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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Undergraduate students - -

Period: October 1st 2024 to December 31st 2024 – Continuation of analyzing the data collected and submission of final manuscript.

During the quarter of October to December 2024, we continued to analyze the variability of microplastics at depth in cores to measure the preservation of plastics in bay sediments. Initial results found minor (2-3 particles) to no microplastics below shallow depths in cores collected during the 2021 field sample campaign. These results align with our hypothesized model of microplastics preferential mobility and low residence time within bay sediments. Future work will aim to test this hypothesis by quantifying particle residence time through numerical models.

The primary achievement from this quarter was the submission of the first manuscript titled "Microplastics in Bays along the Central Texas Coast" to the journal of *Environmental Science & Technology*. We are currently awaiting a decision to be made after the first round of revisions and reviewer feedback. Upon the decision to accept the manuscript for publication we will promptly share the final manuscript version.

Work regarding the post-Hurricane Beryl – Matagorda Peninsula data was continued. Initial results found plastic debris (i.e., micro- & macro-plastic) to be highly concentrated within highwater wrack lines that onlap beach topography and vegetation. These results suggest significant plastic sourcing to bay waters in areas without topographic barriers (i.e., the area which developed new overwash fans and return channels). Future work will utilize LIDAR data collected by the Bureau of Economic Geology of the University of Texas at Austin. Pre- and post-storm LIDAR analyze shows topographic change in area landward of shoreline and try to correlate net depositional areas with plastic-rich deposits.

Site No.	Lat	Lon	Depth (cm)	MP count	Section
3	28.68036	-95.86956	0-4	3	Top
			40-44	3	Mid
5	28.61996	-96.01996	0-4	19	Top
			36-40	3	Mid
			72-76	3	Base
6	28.60060	-96.07653	0-4	3	Top
			8-12	1	Mid
			20-24	4	Base
7	28.57558	-96.15244	0-4	4	Top
			12-16	3	Mid
			20-24	4	Base
10	28.56405	-96.20224	0-4	3	Top
			8-12	1	Mid
			12-16	6	Base
11	28.63204	-96.28788	0-4	0	Top
			12-18	7	Base
12	28.54032	-96.29970	0-4	3	Top
			28-32	2	Mid
			60-64	6	Base
13	28.64221	-96.38280	0-4	2	Top
			8-12	3	Mid
			18-24	1	Base
120	28.63435	-96.02295	0-4	11	Top
			52-54	2	Mid
			110-112	3	Base
18	28.64881	-96.40559	0-4	6	Top
			8-12	10	Mid
			16-20	1	Base
20	28.61000	-96.44994	0-4	6	Top
			16-20	1	Mid
			28-32	0	Base
21	28.53483	-96.43756	0-4	4	Top
			12-16	2	Mid
			24-28	1	Base
22	28.51065	-96.38309	0-4	4	Top
			12-16	2	Mid
			24-28	1	Base
26	28.33982	-96.57020	0-4	2	Top
			16-18	0	Mid
			32-34	5	Base
27	28.29156	-96.63350	0-4	4	Top
			24-28	0	Base
30	28.34970	-96.75121	0-4	5	Top
			12-16	0	Mid
			24-28	2	Base
31	28.29003	-96.76538	0-4	5	Top
			28-30	4	Base
36	28.52156	-96.36396	0-4	1	Top
			20-24	3	Mid
			40-44	2	Base

Figure 1. Table with the microplastic counts on cores at different depths.

