

<b>QUINNIPIAC RIVER FUND FINAL REPORT - GRANT NUMBER 20110076</b>
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Project Name: Surveying for phthalate plasticizers in an effort to characterize potential contamination of the Quinnipiac River by municipal and industrial sources.

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This project studied the presence of phthalate esters in the river and marsh areas of the Quinnipiac River as it passes through Wallingford and North Haven, Connecticut. The analysis of phthalate chemicals in sediments and small fish at trace concentrations was investigated as well as an evaluation of the potential for these species to bio-accumulate in the Quinnipiac River and its watershed.

#### Project Objectives in the Proposal

- Collect and analyze water, sediments, and fish for phthalate esters in the Quinnipiac River
- Measure stream, water quality, and climatic parameters at sample sites during collection
- Provide financial support via a stipend for a summer 2011 undergraduate student
- Disseminate research results on the analysis of phthalate esters in the Quinnipiac watershed

This project addressed the relative presence of the phthalate esters in the waters of the Quinnipiac River. These chemicals are primarily used as plasticizers to soften polyvinyl chloride products such as electrical conduit and sewage piping. Phthalates are also known as endocrine disruptors causing adverse health effects in an intact organism or its subpopulations. In recent years phthalates have attracted interest as environmental pollutants and are currently being scrutinized for their teratogenic properties as studies have reported their ability to produce feminizing effects in both rats and fish at low levels of exposure. Since plastic materials represent at least 10% of wastes in landfills and trash transfer stations, it has been documented that industrial wastewater treatment plants, along with municipal incinerators, are major sources of phthalate ester contaminants.

The presence of organic pollutants are indicators of river and stream water pollution. The characterization of phthalate esters in water and sediments in the Quinnipiac River generated

environmental data, and also benefited an undergraduate student as he performed a research project in the summer months of 2011.

### Laboratory Analysis and Sampling

Our study started in June 2010 and we collected and analyzed water and sediments of the Quinnipiac River at locations in Wallingford and North Haven for the analysis of phthalate esters. We also measured stream and climatic parameters at sample sites during sample collection. These field tests were temperature, flow, and depth. Water was collected at tandem, sites along both rivers at weekly intervals. All of the sampling and determination was performed by the Principal Investigator, Dr. Harry Pylypiw and Bigyan Dahal, a bio-chemistry major, as part of his summer research project in the Quinnipiac University's Interdisciplinary Program for Research and Scholarship. Analysis of water samples were performed at Quinnipiac University.

The technique and detection method we chose for analysis was first an extraction of water by solid phase micro-extraction (SPME) followed by detection and determination via gas chromatography with a mass selective detector (GC-MSD). The advantage of using this type of technique is that the analytical method separates, detects, and identifies chemical compounds in a simple simultaneous procedure. We also ran a mixed standard of eight phthalate esters to check the integrity of our sampling, extraction and detection method.

Samples were collected at six locations along the Quinnipiac River in Wallingford and North Haven. These were 1) Hall Avenue, below the bridge in Wallingford, just below Community Lake; 2) Quinnipiac River State Park behind the service station on the Wilbur Cross Parkway in North Haven; 3) Valley Service Road in North Haven where the Quinnipiac River meets town-owned land; 4) State Street in North Haven, behind the River Street Tavern across from Agway; 5) Sackett Point Road, on the north side of the bridge over the River; and 6) The Department of Environmental Protection's boat ramp behind the Tilcon paving plant in North Haven. An additional site on the Mill River at Clark's Pond was selected for a control since the Mill River is known not to be contaminated with phthalate esters. At sample collection a data gathering and analysis device was used to measure and record the various weather parameters such as ambient air temperature, water temperature, flow rate of the river, depth of the river, and altitude of the sites.

### Results and Discussion

Our study confirmed findings of three particular phthalate compounds: di-butyl phthalate, di-isooctyl phthalate and benzyl-butyl phthalate. Levels of these esters were generally below 50 parts-per-billion in water and below 300 parts-per-billion in sediments. Our study also had some unexpected findings in several sediment samples from the Quinnipiac River. We found four different polyaromatic hydrocarbon (PAH) compounds: phenanthrene, fluoranthene, benzo(b)fluoranthene, benzo(k)fluoranthene. PAH compounds are primarily found in diesel fuel, lubricating oils, paving operations, and other industrial processes which involve the manufacture or accidental spillage of oil and tar products. These compounds are also known to cause adverse health effects in living organisms or their offspring.

We also attempted to correlate our findings with climactic parameters; these are shown in figures 1 and 2 below.

