

**USING GIS TO HELP INTEGRATE BIODIVERSITY AND  
ECOSYSTEM SERVICES INTO REDD+ DECISION MAKING**



**STEP-BY-STEP TUTORIAL:  
EXTRACTING AND PROCESSING IUCN RED LIST  
USING ARCGIS 10.0**

**UN-REDD**  
PROGRAMME



## Introduction

Reducing Emissions from Deforestation and Forest Degradation (REDD) is an effort to create a financial value for the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. "REDD+" goes beyond deforestation and forest degradation, to include the role of conservation, sustainable management of forests and enhancement of forest carbon stocks. This will involve changing the ways in which forests are used and managed, and may require many different actions, such as protecting forests from fire or illegal logging or rehabilitating degraded forest areas.

REDD+ has the potential to deliver multiple benefits beyond carbon. For example, it can promote biodiversity conservation and secure ecosystem services from forests such as water regulation, erosion control and non-timber forest products. Some of the potential benefits from REDD+, such as biodiversity conservation, can be enhanced through identifying areas where REDD+ actions might have the greatest impact using spatial analysis.

This tutorial demonstrates how a species richness grid could be created using species range data from the IUCN Red List (IUCN, 2013). It provides full instructions of how to select and analyze and export information from the non-spatial species data on the IUCN Red List website and how to further analyze the information along- side the IUCN spatial data using ArcGIS 10.0

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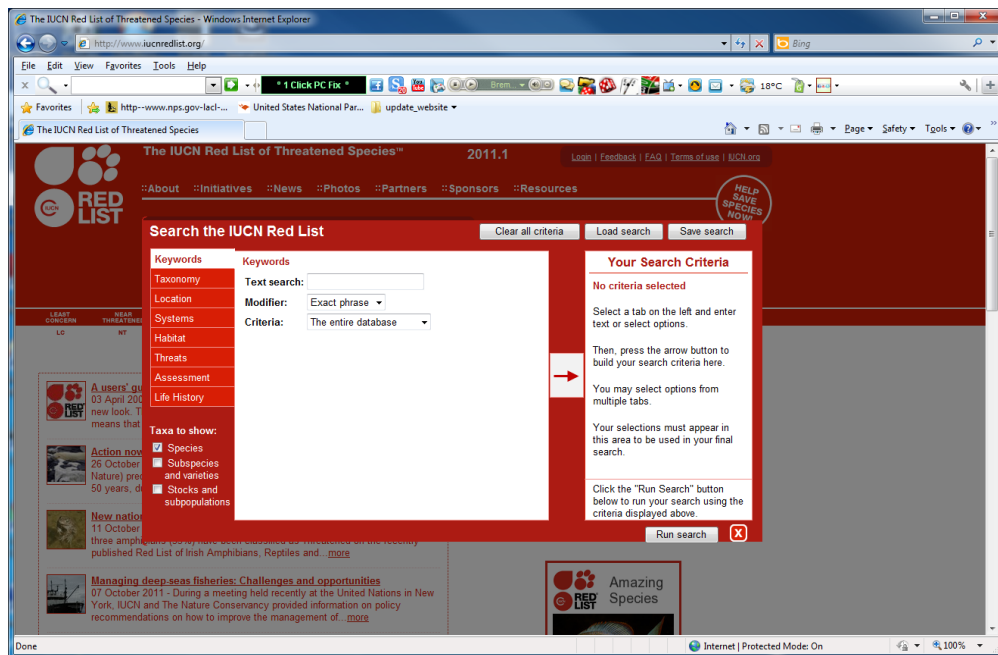
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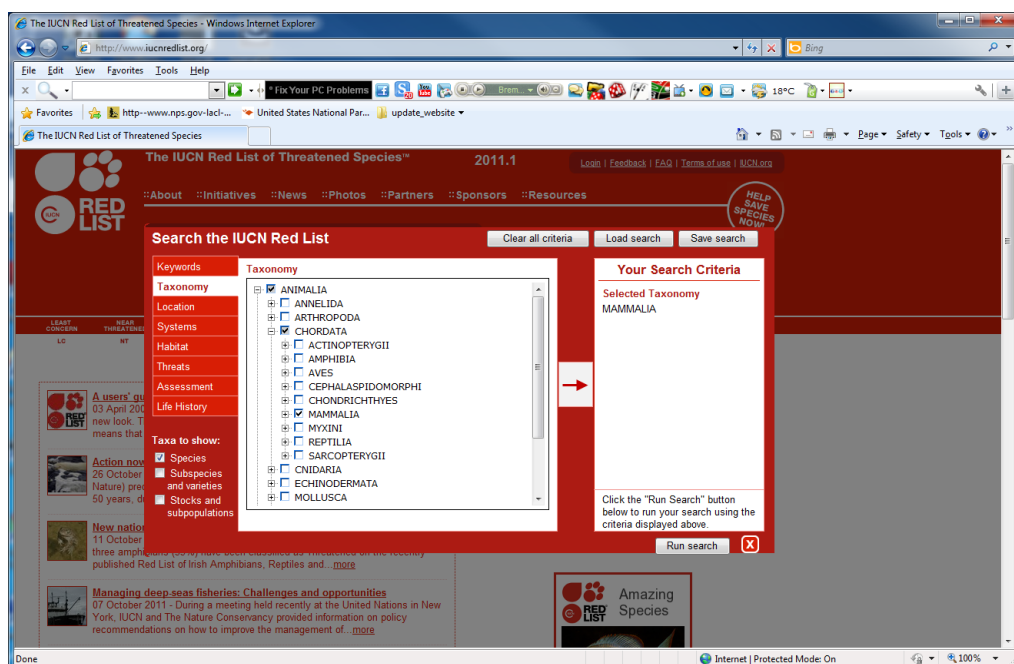
## Step 1: - Selecting species of interest from the IUCN RedList website.

*i.e. you may be interested in certain threat categories only. This example will select out mammals only with assessment CR or EN (you may want to include other taxonomy and criteria)*

- Go to <http://www.iucnredlist.org/>
- Click on “other search options”

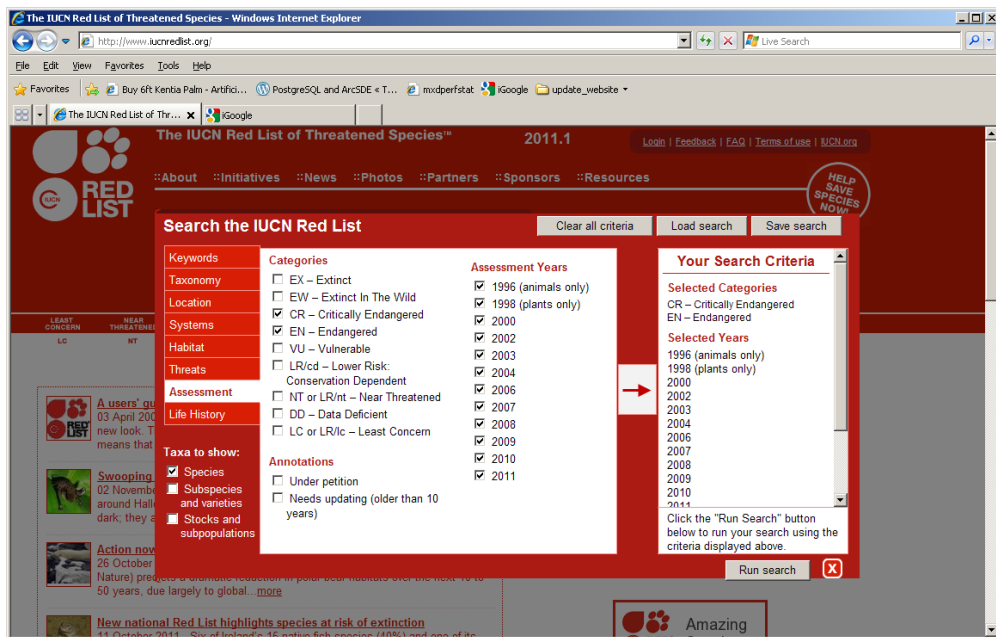


- Click on **taxonomy**, expand **Animalia**, expand **Chordata** and tick **Mammalia**
- Then **press the arrow key** to send your selection across

