Data Compilation on the Occurrence of Man-Made Debris on Southeastern North Carolina Beaches

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Abstract

Marine plastics are a growing concern for the open oceans, coastal waters, and beaches. These substances do not readily biodegrade and therefore accumulate and can persist for centuries. They harm marine organisms at all trophic levels and pose a significant risk to several species. The focus of this study is to establish a baseline data set for marine plastics and other particulate pollution accumulating on area beaches in southeastern North Carolina. Each semester since Fall 2011, DIS students in the chemistry department have conducted a field campaign in order to compile data on the occurrence of these substances. Of particular interest is the correlation between the wrack and cigarette butts. This relationship can assess the effectiveness of the recent cigarette ban on Wrightsville Beach for comparison to local beaches without such a ban and will also be used to monitor trends in marine plastic deposition on our beaches through time.

Introduction

Plastics and other types of man-made debris within oceans are of growing concern because they do not break down easily and therefore collect in open water, coastal areas, and beaches. Untold amounts of marine organisms are susceptible to these plastic accumulations such as sea turtles, which are an endangered species. Though plastics typically originate as large items they will divide into smaller portions over time, becoming nearly unnoticeable microplastics. Plastics are also found to absorb and release other compounds that are potentially harmful, adding to the threat. In addition, cigarette butts can take decades to biodegrade and contain carcinogenic toxins. This study focuses on gathering data on man-made debris that can be found in the wrack line, the dead marsh and sea weed that washes onto the shore, on southeastern North Carolina beaches. This debris can consist of paper, Styrofoam, bottle caps, pellets, cigarette butts, etc. The data will then be compared to other local beaches without a cigarette ban as well and be used to examine trends in the accumulation of these marine plastics through time.

Sampling Methods

- A location is chosen based on wrack line density.
- Once a site is chosen, four marking flags and a one meter string are set up so that an area is enclosed. The dimensions may vary in order to include as much wrack line sample as possible.
- The date, time, latitude, longitude, tide, weather, distance from the berm, and dimensions of the sample are then recorded.
- A sample containing wrack and all present debris is collected into a reusable shopping bag while leaving as much sand out as possible.

Sorting Methods

- Once brought into the lab, the sample is then roughly sifted to remove all the sand. The sifted wrack is set aside in an oven tray.
- The roughly sifted sand is then sifted again with a much finer sieve to collect the smaller debris and wrack particles. These smaller pieces are also placed into the tray.
- The sample is next dried in a preheated 70 ^{o}C oven for at least 40 minutes (or until satisfactorily dry) to remove all moisture.
- It is removed from the oven and weighed.
- Afterward, the sample is sorted into two groups, organic (the wrack sample) and inorganic (man-made debris). The recovered inorganic material is placed in a petri dish.
- The inorganic material is then weighed as a whole and again separately as a part of specified groups; fragments greater than 5 cm, fragments smaller than 5 cm, pellets, film, foam, paper, cigarette butts, bottle caps, unknown and known debris.
- The data obtained from the entire process is entered into the designated spreadsheet.

Sample collection at Wrightsville Beach

Bringing the sample into the lab

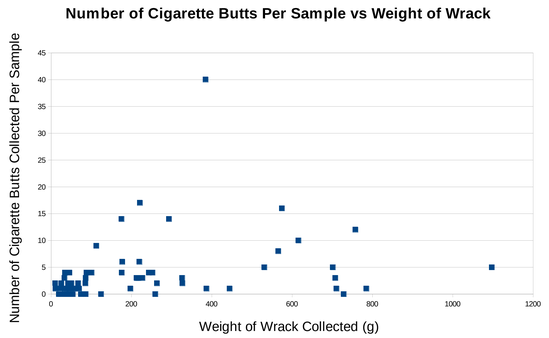
Separating sand from the sample

Inserting the sample into the oven to be dried

Weighing the wrack or organic component of sample

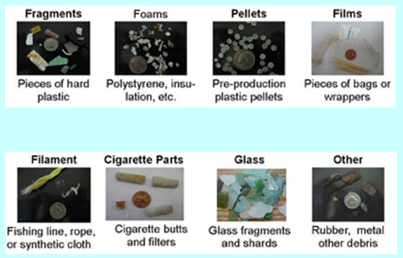
Entering data into the spreadsheet for later analysis

Preliminary Ratio Analysis Concerning the Number of Cigarette Butts and the Wrack Weight



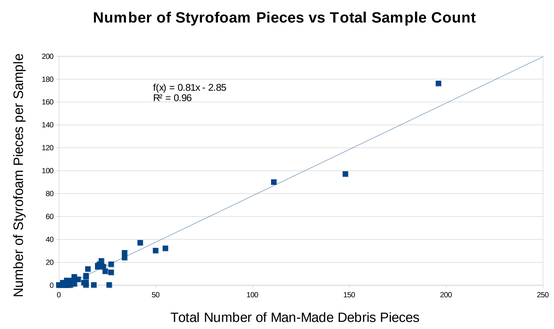
This figure, where measurements are made and recorded in grams, depicts the ratio as seen by the data currently collected of the number of cigarette butts per sample and the total weight of wrack collected.

An example of the type of debris that can be found in the wrack line at Wrightsville Beach



Images and descriptions of the categories used to classify the man-made debris collected

Preliminary Ratio Analysis Concerning Styrofoam Debris



This figure is made using approximately a year's worth of data and suggests a positive correlation between the total number of artificial debris collected in a wrack sample and the number of Styrofoam pieces found within that sample.

Future Studies

- The effects of community organized beach clean up efforts on the amount beach plastic recovered.
- A before and after analysis of the impact that a cigarette ban on North Carolina beaches will have on the density of cigarette butts collected.
- Long term comparative studies between this data set and the amounts of plastic found in other locations globally.
- The effects that this amount of plastic may have on the populations of various local marine and terrestrial species.

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