

Microplastics: Nacogdoches County’s Hidden Threat

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Abstract

Microplastics and their threat to marine environments are well known, but studies in freshwater environments are few and far between. Microplastics can be created by the breaking down of plastics or in the process of making plastics. They affect biological lifeforms in a multitude of ways, water temperature, permeability of the sediment. Pollution in Texas waterways have motivated groups like the Environmental Protection Agency, Trash Free Texas, and EnvironmentTexas to get involved. The objectives of this study are two analyze Bonita and La Nana Bayou for microplastic presence and to educate and create awareness for Nacogdoches County on microplastics. This study uses the Assessment of Microplastic in Great Plains: Comparing densities in water and benthic sediment across Kansas as a guiding reference. Samples were filtered through a 300 µm mesh sieve, rinsed and fixed with 15mL of 0.1N KOH for 14 days. Microplastics were found in each sample. Data was analyzed using ANOVA Single Factor Test to confirm the hypothesis that the sample sites will not equal one another. Future studies should include more samples and experience.

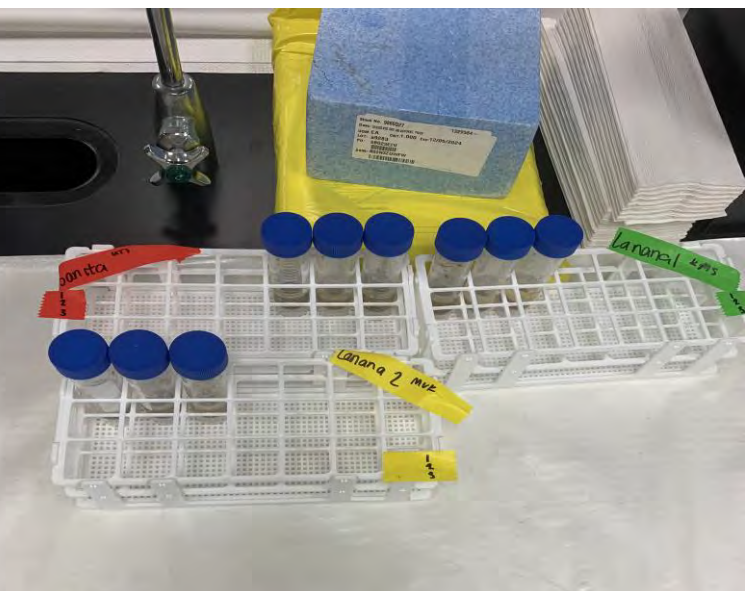
Introduction

- Microplastics
 - Are less than 5 millimeters in size
 - Can be produced by plastic generating companies or broken-down plastic items.
 - Contain toxic chemicals that affect lifeforms
 - Affect environmental conditions such as water temperature and permeability of the sediment
- Over 435 million pieces of trash accumulate on Texas Roadways each year.
- Physical observations generated the hypothesis and null hypothesis which are:
 - Hypothesis: The data for each sampling site will not equal one another.
 - Null Hypothesis: The data for each sampling site will equal one another.
- The objectives of this study are
 - Quantify microplastics in sediment of Bonita Creek and La Nana Bayou
 - Provide education and awareness on microplastics to Nacogdoches County
- The objectives make this study important as no study has been conducted of microplastics in sediment and education and awareness are solutions to eradicating microplastics.

