IUCN Species Mapping Tools

Version: 2019_08

Toolbox Instructions for IUCNRedListToolbox_2019_08

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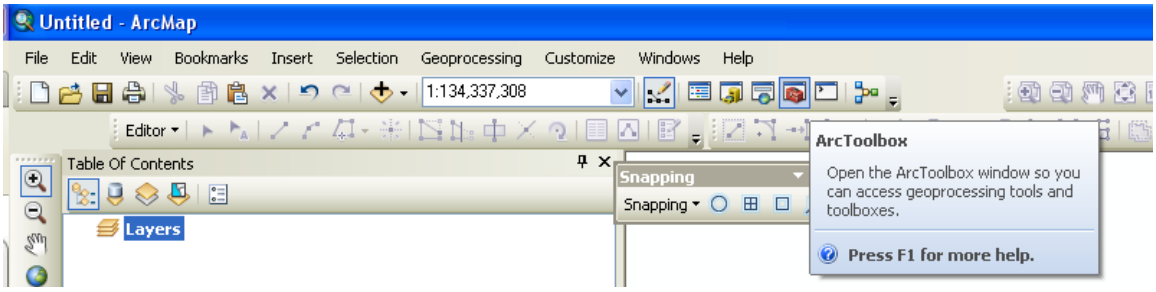
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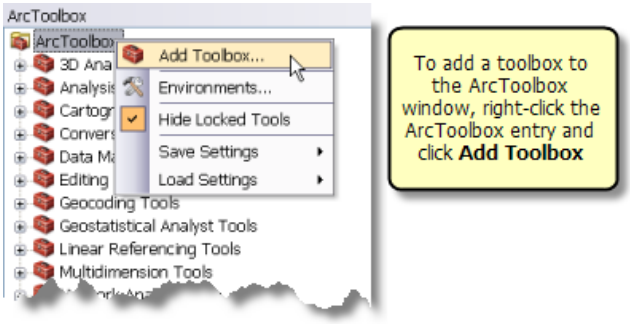
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I. Adding a Toolbox

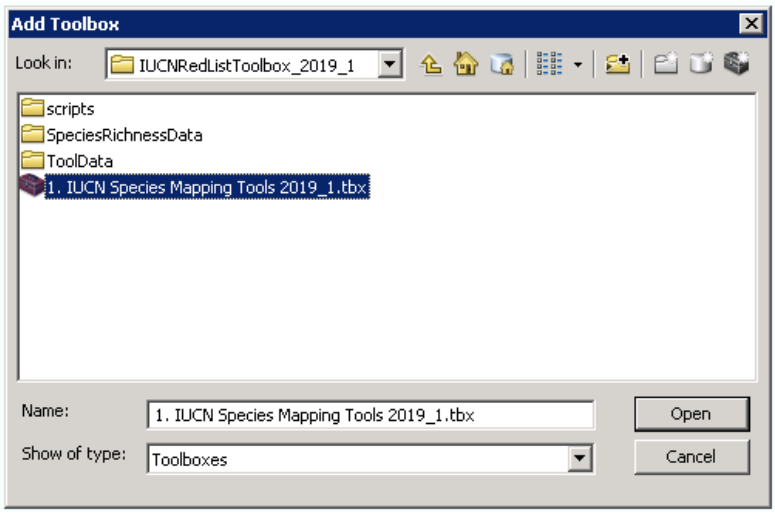
In any ArcGIS Desktop application, the ArcToolbox window is opened with the Show/Hide ArcToolbox Window button found on the menu bar or by selecting Geoprocessing » ArcToolbox.



Right-click on the ArcToolbox entry then select 'Add Toolbox…'



To add any custom or system toolbox to the ArcToolbox window, browse to the location containing the toolbox required, select the toolbox and click 'Open'. In the example below, the toolbox is inside the folder "IUCNRedListToolbox_2019_1"



II. Contents of the Red List Toolbox folder

The toolbox folder contains:

i. scripts *(folder)*
ii. SpeciesRichnessData *(folder)*
iii. ToolData *(folder)*
iv. 1. IUCN Species Mapping Tools 2019_08.tbx *(toolbox)*

Note: The toolbox name is prefixed with a number, specifically so that it appears at the top of the alphabetical list of toolboxes in the ArcToolbox list.

i. scripts

The python scripts used by the custom toolbox tools.

ii. SpeciesRichnessData

- ISEA10_Global.shp - global hexagon grid with 865 km^2 cells

The ISEA10 grid is a geodesic discrete global grid system, defined on an icosahedron and projected to the sphere using the inverse Icosahedral Snyder Equal Area (ISEA) Projection. This corresponds to a hexagonal grid composed of individual units (cells) that retain their shape and area (865 km^2) throughout the globe. These are more suitable for a range of ecological applications than rectangular grids.

iii. ToolData

- DEMLayer.gdb - geodatabase with DEM and bathymetry rasters
- templates.gdb - template empty feature classes
- empty_point.shp - template empty point shapefile with required and recommended attributes only
- empty_point_with_optional_attributes.shp - template empty point shapefile including optional attributes
- empty_polygon.shp - template empty polygon shapefile
- legendPolygons2019symbology.lyr - symbology for polygon legend field

iv. 1. IUCN Species Mapping Tools_2019_08.tbx

a. Custom IUCN Tools

1. Create New Species Shapefile or Feature Class

2. Use Species List to create Multiple Shapefiles or Feature Classes

3. Add Attribute Fields for polygons or points

4. Fill Binomial Field with Species Name

5. Check Fields

6. Split Layer By Attribute

7. Fill Legend Field

8. Species Richness Count

9a. Refine Species to Altitude

9b. Refine Species to Bathymetry

b. Built-in ArcMap Tools

- Add XY Coordinates
- Clip
- Define Projection
- Delete Field
- Dissolve
- Erase
- Merge
- Project
- Smooth Polygon

c. Batching Tools

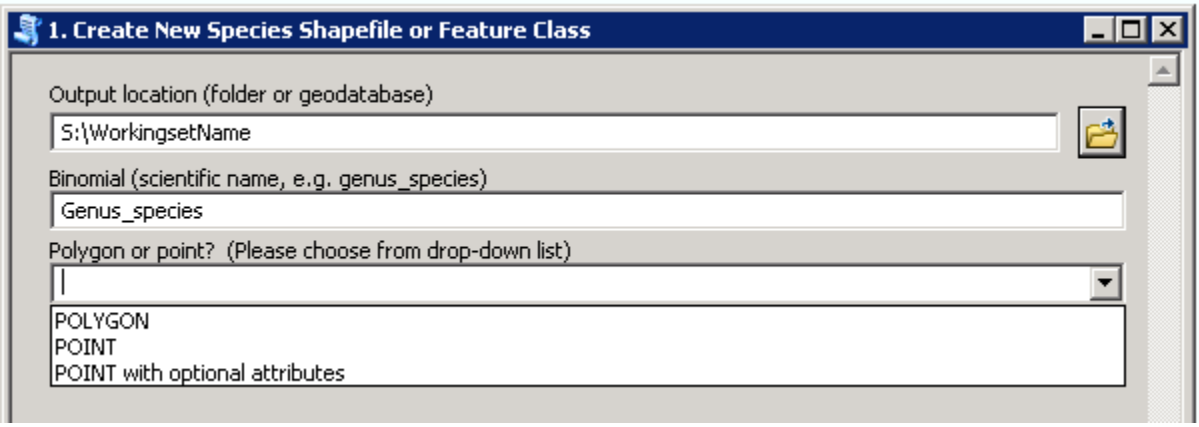
a. Custom IUCN Tool Descriptions

1. Create New Species Shapefile or Feature Class

Creates an empty species shapefile or feature class for the specified binomial with all the required and recommended attributes.

