USGS

DRAFT: Synoptic study of glyphosate entering Lake Champlain from urban and agricultural sources near Burlington, Vermont, 2021

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Background

Glyphosate, the most widely used pesticide worldwide (Benbrook, 2016), accounts for nearly 44% of the total mass of herbicide used on crops in 2016 in the United States (Baker, 2018) and is the top ranked herbicide sold in Quebec (Soumis, 2018). Drainage into Lake Champlain is from land in Vermont, New York, and Quebec (56%, 37%, and 7%, respectively). Use of glyphosate on agricultural land in the 5 counties that border northern Lake Champlain (Franklin, Chittenden, Addison counties in Vermont and Clinton and Essex counties in New York) has increased 73% (from 14,060 to 24,343 kg annually) between 2008 and 2018 (Baker, 2018). Glyphosate also is widely used to control weeds in urban and suburban settings and is likely present in nonpoint runoff and WWTP effluent that discharges to the lake (Kolpin and others, 2006).

Problem

Many studies indicate potentially adverse ecological and human health effects from use of glyphosate. Of the tens of thousands of kilograms of glyphosate applied to agricultural and urban land in Vermont, an unknown amount enters Lake Champlain through direct runoff and from WWTP discharge. An unintended consequence of glyphosate use is the possible release of phosphorus to the environment during degradation (Hébert et al, 2019). In June 2016, the EPA issued a phosphorus TMDL for Vermont segments of Lake Champlain in response to phosphorus concentrations in Lake Champlain that typically exceed Vermont's water quality standards (EPA, 2016).

Objectives and Scope

The overall objective is to characterize the occurrence and distribution of glyphosate and it's primary degradate aminomethylphosphonic acid (AMPA) in wastewater effluent and tributaries entering Lake Champlain in Vermont. Specific goals are to:

1. Characterize seasonal distribution (spring, summer, fall).

2. Determine relative amounts of glyphosate and AMPA from urban and agricultural sources.

Approach

Collect 22-28 water samples during the 202x field season, targeting high-flow events and following USGS protocols for the collection of stream and effluent samples. Sample locations will be preferentially selected at or near USGS gaging stations. Samples will be collected from agricultural reaches of 3 tributaries (exact locations TBD), 1-2 samples will be collected each in spring, summer, and fall; plus 1 field blank and 1 field replicate, for a total of 11-14 samples. Samples will also be collected from urban or suburban reaches of 2 tributaries (exact locations TBD) and effluent from the Burlington Main WWTF, 1-2 samples will be collected each in spring, summer, and fall; plus 1 field blank and 1 field replicate, for a total of 11-14 samples. All water samples will be analyzed at the USGS Ohio Geochemistry Research Laboratory (OGRL) laboratory.

Relevance and Benefits

Synoptic information on glyphosate and AMPA in agricultural and urban tributaries and wastewater effluent to Lake Champlain from Vermont will fill a data gap for the state of Vermont and USGS. As of November 2020, no water samples from Vermont have been analyzed for these herbicides at the USGS Ohio Geochemistry Research Laboratory, or at any other laboratory (to our knowledge) with the capability to detect glyphosate in water at concentrations as low as 0.02 µg/L. In addition, if glyphosate is detected in Vermont water, there will be a basis to investigate this as a potential source of phosphorus to Lake Champlain.

Products

The product will be a USGS Open-File Report that provides analytical results (glyphosate, AMPA) and context of this synoptic study.

Budget Summary

The total cost for this project is $55,000-$75,000, depending on the scope of work and personnel. Some of this cost might be shared by the USGS under a cooperative funding agreement.

References

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