Research Networking Programmes

Short Visit Grant ☐ or Exchange Visit Grant ☒

(please tick the relevant box)

Scientific Report

Scientific report (one single document in WORD or PDF file) should be submitted online within one month of the event. It should not exceed eight A4 pages.

Proposal Title: Good/best practice for monitoring contaminants with raptors

Application Reference N°: 4217

1) Purpose of the visit

In order to achieve the aims of EURAPMON, and in agreement with the third immediate objective of EURAPMON included as a part of the workpackage 5 (Best practice), it is necessary to spread best practices and build capacities in Europe for harmonised monitoring with raptors. In this sense, the expected outcome from workpackage 5 is EURAPMON Outcome 3: "Best practice guidelines and protocols available on web (and possibly in print), including for: fieldwork, sampling, preparation, analyses, etc. building on existing best practice guidance".

Therefore, considering the comprehensive inventory of existing monitoring developed in the last EURAPMON Workshop in Amsterdam, it is necessary to compile information and documents on best practice and to write a manuscript and protocols or guidelines about good and best practice, making this information available in the EURAPMON website. Then, the first aim of the Exchange Visit Grant was to pull together information on good/best practice for monitoring contaminants with raptors, and to draft key scientific information and key discussion issues in preparation for a workshop. This "Workshop on Best Practice" was celebrated in Murcia, Spain, from 31st May to 2nd June 2013. The objectives of the Workshop were to prepare a draft manuscript on best practices for pollutant exposure monitoring of raptors; to prepare a sampling protocol able to be adapted to different species, countries and user needs; and to complete a database on contaminant monitoring with raptors in Europe.
Finally, after the Workshop, a background report was drafted based on the results of the Workshop, and a manuscript on best practices for pollutant exposure monitoring of

raptors is currently being written and will be submitted to an international scientific journal. In addition, a protocol or guidelines about good and best practice was designed, and a database on contaminant monitoring with raptors in Europe is being completed.

In summary, the main tasks during the exchange visit were:

- Definition, together with a supervisory group, of the scope of the review of good/best practice.
- Collation of relevant papers and other information about best practice in monitoring with raptors.
- Drafting of key scientific information and identification of key discussion issues in preparation for the workshop.
- Preparation of draft manuscript on outcome of workshop, and protocols or guidelines of best practices that would be freely available in EURAPMON web page (www.eurapmon.net).

2) Description of the work carried out during the visit

- 8th April-29th May 2013, Norwegian Institute for Air Research, FRAM-High North Research Centre on Climate and the Environment, Tromsø, Norway. Supervised by Dr. Dorte Herzke.

The scope of the review of good/best practice was defined and published literature was collated. Three draft documents were prepared during Dr. Silvia Espín stay in Norway, under the supervision of Dr. Dorte Herzke and working through teleconferences with her other supervisors in United Kingdom (Prof. Richard Shore) and Spain (Prof. Antonio J García-Fernández and Dr. Emma Martínez-López). In this sense, a draft manuscript structure on "Best Practices for Pollutant Exposure Monitoring of Raptors" was written to be used as base during the workshop, including basic information that should be addressed in the different sections. In addition, a draft protocol on "Sampling and Contaminant Monitoring" and a database with information from published literature concerning pollutant monitoring in raptors were prepared to be used as preparatory material for the workshop. These three documents were distributed to the participants before the workshop.

Dr. Silvia Espín also presented a seminar entitled "Biomonitoring of persistent environmental pollutants and assessment of sublethal effects using oxidative stress biomarkers in wildbirds" at the FRAM Centre in Norway.

- 31st May-2nd June 2013, Murcia, Spain. Workshop "Setting best practices on raptor contaminant monitoring activities in Europe".

The workshop covered a 3-days program including short presentations on the different draft documents (manuscript, protocol and database), small sessions to discuss the drafting text, and working sessions to polish the documents. The workshop was successful in meeting its objectives, bringing together a total of 10 participants and a ESF representative from 6 European countries (Belgium, France, Germany, The Netherlands, Norway and Spain). According to the program, Dr. Silvia Espín presented the different sections of the draft manuscript, the draft protocol and the database to the participants.

