2020 Annual Water Quality Report

JANUARY - DECEMBER 2020

Charles River Watershed Association

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River Science Program

The Charles River Watershed Association (CRWA) was formed in 1965 by a group of citizens in response to public concern about the declining condition of the Charles River. CRWA is one of the country's oldest watershed organizations and has figured prominently in major cleanup and protection efforts. CRWA works with government officials and citizen groups from 35 watershed towns in Massachusetts, from Hopkinton to Boston.

Milford town dump on the banks of the Charles, 1965.

Natural Valley Storage Area, Medfield, 1973.

CRWA has been measuring changes in the Charles River since 1995, and our River Science program serves as a model for watershed science programs across the country. Our program monitors water chemistry, pollution, cyanobacteria algal blooms, streamflows, invertebrate species, and invasive plants. Both the Environmental Protection Agency and the MA Department of Environmental Protection use CRWA's sampling data to develop and enforce water quality standards.

This program engages watershed residents as volunteer citizen scientists, who help to collect samples and assist with restoration projects. This annual report will describe and outline the data and methods for each area of watershed monitoring.

Sampling Programs

Volunteer Monthly Monitoring

Since 1995, the Volunteer Monthly Monitoring Program (VMM) has been an essential part of CRWA's work. Each month, over 80 community scientist volunteers gather at 35 sites along the stem of the Charles River to collect water samples, measure temperature and depth, and record river conditions. This monthly data helps us study the health of the river, reduce stormwater impacts and sewage contamination.

X-Cel Conservation Corps volunteers sample water quality and assess the overall habitat at a site on the Charles River.

VMM volunteers help CRWA collect essential water quality data each month.

Flagging Program

CRWA's Flagging Program notifies Lower Charles River boaters about the current state of the river's health from Watertown to Boston. Daily river health is predicted by models of bacteria levels, sampling results, notifications of combined sewer overflows (CSOs), and cyanobacteria blooms. Boathouses fly blue flags on days in which the river is boatable, and red flags on days the river is not boatable.

Biological Monitoring

Biological Monitoring allows CRWA to learn about the health of Charles River tributaries. Benthic macroinvertebrates (BMIs) are small river bugs that live on stream beds and banks, and healthy environments can support an abundance and diversity of BMIs. Along with bug sampling, volunteers conduct habitat assessments to observe overall stream health. These data are then used to identify restoration projects or areas needing further study.

