Activity report on the project "*Microplastic concentration in sediments and waters of Matagorda and San Antonio Bays: Initial assessment and mitigation plans*"

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Period: October 1st 2021 to December 31st 2021 – Field data collection

During October we had the last sampling trip and finalized all proposed samples with very good coverage of both San Antonio and Matagorda bays (figure 1). We collected sediment samples at 89 locations. From these, 54 are grab samples from the top 10 to 20 cm surface sediments while at 35 locations cores (at least one foot/ 30 cm long) have been collected. Also 14 water samples have been collected using plankton nets. We finished the sampling campaign in October, later than expected, because during the previous trips bad weather (thunderstorms, strong winds and high waves) restricted our time on the water and hindered sampling.

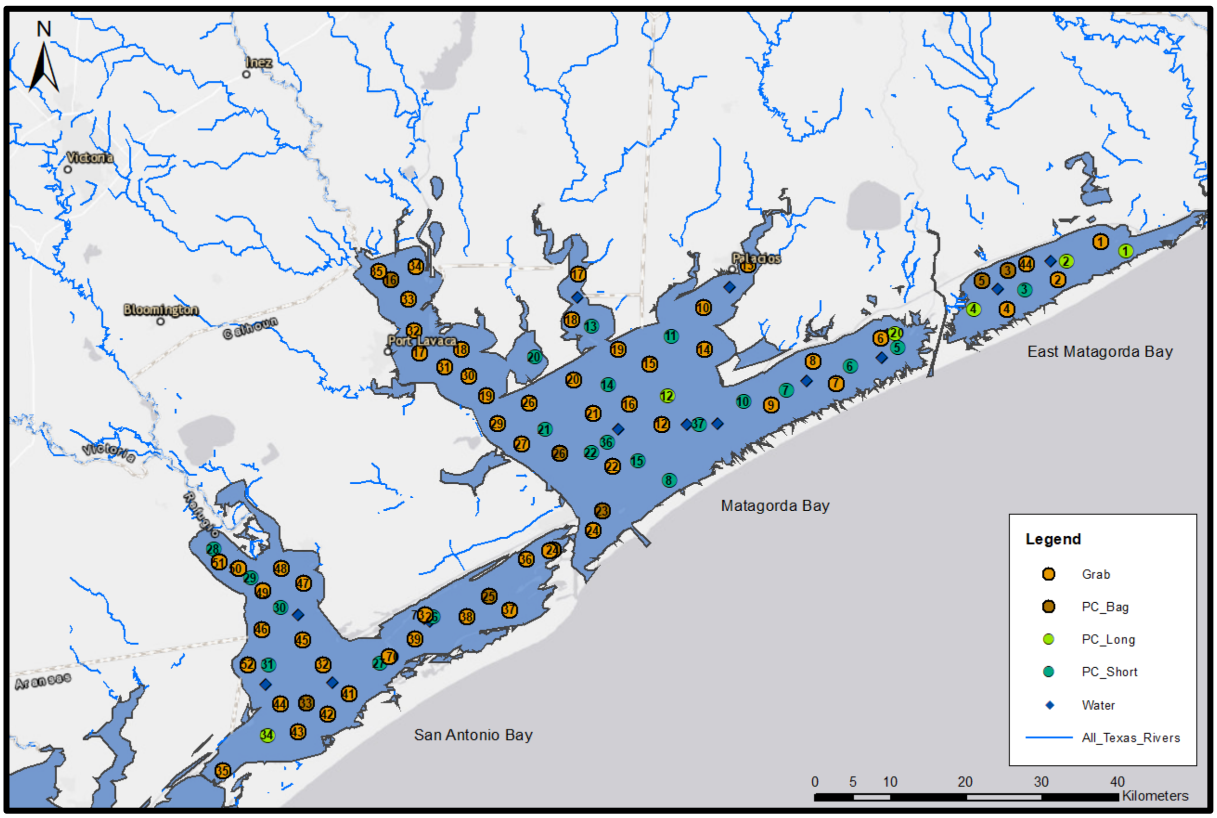

Figure 1. Location map of 2021 sampling campaign on San Antonio and Matagorda bays. PC long and short correspond to 5 ft and 2 ft push core locations, PC bag indicates proposed core location where only a grab sample was recovered. Water sites indicate locations where phytoplankton net samples were collected. Salinity, temperature, PH and Dissolved Oxygen data were recorded at most sites.

Sediment grab samples and core sleeves were indexed and stored in a cold room at Pickle Campus of the University of Texas at Austin.

