REPORT TO EURAPMON ON SHORT-TERM EXCHANGE VISIT: Comparison of best practice for autopsying predatory birds prior to chemical analysis.

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1. Background and aims

Two of the leading laboratories in Western Europe that conduct monitoring of contaminants in predatory birds at national or wider scales are: (i) the research team based at Aarhus University, Denmark that conducts monitoring of contaminants in golden and sea eagles [amongst other species] in Northern Europe, and (ii) the Centre for Ecology & Hydrology laboratory in the UK which conducts the Predatory Bird Monitoring Scheme (http://pbms.ceh.ac.uk/), a chemical surveillance scheme that uses raptors (including eagles) as sentinel species to monitor environmental contamination.

Contact between the two laboratories is *ad hoc* and there has been no opportunity to compare the autopsy methodologies used when collecting samples.

EURAPMON, through provision of support for travel and subsistence, facilitated a 3 day exchange visit between the laboratories for Elaine Potter (CEH).

The aim sof the visit were:

(i) mutual exchange of information and experience on the autopsy and archiving techniques used by each laboratory so that both can benefit from new knowledge about the best practice of the partner lab and, subsequently, seek to improve and enhance their own standard operating procedures
(ii) to initiate discussions as to the potential for future collaborations between the two laboratories

In addition, a final aim was to use this report as a means of providing an on-line information resource as to the types of autopsy recordings that are taken for research purposes and how such measurements are used. This information is likely to be of value to EURAPMON stakeholders who are seeking to initiate new lines of research, including those that involve post-mortem techniques.

2. Details of the exchange visit

Location/visit location:

The host organisation, the Faculty of Science and Technology, Department of Bioscience (ST-BIOS) is based in Aarhus University (AU) in Roskilde, Denmark.
www.au.dk

Date of visit: 04/02/2014 – 07/02/2014.

Participants in visit:
Elaine Potter (CEH Lancaster)
Christian Sonne (Department of Bioscience (ST-BIOS), Aarhus University (AU)
Rune Dietz (Department of Bioscience (ST-BIOS), Aarhus University (AU)
David Boertmann (Department of Bioscience (ST-BIOS), Aarhus University (AU)
Igor Eulaers, PhD student affiliated to the Department of Biology, University of Antwerp

3. Activities conducted during the visit

During the 3 day visit, 47 birds (Table 1) were autopsied as part of the *Species at Risk* project (see Section 3).

All the birds that were autopsied had been found dead, none were killed for the purposes of this project

The post-mortems were carried out in two teams of three scientists. Elaine Potter (CEH) and David Boertmann (AU) performed the post mortems with other team members recording data and storing samples. The bird carcasses were defrosted overnight and the work carried out on an open stainless steel table in the post-mortem room.

Figure 1. Elaine Potter holding a white-tailed sea eagle submitted for post-mortem analysis in the Species at Risk project

This engagement provided practical experience of how autopsies were conducted by the Aarhus team and these were compared with those carried out as part of the Predatory Bird Monitoring Scheme (PBMS) activities.

Table 1. Bird species that underwent a post-mortem during the exchange visit

Common Species	Latin Name	No/ Specimens	No/ autopsied[1]
White Tailed Sea Eagle	*Haliaeetus albicilla*	12	10
Peregrine Falcon	*Falco peregrinus*	9	9
Snowy Owl	*Bubo scandiacus*	11	10
Gyrfalcon	*Falco rusticolus*	17	17

[1]in some cases, carcasses were too decomposed to be autopsied

4. Post-mortem procedures undertaken by the "Species at risk" project and the Predatory Bird Monitoring Scheme

4.1 Species at Risk Project

4.1.1. Background to the Species At Risk project

One aim of this project is to conduct chemical analysis on a number of different high trophic level endangered species. These species includes marine mammals such as killer whales (*Orcinus orca*) as well as the predatory bird species listed in Table 1. The analysis contributes to future Arctic Monitoring and Assessment Programme (AMAP) assessments (http://www.amap.no/).

All the birds that were analysed during the 2014 exchange visit were from Greenland. The White Tailed Sea Eagle (*Haliaeetus albicilla groenlandica*) has evolved into an endemic sub species with a larger beak and wing-span. It is found in southwest Greenland and its estimated population is 150-200 pairs (Kamp and Wilde, 1990). As a top predator, the sea eagle which feeds on fish, birds and small animals and carrion is an important part of the ecosystem and their health status is important to monitor as an indicator of ecosystem health and changes in the environment (Bonstra, 2004, Mallory et al., 2006).

The gyrfalcon (*Falco rusticilous*) is the largest falcon. It nests in the arctic regions of Greenland, feeds mainly on grouse, lemmings and other small mammals and is listed as endangered. The Peregrine Falcon (*Falco peregrinus*) is one of the world's fastest birds and feeds on medium sized birds, including waders, small ducks, crows and black birds. The arctic Peregrine was placed on the endangered species list in 1970 due to pollutants causing failed breeding.

