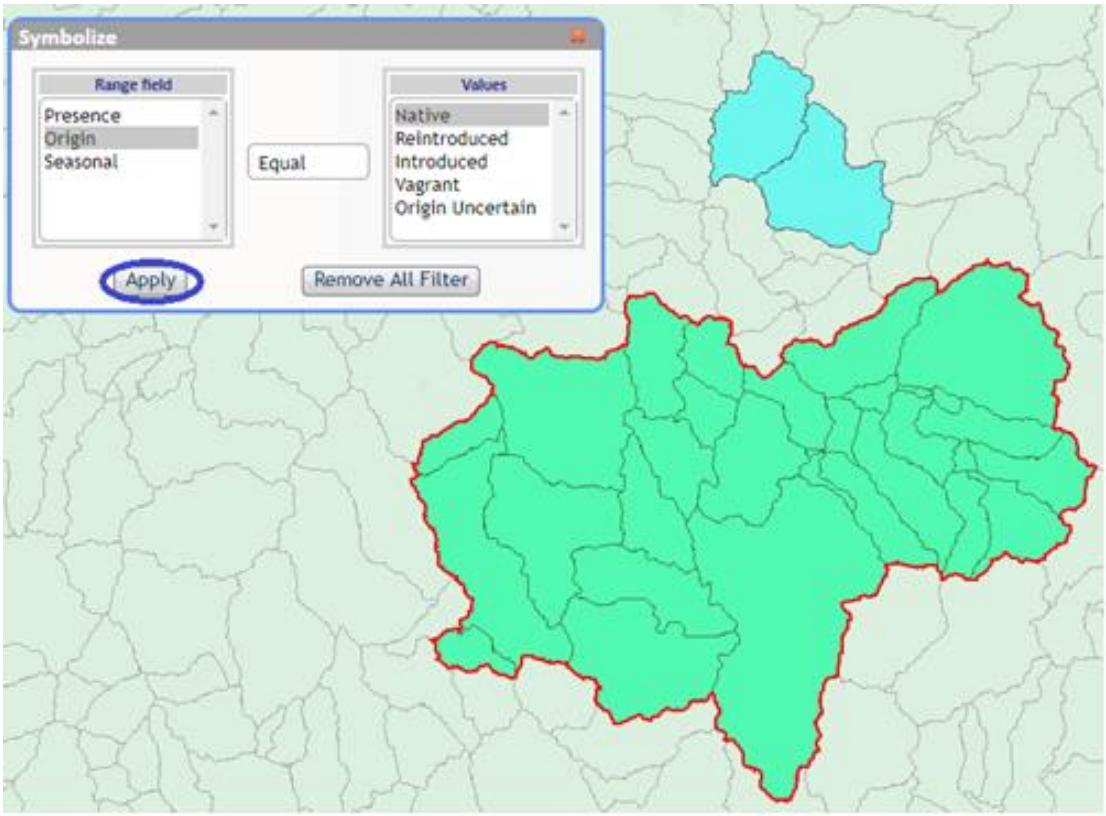
The Symbolize tool allows you to search for specific attribute values from a saved HydroBASIN range. To use this tool:

- In the Map Editor window, click on the Advanced Tools dropdown to open the Advanced Tools toolbar. Click on the Symbolize tool in this toolbar.



- This will open the 'Symbolize' window. In this window, select the Range field to be visualised.
- Selected a Presence, Origin or Seasonal value to be displayed from the 'Values' box.

- When the Range field and values have been selected, click 'Apply'. All HydroBASINS with the selected attribute value will be displayed with a green filter and red outline. If no HydroBASINS exist with the chosen attribute value a message will be displayed to say that no match results were found.



- To clear the results click on 'Remove All Filter'. Alternatively, select another Range and Value and click 'Apply' to overwrite the pervious search.

9 Exporting and printing maps

HydroBASIN maps made within the FWMA can be exported in a number of different ways.