Most of the time was focused on identifying the best laboratory elutriation method for microplastics content analysis. We continued to evaluate the laboratory methods according to published methodologies (USGS or other publications). Some of the observations during multiple methods tryouts are:

1. The funnel separation method didn't work well because the sediment and the heavy liquid (we used $ZnCl_2$ solution for that method) was released too abrupt, and despite multiple attempts the floating material couldn't be separated;
2. The use of "sliced" glass beaker described by scientists at Japan Agency for Marine-Earth Science and Technology (JAMSTEC) and called JAMSS (Japan Agency for Marine…Sediment Separator) (figure 2) was efficient to separate the microplastic particles floating in heavy liquid. However, the devices designed are prone to leaks, and the use of $ZnCl_2$ in a leaking device is hazardous because it is highly corrosive.

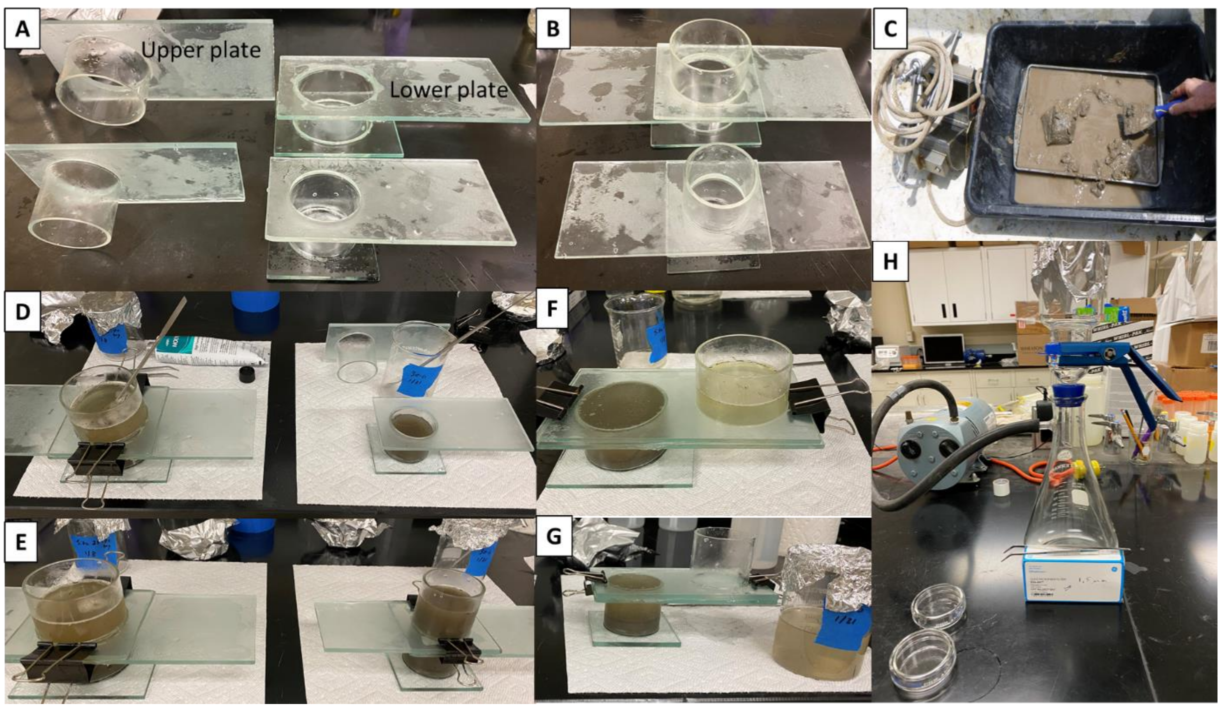

Figure 2. Microplastic separation device designed after JAMSS. A) and B) illustrating the two-part plate components, where the larger and smaller versions holds c.a. 300ml and 150ml of sediment and solution respectively. C) shows our methods for collecting grab samples, where we minimize the use of plastics. D) and E) show the transfer of sieved sediment sample to apparatus with density solution, followed by mixing and settling period. Silicon grease is used to seal the plates. Samples are covered with aluminum foil between all steps. F) and G) illustrates separation step, where plates are slid together to isolate the upper and lower compartments. H) separated upper chamber composition is transferred to vacuum filter using 1.5um filter paper and stored in glass petri dishes for later microscope and FTIR analyses.

We tested the separation method using the LMT (lithium metatungstate) solution that is a less hazardous material to work with and it has a specific gravity of about 2.9 g/cm^3 that is adequate for the preparation of high-density liquid (c.a. 1.5 g/cm^3) necessary to separate microplastics.

