ESF Research Networking Programme 'Research and Monitoring for and with Raptors in Europe (EURAPMON)

SCIENTIFIC REPORT Exchange Grant Reference number 4035

Purpose of the visit

In agreement with one of the key aims of EURAPMON, the purpose of this visit was to describe the raptor contaminant monitoring activities in Europe. In order to achieve this purpose, a survey addressed to the European scientific community working in this field was to be carried out. The results of this survey had to be discussed in the Workshop "Inventory of existing raptor contaminant monitoring activities in Europe" celebrated in Amsterdam between 28th and 30th November 2012 in the IVM (Institute for Environmental Studies) of the Vrije Universiteit of Amsterdam (VU), (The Netherlands). During this workshop, organised by the applicant and their supervisors (Dr. Bert van Hattum, Professor Richard Shore and Dr. Nico van den Brink), 15 invited participants from Belgium, Denmark, France, Germany, Spain, The Netherlands, Norway, Sweden and United Kingdom would review and complete the results of the inventory of raptor contaminant monitoring activities in Europe within the context of Work Package 2. The preliminary results of the questionnaire would had been collated and analysed by the applicant but to be reviewed and discussed during the workshop to draft outputs from the results of the inventory. These results would be presented as a peer reviewed manuscript to be submitted at the end of the applicant's visit. This paper would examine current practices and make recommendations as how pan-European monitoring of contaminants could be developed and the benefits it could deliver

The results of the questionnaire would also be published as an inventory on the EURAPMON website, thereby increasing the profile and awareness of all the monitoring work that is conducted. Hence, the products of this inventory to be presented in EURAPMON website would also be designed and discussed during the workshop in Amsterdam. In addition, a workshop report would be edited to be disseminated via the EURAPMON website, as well as the presentations of the sesseions.

Description of the work carried out during the visit:

24th september-24th october 2012, Lancaster CHE, Lancaster, UK. Supervised by Prof. Richard Shore:

- Design of a questionnaire template to elucidate current contaminant monitoring with raptors across Europe. This template was based on the existing templates for WILDCOM project in United Kingdom and consisted of Excel documents (Microsoft Office 2007) with questions gathered in five worksheets. The majority of questions were close-ended, since they provide a greater uniformity of responses and are more easily processed than open-ended ones, where the respondent is asked to provide his or her own answers (Babbie, 2013).

- Compilation of mail addresses of potential participants in the survey. The mailing list was completed using a contact database of EURAPMON participants in prior workshops and meetings, contact details found in published articles or in internet websites (i.e. European Bird Census Council http://www.ebcc.info/index.php?ID=2).

- Writing of two cover letters addressed to two groups of researchers: a group of researchers known to work on biomonitoring of contaminants using raptor samples (48) and a group of researchers known to be related to studies in raptors, but probably also working in biomonitoring of contaminants (134 researchers). Researchers from this latter group were asked to forward this letter to their contacts that could be able to participate in this questionnaire. In this way, researchers from a total of 44 European countries (plus Israel) ranging from Portugal in the west, Italy in the South, Ukraine in the East and Denmark in the North, were contacted.

- Sending of questionnaires only to people known to be working in biomonitoring of contaminants using raptor samples. Because some researchers provided contact details of other unknown researchers working in biomonitoring of contaminants, the questionnaire was sent to a total of 55 researchers by electronic mail.

- Presentation of a talk entitled "The Toxicology and Forensic Veterinary Medicine Research group of the University of Murcia and the Eagle Owl as an example of biomonitor species" at the Lancaster Centre for Ecology and Hydrology.

24th october-30th november 2012, IVM, Amsterdam, The Netherlands. Supervissed by Dr. Bert van Hattum:

- Compilation of questionnaires received were compiled and the results were analysed and included in a manuscript. This information constituted the scientific content for the workshop that would be celebrated in the same research centre between 28th and 30th november 2012.

- Collaboration in the logistic organization of the workshop (contact the participants, reservation of accomodation, organization of transport, meals and scientific program of the activity)

30th november-20th december, 2012, ALTERRA, Wageningen , The Netherlands, supervised by Dr. Nico van den Brink

- Finalization of the manuscript including main contributions of the participants of the workshop.

- Presentation of a talk entitled "The Eagle Owl as an example of biomonitor species for the assessment of environmental contamination in Southeastern Spain" at the Institute for Environmental Studies, VU University, on the 12th December 2012.

