

## Report on the outcomes of a Short-Term Scientific Mission<sup>1</sup>

Action number: CA18221

Grantee name: Simeon Lukanov

### **Details of the STSM**

Title: Update on the taxonomy and distribution of European amphibians and reptiles through the combined use of GIS analysis and interactive applications

Start and end date: 03/07/2023 to 12/08/2023

### **Description of the work carried out during the STSM**

Description of the activities carried out during the STSM. Any deviations from the initial working plan shall also be described in this section.

During my stay, I carried out two main tasks. For the first task, I compiled a GIS database with point records of amphibians and reptiles from private sources (incl. personal observations, data from NGO's, etc.). This was done following the pattern established in a previous STSM that was focused on publicly available sources (i.e., GBIF, iNaturalist, etc.) and involved reformatting the received data into a .csv file with standardized columns (X, Y, fid, Scientific\_name, Year, Source, Erroneous, Introduced, Class), which was then used to create a geopackage file in ArcGIS. Two separate databases were created in this way, one for amphibian and another for reptile species. As a side activity for this task, I also accounted for any recent taxonomic changes and implemented them in both the existing database (with public data) and the new database that I was building (with private data), updating species name and distribution where necessary. During the work process, I followed the accepted taxonomical units (incl. for introduced species) established in the 2020 update by the Taxonomic Committee of the Societas Europaea Herpetologica (Speybroeck et al 2020).

My second task was to improve the performance of the interactive website for the atlas. The interactive website is written using the ShinyApp in the R environment and its purpose is to allow users to select and view amphibian and reptile species distribution online, in a 50x50 km grid. The original code was working and species distributions were displayed correctly, but performance was slow, especially for species with large ranges, taking 30 seconds or more to show the occurrence grids. During the work process, I kept the packages used for website, but changed a number of aspects of the code in both User Interface and Server Logic sections. In the original code, updates were done using the observe

<sup>1</sup> This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

block, and I replaced that with a single reactive expression, chaining map updates together. The original code also loaded by default all cells from the grid (with and without species occurrence); I changed it so that the entire grid was only loaded if the user selects this option, and by default, only grids with species occurrence are shown.

All of the activities described above followed the initial working plan laid out in the application form, with no deviations.

### **Description of the STSM main achievements and planned follow-up activities**

Description and assessment of whether the STSM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the STSM. Agreed plans for future follow-up collaborations shall also be described in this section.

Currently, the databases with private records for amphibian and reptile species contain 5 555 and 4 973 records, respectively (incl. 2 973 records from my personal observations). During my work on this task, I corrected old taxon names from the private records (e.g., *Rana ridibunda* instead of *Pelophylax ridibundus*), and updated the taxonomy and distribution of a number of amphibian and reptile species. Such updates were necessary in the cases of recently split species - *Hyla orientalis* (in many private sources still labelled *Hyla arborea*, although records were entirely within the *H. orientalis* range), *Lacerta diplochondrodes* (records within the *L. diplochondrodes* range were still labelled as *Lacerta trilineata*). Based on available literature, I also added some species with single records for Europe (e.g., the endemic *Podarcis lewendis* and the introduced *Tenuidactylus bogdanovi*). Although for now, the database with private records is still small, as the contacted sources were slow to respond and share the requested data, this will probably change with the end of the summer holidays in September, and we expect an increase of received data in the following months. This new data will be handled in a third STSM planned for the autumn of 2023.

My changes to the code for the second task proved successful and the performance of the interactive website sped up significantly, while retaining all of the functionalities of the original version (mini-map, measuring tool, three different map provider options, zoom in/out buttons). Currently, the website for the atlas is operational and can be reached at the following address: <https://montobeo.shinyapps.io/NA2RE/>. Although the website is still using the data from the 2014 atlas, the code is written in such a way that it can very easily accommodate for the new database, which will replace the previous one as soon as it is completed (it is only a matter of replacing the source .csv and .gpkg files).

The results obtained during my STSM are related to the first objective of WG2 (Characterise amphibian and reptilian taxa depending on their risk of being affected by pesticides) and the second research coordination objective of the PERIAMAR Action. My contribution will be included in the upcoming new amphibian and reptile atlas, with the related scientific publication co-authored by the host Neftalí Sillero, the other STSM participants, and myself.