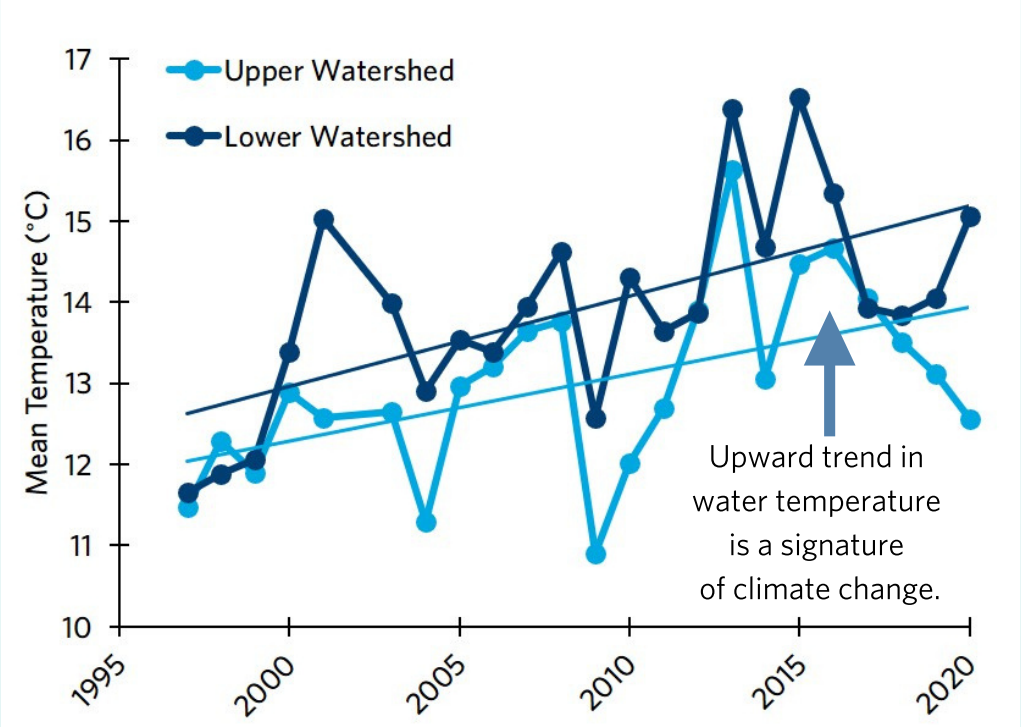
Cyanobacteria

During the summer we monitor levels of cyanobacteria, or blue-green algae, in the Charles River Lower Basin. In warm weather and with excess nutrients, these cyanobacteria populations experience "blooms", which have negative health effects on humans, animals, and the ecosystem. CRWA determines the presence and intensity of cyanobacteria blooms and reports high cyanobacteria levels to the Department of Public Health.

Temperature and Depth

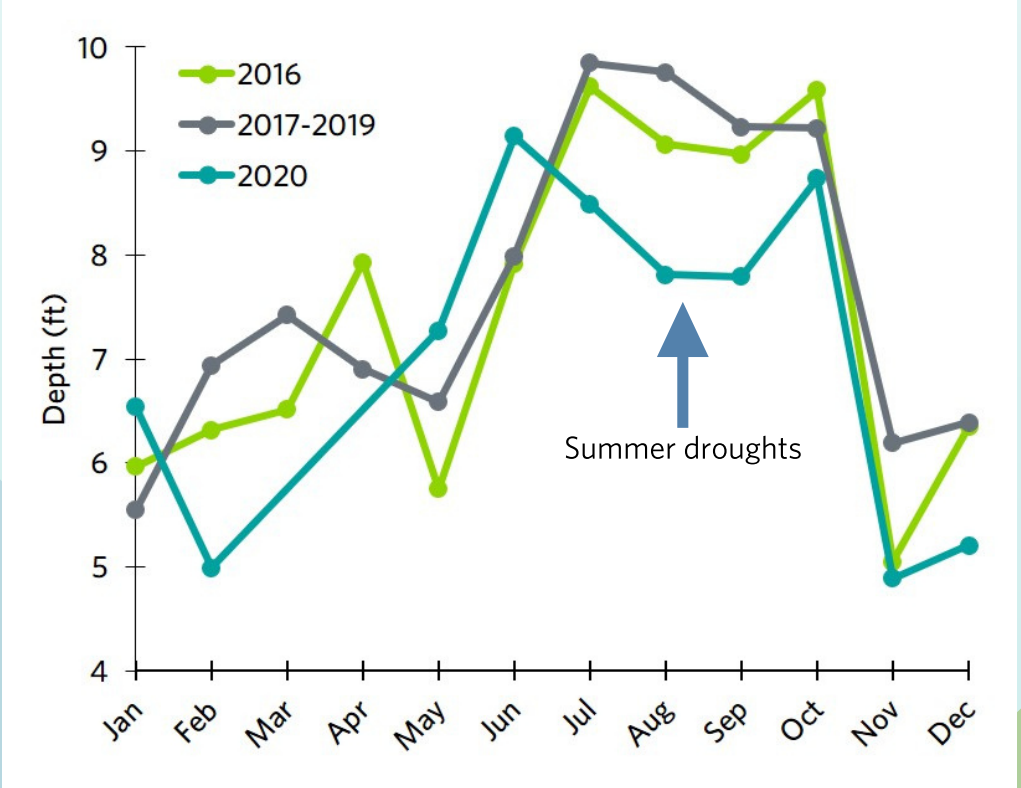
Temperature over Time

Temperature is a quantitative measure of overall water quality, as water temperature has an enormous effect on river ecosystems. Warm water temperatures can be harmful to certain species of fish. Monitoring temperature highlights differences between sites, and identifies "hot spots": areas that are more susceptible to impacts of climate change.