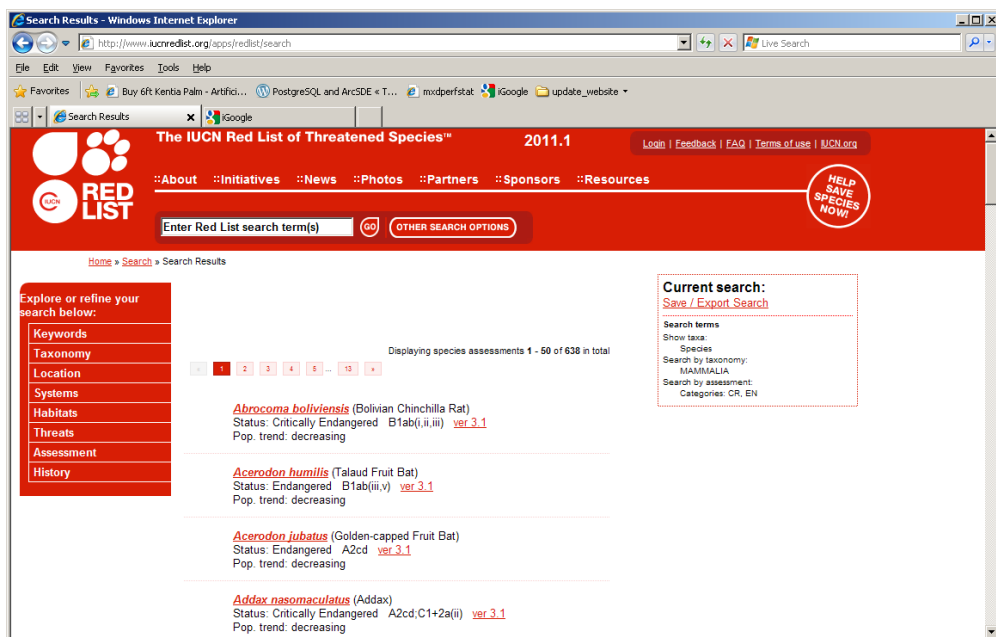


- Then click on **Assessment**

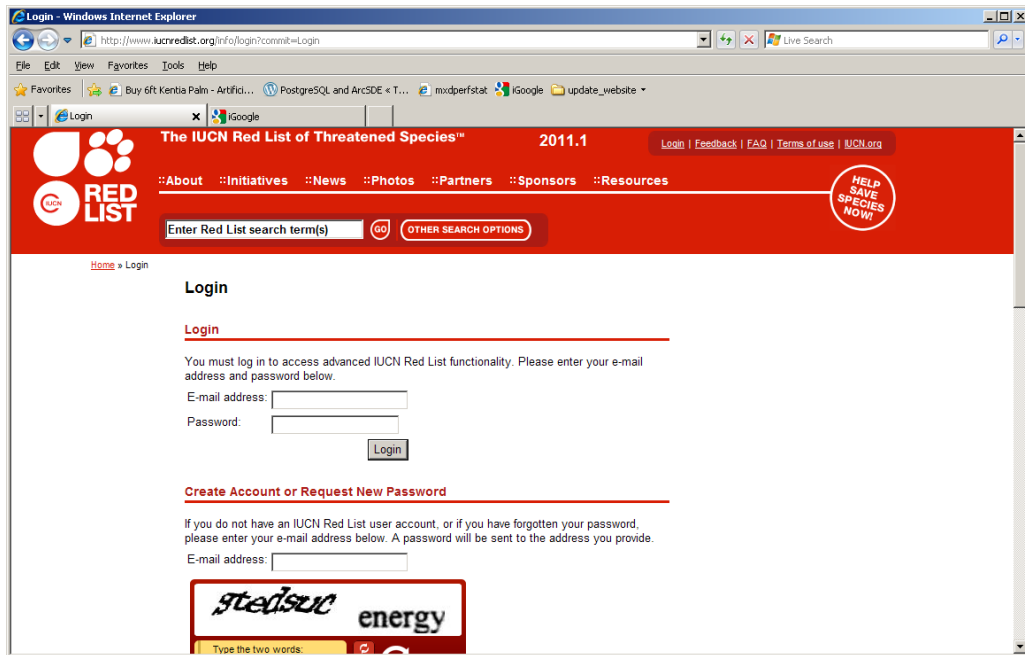
- f. **Untick** those that you don't want to include
- g. Then **click the arrow** to send your selection across



- h. **Click Run search**



- i. **Click Save / Export Search**

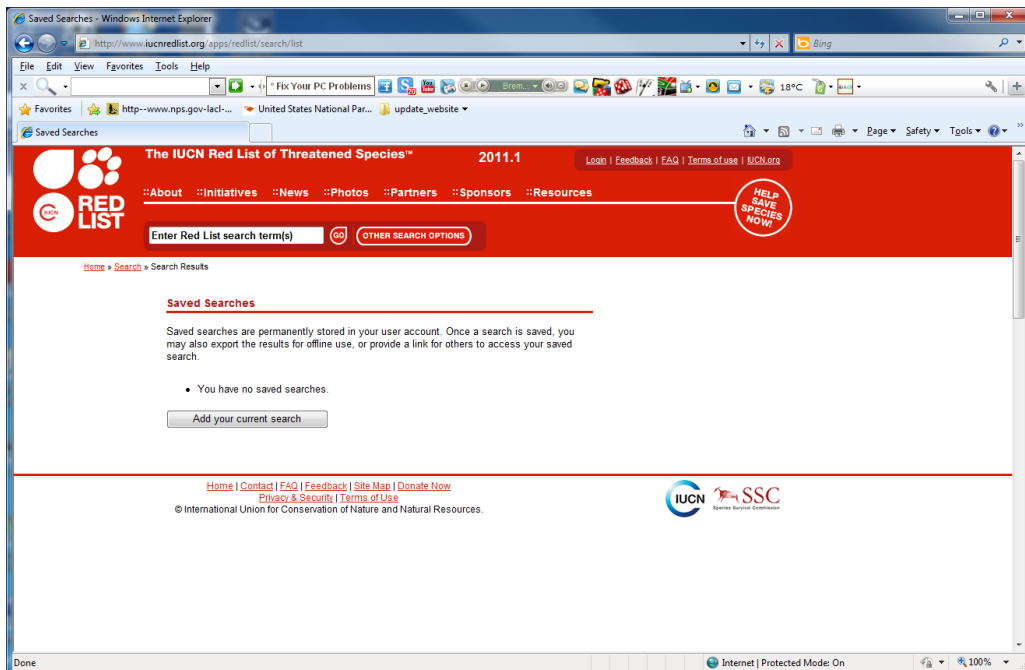


j. Click **Login**

Fill in your email address and password

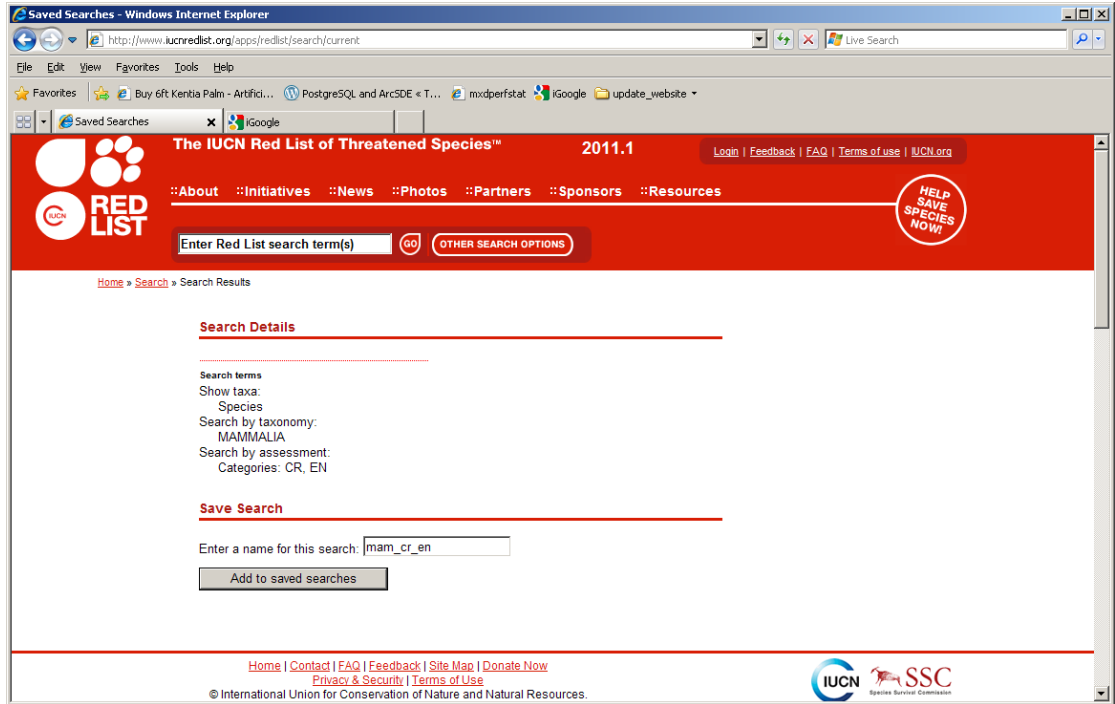
Or if you have not yet registered, **Create Account**.

You need to create an account in order to be able to export the results to a csv file.



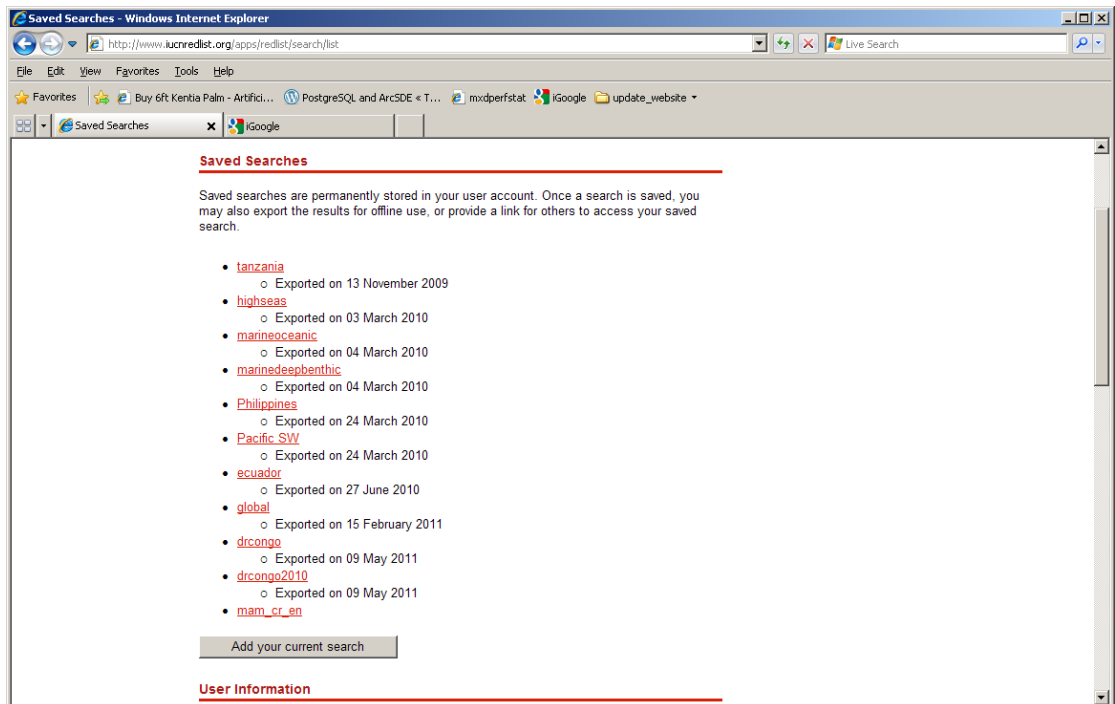
k. Click **Add your current search**

l. Give it a name e.g. **mam\_cr\_en**



The screenshot shows a web browser window displaying the IUCN Red List search results for the term 'mam\_cr\_en'. The page title is 'The IUCN Red List of Threatened Species™ 2011.1'. The search results section is titled 'Search Details' and shows the search terms as 'mam\_cr\_en'. The search results are categorized by taxonomy (MAMMALIA) and assessment (Categories: CR, EN). There is a 'Save Search' section with a text input field containing 'mam\_cr\_en' and a button labeled 'Add to saved searches'. The page footer includes links for Home, Contact, FAQ, Feedback, Site Map, and Donate Now, along with the IUCN and SSC logos.