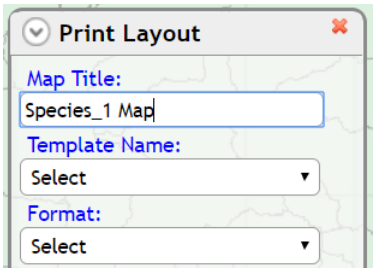
9.1 Exporting and printing map images

To export and print a map in the format PDF, JPG, png8, png32 or gif, use the 'Print' tool:

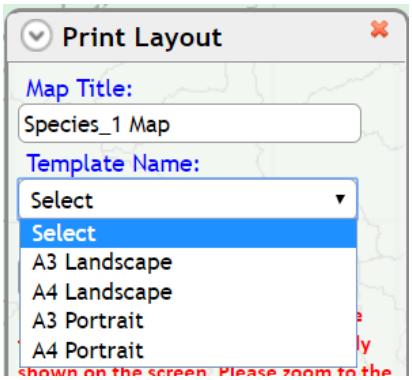
> The print tool will capture the extent of the distribution currently shown on the screen. Please zoom to the entire mapped range if you would like to print an image of the global distribution. See *'4 Navigation'* on how to zoom to the entire mapped range.

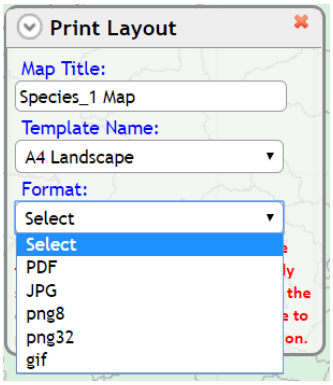
- Click on the 'Print' tool located in the toolbar at the bottom of the screen.

- The Print Layout window will appear. In this, type a name for the map in the 'Map Title' box.

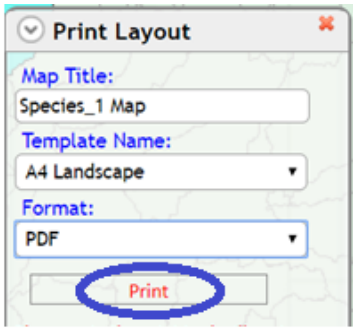


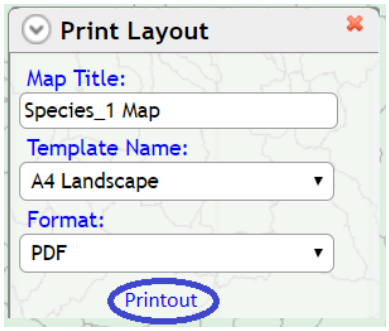
- Click on the Select dropdown under 'Template Name' to select the format of the map to be exported. This gives a choice on the dimensions (A3 or A4) and layout (landscape or portrait) of the output map. Click on the dropdown under 'Format' to select the format of the map export. The output options are PDF, JPG, png8, png32 and gif.





- Click on the 'Print' option. The Print Layout window will display 'Printing' while the map is being produced. Once the export is ready, the 'Printout' option will appear. Click on this to open a separate tab on your internet browser which will display the export in the chosen format.





- On the export tab, download the image from your browser to your computer. This image can then be viewed and printed. The exact method will depend on your browser.

For Google Chrome users, the image can be downloaded by clicking the Download arrow that appears on the top right of the screen. The image can be printed by clicking on the Printer icon at the top right of the screen.

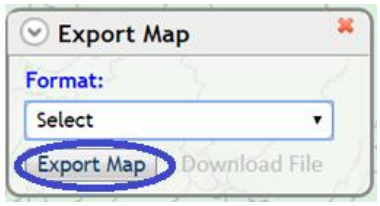
To export additional species maps make sure to refresh the export tab in your browser. If you do not refresh the export tab, the 'Printout' option will reproduce the previous map instead of an updated version.

9.2 Exporting Shapefiles (.shp)

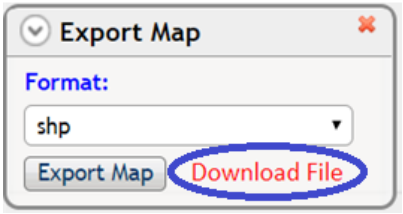
The mapped range can be exported in a Shapefile (.shp) which can be used in other GIS programmes.

- Click on the 'Export' tool located in the tool bar at the bottom of the screen.

- In the Export Map window that appears, click on the dropdown options and select shp (Shapefile). Click 'Export Map' located at the bottom of the window.



- The Export tool will then prepare the export file. This may take some time for wide ranging species. When the file is ready to download, the 'Download File' text will change to red. Click on this text to download the Shapefiles as a zip folder, which will appear in your computer download folder ready to be renamed, moved and unzipped as needed.



10 Submitting and reviewing maps

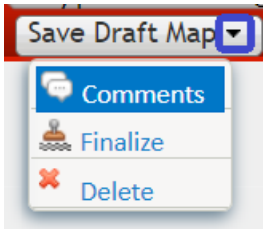
Once a species distribution map has been completed, it can be submitted for review. This changes the map status from 'Draft' to 'Submitted'. Submitted maps cannot be edited, but can be reviewed by users in the FWMA.