In the Species at Risk project, the Greenland white tailed sea eagle, peregrine and gyrfalcon are used as bio-sentinel species to monitor the contamination and health of ecosystems around the West Greenland fjords and coastal regions (Nuuk) (Figure 2).

Figure 2. Map of Greenland, showing position of Nuuk

Recent publications from the Species at Risk project include: Jaspers V.L.B. et al., (2011) and Jaspers V.L.B. et al., (2013).

4.1.2. Post-mortem methods conducted by the "Species At Risk" project

Birds are x-rayed for sign of pellets within the carcass. No assumptions are made as to whether the pellets had caused fatality.

Table 2. Numbers of birds found to contain pellets and number of pellets seen.

Bird Species	Number x-rayed	Number with Pellets	Number of pellets
White-tailed eagle	12	3	Many, 3, 4
Gyrfalcon	17	4	2, 2, 9, 15
Snowy owl	11	0	
Peregrine falcon	9	0	

Samples are taken from birds to meet the analysis requirements for the Department of Bioscience (ST-BIOS) and are stored in freezer. The following table shows the samples and measurements that were important for the Scientists at (AU).

Table 3. Samples taken and measurements recorded for each post-mortem for the "Species at Risk" project

Measurements recorded	**Samples Taken**	**Probable analysis**
Weight of bird		
Photograph taken		
Wing length		
	Primary Feather 5 or 4 (L&R)	Elements, SIs
	All other primaries (one wing)	Elements, SIs, POPs
	Breast (sternum) feathers	Elements, SIs, POPs
	Pectoral muscle (not total)	SIs
Liver weight	Liver (complete)	POPs, elements
Kidney weight	Kidney (complete)	POPs, elements, genetics
Heart weight	Heart	Genetics
	Adrenal Gland (x2)	OH-PCBs
	Thyroid Gland(x2)	OH-PCBs
	Blood (x2)	Elements, POPs
	Adipose	POPs, FAs
	Preen Gland	

SIs – Stable Isotopes
POPs - Persistent Organic Pollutants
OH-PCBs - Hydroxylated Polychlorinated Biphenyls
FAs - Fatty Acids

4.2 Predatory Bird Monitoring Scheme (PBMS)

4.2.1 Background to the PBMS

The Predatory Bird Monitoring Scheme (PBMS) is a long-term, national monitoring scheme that quantifies the concentrations of contaminants in the livers and eggs of selected species of predatory and fish-eating birds in Britain. The levels of contaminants are monitored to determine how and why they vary between species and regions, how they are changing over time, and the effects that they may have on individual birds and on their populations. The scheme is run by the Centre for Ecology and Hydrology.

The aim of the PBMS is to detect and quantify current and emerging chemical threats to the environment. It achieves this by monitoring the concentrations of contaminants of concern in bird carcasses and eggs. This provides information on the extent of risk to vertebrate wildlife (and potentially Man) and how this varies temporally and spatially. Such variation can result from market-led or regulatory changes in chemical use. It may also be associated with larger-scale phenomena, such as global environmental change, which can alter the environmental fate and behaviour of chemicals.

PBMS monitoring also provides evidence of the effectiveness of mitigation measures, such as those incorporated into national and international regulatory directives.

All of the birds that are post-mortemed by the PBMS have been found dead and submitted to the scheme. *None of the birds have been killed for the purposes of the project.* Bird of prey carcasses are sent in to the PBMS by members of the public who respond to adverts placed by the PBMS in bird-watching magazines and similar publications and websites. Typically, the PBMS annually receives between 300 and 400 bird of prey carcasses (Figure 3). The PBMS also receives up to 200 addled eggs per year that are sent by researchers under licence.

