



Freshwater Species Mapping Standards for IUCN Red List Assessments

**Version 6
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This is Annex 1 of the “Mapping Standards and Data Quality for IUCN Red List Spatial Data”. Downloadable from: <https://www.iucnredlist.org/resources/mappingstandards>.

Freshwater Species Mapping Standards for IUCN Red List Assessments

Introduction

IUCN require a species distribution map as part of each Red List assessment. This distribution map needs to show the extant, native range of the species. Mapping the range where a species is introduced, re-introduced, vagrant or extirpated is optional. The only exceptions to this are when a species is assessed as Extinct (EX) or Extinct in the Wild (EW), and in these cases the historical native range of the species needs to be mapped.

This document details the requirements for distribution maps for Red List assessments of freshwater species. Please ask the IUCN Freshwater Biodiversity Unit (freshwater.biodiversity@iucn.org) if you require more assistance or clarification. Alternatively, for general enquiries about spatial data, please contact the IUCN Red List GIS Unit (redlistgis@iucn.org).

Mapping freshwater species distributions for the IUCN Red List

Spatial data for publication on the IUCN Red List need to be in the form of shapefiles, which are digitised range maps that can be opened by GIS mapping software. These shapefiles can contain either polygons or points.

Freshwater species distributions in the form of polygon shapefiles need to be mapped to sub-basins and lakes using the [HydroBASINS layer](#). The standard HydroBASINS resolution level used by IUCN is level 8 (but see the section ‘Different resolutions of basins for restricted-range and widespread species’ below). This layer can be downloaded from the ‘**GIS tools and recommended basedata**’ section of the ‘[GIS Tools, Software and Recommended Base data](#)’ page of the IUCN Red List website, or can be provided by the IUCN Freshwater Biodiversity Unit.

Recent changes to the freshwater mapping standards

The majority of distribution maps on the IUCN Red List website are currently displayed only as polygons but it is now possible to also display point data on top of these. Due to recent changes in the general IUCN Red List Mapping Standards (primarily changes in the way the presence of a species in a polygon or at a point are coded), **both polygon and point data (where available) shapefiles are now required for maps of freshwater species.**

Based on the old mapping standards, sub-basins and/or lakes where the species presence was probable (based on assessor knowledge) were coded using Presence = 2 ‘Probably Extant’. This code has now been removed due to ambiguity and these sub-basins should now be coded Presence = 1 ‘Extant’. Please see the section ‘Shapefile attribute data’ below for more information on these presence codes. The point data overlay will now be used to distinguish the difference between known and probable sub-basins of occurrence.

Options for mapping freshwater species

There are three options for creating distribution maps for freshwater species:

1. IUCN Freshwater Mapping Application (FWMA)

The preferred option is for assessors to use the IUCN Freshwater Mapping Application (FWMA). This is a web-based mapping application designed to map the distribution ranges of freshwater species for Red List assessments. It can be accessed at: <http://mappingfw.iucnredlist.org/FWMA/>. The tool can be used to create maps anywhere

with reasonable internet bandwidth. The FWMA uses standardised map layers that are consistent with IUCN guidelines. Maps can be created from uploaded observation data or by manually selecting sub-basins of occurrence. The FWMA allows calculation of metrics such as extent of occurrence (EOO) and area of occupancy (AOO) following standard IUCN methodology, and also allows generation of a list of countries of occurrence based on the mapped distribution. The maps can also be reviewed online and either approved or rejected, improving the efficiency of the assessment review process. Please see the [IUCN FWMA Manual](#) for guidance on how to use the application.

2. GIS Software

The second preference is for assessors to produce distribution maps using GIS Software. If required, IUCN can provide ArcGIS software (with a time limited licence) to IUCN Species Survival Commission (SSC) members or individuals contracted to complete Red List assessments for IUCN-led projects. Please contact the IUCN Red List GIS Unit (redlistgis@iucn.org) to request a licence. Please see the section below ‘GIS Software - Freshwater mapping protocol’ for guidance on mapping using GIS software.

