

SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

Action number: CA16224

STSM title: Presence, concentrations and (bio)-analytical methods currently available for emerging and legacy organic contaminants in raptors.

STSM start and end date: 10/01/2019 to 10/04/2019

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PURPOSE OF THE STSM:

The general purpose of this mission was to perform a thorough literature review concerning the presence, concentrations, and (bio)-analytical methods currently available for emerging and legacy organic contaminants (i.e., bisphenols, PFASs, UV filters, microplastics, PBDEs, NFRs etc.) in raptors (birds of prey and owls). In this way, we are able to identify occurrence and recent trends, but also current weaknesses and to provide general guidelines for future raptor biomonitoring initiatives at a pan-European scale. We also performed analysis on raptor tissues for bisphenols and benzophenones. We aim for publishing the outcomes of this STSM in two scientific articles, which will be finished in the Home Institution, working in close collaboration with the Host group:

- 1) Literature review of current monitoring activities in raptors in Europe
- 2) Analytical optimization of a method for bisphenols and benzophenones (UV-filters) in raptor tissues.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSM

Literature search was first carried out by searching for scientific journals related to the analysis of legacy and emerging organic contaminants in raptors in Web of Science and PubMed. After this search, all the data from published studies on PBDEs, PFASs and novel flame retardants (NFRs), thus including both novel brominated flame retardants (nBFRs) and organophosphate esters (OPEs), in raptors in European countries was collected. A European map was constructed to show in which countries there is data on these classes of contaminants in raptors (see below Figures 1 and 2). One of the main problems found was the shortage of published studies on contaminants of interest in raptors (specifically the emerging ones).

Because of this lack of information, a questionnaire was made in order to find out if researchers in Europe were performing studies on those legacy and emerging contaminants of our interest. The questionnaire was sent on Friday 22nd of February to the ERB Facility participants as well as to all those people with a professional profile related to the study and research of wild birds. Questions were divided in two separate documents: the first one was a Google Forms survey on the purpose of the study or scheme performed, the scheme information (in case it was needed), the collection strategy and the country of collection. The second one was an Excel file focused on the species, matrices and contaminants analyzed in the study.

In parallel with the literature search, a method for the determination of bisphenols and bezophenones in raptor tissues was developed. Some screening runs were first carried out at the laboratory to know on which tissues, species and contaminants to focus. For this pilot study, three different species were selected: White tailed Eagle (WTE) from Greenland and both Long-eared owl and Eurasian sparrowhawk from France.

Different kinds of tissues were selected such as brain, kidney, liver, preen gland, fat and muscle. Liquid-liquid extraction and further LC-MS/MS analysis were used. Once the results from the screening study were obtained, analyses in 13 preen glands and 6 livers from WTE from Greenland were carried out as well as in the plastic containers where the samples were stored.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

Review results:

A total of 41 articles related to the analysis of PBDEs, NFRs, PFASs and other emerging contaminants, such as neonicotinoids, parabens, bisphenols, UV-filters and microplastics in raptors in Europe were collected from Web of Science and PubMed. Among these 41 articles, 22 were focused on PBDEs, 12 on NFRs, 6 on PFAS and 5 on other emerging contaminants. The following maps (Fig 1.A and Fig 2) show the location of these studies (where they were performed and samples where collected) along Europe. The pie charts (Fig 1.B) show the contribution of each country to the studies on the main classes of compounds (PBDES, PFAS, NFRs).

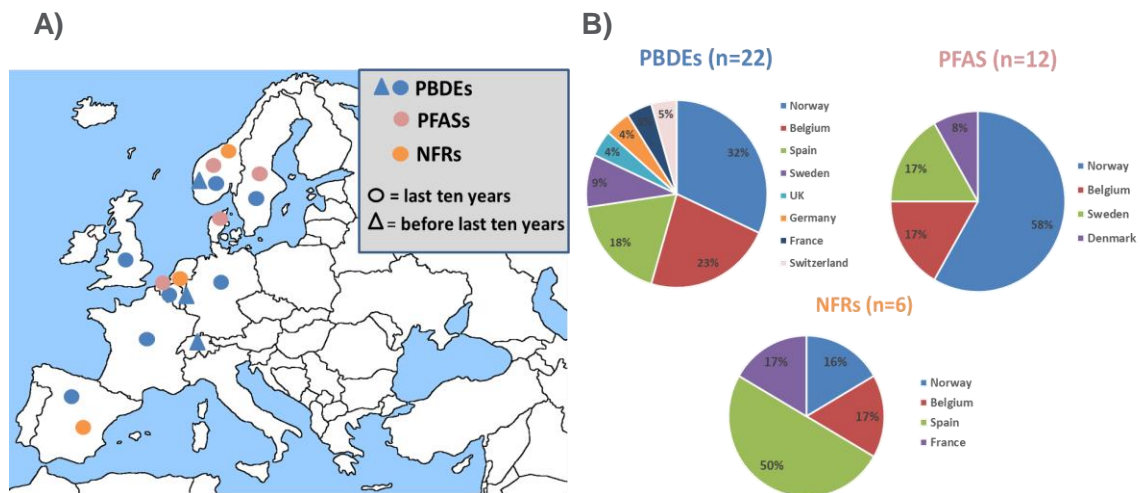


Figure 2. A) Location of studies performed and samples collected on PBDEs, PFASs and NFRs along Europe. B) Contribution of each European country to these studies.