After each presentation, participants discussed about the structure and content and proposed new references that should be included. During working sessions, the information discussed previously was added in the documents and the draft manuscript was polished and completed. The aim of the manuscript is to combine and evaluate the new knowledge collected on activities undertaken across Europe for monitoring either raptor populations and/or contaminant levels in raptors (Gómez-Ramírez et al. submitted; Derlink et al. in preparation). We use that information to provide data about what kind of matrices are collected from raptor species and where are they collected. This manuscript also evaluates the applicability of different matrix samples, proposing the ideal target tissues for a specific compound analysis, and which compound groups should be targeted in monitoring studies.

The sampling protocol about good and best practice was also prepared. The aim of the protocol is to provide a guide that may help to homogenize, share and disseminate best practices between existing and emerging schemes in order to enhance the reliability, comparability and interoperability of data.

In addition, the collaboration with researchers in the field of biomonitoring for raptors and the link to the inventory of their activities has revealed potential of samples to be collected and used for pan-European monitoring, and hence, to fill the gaps in terms of sampling.

- 5th June-26th July 2013, Lancaster Centre for Ecology and Hydrology (CEH), Lancaster, UK. Supervised by Prof. Richard Shore.

After the workshop, Dr. Silvia Espín worked on delivering the outputs from the workshop. This involved shaping the paper and contents with Prof. Richard Shore and working through teleconferences with Dr. Dorte Herzke, Dr. Emma Martínez-López and Prof. Antonio J García-Fernández.

Suggestions done during the workshop were included in the manuscript and protocol, and both the contents and the structure were improved. Questionnaires from both inventories of existing monitoring, one focused on the health of raptor populations themselves and other focused on what raptors can tell us about the environment (Gómez-Ramírez et al. submitted; Derlink et al. in preparation), were combined and the results were analysed and included in the manuscript in order to provide real data about what matrices are collected and where are they collected by different schemes around Europe.
The new version of the manuscript and the list of references included in the database were sent to the coauthors and new comments were received.
Currently, Dr. Silvia Espín is doing some modifications in the manuscript and she is including the new references proposed by coauthors in the database.

While at CEH, Dr. Silvia Espín also worked for short periods of time with members of Prof. Richard Shore's research team to gain experience of and insights into the work they undertake as part of CEH's Predatory Bird Monitoring Scheme. This included attending team meetings, working with colleagues on post-mortem examinations of raptors and preparation of egg contents for chemical analysis, and familiarisation tours of their analytical chemistry facilities. Silvia also attended monthly meetings of CEH section in which talks have been given on various aspects of CEH research.

3) Description of the main results obtained

3.1. "Manuscript"

“Best practice for contaminant exposure monitoring with raptors”.
The manuscript is structured as follows:

1. Introduction and objective

This section contains information about raptors as first wildlife species known to be affected by anthropogenic pollutants, providing some case studies as examples. The presence of different compounds in the ecosystems, how species and populations are exposed, and the adverse effects on health are also presented. In addition, information about raptors as good sentinels of environmental pollution and why raptors are used in biomonitoring studies is provided.

The aim of the manuscript is to combine and evaluate the new knowledge collected on activities undertaken across Europe for monitoring either raptor populations and/or contaminant levels in raptors (Gómez-Ramírez et al. submitted; Derlink et al. in preparation). We use that information to provide data about what kind of matrices are collected from raptor species and where are they collected. In this sense, it has to be kept in mind that each sample matrix may provide different information and not all the samples collected are suitable for biomonitoring depending on the objective and the compound(s) to be targeted. Therefore, this paper evaluates the applicability of different matrix samples, proposing the ideal target tissues for a specific compound analysis, and which compound groups should be targeted in monitoring studies. For this purpose, this paper is also based on a review of the available literature on contaminant monitoring in raptors from Europe.

