TCF - Quinnipiac River Fund Final Report

Instructions

QUINNIPIAC RIVER FUND GRANT AWARD - FINAL REPORT QUESTIONS

This form is to be completed by all nonprofit organizations that received a grant through the Quinnipiac River Fund.

Grant Details

Grant Details

Organization Name

Quinnipiac University

Grant Description

to support the monitoring of pharmaceuticals and personal care products (PPCPs) and water quality in the Quinnipiac River.

Total Grant Amount

16,000.00

Report Questions

1. List the specific objectives/outcomes of the project and tell how they were met during the grant period. Also, provide an update on any special conditions of the grant (if applicable).

Objective 1: Continue to refine method development of PPCP concentrations using solid-phase extraction (SPE) cartridges, extraction, and analysis via GC-MS. Method development will continue to be optimized to enhance compound recovery and detection by testing derivatization of the SPE extract.

SPE concentration for PPCP identification was more streamlined and uniform between samples with samples able to be concentrated directly after collection, instead of having to be frozen. This helped maintain reproducibility between samples. However, derivatization of the SPE extract was not as successful as we had hoped, so we pivoted to see if we could detect four anthropogenic compounds using (caffeine, acetaminophen, acetylsalicylic acid (aspirin), and ibuprofen) an HPLC with a photodiode array. These compounds were selected based on previous identification in river water samples and because they are primarily derived from anthropogenic use. The extracts did not show any caffeine or ibuprofen. There may be some aspirin or acetaminophen, but results are still being interpreted since their retention times are similar to each other as well as another compound.

Base-extraction of particulate matter (BEPOM) on filters was performed, to gain additional information about the particulate matter in the river. The extract was then analyzed by absorbance and fluorescence spectroscopy. This technique provides information about the material in the river that is >0.7 μm showing if it is due to primary production or has been washed into the river.

Objective 2: Collect and analyze water samples between Meriden and New Haven, CT including above and below municipal wastewater treatment plants. At each sampling location, in situ temperature, pH, and salinity will be measured, and bulk samples collected for the analysis of PPCPs, dissolved nitrate, nitrite, organic carbon (DOC) concentrations, absorbance and fluorescence, and E. coli and total coliform.

Samples were collected five times between June-August 2024 and three times between November 2024 and January 2025. Samples were collected at eight locations between Meriden and New Haven, CT including above and below three wastewater treatment plants. An additional sampling location was added for this sampling year at the Front Street boat launch in New Haven, to have another sampling location in the tidal area, south of the Quinnipiac River Marsh. For locations influenced by tides, sampling was always conducted on the outgoing tide. Summer water temperature, pH, and salinities ranged from 20.6-27.3 °C, 7.33-8.24, and 0.12-24.3 ppt, respectively, while winter water temperature, pH, and salinities were 0.1-9.5 °C, 6.22-7.97, and 0.13-25.5 ppt, respectively. PPCP analysis using GC-MS analysis resulted in five identified compounds in the summer and twenty-one compounds identified in the winter, all at low levels. Galaxolide (a synthetic fragrance) and 2,4-di-tert-butylphenol (a commercial antioxidant that is also produced naturally) were most frequently occurring compounds identified in 19% and 16% of samples, respectively. Initial results from HPLC analysis of the SPE extracts showed no detection of caffeine or ibuprofen, while results of aspirin and acetaminophen are still being assessed if they were detected or something else coeluted. Nitrate concentrations ranged from below detection limit (BDL) to 97.6 µM in summer and 2.2 to 89.1 µM in winter, while nitrite concentrations ranged from 0.2 to 3.0 µM in summer and 0.2-8.1 µM in winter. Both nitrate and nitrite typically increased as salinity decreased for the four southern-most sampling locations in both summer and winter. while the four northern-most locations were more highly variable, likely due to changes in inputs and biological and photochemical transformations. While river water will not be consumed without treatment, all concentrations did fall below the EPA's drinking water standard for both nitrate (714 µM) and nitrite (71 µM). 56% of the samples analyzed surpassed the EPA's threshold for E. coli. The higher salinity locations generally had lower colony counts than freshwater locations, and winter samples were elevated over summer samples. Summer DOC concentrations (1.9-4.7 mg/L) were nearly identical to concentrations measured in 2023-2024 (1.9-4.6 mg/L), with slightly more variability at Pragemann Park and Hanover Pond. Winter DOC concentrations (1.7-8.4 mg/L) were more variable, with higher salinity locations having more stable DOC concentrations and greater variability between sampling dates for the more freshwater locations. This is likely due to two winter samplings being conducted following heavy rain events. Fluorescence spectroscopy of both filtrate and BEPOM samples indicated lower overall fluorescence intensity but greater contribution of freshly produced organic matter in the higher salinity locations compared to the lower salinity locations.