- Design of products obtained from the results of the questionnaire to be included in EURAPMON website

Description of the main results obtained

The main results are presented as a draft of the manuscript that will be submitted in the next weeks.

INTRODUCTION

The release of toxic substances into the environment has, in many cases, been associated with detrimental effects both in wildlife and human health. In this sense, biomonitoring of contaminants in raptors permits the detection of these effects in the animal before than in human, and thus, the establishement of legal restrictions for contaminant emissions. Some examples are the ban of lead ammunition in Germany and Sweden after the evidence of the high sensitivity of white-tailed sea eagles to lethal lead intoxications (Krone et al. 2003, 2004, 2006, 2009; Helander et al. 2009; Nadjafzadeh et al. 2012) as an indicator for the potential health risk for humans consuming game meat (Federal Institute for Risk Assessment Germany 2011, Kneubuehl 2011). Another example is the decrease of eggshell thickness due to DDE, which starts at substantially lower DDE concentrations than those where reproductive impairments show up (Helander et al. 2002). For this reason eggshell thickness of White-tailed eagle and guillemot are now to be included as indicators for Good Environmental Status under the national marine directive in Sweden.

Current risk assessment for chemicals in European Union is done under directives or instruments such as REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals; EC 1907/2006), Regulation (EC) No 1107/2009 for plant protection products and the Biocidal Products Directive (BPD) for biocides (Directive 98/8/EC). A key issue with such legislative instruments is to determine how well they are working. This can be measured only by monitoring of contaminants, as they can provide information about the degree of reduction or restriction of environmental exposures to hazardous chemicals. Direct monitoring of air, soil, water and sediments can be useful for determining the degree of contamination in a particular area, but does not indicate bioavailability. This can only determined through biomonitoring (the analyses of contaminants in the tissues of organisms) and thus, relate the contaminant concentrations in body tissues to levels in the physical environment (Schubert, 1985). This measurement of concentrations refers to biomonitoring of exposure to contaminants. When biomonitoring studies also address the study of effects, new data can be obtained on the possible detrimental effects of compounds on a range of species, including sensitive species and Man (NRC, 1991; García-Fernández and María-Mojica, 2000).

Biomonitoring is often carried out using proven sentinels of environmental contamination. The value of birds as biomonitors of environmental pollution has been broadly recognised (Grasman et al., 1998; Newton et al., 1993; van Wyk et al., 2001) as is evident from the establishment of several governmental monitoring programmes like the Trilateral Monitoring and Assessment Programme or the National Swedish Contaminant Monitoring Programme (Becker, 2003). Amongst birds, raptors are especially suitable for monitoring persistent, bioaccumulative and toxic (PBT) chemicals. This is because they are often relatively long-lived apex predators and, as such, are susceptible to bioaccumulating PBT contaminants; they effectively integrate contaminant exposure over time (Furness, 1993), and often forage over relatively large spatial areas.

In Europe, there are several national biomonitoring programmes using raptors. However, only some of them are established at a national scale, like in the case of the National Environment Monitoring Programme in Sweden (Helander et al., 2008), the Predatory Bird Monitoring Scheme (PBMS) in the United Kingdom (Walker et al., 2008), the Bird Monitoring Programme in Finland (Koskimies, 1989) and the Monitoring Programme for Terrestrial Ecosystems (TOV) in Norway (Gjershaug et al., 2008). However, these schemes are not linked between each other and so do not identify trends in contamination at the broader spatial scale. In other EU countries, such as Spain, Germany, Belgium or The Netherlands published papers and reports (Gómez-Ramírez et al., 2012; Jaspers et al., 2008; Kenntner et al., 2003; van den Brink et al., 2003) are evidence that contaminant studies using raptors are conducted. Nevertheless, such studies are typically sporadic, both in space and time (García-Fernández et al., 2008). Overall therefore, there appears to be widespread capability and expertise to use raptors to monitor the effectiveness of EU directives, but existing national and sub-national initiatives need to be reinforced, and coordination at a pan-European scale improved (Movalli et al., 2008).

