Glen Lake Septic NPS Monitoring 2019 Report

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Introduction

SUNY Adirondack encourages participation in undergraduate research by community college students under the mentorship of college faculty. Since 2017, SUNY Adirondack has partnered with the Glen Lake Protective Association (GLPA) of Queensbury, NY, and the Warren County Soil and Water Conservation District (WCSWCD) to investigate whether residential/commercial septic systems could be a contributing factor to nonpoint source (NPS) pollution of Glen Lake.

The US Environmental Protection Agency defines nonpoint source pollution (NPS) to mean, "any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act." That definition states:

> "The term "point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture."

The EPA also notes that, "nonpoint source pollution is the leading remaining cause of water quality problems. The effects of nonpoint source pollutants on specific waters vary and may not always be fully assessed. However, we know that these pollutants have harmful effects on drinking water supplies, recreation, fisheries and wildlife." (https://www.epa.gov/nps)

Generally, NPS pollution of surface or ground water is due to rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, which are then depositing into lakes, wetlands, rivers, coastal waters and ground waters. On residential lakes, septic systems are often the primary source of NPS pollutants and constitute an environmental concern.

Previous research conducted by the SUNY Adirondack ESC has shown that concurrent detection of (1) hypochlorite ion or hypochlorous acid (HOCl), which are chlorine compounds in bleach and cleaning products that are not found naturally in aquatic environments; and (2) fecally-derived bacteria, specifically *Escherichia coli* (EC) can be a reliable indicator of septic system-associated NPS.
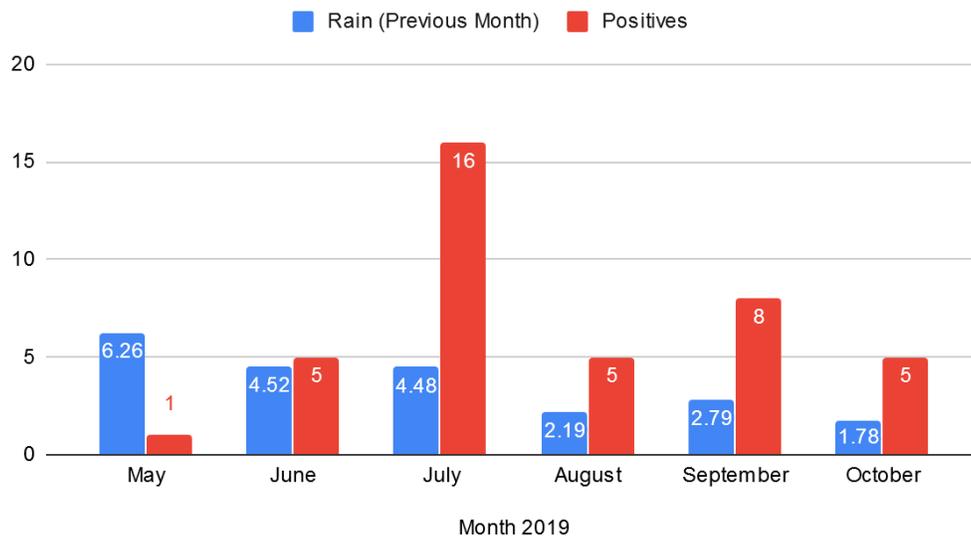
Method

Testing was conducted at selected sites around the lake once a month between May and October 2019. Rainfall data for this period was accessed from the National Climatic Data Center (www.ncdc.noaa.gov). Each sampling location was identified using visual and GPS coordinates. Additional samples were obtained from sites in the fen and inlet areas on an occasional basis.

At each site, a "grab" sample was obtained approximately 10-20 cm below the surface of the water in sterile 250 ml Naglene bottles. All samples were stored in a cooler with ice and transferred to the Microbiology Research Laboratory at SUNY Adirondack where they were processed within 2 hours of collection. Each sample was tested for the presence of *Escherichia coli* (a fecal coliform bacteria) using the IDEXX Colilert testing system according to manufacturer specifications. The samples were also tested for free chlorine (hypochlorous acid and hypochlorite) using a Hach DR/800 colorimeter and HACH reagents according to manufacturer recommendations. For this study, we used the lower limit of detection (0.02 mg/L) of the assay as the positive cutoff value.

