The COMMUNITY Foundation for Greater New Haven
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QUINNIPIAC RIVER FUND FINAL REPORT- 2020

Please complete and submit completed form via e-mail to dcanning@cfgnh.org at The Community Foundation for Greater New Haven by March 31, 2020 (or as otherwise stated on the terms of grant).

Date: ____September 18, 2020_____

Group/Organization Name: ____Southern Connecticut State University_____

Address: ____501 Crescent Street_____

City, State, & Zip: _____New Haven, CT, 06515_____

Telephone #: ___203-392-6602_____

Project Name: ___Examination of the Seasonal Variation in the Composition and Quantity of Microplastic Particles from Wastewater Treatment Facilities_____

Grant Number: ___20190127_____

Name & title of person completing this form: ___Vincent Breslin, Professor, Environment, Geography and Marine Sciences_____

E-mail address: ___breslinv1@southernct.edu_____

Please respond to the following statements:

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).

   The following specific objectives were proposed:

1. **Objective:** Sample microplastics at the North Haven and Meriden WWTFs seasonally during July 2019, October 2019, January 2020 and April 2020 from the treated wastewater discharge channel using an 80 µm mesh plankton net.

Outcome: North Haven and Meriden WWTPs were each sampled seasonally for microplastics in spring (May 2019), summer (July 2019), fall (November 2019) and winter (February 2020).

2. **Objective:** Isolated microplastic particles will be microscopically examined to classify each microplastic particle as a fiber, bead, foam, or fragment. Within each category, the microplastics will also be classified by color and size.

   Outcome: Over 6,000 microplastics were collected during this study. The majority of the microplastics identified were microfibers (74%), while lower quantities were classified as films (21%) and fragments (5%). **Only one microbead was found**. Microfibers were classified according to five color categories. White/clear was overwhelmingly the most abundant, accounting for about 64% of all microfibers. Lesser percentages were identified as black (24%), red (7%), blue (4%), and green (< 1%). Microfibers were also categorized by size, with 72% being ≤ 600 µm in length.

3. **Objective:** Where possible, depending on microplastic dimensions, microplastics will be classified by polymer composition using infrared – attenuated total reflectance (IR-ATR) spectroscopy.

   Outcome: IR-ATR spectroscopy successfully revealed that a selected film and fragment were both polyethylene and a microfiber was determined to be polyester.

4. **Objective:** Results of the laboratory analyses will be used to calculate microplastic concentrations in WWTF effluent and calculate seasonal and annual microplastic discharges.

   Outcome: Average seasonal wastewater microfiber concentrations ranged from 0.007–0.019 mf/l and average seasonal microplastic concentrations ranged from 0.009–0.025 mp/l. Box and whisker plots showed that there was no significant difference between total mean microfiber or microplastic concentrations between the Meriden and North Haven WWTPs. Linear regression modeling showed that Meriden WWTP had a statistically significant trend between microplastic/microfiber concentrations and seasonal temperature. North Haven WWTP shared a similar relationship with microplastic/microfiber concentrations and temperature, but it was not statistically significant.

   Outcome: Based upon each WWTPs discharge volume and the mean microplastic concentration (0.017 mp/l), it was estimated that Meriden WWTP discharges 746,000 microplastics daily and over 272 million microplastics annually, while North Haven WWTP releases 200,000 microplastics daily and over 72 million microplastics annually.

