Charter Boat Captains Help to Monitor Lake Erie Water Quality

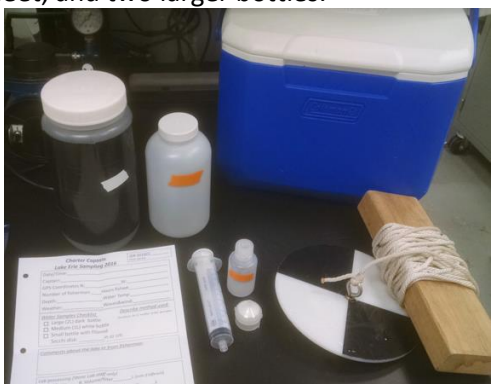
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Why do captains collect water samples?

Routine monitoring programs are needed to determine the water quality of Lake Erie. Many of these programs focus on scientists doing the work, but programs that involve volunteers can perform two functions: augmenting the scientists' data and educating people on the science that addresses water quality issues. Charter fishing boats spend several days per week on the lake with people who already have an interest in Lake Erie. Training charter captains to collect water samples can increase existing monitoring programs and provide a valuable learning experience to anglers.

The captains' sample kit includes (clockwise) a cooler, Secchi disk, syringe and filter to remove particles from a small sample, a data sheet, and two larger bottles.



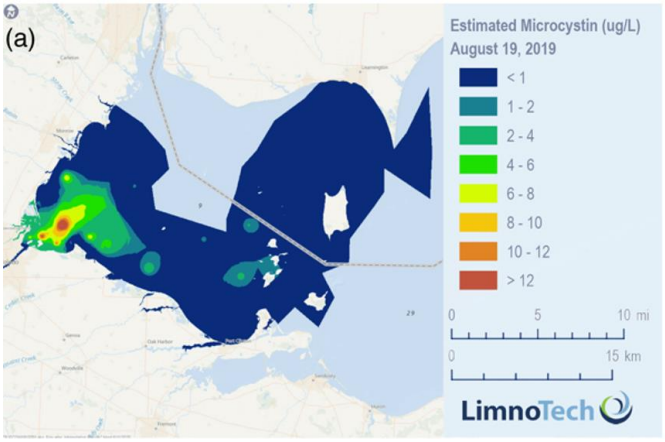
In 2012, several captains in the Lake Erie Charter Boat Association began to collect water samples in the western basin of Lake Erie under Ohio EPA guidance. Stone Laboratory took over coordination of the sampling program the following year, with funding provided by Ohio EPA. Currently, the program is funded by the Ocean and Human Health program administered by the National Institutes of Health and the National Science Foundation. The overall process is pretty simple. Once a week during the fishing season (usually on Monday), captains fill sample bottles with lake water, record water transparency with a Secchi disk, and record their GPS location and water temperature on a datasheet. The samples are placed in a cooler and dropped off at a designated location near their marina. Stone Lab staff picks up the samples later in the day and replaces them with clean, empty bottles for the captain to use for the next week. Stone Lab processes the samples as if they collected the samples.

The primary focus of the captain's water quality program focuses on Harmful Algal Blooms (HABs). HABs in Lake Erie are formed by a type of bacteria called cyanobacteria. These cyanobacteria are also called "blue-green algae" due to their bluish-green color and their behavior like other algae. Cyanobacteria can produce a toxin, called microcystin, which was responsible for Toledo's 2014 do not drink advisory. HABs form during the warm summer months, and their size in Lake Erie depends on how much rainfall it receives during the spring and early summer. More rain brings more of the growth-stimulating fertilizers (phosphorus and nitrogen) to Lake Erie via runoff, which results in a larger bloom. While researchers can predict how much algae will be in the lake, they are still working on what causes algae to produce the microcystin toxins because there is no correlation between toxins and algae levels.

How has the captains' *data been used?*

Lake Erie is too large for any one institution or agency to monitor its water quality. Researchers from NOAA, the University of Toledo, Stone Lab, Ohio EPA, ODNR, and others collect samples at various locations in Lake Erie. The captains' data augments these datasets, and all data are combined into one extensive database. One example of data output from the combined dataset is maps of microcystin toxin concentrations in the western basin. Working with researchers from Michigan Technological University and LimnoTech with funds from NOAA, Stone Lab used microcystin maps to assess a new microcystin model developed to forecast the toxin's concentration one week in advance. The researchers found that their model was 88% accurate at predicting if microcystin concentration would increase or decrease at the Toledo crib from one week to the next. This information can be used by at the water treatment plant to better prepare for HAB toxins. The microcystin maps and the forecasts would be less accurate without the captains' data.

The microcystin concentration map for August 19, 2019. The map was made with data collected by charter captains, NOAA, U Toledo, Stone Lab, and Ohio EPA.



The captains' samples were analyzed for all the standard water quality variables, including total and dissolved phosphorus and nitrogen concentrations, microcystins, total algae biomass, and biomass of cyanobacteria as well as beneficial algae like green algae, diatoms, and cryptophytes. Many researchers have contacted Stone Lab requesting the captains' dataset. The data is publicly available on Ohio Sea Grant's webpage and in NOAA's data repository.

