State of Rhode Island
Freshwater Cyanobacteria Monitoring
And Bloom Response Program

2019 Summary

Slack Reservoir June 2019

Rhode Island Department of Environmental Management
Office of Water Resources
235 Promenade Street
Providence, Rhode Island 02908

Introduction

Cyanobacteria, also known as blue-green algae, are naturally found in many freshwater ecosystems. A combination of excess nutrients, sunlight, and high temperatures can lead to a rapid increase in cyanobacteria, called a "bloom." Blooms of cyanobacteria generally occur in late summer into the early fall when water temperatures are warmest and an abundance of sunlight and nutrients are available. Some species of cyanobacteria can also produce toxins. These toxins are harmful to people and pets. There are no visual properties of a cyanobacteria bloom that indicate the algae are producing toxins. It is only possible to determine if toxins are present with laboratory tests.

The Rhode Island Department of Health (RIDOH) and the Rhode Island Department of Environmental Management (RIDEM) work cooperatively to detect/respond to the presence of cyanobacteria blooms, evaluate the potential risks to the public, and, when necessary, issue health advisories notifying the public of health concerns. The agencies jointly issue health/recreational advisories when conditions indicate that a cyanobacteria bloom poses a risk to public health. In general, if any of the three guidelines are met, the waterbody is considered to be experiencing a harmful algal bloom, or 'HAB'. Advisories are issued when any of the following three guidelines are met:

- Evidence of a visible cyanobacteria scum or mat or lake/pond-wide cyanobacteria bloom.
- Cyanobacteria cell count exceeding 70,000 cells/mL.
- Toxin (Microcystin-LR) level of lysed cells meeting or exceeding 4 ppb (µg/L)[1].

Health advisories recommend that individuals avoid all contact with the affected waterbody, including recreational activities such as swimming, boating, or fishing. People are also advised to not eat fish from the affected waterbody or to allow pets to wade or swim in, or drink untreated water from the affected waters. Health advisories remain in effect for the remainder of what is considered to be the recreation season (generally November 1st although some blooms last into winter), unless follow-up sampling by a city, town, third party or RIDEM indicate that the advisory can be lifted. Health advisories may be lifted after two successive and representative sampling rounds, two weeks apart, demonstrate no evidence of a cyanobacterial scum or mat and demonstrate cyanobacteria cell counts and toxin levels below threshold concentrations.

RIDEM's Office of Water Resources (OWR) receives reports annually about nuisance algal conditions and potential HAB's from municipal staff, lake and watershed associations, as well as the broader public. From 2011 to 2018, thirty-eight (38) waterbodies have had recreational/health advisories issued with an average of fifteen (15) waterbodies per year. Twelve (12) of the 38 waterbodies are public drinking water supplies and nearly all the remaining waterbodies have a public boat/canoe launch, are routinely used for recreational activities and have well-known public access points.

[1] In 2016 EPA published "Human Health Recreational Ambient Water Quality Criteria or Swimming Advisories for Microcystins and Cylindrospermopsin" (EPA-822-P-16-002). The draft criteria recommended a microcystin level not to exceed 4 micrograms per liter (ug/l).

Overview

Rhode Island's freshwater cyanobacteria bloom response and monitoring program consists of two parts: 1) responding to reports of potential cyanobacteria and/or other algae blooms, and 2) conducting bi-weekly evaluations/screenings of waterbodies throughout the state which are at high risk of cyanobacteria blooms. Levels of funding for both screening and response level portions of the program has varied throughout the 2011-2018 time period. In 2017 and 2018, RIDEM utilized Multi-purpose Grant (MPG) funding provided by EPA to enhance surveillance of cyanobacteria blooms in RI. This included funding for bi-weekly evaluations of 32 waterbodies throughout the recreational season (June-Oct) and analysis of more than 60 samples for cyanobacteria identification/enumeration and cyanotoxins. No funding for bi-weekly evaluations screening analysis was available in 2019; however, some of the 2017-18 MPG funding was available to analyze samples collected in response to citizen complaints. This report summarizes the field reconnaissance, sampling, results, and advisory history for the 2019.

RIDEM's Quality Assurance Project Plan (QAPP) describes in detail the field and analytical methods and quality assurance/quality control procedures related RIDEM's HAB monitoring and bloom response program. The QAPP, titled "Rhode Island Freshwater Harmful Algal Bloom Monitoring" is available at:
http://www.dem.ri.gov/programs/benviron/water/quality/surfwq/pdfs/qapp.pdf

A response level evaluation consists of a site visit and visual examination of as much of the waterbody as possible from the shoreline of public access areas and/or private property (with permission). Photographs are taken at various locations at each site regardless of the presence or absence of a bloom in order to keep continuous visual records of RIDEM visits. If a cyanobacteria bloom is evident (scum, dense mat, extensive clumps, spilled paint or pea soup appearance, streaking, etc.), a sample is collected following QA/QC methods outlined in the QAPP and submitted to the State Health Laboratory for cyanotoxin analysis and enumeration/ID of cyanobacteria genera.