Average temperatures measured in the upper and lower sections of the watershed over time.

2020 Drought



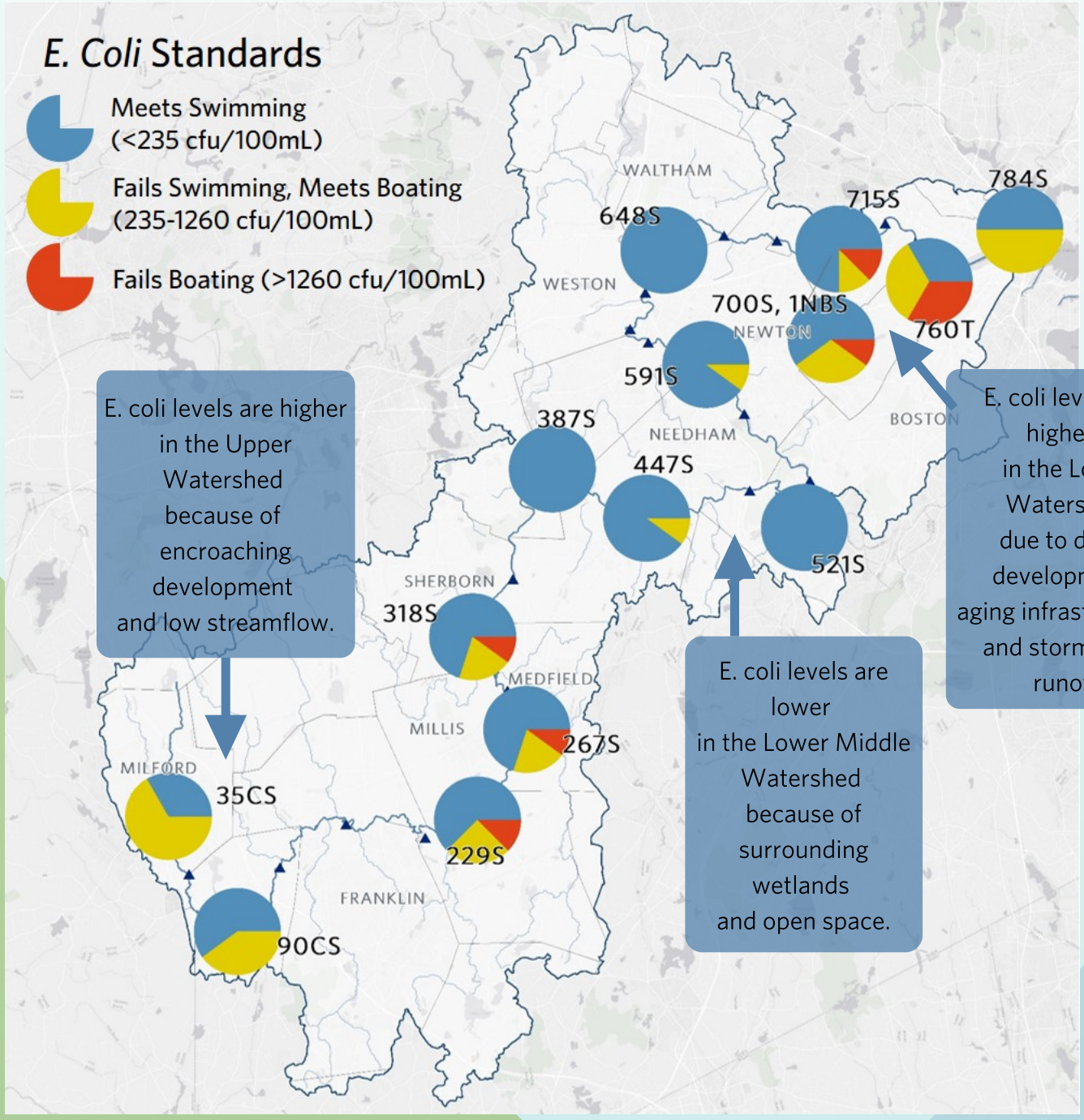
5 Average river depths in 2016-2020. 2016 and 2020 were drought years, while the intervening years were not.