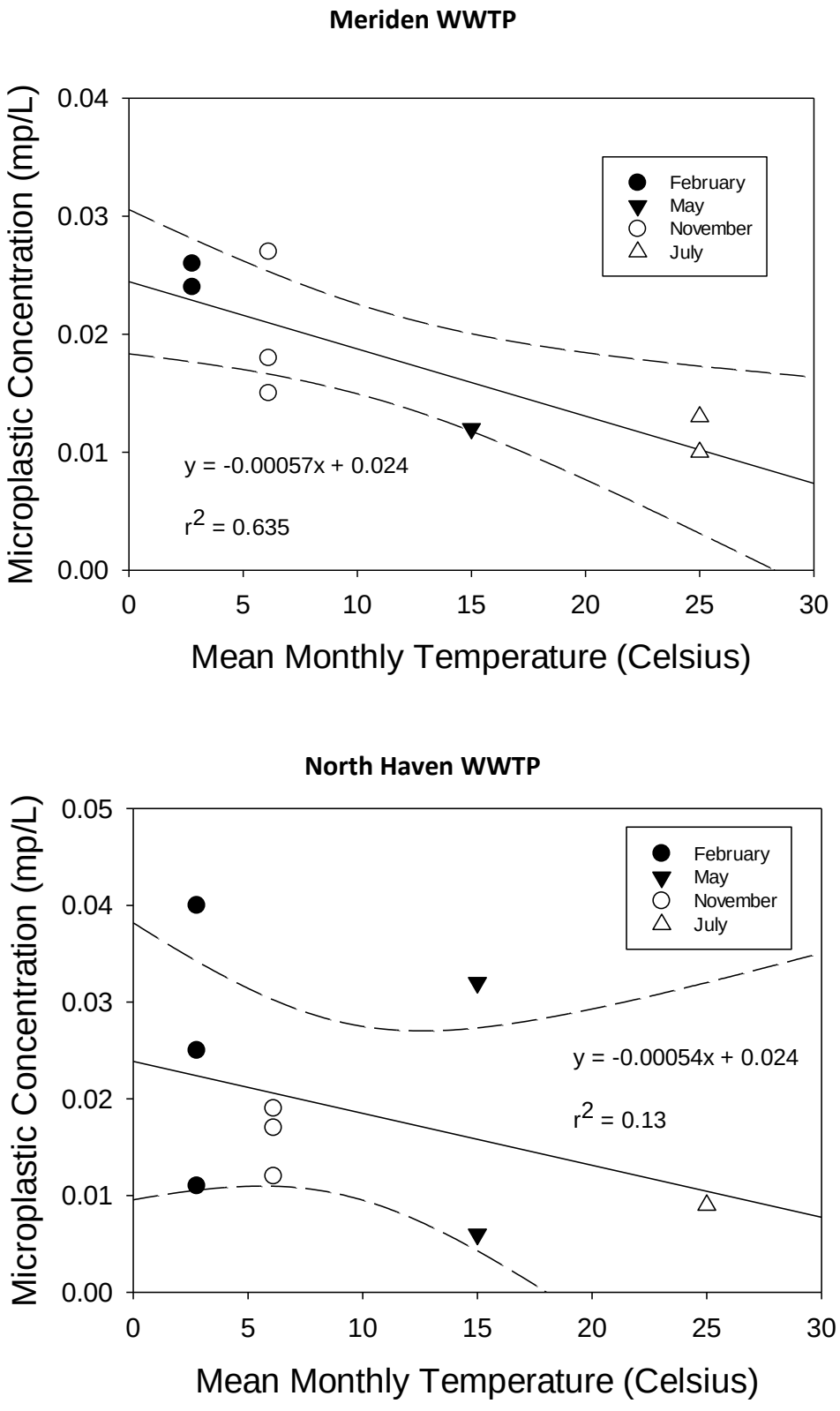

Figure 1: Linear regression models for seasonal microplastic concentrations for Meriden and North Haven WWTPs.

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?

   The collection of waste water for microplastics from these two facilities was challenging. One of the major challenges in this work was determining the appropriate plankton net sampling times in the wastewater discharge channels. The total suspended solids concentrations and water flow rates vary daily and seasonally in these facilities and many samples need to be collected to obtain samples with optimum suspended solids to complete the wet peroxide oxidation procedures properly. For some seasons, these challenges resulted in only one wastewater sample processed for microplastics. We were gratified by the commitment of the staff at both the North Haven and Meriden WWTPs in collaborating with us to access the facilities and conduct our sampling protocols. The results of our study represent an important step forward in understanding the quantities and types of microplastics released into the Quinnipiac river. The lack of microbeads found in our samples points to the success of legislation banning the use of plastic microbeads in consumer cosmetic products.

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?

   Results of our study clearly show the nature and extent of microplastics in treated wastewater discharged to the Quinnipiac river. The trend in increasing wastewater microplastic concentrations with decreasing seasonal temperatures is an important result that merits further study.

Also, please email a photo or image that can be uploaded along with your report to The Quinnipiac River Fund website to dcanning@cfgnh.org.