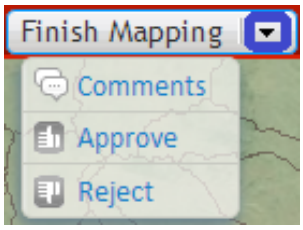
10.1 Adding comments for assessors and reviewers

Comments can be added to a draft species distribution map if assessors or reviewers wish to provide additional information.

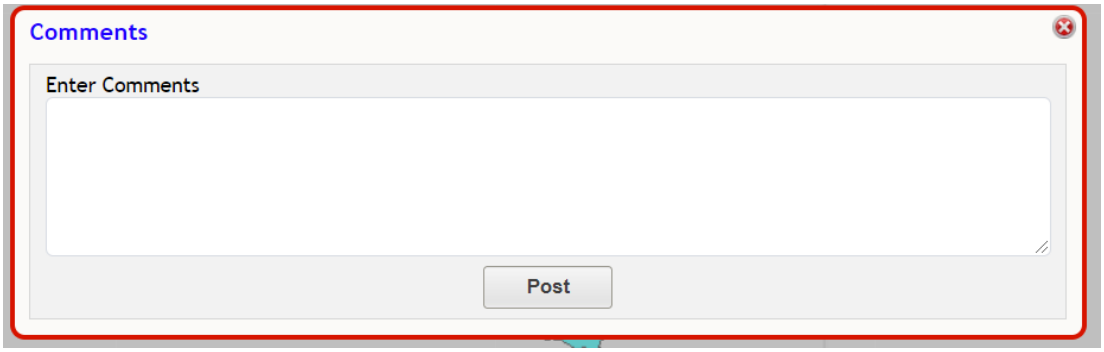
Assessors and reviewers can post comments using the same method:

- **Assessors** must click on the dropdown arrow next to 'Save Draft Map' located at the top right of the screen. Assessors should not click on 'Save Draft Map' directly, as this will save and close the current map. **Reviewers** must click on the dropdown arrow next to 'Finish Mapping'.





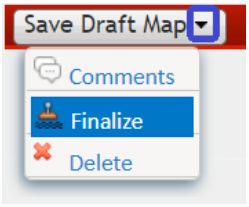
- Choose 'Comments' from the dropdown options to open the Comments window. Any previous comments will appear in this window along with the user name of the poster and the date and time of the comment.
- To enter a new comment type into the text box. Make sure to indicate who is commenting and to whom (i.e. 'Comments for reviewer from assessor'). When complete click 'Post' to save the comment.



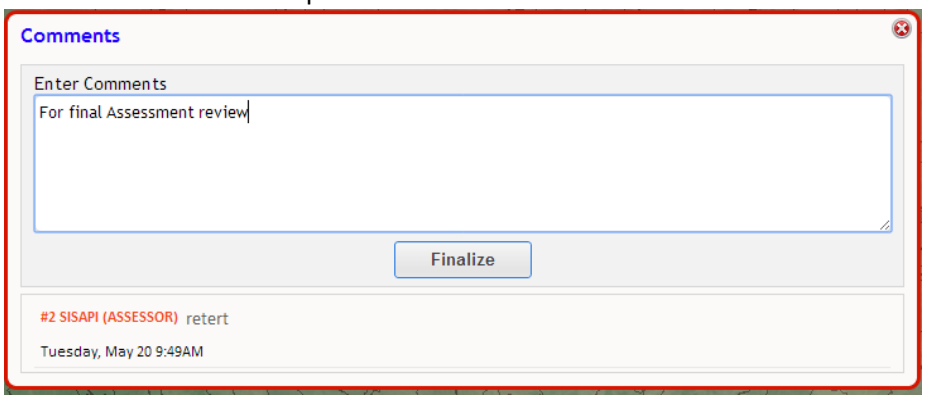
10.2 Submitting a map

To submit a species distribution map for review:

- Click on the dropdown arrow next to 'Save Draft Map' located at the top right of the screen. Do not click on 'Save Draft Map' directly, as this will save and close the current map. Choose 'Finalize' from the dropdown options.



- This will open the Comments window. Enter comments in the 'Enter comments' text box and click 'Finalize'. To submit a map on the FWMA there must be a comment attached here.



