



Emerging and Legacy Pesticide Contamination in Waishkey Bay, Brimley, Michigan



Alyssa McGlinch¹, Dan Napoletano¹, Dr. Diana McKenzie¹, Brian Wesolek², Aubrey Maccoux-LeDuc²
¹Bay Mills Community College, ²Bay Mills Biological Services

Introduction

The Bay Mills Indian Community is a federally recognized Anishnaabe tribe that is located along the shore of the Waishkey Bay. The community relies heavily on fishing, recreation that take place within the bay. Waishkey Bay's location at the apex of the Lake Superior-St Marys River junctions, places it directly upstream of the Lake Huron watershed.

Three permitted wastewater facilities, as well as runoff from agricultural lands, a golf course, and residences located within the Waishkey Bay watershed may contribute to elevated levels of pesticides in the bay. Many of these chemicals are known to persist in the environment and may biomagnify in the aquatic food web.

There is little research on the levels of these chemical contaminants in the Waishkey Bay.

The characterization of co-existing chemicals in the Great Lakes is lacking. The prevalence, exposures, and toxicities of chemical mixtures in the food chain is not well understood in this, and other, aquatic systems.

Objectives

- Identify and measure levels of legacy and emerging pesticide contamination within the Waishkey Bay watershed.
- Analyze for 76 compounds in surface water and sediment collected from 10 sites within the Waishkey Bay and it's tributaries.

Methods

- Sediment sample collection in summer 2018
 - 175 mL Traceclean Amber Glass Bottles
- Water sample collection in summer 2018
 - Surface Water Grabs
 - 1 Liter Traceclean Amber Glass bottles
- Quantitative analysis of 76 chemicals
 - Lake Superior State University Environmental Analysis Laboratory
 - EPA method 8270D



Figure 1: Map depicts the locations of the 10 sites from which the water and sediment samples were taken. One site is in the open bay while the other nine are in tributaries or their outlets into the bay.

