The Community Foundation *for* Greater New Haven

# QUINNIPIAC RIVER FUND FINAL REPORT- 2015

Please complete and submit completed form via e-mail to dcanning@cfgnh.org at The Community Foundation for Greater New Haven by March 31, 2016.

Date: 12/01/2016

Group/Organization Name: University of New Haven

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City, State, & Zip: West Haven CT 06516

Telephone #: 203-931-2926

Project Name: Ecotoxicology of the Quinnipiac River: detection of estrogenic substances and toxicity in the Quinnipiac River watershed.

Grant Number: 20150151

Name & title of person completing this form: Melanie Eldridge, Assistant Professor of Biology and Environmental Science

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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).

Results from our objectives are listed below (following each objective (A, B, C) as listed in the grant application):

**A. Identify sites that are most likely to be impacted by anthropogenic inputs to the watershed.** Examine watershed data and previous QRF reports to determine which areas along the river are the most likely to be impacted by anthropogenic inputs.

- We have identified six sampling sites along the Quinnipiac River to examine endocrine disrupting inputs into the watershed. The sampling sites are depicted in Figure 1.

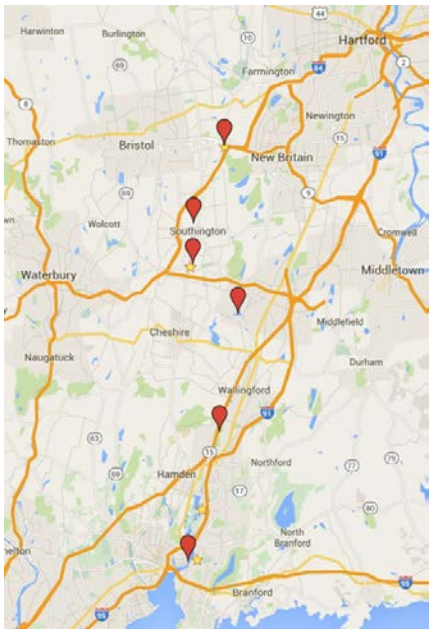


**Figure 1. Map of sampling sites along the Quinnipiac River watershed.**
Six sampling sites were selected for this study:

1) Hamlin Pond Park
   Plainville, CT
2) Farmington Canal Heritage Trail
   Southington, CT
3) Meriden-Waterbury Turnpike,
   Plantsville, CT
4) Hanover Pond,
   Meriden, CT
5) Quinnipiac River State Park,
   North Haven, CT
6) Quinnipiac River Park,
   Fair Haven, CT

**B. Survey sites along Quinnipiac River, upstream, at source, and downstream of possible sources to determine if the input causes an estrogenic response and whether it is a seasonal effect.** Water samples will be collected, solid phase extracted, and processed with bioluminescent yeast bioassays to determine the concentration of bioavailable estrogens and any toxic substances. We will also collect samples along parts of the river not known to have anthropogenic inputs such that unknown sources can be identified, if present.

- We have completed sampling, extractions, and yeast assays for the six sites each month, beginning in May 2015 through March 2016. We have processed samples with bioluminescent yeast bioassays (for an example of typical yeast bioassay output, see Figure 2) and calculated the amount of estrogenic substances present (Table 1). Interestingly, we detected a number of positives (samples that, once extracted, caused light to be produced by our genetically engineered yeast). This means that there are substances present in the river that may interact with the human estrogen receptor (for concentrations, see Table 1).

