Microplastic Analysis of Cape Eleuthera Fish Species

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Introduction

The objective of this continuation project was to discover if Bahamas fish are consuming plastics and the composition of the materials consumed. Along the Northern hemisphere plastic accumulation is most abundance compared to other locations[3]. Plastics found in the ocean have proven to have a minimal degradation[1]. Another key understanding of the way plastics move and migrate would be with the aid of fish. Plastic accumulation in the digestive tract can influence the transport of plastics[2]. Within the fish lifespan, plastic both directly and indirectly impacts whether it is from accidental consumption/accumulation or physical damage. Original hypothesis states that if Bahamas fish are consuming plastics, then plastics will be found within their stomach contents. If the Cape Eleuthera fishes are consuming plastics either directly or indirectly, then plastics will be found in their digestive tracts.

Sample Composition

The samples originate from three habitats within the Exuma Sound located in the Bahamas. The Cape Eleuthera Institute collected fish that are generally known as popular commercial and sport fish species. After the digestive tracts were removed, they were frozen and shipped to the University of North Carolina Wilmington (UNCW).

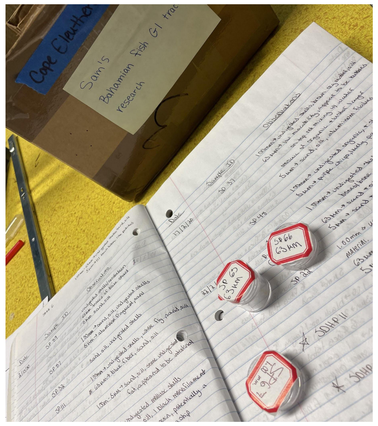


Figure 1: The box of 72 samples that will be observed from the Cape Eleuthera Institute (above).

Methodology

The 72 samples were collected from the digestive tracts of fish specimens after being chemically digested using KOH. Particles were removed under a dissecting scope located in a laminar hood to reduce contamination. Particles were recorded with ID tags, data sheets, and a notebook provided by previous research. The continuation of this work required organizing the data based on the Original Sample ID Label.

- Original Sample ID Label
  - ~ Total Sample (based on label similarities)

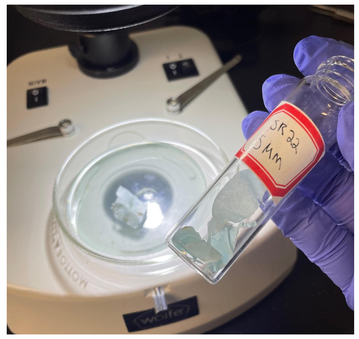
Once the samples were organized it was time to separate in categories based on the available resources. Cross-referencing between the 72 samples, the Data Book that had notes on the research, and given list of samples.

- Categories
  - ~ Box/DB/List
  - ~ Box/List
  - ~ Box Only

Separating each in three main categories, next step is to start the grouping to run samples. Using tweezers and microscopes, each sample was observed for noticeable particles. Each particle was then removed and placed on a 12-slot plate.

Fourier Transform Infrared (FTIR) spectroscopy with a 12-slot plate was utilized to run the samples.

Next identification of the fish that will be recorded from the Data Book into the project spreadsheet.



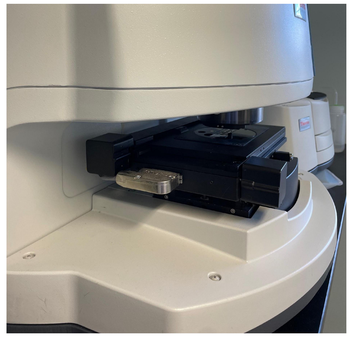
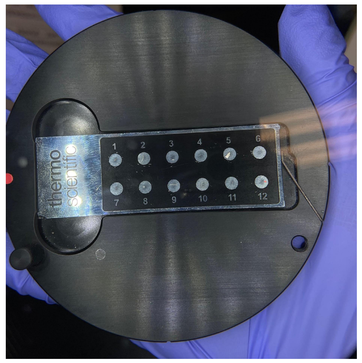


Figure 2 (left) & Figure 3 (right):. The images display the extraction method of taking the particles from the sample containers (left). FTIR set up ready to look at the samples particles (right).

