



# MEGALOPTERA AS A REPRESENTATIVE BENTHIC INVERTEBRATE FOR WORST CASE SCENARIO SCREENING LEVEL EXPOSURE ASSESSMENTS



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## ABSTRACT

Traditionally, collection and chemical analysis of aquatic insects for food web studies is hampered by difficulty in obtaining samples that appropriately reflect community diversity and provide sufficient sample weight for chemical analysis. Rather than collection and analysis of complete communities, megaloptera may serve as a representative aquatic insect for screening-level exposure assessments. Megaloptera larvae are in contact with sediment between two and three years, have high lipid content, and are indiscriminate, opportunistic feeders. In addition, they are relatively easy to collect in most river systems and have large body masses. Congener specific PCB concentrations were measured in six orders of aquatic insects collected from PCB contaminated sediment and upon emergence from the surface, in the Kalamazoo River as well as a less contaminated upstream reference area. The mean concentration in the contaminated area ranged from 1820±1004 ng/g ww in ephemeroptera to 290±233 ng/g ww in odonata. The mean concentrations in the reference area ranged from 245 ng/g ww in odonata to 51±28 ng/g ww in diptera. The mean concentrations in megaloptera were 780±305 ng/g ww and 148±49 ng/g ww, in the contaminated and the upstream reference area respectively. The benthic invertebrate order megaloptera either had greater total PCB concentrations or was not significantly different from all orders sampled (p<0.05). Thus it appears that megaloptera may be useful for screening level dietary exposure assessments as a representative order for all aquatic insects.

## INTRODUCTION

Aquatic insects were collected for the Kalamazoo River Ecological Risk Assessment as part of a large scale food chain analysis to determine polychlorinated biphenyl (PCBs) exposure in upper trophic level key receptors. Data collected from this effort was used to test the hypothesis that megaloptera can serve as a representative aquatic insect for other similar sampling scenarios.

### Problem

Initial screening level assessments of contaminants in the aquatic environment are an important part of identifying concerns for environmental risk assessments. Collection and chemical analysis of aquatic insects for food chain studies is hampered by difficulty in obtaining samples that appropriately reflect community diversity and provide sufficient sample weight for chemical analysis.

### Proposed Solution

Rather than collection and analysis of complete communities, megaloptera may serve as a representative aquatic insect for screening level exposure assessments. Megaloptera larvae are in contact with sediment between two and three years, have high lipid content, and are indiscriminate, opportunistic feeders. In addition, they are relatively easy to collect in most river systems and have large body masses.



## MATERIALS AND METHODS

All samples were collected from the Kalamazoo River during the summers of '99, '00, and '01 at Fort Custer, an upstream reference site, and within the Trowbridge floodplain, an area of concern.

Samples were collected by use of sieve buckets, seines, kick nets, HPV lamp, and by manual picking on or near the banks of the river.

All aquatic insects were identified to order and massed for analysis on an order-specific basis.

Samples were Soxhlet extracted, H<sub>2</sub>SO<sub>4</sub> hydrolyzed, and cleaned in Florisil® silica gel columns.

Congener specific PCB analysis was conducted via gas chromatography with an electron capture detector.



## RESULTS AND DISCUSSION

- Concentrations in the Trowbridge area of concern were significantly greater than concentrations in the Fort Custer reference area. (p<0.05)
- Megaloptera either had a greater total PCB concentration or was not significantly different from other aquatic insect orders (based on an ANOVA).
- Total PCB concentrations in megaloptera appear to be a representative of aquatic insects at both the contaminated and reference areas where total PCB concentrations differed by approximately one order of magnitude.

Order	TROWBRIDGE			FORT CUSTER		
	N	Total PCBs	stdev	N	Total PCBs	stdev
Megaloptera	4	780	305	7	148	49
Diptera	10	465	229	6	51	28
Trichoptera	7	993	288	7	162	31
Odonata	6	290	233	1	245	
Plecoptera	3	1603	1002	2	157	103
Ephemeroptera	2	1820	1004	1	144	
Aquatic emergent comp.	4	707	445	3	120	30
Benthic invert comp.	14	905	742	6	116	67

Table 1. Mean total PCB concentrations (pg/g ww; ppb) for each aquatic insect order.

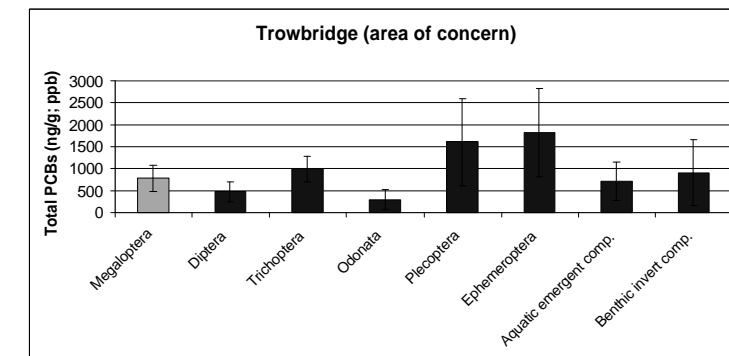


Figure 1. Mean total PCB concentrations at the Trowbridge area of concern.

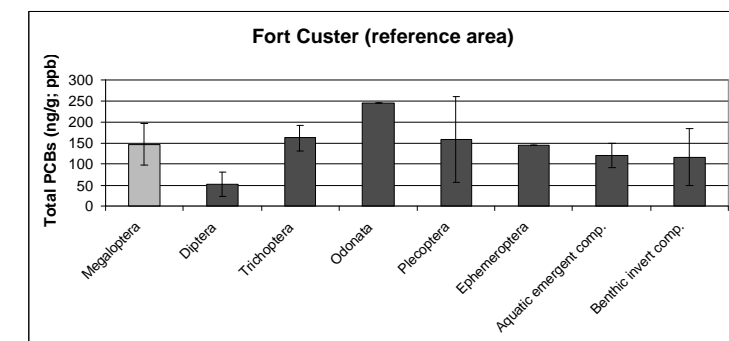


Figure 2. Mean total PCB concentrations at the Fort Custer reference area.

## CONCLUSIONS

Megalopteran total PCB concentrations were not significantly different from other aquatic insects within the same sampling locations on the Kalamazoo River. Screening level exposure assessments may be simplified by using megaloptera as a representative order for all aquatic insects. Sampling of only megaloptera is less time consuming and more efficient than sampling other orders separately. This experiment should be repeated in different river systems in order to gain a broader perspective of the use of megaloptera in screening assessments.



## ACKNOWLEDGEMENTS

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