m. Click **Add to saved searches**

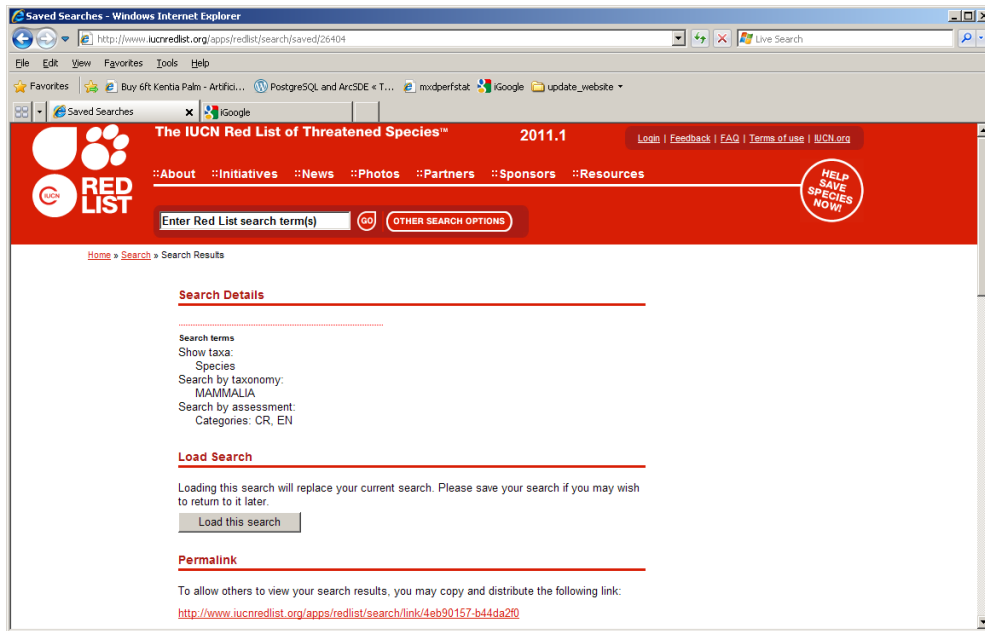


The screenshot shows the 'Saved Searches' page on the IUCN Red List website. The page title is 'Saved Searches'. The text explains that saved searches are permanently stored in the user account and can be exported for offline use or shared. A list of saved searches is displayed, each with a date of export:

- [tanzania](#)
  - Exported on 13 November 2009
- [highseas](#)
  - Exported on 03 March 2010
- [marineoceanic](#)
  - Exported on 04 March 2010
- [marinedeepbenthic](#)
  - Exported on 04 March 2010
- [Philippines](#)
  - Exported on 24 March 2010
- [Pacific\\_SW](#)
  - Exported on 24 March 2010
- [ecuador](#)
  - Exported on 27 June 2010
- [global](#)
  - Exported on 15 February 2011
- [drcongo](#)
  - Exported on 09 May 2011
- [drcongo2010](#)
  - Exported on 09 May 2011
- [mam\\_cr\\_en](#)

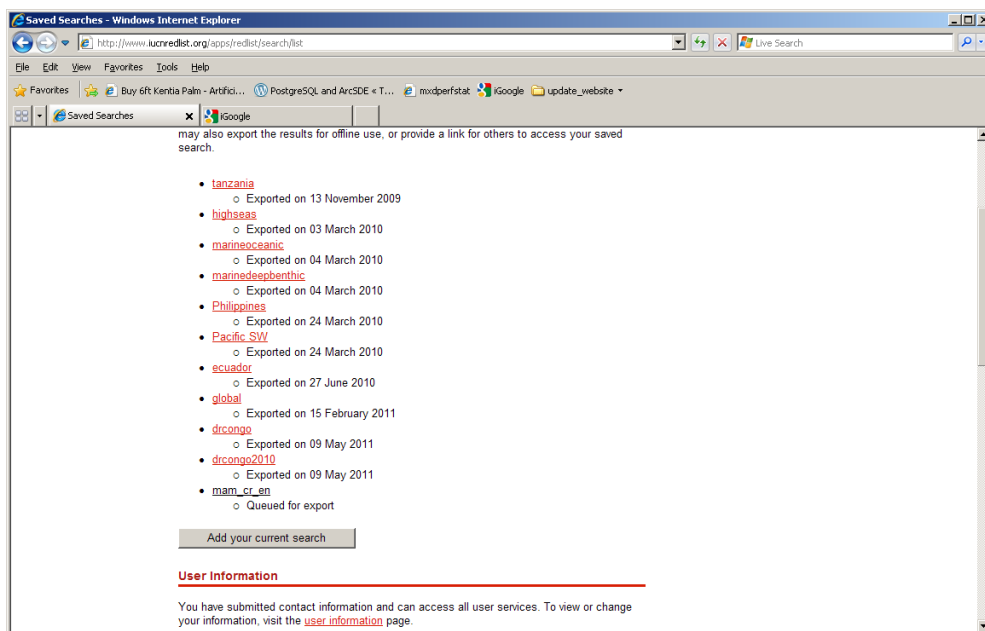
There is a button labeled 'Add your current search' at the bottom of the list. The page also includes a 'User Information' section at the bottom.

n. Click on **your saved search e.g. mam\_cr\_en**



- o. **Scroll down** and click on **Export results**

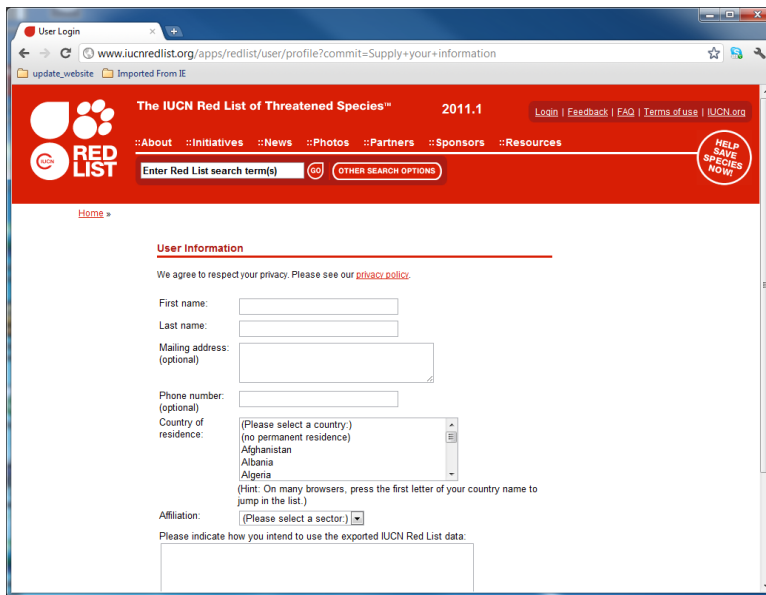
It will then give a status of Queued for export.



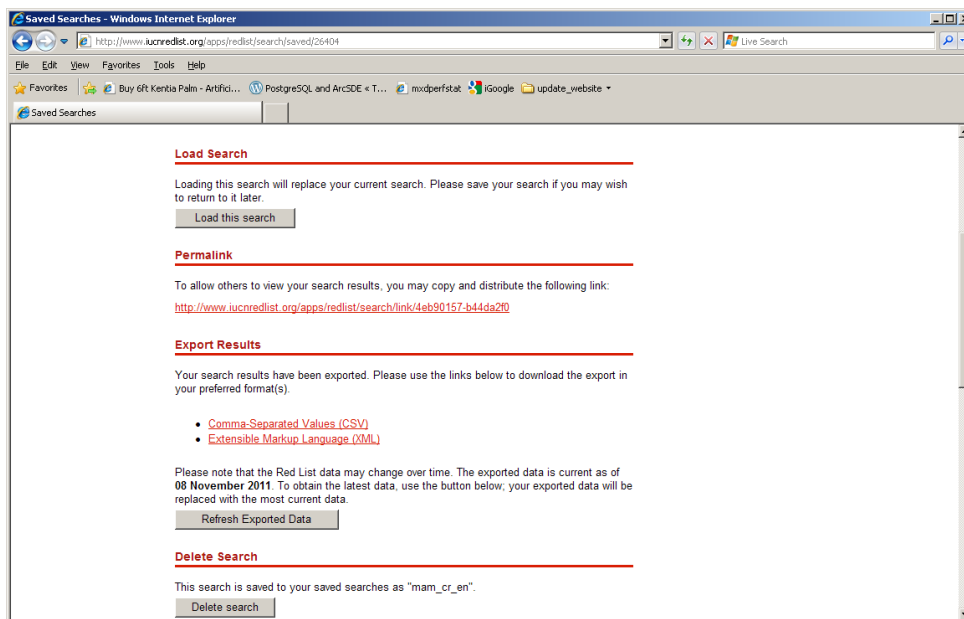
An email will be sent to you when it is exported.