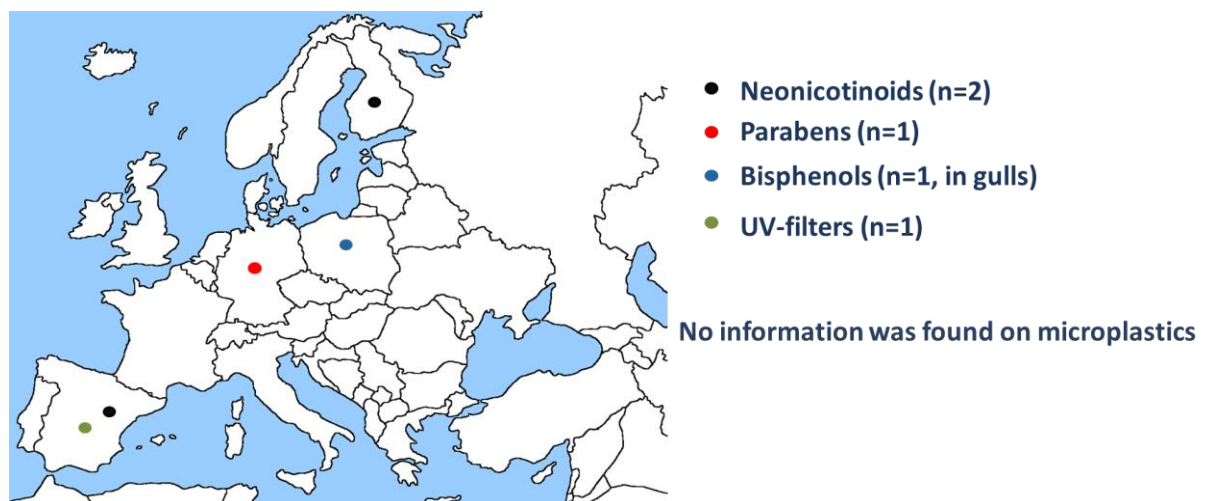


Figure 1. Location of studies performed and samples collected on other emerging contaminants along Europe.

Results indicated that most of the studies were performed in Western Europe and that there is still a great lack of published studies on emerging contaminants in raptors. All the concentrations of chemicals found in these articles were at ng g⁻¹ level.

Regarding the questionnaire, a total of 32 and 14 responses were obtained for the Google Forms survey and the Excel File, respectively. The following table shows the results from these two documents (in some questions participants could tick all available options):

Survey Method	Question	Response
GOOGLE FORMS (32 responses)	Are these studies part of a monitoring scheme or research project?	Yes: 71.9% No: 28.1%
	Purpose of the study	Exposure: 75% Effects: 37.5% Forensics: 37.5% Other purposes: 3.1% each one
	Purpose of the study	Ongoing studies: 52.2% One-off studies: 26.1% Intermittent studies: 17.4% Less than 5 years studies: 4.3%
	Lenght of the scheme	
	Scheme information	
	Funding	Private: 26.1% Public: 100%
	Country of funding	Mostly Norway, Portugal and Spain
	Collection strategy	Planned: 65.6% Responsive: 59.4%
	Raptors	
	Collected by	Staff: 80.6% Volunteers: 48.4% MSc students: 19.4% Other: 3.2% each one
Country of collection	Mostly Norway, Portugal and Spain	
EXCEL FILE (14 responses)	A total of 33 species	Most studied: <i>Bubo bubo</i> , <i>Strix Aluco</i> , <i>Asio otus</i> and <i>Tyto Alba</i>
	Samples collected from birds	Alive: 39% Death: 61%
	Age of individuals	Adults: 53% Nestlings: 33% Unhatched eggs: 14%
	Matrices	Liver: 21.9% Blood: 14.3% Kidney: 12.5% Feathers: 11.3% Other: 40%
	Contaminants	Metals and other elements: 54.5% Other POPs: 20.6% PBDEs: 3.6% PFASs: 1.9% NFRs: 1.7% Bisphenols and benzophenones: 0.9% New agrochemicals: 3.6% Rodenticides: 2.6% Pharmaceuticals: 2.6% Biomarkers: 7.9%
	A total of 693 contaminants (studies) are being analyzed	

A graph showing which contaminants are being analyzed in which raptor tissues will be posted on the ERBFacility website.

Method results:

Screening results indicated that the most suitable tissues and species for the determination of bisphenols and benzophenones in raptor tissues were both preen gland and liver from WTE from Greenland because of higher concentrations and less matrix effects. On the basis of these results, analyses in both matrices from different WTE individuals were carried out. Some contaminants were detected at ng g^{-1} level (being 805.9 ng g^{-1} the highest concentration found for BPA in one preen gland sample). Recoveries were quantitative for all the contaminants analyzed (above 70% in all cases) and RSDs were below 20%, thus indicating that the method developed exhibits great analytical performance in terms of accuracy and precision.

FUTURE COLLABORATIONS (if applicable)

Besides the continuing collaboration on the two papers (review and method paper) resulting from this STSM, future collaborations between the Host and Home institutions are being discussed. The general aim of this collaboration would be to investigate the potential of nanosolvents to develop a new wide-scope, faster, cheaper and greener analytical method for the determination of emerging contaminants in raptor tissues.

For this collaboration, different emerging contaminants (such as flame retardants) will be used for method assessment, both of high concern and widely used. Preliminary tests will be made at the Home institution laboratory (expertise in nanosolvents) in order to select the most suitable nanosolvent/s for wide screening by LC-qqq-MS/MS. The Home Institution laboratory will receive samples (raptor tissues) and guidance for the analysis of the selected contaminants from the Host Institution, which has a wide expertise in the analysis of these type of samples. We aim for publishing the outcomes of this collaboration in a scientific article.