Stony Brook University

School of Marine and Atmospheric Sciences

Peconic Estuary Partnership

# Identification, Distribution, and Source Assessment of Microplastics in the Peconic Estuary

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Prepared By

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**Introduction.**

This report presents the different activities carried out within the project "Identification, Distribution, and Source Assessment of Microplastics in the Peconic Estuary" from January 2024 to December 2024. The main objective of this work is to understand the dynamics of microplastics (MPs) in the Peconic Estuary. We will determine the primary factors (e.g., the Peconic river discharge intensity, touristic activity, and local sources) affecting concentrations of specific MP polymers and their distribution within this coastal environment.

From January to April 2024, we worked together with the Peconic Estuary Partnership program, the New York Department of Environmental Conservation (DEC), and the New York Office of the Attorney General (OAG) to prepare the Quality Assurance Project Plan (QAPP). We applied protocols established in the QAPP approved in April 2024 by NYDEC and the NYOAG. We followed all the steps described in the Data Quality Objectives (DQOs) to ensure that our data collection design, procedures, and strategies were followed as accurately as possible.

**Field Activities**

The field activities started in August 2024 in collaboration with the Office of Ecology of the Suffolk County Department of Health Services (SCDHS) (Fig 1). We divided the Peconic Bay into two areas due to the extensive area covered by the sample design. On August 14, we sampled the west Peconic Bay, including the Peconic River, Flanders Bay, Great Peconic Bay, and Little Peconic Bay. We cover 13 surface stations collecting discrete water samples for the analysis of the micron-size MP (~1 to 300 µm) and conduct six nets tows to collect samples for the analysis of the big size fraction (>300 µm).

**Figure 1.** (a) and (b) Station 12, Oyster farm at Hog Neck Bay. (c) Plankton net deployed at station 4. (d) Office of Ecology of the Suffolk County Department of Health Services (SCDHS) research boat at the dock in Greenport.

The east Peconic Bay was sampled on August 21, 2024. We collected discrete water samples in 6 stations for the analysis of the micron-size MP (~1 to 300 µm) and conducted six nets tows to collect samples for the analysis of the big size fraction (>300 µm). In addition, on August 28, we conducted systematic beach surveys of MPs at three strategic beach sediment stations (Figure 1, table 1). Sample sites covered the north and south shores of the estuary, targeting creeks and potential point sources, for example, the oyster farm at Hogneck Bay (station 12) and the Peconic River (station 1).

