

Association between Polychlorinated Biphenyl (PCB) Concentrations and Intestinal Nematodes in Glaucous Gulls, *Larus hyperboreus*, from Bear Island

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Introduction

Glaucous gulls (*Larus hyperboreus*) and polar bears (*Ursus maritimus*) constitute the top of the Arctic marine food chain. Due to biomagnification in the food chain, these two species accumulate high tissue levels of persistent organochlorine pollutants compared to other Arctic species (1-4). Particular high levels of organochlorines have been observed in glaucous gulls found dead at Bear Island and south-Svalbard. The high levels of polychlorinated biphenyls (PCBs) found in the dead glaucous gulls were discussed as a possible contributing cause of mortality (5).

Organochlorines may generate a range of negative effects in organisms, including neural disturbances, reduced reproduction and immuno-toxicity (6,7). An association between exposure to organochlorines and suppressed immune function has been observed in several studies of mammals (8-11). Seals fed with herring from the contaminated Baltic sea had reduced immune activity, compared to seals fed with fish from the less contaminated Atlantic (9,11). Tryphonas (7) argue that the immune system is a target for PCB, and that it may be the most sensitive indicator for negative PCB-induced health effects.

Negative effects of PCBs on the immune system, may result in increased infection of parasites with increased organochlorine levels. In this preliminary report, we summarise our findings on the relationship between PCB levels and helminth nematode infection intensities in glaucous gulls from Bear Island.

Material and Methods

The field part of the study was carried out during July 1996 on Bear Island (74°23' N, 19°10' E) in the Svalbard archipelago. A total of 40 adult glaucous gulls were sampled. The liver and

the intestine were collected for organochlorine and parasite analyses. Organochlorine was analysed with GC-ECD using the method described by Brevik (12) with modification by Bernhoft & Skaare (13). Previous experience have shown that a few congeners of PCBs make up the major part of the total PCB (5,14,15). Here, we analysed nine congeners of PCBs. The nine PCB congeners were PCB-28, -52, -101, -99, -118, -153, -138, -180 and -170, numbered after IUPAC-numbers originally proposed by Ballschmiter and Zell (16).

The intestine of each gull was examined for macro-parasites using a stereo-microscope (17). Spearman rank correlation coefficients (Rsp) for the correlations between PCB concentrations in liver and intensity of intestinal nematode infection were calculated using Statistica 5.0B for Windows from StatSoft.

Results and Discussion

The total concentrations of PCB (Σ 9PCB), in liver samples from the glaucous gulls ranged from 15147 to 292439 ng/g lipid weight. The PCB-153 congener is the most abundant accounting for approximately 36% of Σ 9PCB. The PCB levels found were comparable with other studies made in the same area (4,18).

A total of 12 helminth parasite species were identified in the gastrointestinal tract of the gulls. The highest prevalence was observed for the nematode *Paracuarria adunca*, which infected 63% of the gulls examined. The highest intensity was observed for the trematode *Cryptocotyle lingua*, with a maximum of 269 individuals in one host.

The intensity of nematodes (sum of all nematodes) was positively correlated to Σ 9PCB (n=40, Rsp=0.48, p=0.0016), illustrated in Figure 1. Intensities of other helminths were not associated with PCB concentrations in the liver.

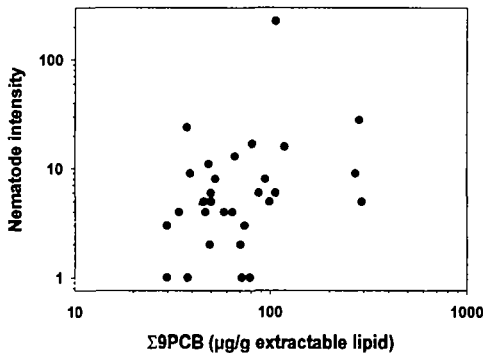


Figure 1: Scatterplot between Σ 9PCB in liver and intensity of intestinal nematodes in glaucous gull from Bear Island. (n=40, Rsp=0.48, p=0.0016).

The nematodes found in the gulls were penetrating tissues in the pro-ventricle and ventricle area. Injured tissue are costly for the host to repair, and a well functioning immune system is critical for the protection against pathogenic parasites. The positive correlation between PCB concentrations and numbers of nematodes found in this study is what we would expect if one or more of the organochlorines suppress the immune function, and thereby increase the susceptibility to parasite infection.

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