Nestling predatory bird feathers as a non-destructive biomonitor for persistent organic pollutants in northern ecosystems

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Abstract

We were able to detect a wide variety of persistent organic pollutants (POPs) in nestling feathers of predatory birds. Furthermore, concentrations and accumulation patterns in feathers reflected the internal state of pollution, as determined by blood plasma analysis. Additionally, 13C and 15N stable isotope analysis of feathers provided information on diet and trophic position of the studied species and seems to explain accumulation and spatial distribution patterns. In conclusion, using nestling body feathers seems to be a valid non-destructive biomonitoring strategy for assessing the pollution with POPs of arctic predatory bird species and the ecosystems they reside in.

Introduction

Global long-range transport mechanisms are responsible for pollution of vulnerable Arctic ecosystems with persistent organic pollutants. Monitoring all individual compartments of the environment is not practical, or relevant. Therefore biomonitoring of spatial distribution patterns. Finally, we made a holistic evaluation of nestling feathers as a non-destructive monitoring matrix for POPs in Norwegian arctic ecosystems.

Analysis

Feathers: After washing and cutting of feathers, they were incubated overnight with HCl (4 M) and hexane/dichloromethane (4:1, v/v) at 45 °C. Organic layers were liquid extracted and cleaned up on acidified silica. Analytes were detected and quantified using GC-MS2.

Blood plasma: After denaturation with (NH4)2SO4 and ethanol, organic layers were liquid/liquid extracted and cleaned up using Florisil column chromatography. Analytes were detected and quantified using GC-MS5.

Results & Discussion

POP concentrations in feathers and blood plasma

We could detect a wide variety of pollutants in feathers and blood plasma of all species (Table 1). More pollutants could be detected in feathers. As expected13, PCB and DDE levels were at least ten times higher than levels of PBDEs and other OCPs. This is observed for both feathers as blood plasma:

Analysis of spatial distribution patterns. Finally, we made a holistic evaluation of nestling feathers as a non-destructive monitoring matrix for POPs in Norwegian arctic ecosystems.

Spatial distribution of POPs in northern Norway

Above stated observations were based upon POP accumulation patterns, depicted in accumulation profiles, and were supported by diet and trophic level data outcome from 13C and 15N stable isotope analysis.