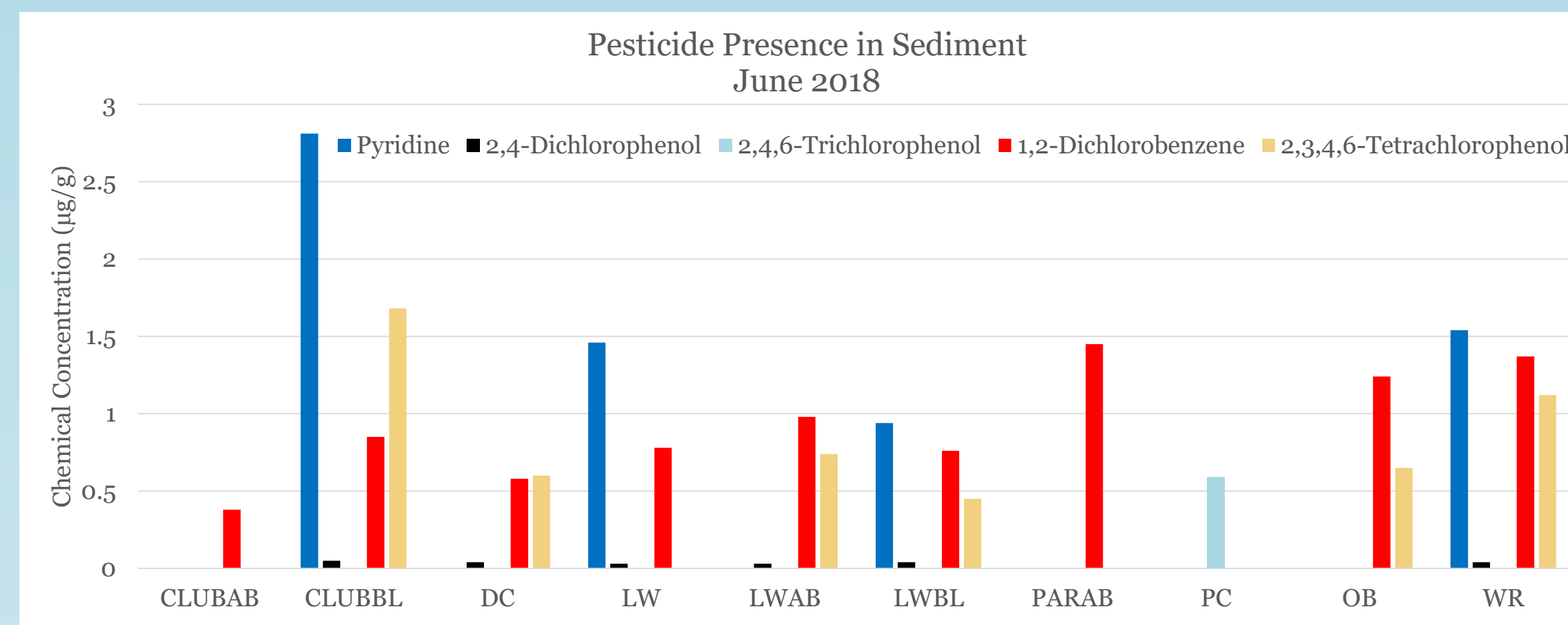


Figure 2. Concentration of five pesticides present in sediment during June 2018 collection.