3. Hard Copy Maps/Point Data

The final option is for assessors to submit point data in a non-shapefile format or scans of hand drawn maps/images of the species distribution. These will then be digitised by a member of the IUCN Freshwater Biodiversity Unit.

Shapefile attribute data

As the species distributions are digital, each polygon or point needs to have an attribute table attached. Note that a species distribution map is likely to have more than one polygon as each HydroBASINS sub-basin or lake is a single polygon.

Please see the PDF document [‘Definitions for Presence, Origin and Seasonal distribution codes’](#) for information on the required and optional attributes for polygon and point data. IUCN maps indicate three different aspects of the species range: Presence, Origin and Seasonality. The different code options for each of these are also presented in this document, along with the full definitions of each code.

The Excel spreadsheet available from the [Mapping and Distribution Data Attribute Standards](#) page provides information on the required and optional attributes for point data, definitions of the attribute codes for Presence, Origin and Seasonality, and an example of a complete attribute table for point data.

For polygon maps, distribution maps created using the IUCN FWMA will automatically have the required and optional attribute columns attached. If mapping using GIS software, IUCN can provide the required sub-basin mapping shapefile (HydroBASINS shapefile), which already contains these attribute columns.

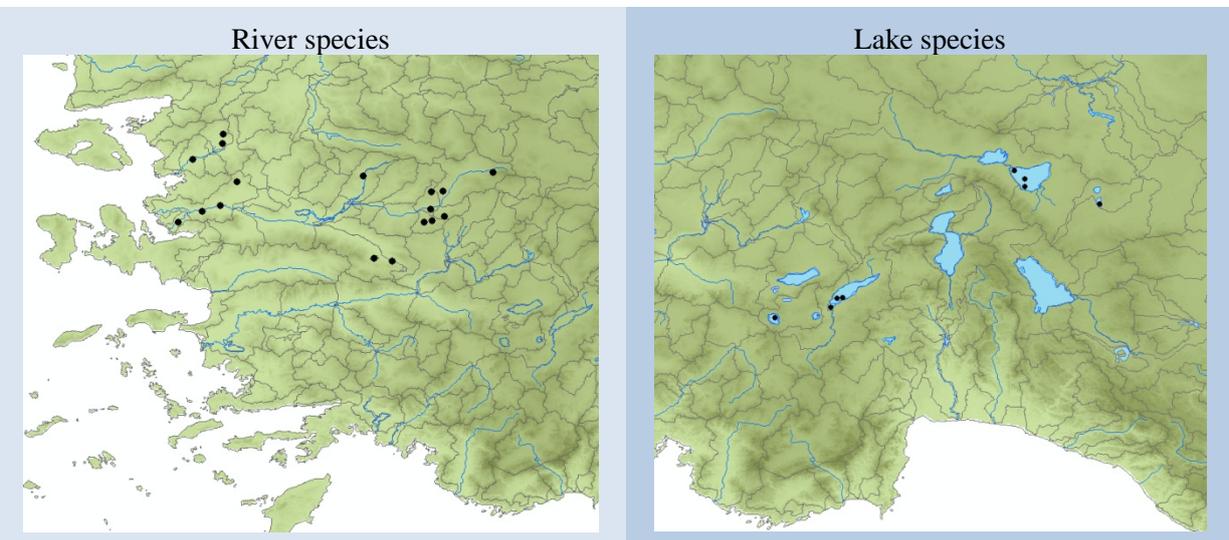
For point data maps, the ‘Example’ tab of the Excel spreadsheet available from the [Mapping and Distribution Data Attribute Standards](#) page contains an example of a complete attribute table for point data. This can be copied to a blank Excel document and completed. Point data can either be submitted in Excel files or be converted to shapefiles in GIS software and then submitted.

