

HOW DO PERSISTENT ORGANIC POLLUTANTS BEHAVE IN COLD-BLOODED NON-HIBERNATING FISH?

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It is well known that persistent organic pollutants (POPs) accumulate and usually remain immobilized in fatty tissues of warm-blooded and even cold-blooded hibernating organisms. The partitioning behavior of these chemicals in cold-blooded non-hibernating organisms is much less clear and hardly known although undoubtedly crucial in understanding the mechanisms behind biological effects of contaminants and their respective risk assessments.

This gap in knowledge was taken onboard in this study on partitioning of important pollutants and other variables in the liver of dab (*Limanda limanda*), sampled in the Belgian part of the North Sea in distinct seasons. The liver tissue is the main fat storage matrix in dab and was therefore chosen. The determinants were the liver fat and multiple congeners of chlorinated POPs: 7 dioxins, 10 dibenzofurans and biphenyls, including 4 planars and 8 mono-orthos, and is a continuation of previous work on the seasonal partitioning of long-term monitored indicator biphenyls. Other measured variables were, in the first place, the bottom water temperature amongst others.

The seasonal temperature conditions have a profound impact on the fat matrix with approx. 2.5-fold concentration differences between March and August/September. The use of fat reserves in winter is a logic and recurrent metabolic necessity and, surprisingly, all measured POPs exhibited exactly the same patterns and ratios and that is a net observation. Since the persistence of these chemicals prevents biotransformation, the most plausible explanation for the distributional behavior is that approx. 60% of the accumulated liver contaminant burdens recirculate yearly. A clear-cut conclusion is that the seasonal influences on the liver fat contents mobilize these chemicals in and out of the liver and that concentration in the remaining fat during elimination does not take place. The big question is: where do these chemicals go to? Storage in other compartments of dab is unlikely because of the low fat concentrations in those tissues that might well exhibit similar seasonal patterns as the liver fat tissue.

In terms of toxicological equivalents, the results show that the chemicals can be ranked in order of toxicological importance: planar biphenyls > dibenzofurans > dioxins > mono-ortho biphenyls. Very interesting and promising is that sampling and analyses on a more frequent basis (e.g. on a weekly basis) would allow quantification of released and accumulated POPs. These fluxes may be assumed active **doses of exposure**, distinguished from the bulk of the contaminants. The data would allow the design of a dynamic model on **the mechanistic roles of chlorinated POPs**, providing a better understanding and interpretation of their biological actions and the biomarkers that are recommended in risk assessments. The model would also clearly demonstrate the periods with highest release and accumulation rates during which organisms might be most vulnerable. The conclusive message is that (1) a large part of the bulk of accumulated chlorinated POPs in fat tissues of cold-blooded fish is being recirculated during the year, and (2) the presented concept might provide **the approach needed to tackle questions and complex interactions in the field that compromise a reliable risk assessment**.

References

- Roose P., K. Cooreman and W. Vyncke. 1993. Correlations between EROD and glutathion S-transferase activities and the presence of organochlorines in the liver of dab from the Belgian continental shelf. ICES CM/E:15.
- Cooreman K., P. Roose and W. Vyncke. 1994. EROD monitoring in dab from the Belgian continental shelf: seasonal variation and relation to organochlorines. Proceedings of the Symposium on the Quality Status Report of the North Sea. Ebeltoft, Denmark.