Objective 3: Disseminate study results through presentation of research at a conference and through Quinnipiac University's Public Relations Office to local news outlets.

Two students worked on this project from June 2024 to April 2025. One student presented their poster at the local ACS-New Haven 9th Annual Student Research Symposium held at Yale on 4/26/2025 focusing on the PPCP and DOC analysis and results. A second student presented their poster at the 14th Annual Quinnipiac Sigma Xi Student Research Symposium at Quinnipiac University on 4/23/2025, focusing on water quality parameters. Both students also presented at the Quinnipiac University CAS Illuminate Student Research Symposium on 5/2/2025. I presented a poster at the Aquatic Sciences Meeting in Charlotte, NC March 26-31, 2025, which provided an overview of our findings for the last two years.

2. Please share your successes, challenges and any lessons learned through the implementation of your project. Were there any unintended consequences or lessons learned that may affect how you operate your program moving forward?

Overall, the project was successful and resulted in two students gaining field and laboratory skills, as well as experience making and presenting posters at local conferences. One student was even hired to do similar water quality testing this summer. Discussion with colleagues at the ASM conference provided guidance on additional statistical modeling that could be done to tease out differences within the fluorescence results to hopefully improve identification of differences between samples collected above and below water treatment plants. We were disappointed that we were not able to markedly improve the PPCP analysis with our current instrumentation. However, we were surprised that winter samples had much higher occurrences and numbers of compounds detected. It is possible that this is due to higher microbial

and/or photochemical degradation of these compounds during the summer and/or possible degradation within the water treatment plants when chlorination is used during summer months. No unintended consequences were noted during this year.

3. What are the opportunities and needs of your organization as it continues to move forward with its work to positively impact the Quinnipiac River?

The Quinnipiac River is an important resource for both humans and organisms that live in and around the river. River water quality can directly impact the health of all organisms that use it and therefore, continued monitoring of water quality parameters including pH, salinity, dissolved organic carbon, nutrients, as well as emerging contaminates will be important. This is especially true as climate change is expected to increase the frequency of intense storms with high rainfall amounts, sea level rise, and seasonal temperatures. Higher frequency storms may increase run-off, adding pulses of organic matter and emerging contaminates into the river. Additionally, anthropogenic activities in and around the river could alter the type and amounts of compounds entering the river. Continued monitoring of the river during this critical time will be important to identify issues early and keep the river healthy for all who use it.

Attachments

Financial information (required): Please provide a detailed accounting of how the specific grant dollars were spent based on the budget submitted in the grant application.

Detailed Accounting

61-6096_Kinsey_CFGNH_2025.04.30.2025.05.09.xlsx

Pictures (optional): Please attach one to three pictures in JPEG format, in the highest resolution possible, of activities that have occurred throughout the grant period as a result of grant funding. By providing pictures, your organization is consenting to unlimited use of the pictures by The Community Foundation for Greater New Haven and/or the Valley Community Foundation in publications in print and online (including www.thequinnipiacriver.com). Please include a description of each photo and, when known, the photographer to be credited.

Picture 1

20240811_092841.jpg

Description and Photo Credit

Student admiring the Quinnipiac River marsh prior to sampling at the DEEP boat launch. (Photo credit: J. Kinsey)

Picture 2

20250108_115227.jpg

Description and Photo Credit

Hanover Pond in Meriden, CT on a chilly January day. (Photo credit: J. Kinsey)

Picture 3

Description and Photo Credit