

Impacts of a major oil spill on riverine benthic communities

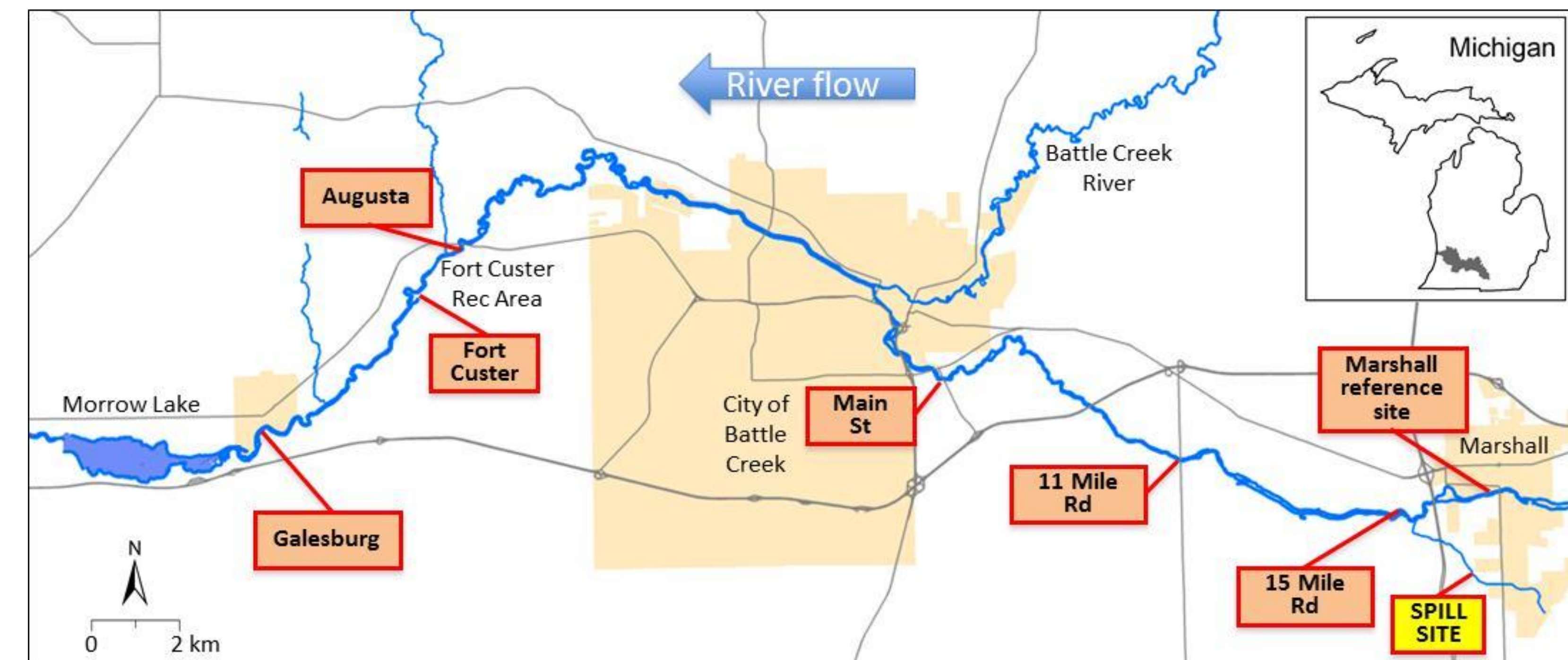
(Kalamazoo River, MI)

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Introduction

One of the largest oil spills, and first oil sands spill in a freshwater system occurred on the Kalamazoo River in summer 2010. No fish kills were reported. Hundreds of birds, mostly geese, and thousands of turtles were cleaned and returned to the river. This work focuses on measuring the effects of the spill and clean up on macroinvertebrates, which are often the most affected organism in oil spills of this magnitude.