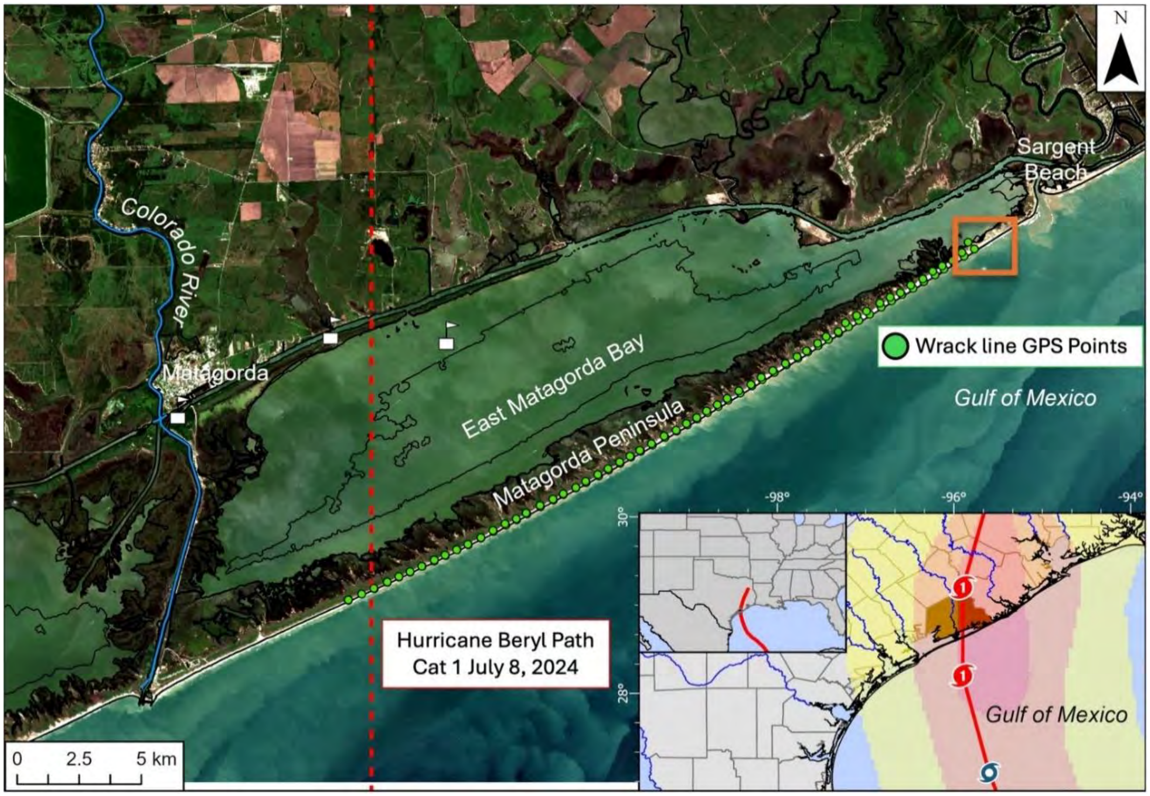

Figure 2. Post-Hurricane Beryl field campaign overview map illustrating storm path and locations of measured points along Matagorda Peninsula with plastic-rich deposits. Inset rectangle indicates location of new overwash fans in lower relief part of the barrier (**Figure 3**).