Field sheets are completed at each site to record various weather conditions, document any existing recreational uses (i.e. swimming, wading, canoeing, fishing, etc.), location of the bloom, and if a sample was collected. Samples were collected from the shoreline with the aid of a sampling stick from the densest portion of the bloom. Evaluation and sample collection generally occur at public access points on each waterbody. If no public access is available, evaluations and sample collection are completed from a secondary access location or through permission of a private property owner.

All samples collected in 2019 were sent to the Rhode Island State Health Laboratory in Providence for cyanotoxin analysis and identification/enumeration by colony count of cyanobacteria genera. Tables 1 and 2 list the analytical capabilities of the state laboratory as well as the quantitative thresholds for issuing an advisory. Cyanobacteria cell counts were estimated from laboratory colony counts using conversion factors provided in Hartman and Graffius (1960).

Table 1: List of cyanotoxins analyzed by the State Health Laboratory.

Toxin	Threshold for Issuance of Health Advisory
Total Microcystins	4.0 µg/L
Cylindrospermopsin	None Defined
Anatoxin	
Nodularin	

Table 2: List of cyanobacteria genera commonly identified by the State Health Laboratory.

Genera	Threshold for Issuance of Advisory
Anabaena	70,000 cells/mL (total cyanobacteria)
Aphanizonmenon	
Cylindrospermopis	
Microcystis	
Planktothrix	
Woronichina	

Results

Twenty (20) site visits were conducted by RIDEM staff in response to calls from citizens, town managers, environmental organizations, or other RIDEM field staff about potential algae/cyanobacteria blooms. The only exception to this was the routine evaluation (in August and November) of the City of Newport's nine water supply reservoirs. A total of 28 samples were submitted to the State Health Laboratory for analysis in 2019. Field visits and/or laboratory results led to the issuance of health advisories on 14 waterbodies. The majority of the advisories were issued based on visual appearance of the bloom and exceedance of the cell (colony) count threshold. A summary of field and analytical results from the 14 waterbodies is presented in Table 3. Table 4 lists additional information about each waterbody, including waterbody ID, location, and date of issuance and rescindment of advisories.

As seen in Table 3, microcystin levels in a majority of samples collected were non-detect (< 1.0 ug/l). Samples exceeding the detection limit include those collected from Roosevelt Lake, Slack Reservoir, and Melville Pond. Detectable levels of microcystin in these three waterbodies ranged from 1.3 ug/l to 50 ug/l with exceedances of the 4 ug/l threshold in Slack Reservoir and Roosevelt Lake. The highest level of microcystin in 2019 was observed in Slack Reservoir. Blooms in this waterbody continue to exhibit some of the highest microcystin levels in the state. Anatoxin-a was detected (3.2 ug/l) in a sample collected from Almy Pond on 8/18/19. No other samples collected in 2019 had detectable levels of anatoxin-a.

Anabaena, *Aphanizomenon*, and *Microcystis* spps. were the most frequently identified genera in samples collected in 2019. *Planktothrix* spp. was found in abundance in Georgiaville Pond and in a majority of collected samples accounted for over 99% of the cyanobacterial community. It is noted that, in 2018, *Planktothrix* spp. also dominated during a cyanobacteria bloom. Total cyanobacteria cell counts varied by waterbody with the highest cell counts (>500,000) observed in samples collected from Sisson Pond, Elm Lake, Georgiaville Pond, Slack Reservoir, Watson

Reservoir, Little Pond, and Little Wash Pond. The highest total cyanobacteria cell counts (> 27 million) was documented in a sample collected in Slack Reservoir on 10/31/2019. This same sample exhibited the highest microcystin level (50 ug/l) of samples collected in 2019.

With the exception of Georgiaville Pond, no follow up sampling was performed and all advisories expired on 12/17/2019 after site visits and visual confirmation of clear water conditions. The town of Smithfield conducted follow up sampling, per RIDEM/RIDOH requirements, on 7/18/19 and again on 8/1/19. Both samples met advisory rescindment requirements and on 8/2/19 the advisory was lifted.

