Causes of nestling deformities in a UK heronry – possible sources of pollutants

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Introduction

An earlier study[1] has highlighted the incidence of dead and deformed heron (*Ardea cinerea*) chicks at a large heronry in North Nottinghamshire, UK between 1996 -and 2002. Many of the birds died for no obvious reason but deformities in others included multiple fractures of the tarsus and tibia and metacarpal bones (angel wings) (Figure 1). Previous work showed higher levels of PCBs, PCDD/Fs and PBDEs in deformed heron nestlings in 2002 and in eggs taken from nests in 2003 suggesting that this may be the underlying cause of the deformities, possibly due to effects on deposition of calcium in bone. Only single nests were affected in 2003 and 2004

This paper describes ongoing investigation at the heronry with the aim of identifying possible sources and routes of exposure to the contaminants.

Methods

To determine the source of these contaminants, radar was used in 2004 to track flight movements of adult herons to possible feeding sites. This showed that the herons were predominately foraging to the south of the heronry and earthworms, eels and sediment samples were collected from sites to the south of the heronry in 2004.

A fat sample from an affected nestling and a regurgitated food sample from the same nest were also collected in 2004 and archived regurgitated food samples from 2002 were sourced.

The PCB, PCDD/F and PBDE levels in these samples were analysed and compared with the levels and profiles in the affected birds and food items from 2002 to determine whether this may be the source of the contaminants.

Data were expressed as the WHO-TEQ on a wet weight basis for tissue samples and dry weight for sediment.

Results

Analysis of the eel samples collected in 2004 showed higher levels of PCBs around site 2 (Figure 2), sediment levels were also higher around site 2 (10.5 ng/kg WHO-TEQ). However, the congener profile of the PCBs differed between the sediment and the eel sample in 2004 suggesting metabolism of some congeners (e.g. PCB 77) by the eels. Only low levels of PCB and PCDD/Fs were detected in earthworms (2.4 ng/kg WHO-TEQ maximum at site 2).

The fish regurgitate sample collected from the affected nest in 2004 showed similar levels of PCBs/PCDD/Fs to the fish regurgitate samples from 2002 when 13 nestlings were affected (Table 1). All the fish regurgitates showed similar ortho- and non-ortho congener profiles of PCBs.

The eel regurgitate sample from 2002 (Table 1) showed similar levels of PCBs/PCDD/Fs to those collected in 2004 from sites 1 and 2. The congener profile for the non-ortho PCBs in the 2002 eel regurgitate was similar to those for the sediment from site 1 and site 2 in 2004. The ortho PCB congener profile was however different.

The PCB/PCDD/F levels and PCB congener profiles in the fat sample from the affected nestling in 2004 was similar to those in the affected nestlings in 2002 (Table 1).

The profiles for the ortho- and non-ortho-PCBs were similar between sediment from site 2, the fat sample from the affected nestling in 2004 and the fish regurgitate sample from the affected nest (Figure 3).

Conclusions

The deformities appear to be more closely correlated to PCBs than dioxins around the two most Southerly sites (sites 1 and 2).

The congener profiles of the sediment samples, eels and fat samples from the affected nestlings differed whereas those between fish, sediment and the fat samples were more similar. This could suggest that the major contribution to the PCBs, particularly the non-ortho PCBs, in the herons was from fish from the feeding sites.

This study has shown the difficulties in matching environmental sources of contamination with effects in birds when metabolism occurs in food items. Further sampling of food items, e.g. fish, eels, and sediment is required to more accurately pinpoint the source of the contamination.

Table 1. PCB/dioxin levels in regurgitated fish and eel, live eel samples and nestling fat from 2002 and 2004.

Sample Details:	**Regurgitat-ed fish sample from affected nest 2004**	**Regurgitat-ed fish sample from affected nest 2002**	**Regurgitat-ed fish sample from unaffected nest 2002**	**Regurgitat-ed fish sample from unaffected nest 2002**	**Regurgitat-ed eel sample from unaffected nest 2002**	**Fat sample from deformed nestling 2004**	**Fat sample from apparently unaffected nestlings 2002**	**Fat sample from deformed nestlings 2002**	**Fat sample from deformed nestlings 2002**	**Fat sample from apparently unaffected adult Herons 2002**
Dioxin ng/kg	1.58	1.72	0.44	1.76	2.12	94.05	31.53	73.85	103.30	119.31
non ortho-PCB ng/kg	2.18	2.78	0.73	1.76	3.64	220.15	78.67	157.44	201.46	207.72
ortho-PCB ng/kg	1.13	0.66	0.36	0.60	4.88	92.18	39.63	37.20	105.40	71.74
Sum of WHO TEQs ng/kg	**4.89**	**5.16**	**1.53**	**4.12**	**10.64**	**406.38**	**149.83**	**268.49**	**410.16**	**398.77**

Acknowledgements

This work was funded by the UK Environment Agency. The authors would like to thank the North Notts Wildlife Trust for allowing access to the heronry and the Institute of Zoology, London for the 2002 samples.

