EFFECTS OF LONG-TRANSPORTED ORGANOCHLORINES (PCB) ON THE BEHAVIOUR OF ARCTIC BREEDING GLAUCOUS GULLS *(Larus Hyperboreus)* : EVIDENCE USING BLOOD SAMPLES

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Introduction

In ecotoxicology a central question is whether pollution impairs normal behaviour in wildlife populations. A general conclusion from a wide variety of experimental and observational studies is that heavy metals and various organochlorines (OCs) induce changes in behaviour of birds, but there is little evidence of serious threats to populations[1, 2, 3]. There is, however, a great need to study behaviours that can be linked to population parameters, such as reproduction and survival[3]. Field assessments are invariably confounded by ecological differences between contaminated and uncontaminated sites, and behaviour of individual birds in field has rarely been related to their contaminant burden. In this study, we examined how the pattern of incubation and nest-site attentiveness of individual glaucous gulls *Larus hyperboreus* varied in relation to their blood PCB concentration.

Methods and Materials

The study was conducted at Bear Island (74° 30' N, 19° 01' E) in the Barents Sea. Two different breeding areas were used, one at a seabird cliff, where birds fed predominantly on eggs and of other seabirds, and one close to sea level where the birds fed largely on fish[4]. Birds were caught on the nest and 10 ml blood were sampled from the wing vein[5,6]. Blood samples were analysed for organochlorines at Veterinary Institute in Oslo[7]. Blood PCB concentrations ranged from 52 ppb to 1079 ppb (wet weight).

Result and Discussion

The nesting period is the most critical phase in avian reproduction, rendering both parents and offspring vulnerable to predation and starvation. Thus, factors impairing nesting behaviour may cause reproductive failure. In this study, gull behaviour differed significantly between breeding areas and sexes independently of PCB. Females incubated more than males (54% vs. 46%), but spent more time away from the nest site than males, both overall (23% vs. 12%) and when not incubating (50% vs. 21%). They were also absent for longer periods (4.5 vs. 2.8 h). Moreover, length of incubation bouts (6.4 vs. 4.4 h), the amount of time absent from the nest-site when not incubating (51% vs. 25%), and length of absences (5.6 h vs. 1.8 h) differed between breeding areas, probably due to different feeding specialisation. After controlling for these area and sex effects,

the proportion of time absent from the nest site when not incubating, and the number of absences, were both significantly related to blood concentration of PCB.

A number of experimental studies in birds have shown that exposure to various organochorines affect parental behaviour. This has often been attributed to neurological effects of intoxication[1,8]. Moreover, the reproductive cycle of birds is controlled by hormones[9]. Organchlorines may therefore affect reproductive behaviour through endocrine disruption[10], since several compounds are known to alter hormone levels and may act as estrogen or thyroxine agonists or antagonoists[11]. Effects of PCBs from field studies demonstrated previously may thus be of a nature similar to those we found for nest site attentiveness.

Even if the levels of PCB found in the brains of glaucous gulls at Bear Island[12] are considerably lower than those usually considered lethal in birds[13, 14], the individuals with high levels are well within the range expected to produce behavioural aberrations[1, 12].

Recent studies have found that incubation has considerable energetic costs, and an increase in these costs can lead to reduced reproductive output[15, 16]. Although we did not observe nests being destroyed because they were left unattended, this study does indicate that birds with higher levels of PCB suffer some type of behavioural impairment. Possibly reproductive propensity was affected through endocrine disruption[10]. Alternatively, neurological disorders may lead to difficulties catching food and thus higher energy costs during incubation. If such effects were large, they may lead to reduced ability to raise young in the more energy demanding chick period.

Acknowledgments

We are grateful to magnus fjeld, øystein miland and kjetil sagrup for valuable help during field work, and to rob barrett who commented on the paper and corrected the english. We are especially thankful to dr. Nigel yoccoz for help with the statistical analyses. The study was funded by the norwegian research council (project no. 114198 / 720) and the norwegian ministry for environment.

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