Biological Responses In White Sucker To Polychlorinated Dioxin and Furan Exposure At Pulp and Paper Mills

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Several recent studies have reported a variety of biological responses in fish downstream of bleached kraft mills in Canada. This includes change in condition factor, decreased gonad size, increased liver size, induction of hepatic MFO, and reduced circulating levels of sex steroids. Correlations between polychlorinated dibenzo-p-dioxin (PCDD) and dibenzofuran (PCDF) concentrations and elevated MFO activity in fish and birds at pulp and paper mill sites has led to speculation that there may be a causal relationship between the two at these sites. Existing studies on PCDD/PCDF contamination seldom included measurements of biological parameters other than simple meristics. Small sample sizes, pooled tissue measurements (usually fillets), differences among methodology, species selection and season of collection, make interpretation of the effects of PCDD/PCDF contamination on biological responses in fish difficult.

The objective of this study was to evaluate the relationship between biological responses in white sucker (*Catostomus commersoni*) and the PCDD/PCDF contamination at pulp and paper mill sites in Ontario, Canada. PCDD/PCDFs were measured in white sucker liver samples from 5 bleached kraft mills, with and without secondary treatment, two sulphite-mechanical mills and three reference sites. 2,3,7,8-TCDD and 2,3,7,8-TCDF were the dominant congeners detected in both liver and fillet samples at all of the pulp and paper mill sites with TCDD-toxic equivalent concentrations (TEQs) as high as 124 pg g^{-1} in liver tissue. Concentrations of PCDD/PCDF in liver tissues were several fold higher than in fillet tissue but this difference can be accounted for by lipid normalization. There was no relationship between TEQs and condition factor, gonadosomatic index, liver somatic index or circulating plasma 11-ketotestosterone. A weak negative correlation was observed between circulating plasma testosterone and TEQs. Although there was a positive correlation ($r = 0.49$, $p < 0.001$) between mixed function oxygenase activity (EROD) and TEQ, one site with very low chlorine use and low TEQs had EROD activity similar to levels observed at more contaminated sites. This observation casts doubt on a causal relationship between MFO activity and PCDD/PCDFs contamination in fish exposed to pulp and paper mill effluents. This observation is supported by field experiments which show rapid clearance of MFO activity in fish exposed to pulp and paper mill effluents.