- p. Once you have received your email, **log in to the Red List website again**.
- q. Click on **mam\_cr\_en**
- r. **Scroll down** to the **Export results** section, the first time you use this site you will need to click on **supply your information**





- s. **Fill out the requested information and**
- t. **Click Submit**
- u. **Click on mam\_cr\_en again**
- v. **Scroll down to the section export results**



- w. **Click on Comma-Separated Values (csv) and the zip file will download.**
- x. **Click on Show all downloads and click Show in folder.**
- y. **Copy the zip file to your project folder. You probably want to rename it to mam\_cr\_en.zip**
- z. **Right click on zip folder , then extract here. Rename the 'csv' file to mam\_cr\_en.csv**

## Step 2: - Open the .CSV file in Excel and format for joining with spatial data

This step will add a combined column for genus and species called 'binomial' to match with the column in the spatial data.

- Double click on **mam\_cr\_en.csv** to open in Excel.
- Insert a **new column** after species and name it **binomial**
- In the 1<sup>st</sup> cell type in **=G2&" "&H2** and press **Return**

Class	Order	Family	Genus	Species	Binomial	Authority
MAMMALIA	RODENTIA	ABROCOMIDAE	Abrocoma	boliviensis		Glanz & Anderson, 1990
MAMMALIA	CHIROPTERA	PTEROPODIDAE	Acerodon	humilis		K. Andersen, 1909
MAMMALIA	CHIROPTERA	PTEROPODIDAE	Acerodon	jubatus		(Eschscholtz, 1831)
MAMMALIA	CETARTIODACTYLA	BOVIDAE	Addax	nasomaculatus		(de Blainville, 1816)
MAMMALIA	CARNIVORA	URSIDAE	Ailuropoda	melanoleuca		(David, 1869)
MAMMALIA	DIPROTODONTIA	PHALANGERIDAE	Ailurops	melanotis		(Thomas, 1898)
MAMMALIA	PRIMATES	ATELIDAE	Alouatta	pigra		Lawrence, 1933
MAMMALIA	PRIMATES	ATELIDAE	Alouatta	ululata		Elliot, 1912
MAMMALIA	AFROSORICIDA	CHRYSOCHLORIDAE	Amblysomus	marleyi		Roberts, 1931
MAMMALIA	RODENTIA	SCIURIDAE	Ammospermophilus	nelsoni		(Merriam, 1893)
MAMMALIA	CHIROPTERA	FURIPTERIDAE	Amorhophilus	schnablii		Peters, 1877
MAMMALIA	RODENTIA	MURIDAE	Apodemus	gurkha		Thomas, 1924
MAMMALIA	CHIROPTERA	PTEROPODIDAE	Aproteles	bulmerae		Menzies, 1977
MAMMALIA	CETARTIODACTYLA	BOVIDAE	Arabitragus	jayakari		(Thomas, 1894)
MAMMALIA	CARNIVORA	OTARIDAE	Arctocephalus	galapagoensis		Heller, 1904
MAMMALIA	CHIROPTERA	PHYLLOSTOMIDAE	Artibeus	incomitatus		Kalko & Handley, 1994
MAMMALIA	PRIMATES	ATELIDAE	Ateles	belzebuth		É. Geoffroy, 1806
MAMMALIA	PRIMATES	ATELIDAE	Ateles	chamek		(Humboldt, 1812)
MAMMALIA	PRIMATES	ATELIDAE	Ateles	fusciceps		Gray, 1866
MAMMALIA	PRIMATES	ATELIDAE	Ateles	geoffroyi		Kuhl, 1820
MAMMALIA	PRIMATES	ATELIDAE	Ateles	hybridus		I. Geoffroy, 1829
MAMMALIA	PRIMATES	ATELIDAE	Ateles	marginatus		(É. Geoffroy, 1809)
MAMMALIA	PRIMATES	INDRIIDAE	Avahi	cleesei		Thalmann & Geissmann, 2005
MAMMALIA	PRIMATES	INDRIIDAE	Avahi	occidentalis		von Lorenz-Liburnau, 1898
MAMMALIA	CETARTIODACTYLA	CERVIDAE	Axis	calamianensis		(Heude, 1888)
MAMMALIA	CETARTIODACTYLA	CERVIDAE	Axis	kuhlii		(Temminck, 1836)
MAMMALIA	CETARTIODACTYLA	CERVIDAE	Axis	porcinus		(Zimmermann, 1780)
MAMMALIA	CETARTIODACTYLA	SUIDAE	Babyrousa	togeanensis		(Sody, 1949)
MAMMALIA	CETARTIODACTYLA	BALAEONOPTERIDAE	Balaenoptera	borealis		Lesson, 1828
MAMMALIA	CETARTIODACTYLA	BALAEONOPTERIDAE	Balaenoptera	musculus		(Linnaeus, 1758)
MAMMALIA	CETARTIODACTYLA	BALAEONOPTERIDAE	Balaenoptera	physalus		(Linnaeus, 1758)
MAMMALIA	CHIROPTERA	EMBALLONURIDAE	Balantiopteryx	infusca		(Thomas, 1897)
MAMMALIA	RODENTIA	MURIDAE	Batomys	russtus		Musser, Heaney & Tabaranza Jr., 1998
MAMMALIA	CETARTIODACTYLA	BOVIDAE	Beatragus	hunteri		(P.L. Sclater, 1889)
MAMMALIA	DIPROTODONTIA	POTOROIDAE	Bettongia	penicillata		Gray, 1837
MAMMALIA	DIPROTODONTIA	POTOROIDAE	Bettongia	tropica		Wakefield, 1967
MAMMALIA	RODENTIA	SCIURIDAE	Biswamoyopterus	biswasi		Saha, 1981
MAMMALIA	CETARTIODACTYLA	BOVIDAE	Bos	javanicus		d'Alton, 1823
MAMMALIA	CETARTIODACTYLA	BOVIDAE	Bos	sauveli		Urban, 1937
MAMMALIA	RODENTIA	NESOMYIDAE	Brachytarsomys	villosa		Petter, 1962
MAMMALIA	PRIMATES	ATELIDAE	Brachyteles	arachnoides		(É. Geoffroy, 1806)
MAMMALIA	PRIMATES	ATELIDAE	Brachyteles	hypoxanthus		(Kuhl, 1820)

- Click into the cell and move your cursor to the bottom right hand corner until it turns into a small black cross + **double-click on the corner to extend the formula to all cells in the column.**

Class	Order	Family	Genus	Species	Binomial	Authority
MAMMALIA	RODENTIA	ABROCOMIDAE	Abrocoma	boliviensis	Abrocoma boliviensis	Glanz & Anderson, 1990
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MAMMALIA	CHIROPTERA	PTEROPODIDAE	Acerodon	jubatus	Acerodon jubatus	(Eschscholtz, 1831)
MAMMALIA	CETARTIODACTYLA	BOVIDAE	Addax	nasomaculatus	Addax nasomaculatus	(de Blainville, 1816)
MAMMALIA	CARNIVORA	URSIDAE	Ailuropoda	melanoleuca	Ailuropoda melanoleuca	(David, 1869)
MAMMALIA	DIPROTODONTIA	PHALANGERIDAE	Ailurops	melanotis	Ailurops melanotis	(Thomas, 1898)
MAMMALIA	PRIMATES	ATELIDAE	Alouatta	pigra	Alouatta pigra	Lawrence, 1933
MAMMALIA	PRIMATES	ATELIDAE	Alouatta	ululata	Alouatta ululata	Elliot, 1912
MAMMALIA	AFROSORICIDA	CHRYSOCHLORIDAE	Amblysomus	marleyi	Amblysomus marleyi	Roberts, 1931
MAMMALIA	RODENTIA	SCIURIDAE	Ammospermophilus	nelsoni	Ammospermophilus nelsoni	(Merriam, 1893)
MAMMALIA	CHIROPTERA	FURIPTERIDAE	Amorhophilus	schnablii	Amorhophilus schnablii	Peters, 1877
MAMMALIA	RODENTIA	MURIDAE	Apodemus	gurkha	Apodemus gurkha	Thomas, 1924
MAMMALIA	CHIROPTERA	PTEROPODIDAE	Aproteles	bulmerae	Aproteles bulmerae	Menzies, 1977
MAMMALIA	CETARTIODACTYLA	BOVIDAE	Arabitragus	jayakari	Arabitragus jayakari	(Thomas, 1894)
MAMMALIA	CARNIVORA	OTARIDAE	Arctocephalus	galapagoensis	Arctocephalus galapagoensis	Heller, 1904
MAMMALIA	CHIROPTERA	PHYLLOSTOMIDAE	Artibeus	incomitatus	Artibeus incomitatus	Kalko & Handley, 1994
MAMMALIA	PRIMATES	ATELIDAE	Ateles	belzebuth	Ateles belzebuth	É. Geoffroy, 1806
MAMMALIA	PRIMATES	ATELIDAE	Ateles	chamek	Ateles chamek	(Humboldt, 1812)
MAMMALIA	PRIMATES	ATELIDAE	Ateles	fusciceps	Ateles fusciceps	Gray, 1866
MAMMALIA	PRIMATES	ATELIDAE	Ateles	geoffroyi	Ateles geoffroyi	Kuhl, 1820
MAMMALIA	PRIMATES	ATELIDAE	Ateles	hybridus	Ateles hybridus	I. Geoffroy, 1829
MAMMALIA	PRIMATES	ATELIDAE	Ateles	marginatus	Ateles marginatus	(É. Geoffroy, 1809)
MAMMALIA	PRIMATES	INDRIIDAE	Avahi	cleesei	Avahi cleesei	Thalmann & Geissmann, 2005
MAMMALIA	PRIMATES	INDRIIDAE	Avahi	occidentalis	Avahi occidentalis	von Lorenz-Liburnau, 1898
MAMMALIA	CETARTIODACTYLA	CERVIDAE	Axis	calamianensis	Axis calamianensis	(Heude, 1888)
MAMMALIA	CETARTIODACTYLA	CERVIDAE	Axis	kuhlii	Axis kuhlii	(Temminck, 1836)
MAMMALIA	CETARTIODACTYLA	CERVIDAE	Axis	porcinus	Axis porcinus	(Zimmermann, 1780)
MAMMALIA	CETARTIODACTYLA	SUIDAE	Babyrousa	togeanensis	Babyrousa togeanensis	(Sody, 1949)

- e. **Scroll** along the column headings. Some will need to be changed as ArcMap will not support them so **change the ones in red**.