Map of Kalamazoo River. Spill occurred downstream of Marshall. Boxes are sampling locations

Question: How was the benthic macroinvertebrate community impacted shortly after the spill?

Methods: Multi-plate Hester Dendy samplers were placed in the river to collect macroinvertebrates two months after the spill.

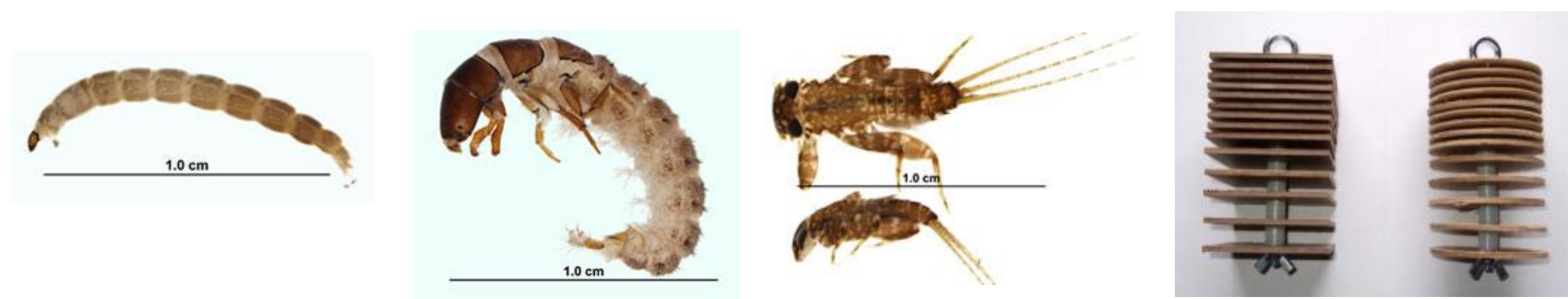
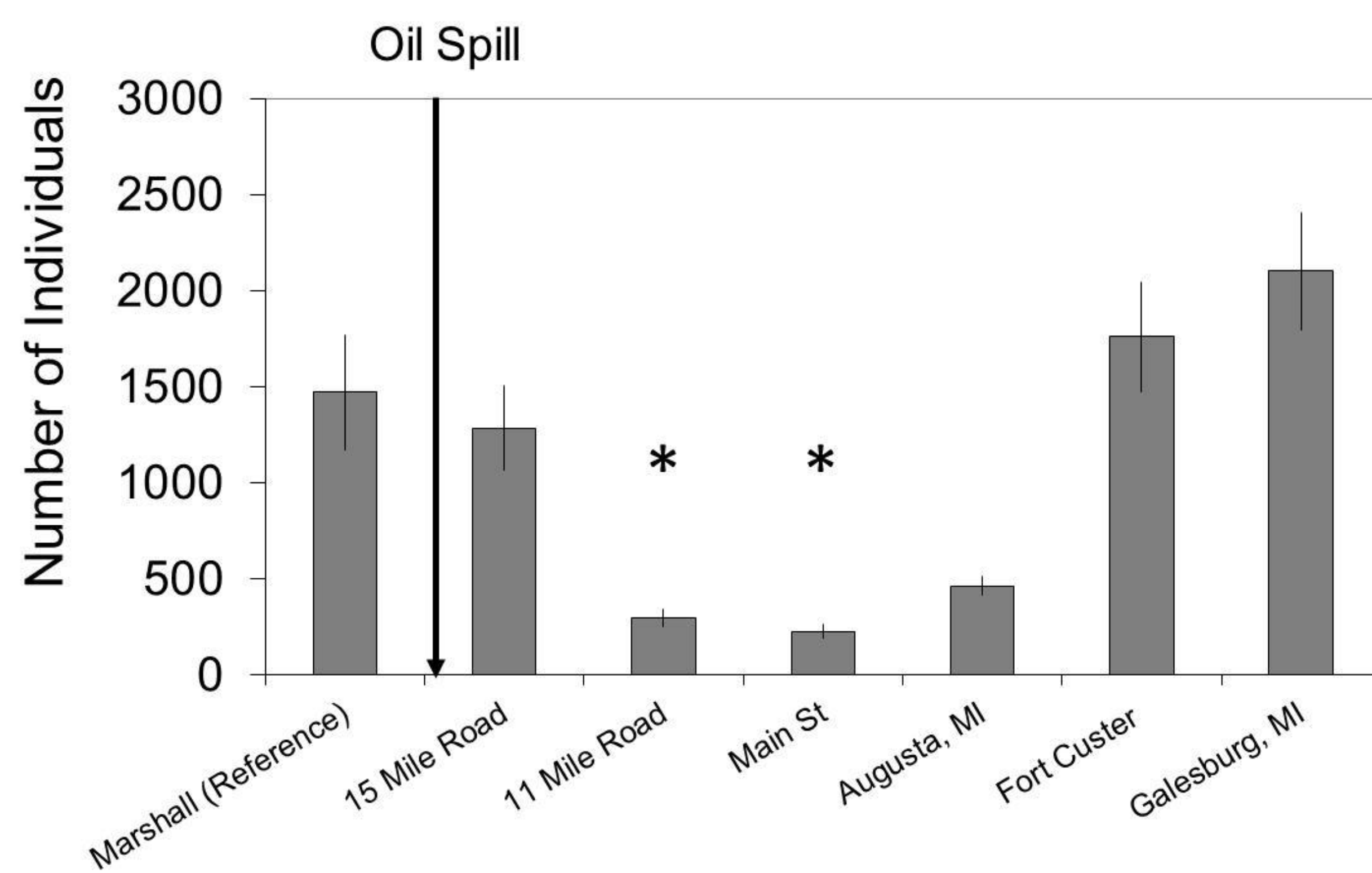