GIS software - Freshwater mapping protocol

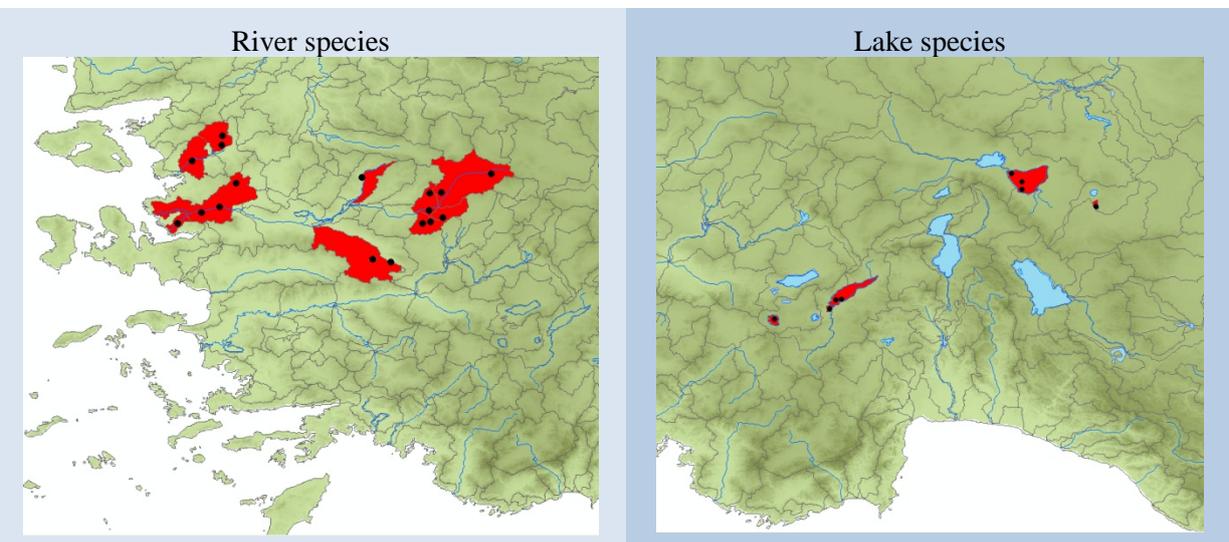
This section outlines the mapping protocol when using GIS software (Option 2 in the 'Options for mapping freshwater species' section above).

