Preventing the Impending Oceanic Apocalypse

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Abstract

This article addresses the global oceanic waste disaster and how now more than ever the world's oceans are under threat of becoming ecological dead zones for marine life. Presented throughout this article are arguments of why garbage patches are not only harming marine life and underwater ecosystems, but why garbage patches also pose a threat to the global water supply for humans as well. In addition to the oceanic garbage patch problem, this article also focuses on industries that are known for causing excess pollution, such as the petrochemical and poultry industry, both of which pose a significant threat to water distribution networks in cities throughout the world. This article specifically addresses regional environmental challenges and efforts faced by the Eastern Shore and Delmarva Peninsula, the spread of pollutants and formation of garbage patches nationally and internationally, national and United Nations endeavors, and proposed recommendations and solutions to mitigate the oceanic catastrophe that is unfolding right now. Case studies will be presented of Ocean City's Compost Program, the toxicity of the Chesapeake Bay, local wastewater management, the chicken farming industry's waste runoff, and the formation of garbage patches.

Introduction

The oceans have become gigantic landfills. In 2011, it was estimated that each year 6.4 million tons of waste end up in the ocean ("Plastic Trash Flowing into the Seas"). According to recent estimates by 2040 we are expected to be close to 30 million tons. Between sixty and eighty percent are plastic, with peaks of up to ninety-five percent in some areas ("Plastic Trash"). The largest percentage of them are bags, but beverage containers, cans or cigarette filters account for almost half of the total. This widespread

mismanagement of urban waste is polluting the seas to unimaginable levels and garbage in the sea is becoming the symptom of a serious disease: the misuse and constant mismanagement of natural resources. The serious problem that this has created has led the United Nations and other international organizations to launch a global alert on the rapid proliferation of oceanic waste and water pollution. A study by the United Nations Environment Program, known as the UNEP, has, also, quantified in millions of tons the garbage that accumulates in the seabed, the water column, the sea surface, and the coasts. Marine debris is gradually fragmenting into smaller and smaller pieces that can be consumed by living beings at the bottom of the food chain. Plastics are mistaken for food by birds, fish, turtles or marine mammals such as whales or dolphins. The health consequences could be very serious: contamination would be increasing in food from the sea. Drift fishing nets are another kind of residue with serious consequences for marine life. The amount of plastic bags, bottles and other waste in the ocean can be drastically reduced by improving waste management, reducing its quantity, composting, and recycling.

Oceanic waste and marine debris are a serious problem that has become widespread on the shores of the world. In the past, it was considered nothing more than an offensive sight to the eye, but today, thanks to research, it is known that oceanic waste has serious effects on habitats, fauna, health and safety of animals, and human beings, which all ultimately impact navigation and the economy. Plastic bags, abandoned fishing nets, and other discarded objects can suffocate delicate habitats. Every year, many aquatic mammals, birds, and other living organisms become entangled in or ingest the various forms of waste in the ocean. Shipping and fishing industries, also, suffer the effects of debris, as they have to pay for the repair of their ships and replace damaged implements in order to continue working. Additionally, coastal communities spend hundreds of millions of their nation-state's respective currency year after year, cleaning up their coastlines. The global oceanic waste and marine debris problems have gotten so out of hand in the past decade that the damage done to marine ecosystems around the world almost feels completely irreparable at this point.

The world is watching as an extremely fragile situation unfolds around the world's coastlines and oceans and the east coast of the United States is seeing increasing negative effects. This article addresses regional environmental challenges and efforts faced by the Eastern Shore and Delmarva Peninsula, the spread of pollutants and

formation of garbage patches nationally and internationally, national and United Nations endeavors, and proposed recommendations and solutions to mitigate the oceanic catastrophe that is unfolding right now. Case studies will be presented of Ocean City's Compost Program, the toxicity of the Chesapeake Bay, local wastewater management, the chicken farming industry's waste runoff, and tax ditch mismanagement.