For point data there is an option to add the optional attributes as well. There are 26 of these, therefore it is advisable **only** to add them if needed.

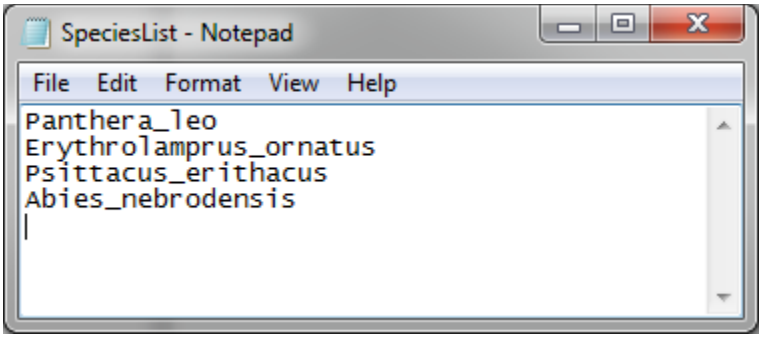
If the output location is a folder, a shapefile will be created.
If the output location is a geodatabase, a feature class will be created.



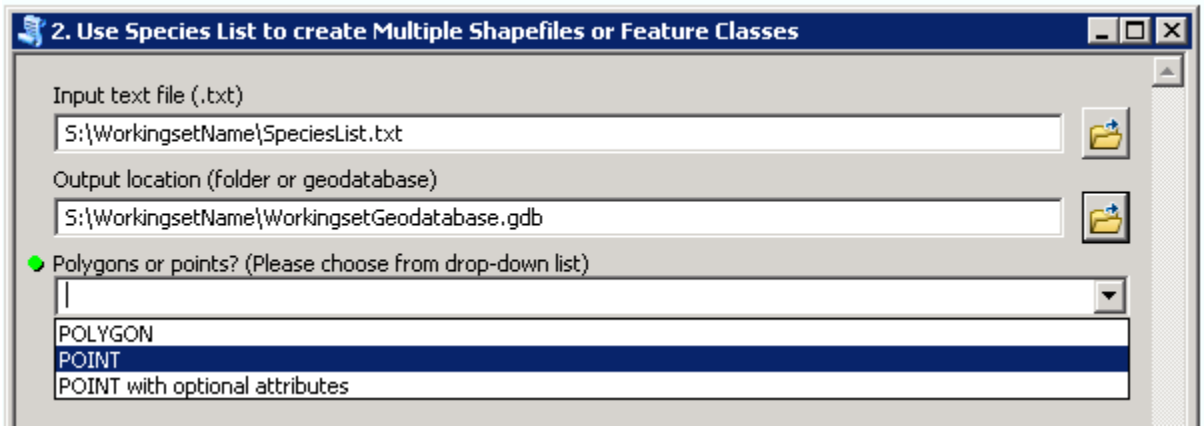
2. Use Species List to create Multiple Shapefiles or Feature Classes

Creates a new shapefile or feature class for each binomial listed in a text file.

The text file should be in the format shown below, with each species on a new line. If the underscore is absent between the genus and species names, an underscore will be added by the tool.



The Output location specified (folder or geodatabase) will determine whether shapefiles or feature classes are created. A new folder or geodatabase can be created when selecting the Output location.



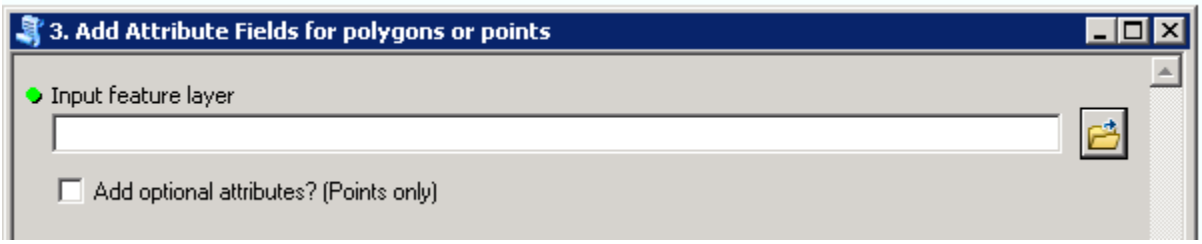
If a shapefile/feature class already exists for a species name in the Output location, a warning will be given and a new file will not be created.

```
Running script CreateEmptySpeciesShapefilesFromText...
Text file contains:
['Panthera_leo\n', 'Erythrolamprus_ornatus\n',
'Psittacus_erithacus\n', 'Abies_nebrodensis\n']
Panthera_leo already exists in the output geodatabase. New feature
class not created.
```

3. Add Attribute Fields for polygons or points

Checks whether all the required and recommended attributes are present in an existing shapefile or feature class and adds any that are missing.

There is a tick box to choose to include all the optional attribute fields for points. There are 26 of these, therefore it is advisable **only** to add them if needed.

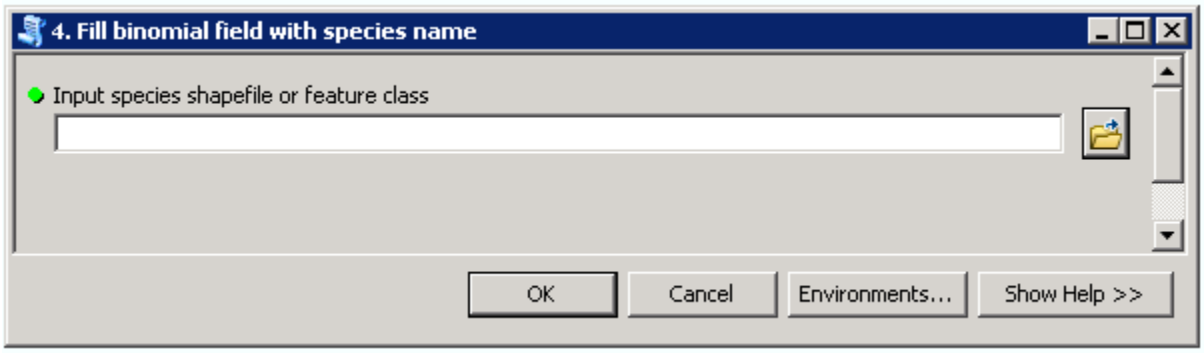


Note: the id_no field is now optional for polygons and points but will nevertheless be added by this tool.