River depth naturally varies with the seasonal and annual effects of runoff, precipitation levels, and water withdrawals. If the depth is too low, the amount of aquatic habitat available may be reduced and the river can experience greater warming. On the Charles, depth varies significantly due to the location of dams. Over time, depth may decrease as sediments settle in the river. Monitoring the river depth allows us to observe the balance of these factors and alert officials if there are problems. Depth and temperature are collected as part of the VMM, Flagging, and Cyanobacteria monitoring programs. In total, CRWA and our volunteers collected 310 temperature and 224 depth measurements in 2020.

E. coli

Escherichia coli (E. coli) is a bacteria species which is frequently used as an indicator of water quality. High concentrations of E. coli in the river indicate the presence of pathogens which may be harmful to human health. In 2020, CRWA's VMM and Flagging programs collected 451 E. coli bacteria samples in the Charles River and its tributaries. Here, we compare these levels to Massachusetts' Water Quality Standards for each sample: 235 cfu/100mL for primary contact (the "swimming" standard) and 1260 cfu/100mL for secondary contact (the "boating" standard).

2020 E. coli

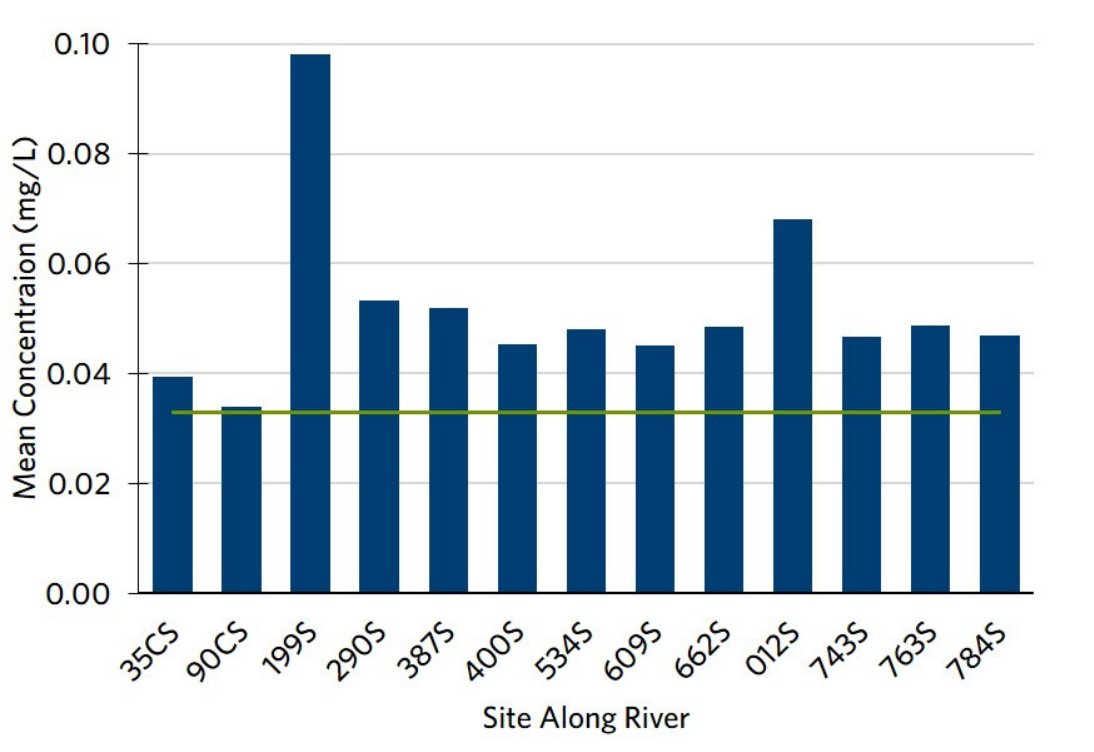


Percentage of samples meeting each E. coli standard at select sites.