Mapping steps for GIS software

1. Import species record point locality data (where available) into GIS software:

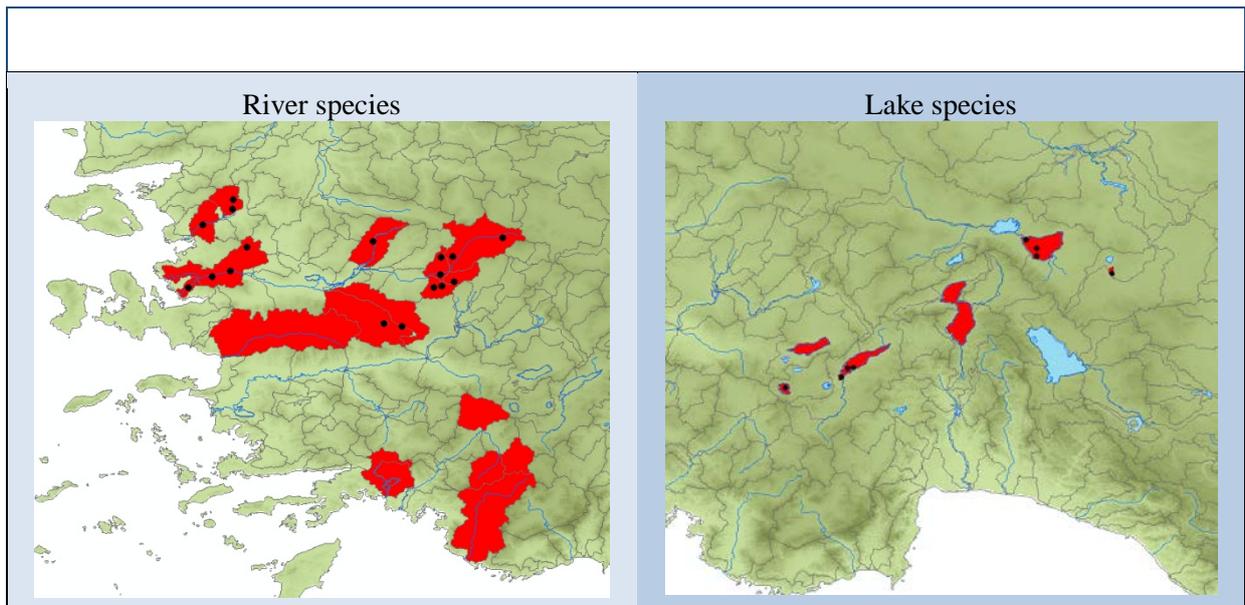


2. Select sub-basins and/or lakes where species native presence is known based on the imported point data. If using ArcMap, the 'Select by Location' tool can be used to select these sub-basins and/or lakes, or alternatively they can be selected manually. The selected polygons should be coded Presence = 1; Origin = 1 (Seasonality depends upon the life history of the species).



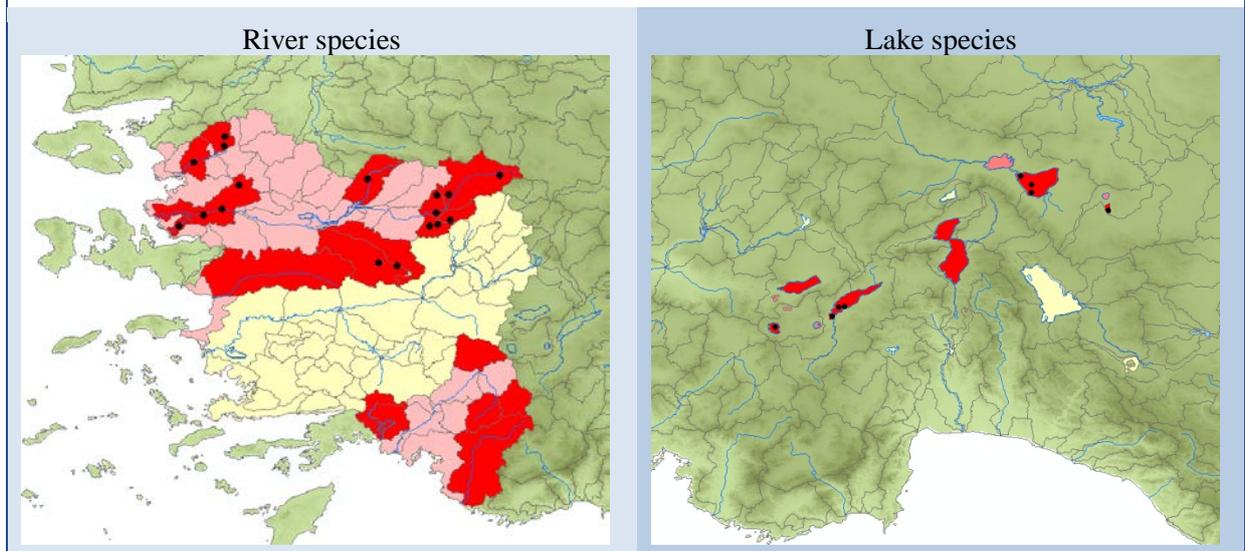
3. Select sub-basins and/or lakes where the species native presence is probable based on literature, or assessor knowledge. These polygons should also be coded Presence = 1; Origin = 1 (Seasonality depends upon the life history of the species). This will be the first step if no point data are available.

Based on the old mapping standards, catchments and/or lakes where the species native presence was probable were coded using Presence = 2 'Probably Extant'. This code has now been removed due to ambiguity and these basins should now be coded Presence = 1 'Extant'. On the IUCN Red List website, it is now possible to overlay point data on the polygon map. These points will be used to distinguish between known and probable basins of occurrence (previously coded Presence = 2 'Probably Extant').