4. Fill binomial field with species name

Takes the name of a shapefile (e.g. Genus_species.shp) or feature class (e.g. Genus_species) and populates the *binomial* field with the name, e.g. "Genus species".

To prevent errors, ensure there are no spaces after the name of the input shapefile/ feature class.



5. Check Fields

Checks a shapefile or feature class for a single species for the presence of the required fields and performs some checks on the content of those fields:

Check required attributes are present

The attributes *binomial, presence, origin, citation, compiler* and *yrcompiled* are required for both polygons and points. For points, the fields *dec_lat, dec_long* and *spatialref* are also required. If any of the required fields are not present, an error message will be displayed and the tool will not continue to check the field contents. All missing fields can be added using the tool: *3. Add Attribute Fields for polygons or points*.

Note: the seasonal field is now only required if applicable to the species in question. It must, however, be present before the legend can be added, and should be filled with the default value, 1, if no other value is appropriate.

Check attribute values

presence, origin, seasonal (if present): A warning message lists any invalid values.

binomial, citation: A warning message is given if there is more than one distinct value for the field and the values are listed.

compiler: A warning is given if there are any null values and lists any values which are 3 characters or shorter in case these are incorrect.

yrcompiled: A warning is given if there are any null values and lists all distinct values for the field for a visual check.

for points:

spatialref: The value(s) are listed for a visual check and a warning is given if there is more than one value.

dec_lat, *dec_long*: These are checked for null and zero values.

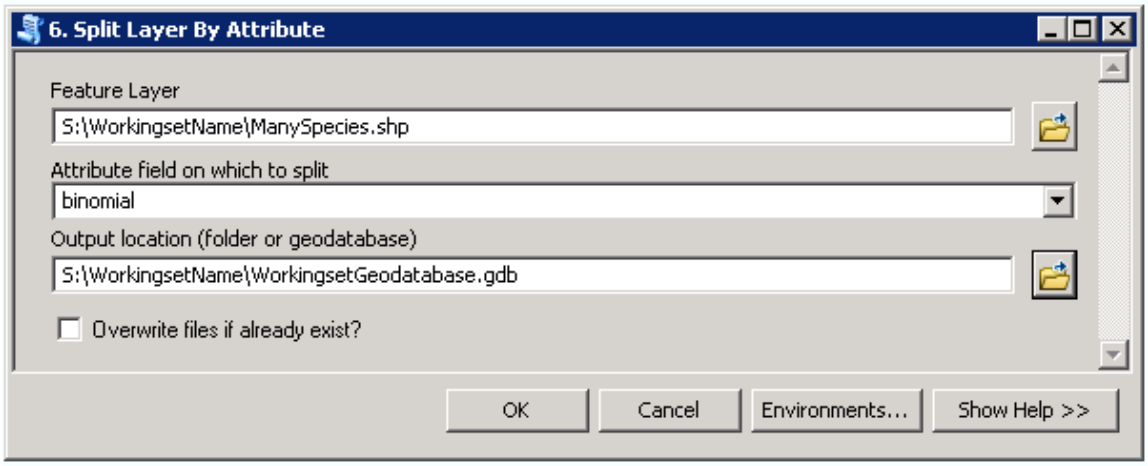
dec_lat is checked for values greater than 90° and less than -90°.

dec_long is checked for values greater than 180° and less than -180°.

6. Split Layer By Attribute

Splits a shapefile or feature class into multiple single shapefiles or feature classes by distinct values of the specified attribute.

For example, a shapefile containing multiple species can be split by *binomial* to create an individual shapefile for each species.



The new files created are listed as the tool runs.

If the option to 'Overwrite files if already exist?' is not checked, a warning will be given for each new file which cannot be created because there already is a file with that name in the output location.

```
Running script SplitLayerByAttributes...
Abies_nebrodensis created
Erythrolamprus_ornatus created
Panthera_leo already exists. New file not created.
Psittacus_erithacus created
Completed script SplitLayerByAttributes...
```

Any rows with blank values or only spaces in the split field will be put into a separate file e.g. binomial_isBlank.shp.

Similarly any rows with null values will be put into e.g. binomial_isNull.shp.

7. Fill Legend Field

Fills the legend field of the specified shapefile or feature class with the appropriate legend text based on the values of the *presence*, *origin* and *seasonal* fields.

It is recommended to run the *5. Check Fields* tool first to check that the *presence*, *origin* and *seasonal* (if applicable) fields all have valid values.

