

# Pharmaceuticals and Illicit drugs in New York/New Jersey Estuary Water and Biofilm

Teeshavi Acosta, Kate Good, Marta Concheiro-Guisan, Shu-Yuan Cheng

Pharmaceuticals and illicit drugs have been detected in surface water and groundwater worldwide, and are increasingly recognized as a contaminant of emerging concern. Although consumption of these substances continues to accelerate, there is a lack of knowledge on their impact in the environment, and additional research is needed. Many of these drugs were designed to maximize their effect in humans at low levels (ng/mL), therefore their presence in the environment at any concentration comes with significant potential risk to non-target organisms. Biofilms are the base of aquatic foodwebs, and absorb, retain and transform contaminants over time. Biofilms represent a mode of entry for pharmaceuticals to organisms of higher trophic levels. Recently, there have been few published studies on pharmaceuticals in biofilms in European rivers, but there have been no such studies from the United States. The objective of our study was to develop and validate analytical methods to identify and quantify 12 pharmaceuticals commonly prescribed in New York State in biofilm and water samples, and to apply these methods to authentic samples. Biofilm and water samples were collected from six locations along the lower Hudson River on three dates: 06/08/2018, 08/17/2018, and 11/30/2018. Two pharmaceuticals, oxycodone (opioid) and sulfamethoxazole (antibiotic) were detected with concentrations up to 6 ng/g in the biofilm samples from the Hudson River. Four pharmaceuticals, atenolol and metoprolol (cardiovascular drugs) and fluoxetine and alprazolam (mood altering drugs) were detected in river water samples. See Figure 1 for sample collection locations and dates of positive samples.

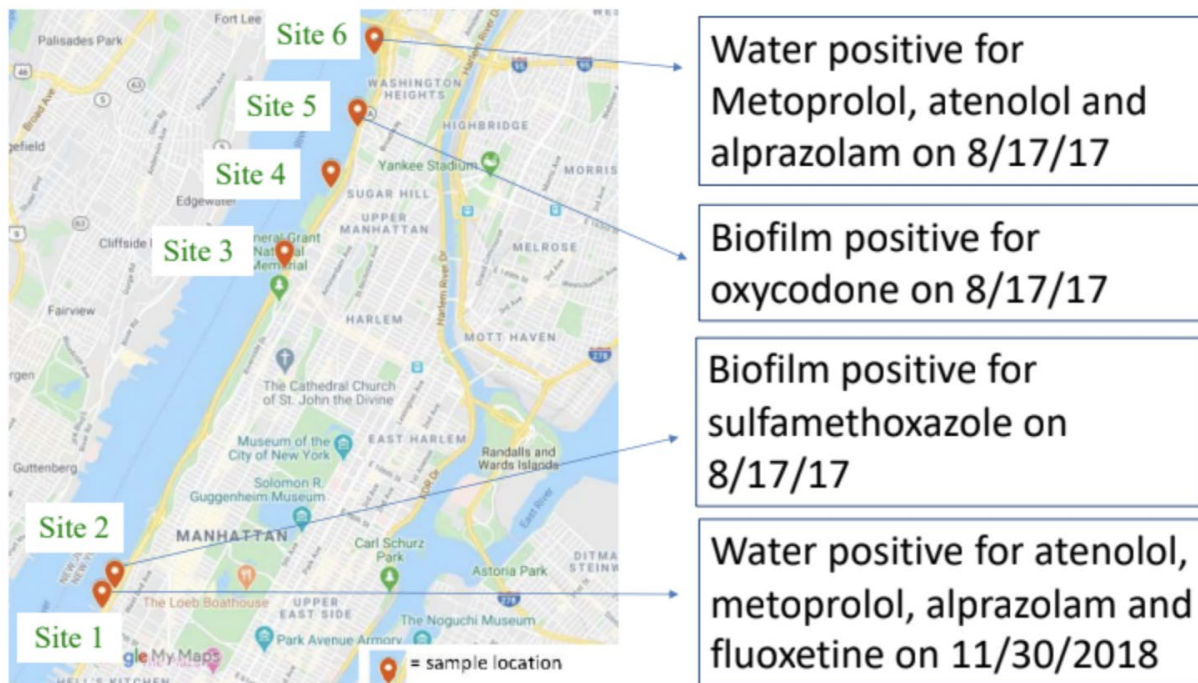


Figure 1: Map of collection sites

In 2021 we expanded our original study by partnering with the Hudson River Park, the Billion Oyster Project and the Citizens' Water Quality Testing (CWQT) program. Partnering with these

groups allowed us to greatly expand our sample locations, as well as increase the number of samples overall. In addition to pharmaceuticals we have added illicit drugs to our list of targeted compounds. Initially we are focusing on water and increasing the number of sample sites to locations throughout the New York/New Jersey estuary. The target drugs are 16 pharmaceuticals (paroxetine, alprazolam, fluoxetine, sertraline, clonidine, prednisone, hydrocortisone, fluticasone, metoprolol, atenolol, hydrocodone, oxycodone, hydromorphone, oxymorphone, ranitidine and sulfamethoxazole) and 16 drugs of abuse and metabolites (cocaine, benzoylecgonine, cocaethylene, amphetamine, methamphetamine, MDMA, MDA, morphine, codeine, 6-monoacetylmorphine, fentanyl, norfentanyl, methadone, EDDP, delta-9-tetrahydrocannabinol and 11-nor-9-carboxy-tetrahydrocannabinol).

Two sets of water samples were collected (one for drug analysis and one for *enterococcus* bacterial analysis) by the CWQT volunteers at 18 locations in the New York/New Jersey Estuary once a week from May-August 2021. Samples were transported to John Jay College and frozen until analysis. An aliquot (100 mL) of each water sample will be measured, spiked with internal standard mixture and filtered through a glass microfiber filter. The samples will be extracted by mixed mode cation exchange solid phase extraction (SPE) cartridges. After the sample cleanup, the extract will be analyzed by liquid chromatography tandem mass spectrometry (LC-MSMS). Results are expected in early 2022.



Teeshavi Acosta collecting water samples by boat from the East River with CWQT volunteers and the Billion Oysters Project.



Kate Good collecting water and biofilm samples from the Hudson river by bike



Scraping biofilm from the surface of rocks collected from the Hudson River