

## Report on the outcomes of a Virtual Mobility<sup>1</sup>

**Action number: CA16224**

**Grantee name: Urška Ratajc**

### **Virtual Mobility Details**

**Title:** Review of contextual data and guidance for Tawny Owl monitoring to support a future European Raptor Sampling Programme

**Start and end date:** 10/03/2022 to 15/04/2022

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

In the first half of the STSM period, we have analysed the spatial variation of selected ecological traits across the Tawny Owl's distribution area in Europe: population size, population trends, several diet parameters (proportion of main prey groups and proportion of different mammal groups – both in frequency and biomass), clutch size and dispersal distances. Depending on the amount and type of data available, some traits were visualised only (population size and population trends) and others were further examined for the presence of spatial patterns (diet, dispersal, and clutch size). For the latter, we used generalised additive models (GAMs) with smoothing parameters to relate the dependent variables (a set of 18 variables describing diet composition, 1 variable describing dispersal, and 1 variable describing breeding performance) to latitude and longitude. To obtain a visual output of continuous variation in the dependent variables across Europe, I converted the point spatial data for the proportions in diet, dispersal distance, and mean clutch size to raster data using inverse distance-weighted (IDW) interpolation. All statistical analyses and visualisations were performed in R 4.0.3 statistical software using the mgcv, MuMIn, gstat, tmap and ggplot2 packages. The second half of the STSM period was dedicated to advance in the finalisation of the article (mainly the Results and Discussion chapters), as some material has already been prepared.

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

With our research we have highlighted spatial variations in some contextual data, which should be considered when interpreting the biomonitoring results. We have also flagged some gaps in our knowledge about the species (particularly gaps on a spatial level) and some inconsistencies in reporting certain data (very rough estimates of population trends, unclear methods for clutch size determination, etc.).

Our results on Tawny Owl's diet showed that mammals are the main prey group all across Europe,

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<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.

although in some urban areas birds can be important. Invertebrates were a more frequent prey in S and SW Europe, but their biomass proportions were very low. Amphibians and reptiles were rarely a part of the diet in significant proportions. From the mammal groups, herbivore and omnivore mammals were the most frequent prey. Particularly, their biomass gradient in the direction SW – NE was significant, with herbivore decreasing and omnivore proportions increasing towards SW.

As a measure of population size we calculated the crude density for 39 countries. In Belgium, Slovenia and Bosnia and Herzegovina the densities were the highest (0.419, 0.347 and 0.341 pairs / km<sup>2</sup>, respectively). Western Balkan had the highest densities and the populations were less dense at the edges of the distribution area (e.g. Norway, Finland, Spain, Turkey).

In 53.8 % of the countries the population was stable and in 5.1% it was fluctuating. Tawny Owl's populations were decreasing in 15.4% of the countries. For 25.6% of the countries the population trend was unknown. Southern Europe was the region with seemingly the most stable populations (with the exception of Albania), however there was too much missing data in general to describe any spatial pattern of Tawny Owl's population trend. We found that a best practice for estimating population density, size and trends is needed to harmonise the studies across Europe.

The dispersal analysis confirmed that Tawny Owl is a sedentary species and, as such, a good indicator of contaminant issues on a local level. The overall mean dispersal distance was 18.2 km. Mean dispersal distance of juvenile birds was 22.0 km and of adult birds 6.1 km. Thus, a certain level of cautiousness with samples taken from young birds is recommended, since they can disperse over significantly longer distances than adults. Our analyses also revealed a pattern of increasing dispersal distances towards the north-east, therefore additional cautiousness with interpretation of ecotoxicological samples is advisable in N and NE Europe.

The range of mean clutch size across Europe was between 2.4 and 4.5 (median = 3.35). According to interpolation model the clutch size increased towards east.

The paper needs some final adjustments and then it will be submitted to one of the journals in the field of ornithology or biodiversity. We expect our results will be very valuable for large scale monitoring of contaminants.

The materials will also be a part of at least one of the chapters in the 'Advice Hub'. The chapter on Tawny Owl monitoring guidance is under development and will be published later as a part of a second phase of the Advice Hub publication.

During this virtual STSM I had the opportunity to meet and work with several members of the ERBF WG4 and since we have plenty of research ideas, I hope this mission will result in some future collaborations as well.