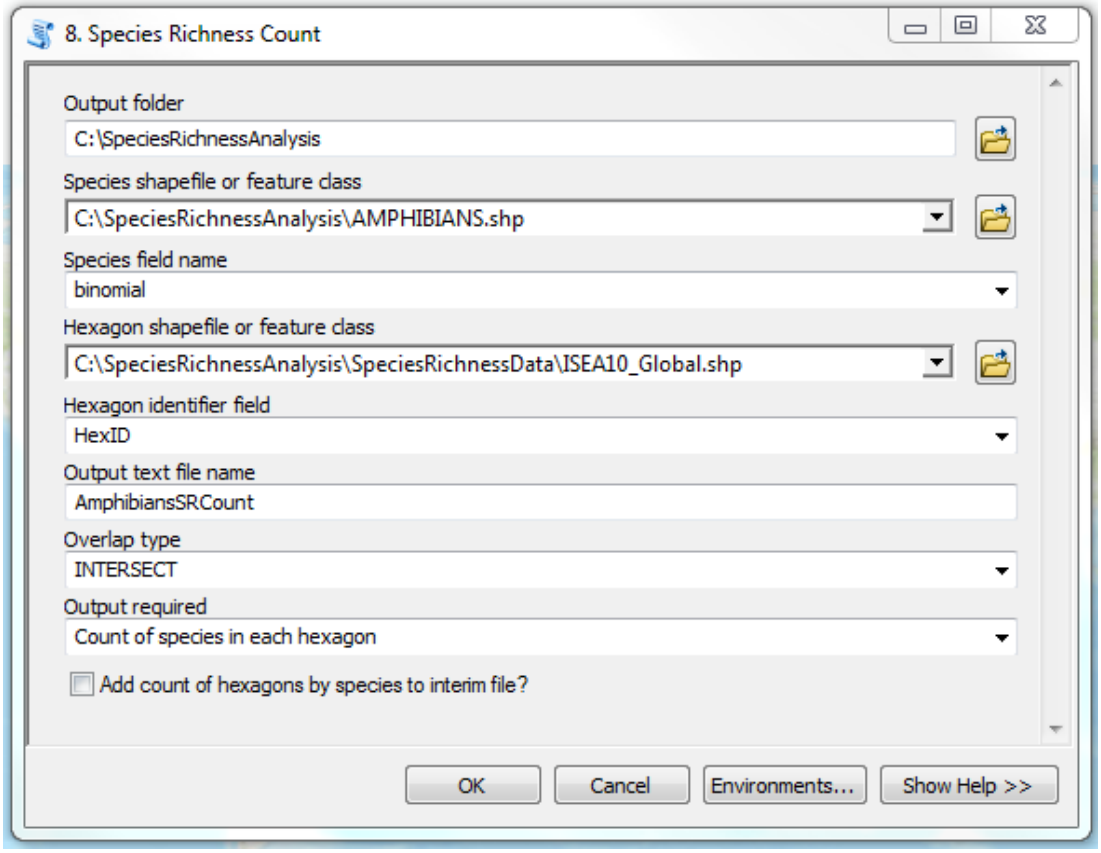
8. Species Richness Count

Creates a species richness count for a species shapefile or feature class split into cells defined by a grid.

The shapefile ISEA10_Global.shp provided in the SpeciesRichnessData folder can be split into Marine and Terrestrial using the *SYSTEM* attribute.

If you wish to use your own gridded shapefile/feature class, it must have an attribute giving a unique identifier to each cell.

It is recommended that you clip the grid you are using (ISEA10_Global.shp or your own grid) to the area for which you are conducting the analysis to minimise the running time of the tool. The time taken by the tool is dependent on the number of species and the size of the area being analysed.



The output is a csv file named <Output text file name>_final.csv (e.g. AmphibiansSRCount_final.csv).

Depending on the choice of 'Output required', this will contain:

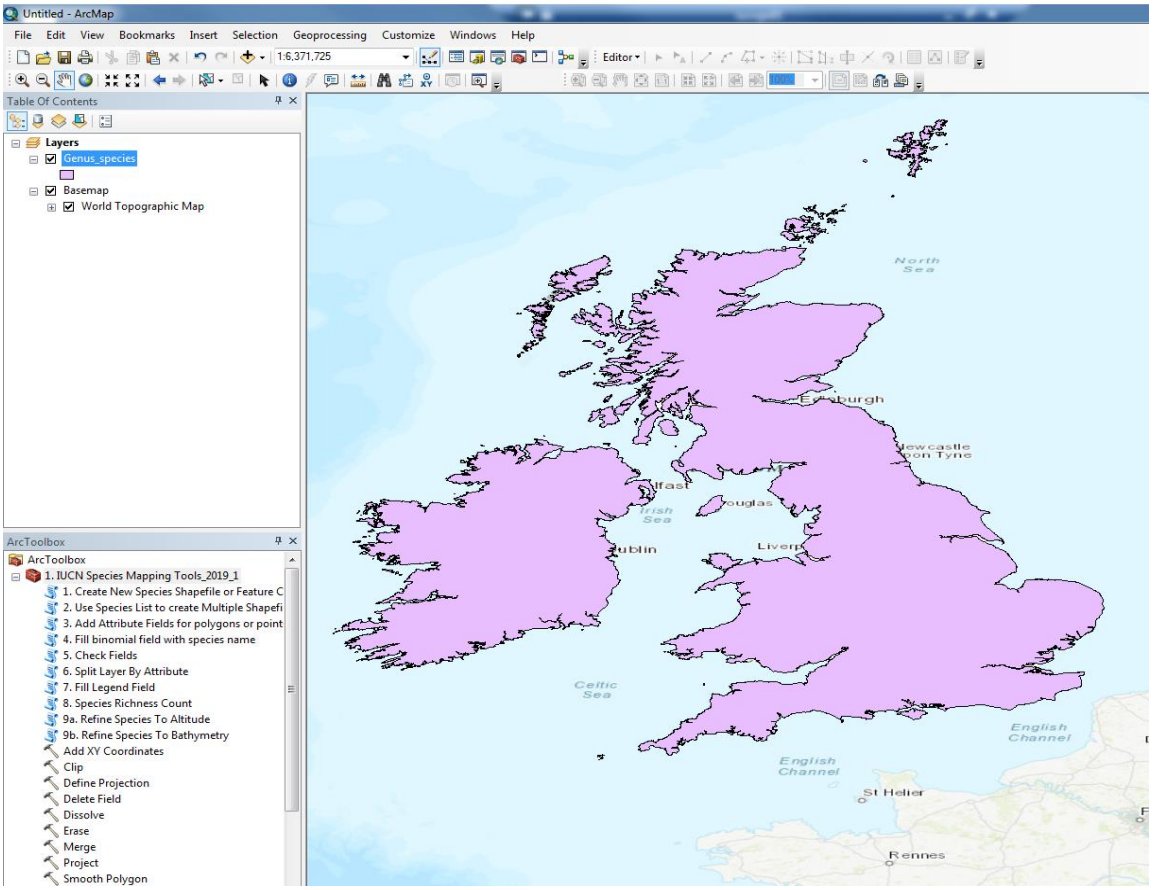
- Full list of species in each hexagon
    - hexid, count, specieslist (species names separated by ;)
- Count of species in each hexagon
    - hexid, count

An interim text file is also produced, named <Output text file name>.txt. This contains a list of the grid cells in which the species is found. If the check box 'Add count of hexagons by species to interim file?' is ticked, the file will contain for each species: binomial, Count, Hex (list of cells in which that species is found). Otherwise the binomial will be followed by the list of cells). Following the column headings, the selected 'Overlap type' is specified (this will usually be 'Method: INTERSECT').

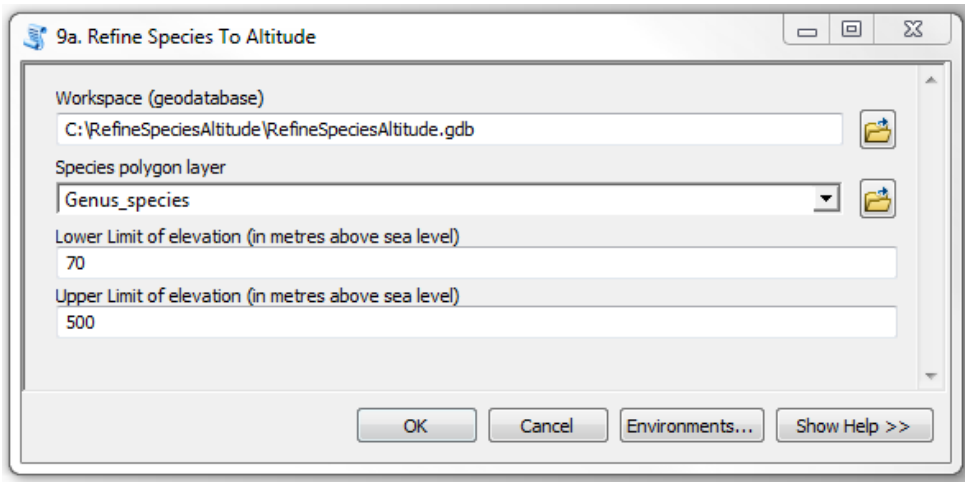
9a. Refine Species to Altitude

Refines the species shapefile or feature class to the specified altitude range.