Reference

1. Fernandes, A., Thompson, H., D'Silva, K., White, S. andRose, M. *Organohalogen compounds* **66** 1711-1717 (2004)

Figure 1. Deformed nestlings from affected nests

(a)

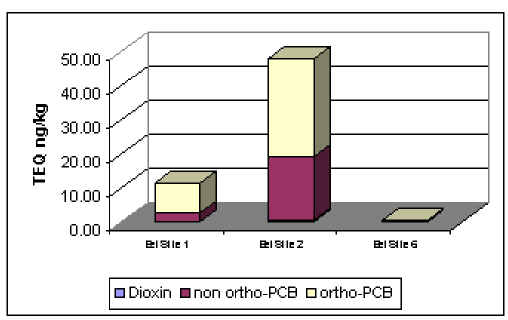

Figure 3. Maximum PCB/dioxin levels in eels from the selected sites
(b)

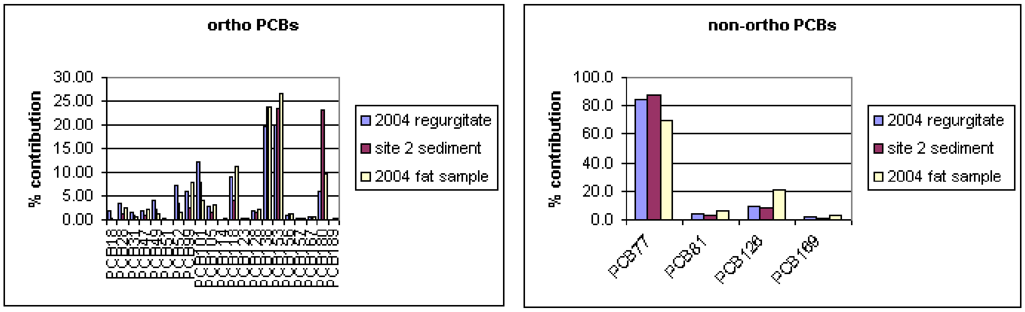

Figure 4: (a) Ortho- and (b) non-ortho PCB profiles for the fish regurgitate from the affected nest in 2004 and a sediment sample from site 2 and a fat sample from the deformed nestling in 2004

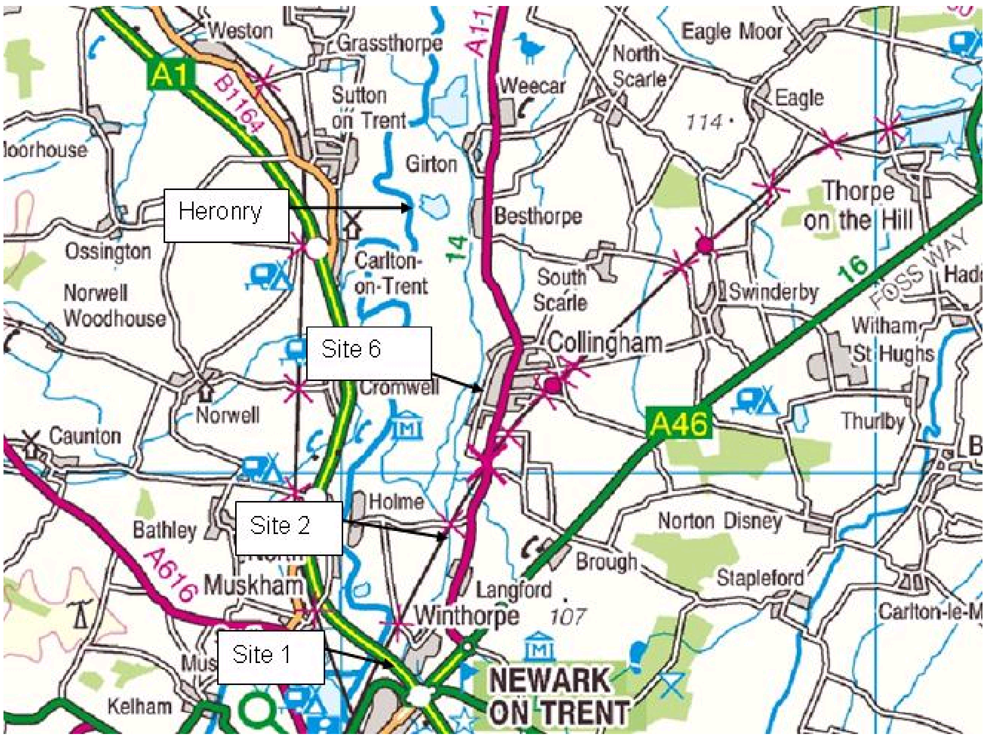

Figure 2. Location of sampling points in 2004