The first requirement to develop EU-wide coordinated monitoring is knowledge of the current scale of activity. There is presently no inventory of current monitoring with raptors. Given this, it is possible that monitoring of some contaminants of concern may already be sufficiently widespread to allow assessment of trends at an EU scale. Monitoring of most compounds is, however, likely to be patchy. The aim of this paper is to offer a snapshot of the current situation of monitoring of contaminants with raptors by reporting the results of a questionnaire designed to elucidate current contaminant monitoring with raptors across Europe. To evaluate commonalities and differences between schemes, and examine the potential for an EU-wide coordinated network to assess the effectiveness of EU-wide legislative control of chemical releases is also pretended.

MATERIAL AND METHODS

A questionnaire was designed based on the existing templates for WILDCOM project in United Kingdom. The majority of questions were close-ended, since they provide a greater uniformity of responses and are more easily processed than open-ended ones, where the respondent is asked to provide his or her own answers (Babbie, 2013).

A mailing list compiling contact details of all the potential researchers working in the field of biomonitoring environmental pollutants with raptors in every European country was done using a contact database established by EURAPMON, or by directly contacting researchers identified by their peer-reviewed research articles. Additionally, a total of 134 other researchers, identified through the EURAPMON network as potentially working on raptors, were also contacted by e-mail to inform them about the questionnaire and request them to provide contact details for researchers known to them as conducting biomonitoring studies with raptors. In this way, researchers from a total of 44 European countries (plus Israel) ranging from Portugal in the west, Italy in the South, Ukraine in the East and Denmark in the North, were contacted. In all, the questionnaire was sent by electronic mail to a total of 58 researchers working in the field of biomonitoring of contaminants using raptor samples .

Statistical analyses were performed using IBM SPSS v.20 statistical package. These consisted on descriptive analyses of frequencies and cross-tabs. Results of the questionnaire were graphically represented as bars and pies charts using Microsoft Excel 2010.

RESULTS AND DISCUSSION

A total of 28 questionnaires were received and 46 biomonitoring programmes using raptor samples to analyse contaminants were identified in 14 of the 26 European countries. A response rate of at least 50 % is adequate for analysing and reporting, a response of at least 60% is good and a response of 70% is very good (Babbie, 2013). It is however aknowledged, that some programmes are missing in the inventory. It is noteworthy that the majority of the European studies about biomonitoring of environmental pollutants in raptors are longer than 5 years. (22 studies, 60% of the total). In fact, 13 of the studies have been undertaken for more than 20 years and even for more than 50 years in two cases (the White-tailed Eagle Project from Finland and the Wildlife Incident Investigation Scheme from England and Wales). Cntinuous studies shorter than 5 years are also common (8 studies, 22%) but intermittent studies (3 studies, 8%) and one-off studies (4 studies, all of them from Italy) are the minority. The monitoring of temporal trends of contaminants is crucial when scientific and regulatory programs pretend to study of possible effects of contaminants on wildlife and human health. This time-series studies provide information not only for risk assessment, but also to evaluate the success of any regulatory action to reduce emissions (Birgnert et al., 2004). However, in relation to temporal trend monitoring, statistical power (the probability of data to detect a trend or change), should be considered (Riget et al., 2000; Birgnert, 2002). This power can be influenced, among other factors, by the length of the study (Birgnert et al., 2004). Hence, the availability of a significant number of these long term studies in Europe represents an advantage for the assessment of time trends of contaminants in Europe. For the same reason, existing monitoring studies should be extended.

The selection of a suitable species for monitoring purposes could be influenced by its abundance, geographical distribution and the frequency of studies that have include it. Although the group of diurnal raptors is predominant in European monitoring studies of contaminants (59% of the cases), followed by owls (32%) and scavengers (9%), the Tawny owl (Strix aluco) has been the most commonly studied species(11 studies), but in similar frequency as the Common buzzard (Buteo buteo) (10 studies), closely followed by the Northern goshawk (Accipiter gentilis), the Golden eagle (Aquila chrysaetos), the European kestrel (Falco tinnunculus) and the Barn owl (Tyto alba) (each of them in 8 studies). Because diet is an important factor affecting the load of contaminants in living beings, it should also be taken into account in the selection of a sentinel species process. While the Tawny owl mainly feeds on mammals, the Common buzzard preys on birds and mammals. Although Northern goshawks have been also been frequently studied, they have the same diet as Buzzards. On the other side, Common kestrels and Golden eagles would also be of interest because they mainly feed on insects and mammals and carrion, respectively. Since most of these species are common and widely distributed in all European countries (IUCN, 2012), all of them could be selected. This would, for example, allow the study of differences in contaminant loads due to diet.