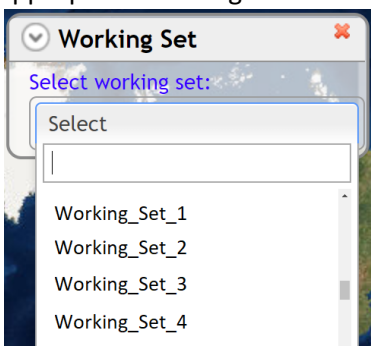
- A window will appear to confirm that the assessment map has been submitted for review. Click 'OK' and the application will then exit the current species map.

10.3 Reviewing a map

Once a map has been submitted it can be reviewed within the FWMA by any user with permission to access the Working Set in SIS.

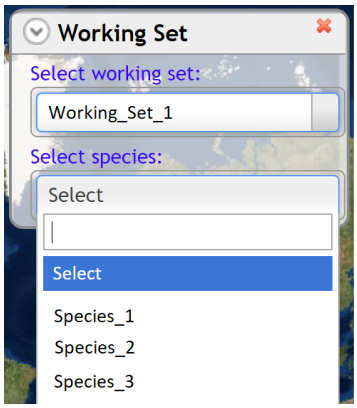
10.3.1 Opening a map for review

- Navigate to the Working Set window, which will automatically appear in the top left of the screen after logging in to the FWMA. Click 'select' on the 'Select working set' dropdown, and choose the appropriate working set from the given list.

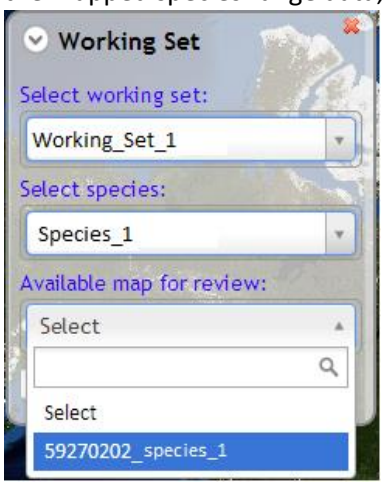


To review a map in the FWMA, you will need the permission to access and edit the specific Working Set in SIS.

- The 'Select species' dropdown will appear. In this, navigate to and click on the name of the chosen species.



- If the chosen species has a map available for review this will be displayed below the Select species dropdown. Select a map available for review and click on 'Load Last Edit' to open it. This will display the mapped species range data, as well as any comments and loaded layers.

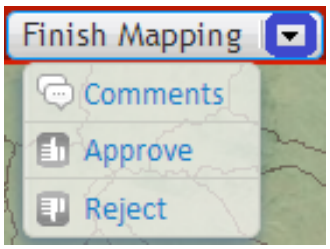


10.3.2 Approving or rejecting a map

Once a species map has been opened for review, the reviewer can decide to approve or reject the map.

To do this:

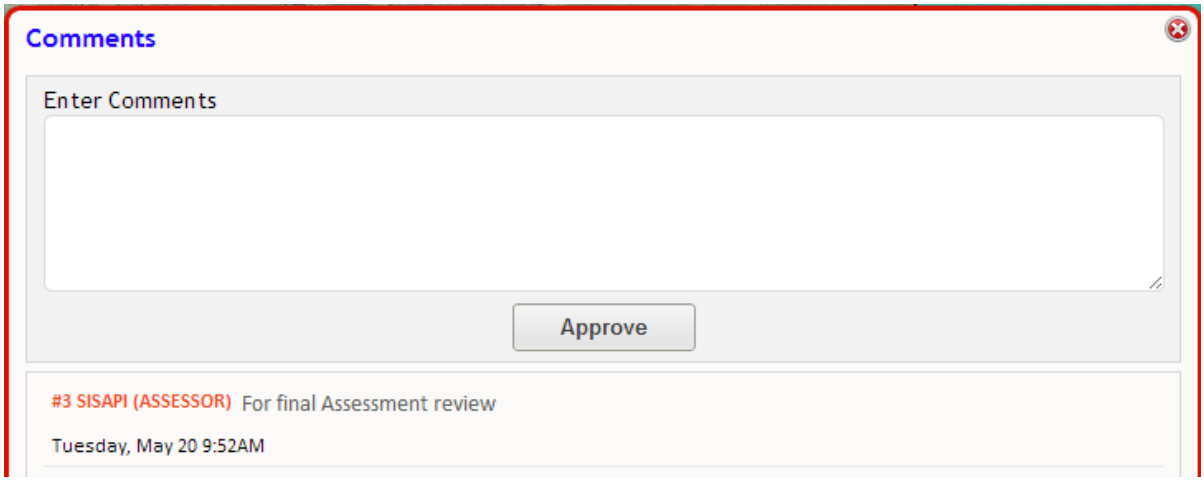
- Click on the drop down option next to 'Finish Mapping' located at the top right of the screen. Choose 'Finalise' from the drop down options.