Figure 1: Bars represent total number of invertebrates. Numbers of individuals are dominated by midges (Chironomidae), filter feeding caddisflies (Hydropsychidae) and mayflies (Heptageniidae).

Results: Macroinvertebrates were reduced in two sections of the river in 2010.

Question: Is there a possibility of toxicity of the residual oil one year after the spill?

Methods In August of 2011, a in-situ bioassay using two week old *Hyaella azteca* amphipods was used to assess possible toxicity of any submerged oil in river sediments.

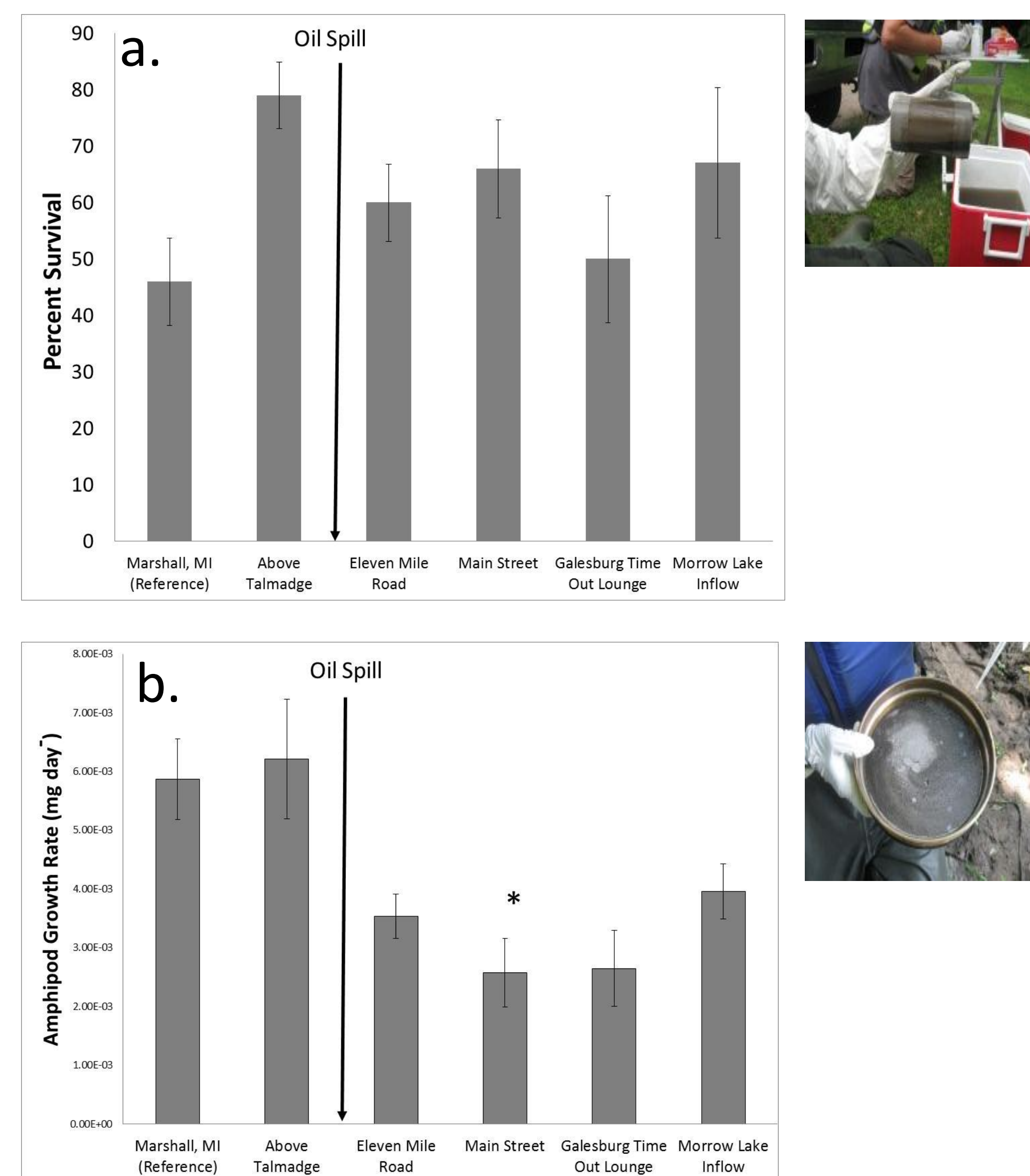


Figure 2: Results of in-situ bioassay: percent survival (a) and growth rate (b).

Results: Amphipod survival was not significantly different among sites using in-situ chambers. Growth rates may be reduced in one section of river.

Question: Is there a possibility that metals abundant in oil sands bioaccumulated in crayfish in sites affected by the spill?

Methods: In winter of 2011, crayfish were collected above and below the spill for metal analysis to assess if metals specific to oil were bioaccumulating in crayfish tissues. These metals include nickel (Ni), vanadium (V), beryllium (Be) and molybdenum (Mo). Crayfish tissues were dissected (hepatopancreas, muscle and carapace). These tissues and the remaining whole body were then sent to Exova for microwave digestion and metal analysis by ICP-MS. Replicates are composites of whole bodies.