The analysis procedure which we found effective is:

- **Wet sieving: c.a. 100g sediment using 45um sieve;**
- **Separation with JAMSS (2) using LMT solution (diluted at c.a. 1.5 g/cm^3);**
- **Microscope examination and photography of the filtered material;**

Following this method multiple samples from San Antonio Bay have been sieved and analyzed (Figure 3). The observation of the microplastics on the filters reveal the presence of multiple plastics particles with varied morphologies (fibers, fragments, pellets, and nurdles) (see multiple microscope photos of figure 4). However, during the plastic separation we identified possible contamination avenues in the lab. Some fibers might come from clothing of lab personnel, and some of the red fragments might come from lab equipment (magnets used to stir the sediment in the beaker).

We are in the process of reanalyzing the contaminated samples without using the stirring magnets, the lab personnel are using cotton clothes, and we set ambient “traps” to try to identify possible contamination sources.

Once the samples are processed again with careful attention to possible contamination sources, the plastics particles physical characteristics will be described, and the filters will be submitted to Marine Science Institute in Port Aransas for plastic type identification using FTIR method.

Shimadzu Scientific Inc. is developing a device that can automatically pretreat solid samples and isolate the plastics. PI Liu is permitted to evaluate the beta model of this devise, and is expected to receive it in March or April 2022 (will be shipped from Japan). We plan to use this device to further polish our pretreatment protocol, and if possible, this device will help streamline the process and enhance the data quality.

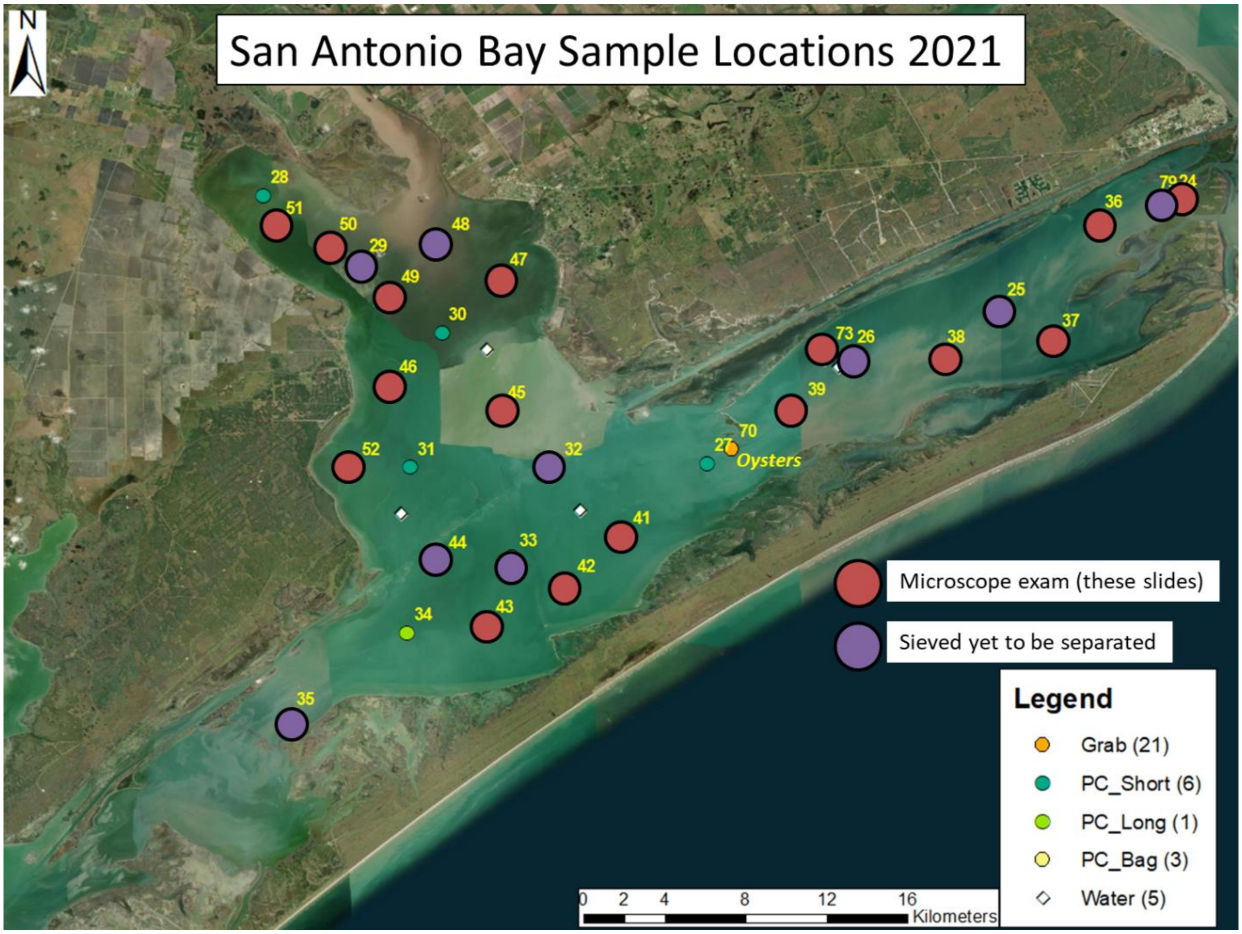

Figure 3. Location of San Antonio Bay with sampled processed. All grab sampled have been sieved for clay separation (first step) and some have been analyzed for microplastics and observed at the microscope.

