

Copper Concentrations at Lake Erie Marinas

Lake Erie Protection Fund Project SG 439-12

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Dealing with fouling organisms is necessary to ensure fuel efficiency, to prevent the spread of invasive species such as the zebra mussel, and to protect the boat itself. However, as boats are power washed to remove residual fouling, copper from antifouling paint leaches into the wash water and can enter Lake Erie as runoff. A free copper ion can adsorb suspended particulate matter as it settles and accumulates in the sediment. The Ohio Clean Marinas Program, with a grant from the Ohio Lake Erie Commission's Lake Erie Protection Fund, performed a study on copper concentrations at Lake Erie marinas. In collaboration with Bowling Green State University and Lake Erie marinas, data was collected on copper accumulation in sediment over the course of one boating season. The results will aid scientists, agencies, marina owners, and boaters in obtaining a better picture of the contribution of boat bottom wash wastewater to copper concentrations in Lake Erie nearshore sediments, and in finding sustainable solutions for boat bottom washing.

In the fall of 2012, sediment samples were taken at nine marinas along Lake Erie following boat bottom washing in preparation for winter. Sediment samples were collected within the pullout bay and power-washing area of the marina at 2-meter intervals following USEPA guidelines. A channel sample was also collected 100 meters from shore. In the spring of 2013, sediment samples were taken again at the same locations, following six months of little-to-no boat activity and prior to the 2013 boating season. Samples were analyzed using EPA method 3051A for acid-leachable metals analysis.

PROJECT RESULTS

Amongst the marinas studied, the activity of boat bottom washing had a significant impact on the concentration of copper in sediment at that facility (Figure 1). Also, the highest copper concentrations were at the boat bottom wash pullout area, but declined rapidly to within 10 meters from the boat bottom wash pad (Table 1). The results of this study indicate that boat bottom washing may provide a high source for copper to the marina. The mean copper concentration in sediment at the control marinas was 100.97 parts per million, or ppm. Mean concentration at the boat bottom washing marinas was 4932.88 ppm. Samples collected in September (before power-washing) and December (after power-washing) from similar locations as samples collected in April show

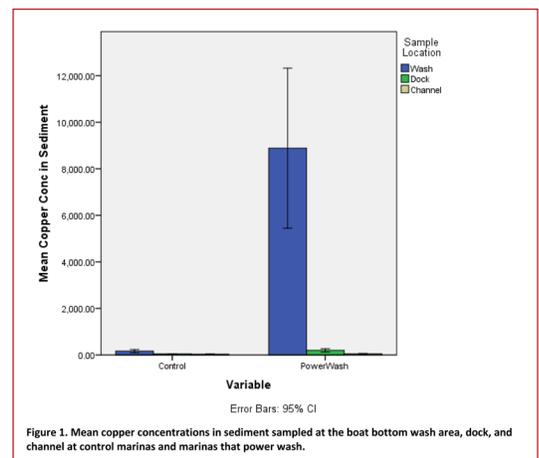


Table 1. Subsample example: Copper concentrations (ppm) in samples Collected Fall 2012, Winter 2012, and Spring 2013 at Marina B.

Sample Location	September	December	April
Inner Pullout	1481	8190	10182
Midway Pullout (~6m)	568	1360	971
Channel	48	32	25

copper concentrations increased significantly from September to December but changed little from December to April. While all boat bottom washing marinas had higher copper concentrations than the control marinas, there was high variability in the extent of copper concentrations between the marinas (Figure 2). These differences may have been influenced by a variety of factors, both man-made and environmental, and warrant further research.

While copper concentrations in nearshore sediments may be in part due to boat bottom washing at marinas, there are a variety of factors that affect the bioavailability and toxicity of copper in this environment. These include pH, temperature, and dissolved organic carbon, among others. Further research is required to better understand the toxicity of copper in Great Lakes environments, and to study comparative communities for concentrations of runoff from copper-based antifouling paint.

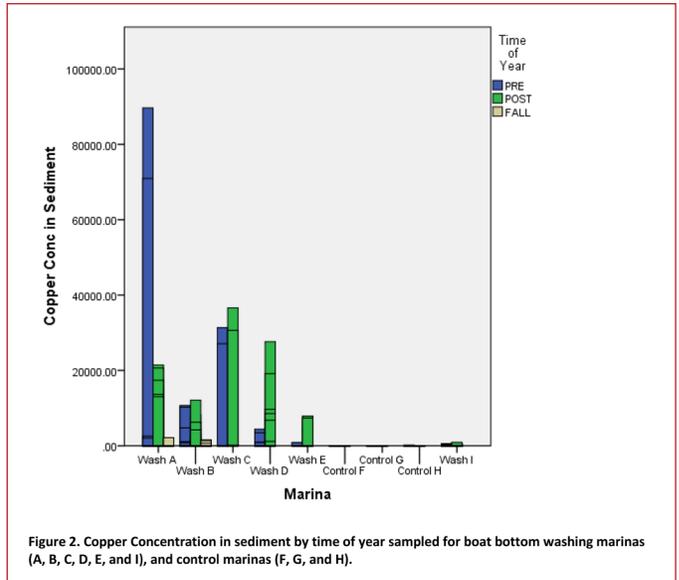


Figure 2. Copper Concentration in sediment by time of year sampled for boat bottom washing marinas (A, B, C, D, E, and I), and control marinas (F, G, and H).

Also, research must be completed to assess the effectiveness of alternatives to copper-based antifouling paint, including non-copper-based paints and wash water treatment technologies in the Great Lakes. As waterfront stakeholders, the participants in this study have been proactive in attempting to understand their individual contribution to copper concentrations in Lake Erie, and ultimately impact that proportion of the total copper content in nearshore sediments.



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