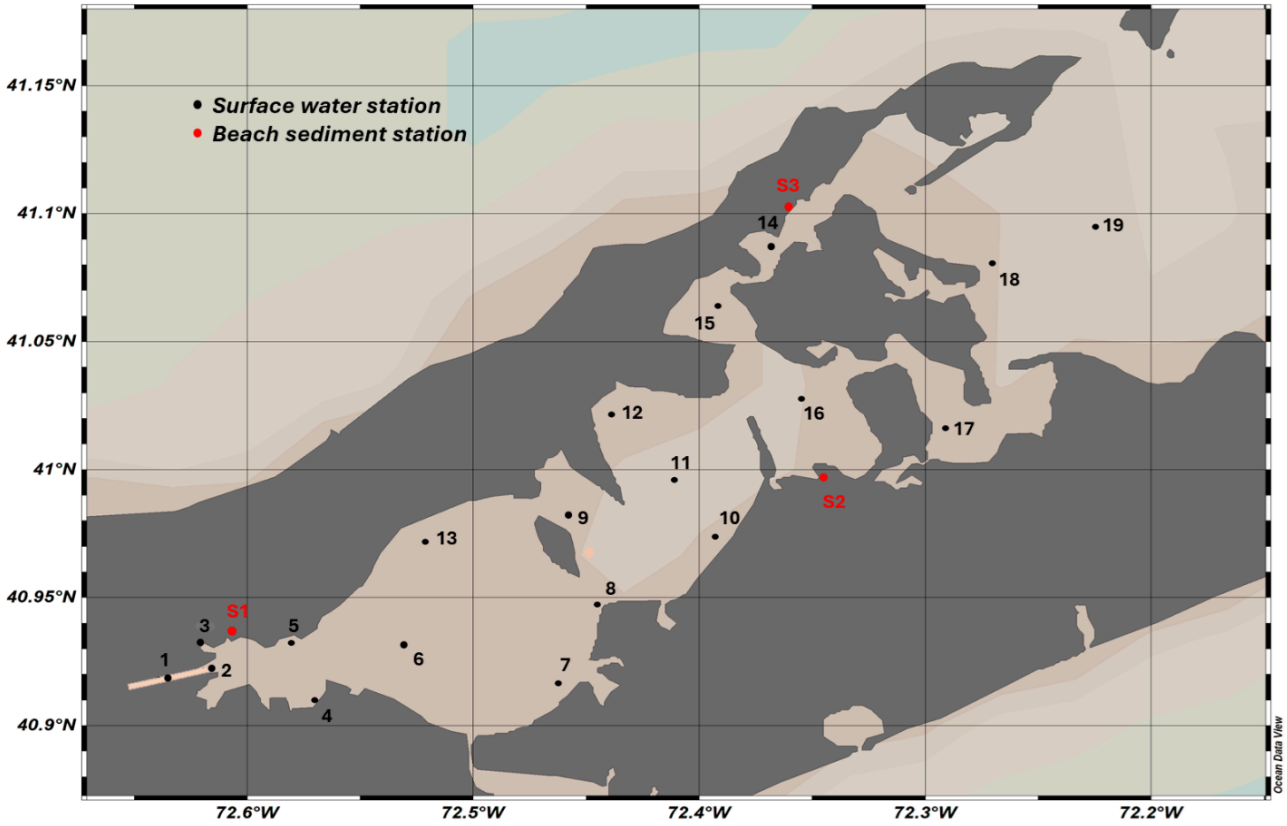


**Figure 2**. Map of the study area showing the location of 19 surface water and 3 beach sediment sampling sites. Water samples (black circles) and beach sediment samples (red circles).

Due to the high abundance of Ctenophores that rapidly clogged our plankton net during the August 14 sampling event, we were not able to collect good net samples. A second trip to the west Peconic Bay was conducted on October 10, 2024, during which we collected 6 samples for the analysis of the big size fraction (>300 µm).

**Table 1.** Identification, location and status of analysis of sample collected on August 2024 across Peconic Bay.

| ***Station ID*** | ***Lat*** | ***Long*** | ***Type of sample*** | ***Status*** |
|---|---|---|---|---|
| 1 west | 40.91791 | -72.6393 | Discrete water bottle | Filtered |
| 2 west | 40.9216 | -72.619 | Discrete water bottle + Plankton net | Filtered |
| 3 west | 40.93834 | -72.6188 | Discrete water bottle | Filtered |
| 4 west | 40.90999 | -72.5702 | Discrete water bottle+ Plankton net | Filtered |
| 5 west | 40.93236 | -72.5805 | Discrete water bottle | Filtered |
| 6 west | 40. 92848 | 72.5098 | Discrete water bottle + Plankton net | Filtered |
| 7 west | 40.91661 | -72.4623 | Discrete water bottle | Filtered |
| 8 west | 40.94725 | -72.4451 | Discrete water bottle | Filtered |
| 9 west | 40.96703 | -72.4485 | Discrete water bottle+ Plankton net | Filtered |
| 10 west | 40.97381 | -72.3929 | Discrete water bottle + Plankton net | Raman analysis completed |
| 11 west | 40.99625 | -72.4109 | Discrete water bottle | Filtered |
| 12 west | 41.02155 | -72.4388 | Discrete water bottle+ Plankton net | Raman analysis completed |
| 13 west | 40.97182 | -72.5212 | Discrete water bottle | Filtered |
| Field blank | | | Discrete water bottle | Filtered |
| 14 east | 41.10406 | -72.3442 | Discrete water bottle + Plankton net | Filtered |
| 15 east | 41.06392 | -72.3918 | Discrete water bottle + Plankton net | Filtered |
| 16 east | 41.02774 | -72.3547 | Discrete water bottle+ Plankton net | Filtered |

| | | | | |
|---|---|---|---|---|
| 17 east | 41.01612 | -72.291 | Discrete water bottle+ Plankton net | Filtered |
| 18 east | 41.0807 | -72.2703 | Discrete water bottle+ Plankton net | Filtered |
| 19 east | 41.09491 | -72.2247 | Discrete water bottle+ Plankton net | Filtered |
| Field Blank | | | Discrete water bottle | Filtered |
| S1 | 41.10406 | -72.3442 | Beach sediment sample (Greenport) | Filtered |
| S2 | 40.93834 | -72.6188 | Beach sediment sample (Riverhead) | Filtered |
| S3 | 40.99104 | -7236933 | Beach sediment sample (E Morton National Wildlife Refuge) | Filtered |

**Preliminary Results**

A total of 22 samples were collected during the August sampling event across Peconic Bay. All discrete, net, and sediment samples and several laboratory and field blanks have been processed following the protocol presented in the QAPP. Here, we present preliminary results from surface water from 2 stations in the west Peconic Bay (Station 10 and 12, Fig 1). For each station, 1.5 L of water was collected using glass containers. Then, samples were processed and analyzed at the School of Marine and Atmospheric Sciences - Stony Brook University (SoMAS-SBU) laboratories.