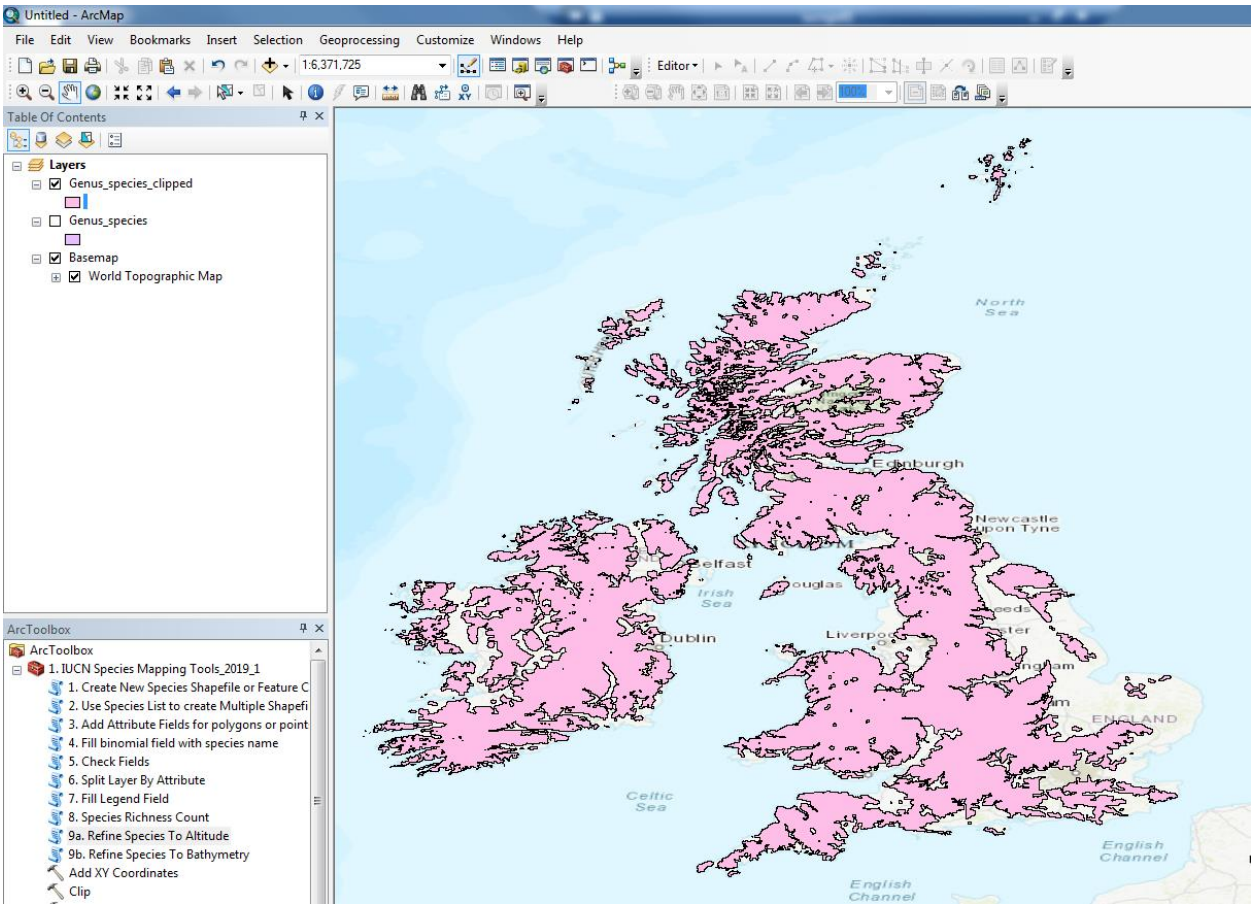
Example species range before refining to altitude:



Refine to altitude range 70m to 500m:



Refined species range:

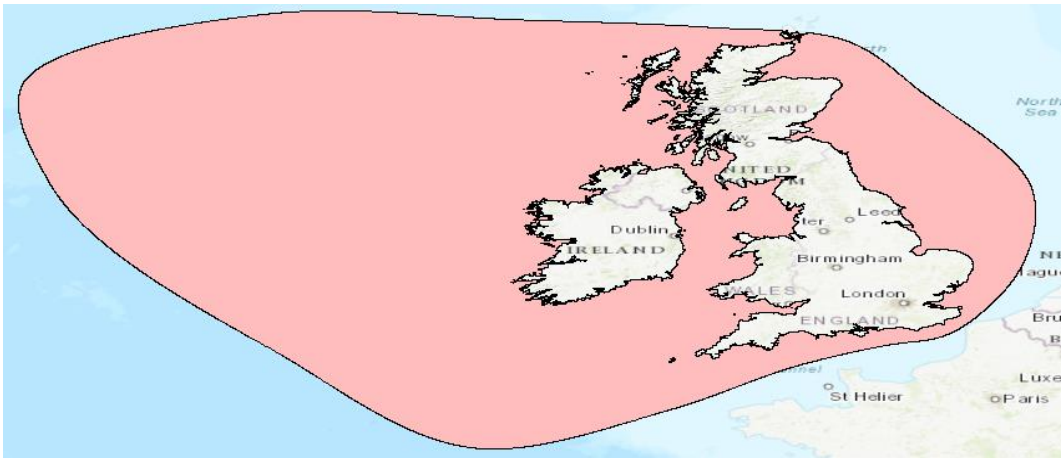


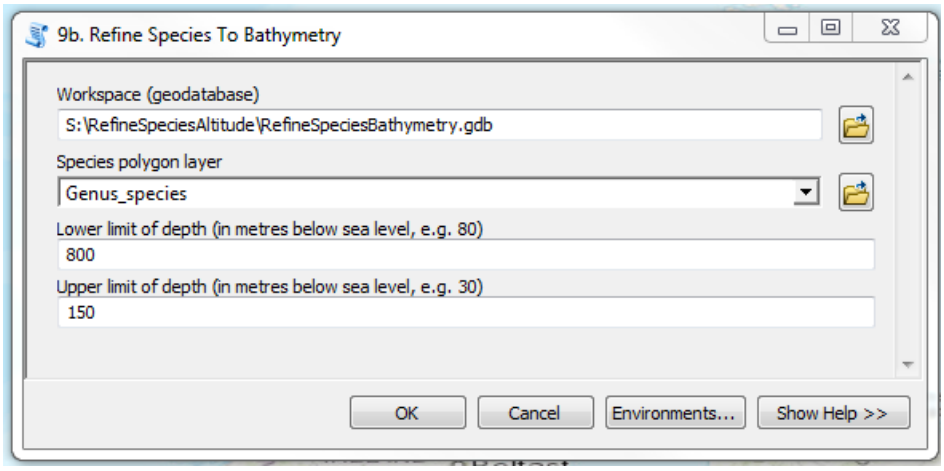
A file called DEM_clip is also produced. This is the DEM clipped to the extent of the species layer. If you wish to save this file, rename it so that it is not overwritten the next time the tool (or *9b. Refine Species to Bathymetry*) is run.