Species ID	=	<b>Species_ID</b>
Kingdom	=	Kingdom
Phylum	=	Phylum
Class	=	Class
Order	=	Order
Family	=	Family
Genus	=	Genus
Species	=	Species
Binomial	=	Binomial
Authority	=	Authority
Infraspecific rank	=	<b>Inf_nank</b>
Infraspecific name	=	<b>Inf_name</b>
Infraspecific authority	=	<b>inf_auth</b>
Stock/subpopulation	=	<b>stk_subpop</b>
Synonyms	=	Synonyms
Common names (Eng)	=	<b>com_eng</b>
Common names (Fre)	=	<b>com_fre</b>
Common names (Spa)	=	<b>com_spa</b>
Red List status	=	<b>rl_status</b>
Red List criteria	=	<b>rl_criteria</b>
Red List criteria version	=	<b>rl_version</b>
Year assessed	=	<b>year_ass</b>
Population trend	=	<b>poptrend</b>
Petitioned	=	Petitioned

- f. Save the file as **mam\_cr\_en.xlsx**

- g. Close Excel

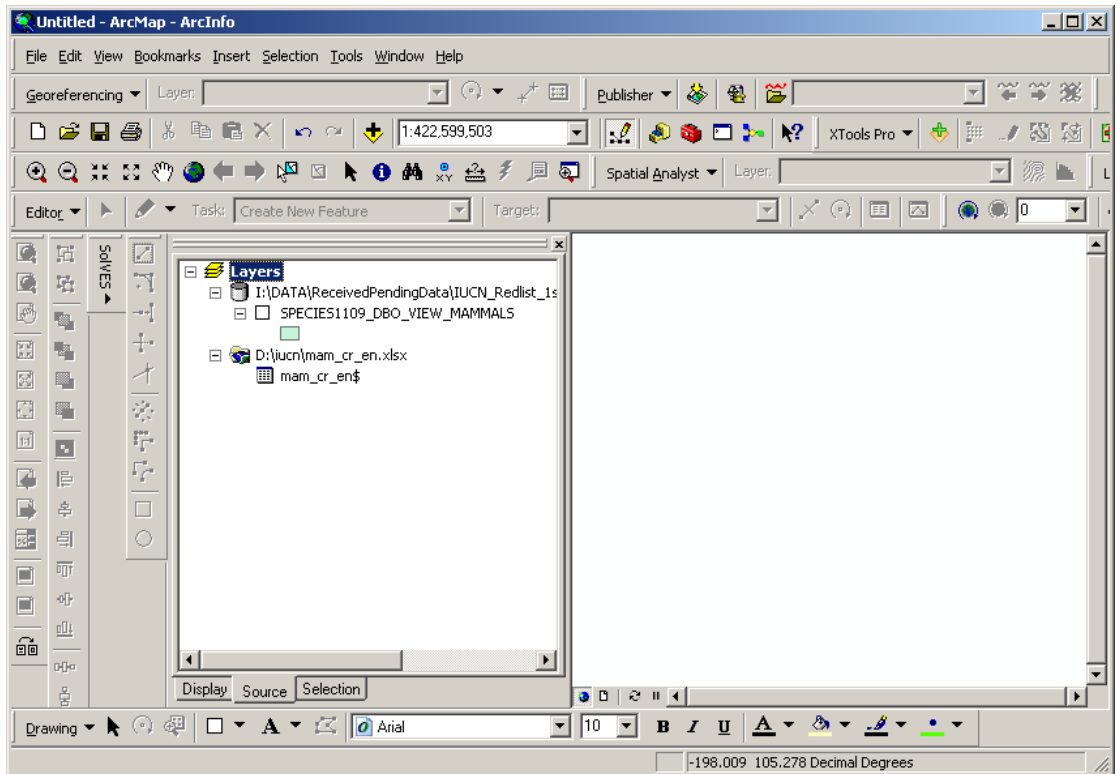
### Step 3: - Join CSV to spatial data in ArcMap to create subset of selected data

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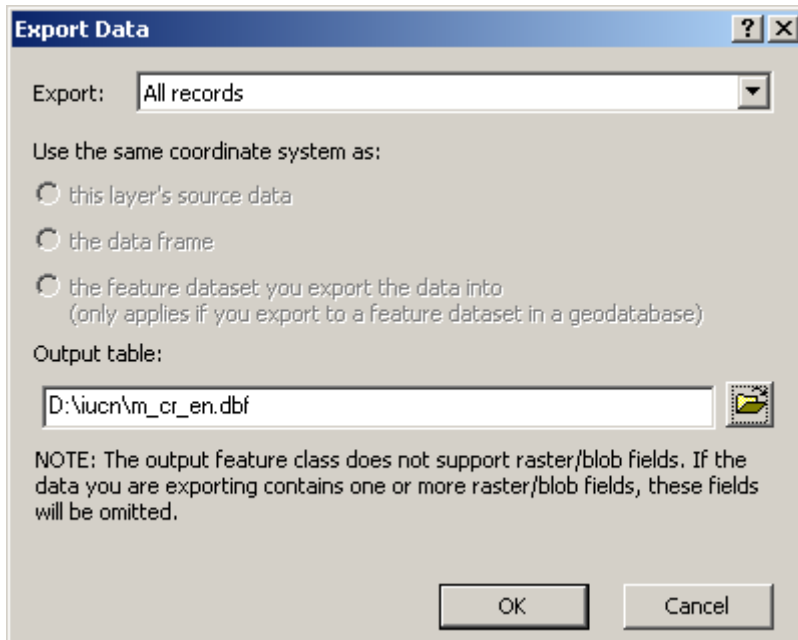
*Note: you should either have obtained spatial data from IUCN or have already downloaded the global version of the spatial data from <http://www.iucnredlist.org/technical-documents/spatial-data>*

- a. Open **ArcMap**
- b. For example - Add the mammals spatial data (**e.g. species\_dbo\_view\_mammals**)

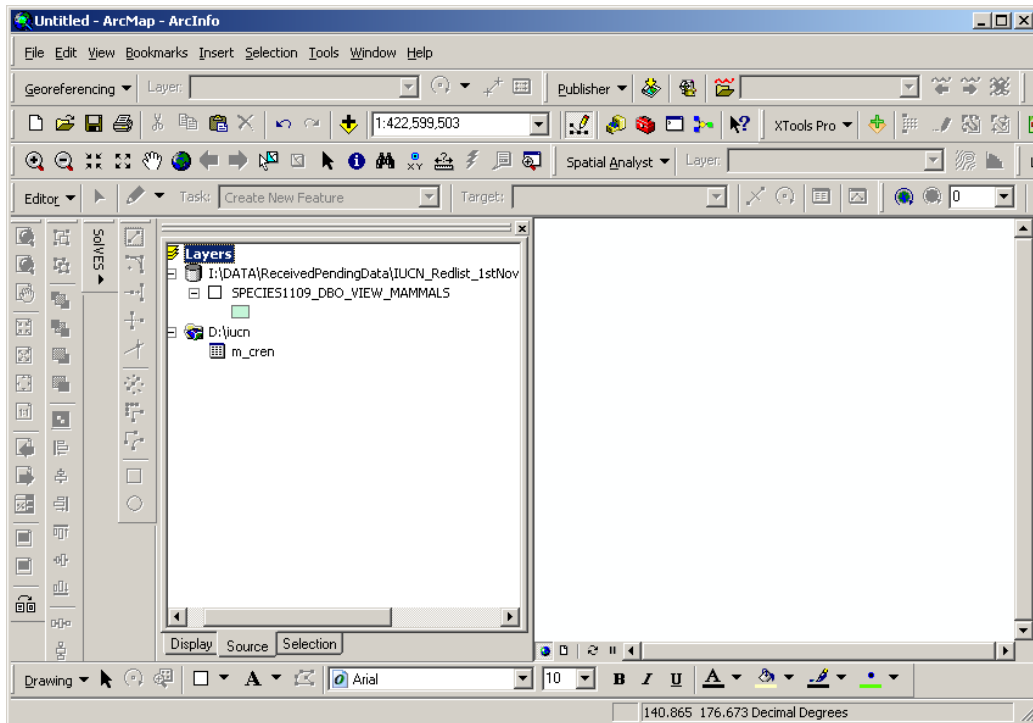
- c. Add into ArcMap the **mam\_cr\_en.xlsx**. It will be added as **mam\_cr\_en\$**.