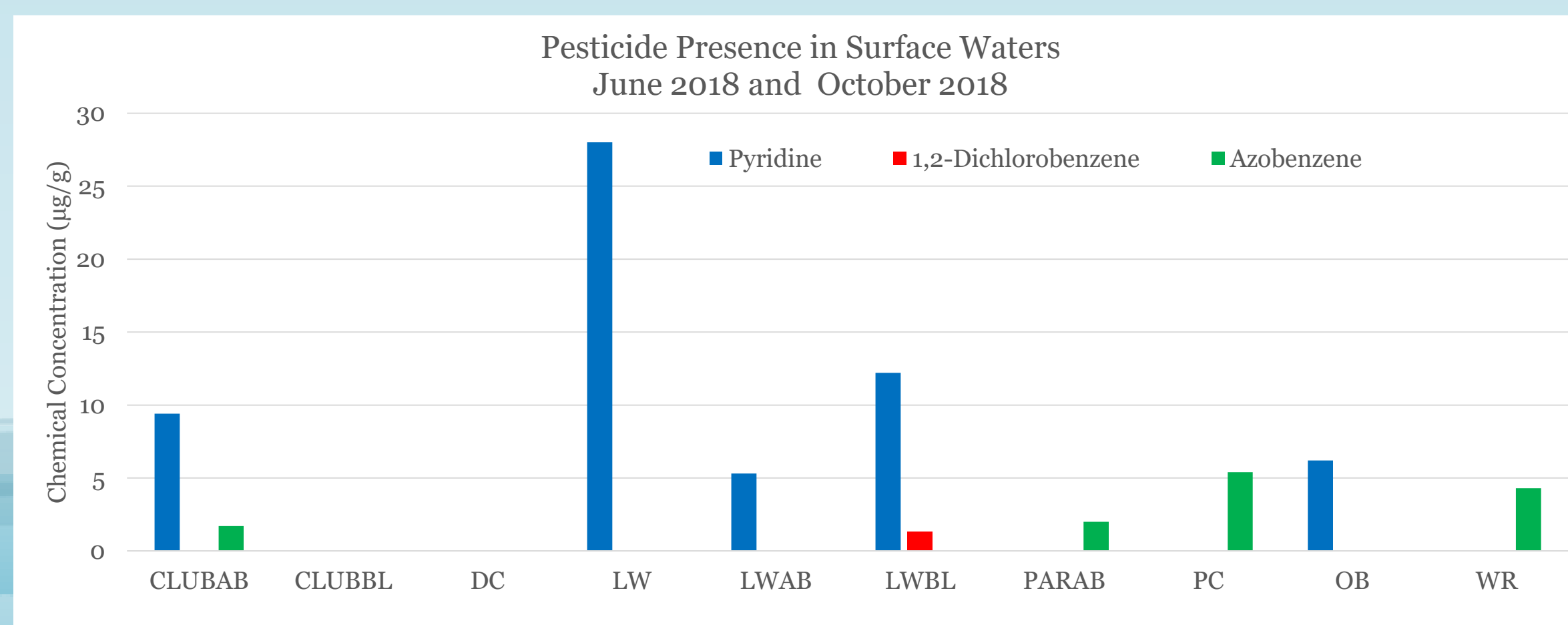


Figure 3: Concentrations of pesticides present in surface waters during June 2018 (pyridine, 1,2-dichlorobenzene) and October 2018 (azobenzene) collections.

Acknowledgements

Partners in this project include Bay Mills Indian Community, Brimley, MI; Bay Mills Biological Services, Brimley, MI; Lake Superior State University Environmental Analysis Lab, Sault Ste Marie, MI; Wayne State University Lumigen Instrument Center, Detroit, MI; Michigan State University, Michigan Sea Grant, Sault Ste. Marie MI branch; USDA National Institute of Food and Agriculture (2017-38424-27083).

Results

Of the 76 pesticides analyzed, 6 were present above level of detection; 70 were below detection level, or not detected. These six pesticides were pyridine, 1,2-dichlorobenzene 2,4-dichlorophenol, 2,3,4,6-tetrachlorophenol, 2,4,6-trichlorophenol, azobenzene.

Pyridine is a pesticide found in cigarettes and used in the synthesis of some antihistamines, herbicides, and water repellents. The Dutch target standard level for pyridine in sediment is (0.1 µg/g). It was found in sediment samples at four sites averaging 1.69 µg/g. It was found in Club Creek, Little Waiska Creek and the Waishkey River. Pyridine was also found in water samples for six sites averaging 12.22 µg/L. It was found in Club Creek, Little Waiska Creek and the open Bay.

1,2-Dichlorobenzene is used as an insecticide and in the softening and removing of carbon based contamination on metal surfaces. Sediment contained levels well above the Dutch target standard for 1,2-dichlorobenzene (0.03 µg/g). Dichlorobenzene was detected in sediment samples at nine sites with an average of 0.92 µg/g and surface water samples at one site in Little Waiska Creek with an average of 1.3 µg/L.

2,4-Dichlorophenol (commonly known as 2,4-D) is a chemical used in the preparation of herbicides and can also appear in the environment as a product of the photo degradation of triclosan. It can cause renal failure and liver damage with elevated exposure. The Dutch target standard for 2,4-dichlorophenol in sediment is 0.01 µg/g. It was found in sediment samples from six sites averaging 0.94 µg/g.

Azobenzene is used in some sunscreens, personal care products, as well as some pesticides. Azobenzene was detected in water samples at four sites, averaging 3.35 µg/L. these sites included both upper tributaries as well as lower rivers.

2,3,4,6-Tetrachlorophenol was used as a preservative and a pesticide but is no longer produced in the United States. Little research has been done on the effects of this chemical on humans, but studies have shown that it causes cancer in mice and rats. Dutch target standard for 2,3,4,6-tetrachlorophenol in sediment is 0.01 µg/g. 2,3,4,6-Tetrachlorophenol was detected in sediment samples at six sites averaging 0.04 µg/g which is well above the standard.

2,4,6-Trichlorophenol is a component of insecticide, fungicide, herbicide and antiseptic applications. Production of 2,4,6-trichlorophenol was discontinued in the United States in the 1980's and the levels detected in the environment are generally less than 0.00001 µg/g. The Dutch target standard in sediment (0.01 µg/g). Concentration in the sediment at the Parish Creek site was nearly 6-fold higher at 0.59 µg/g.

Discussion

The results of this study provide data on emerging and legacy pesticides in the Waishkey Bay. The results so far indicate that pesticides are found even in the most-pristine headwaters with little human development. There is also much variability in the types and quantities of pesticides in these sites.

These data will be supplemented with pesticide concentrations in biota (fish and mussels) in the near future.