Phosphorus

Nutrient pollution, particularly phosphorus pollution, is a serious issue for the Charles River, primarily caused by stormwater runoff from urban areas. An excess of nutrients causes cyanobacteria blooms and invasive plant growth, which lead to ecosystem imbalance. The VMM program samples various nutrient parameters at 13 sites four times per year. In 2020, 29 samples of Total Phosphorus were collected on the main stem of the river and compared to the action limit of 0.0328 mg/L.

2020 Phosphorus



Mean phosphorus concentrations do not meet the EPA action limit at any site where it is measured.

Phosphorus Through Time

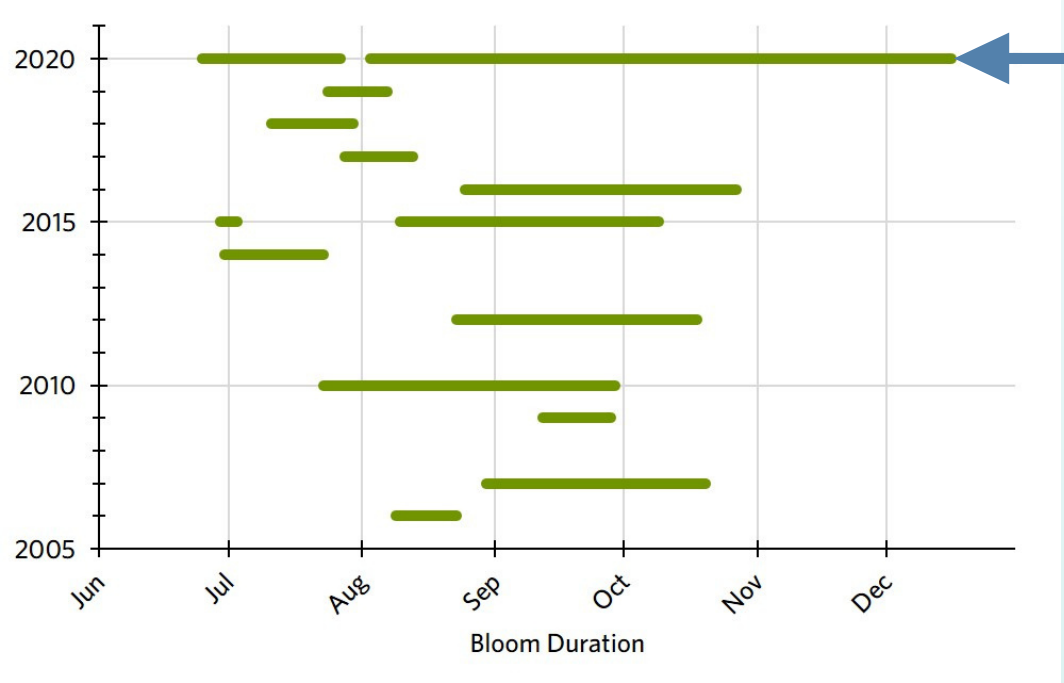
While phosphorus concentrations have decreased over time, they still exceed the EPA action limit.

Cyanobacteria

From early summer through fall, CRWA monitors cyanobacteria concentrations at three sites in the Lower Basin of the Charles River. Collecting samples and making visual observations allows us to track the progression of blooms that may arise. When blooms begin, we notify the Mass. Department of Public Health (DPH), which determines if a bloom advisory should be put in place. CRWA also includes bloom notifications in our Flagging program, flying red flags when DPH recommends an advisory, as cyanobacteria toxins indicate a potential for public health risks.

Charles River Lower Basin Blooms

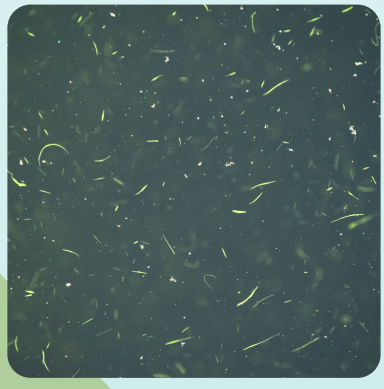
Lower Basin cyanobacteria bloom lengths since 2006.