- d. **Right click** on the **mam\_cr\_en\$** and export the xls to a shortname e.g. **m\_cren.dbf**

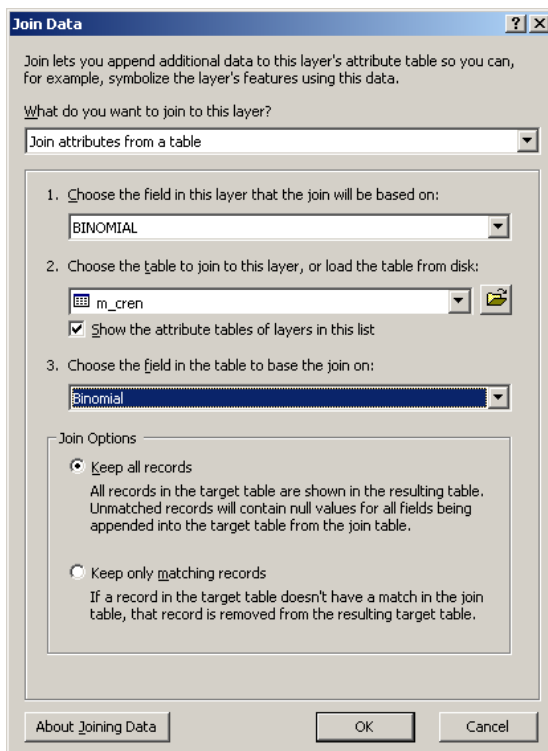


- e. Say **Yes** to add it to the current map. Open to check that the data are displaying properly.  
f. **Remove** the .xls file from Arcmap



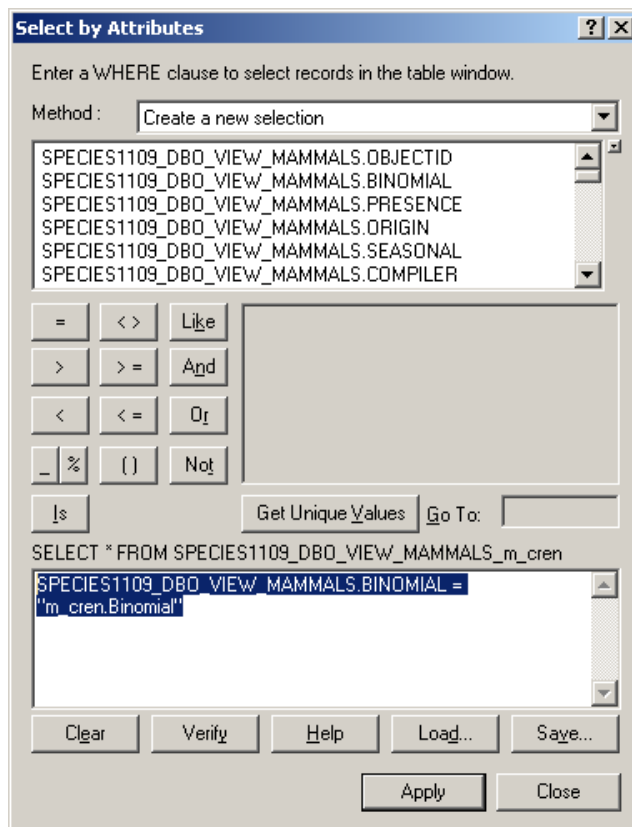
**\*\*\*IMPORTANT NOTE: As the IUCN spatial data files have increased in size. The instructions for steps g) to l) may need to be modified. Joining may not work or select out all of the species correctly. Instead you can use the species lists to create an SQL query to select out the group of species required (see separate document on using sublime text editor to create an sql query from the .csv file of required species). You will still need to double check that there is no data missing.\*\*\***

- g. Join on the dbf to the spatial data by right clicking on mammals spatial data e.g. **species\_dbo\_view\_mammals** and join to the dbf e.g. **m\_cren.dbf**

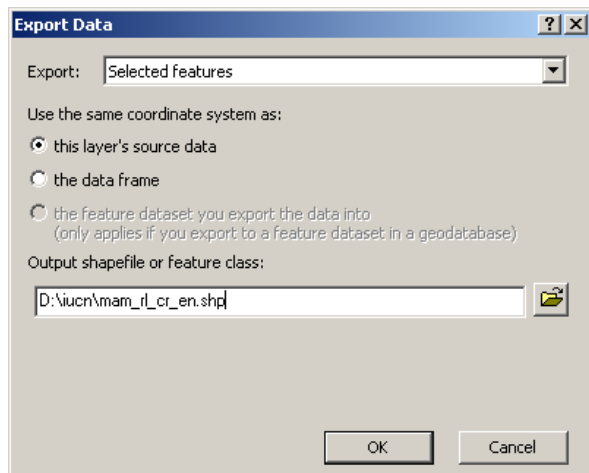


- h. Click **OK**
- i. Open **attribute table of the mammals spatial data** e.g. species\_dbo\_view\_mammals
- j. Click on **Options – Select by attributes**
- k. In the box select where binomial in the spatial data = binomial in the dbf file  
e.g. in the example:-

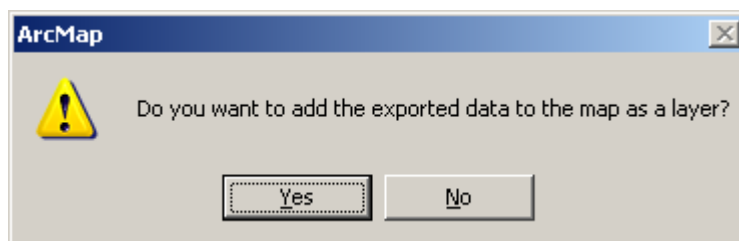
**SPECIES1109\_DBO\_VIEW\_MAMMALS.BINOMIAL = "m\_cren.Binomial"**



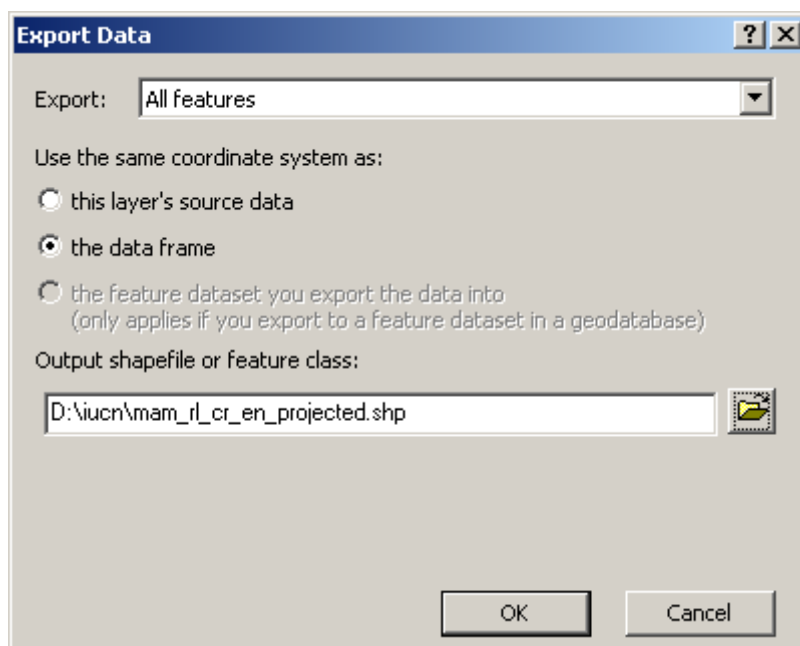
- l. Once selected, **close the attribute table** by clicking on the cross in the top right hand corner
- m. **Right click** on the **mammals spatial dataset** e.g. species\_dbo\_view\_mammals and click on **Data – Export data**
- n. Make sure it says **'Selected features in the top box'**. Then click **OK** to export the selected features to a new shapefile. E.g. mam\_rl\_cr\_en.shp



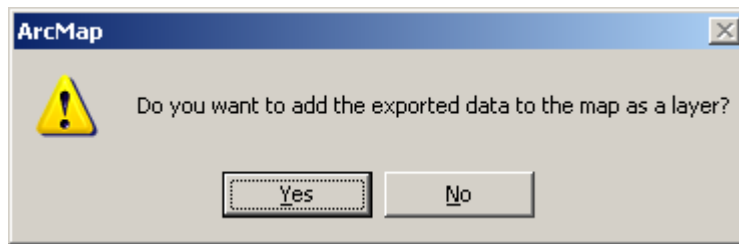
- o. Click **OK**



- p. Click **yes**
- q. Set the dataframe to **an equal area projection** (for example lambert\_azimuthal equal area projection, or a UTM projection if your data falls within a single utm zone)
- r. **Right click** on mam\_rl\_cr\_en.shp and **data – export data to mam\_rl\_cr\_en\_projected.shp** with the coordinate system set to **same as the dataframe**



- s. Click **OK**



t. Click **OK**

#### Step 4: - Generate a dataset of hexagons or squares.

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- a. **Download** the Repeating shapes 10 tool from [http://www.jennessent.com/arcgis/repeat\\_shapes.htm](http://www.jennessent.com/arcgis/repeat_shapes.htm) and **follow their instructions** for installation.