2. Choice of matrices

Destructive sampling can be defined as any action leading to impairment of individuals or populations from which recovery cannot be expected on short term like voluntary sacrifice of the individual and fresh egg sampling. Raptors are protected species and active monitoring is limited to sampling live birds for non-destructive samples, whereas passive monitoring can be performed with found dead animals. Therefore, destructive sampling is not recommended and will thus not be considered in this paper. For non-destructive sampling, invasive and non-invasive sampling are distinguished. Invasive sampling will refer to as any sampling that implies potential stress to a bird and/or handling without adverse effects from which it cannot recover in a short term. Samples such as blood (and its compartments), plucked feathers, biopsies and preen oil are considered as invasive. Non-invasive sampling refers to as actions that don’t imply any disturbance to a living bird. The following samples are regarded as non-invasive: molted feathers and addled or deserted eggs sampled while ringing/marking the nestlings or after the end of the breeding period, pellets, excrements and tissues from carcasses (including internal tissues, feathers, preen gland and clipped nails).

An important aspect when designing a monitoring study is to establish which matrices are most sensitive and relevant for monitoring. The selection of the matrix should be related with the toxicokinetics of the compound and the site of its toxic action. In addition, it is important to take into account that residue concentrations have to be well above limit of detection, playing the appropriate selection of the sample and the sample volume an important role. It has also to be kept in mind that the collection of birds of prey samples (blood or feathers from chicks, addled eggs, etc.) is demanding logistically since nests normally are located at remote and isolated locations which are difficult to access, requiring skilled personal and advanced equipment. Thus, the appropriate sampling design is particularly important.

This section is based on the information of two different questionnaries on inventory of existing monitoring, one focused on the health of raptor populations themselves and other focused on what raptors can tell us about the environment (Gómez-Ramírez et al. submitted; Derlink et al. in preparation). In order to provide real data about what matrices are collected and where are they collected by different schemes around Europe by personnel form both monitoring areas, we have combined data of these two different questionnaires. A total of 281 different monitoring schemes from 35 countries have sent their questionnaires, and 33 countries collect samples of raptors in Europe. United Kingdom, Sweden and Italy are the countries with the highest number of schemes collecting samples of raptors in Europe. Of the countries that have sent their questionnaires, samples of raptors are not collected in Luxembourg and Serbia. In addition, to our knowledge, there is no sampling collection in other European countries such as Greece, Lithuania, Albania, Moldova, Macedonia and Montenegro, but questionnaires have not been received from these countries. The questionnaire results revealed that feathers and eggs are the most frequently collected samples by the different European schemes (35.6 and 32.4 % of schemes collect feathers and eggs, respectively), followed by food remains (28.8%), pellets (23.5%), internal tissues (22.1%), blood (19.2%), and finally preen oil (2.1%).

This section is subdivided in (i) invasive sampling (blood, plasma and serum, and feathers), (ii) non-invasive sampling (addled or deserted eggs and internal tissues), and (iii) other samples (regurgitated pellets, crop content, excrements, preen oil, and nails). Here we include information about how many schemes collect each kind of sample, which countries collect each kind of sample, and pros and cons about the use of each type of matrix. We also provide tables and maps to provide numbers and indicate where each kind of sample is collected.

3. Compounds to be analysed in each type of sample

This section is based on a literature review about monitoring of pollutants in raptors from Europe. A database with detailed information about the published literature reviewed will be included on the EURAPMON webpage (http://www.eurapmon.net), and a summary of this database is presented in a table in the manuscript. We put special attention about which contaminants should be analysed. The section is subdivided into the different compound groups: persistent organic pollutants (POPs), poly- and perfluoroalkyl substances (PFASs), metals, pharmaceuticals and personal care products, and anticoagulant rodenticides. We provide information about which samples are most frequently used in monitoring studies, why these matrices are used taking into account

the toxicokinetic of each compound group, and benefits and uncertainties on the use of the different matrices for each compound group.

Different compounds may be analysed in different samples, and the same sample may be used for the analysis of several compounds. Since analyses methods are different for different contaminants, some samples should be homogenised and subsampled. However, sometimes there is small amount of sample and it is necessary to decide what analysis should be performed. Selection of tissues would depend on the contaminant to be analysed but also on the length of exposure and the aim of the study. In this section, we also provide a table on recommendations about the matrices to be used for the analysis of different compound groups for pan-European monitoring schemes.

