

ENVIRONMENTAL LEVELS - POSTERS

PCDD/Fs AND OTHER CHLORINATED POPs IN BLACK-TAILED GULLS FROM HOKKAIDO, JAPAN

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Introduction

Chlorinated persistent organic pollutants (POPs) are distributed worldwide^{1,2}. Polychlorinated dibenzo-*p*-dioxins (PCDDs), dibenzofurans (PCDFs), and coplanar polychlorinated biphenyls (co-PCBs) are more concerning and toxic compounds than other POPs. The adverse effects of planar-structured pollutants on the bird populations have been reported as interference of thyroid hormone and/or vitamin A metabolism^{3,4}. As chlorinated POPs have high octanol-water partition coefficients, bioaccumulate in high-ranked animals and humans through the food chain^{5,6}. However, there is no available POPs data on the wildlife including PCDD/Fs in Japanese background environment.

The objectives of the present study are to provide baseline data on POPs (PCDD/Fs, non-*ortho* PCBs, t-PCBs, DDTs, HCHs, CHLs and HCB) in black-tailed gulls and eggs from the Hokkaido, and to compare these with the levels of chlorinated POPs reported in other studies and/or the same species from Korea ⁷.

Materials and Methods

During the population control program on black-tailed gulls managed by local government in Rishiri Island (Hokkaido coast), eggs (n=10) and adult birds (n=5) were collected in breeding grounds, during June 1998. Size and weight of all the samples were measured prior to freezing and transported to our laboratory. Subcutaneous fat of adult birds and yolk of eggs were homogenized with sodium sulfate and extracted with dichloromethane in a Soxhlet apparatus. The extractable lipid was transferred to hexane and spiked with 2.5ng of fifteen ¹³C₁₂-labeled PCDDs, PCDFs and ¹³C₁₂-labeled non-*ortho* PCBs (PCB 81, 77, 126 and 169), respectively. Samples were prepared and analyzed according to the methods of multi-POP with some modifications for silica-mixed carbon column chromatography ⁸.

Results and Discussion

Chlorinated POPs were detected in all the gull fat and eggs analyzed. The highest concentration was measured for PCBs, which ranged from 1,872 to 7,094 ng/g lw in gull fat tissue and 1,310 to 3,510 ng/g lw in eggs, followed by DDTs>HCHs>CHLs=HCB> non-*ortho*

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PCBs>PCDD/Fs. PCB 153 was the most dominant PCB congener in both gulls and eggs. The mean concentrations of PCB 153+138+180 were 44.6%, 43.6% to the total PCB concentrations in black-tailed gull fat and eggs, respectively. In a previous study⁹, proportions of these three congener to the total PCBs in soils and sediments (5-15%), fish (14-22%), and birds (28-40%), which means a metabolic transformation of PCB congener in the aquatic food web. The highest concentration of OCPs was found to be *p,p'*-DDE. The use of organochlorine pesticides was restricted in early 1970's in Japan. Presence of higher DDTs in gulls suggests origination of this compound in Southeast Asia or China by atmospheric transport on a global scale. The range of concentrations of PCBs (1,753– 6,734 ng/g, lw), DDTs (507– 5,485 ng/g), HCB (46– 196 ng/g) and CHLs (47 – 214 ng/g) found in black-tailed gull's eggs from Korean breeding colonies in 1997⁷ are of the same order of levels found in this study.

The concentrations of toxic 2,3,7,8-substituted PCDD/Fs ranged from 31.6 to 144.5 pg/g lw in black-tailed gull fat and from 22.9 to 120.2 pg/g lw in eggs. 2378-TCDD, the most toxic PCDD/Fs congener, was found on average 6.4 pg/g lw in gulls and 3.8 pg/g lw in eggs, respectively. 12378-PeCDD, 123678-HxCDD, 23478-PeCDF and 123678-HxCDF were among the major congeners of PCDDs and PCDFs, respectively. Thus, penta- and hexachlorinated dibenzo-*p*-dioxins and furans were dominated. This congener profiles was similar to that in Korean black-tailed gull's eggs⁷, but the ratio of 12378-PeCDD:123678-HxCDD and 23478-PeCDF:123678-HxCDF between two colonies were different. Higher concentration of HxCDD and HxCDF in Korean black-tailed gulls, suggest the latest use of PCP and CNP in Korea. PCDD/F congeners accumulated in black-tailed gull tissues and eggs have similar pattern to those found in other fish-eating birds^{10,11}. There were differences in congener profiles indicating different contamination sources and/or metabolism among species.

Non-*ortho* PCB concentrations ranged from 3.4 to 13.5 ng/g, lw in black-tailed gull tissues and ranged from 2.4 to 7.4 ng/g, lw in eggs. Both black-tailed gulls and eggs had PCB 126 as the dominant congener among non-*ortho* PCBs, which comprised 59.6% in gulls and 52% in eggs. However, the ratio of congeners PCB 77 and PCB 169 were different. These non-*ortho* PCBs were present at similar levels in black kites (*Milvus migrans*) and slaty-backed gulls (*Larus schistisagus*), but lower than black-tailed gulls, little egret (*Egretta garzetta*) and cormorants from other region in Japan¹². Thus, black-tailed gulls and eggs were thought to have low concentrations of coplanar PCBs compared to birds and eggs collected in contaminated areas in Japan.

TEQs for PCDDs, PCDFs and non-*ortho* PCBs were calculated using the latest TEF for bird proposed by WHO₁₉₉₈¹³. The TEQs for these planar-structured compounds ranged from 0.26-1.0 ng-TEQ/g lw in black-tailed gull tissues and 0.19-0.58 ng-TEQ/g lw in eggs, and this level is higher than in the eggs of same species from Korean colonies⁷. The majority of TEQs in samples was contributed by non-*ortho* PCBs, which accounted for 94.5±1.5% and 93.1±2.3% of the TEQs in black-tailed gulls and eggs, respectively. PCB 126 was the most important contributor to the TEQs. Fish-eating bird species having high proportion of non-*ortho* PCBs to the TEQs¹⁴, and this means that PCBs contamination of prey fish is ubiquitous.

TEQs of black-tailed gull eggs was on average 14±69 pg-TEQ/g (52.4-248.8 pg-TEQ/g, wet weight), and this level was in the range of LD₅₀ for chicken embryo¹⁵. However, it is well known that large differences in sensitivity to TCDD or related compounds between gull and chicken exist¹⁶. Thus TEQs in black-tailed gull eggs in the present study may not appear to produce adverse effect to the black-tailed gull populations in Hokkaido.

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