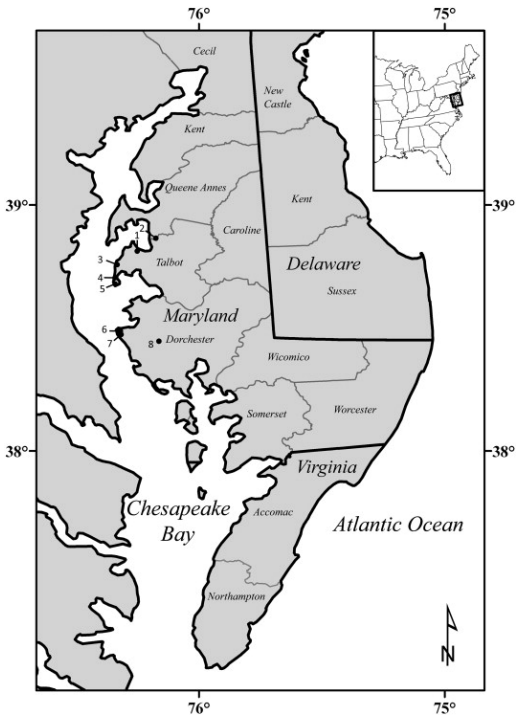
What is Marine Debris?

Marine debris, also known as marine litter, has been defined by the United Nations Environment Programme (UNEP) as "any solid, persistent, manufactured or processed material that is discharged, evacuated or left in the marine and coastal environment. Marine litter consists of items that have been manufactured or used by people and that are deliberately disposed of in rivers, seas and beaches; indirectly swept through rivers, dirty waters, torrential waters or winds; lost, including material lost at sea due to bad weather - fishing gear, cargo - or deliberately left by people on beaches and coasts" ("Marine Litter"). A good portion of marine debris is a result of purposefully human-induced water pollution and an excess of waste mismanagement by various municipalities using large garbage barges that release garbage into the oceans. A significant portion of the waste dispersed into the oceans are plastics, which should technically be recycled or composted more. Yet, due to a lack of regulation, and a lack of municipalities with a compost program or an effective recycling program most reusable and recyClable plastics end up getting trashed in the oceans and turned into marine debris. Fish and other marine lids end up eating or getting trapped in these plastics and other pollutants as a result of this process. (Ritchie, 2021). However, it is worth noting that not all marine debris is a result of waste mismanagement. Some of the marine debris in the large oceanic garbage patches appear as a result of natural disasters such as hurricanes, flooding, and/or tsunamis. This is especially true with what happened as a result of the 2011 Tōhoku Earthquake and Tsunami in Japan, where most of the debris that was taken out to sea by the tsunami was pushed by the currents across the North Pacific Ocean (NOAA National Ocean Service, 2021).

Background to the Problem

The mass production of everyday products such as containers, food utensils, garbage bags, as well as electrical and electronic devices, are made mostly of polymer materials such as PET (polyester), PVC (polyvinyl chloride), PP (polypropylene), etc. This has generated great benefits for the industries in terms of profits and costs over time, at first it was a great solution to replace very expensive materials such as metal or glass in some products, being an easy material to manufacture. For this reason, its applications are multiple and on various scales. This has caused plastic (polymers) to become a problem mainly due to its degradation time, that is, the time it takes to decompose. For example, a bag made of low-density polyethylene takes more than a hundred years and even worse a bottle that takes around a thousand years if they remain buried. Thus, plastic becomes a problem for the environment because due to the time it takes to decompose this material ends up in the ocean where it remains immobile in the waters and floating on the surface, which is why marine animals reach ingesting these wastes causing damage to their digestive systems and causing death.

The Delmarva Peninsula and the Chesapeake Bay



Map 1: The Delmarva Peninsula

Caption: Map of the Delmarva Peninsula displaying county names and the location of the Miles Point study site (1) and other locations discussed in this study, (2) Wye Island, (3) Crane Point, (4) Paw Paw Cove, (5) Blackwalnut Point, (6) James Island, (7) Oyster Cove, and (8) Blackwater Wildlife Refuge.

Source: Featured in a 2010 article entitled "Late Pleistocene upland stratigraphy of the western Delmarva Peninsula" of *Quaternary Science Reviews* by Darrin L. Lowery, M. O'Neal, J. Wah, D. Wagner, D. Stanford.

The Delmarva Peninsula and the Eastern Shore of Maryland are one of the region's most affected by the problem and the beaches are a true reflection of this. The Eastern Shore comprises several Maryland and Virginia counties located on the Delmarva Peninsula, separated from the mainland to the west by the Chesapeake Bay, and washed by Delaware Bay and the Atlantic Ocean on the east. In addition to portions of Maryland and Virginia, the peninsula contains the entire state of Delaware—hence the tri-state name, Delmarva.