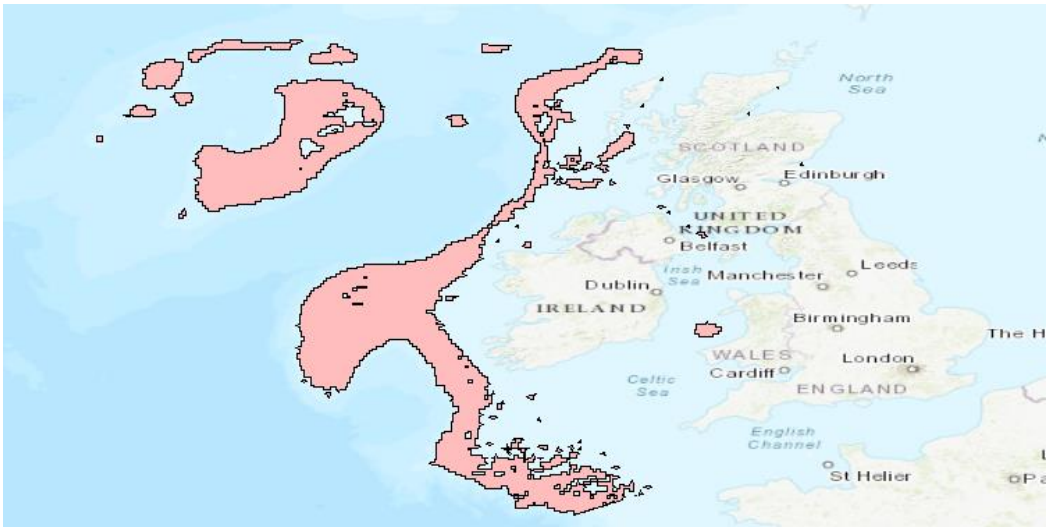
9b. Refine Species to Bathymetry

Refines the species shapefile or feature class to the specified depth range.

This tool works in a similar way to *9a. Refine Species to Altitude*. The lower limit will be a larger number than the upper limit as the measurement is metres below sea level.







b. Built-in ArcMap Tools

These tools all have descriptions and usage information online and in the tool itself. 'Help' can be found on the Menu Bar.

- **Add XY Coordinates**

For a point shapefile or feature class, this tool adds the fields POINT_X and POINT_Y and calculates their values.

Important: Ensure that the projection is set to WGS 1984 before doing this.

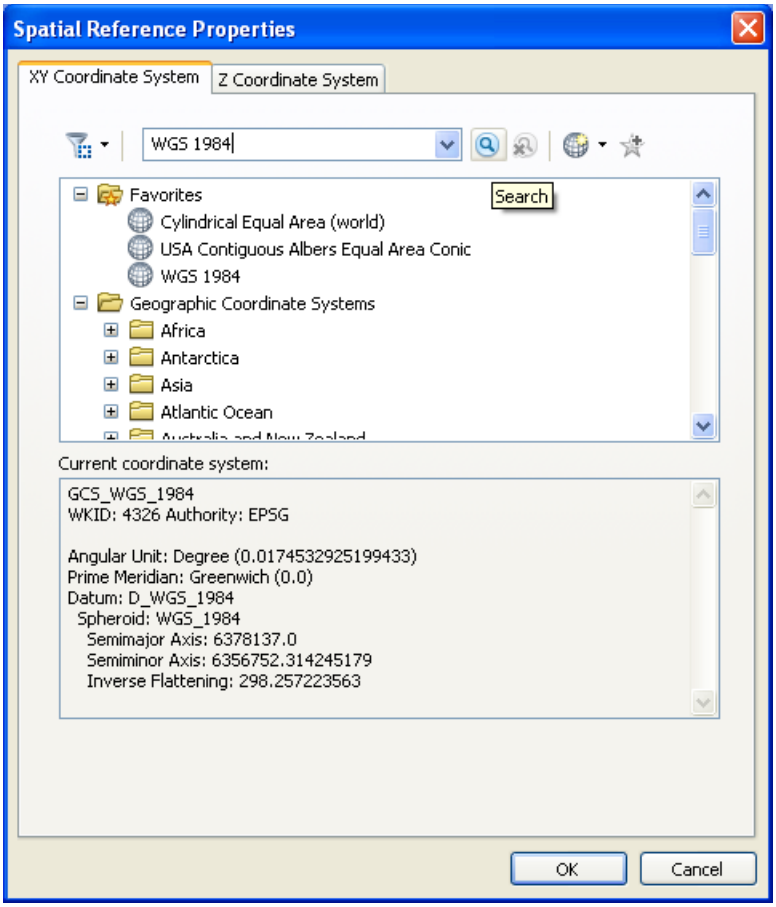
- **Clip**

Extracts input features that overlay the clip features. Use this tool to cut out a piece of one feature class using one or more of the features in another feature class as a cookie cutter.

