Reference number: 1596

Persistent organic pollutants in four bivalve species from Kongsfjorden and Liefdefjorden, Svalbard

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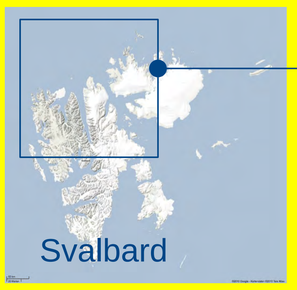


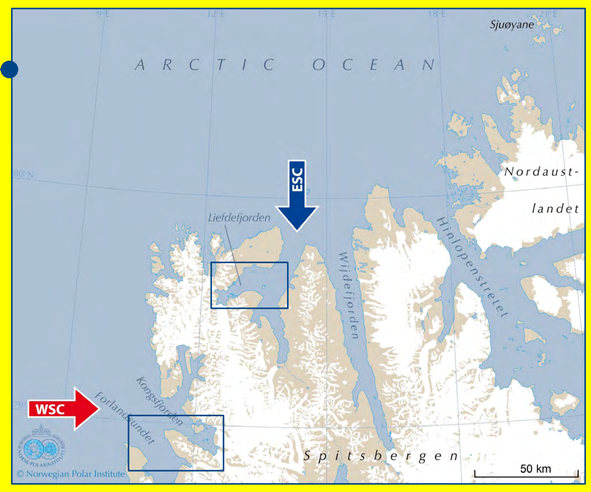
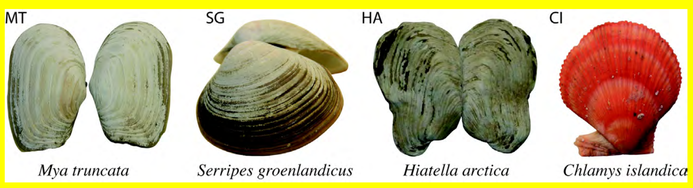


Fig. 1 Map of Svalbard with the sampling areas Kongsfjorden and Liefdefjorden. Arrows indicate the influence of the West Spitsbergen Current (WSC) with warm and saline Atlantic water and the East Spitsbergen Current (ESC) bearing cold and relatively fresh Arctic water for the fjords.

1. Rationale

This study investigated how persistent organic pollutants (PCBs, Chlordanes and HCHs) accumulate in Arctic bivalves from two fjords in Svalbard, which are influenced by either Atlantic or Arctic water masses (Fig. 1). Four bivalve species (*Mya truncata*, *Serripes groenlandicus*, *Hiatella arctica*, and *Chlamys islandica)* were collected by SCUBA divers in Kongsfjorden (warm system) and Liefdefjorden (cold system) (Fig. 1) and analysed for organochlorine compounds (OCs) and age composition.



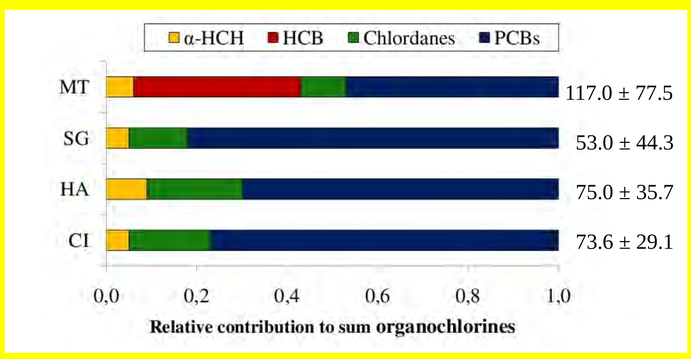


Fig. 2 Mean relative contribution of the OC groups to the sum OC load in *Mya truncata* (MT), *Serripes groenlandicus* (SG), *Hiatella arctica* (HA), and *Chlamys islandica* (CI) from both sampling locations. Total OC concentrations detected in the bivalve species are presented in mean ± (SD) ng g^{-1} lipid weight.

2. Results

Organochlorine compounds in Arctic bivalves
Higher chlorinated PCBs (PCB 101-PCB 194), chlordanes (*oxy*-, *cis*-, *trans*-chlordane, and *cis*-, *trans*-nonachlor) and ∝-HCH were consistently found in the bivalves. Some OCs were less frequently detected (e.g. HCB) or even below the limit of detection (e.g. Mirex, ß-HCH).
The OC groups PCBs, chlordanes and ∝-HCH were found in similar ratio in the four bivalve species, though HCB was only detected in *Mya truncata* specimens (Fig. 2).

Variations in OC levels were mainly related to the variables bivalve species and sampling location. In contrary, the bivalve's size and age were inappropriate predictors for variations in OC concentrations (PCA, Fig. 3).