Due to the location, Maryland, Delaware, and Virginia's Eastern Shore counties have faced great changes in recent years. Virginia, for instance, has a chain of fourteen barrier islands that up until 1933 had an abundance of pine forest and small villages; however, a major hurricane caused the destruction of the villages, submerged the pine forests, and eroded dunes (Rood, 2012). A combination of hurricanes, along with diseases, greatly affected sea life by killing off the seagrass where wildlife, such as shellfish, flourish. This is just one major example of the constant changes that occur in this fragile environment. Today the barrier islands are protected by the Virginia Coast Reserve. Research shows that in recent years various islands have lost an estimated 300 yards of the shoreline, which puts the region at great risk (Rood, 2012).

Abundant parks, preserves, wildlife management areas, and refugees can, also, be found on Maryland's Eastern Shore. Some of these most known nature areas include: the Eastern Neck Island National Wildlife Refuge in Kent County, the Horsehead Wetlands Center of the Wildfowl Trust of North America in Queen Anne's County, Blackwater National Wildlife Refuge in Dorchester County, Pocomoke River State Park in Worcester County, and Assateague Island National Seashore in Worcester County. The Peninsula, though, is a delicate ecosystem composed of two critical habitat types, wetlands and upland forest/farmland interfaces. Tourist attractions can, also, be found such as Ocean City in Worcester County, Maryland.

Case Study: Oceanic Waste in Maryland's Most Busiest Beach Town - Ocean City

The volume and weight of the garbage that is collected at tourist attractions such as the Ocean City beaches are increasingly becoming packaging. The beach bins are filled every day and containers are left everywhere. Added to this invasion of waste is the garbage that arrives floating, thrown from other points of the coast, ships or even neighboring countries. Despite cleaning services, strolling along a beach has become a nightmare: the tide line is an endless stream of floating objects, mostly plastic, returned by the sea.

Tourism has a huge impact when it comes to oceanic waste. In some coastal areas around the world, up to seventy five percent of the marine waste throughout the year is generated in the tourist season and can be as large as a bed or door. The total amount of ocean debris is unknown, due to the lack of more in-depth studies and the fact that much of the debris is not seen. They end up on the bottom or ingested by marine life. With increasing tourism and the demand for single-use plastics, plastic products are now invading all daily life, as a result of poor management of this waste, so that about millions of tons end up in the seas and oceans annually. This represents sixty to eighty percent of total garbage (Ritchie, 2021).

Ocean City, a seaside resort town in Maryland that lures in eight million vacationers each summer, yet, also, produces about 34,227 tons of waste of which most are materials composed of plastics such as containers, bottles, covers, etc. And that they can remain in the environment due to their difficult degradation for more than five hundred years if they reach the sea ("Media"; Maryland Department of the Environment Land and Materials Administration Resource Management Program). Tourists will find empty plastic fast food containers bottles being blown from the streets onto the beach on a busy summer beach day. The plastic, after its useful life, ends up being dragged to a point where the marine currents converge and where the water enters calm, that is where the plastic rests, forming islands of this waste. This is due to the pollution that is generated on the beach mainly by tourism where large concentrations of plastic waste are generated on the shores that are ultimately washed out to sea where due to its difficult degradation of the plastic it ends up floating on the surface creating islands of garbage.

The majority of the trash that is intended to reach a landfill from Ocean City actually doesn't travel to a local destination but to Chester, Pennsylvania, a town a hundred and

thirty miles to the north ("Environmentalists Want Boycott of Ocean City, Maryland"...). Ocean City stopped recycling in 2010 and chose instead to burn trash to create energy as part of their "innovative waste-to-energy program", but incinerators such as the one in Chester are under critique for the pollution they create ("Environmentals Want Boycott"...). The town essentially pays Covanta, the waste-to-energy operation, per ton to incinerate waste collected and convert into renewable energy (Soper, 2021). However, the energy generation is characterized as being less efficient and more polluting than other energy sources, even coal. Ultimately, the ash heads for landfills anyway, and incinerator emissions, which can exacerbate asthma and other health conditions, causing unique harm for the neighborhoods where they are located.

