Threats to the global environment have been on a rising stance the past several decades. Between natural disasters, global warming, subsidization, and human waste, the healthful stance of the earth is plummeting. Microplastics, since the beginning of plastic development in the early twentieth century, has increased exponentially at a threatening rate to the world environment [1]. From the output of macro-plastics as human waste, microplastics are fragmented and distributed over land and sea. Over the past several decades since the beginning of plastic development, the disposal of such debris has not been taken into mind. Garbage is burned, thrown into the sea, buried, and put into landfills, each of which are several different ways of covering up a problem and putting it out of sight rather than clearing it up.

The production of plastics began in the early twentieth century after the production of polyethylene in the late nineteenth and early twentieth centuries; "The starting point of the plastic production model is global annual pure polymer (resin) production data from 1950 to 2015." [1]. From its production, many industries caught onto the flexibility and cost-effectiveness that came from the use of plastics. From this, plastic-ware boomed and nearly every corporation followed behind its benefits of expense and process. The decades of immense plastic production across the entire globe has begun to create a version of a 'plastic' society in which much of every economy has adapted to the business aspects as well has the culture that has become dependent on their material advantages. "While the use of plastic materials has generated huge social benefits, the 'plastic age' comes with downsides: one issue of emerging concern is the accumulation of plastics in the aquatic environment." [2]. From the founding of macro-plastics, plastics over the size of five millimeters, the fragmentation and production of smaller plastic parts created the rise of microplastics in production.

Microplastics are the small fragmented portions of plastic less than five millimeters in size that litter the globe [2]. "Within the marine environment, plastic is widely considered the primary constituent of 'marine debris', a category that includes both anthropogenic litter and naturally occurring flotsam." [3]. Generally, these pieces are founded from the larger pieces of macro-plastics branched off from human waste, such as: manufacturing companies, individual population waste, etc. nearly 70-80% of all marine debris has originated from the land and human populations [2]. Many examples of these microplastics can include plastic beads, thin

plastic coverings, capsules, microfibers, toiletry products, single-use wares, or even biodegradable plastics, each of which are difficult to remove once introduced into the environment. Because of this difficulty in collection and disposal, the challenge arose on how the surge of plastics might be handled and the harm they may cause if they are left to their own devices, which may take thousands of years for them to completely disintegrate.

Plastics have a low rate of disposability which leads to the complications in removal from the environment. “Plastic litter with a terrestrial source contributes ~80% of the plastics found in marine litter… a large proportion of microplastics will pass through such filtration systems.” [3]. The contamination of such waste leads to an impact in the sustainability of the habitats as well as the survival of the organisms within them. Once any plastic is created and given off into the environment, it will take many hundreds or thousands of years for it to be officially disposed of. As these plastics are transferred into organisms such as animals or humans, the health impact takes a great toll on the welfare of the ecosystem. “Microplastics are of concern especially because they can be ingested by a variety of organisms, and possibly be also transferred along the food web.” [4]. When microplastics transfer directly into biological organisms, the harm on the environment is irreparable; “Once ingested, these microplastics can either be eliminated through defecation or retained in the tissues of the exposed animals (called translocation).” [5] When microplastics transfer themselves through the food web from microscopic to macroscopic organisms, the plastics and debris is transferred with them which leaves remaining harmful substances throughout each body [4]. The debris thus affects the function of the organism between its digestive system and its brain function if widely enough effected. Plastics, once transferred into the habitat and/or then into an organism, may then be directly translated into humans as well if the organisms may be a source of food into the human economy or if the microplastics reach and contaminate human waterways.

Much of the plastics in the environment are thought of as waste from the land. It is believed that most of the plastics in the waterways are centered near to the shorelines, yet that is hard to directly record by way of population, distribution, urban outputting, and geographical circumstance (i.e. current patterns). The growth of plastic debris has increased by an annual 8.4% with a mass output in the last 13 years [1]. Because of this concept, there are many large

and growing mounds of trash that are spread across the seas as well as trash that has reached the greatest depths of the oceans [5]. The greater amount of recognized plastics is packed together on shorelines and out at sea in various locations depending on geographical circumstance and buoyancy: “Plastic Debris items are commonly found at the sea surface or washed up on the shoreline.” [6]. Without a doubt, large urban centers have an increasingly high rate of waste output with an inefficient process of sorting and disposal. Because of this, much of the plastics found are centered around the areas of large population. Data recording in such variation comes in many techniques: “Sampling of microplastics in the main marine environments (sea surface, water column, sediment) requires different approaches: samples can be selective, bulk, or volume-reduced.” [7]. Much of the microplastics to be found in the marine environment would span from certain areas in bodies of water with the ability to collect the exact data needed.

Within this experiment, the marine environment is to be tested in the Chesapeake Bay, the largest estuary of the United States that runs between Maryland and Virginia. The Chesapeake Bay connects many locations between the Atlantic Ocean and the five main rivers that are within the Bay itself. Because of the large amount of connection, the eventual run-off within the Bay is at a dangerous high rate of contamination that has left the bay score report to be at a rest at a 33 (D+). The annual State of the Bay Report summarizes the score and grade of the Fisheries, Habitats, and Pollution within the estuary, which does not stand at a high rate as of 2018 [8]. As quoted by the State of the Bay report; “Studies in the U.S. Geological Survey suggest that toxic contaminants are compromising the immune system of fish, making them more susceptible to disease and other factors degrading their health.” The goal of the representatives of the Bay is to restore its health, yet that incline is at a slow rate. Upon the continuation of collection of data, it was found that plastic debris increased greatly with greater proximity to urban shorelines; “Concentrations demonstrated statistically positive correlations with population density and proportion of urban/suburban development within watersheds.” [9]. Thus, it demonstrated the accumulation in proportion to the approximation of urban centers in relation to the Chesapeake Bay. The plastic debris that has been processed into the marine environment has placed irreparable harm onto the environment including the worlds major

marine habitats. With little decrease in production, the threats toward the environment will come at a cost toward all humans. The intended goals and movements toward the plastic and microplastic productions must be made at a consistent and implementing effort in order to benefit the overall health of all marine systems across the globe.

From the research that has been recorded, it is understood that the microplastics are moving at a constant rate of change. Because of this constant rate of change it would inevitably be difficult to determine the exactness of the where the microplastics may have originated from as well has how much they may have increased or decreased due to the change in water and wind currents [6]. Data to record such evidence of the variation upon waste is difficult to depend upon because of its variety in locational circumstance, geographical conditions, and water and wind movement patterns. Thus, the precision of the measurements in accumulation would vary.

The harm that microplastic cause to the environment will irreparable unless otherwise acted upon by society. The accumulation and fragmentation of microplastics is widespread across every area on earth with a larger abundance in relation to that of larger urban coastlines and centers of greater population. Although much of the plastics found are at an increasing rate close to the coasts, there are ever-larger bodies of waste out in the oceans that are left to their own devices, driven along by wind and water currents until they may degrade after thousands of years. The harm that microplastics, as well as any other debris or toxins, cause to the environment is damaging to the health of habitats and individual organisms that intake and spread them through the food web. As of the state of the Chesapeake Bay, the estuary is under a health crisis with major pollution harm from the population centers that run around and through the environment. The data in record displays that, from the numerous decades of plastic consumption by the economy, the output of such plastics delivers waste into the hands of the habitats across the world with no immediate process to degrade the life-threatening contaminants. The research was conducted to display the distribution and locational accumulation of microplastics that effect the environment in relation to the increase or decrease in production. In hypothesis, the accumulation of microplastics will be at an increase in proximity to urban coastlines from increase in human population and corporation.

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