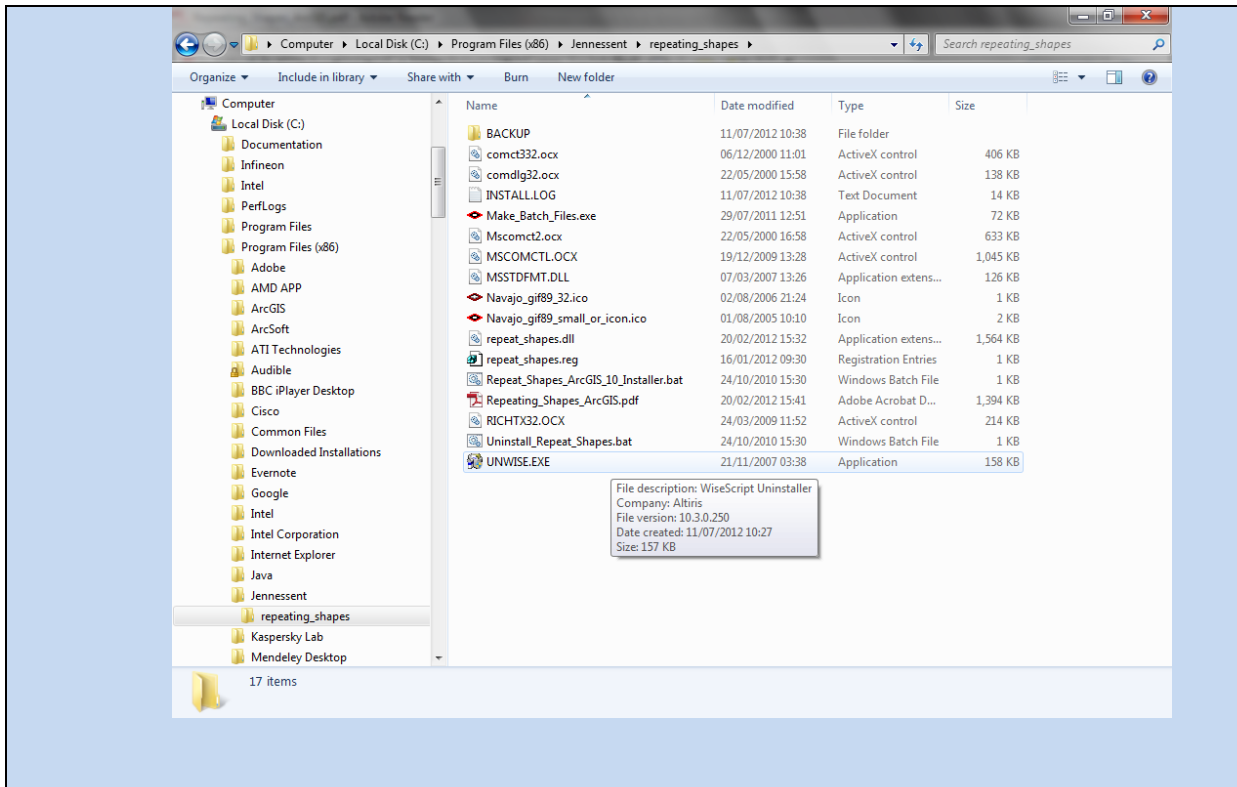
Make sure you don't have any ArcGIS applications open on your machine while installing. Install on your machine by double clicking on repeat\_shapes\_10.exe

#### **If it fails first time (as in the dialog below)**

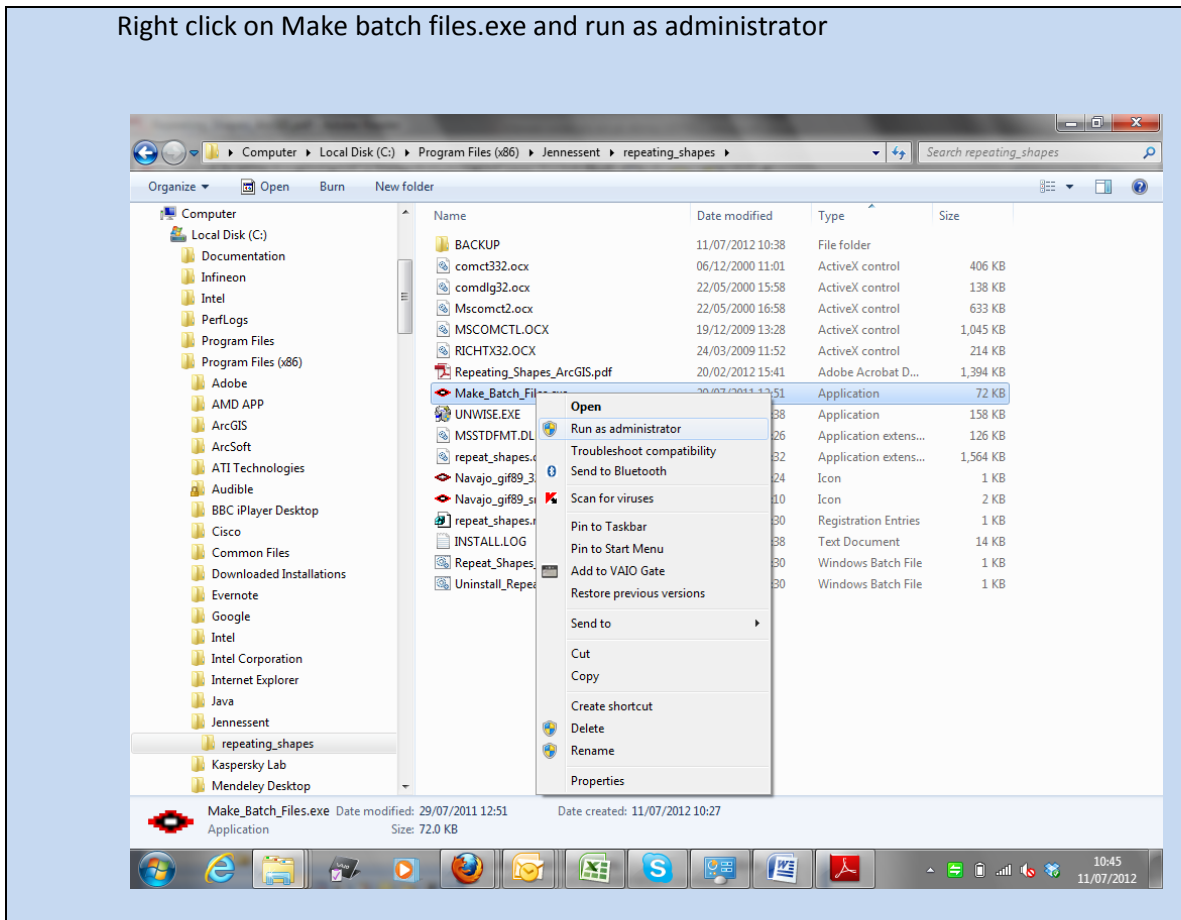


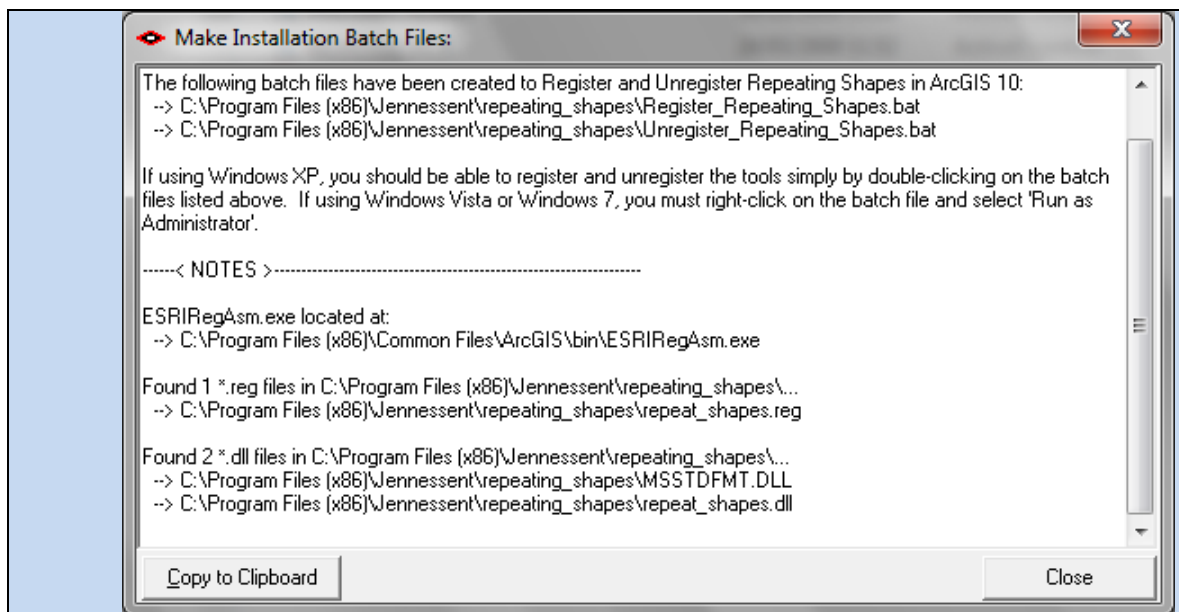
Go to your installed folder in your programme folder





Right click on Make batch files.exe and run as administrator

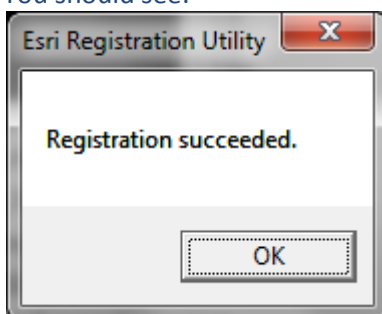




Once you have done this new files have been created one of which is Register\_Repeating\_Shapes.bat, double click on this.

Now go to **step c** and to try adding the tool to ArcMap. This time you should be able to see it.

b. You should see:



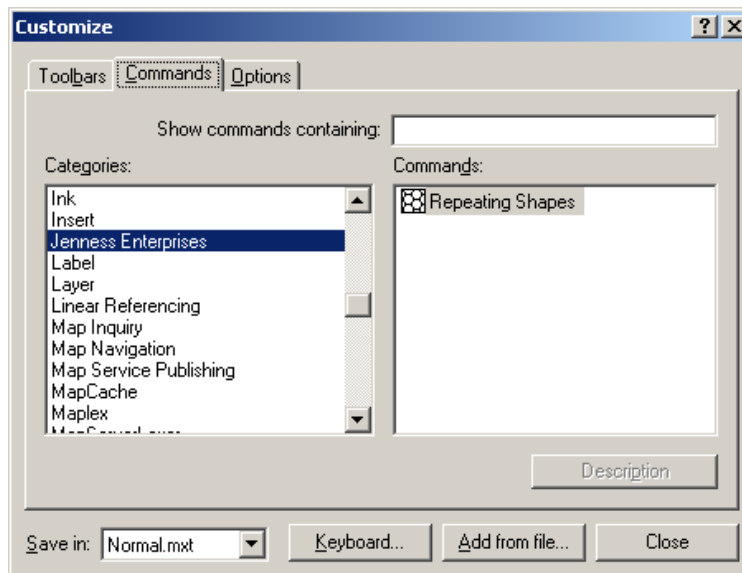
c. **Open ArcMap**

d. If you cannot see the **Repeating shapes** tool

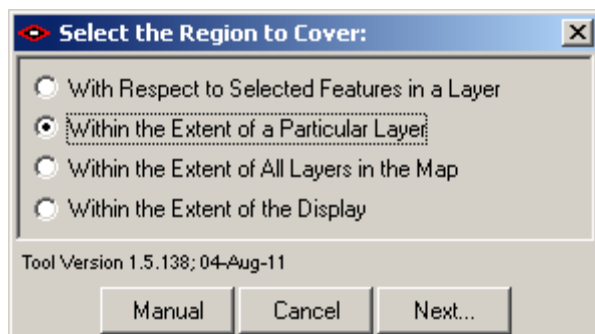
e. Click on **Customize - Toolbars - Customize**