In 2019, HABs were documented by RIDEM for the first time in Little Wash and Carbuncle Ponds. On October 11th, staff from the University of Rhode Island's Watershed Watch (URIWW) program notified RIDEM of a potential cyanobacteria bloom on Little Wash Pond in South Kingstown. RIDEM conducted a site visit on October 15th and observed a significant cyanobacteria bloom that appeared to be isolated to the eastern half of the pond. Two samples were collected from the eastern shore and submitted to the Health Department on October 17th. Both samples (S) consisted primarily of *Anabaena* spp. (S1/1,655,000 cells/ml and S2/1,621,000 cells/ml) and *Woronichinia* spp. (S1/45,000 cells/ml and S2/10,000 cells/ml). No cyanotoxins were detected in either of the samples.

Little Wash Pond receives flow from Wash Pond. No evidence of a cyanobacteria bloom was seen in Wash Pond on October 15th. Little Wash Pond is located on private property and there is no public access. An unmaintained trail partially surrounds Little Wash Pond however no homes are sited along the shoreline and it is unclear if the pond is used for either primary or secondary contact recreation or fishing use. RIDEM/RIDOH did not issue a recreational advisory for Little Wash Pond but results were shared with staff at URIWW. There appears to be private access to Wash Pond and it is sampled by a volunteer with URIWW. URIWW notified the volunteer of the results from Little Wash Pond.

Carbuncle Pond is a 39-acre pond completely within the Nicholas Farm Management Area in Coventry. The shoreline of the pond is undeveleoped. Carbuncle Pond is popular with anglers and swimming occurs in the pond. There are two gravel parking lots. The first provides access to a RIDEM-owned handicapped-accessible fishing pier and the second provides access to the concrete plank boat ramp. The pond is stocked with trout several times throughout the year. RIDEM received notice of cyanobacteria bloom in Carbuncle Pond on Aug 14th. The pond was evaluated the following day by RIDEM Fish and Wildlife staff and pictures were sent to the Office of Water Resources. The pictures revelaed a significant pond-wide bloom with scum along the eastern portion of the pond along the sand beach and fishing pier area. Samples were collected and submitted to the State Health Laboratory for analysis.

Out of an abundance of caution, and due to reports of individuals allowing their pets in the water, DEM's Fish and Wildlife staff posted cautionary signs at access points along the pond. RIDEM/RIDOH precautionary yellow signs that indicate that the algae may be toxic. The State Health Laboratory indicated that matrix interference caused by dense concentrations of algae/cyanobacteria affetcted the quality control and cyanotoxin concentrations could not be

determined. The dominant genus of cyanobacteria in the sample was *Anabaena* spp.; however, cell counts were below the 70,000 cells/ml threshold. Despite laboratory results, the pond continued to exhibit significant discoloration with scums along the eastern shoreline. Signage was left at access points and no follow up sampling was conducted on Carbuncle Pond.

Table 3. 2019 Response Visit Summaries.

Waterbody	Site Visit/Sample Date	Visual Summary of Bloom	Toxin Results (Anatoxin) (Microcystin)	Cyanobacteria ID/ Cell Count Total Cyano #	Advisory Issued/Rescinded (Basis)
Almy Pond	8/8/19	Pond-wide with scum/mat along shoreline	**Anatoxin-A (3.2 ug/l)**	Anabaena/10,350 Aphanizomenon/47,600 Microcystis/14,000 Total/71,950	Based on 8/8/19 visual and Cell Count
Sisson Pond	8/8/19 site visit 11/16/19 sample date	8/8/19 pond-wide w/scum 11/16/19 pond wide, no scum	Non-detect	Anabaena/21,850 Microcystis/278,600 Woronichinia/1,000,000 Total/1,300,450	Based on 8/8/19 visual
J.L. Curran Reservoir	8/7/19 site visit and sample collection	Pond-wide discoloration, no scum or mat	Non-detect	Anabaena/9,200 Aphanizomenon/184,800 Total/194,000	Based on 8/7/19 visual and cell count
Pleasure Lake- RWP	8/8/19 site visit and sample collection	Pond-wide discoloration, no scum or mat	Non-detect	Anabaena/22,310 Aphanizomenon/11,200 Total/39,110	Based on visual
Roosevelt Lake-RWP	8/8/19 site visit and sample collection	Pond-wide discoloration, some scum along shore	**Microcystin (8.2 ug/l)**	Anabaena/46,000 Microcystis/84,000 Woronichinia/150,000 Total/280,000	Based on visual, cell count, and toxin level
Elm Lake-RWP	8/8/19 site visit and sample collection	Pond-wide discoloration, no scum or mat	Non-detect	Anabaena/11,500 Aphanizomenon/1,792,000 Total/1,804,620	Based on visual and cell count
Mashapaug Pond	8/8/19 site visit and sample collection	Pond-wide discoloration, no scum or mat, streaking on surface	Non-detect	Anabaena/10,120 Aphanizomenon/109,200 Microcystis/5,600 Woronichinia/10,000 Total/134,920	Based on visual and cell count
Georgiaville Pond	7/9/19 site visit and 2 samples collected 8/1/19 site visit and samples collected	Green clumps pond wide and regularly dispersed No clear evidence of bloom	Non-detect	Sample 1 Planktothrix/112,000 Total/112,000 Sample 2 Planktothrix/1,204,000 Total/1,204,000 Sample 1 Anabaena/230 Microcystis/4,200 Planktothrix/280 Total/4,710	Based on visual and cell count Advisory rescinded based on analytical results and visual

Table 3. 2019 Response Visit Summaries (continued).