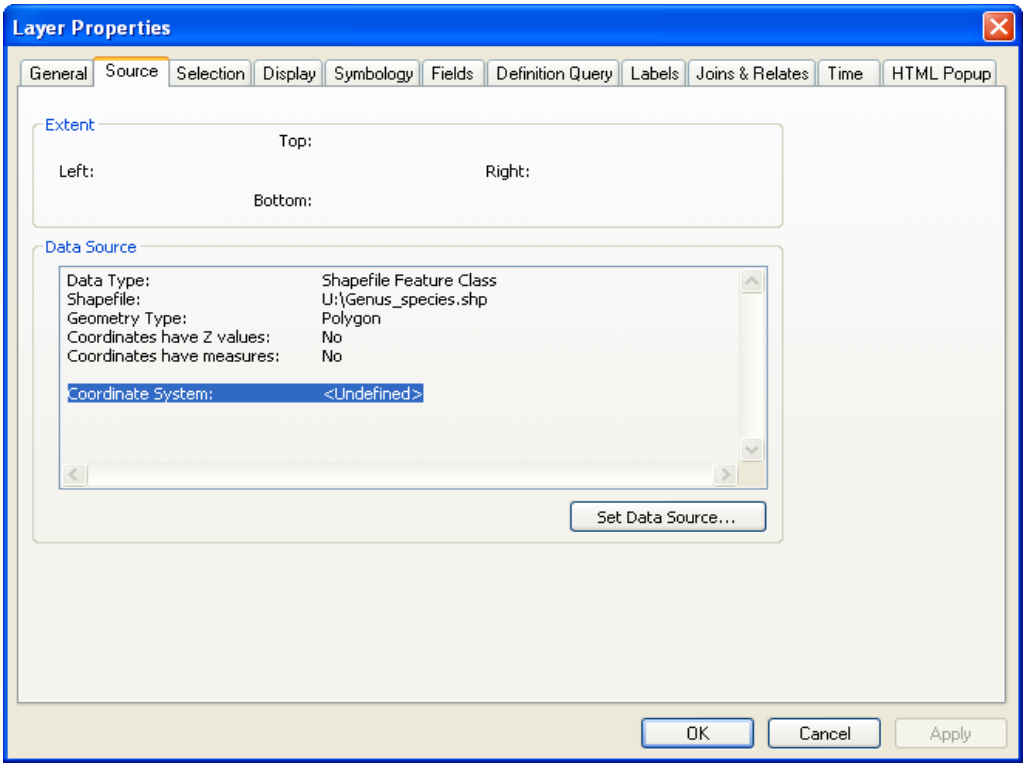
- **Define projection**

This tool is used for data that have an undefined or incorrect coordinate system (map projection and datum). It merely updates the coordinate system information stored with the dataset without changing the data. The Projection required by IUCN is 'GCS_WGS_1984' (WKID: 4326) under Geographic Coordinate Systems » World.

(If a dataset has a correctly defined coordinate system but is not in WGS 1984, the *Project* tool should be used to reproject the data to WGS 1984.)



To find out whether your shapefile has a coordinate system, right click on the file name, select 'Properties' and then the 'Source' Tab.



- **Delete Field**

This tool deletes one or more fields from a table, feature class, feature layer, or raster dataset.

- **Dissolve**

Aggregates features based on specified attributes. This tool can be used to combine polygons which have the same attribute values, removing any overlaps.

- **Erase**

Creates a feature class by overlaying the Input Features with the polygons of the Erase Features. Only those portions of the Input features falling outside the Erase features are copied to the output feature class.

- **Merge**

Combines multiple input datasets of the same data type (point, line, polygon or table) into a single, new output dataset.

- **Project/ Batch Project**

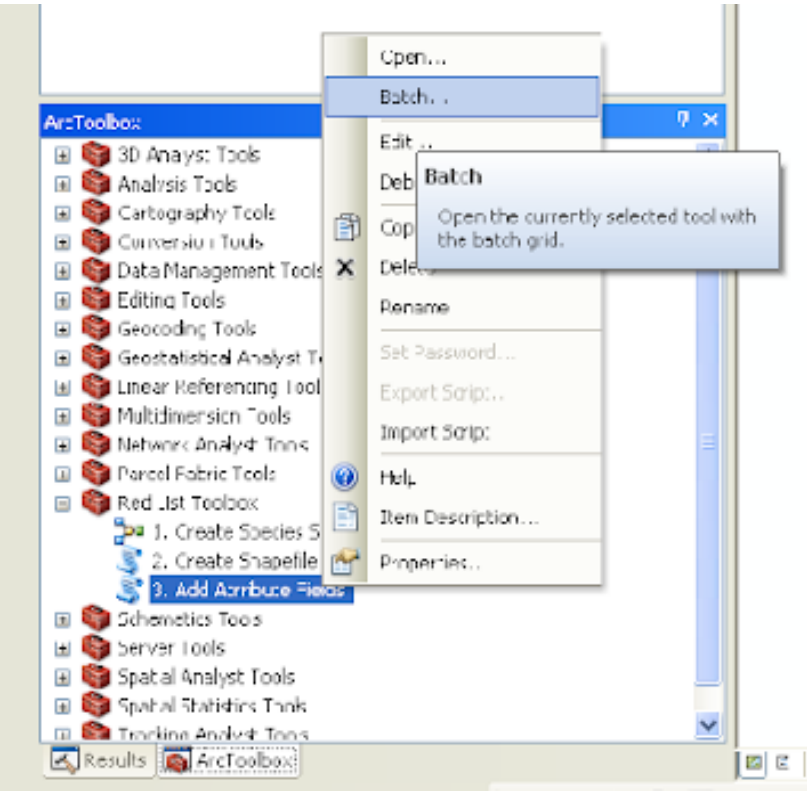
If a shapefile has a different projection to WGS 1984 (WKID: 4326) it should be changed. This tool produces a new shapefile or feature class in the specified coordinate system (map projection and datum).

- **Smooth Polygon**

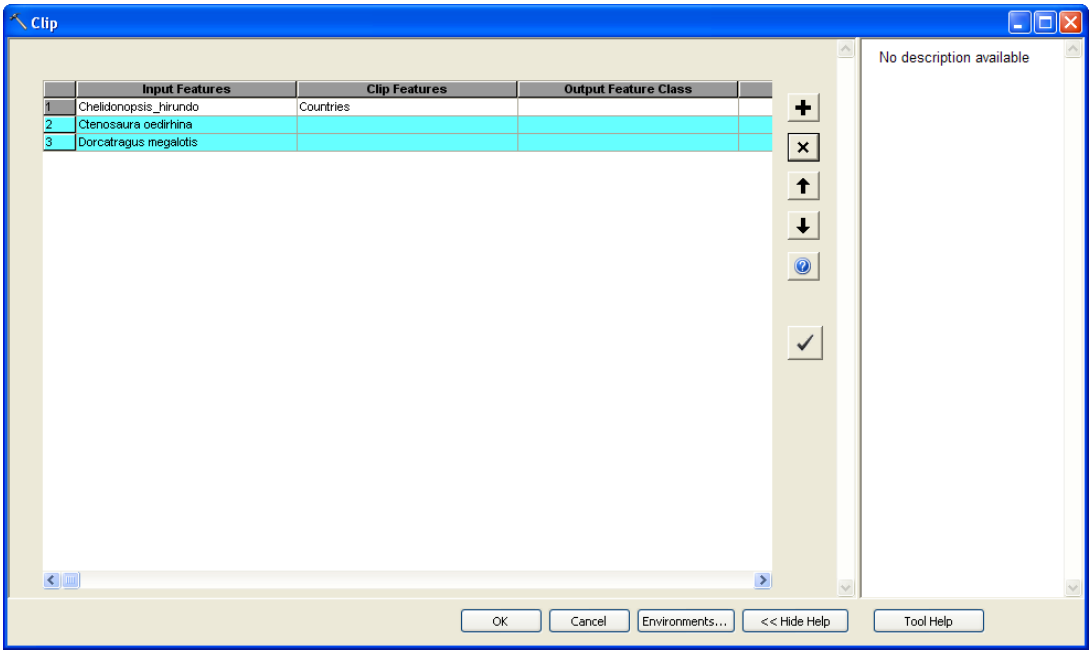
Smoothes sharp angles in polygon outlines to improve aesthetic or cartographic quality.