OPTIONAL steps:

- Select catchments where the species is extinct. These should be coded Presence = 5 'Extinct'.
- Select catchments where the species has been re-introduced. These should be coded Origin = 2 'Reintroduced'.
- Select catchments where the species has been introduced. These should be coded Origin = 3 'Introduced'.



Different resolutions of sub-basins for range-restricted and widespread species

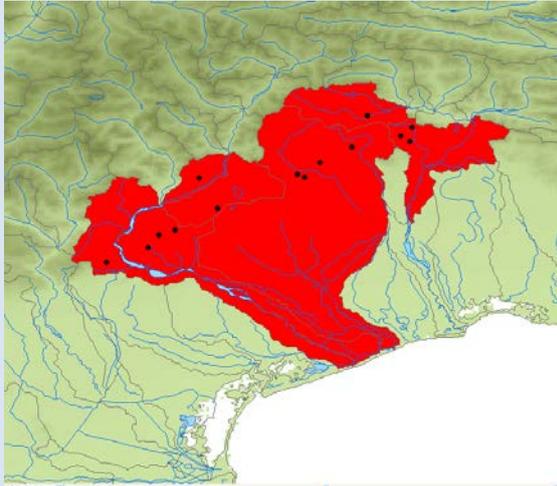
The HydroBASINS sub-basin layer comes in different resolutions (size of sub-basins), with the smaller sub-basins being nested within larger ones. The standard resolution level used by IUCN is level 8 (as shown above). However, if you are mapping highly range-restricted species and you feel level 8 does not represent the distribution of the species accurately enough, you can use a higher resolution version of the sub-basin layer. Please note also that there are different resolution lakes (size of lakes) in each layer and therefore, if you are mapping to very small lakes, you may need a higher resolution sub-basin layer.

For freshwater species with distributions more restricted than the finest scale HydroBASINS layer, the range should be mapped as a polygon reflecting, for example the location of a cave or small

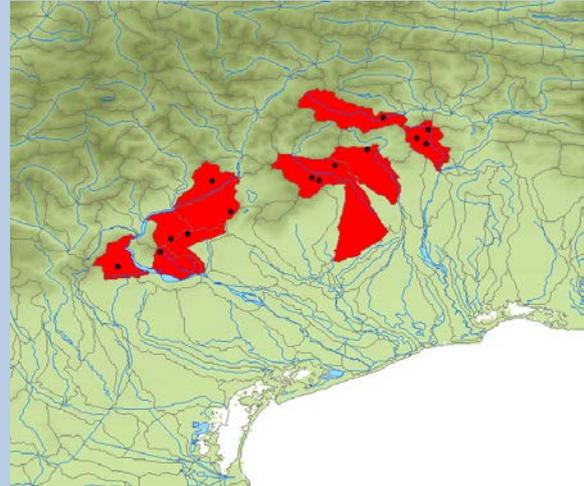
wetland to which a species is restricted, rather than generalising to the finest scale HydroBASINS layer.

Range-restricted species

For those species that are restricted in range, or are widespread but have very small habitat patches a higher resolution HydroBASINS sub-basin layer can be used. Alternatively, for highly restricted species detailed polygon maps can be submitted.



Level 8 sub-basins showing large areas (especially in the lowlands) that ideally would not be included in the range map of this mountain stream species.



Level 10 sub-basins showing a more restricted distribution map, more accurately reflecting the range of this mountain stream species.

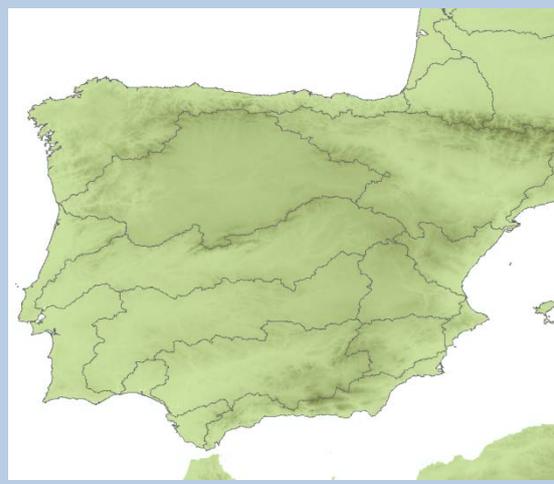
If you are mapping many widespread species it may be worthwhile to use a lower resolution sub-basin layer, in order to save time selecting many catchments.