Figure 4. A) Examples of micro-disks, or possible nurdles; B) microfibers; C) red fragments; and D) blue fibers observed from microscope photographs of filtered sediment samples from San Antonio Bay. Red particles (C) and blue fibers (D) likely correspond to plastic coating observed on magnetic stirrers and clothing worn by lab personnel, respectively. Grab sample site numbers: A) 24, 39; B) 29, 39, 41, 43; C) 41, 52; D) 43 and others. Please refer to figure 1 for sample locations.

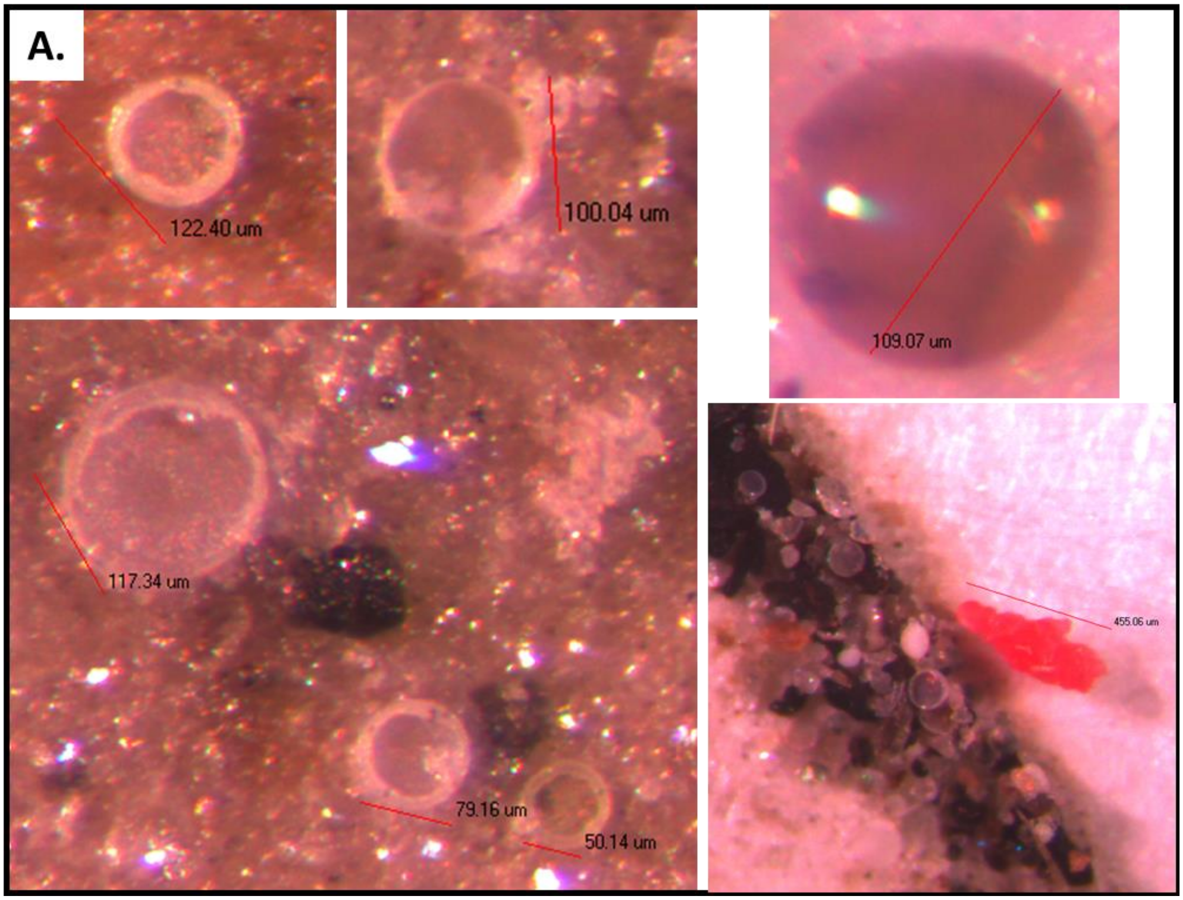

Figure 4 continuation.