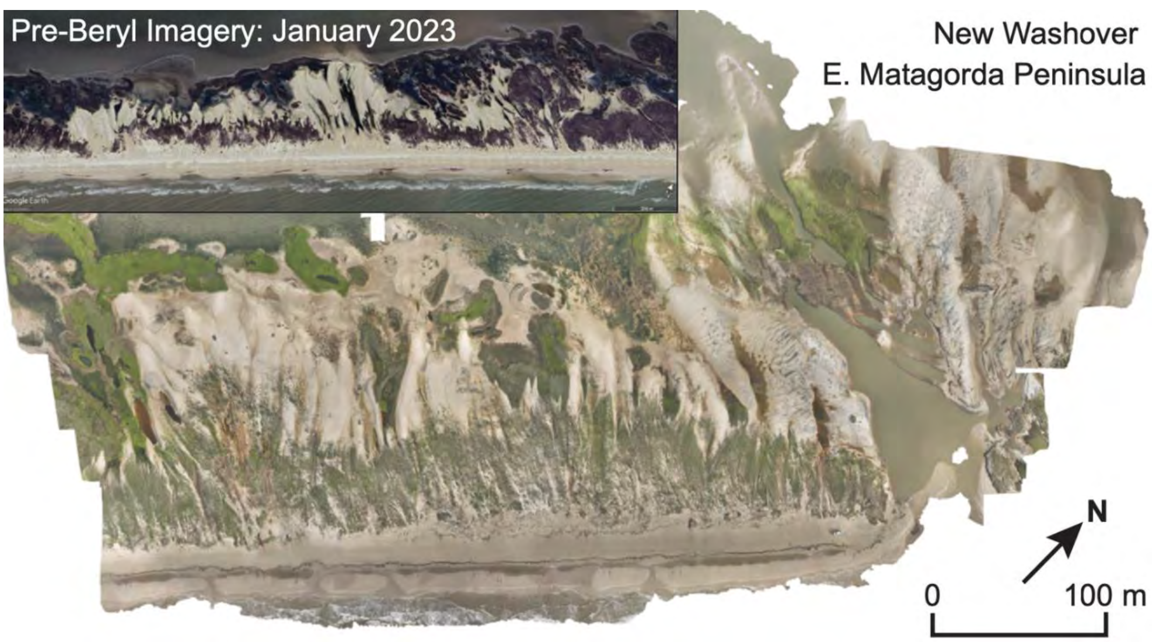

Figure 3. New overwash fans and flood-return channels, which lacked plastic-rich deposits and likely transported debris into East Matagorda Bay.

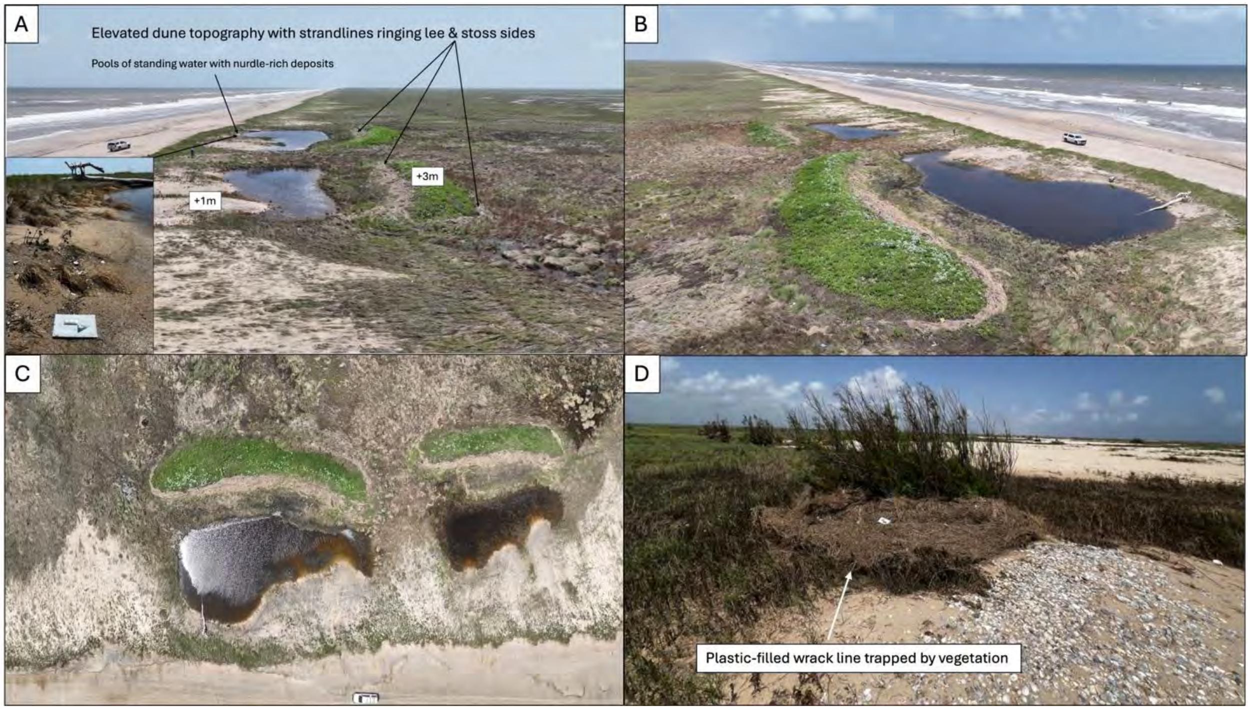

Figure 4. A-C) Plastic-filled deposits onlapping barrier dune topography and D) preserved vegetation acting as a filter for floating debris.