Widespread species.

For those species that are widespread a lower resolution HydroBASINS sub-basin layer can be used.



Level 8 sub-basins is the standard mapping resolution layer.



Level 5 sub-basins may be more suitable for mapping very widespread species.

If you are mapping using the FWMA then you can choose the appropriate HydroBASINS level to map to when starting a new map. If you are mapping using GIS software and would like different resolution layers to map your species to then please visit the **‘GIS tools and recommended basedata’** section of the **‘GIS Tools, Software and Recommended Base data’** page of the IUCN Red List website. If the level of resolution you require is not available then please contact the IUCN Freshwater Biodiversity Unit.

Mapping detailed distributions within large lakes

For species that occur in large lakes (e.g. Lake Victoria in East Africa) polygon (non-HydroBASINS) maps of the in-lake distribution can be submitted to provide detailed information on the distribution of a species within a lake.

For species endemic to large lakes, only a polygon (non-HydroBASINS) map of the in-lake distribution should be provided. This polygon map should be guided by species records (for which point data should be provided where possible) and bathymetric and habitat preference data.

For species occurring within a large lake in addition to the wider catchment, two map shapefiles should be provided: a polygon (non-HydroBASINS) map of the in-lake distribution and a HydroBASINS map of the distribution in the wider catchment. In this case the HydroBASINS sub-basin for the lake of interest should not be included in the HydroBASINS map. This is required because the two maps will be overlaid for presentation on the IUCN Red List website, and inclusion of the lake sub-basin itself would hide the more detailed in-lake distribution polygon.

Sensitive spatial data

Some species have sensitive spatial data and assessors would not want to make the distributions of these species publically available. For example, the species might be found in only a few localities and may be collected for the aquarium trade. Publishing a map of the species distribution could lead collectors directly to the species, which would be contrary to any conservation efforts. For these species, it is still necessary to provide a distribution map as these spatial data are important for analyses. However, when creating the map the optional attribute “Data_sens” should be completed with “YES”. This means the map will not be published on or available for download through the Red List website.

Calculation of the extent of occurrence (EOO) for freshwater species

The extent of occurrence (EOO) is defined as “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” (IUCN 2012). This parameter is used primarily in criterion B of the **IUCN Red List Categories and Criteria**. For further information on the intent behind the EOO parameter and its relationship with the area of occupancy (AOO) see the **‘Guidelines for Using the IUCN Red List Categories and Criteria’**.

For assessments of freshwater species, the EOO can be calculated in two ways:

- If point data are available, the EOO can be calculated as the area of the minimum convex polygon (MCP) drawn around all points. The EOO can be calculated in this way using the free online tool **GeoCAT**. Point data can be uploaded, manually added or imported from online sources e.g. GBIF. GeoCAT can also be used to calculate the AOO of a species. Alternatively if GIS software is available, the EOO can be calculated in this way using the **EOO calculator** available for download from the **‘GIS tools and recommended basedata’** section of the **‘GIS Tools, Software and Recommended Base data’** page of the IUCN Red List website.
- If point data are not available, the EOO can be calculated as the area of the MCP drawn around all HydroBASINS of the species distribution coded as Presence = 1 ‘Extant’. This is

the method used by the EOO calculation tool in the FWMA. Alternatively if GIS software is available, the **EOO calculator** available for download from the '**GIS tools and recommended basedata**' section of the '**GIS Tools, Software and Recommended Base data**' page of the IUCN Red List website can also be used to calculate the EOO in this way.

- The EOO can be presented as a range, with the EOO based on point data given as the lower limit and the EOO based on HydroBASINS as the upper limit.

Bibliography

IUCN. 2012. *IUCN Red List Categories and Criteria: Version 3.1*. Second edition. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

Version

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