Benefits of the captains program.

1. Expanded Data Collection: By leveraging the network of charter boat captains who operate on the water regularly, the program can collect a larger number of water samples from various locations, which can significantly expand the data collection efforts of the scientists. This can provide a more comprehensive understanding of water quality in different areas, which can be valuable for research, monitoring, and management purposes.

2. Increased Spatial Coverage: Charter boat captains can cover a wider geographic area when compared to scientists alone, and they operate in different regions of interest. This allows for a more extensive sampling coverage, providing a more holistic picture of water quality conditions in a particular region or ecosystem.

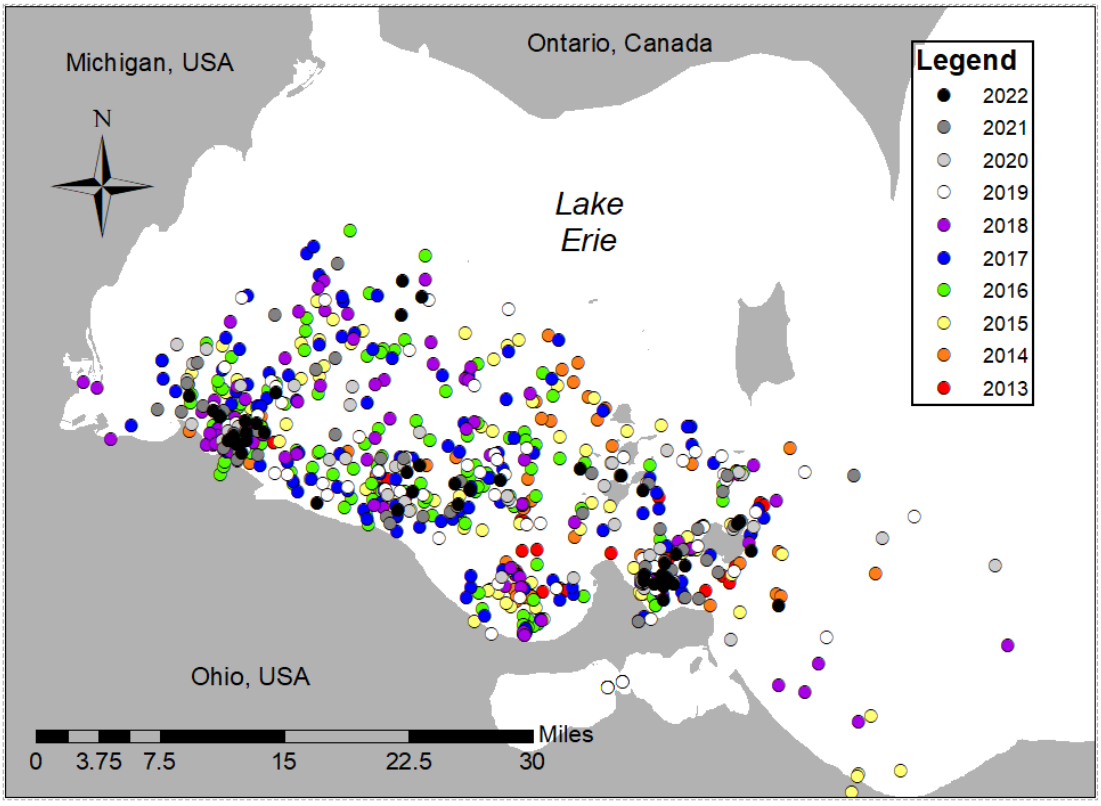
3. Enhanced Sampling Frequency: Charter boat captains can collect water samples more frequently due to their regular operations on the water. This increased sampling frequency can provide valuable temporal data on water quality dynamics, such as seasonal or episodic changes,

which may not be possible with limited resources or personnel. This temporal data can help detect trends, patterns, and changes in water quality, and can aid in understanding the impacts of various factors on the ecosystem.

4. Cost-Effective Approach: Partnering with charter boat captains can be a cost-effective approach for water sample collection, as it can utilize the existing infrastructure and resources of the charter boat operators. This can help reduce the overall cost of the data collection program, making it more financially feasible for research and monitoring efforts.

5. Stakeholder Engagement: Involving charter boat captains in water sample collection can foster stakeholder engagement and participation in the scientific process. Charter boat operators have a vested interest in the health and sustainability of water bodies where they operate, and engaging them in data collection can enhance their understanding of water quality issues and foster a sense of ownership and stewardship. This can also create opportunities for knowledge sharing and collaboration between scientists and charter boat captains.

The captains have collected a total 842 since 2013. The highest density of samples is around the Toledo water intake, the reefs, Port Clinton area, and between Marblehead and Kelleys Island, but the captains have also collected a high number of samples in the middle of the basin and near the US-Canadian border.



Overall, the partnership between Stone Lab and charter boat captains for water sample collection can provide a synergistic approach to water quality monitoring, leveraging the strengths and capabilities of both scientists and charter boat operators. It can lead to more comprehensive data

collection efforts, increased spatial and temporal coverage, cost-effective sampling, and stakeholder engagement, ultimately benefiting research, management, and conservation efforts related to water quality and ecosystem health.