Enhanced Detection Method for Microplastic Identification

We further optimized our protocol of quantifying microplastic in the water and sediments. As last quarter, we started to use an IQ MILL-2070 cryogenic mill to homogenize samples more thoroughly, and the F-Search MPs 2.1 software and a calibrated plastic standard set. The holistic protocol for quantifying suspended plastics is illustrated in Figure 5, and with Figure 6 showing that plastics largely remained intact after the digestion by the chemical cocktail, nitric acid and persulfate that can oxidize most of the natural organic matter. This step is critical because without such digestion the presence of natural organic matter would severely affect interference the analysis of microplastics using the pyrolysis GC/MS. Our preliminary data showed that polyethylene is the dominated type of plastics in the Corpus Christi Bay, with a concentration of up to 1.14 μg per liter. Currently we are analyzing the archived samples collected from the Matagorda Bay using this optimized analytical protocol.

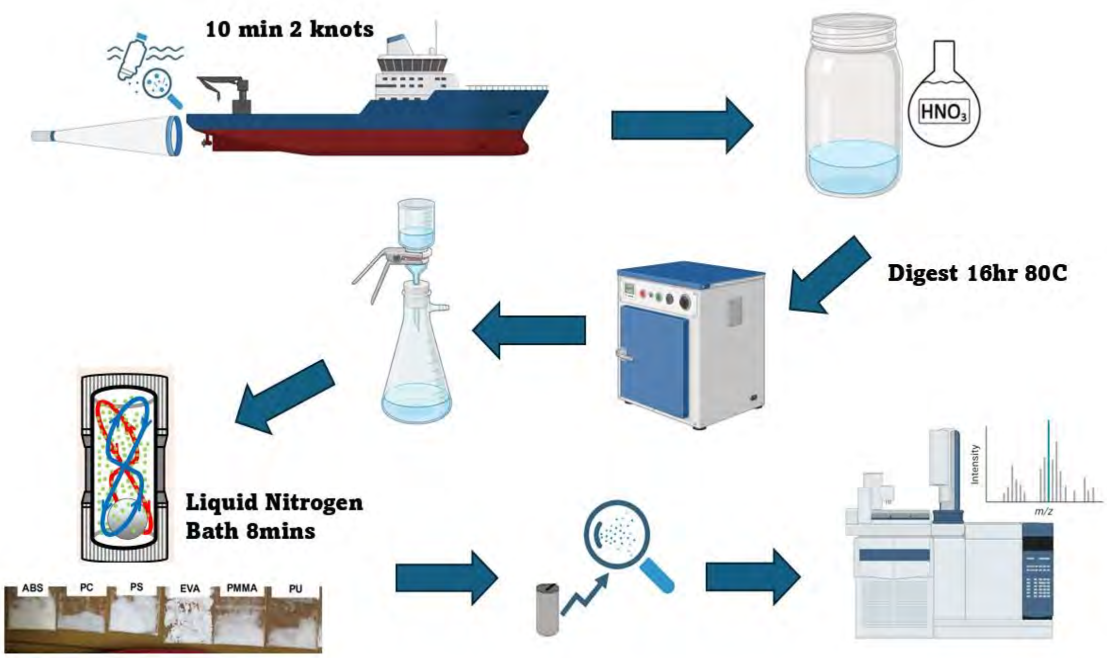

Figure 5. Graphical representation of sampling and analytical protocol of suspended microplastics. The plankton tow typically can filter 10-50k liters of seawater with a mesh size 150 um. We used nitric acid with sodium persulfate to remove the natural organic matter, while the microplastics remain largely intact. After the cryogenic milling, a subsample can be analyzed