Drought conditions in 2020 contributed to an extended bloom.

In 2020, CRWA and our volunteers collected 48 samples of cyanobacteria and made 95 visual observations at 16 locations in the Lower Basin and the Lakes District of the Charles River. Because of higher than normal temperatures and lower than normal precipitation, the Lower Basin experienced an historic 169 day long bloom in the Lower Basin and a 41 day bloom in the Lakes District.

Sampling cyanobacteria at the Museum of Science.



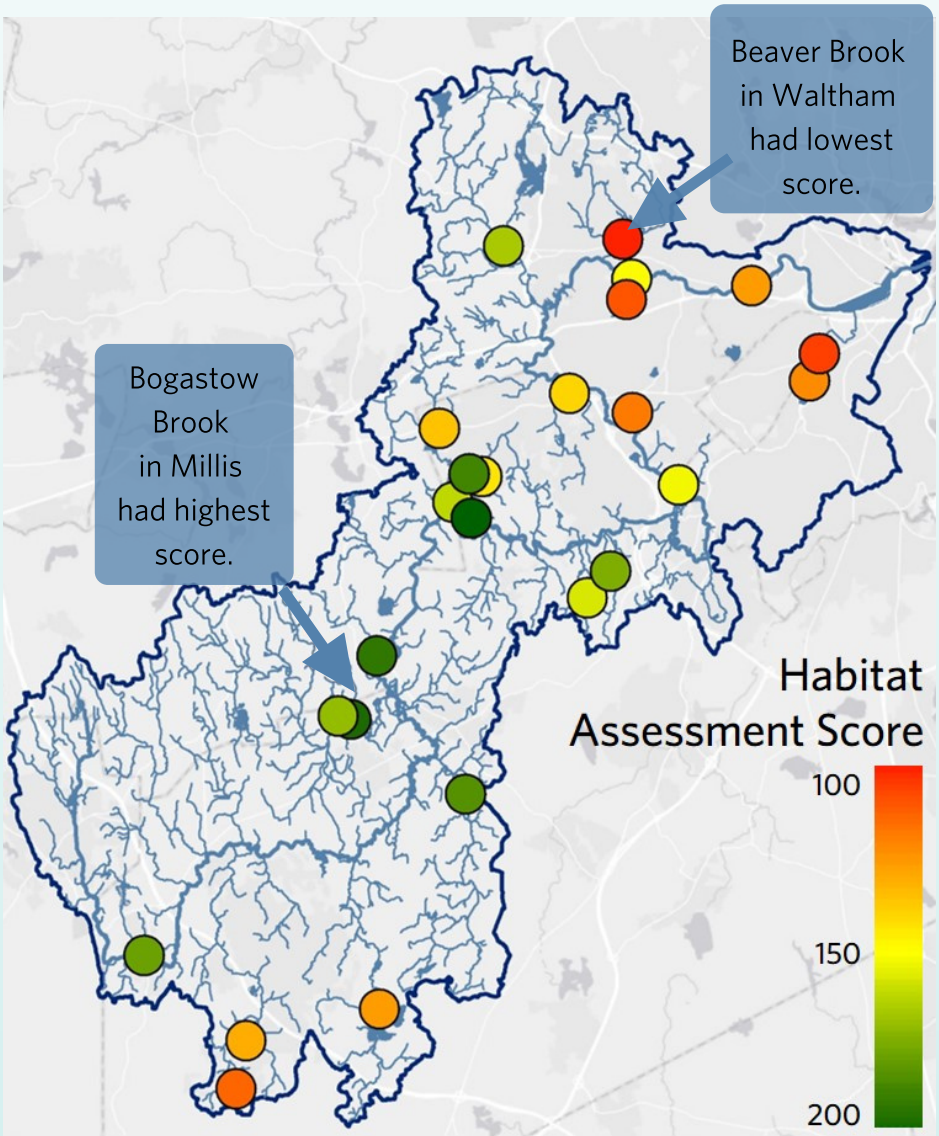
Close up of cyanobacteria under water.

Making a visual assessment with our new monitoring app.