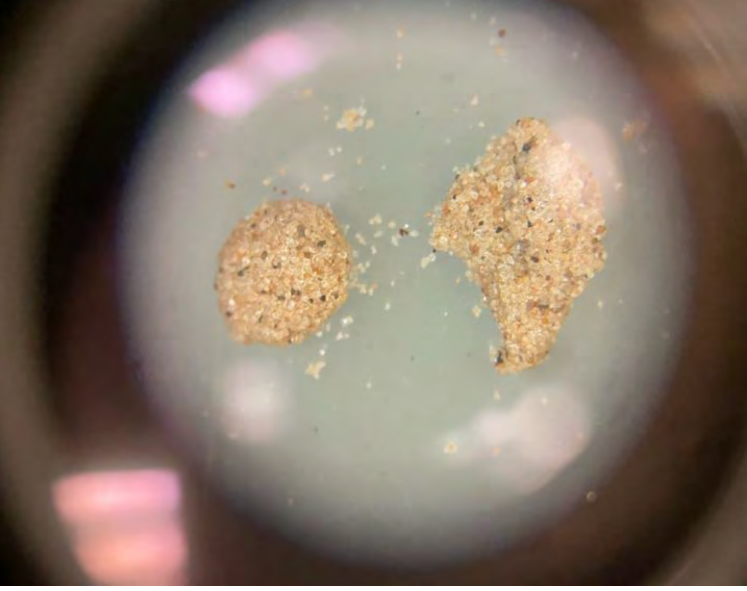
Methods

Procedures

Sediment samples were collected at accessible points of the creek shown in the maps below. The coordinates are also in Table 1. Approximately 236 cm^3 of sediment was filtered through a 300 µm mesh sieve. 10 cm^3 was placed into collection jars and fixed with enough 95% ethanol to entirely cover the sediment sample. At the laboratory, the samples were rinsed and placed into polypropylene vials and filled with 15 mL of 0.1N KOH to soak in the solution for 14 days. After this time period, the samples were rinsed once more and 0.30 grams was moved into uncovered glass petri dishes to dry in a scientific oven at 60°C to dry for 36 hours. Lastly, a compound microscope was used to count microplastic levels in the sediment samples. A trusted reference was used to determine microplastics from other organisms complete with pictures and descriptions. For data analysis, the values were converted into microplastics per milliliter and microplastic per cubic meter for easy conversion. Anova single factor test was ran to support or reject the null hypothesis. A P-value of less than .05 would reject the null hypothesis ($P < .05$)

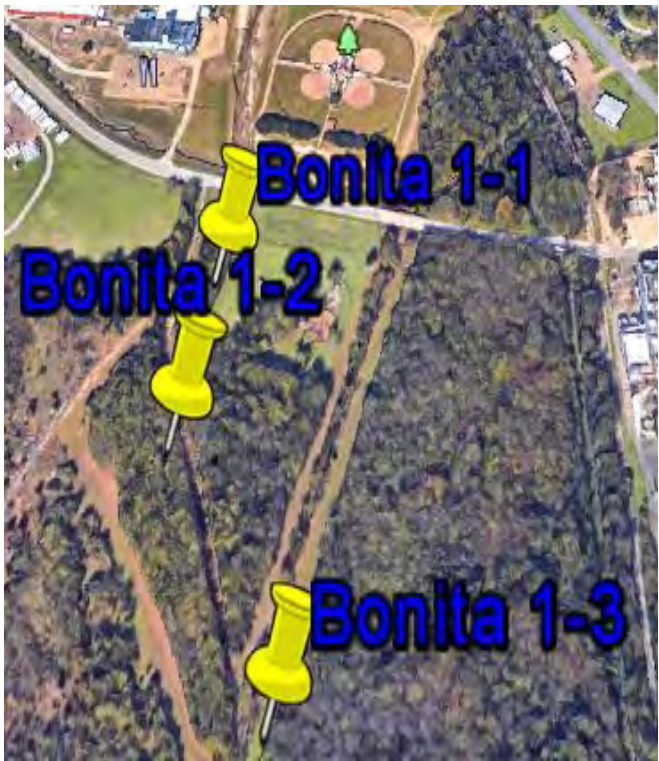


Sediment resting in the polypropylene vials fixed with KOH



Sediment being analyzed under the microscope

Sample Locations



Sampling Location	Sampling GPS Coordinates
Bonita 1-1	31°35'32" N 94°39'14" W
Bonita 1-2	31°35'27" N 94°39'16" W
Bonita 1-3	31°35'19" N 94°39'13" W
La Nana 1-1	31°34'39" N 94°39'16" W
La Nana 1-2	31°34'36" N 94°39'15" W
La Nana 1-3	31°34'32" N 94°39'15" W
La Nana 2-1	31°36'05" N 94°38'52" W
La Nana 2-2	31°36'02" N 94°38'53" W
La Nana 2-3	31°36'00" N 94°38'55" W

Table 1. GPS Coordinates of Sampling Locations



Results and Discussion

Table 2. Microplastic values per milliliter per day and location along the sample sites.