f. Click on **Commands**

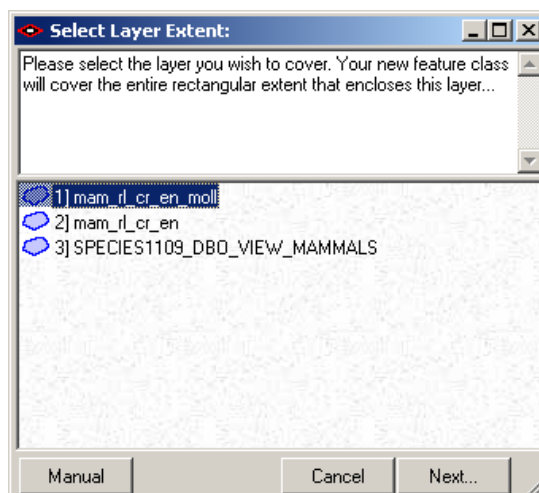
g. Scroll down and **click on Jenness Enterprises**



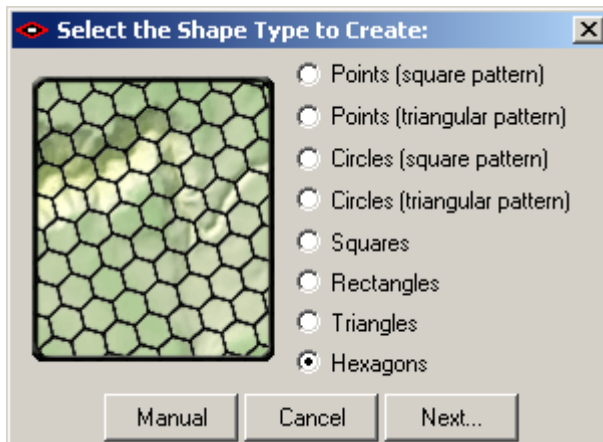
- h. **Drag the repeating shapes tool and place it somewhere on your toolbars.**
- i. **Click Close**
- j. **Click on the repeating shapes tool button**



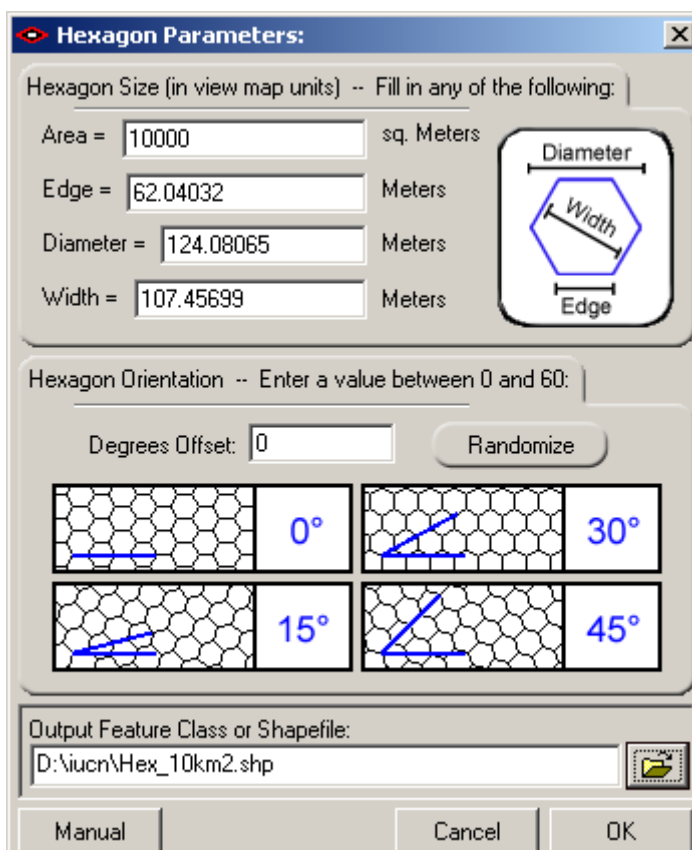
- k. **Click the extent of a particular layer**
- l. **Click Next**



- m. Click on the **mammals spatial dataset** (i.e. the one that you saved in the equal area projection) e.g. spatial datamam\_rl\_cr\_en\_moll
- n. Click **Next**



- o. **Choose** the shapes you want to use e.g. **hexagons**.
- p. Choose **size of hexagons** (the units will be in map units i.e. meters) e.g. area 10000 (for 10km2 dataset)



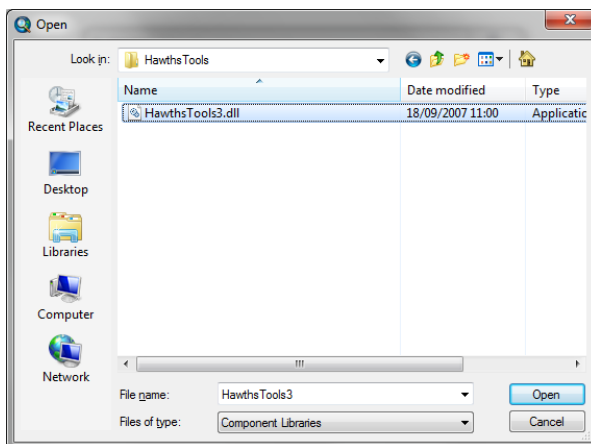
- q. Click **OK**

## Step 5: - Use Hawth's Analysis tools to generate species richness

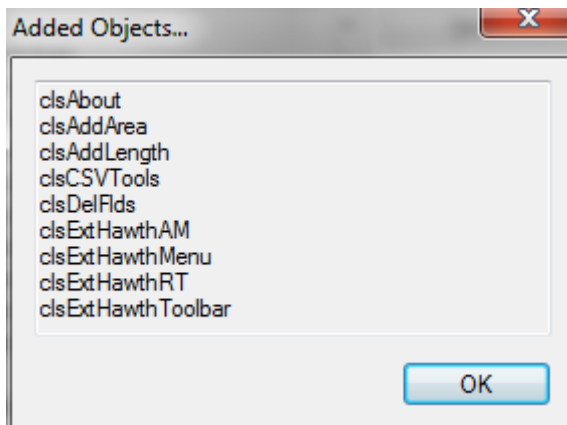
- a. Download Hawth's Analysis tools from <http://www.spatial ecology.com/htools/tooldesc.php>

**\*\*\*IMPORTANT NOTE: the documentation for Hawth's tools states that it will not work for ArcGIS 10. However it will work. Install the tool as instructed. At the end it will say that it has not installed correctly. Ignore this message and continue to step b.**

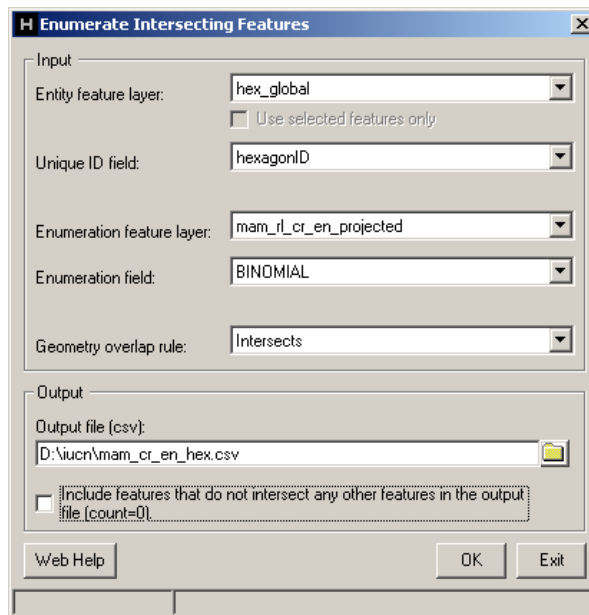
- b. Click on **Customize - Toolbars - Customize**
- c. Click on **Add from file**
- d. navigate to **C:\Program Files\HawthsTools**
- e.



- f. Click on **Hawthstools3.dll** and click **open**
- g. Say **yes** to any messages asking if you want to allow it to install  
You should see then see following screen



- h. Click **OK**
- i. Click **Close**
- j. Click **Customize - Toolbars – Hawth's Tools**
- k. From the **Hawth's tools menu bar** Click on **Hawthstools – Analysis Tools – Enumerate Intersecting Features**.



- l. The entity layer is the **hexagons shapefile**
- m. The **Enumeration feature layer** is the **mammals spatial data in equal area projection** e.g. mam\_rl\_cr\_en\_projected.shp
- n. Chose the **output location and new name** for the output **.csv** file
- o. Chose whether to tick to **include hexagons containing 0 features** or exclude them.
- p. Click **OK**

**Be patient!** - This will take a while to run but will eventually produce a new **output .csv** file containing a list of hexagon id's, the number of species it has intersected and which species.

- q. The **output .CSV file** can be opened in **Excel**.
- r. **Make a copy** of the sheet which just includes the **hexagon id and number of species**.
- s. Save as a **new .xlsx file** and close excel
- t. **Add new .xlsx** to your **ArcMap** session and **join onto the hex\_global dataset by HexagonID**.
- u. You can now **export the hexagons to a new shapefile to make the join permanent or add a field to the hexagons and calculate the values across**.

You should now be able to shade the hexagons by species number.

**END**