- The next step will depend on if the map is **approved** or **rejected**.

To approve a species distribution map:

- Click on the 'Approve' option from the dropdown menu. This will open the Comments window that will display any pervious comments. Comments must be entered into the Comments box to approve a map on the FWMA.



- Click on the 'Approve' button below the comments box to close the comments box. The FWMA will exit the species distribution map and this will be marked as 'Published'. Assessors will not get an email notification of this, but the map can be viewed under the 'Published' tab of the Working Set window in the same way as 'Submitted' and 'Rejected' maps.

Approving a map on the FWMA will not automatically published it on the Red List Website. After a map is approved the user should download it from the FWMA, then send it to the Freshwater Biodiversity Unit or directly to the Red List Unit when submitting the assessment. After both are accepted, they will be published together during a Red List Update, which are scheduled throughout the year.

To reject a species distribution map:

It should be noted that at this time, **rejected maps cannot be edited in the FWMA**. Once a map has been rejected, the assessor will need to reproduce the map to make the required edits. Therefore, reviewers are discouraged from rejecting maps before contacting the assessor to discuss any needed changes. The reject function should only be used as a last resort.

- Click on the 'Reject' option from the dropdown menu. This will open the Comments window, which will display any pervious comments.
- In the Enter Comments text box, enter comments on why the map has been rejected (e.g. incorrect or incomplete distribution range). Once this has been entered, click the 'Reject' button below the Enter Comments box.
- A window will display the message 'Assessment map has been rejected' and the species map will be closed in the FWMA. The status of the map will be updated to 'Rejected' and an email notification will be sent to the assessor. Rejected maps can be viewed under the 'Rejected' tab of the Working Set window in the same way as 'Submitted' and 'Published' maps, but cannot be edited.

Appendix 1: FWMA HydroBASIN Regions

Countries and territories within each HydroBASIN Region layer* **
*Cabo Verde (Cape Verde) and the Antarctic region are not included in any FWMA Region layer
**Not all countries/territories are listed in the following tables (e.g., unnamed islands)

Africa

Algeria	Gambia	Republic of the Congo
Angola	Ghana	Rwanda
Benin	Guinea	Sao Tome and Principe
Botswana	Guinea-Bissau	Senegal
Burkina Faso	Ivory Coast	Seychelles (Groupe d'Aldabra, Atoll de Cosmoldeo, Atoll de Farquhar, Les Amirantes)
Burundi	Kenya	Sierra Leone
Cameroon	Lesotho	Somalia
Canary Islands	Liberia	South Africa
Central African Republic	Libya	South Sudan
Chad	Madagascar	Sudan
Comoros	Madeira	Tanzania
Democratic Republic of the Congo	Malawi	Togo
Djibouti	Mauritania	Tunisia
Equatorial Guinea	Morocco	Uganda
Eritrea	Mozambique	Zambia

Eswatini	Namibia	Zimbabwe
Ethiopia	Niger	
Gabon	Nigeria	

North American Arctic

Alaska (USA)	Russia (eastern)
Canada (northern)	

Central South-East Asia

Afghanistan (excluding south-west)	Lao People's Democratic Republic	South Korea
Bangladesh	Malaysia (Peninsular)	Sri Lanka
Bhutan	Mongolia (southern)	Taiwan
Cambodia	Myanmar	Tajikistan
China	Nepal	Thailand
India	North Korea	Turkmenistan (eastern)
Japan	Pakistan (excluding south-west)	Uzbekistan (excluding western)
Kazakhstan (excluding western and north-eastern)	Russia (south-eastern)	Viet Nam
Kyrgyzstan	Singapore	

Australia and Oceania

Guam	New Zealand	Timor-Leste
Indonesia	Northern Mariana Islands	Vanuatu
Malaysia (Sabah and Sarawak)	Palau	
Marshal Islands	Papua New Guinea	