4. Conclusions

Finally we include a chapter with missing information and gaps in monitoring studies, and recommendations and suggestions for the future.

3.2. "Sampling Protocol"

Different matrices need appropriate sampling methods, transport and storage conditions that should be warranted by the different schemes. Then, the aim of the sampling protocol is to provide a guide that may help to homogenize, share and disseminate best practices between existing and emerging schemes in order to enhance the reliability, comparability and interoperability of data.

This protocol starts with an introduction and general guidelines that should be considered during sampling. These guidelines include recommendations in order to avoid stress of the animals and external contamination of the samples. Then, a section about basic data that should be reported is presented, including date of sampling, studied area, species, identifications, age, gender, morphometric measurements, body condition index, samples and number of samples collected, productivity of the nest, information of the species and other observations. Then, the protocol is structured in different sections corresponding to the different matrices, i.e. blood, feathers, eggs and internal tissues. For each matrix, information about sampling, transport, pre-treatment of samples, storage, and characterization of samples is provided. In addition, several references, figures and tables are provided in the document to show how to take samples and how to measure some parameters.

3.3. "Database"

A database with information on published literature on contaminant monitoring in raptors from Europe has been developed during the last years by the personnel of the research group “Toxicology and Forensic Veterinary Medicine” (E008-12) of the University of Murcia, Spain. The database includes information on year and sampling area, species studied, number of samples collected, tissues analysed, concentrations of organochlorine compounds and metals, aim of the study and references.

The list of references included in the database (more than 150 references) has been provided to the participants in order to check if there is missing information. Dr. Silvia

Espín has received the new references suggested by participants in order to include them and improve the database.

4) Future collaboration with host institution (if applicable)

There are some possible future collaborations between the research group of Dr. Silvia Espín, i.e. "Toxicology and Forensic Veterinary Medicine" (E008-12) of the University of Murcia, Spain, and the host institutions. Analyses of pollutant concentrations in different matrices of bird species could be done in the FRAM Centre-High North Research Centre on Climate and the Environment (Norwegian Institute for Air Research) in Tromsø, Norway, under the supervision of Dr. Dorte Herzke; and analyses of stable isotopes could be done in the Centre for Ecology and Hydrology (CEH), Lancaster, UK, under the supervision of Prof. Richard Shore.

5) **Projected publications / articles resulting or to result from the grant *(ESF must be acknowledged in publications resulting from the grantee's work in relation with the grant)***

Three different publications will be result from the grant:

"Espín S, García-Fernández AJ, Herzke D, Shore R, van Hattum B, Martínez-López E, Coeurdassier M, Eulaers I, Fritsch C, Gómez-Ramírez P, Jaspers VLB, Krone O, Duke G, Helander B, Mateo R, Movalli P, Sonne C, van den Brink NW. Best practices for pollutant exposure monitoring of raptors". This manuscript will be submitted for publication to the international journal Reviews of Environmental Contamination and Toxicology.

"Sampling and contaminant monitoring protocol". This protocol will be freely available in the EURAPMON webpage (www.eurapmon.net) and it will be send to all EURAPMON members to be distributed among research groups and institutions in each country.

"Database on contaminant monitoring in raptors from Europe". The database will be available in the EURAPMON webpage (www.eurapmon.net).

6) Other comments (if any)

The manuscript is still in progress but a first draft has being circulated between participants. Currently, Silvia Espín is doing some modifications and improvements of the manuscript, and supervisors are reviewing the new version. We hope to submit the paper for publication later in 2013 to "Reviews of Environmental Contamination and Toxicology". Dr. Silvia Espín has already been in discussions with the editor of the journal to confirm that the topic of the paper is within scope. The protocol and database is currently being updated to be available in the EURAPMON webpage later in 2013.

Please note that although the initial project was for 18 weeks, the exchange visit was finally of 16 weeks since I received a notification that the budget for exchange visits was for a 16 weeks period.