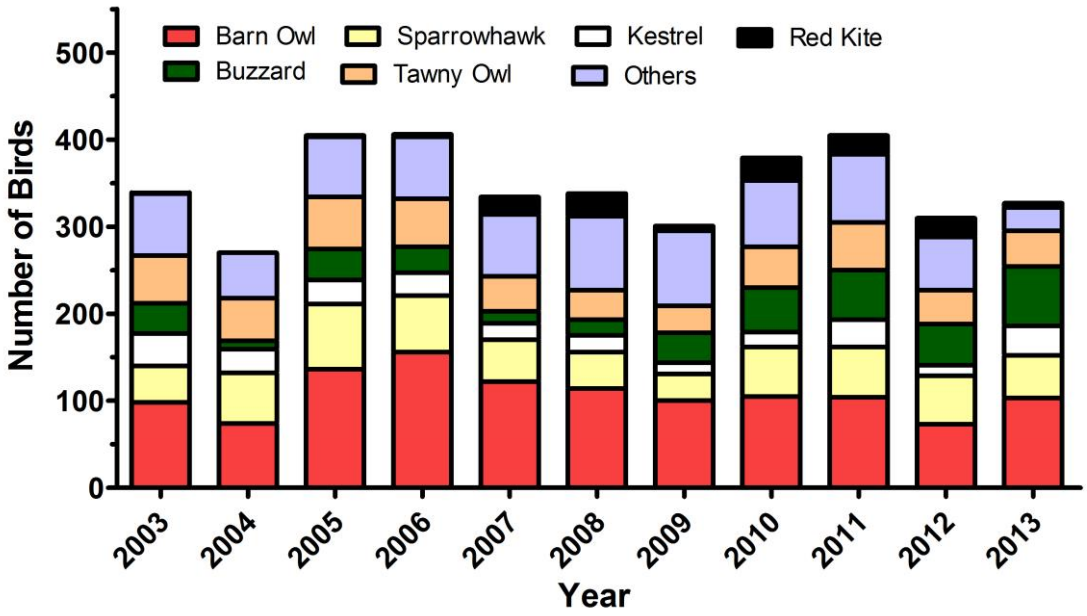

Figure 3. Numbers of different species of birds sent into the PMBS each year.

Recent publications and reports related to PBMS activities include Crosse et al., (2012a,b, 2013), Gómez-Ramírez et al., (in press), Dittman et al., (2012), Llabjani et al., (2011), Leslie et al., (2011), Thomas et al., (2011) and Walker et al., (2013a,b).

4.2.2. Post-mortem methods conducted by the PBMS

Carcasses that are sent in to the PBMS are stored at -18°C and defrosted overnight prior to the post-mortem analysis being conducted. However, some tissue samples are submitted directly to the scheme from collaborators after they have autopsied the birds for their own projects. A range of samples are routinely collected for the PBMS -18°C long-term archive and they are often used for retrospective studies.

A post-mortem examination is carried out on each carcass. Up to 50 observations are made during the examination and recorded directly into a Microsoft Access database. A typical post-mortem template report is attached as Appendix A to this report.

All samples are labelled with a unique sequential carcass reference number, species, tissue type, and sample weight. Core PBMS species are the barn owl (*Tyto alba*), kestrel *(Falco tinnunculus*), sparrowhawk (*Accipiter nisus*), tawny owl (*Strix aluco*) and buzzard (*Buteo buteo*) and the most measurements are taken for these species (Table 4). Some measurements, such as condition index and pectoral muscle mass are calculated.

Table 4. Samples taken and measurements recorded for each PBMS post-mortem.

Measurements/ observations recorded	**Samples Taken**	**Reason taken**
Weight of bird		General morphometric data
10th Primary weight(L&R)		Fluctuating asymmetry
Wing length		General morphometric data
Sternum length		Calculate condition index
Sternum diagonal length		Calculate condition index
Fat Score		Body condition
Sex		General morphometric data
Other trauma/disease		Attribute cause of death
Body condition		General information
Carcass condition		General information
Age code		General morphometric data
	Primary Feather 10&9 (L&R)	Pollutant, hormone and stable isotope analysis
	Full wing –P10 and P9	Pollutant, hormone and stable isotope analysis
	Breast (sternum) feathers	Stable isotope analysis
Pectoral muscle weight	Pectoral muscle (complete)	Pollutant and stable isotope analysis
Liver weight	Liver (complete)	Pollutant and stable isotope analysis
Kidney weight	Kidney (complete)	Pollutant and stable isotope analysis
Brain weight	Brain	Pollutant and stable isotope analysis
	Fat	Pollutant and stable isotope analysis
	Tarsus	Metals analysis

The range of chemical analysis carried out each year depends on current key questions and is agreed with stakeholders. Currently the PBMS analyses the following pollutants: second generation anticoagulant rodenticides, brominated and fluorinated organic compounds, lead, mercury and a range of other toxic and trace metals.

5. Conclusions

The *Species at risk* project and the *PBMS* have many similar aims. The post-mortem techniques employed by both schemes are, therefore, quite similar with some variation dependant on their specific aims. Both projects clearly conduct post-mortem analysis to a high standard that is fit for the research purposes.

Perhaps, most notably, the PBMS post-mortem analysis includes several measurements to assess body condition since this can have a major impact on the magnitude of the liver residues of organic pollutants (Weinburg & Shore, 2003, Crosse et al., 2013). Details of cause of death and post-mortem measurements are also provided by the PBMS to members of the public who send carcasses in. This engagement is considered esential to maintain the vibrancy of the Citizen Science component of the PBMS.

The PBMS will review its post-mortem procedures in the light of the new knowledge gained through the exchange visit, so as to maximise efficiency and value.

The contact through this exchange visit and associated EURAPMON activities has led to initial discussions about the potential of conductiong a Risk Assessment of European Raptor Populations from pollutants.

Finally, this report provides key information as to the types of post-mortem measurements that can and should be taken for research purposes when the key interest focusses on the exposure to and impacts of environmental contaminants.

6. Acknowledgements

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8. Appendix A