Europe and Middle East

Afghanistan (western)	Iran	Portugal
Albania	Iraq	Qatar
Andorra	Ireland	Republic of Moldova
Armenia	Israel	Romania
Austria	Italy	Russian Federation
Azerbaijan	Jordan	San Marino
Bahrain	Kazakhstan (western)	Saudi Arabia
Belarus	Kosovo	Serbia
Belgium	Kuwait	Slovakia
Bosnia and Herzegovina	Latvia	Slovenia
Bulgaria	Lebanon	Spain
Croatia	Lithuania	Sweden
Cyprus	Luxembourg	Switzerland
Czechia (Czech Republic)	Malta	Syria
Denmark	Moldova	Turkey
Egypt (north-eastern)	Monaco	Turkmenistan (excluding eastern edge)
Estonia	Montenegro	Ukraine
Finland	Netherlands	United Arab Emirates

France	North Macedonia	United Kingdom of Great Britain and Northern Ireland
Georgia	Norway	Uzbekistan (far western)
Germany	Oman	Vatican City
Greece	Pakistan (western)	Yemen
Hungary	Palestine	
Iceland	Poland	

Greenland

Greenland

North America and Caribbean

Anguilla	Dominica	Mexico
Antigua and Barbuda	Dominican Republic	Montserrat
Bahamas	El Salvador	Nicaragua
Belize	Guadeloupe	Panama (western)
British Virgin Islands	Guatemala	Saint Kitts and Nevis
Canada (southern)	Haiti	Turks and Caicos
Costa Rica	Honduras	United States of America (USA) (excluding Alaska and Hawaii)
Cuba	Jamaica	US Virgin Islands

South America

Argentina	Curaçao	Paraguay
Aruba	Ecuador (including Galapagos islands)	Peru
Barbados	Falkland Islands	Saint Lucia
Bolivia	French Guiana	St. Vincent and the Grenadines
Bonaire	Grenada	Suriname
Brazil	Guyana	Trinidad and Tobago
Chile	Venezuela	Uruguay
Colombia	Martinique	

Siberia

Kazakhstan (northern)	Russia (excluding western and south-eastern)
Mongolia (north eastern)	USA (western Alaskan Islands)

Islands*

American Samoa	Fiji (eastern islands)	Pitcairn Islands
Azores	French Polynesia	Réunion
Bermuda	French Southern and Antarctic Lands (northern Islands)	Russia (northern Taymyrsky Dolgano-Nenetsky District)
British Indian Ocean Territory	Hawaii (USA)	Samoa
Chatham Islands	Kiribati	St Helena, Ascension and Tristan da Cunha
	Maldives	The Cocos (Keeling) Islands

Christmas Islands	Mauritius	Tokelau
Cook Islands	New Zealand (Auckland and southern islands)	Tonga
Easter Island	Niue	Wallis and Futuna

***** Also includes some coastal islands around: India, Sri Lanka, Pakistan, Thailand, Myanmar, Indonesia (south-western Sumatra), China (Liaoning), North Korea (south-western), Somalia, Kenya, Tanzania, Madagascar, Mozambique, Libya, Greece (eastern), Turkey, Black Sea, Azov Sea, Ecuador, Chile, Peru, Greenland, USA (eastern coast north from North Carolina), Canada (eastern coast), Russia (Novaya Zemlya Rayon and Zapolyarny District)

Appendix 2: Baselayer resources

There are a number of online baselayer resources that can be used to aid in mapping freshwater species in the FWMA. A selection are detailed here.

For help on uploading these layers to the FWMA please see *5.1 Importing observation data.*

⇨ **Freshwater Ecoregions of the World (FEOW)** (http://www.feow.org/)

The FEOW provides a global biogeographic regionalization of the Earth's freshwater biodiversity covering virtually all freshwater habitats on Earth. The ecoregion map has 426 units and includes additional information on biodiversity and threat data.

⇨ **Protected Planet** (https://www.protectedplanet.net/)

The Protected Planet database is an up to date and complete source of information on protected areas globally. It is a publicly available online platform where users can discover terrestrial and marine protected areas, access related statistics and download data from the World Database on Protected Areas (WDPA).

⇨ **The Global River Classification (GloRiC)** (https://www.hydrosheds.org/page/gloric)

The Global River Classification (GloRiC) provides a database of river types and sub-classifications for all river reaches globally. It provides a hydrologic, physio-climatic, and geomorphic sub-classification, as well as a combined type for every river reach, resulting in a total of 127 river reach types.

Appendix 3: Summary of Changes to the FWMA Help Manual

Changes in version 2.1 (September 2019)

Significant edits to all sections to reflect redevelopment of the FWMA