Data Collected



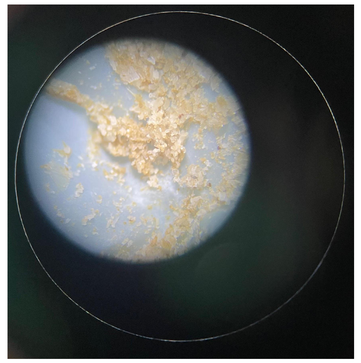


Figure 4 (left) & Figure 5 (right). The 12-slot plate filled with individual particles from a couple 63 um samples (left). From the lens of a microscope a sample of a 5 um filter paper (right).

Throughout two months of running the FTIR machine, 93 individual particles were inspected from the original 72 sample containers. Three different filtration size categories were identified: 1 mm, 63 um, 5 um. The samples that are being handled are microscopic, like the example in Figure #. The plate for the FTIR holds 12 individual samples.

Results

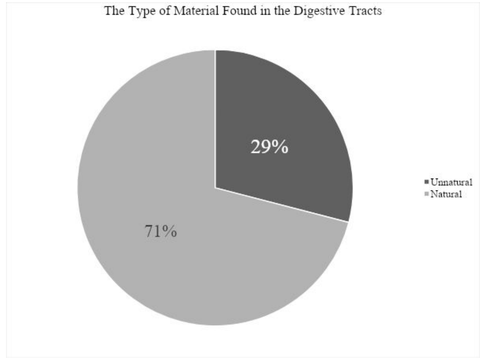


Figure 6 (Above) & Table 1 (Top 3rd Column). Pie chart of the distribution of natural and unnatural particles found in the samples.

Fish Species	5 um (f.p)	63 um	1 mm	NA	Total
Wahoo		2			2
Mahi Mahi	10	9	6	1	26
Yellow Fin Tuna		1	1		2
Barracuda	1	1	1		3
Porgy	5	1			6
Unidentified	3	23	6		32
Multon Snapper			1		1
Total	19	37	15	1	72

Table 1. Table shows the distribution of fish species and filtration sample size.

Running the samples, the highest percentage match was 89.11% and the lowest resulted a 25.51% with an approximate standard deviation of 12.23%. There was a wide range in the percentage match of each sample with the available database as seen on Figure 7.

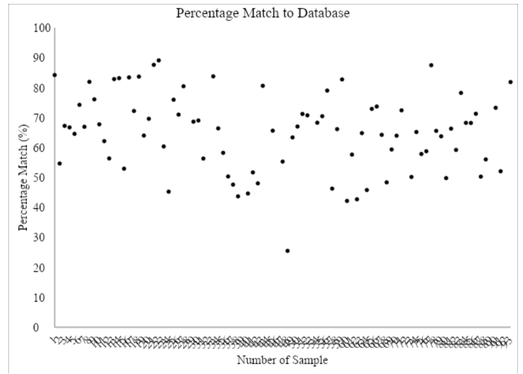


Figure 7. Scatterplot of the percent matches demonstrating the range for each sample.

Discussion

The data results from the fish samples provided by Cape Eleuthera Institute suggests that plastic in the gastrointestinal tract of various local fish species is respectfully low. Most of the particles found were smaller than 1 mm with the highest abundance revealed in the 63u range. One thing must take into consideration that some of these particles and fibers removed from the intestines are extremely microscopic and are difficult to clean to have a non-contaminated sample to test. Even though the evidence of plastic in this study is low, that does not dismiss that no plastic is being directly or indirectly ingested by marine fish species in the area.

Further research needs to be conducted in order to develop a better understanding regarding the impact of plastic marine debris ingested by marine species as it relates to fish, ocean, and human health. One way to prevent plastic ingestion is to incorporate laws in order to prevent plastic marine debris impacting these species and areas.

References

[1]Barnes D. K. A., Galgani F., Thompson R.C., and Barlaz M. (2009) Accumulation and fragmentation of plastic debris in global environments. *Phil. Trans. R. Soc*. B3641985–1998. https://doi.org/10.1098/rstb.2008.0205

[2]Pazos, R. S., Maiztegui, T., Colautti, D. C., Paracampo, A. H., & Gómez, N. (2017). Microplastics in gut contents of coastal freshwater fish from Río de la Plata estuary. *Marine Pollution Bulletin*, 122(1-2), 85–90. https://doi.org/10.1016/J.MARPOLBUL.2017.06.007

[3]Wieczorek A.M., Morrison L., Croot P.L., Allcock A.L., MacLoughlin E., Savard O., Brownlow H., and Doyle T.K., 2018. Frequency of Microplastics in Mesopelagic Fishes from the Northwest Atlantic. *Front. Mar. Sci.* 5:3 9 https://doi.org/10.3389/fmars.2018.00039

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