Up to now, most biomonitoring studies in Europe have been funded by public institutions, as it is the only source in 49% of the cases, but accompanied by private funding in 35% of the projects. Only 14% of the projects were exclusively funded by private organisms.

Collection strategy of samples was performed in a similar proportion as planned, responsive or a combination of both (35%, 35% and 30% respectively). Similarly, the personnel responsible for the sample collection could be volunteer (35%), staff (27%) or a combination of both (38 %). Only in 8 projects, samples were archived.

Biomonitoring of contaminants was clearly the main purpose of the projects undertaken in Europe (95%), followed by far by the analysis of factors that influence exposure of contaminants

(51%), The use as indicators of disasters, the report of high levels of contaminants in the environment and the study of effects on health were found in a similar proportion (38, 38 and 32%, respectively). The research of biomarkers (27%) and toxicokinetic studies (14%) were less frequent.

In regards to the main compounds analysed in Europe, insecticides, metals-metalloids and PCBs are the most frequent (in about 70% of the projects). Although to a lesser extent, flame retardants and anticoagulant rodenticides are also common (38% and 24%, respectively). In 27% of the projects, other compounds not included in the questionnaire (perfluorinated compounds, barbiturates and dioxins and furanes), are also being analysed, with dioxines and furanes as the most common (in 11% of the total). United Kingdom and Spain are the countries where all or almost all of the compounds included in the questionnaire are being analysed, Metals have been analysed in all the countries, while for the case of insecticides and PCBs, Switzerland is the only country where they have not been studied. The existence of such a commonalty constitutes an advantage for the comparison of levels on a pan-European scale. Furthermore, when contaminants have been analysed in long term monitoring programmes, time trends could also be studied and compared among the countries. This would allow the identification of the influence of potential contaminant sources or the effect of different banning policies among countries. However, in terms of comparison, it is important to consider the matrix analysed, since various tissues may have very different rates of uptake and excretion thus implying changes in different scales of time (Birgnert et al., 2004). In the case of European studies, feathers constitute a common matrix, since they have been analysed in all the countries except France. In fact, feathers were collected in 73% of the studies. Also Liver (65%), eggs , kidney (62% for both types of samples); blood (60%) and muscle (57%) were frequently collected. Bone and fat were collected in the same proportion (43%), as well as plasma and whole carcasses (35%). Finally, brain and serum were collected in 30 and 22% of the projects respectively. ReThe usefulness of feathers as a tool for monitoring of contaminants, both metals and persistent organic pollutants, has been recognized in numerous studies (Burger, 1993; Dauwe et al., 2005; Martínez-López et al., 2004). In these studies, levels of organochlorines and metals have shown to be correlated with levels in blood and internal tissues. Moreover, feathers can be easily found in nests or collected during ringing activities. These facts enhance the usefulness of feathers as a non-invasive sample, which is nowadays especially important due to practical, ethical and conservation reasons. For the same cause, blood and unhatched eggs are considered suitable samples for biomonitoring of contaminants. Because they respectively reflect recent and long term exposure, collection of these samples provides valuable information about exposure to contaminants. In fact, both types of samples have also been frequently collected in European projects, with the exception of Slovenia and Switzerland for the case of eggs, and Finland for the blood. With a similar frequency as blood and eggs, liver and kidney have been also collected in all the countries but Slovenia and Norway. Because most toxicants tend to accumulate in these internal tissues, their collection in post-mortem examinations should not be disregarded.

Regarding the spread of results, the publication in research articles is the most common way in European studies (78%), followed by reports (70%), internet websites (35%) and books (14%). In this sense, only Spanish, Swedish and German studies are disseminated by the four means mentioned in the questionnaire.

Future collaboration with host institution (if applicable):

Future possible activities in collaboration with the host institutions would consist on the analyses for stable isotopes in CEH Lancaster (UK), under the supervision of Professor Richard Shore of raptor samples archived by the research group of the applicant and in IVM, also for the analyses of contaminants, under the supervision of Dr. Bert van Hattum from IVM (The Netherlands).

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):

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Other comments (if any).

An update of the activities related to the inventory have been posted during the exchange grant period in EURAPMON website: http://www.eurapmon.net/, http://www.eurapmon.net/activities/inventory/questionnaires/monitoring-questionnaire-with-raptors, http://www.eurapmon.net/workshop-raptor-contaminant-monitoring-activities-europe-amsterdam-november-2012-science-meeting-3

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