Results and Discussion

The highest number of positive sites occurred in July and September, when 65% and 40% of the sites tested positive for both indicators (Table 1). The testing dates for these months correlated with holidays associated with increased usage (Fourth of July and Labor Day). As shown in the chart below, this increase in the number of NPS positive sites showed little correlation with monthly rainfall totals in 2019.

Rain (Previous Month) and Positives - Glen Lake

Legend: Rain (Previous Month) ▇ (blue) Positives ▇ (red)

Month 2019	Rain (Previous Month)	Positives
May	6.26	1
June	4.52	5
July	4.48	16
August	2.19	5
September	2.79	8
October	1.78	5

Additional sites in the Glen Lake fen and inlet were sampled during the testing period. A total of 23 tests were done across several sites on different dates. All 23 tests were positive for *E. coli*, which is not an unexpected finding, since this is an area with abundant animal life and shallower waters providing near optimal conditions for natural growth of heterotrophic bacteria such as *E. coli*.

In addition to *E. coli*, free chlorine was detected in 4 samples (4/23), with three of the four tests located between the Bike Path bridge west to the I-87 highway bridge. The fen has fewer surrounding residential properties but does adjoin a large commercial property, suggesting that the hypochlorite/hypochlorous acid detected in the fen may be either point source or nonpoint source in origin.

The cumulative data from the three year study period suggests that Glen Lake receives NPS pollution as a result of snowmelt and runoff, with residential/commercial septic systems the most likely contributor. NPS detection increases during periods associated with increased seasonal use of lakefront properties. The ecological impact of NPS on Glen Lake was not assessed in this study.

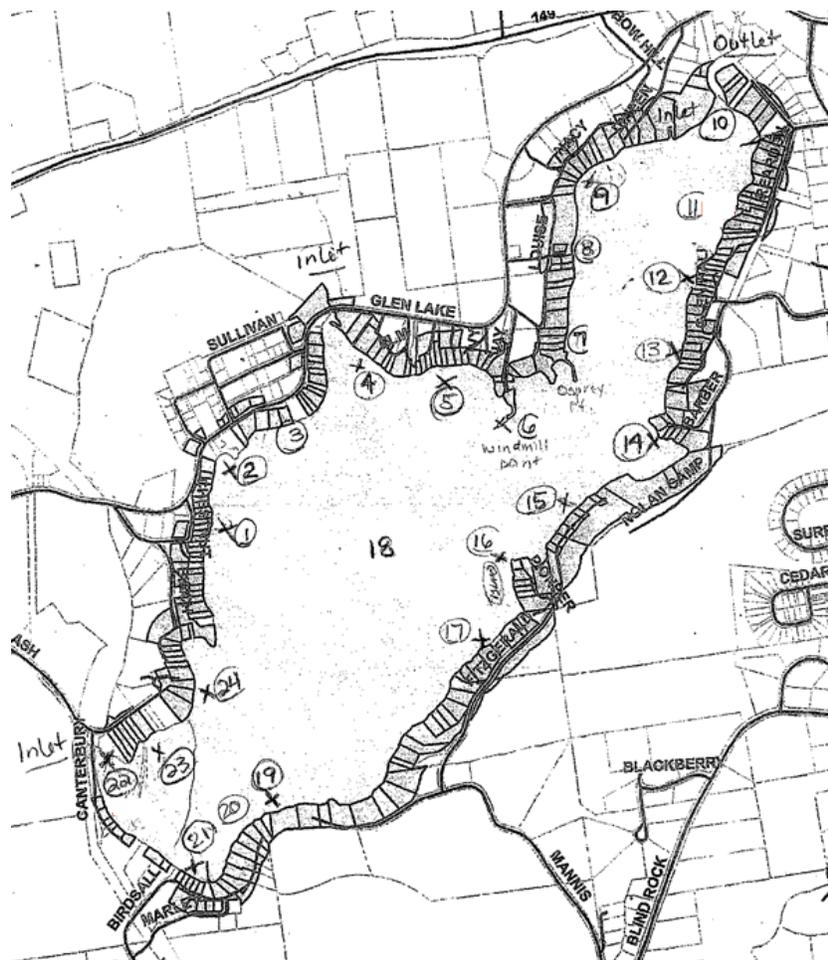Figure 1: Glen Lake map showing the locations of the testing sites.