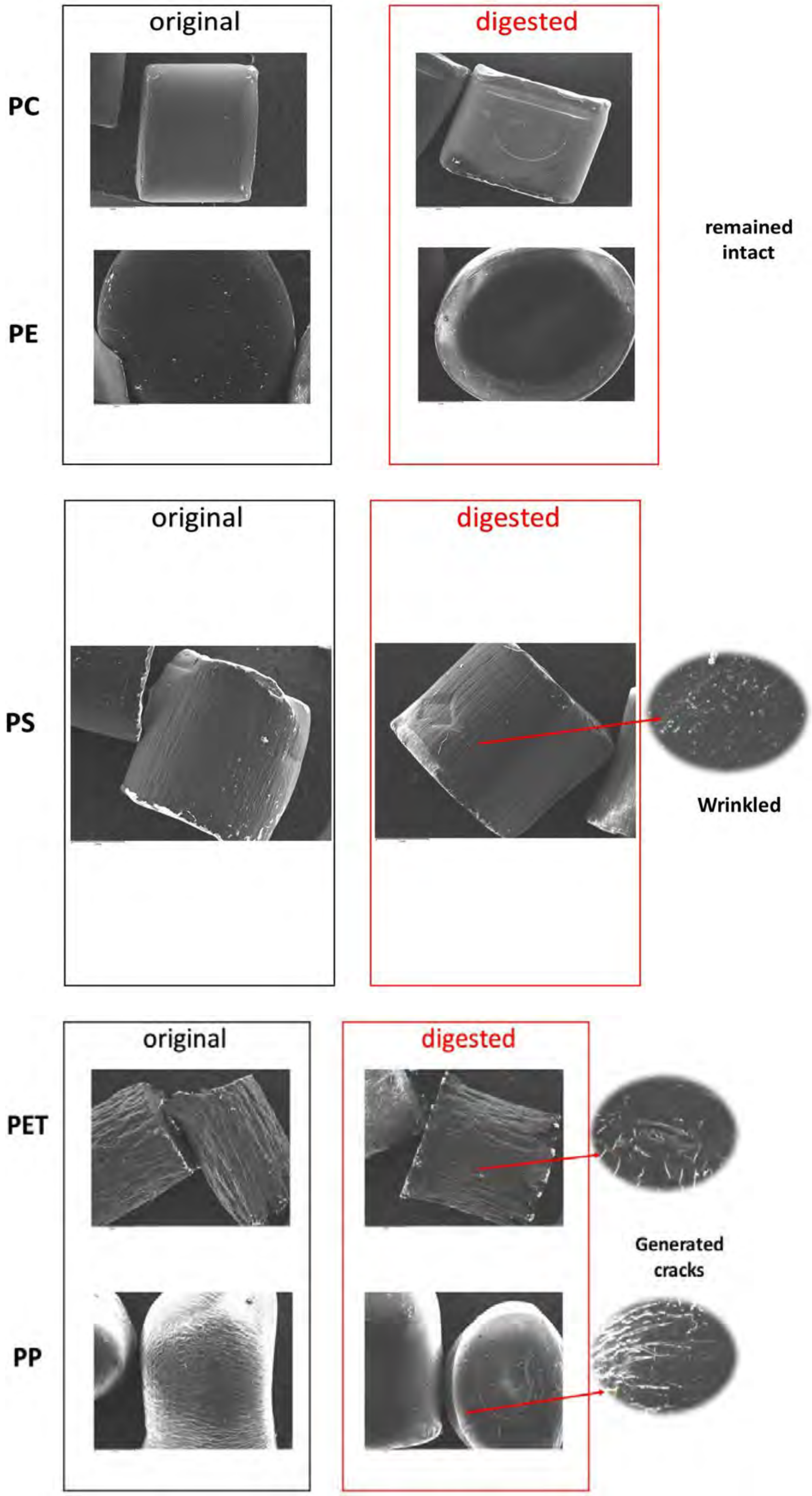

Figure 6. SEM images of 5 plastic nurdle pellets prior to and following exposure to digestion cocktail, demonstrating that the plastics remained largely intact.