Biological Monitoring

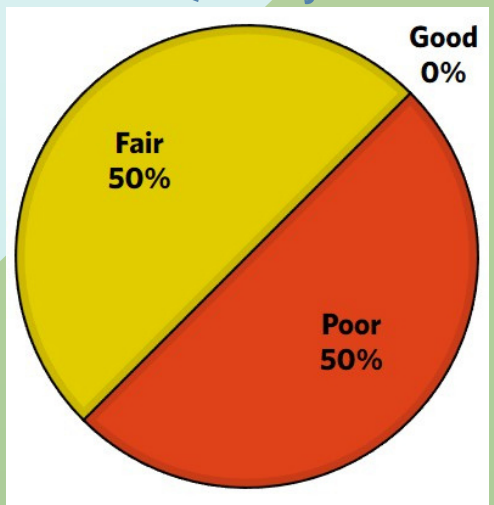
In 2020, 54 volunteers sampled at 25 sites throughout the Charles River Watershed. Using EPA Bioassessment and Habitat Assessment forms, volunteers and CRWA staff translate aquatic animal and invertebrate population data and habitat assessment scores into overall water quality scores.

2020 Habitat Assessment Scores



Habitat assessments scores collected at 25 tributaries in 2020.

2020 Water Quality Scores



2020 water quality scores based on EPA streamside standards for 10 sites in the Charles River watershed.

What's Being Done?

Efforts to Improve the Charles River

CRWA's work strives to improve Charles River water quality through science, engineering, and advocacy. Below are only some of the ways this has happened in 2020!

Water quality monitoring allows CRWA to both keep track of long-term trends and respond to evolving conditions. During summer, the Flagging program notifies boaters of water quality conditions on a daily basis. CRWA also informs the Mass. Department of Public Health when cyanobacteria blooms are apparent and alert river users to the conditions. Every season, data is reported to Mass. Department of Environmental Protection and the EPA to help them determine a list of impaired water bodies.

In 2020, CRWA helped to pass statewide legislation, requiring public notification in the event of a combined sewer overflow (CSO). CSOs are discharges of raw sewage and stormwater, which occur when heavy rainfall overwhelms sewer pipe capacities and result in large amounts of contaminated water flowing into the Charles River. By making the public aware of potential health risks due to contamination in the river, we can not only better protect public health but also spur progress on eliminating sewage discharges entirely.

CRWA's Blue Cities initiative uses modern engineering to recreate the natural water cycle in a developed environment. CRWA works with partners to design and build nature-based solutions, which mimic natural processes to treat stormwater runoff. CRWA recommends retrofits to streets, parking lots, and other areas to reduce risk of flooding and pollution through green infrastructure installations. In 2020, CRWA completed a subwatershed restoration plan with Milford, and continued to work on a green streets plan in Natick.

The EPA's Small Municipal Separate Storm Sewer System (MS4) general permit requires municipalities to take steps to improve stormwater runoff management in the Charles River watershed and reduce phosphorus concentrations. In 2020, CRWA continued to educate watershed communities about their obligations under the permit and assisted them in meeting those obligations.

While communities are taking steps to reduce stormwater pollution in the Charles, private property owners must also address the issue. CRWA, along with Conservation Law Foundation, petitioned the EPA in 2019 to require large properties to do more to manage their stormwater on site. In 2020, we are continuing to push the EPA to take the step of regulating these polluters.

Acknowledgements

Thank You for Your Help!

Charles River Watershed Association is immensely grateful to all of its funders, volunteers, and partners. Without you, we would not be able to continue monitoring the health of the Charles River, or effectively address the challenges caused by pollution, contamination and runoff, and climate change. Thank you for all that you do!

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Biological Monitoring Volunteers

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Cyanobacteria Volunteers

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Volunteer Monthly Monitoring Volunteers

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Bill Lawson
Bill Nicholson
Bob Schlauch
Brad Nissenbaum
Brian Merson
Cameron Bechman
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Earl Fahey
Ed Wertheim
Emily Kerr
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Fred Hewett
Ginger Lawrence
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