Creek Location	Day 1	Day 2	Day 3
Bonita 1-1	77.7	88.8	99.9
Bonita 1-2	55.5	88.8	88.8
Bonita 1-3	11.1	88.8	99.9
La Nana 1-1	44.4	33.3	55.5
La Nana 1-2	66.6	88.8	99.9
La Nana 1-3	22.2	55.5	33.3
La Nana 2-1	66.6	77.7	55.5
La Nana 2-2	33.3	22.2	33.3
La Nana 2-3	33.3	22.2	22.2

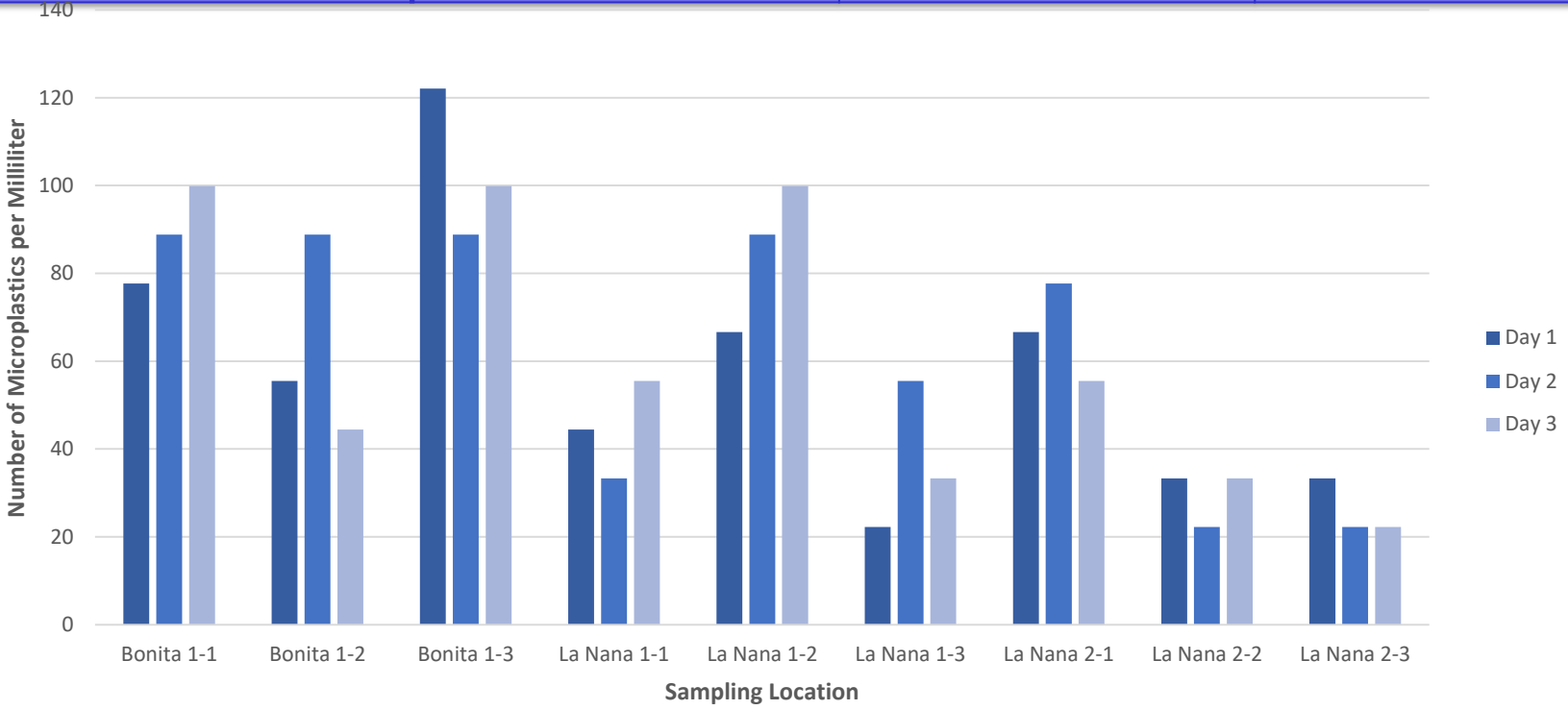


Figure 1. Display of microplastic per milliliter per sampling location.