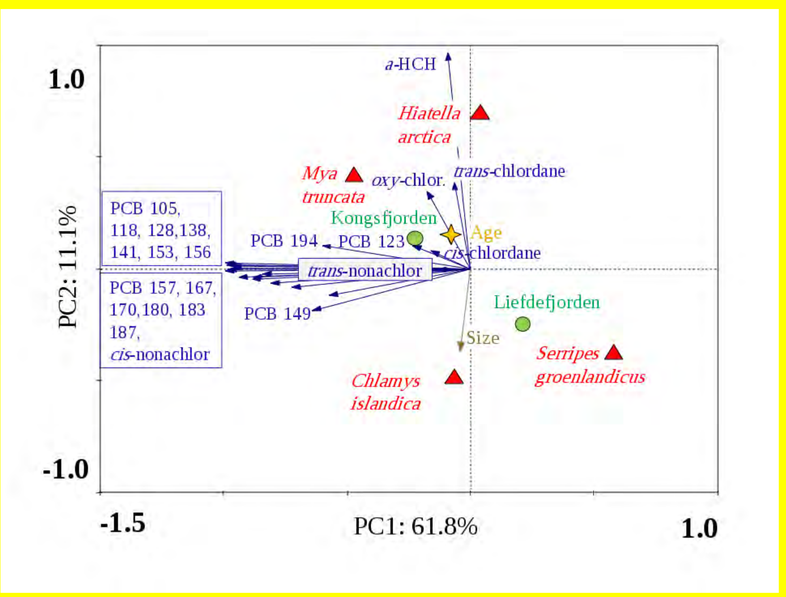


Fig. 3 Principle component analysis (PCA) of logarithmic transformed organochlorine compound (OC) concentrations. Arrows indicate the individual OCs (blue) and the continuous explanatory variable size (grey). Symbols represent average sample score identified by age (star), location (circle) and bivalve species (triangle).

OC variability in species and space
Concentrations of PCBs, chlordanes and ∝-HCH differed distinctly among the four bivalves and the general pattern indicated the highest OC levels in *Mya truncata* and the lowest OC levels in *Serripes groenlandicus* (Fig. 4).
The OC load varied distinctly between the sampling locations with generally higher OC concentrations in bivalves from Kongsfjorden compared to specimens from Liefdefjorden, except for the compound HCB, which was only detected in *Mya truncata* specimens from Kongsfjorden (Fig. 5).

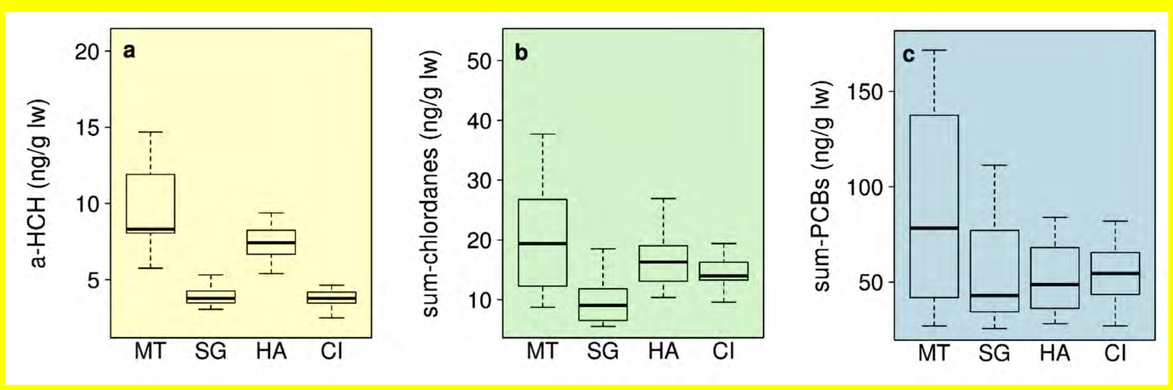


Fig. 4 Mean concentrations (ng g^{-1} lipid weight [lw]) of ∝-HCH (**a**), sum-chlordanes (**b**), and sum-PCBs (**c**) in *Mya truncata* (MT), *Serripes groenlandicus* (SG), *Hiatella arctica* (HA), and *Chlamys islandica* (CI) from both locations.

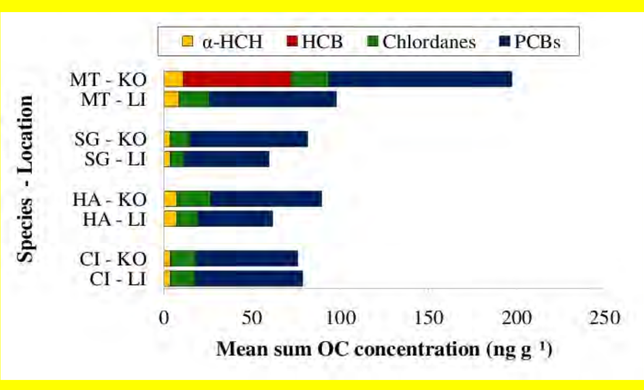


Fig. 5 Mean total OC concentration (including ∝-HCH, HCB, Chlordanes, PCBs) in *Mya truncata* (MT), *Serripes groenlandicus* (SG), *Hiatella arctica* (HA), and *Chlamys islandica* (CI) from Kongsfjorden (KO) and Liefdefjorden (LI).

3. Conclusion

- In the Arctic bivalves, most of the analysed legacy POPs were detected, with PCBs as the predominant OC group.
- Different OC levels were found among the four bivalve species.
- Higher OC levels in bivalves from Kongsfjorden indicated the Atlantic water mass as an important transport route for OCs.
- Variability in OC levels was not related to the bivalve's age, implying the absence of OC bioaccumulation with age.
- Further investigations are needed to define which factors might explain the different OC concentrations among the four bivalve species.

Acknowledgements

I would like to thank my supervisors Haakon Hop, Thomas Brey, and Geir Wing Gabrielsen for their support during my Master thesis. Additionally, I thank Sandra Huber for her help with the chemical analyses and I would like to thank all the people that supported me during my work at the Norwegian Polar Institute. The master thesis was part of the IPY-project COPOL (Contaminants in Polar Regions). Finally, I would like to thank Ines Göpfert and Micha Leykum for the help with the poster layout.