c. Batching Tools

To process many files using a tool for which the input is a single file, right click on the tool and select 'Batch…'

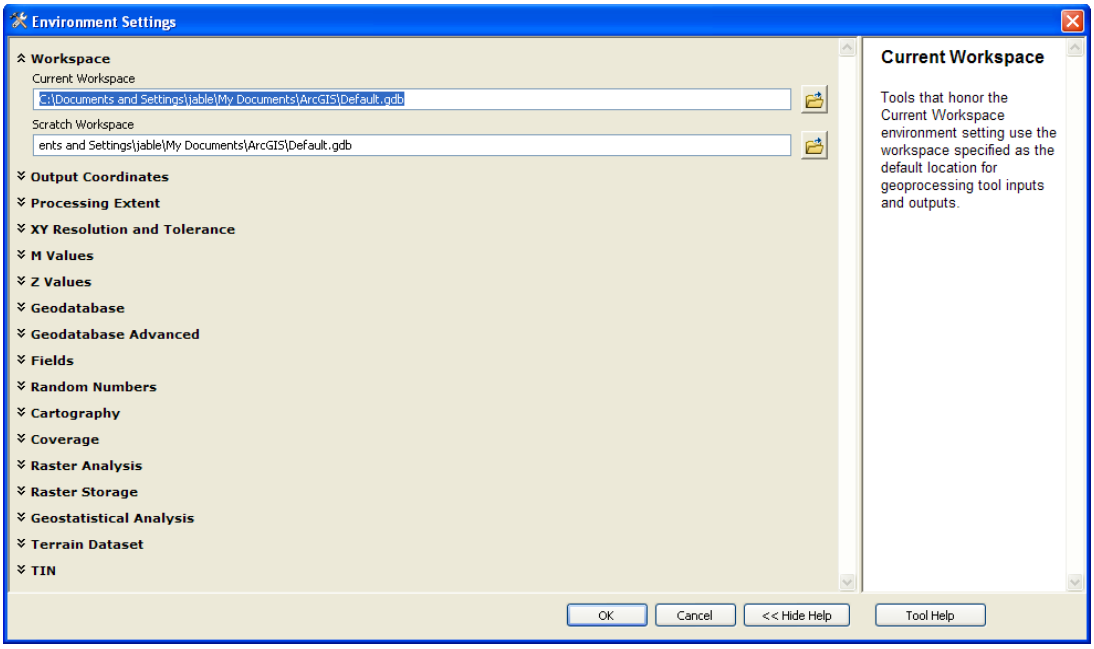


Then drag and drop the shapefiles or feature classes from the 'Table of Contents' or 'Catalog' windows into the space below the 'Input Features'.

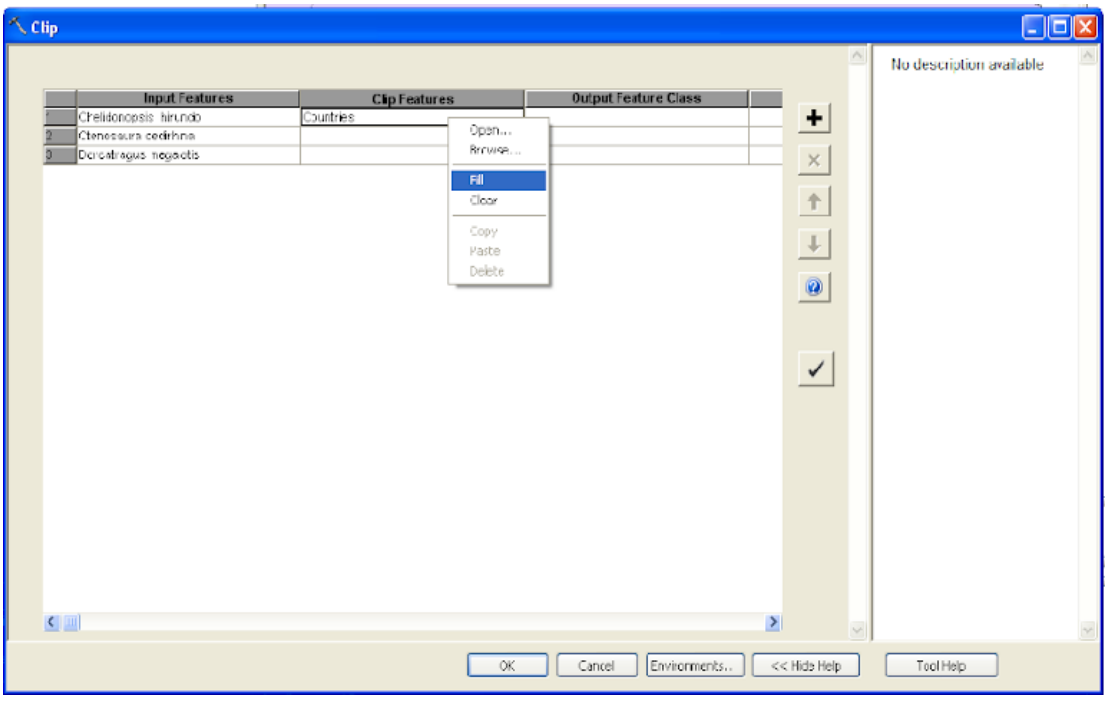


If multiple outputs are required for a single folder, select the "Environments…" button, click "Workspace" and enter the file/folder path (e.g. "C:/MyMaps/Marine/Fish") into the 'Current Workspace' and 'Scratch Workspace' and select OK (you may need return to the Environments… window and click OK again to activate the changes).

This option is also available in the ArcMap document, on the Menu bar » Geoprocessing » Environments…



If the same value is required for multiple rows right click the already filled in value and select 'Fill'. This will enter the same value for all the rows below that row (not above).



III. Notes

i. Mapping Standards

The tools in this toolbox were created following the Mapping Standards and Data Quality for the IUCN Red List Spatial Data document version 1.18 (August 2019).

As the mapping standards may change, please check the Spatial Data & Mapping Resources section of the Resources & Publications page on the IUCN Red List website for the latest documentation.

ii. ArcGIS version

The tools in the toolbox were written and tested in ArcGIS Desktop 10.5.1.

The screenshots in this document were taken from ArcGIS Desktop 10.5.1.