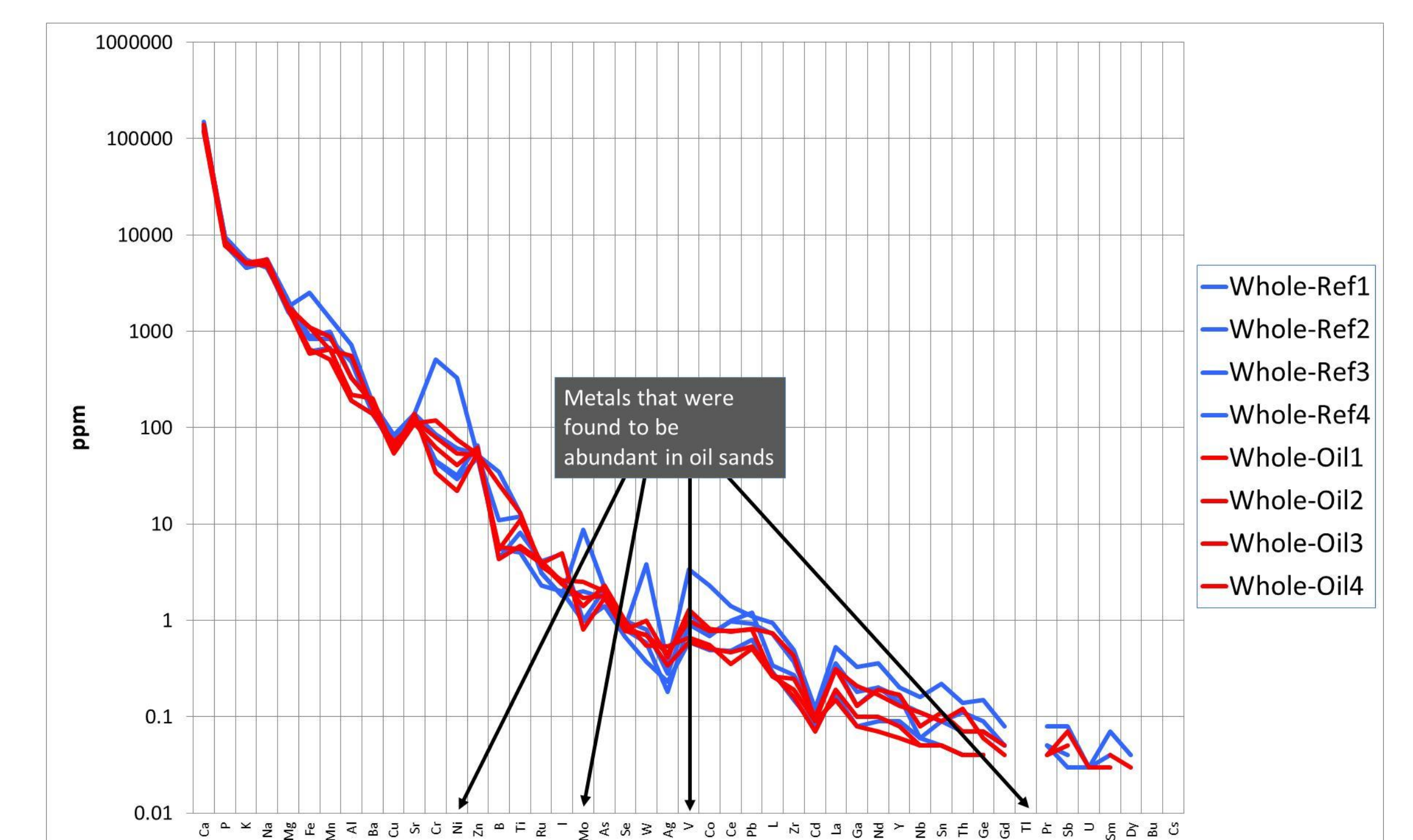


Figure 3. Metal concentration in crayfish. Reference samples (Ref) are from Marshall, MI, while oil spill samples are from Eleven Mile Road (Oil).

Results: Metals did not accumulate differently in crayfish collected from the two sites. No beryllium was detected

Conclusions: These results provide evidence regarding the effects of one of the first oil sands spills and one of the largest freshwater oil spills in the United States. Macroinvertebrate densities were reduced in two sections of river. There may be possibilities of sub-lethal effects (reduced growth rates) in Battle Creek. EPA reports that they have found significant amounts of submerged oil within the major reservoirs and possibly along the river. Research from previous spills has found that while macroinvertebrates can be reduced by 90% in reaches affected by oil spills, macroinvertebrate densities return after one year. This work will examine to see if this is the case using Hester Dendy samplers in 2011 (one year later).

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