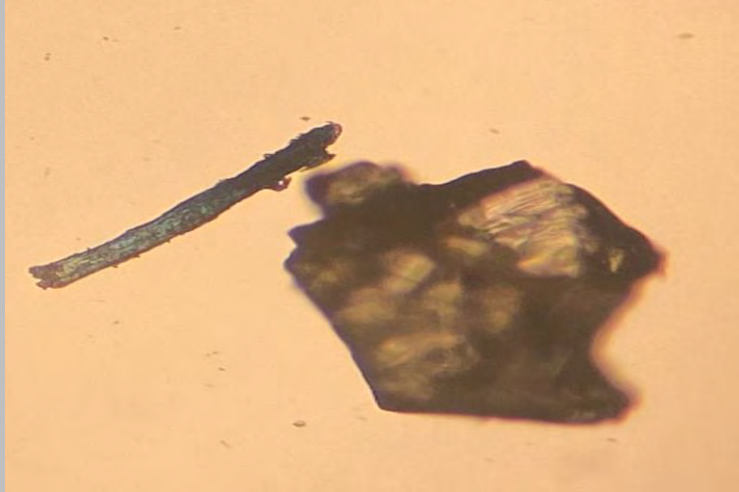
Anova: Single Factor						
SUMMARY						
Groups	Count	Sum	Average	Variance		
Bonita	9	765.9	85.1	554.445		
La Nana 1	9	499.5	55.5	677.655		
La Nana 2	9	366.3	40.7	431.235		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	9199.68	2	4599.84	8.2962963	0.001824624	3.402826
Within Groups	13306.68	24	554.445			
Total	22506.36	26				

Figure 2. Display of Anova Single Factor Test of Microplastics per milliliter.

Discussion

Table 2 shows the microplastic per milliliter of sediment sample. These values are alarming because Bonita Creek feeds into La Nana Bayou, then the Angelina River, and finally Sam Rayburn Reservoir. Angelina River and Sam Rayburn Reservoir are major recreational and fishing bodies of water that are being harmed by these microplastics. Figure 1 displays Table 2 graphically to weigh in the daunting data that was discovered. Figure 2 is the Display of the Anova Single Factor test of the data shared in Table 2. This figure is most important for determining if the hypothesis or null hypothesis is supported. The P-value to reject the null hypothesis should be less than .05 which is the case as seen in figure 2. This figure also reports the sum and averages which supports physical observations of the sampling sites.

Images of microplastics found in data analysis.



Conclusion

This study is the first attempt to quantify microplastic presence in the sediment of Bonita Creeks and La Nana Bayou. The data is very alarming and worrying as microplastics have wreaked havoc on marine ecosystems. The data supports the hypothesis which is, the data for each sampling site will not equal one another. The objectives of this project were also met. However, education and awareness on microplastics and their presence in Nacogdoches County should continue and be of utmost importance. For future studies, sampling time and experience should be increased. This would allow for more samples to be collected for analysis and then more accurate data to be reported. Lastly, sample contamination can occur very easily. Every preventative measure was followed, but contamination can not be completely ruled out.

Acknowledgements/ References

Acknowledgements

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- Dr. Candis Carraway

References

Assessment of Microplastics in the Great Plains: Comparing Densities in Water and Benthic Sediment Across Kansas
Keep Nacogdoches Beautiful
Trash Free Texas
Proceedings of the National Academy of Sciences of the United States of America; Marine Microplastics spell big problems for future generations