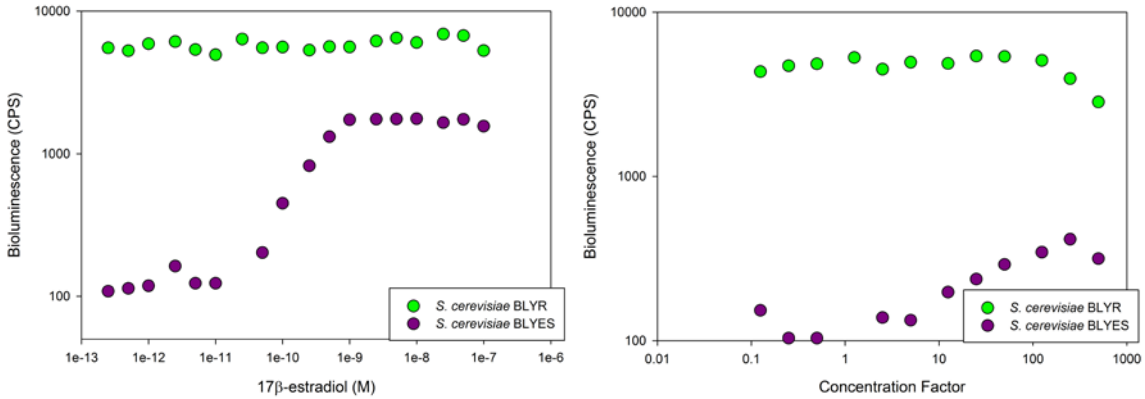


**Figure 2. Examples of yeast bioassay output.** Sample curves are compared to the standard curve values to determine the concentration of potential estrogens present. Values are expressed as estrogenic equivalents (ng/L) and approximate the amount of potentially estrogen-active substances in reference to natural human estrogen (17β-estradiol).

**Table 1. Results of estrogen detection 2015-2016.** Values are given in estrogenic equivalents (ng/L). This indicates that potential estrogens exist in Quinnipiac River samples. Samples will only be detected as a positive result if substances are able to bind sequentially to two different estrogen-responsive genetic elements from humans (estrogen receptor alpha and estrogen response elements engineered into the yeast bioreporter).
ND = not detectable. BDL = below detection limit.
Values are expressed as estrogenic equivalents in ng/L.

| Site | May | June | July | August | Sept | Oct | Nov | Dec | Jan | Feb | March |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plainville | 0.26 | 0.37 | 0.01 | 0.05 | 0.16 | 0.03 | BDL | 0.13 | 0.17 | BDL | BDL |
| Southington | 0.01 | -- | 0.04 | 0.18 | 0.03 | BDL | BDL | BDL | 1.98 | BDL | 0.02 |
| Plantsville | 0.02 | 0.01 | 0.00 | 0.21 | BDL | BDL | 0.02 | BDL | 0.17 | BDL | BDL |
| Meriden | 0.50 | BDL | 0.38 | 0.03 | BDL | BDL | 0.09 | 0.09 | 0.65 | BDL | BDL |
| North Haven | 2.86 | ND | 0.70 | 1.48 | 2.00 | 0.20 | 0.17 | 0.21 | 0.19 | BDL | 0.05 |
| New Haven | 0.00 | 0.18 | 0.04 | 0.74 | 0.51 | 0.18 | 0.14 | 1.19 | 0.53 | BDL | 0.08 |

**C. Target positive sites for further study and determine potential sources of endocrine disruptors.** Sites that contain positive samples will be monitored more intensively and an attempt to track sources of the anthropogenic inputs will be made. Sites that need more extensive study, once identified, may be studied by this research group or by other groups who can use chemical analysis to determine which particular chemical compounds are present if necessary.
We began in May 2015with a goal of sampling seasonally (four times per year) and quickly determined that we would be able to get a more extensive picture of river health if we sampled monthly. Bioluminescent yeast assay data is contained in Table 1.

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?

Originally we proposed and were funded to survey six sites seasonally (four times per year) along the Quinnipiac River as a way to test for the presence of estrogenic substances and toxicity. Instead, we began sampling at monthly intervals and continued throughout the duration of the grant. In this way, we have attempted to more accurately pinpoint timeframes when estrogenic and toxic contaminants enter the watershed. In addition, we began looking at potential sources of contamination being inputted into the watershed e.g. local wastewater treatment plants. Interestingly, the values in Meriden and North Haven are commonly higher than in other parts of the river therefore we are focusing on source tracking in these locations.

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?

Our lab at the University of New Haven recognizes the need to continue sampling and to pinpoint where these estrogens are being inputted into the Quinnipiac River. We have determined that while some potentially estrogenic substances are present in certain locations in the river, they are typically present at very low levels. We will continue to sample surface water and sediment in the future to determine if the locations where no estrogens are detected truly can be considered “clean”. Sediment analysis is useful to examine contamination that occurred previously as compounds may be taken up by sediment and remain present for far longer periods of time than in flowing water. Legacy contamination is worthy of investigation as previous industry may have left its mark on the river but not be detected using methods that sample just in flowing surface water.