An example that demonstrates the ability of this method to identify types of polymers and their pigments and additives from a wide range of particle sizes is presented in Fig. 3. Two ~ 20 µm diameter particles, appearing similar in morphology by reflected bright-field microscopy, were interrogated by Raman and color-coded based on their composition (Fig. 3). Raman mapping revealed two adjacent and visually indistinguishable particles that were chemically distinct. Raman-scattered peaks at 808, 840 cm-1 revealed that the larger particle (20 µm diameter) was primarily polypropylene (PP, green), while peaks at 678, 744 cm-1 established that the smaller ~18 µm particle was phthalocyanine copper blue (CuPc, blue).

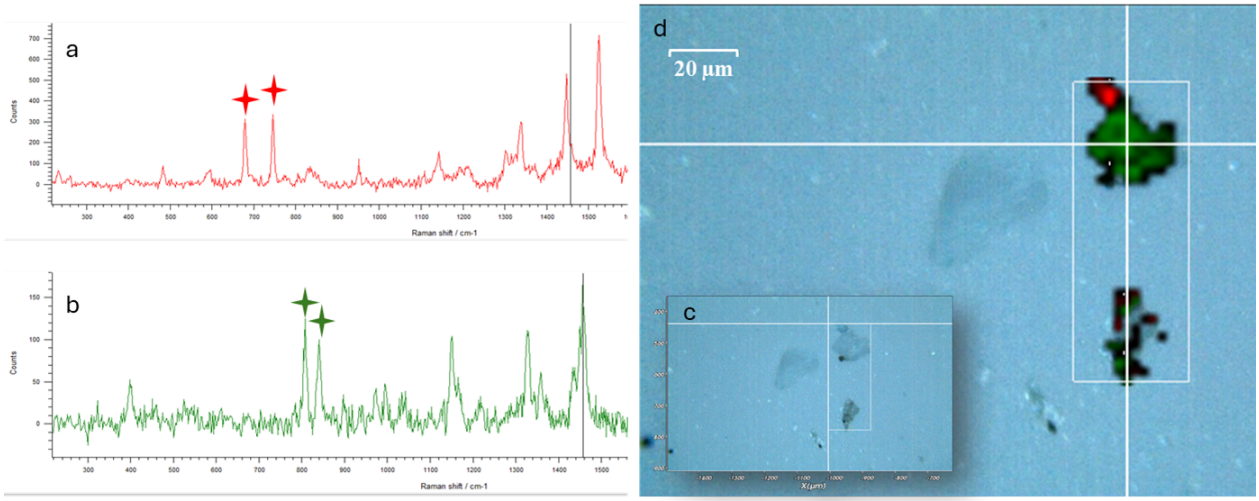


**Figure 3.** Composite images of Raman chemical maps superimposed on micrographs of the sampled filter (station 12). Floating rectangle **(c)** is reflected bright-field micrographs of the mapped regions of interest (ROI). Chemical maps in rectangle **(d)** are color-coded based on diagnostic Raman peaks (*) produced by individual particles, examples of which are superimposed on micrographs. **(a)** One relatively large (ESD = 20 µm) polypropylene particle (PP = green) and **(b)** one (ESD = 15 µm) phthalocyanine copper blue (CuPc) particle (red) appears in this ROI.

The size range of MP particles collected in discrete water bottles from the two stations in the PB was between 1 and 45 µm ESD, with most of the particles (75%) being less than 5 µm. MPs were found in both samples, ranging from 104±18 x 103 part L–1 (station 10) to 520 ± 38 x 103 part L–1 (station 12). MP masses were higher at station 12 (105 ± 96 µg L–1) compared to station 10 (3.29 ± 3.05 µg L–1). The higher value at station 12 was driven by the presence of 3 polyethylene (PE) particles with equivalent spherical diameters (ESDs) 21, 17 and 16 µm, respectively (mean ESD all particles 2.36 ± 1.77 µm). A total of 4 types of synthetic polymers were identified (polyethylene (PE), phthalocyanine copper blue (PcCu), phthalocyanine copper green (PcCu-green), polypropylene (PP)) with PE being the most abundant.