Waterbody	Site Visit/Sample Date	Visual Summary of Bloom	Toxin Results (Anatoxin) (Microcystin)	Cyanobacteria ID/ Cell Count Total Cyano #	Advisory Issued/Rescinded (Basis)
Carbuncle Pond	8/16/19 site visit	Pond-wide highly discolored, scum and mat present	Non-detect	Anabaena/62,100 Total/62,100	Based on visual
Little Pond (Sandy Pond)	9/4/19 site visit and 2 samples collected	Pond-wide highly discolored, no scum or mat reported	Non-detect	Sample 1 Anabaena/230 Aphanizomenon/420,000 Total/420,230 Sample 2 Anabaena/230 Aphanizomenon/728,000 Microcystis/1,400 Total/729,400	Based on visual and cell counts
Slack Reservoir	6/3/19 site visit and sample 9/27 site visit and sample 10/31/19 site visit and sample	Slight discoloration, no scum or mat Clear Northern shoreline scum, mat present	Non-detect **Microcystin (1.3 ug/l)** **Microcystin (50 ug/l)**	Sample 1 Anabaena/13,800 Total/13,800 Sample 2 Anabaena/380 Microcystis/9,800 Woronichinia/17,500 Total/28,680 Sample 3 Anabaena/2,300,000 Microcystis/67,200 Woronichinia/25M Total/27,367,200	Based on toxin result and cell count
Watson Reservoir	11/6/19 site visit and sample	Pond-wide, highly discolored, scum along windward shoreline	Non-detect	Aphanizomenon/4,760,000 Woronichinia/55,000 Total/4,815,000	Based on visual and cell count
Melville Ponds	6/28/19 site visit and sample	Pond-wide, highly discolored with streaks, scum along shoreline	**Microcystin (3.7 ug/l)**	Anabaena/29,000 Aphanizomenon/53,200 Microcystis/19,600 Total/102,700	Based on visual and cell count
Little Wash Pond	10/15/19 site visit and 2 samples	Pond-wide bright green bloom, scum along shore	Non-detect	Sample1 Anabaena/1,610,000 Woronichinia/45,000 Total/1,655,000 Sample 2 Anabaena/1,610,000 Microcystis/14,000 Woronichinia/10,000	None issued

Table 4. Additional information on 14 waterbodies impacted by cyanobacterial blooms in 2019.

Waterbody	Waterbody ID	Town	Date Advisory Posted	Date Advisory Rescinded
Melville Ponds	RI0007029L-01	Portsmouth	7/2/2019	12/17/2019
Almy Pond	RI0010047L-01	Newport	8/9/2019	12/17/2019
Sisson Pond	RI0007035L-10	Sisson Pond	8/9/2019	12/17/2019
JL Curran Reservoir	RI0006016L-02	Cranston	8/9/2019	12/17/2019
Pleasure Lake	RI0006017L-05	Providence	8/9/2019	12/17/2019
Roosevelt Lake	RI0006017L-05	Providence	8/9/2019	12/17/2019
Elm Lake	RI0006017L-05	Providence	8/9/2019	12/17/2019
Mashapaug Pond	RI0006017L-06	Providence	8/9/2019	12/17/2019
Georgiaville Pond	RI0002007L-02	Smithfield	7/10/2019	8/2/2019
Carbuncle Pond	RI0005011L-01	Coventry	8/16/2019	12/17/2019
Little Pond (Sandy Pond)	RI0007024L-01	Warwick	9/6/2019	12/17/2019
Slack Reservoir	RI0002007L-03	Smithfield-Johnston	11/4/2019	12/17/2019
Watson Reservoir	RI0007035L-07	Little Compton	11/8/2019	12/17/2019*
Paradise Pond	RI0007035L-02	Middletown	11/8/2019	12/17/2019

*Advisory for Waton Reservoir was not rescinded due to visual signs of the cyanobacteria bloom did not subside during the sampling period for 2019, but the last visual inspection of Watson Reservoir occurred on 12/17/2019

Reference

Hartman RT, Graffius JH (1960) Quantitative seasonal changes in the phytoplankton communities of Pymatuning Reservoir. Ecology 41(2): 334-340