Table 1: Summary of Glen Lake NPS Indicator Testing Results 2019.

Lake Sites	May 16	June 10	July 8	August 12	Sept. 10	Oct. 8	Total Site Pos (6)
1	--	--	+	--	(-/+)	--	1
2	+	--	--	--	(-/+)	--	1
3	--	--	--	--	--	--	0
4	--	--	+	--	+	--	2
5	--	--	+	--	+	--	2
6	--	--	--	--	--	--	0
7	--	--	+	--	+	+	3
8	--	--	+	+	--	--	2
9	--	--	+	--	+	--	2
10	--	+	--	+	(-/+)	--	2
11	--	+	(+/-)	--	+	--	3
12	--	--	--	--	--	--	0
13	--	--	(+/-)	--	+	+	3
14	--	--	+	--	--	+	2
15	--	+	--	--	+	--	2
16	--	--	+	--	+	--	2
17	--	--	+	+	--	+	3
18	--	--	+	+	--	--	2
19	(-/+)	--	--	+	--	(-/+)	1
20	--	+	(+/-)	--	--	--	2
21	--	--	--	--	--	(-/+)	0
22	--	--	+	--	--	--	1
23	--	+	+	--	--	(-/+)	2
24	--	--	+	--	--	--	1
28*	--	--	--	--	--	+	1
Total Pos	1	5	16	5	8	5	
% Positive	4%	20%	64%	20%	32%	20%	

Key to abbreviations: **+** = HOCl and *E. coli* were BOTH detected; **(-/+)** = Very weak reaction for HOCl with positive EC: **(+/-)** = positive HOCl with weakly positive EC.

Table 2: Glen Lake Composite Data from August 2017 – October 2019

Site	8.17	10.17	5.18	6.18	7.18	8.18	9.18	10.18	5.19	6.19	7.19	8.19	9.19	10.19	Site +	%
1	--		+	--	+	+	--	--	--	--	+	--	(-/+)	--	4/13	31%
2	--					+	--	--	+	--	--	--	(-/+)	--	2/10	20%
3	--		+	--	+	--	--	--	--	--	--	--	--	--	2/13	15%
4	--					+	+	--	--	--	+	--	+	--	4/10	40%
5	--		+	--	--	--	--	--	--	--	+	--	+	--	3/13	23%
6	+	--				--	+	--	--	--	--	--	--	--	2/11	18%
7	+	+	+	--	+	+	--	--	--	--	+	--	+	+	8/14	57%
8	--					+	+	--	--	--	+	+	--	--	4/10	40%
9	--		+	+	--	+	--	--	--	--	+	--	+	--	5/13	38%
10	--					+	--	--	--	+	--	+	(-/+)	--	3/10	30%
11	+	--	+	--	--	+	--	--	--	+	(+/-)	--	+	--	6/14	43%
12	--					+	--	--	--	--	--	--	--	--	1/10	10%
13	--		+	--	--	+	+	--	--	--	(+/-)	--	+	+	6/13	46%
14	--					+	--	--	--	--	+	--	--	+	3/10	30%
15	--		--	--	--	+	--	--	--	+	--	--	+	--	3/13	23%
16	+	--				--	--	--	--	--	+	--	+	--	3/11	27%
17	--		--	--	--	+	--	--	--	--	+	+	--	+	4/13	31%
18	--		--	--	--	--	--	+	--	--	+	+	--	--	3/13	23%
19	--					+	--	--	(-/+)	--	--	+	--	(-/+)	2/10	20%
20	--		+	--	--	--	--	--	--	+	(+/-)	--	--	--	3/13	23%
21	--					+	--	--	--	--	--	--	--	(-/+)	1/10	10%
22	+	+	+	--	+	+	--	--	--	--	+	--	--	--	6/14	43%
23	--					+	--	--	--	+	+	--	--	(-/+)	3/10	30%
24	+	--	--	--	--	+	--	--	--	--	+	--	--	--	3/14	21%
28*									--	--	--	--	--	+	1/6	17%
Date +	6/24	2/6	9/13	1/13	4/13	18/24	4/24	1/24	1/25	5/25	16/25	5/25	8/25	5/25		
%	25%	NA	69%	7%	31%	75%	17%	4%	4%	20%	64%	20%	32%	20%		