For the bigger fraction (>300 µm) sampled using the plankton net, in station 12 a total of 173 particles were found, representing ~5 part L–1. The majority of the particles were red fiber composed of PP (n=164), 4 polystyrene (PS) fragments, and 5 polyethylene terephthalate (PETE) blue fibers (Fig 4)

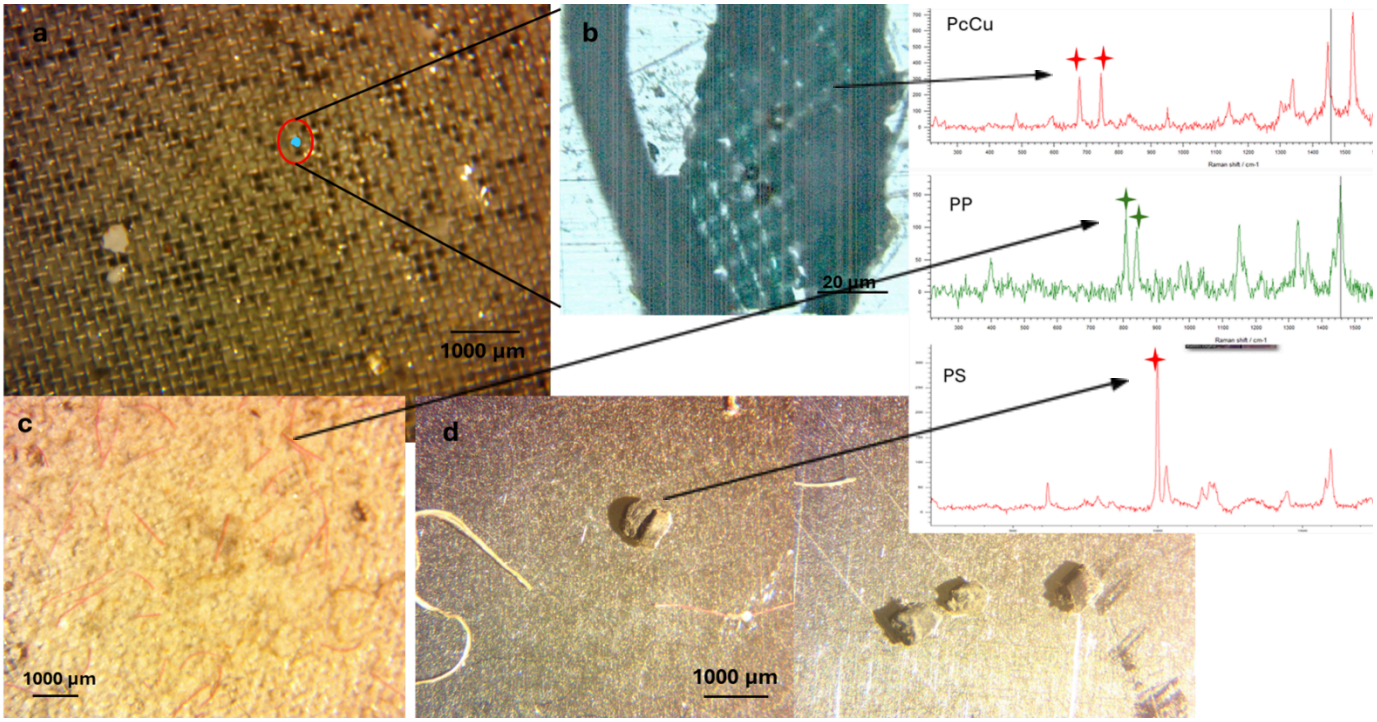


**Figure 4.** (a) Particles retained on the filter from net samples on station 12. (b) View of the Blue particle (red circle) in (a) under the bright light microscope (50x objective). Raman peaks at 678, 744 $cm^{-1}$ established that the particle was phthalocyanine copper blue (CuPc). (c) Red Fibers retained on the filter from net samples on station 12. A total of 164 red fibers were counted on the filters. Raman-scattered peaks at 808, 840 $cm^{-1}$ revealed that fibers were primarily polypropylene (PP). (d) 4 Polystyrene particle (700 µm diameter) from net samples on station 12.

**Future Work**

We plan to finish the analysis of the samples and blanks collected in the first sample event (August 2024) during the first trimester of 2025. In addition, a second campaign is planned to be conducted in April 2025.