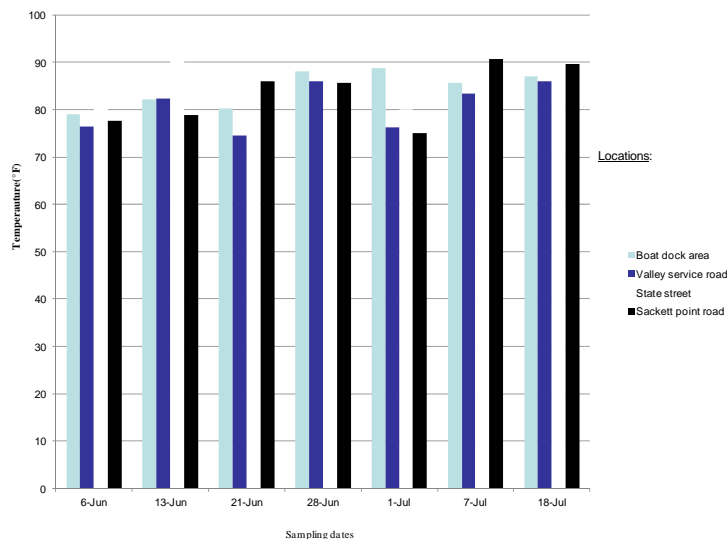


Figure 1. Ambient Air Temperature for June and July 2010.

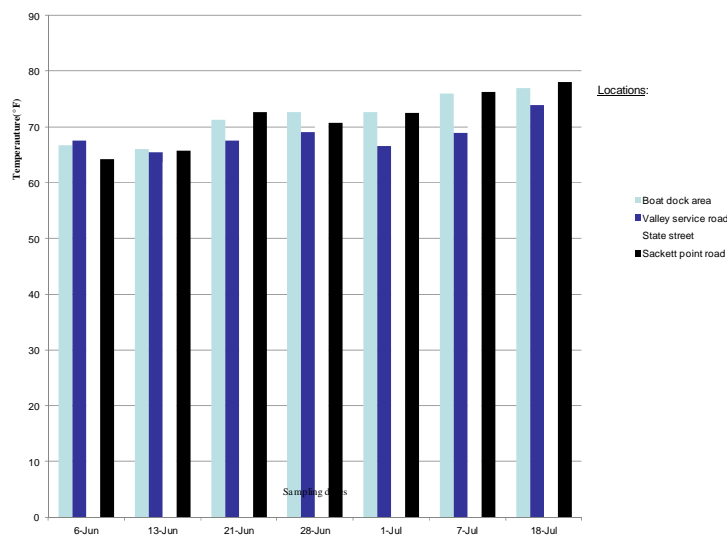


Figure 2. River Water Temperature for June and July 2011.

In general we noted that the levels of phthalate esters increased slightly as water temperature increased, however, a statistical trend was not able to be established. We did not find a correlation with PAH levels.

In water we found phthalate esters at two locations in North Haven, State Street behind the River Street Tavern across from Agway, and Valley Service Road and in one Wallingford location at Hall Avenue. At the Wallingford location we only found di-butyl phthalate, but in the North Haven locations di-butyl phthalate, di-isooctyl phthalate and benzyl-butyl phthalate were all

found. For sediment samples in North Haven we found levels of di-isooctyl phthalate and benzyl-butyl phthalate esters, but in Wallingford we did not find any phthalate esters.

The analysis of water and sediment is still in progress in our laboratories at the time of this report. We have confirmed that the PAH compounds phenanthrene, fluoranthene, benzo(b)fluoranthene, benzo(k)fluoranthene, are present in sediments from three sampling sites, State Street behind the River Street Tavern across from Agway, Valley Service Road, and the Environmental Protection's boat ramp boat launch area behind the asphalt plant.

## Conclusions

We intend to complete the analysis of PAHs in collected samples and to continue to monitor sites along the Quinnipiac River for phthalate plasticizers. We are going to expand the scope of environmental contaminants which can be tested and detected in samples of river water and sediment. We are also expanding our testing sites further north towards Wallingford and south toward Hamden/New Haven. Our findings were presented at a seminars held at Quinnipiac University and the Community Foundation for Greater New Haven's annual round table discussion of projects in October 2011.

## Budget Summary

\$5000 was allotted by the Foundation for this project. \$4300 was spent for a student stipend, \$200 was spent on consumable laboratory supplies and \$500 was paid to The Connecticut Agricultural Experiment Station as a sub-contractor for the analysis of the residues of phthalates in water.