Fortunately, Ocean City's private sector has taken an innovative approach to the waste management problem in the area. Local owner of the Hobbit Restaurant, Garvey Heiderman, successfully pitched his pilot foot waste composting program, Ocean Compost, LLC, to the Mayor and Council (Soper, 2021). The program calls for Ocean Compost, LLC to collect food waste from a handful of restaurants, weighes it at the town's public works at 65th street, and transport it to a composting site in Bishopville, instead of to Pennsylvania (Soper, 2021). Since the collected food is to be weighed at the town's public works facility, Ocean Compost, LLC needed the approval from the Mayor and Council. The idea of this program is to reduce the overall waste stream emanating from Ocean City by removing a large amount of biodegradable food waste and composting it on a five-acre site in northern Worcester County (Soper, 2021). Ocean Compost, LLC is being paid by Ocean City the same per-ton rate as it pays Covanta, therefore, being cost-neutral (Soper, 2021). In 2021, one restaurant had around twelve thousand pounds of waste (Soper, 2021).

Toxicity of the Chesapeake Bay

From the Atlantic Coast beaches of Ocean City to the shores of the Chesapeake Bay and her tributaries, there is extensive pollution and contaminants. The Chesapeake Bay is the largest estuary in the United States. It is overseen by the Chesapeake Bay Commission and the health of the entire region is impacted by their decisions (*Chesapeake Bay Commission*). Much of the bay is surrounded by Maryland and Virginia which, together, have more than 11,000 miles of shoreline. The entire watershed encompasses over 64,000 square miles that expands to include the District of Columbia

and six states: Maryland, Delaware, Virginia, (Eastern and Central) Pennsylvania, West Virginia, and parts of central New York. The Chesapeake Bay watershed has more than one hundred and fifty tributaries that flow into it. The bay is also the largest regional source of seafood production, particularly claims, crabs, and oysters.

Map 2: Mid-Atlantic Region of the Country (States within the Chesapeake Bay Watershed)
Source: Dr. Brittany Foutz

Map 3: The Area Comprising the Chesapeake Bay Watershed (States in Abbreviated form)
Source: https://www.epa.gov/chesapeake-bay-tmdl.

According to preliminary data collected in 2018, approximately 1,364,301 acres of land in the Chesapeake Bay watershed have been permanently protected from development since 2010 ("Protected Lands"). This marks an achievement of 68

percent of the land conservation goal adopted in the Chesapeake Bay Watershed Agreement and brings the total amount of protected land in the watershed to 9.2 million acres.

The Chesapeake Bay faces a wide range of challenges stemming from pollution and run off to over-harvesting fisheries. The overharvest of marine life in the Chesapeake not only depletes populations but can also upset the natural balance of the ecosystem. The Chesapeake, also, suffers from invasive flora and fauna species, with a loss of plant life that are essential to the area for fish nurseries, water filtration, and oxygen production. Over one hundred and seventy species from other areas now live and reproduce in the Chesapeake Bay watershed ("Invasive Plant Species"). Some have been brought here accidentally, through ballast water or as hitchhikers on boat bottoms, and others have been introduced to serve a specific purpose. Although some have proven beneficial, others are a nuisance, and a few threaten our ecosystem.

Focusing on just one of these challenges - pollution in the Chesapeake Bay, has revealed that "almost three quarters of the Bay's tidal waters are impaired by pesticides, pharmaceuticals, metals, and other chemicals, which can harm the health of both humans and wildlife" ("Chemical Contaminants"). According to the Chesapeake Bay Foundation, from the insecticides that are put on farm fields to the cleaners used to disinfect homes, contaminants can enter the Bay and its tributaries. Different contaminants can affect the survival, growth and reproduction of fish and wildlife in different ways. Two variants of chemical contaminants can be found in the Bay, of which are metals and organics ("Chemical Contaminants"). Mercury is one of the most common and widespread metals found in the Bay. Production bans have lowered the presence of some contaminants in the watershed, but others are still widely used today.

Local Wastewater Management Problems

The only regional organization solely dedicated to providing free legal services to protect the Chesapeake Bay watershed is the Chesapeake Alliance. The Alliance recently released a report that found only about twenty five percent of facilities with groundwater discharge permits were in full compliance. Nearly half of all such facilities

on the Eastern Shore failed to meet groundwater permit conditions between fiscal 2017 and the first half of fiscal 2020, according to the report ("Opinion: Eastern Shore Development's Wastewater Treatment Plan"...). Meanwhile, sewage treatment plants have continued on the Eastern Shore to release excessive amounts of nitrogen or phosphorus pollution that fueled algal blooms and low-oxygen "dead zones" in waterways. Even with the most advanced methods to soak up pollutants, the risk of nitrogen and phosphorus resides in groundwater and close waterways.

Furthermore, "the state" [of Maryland] "requires treated sewage discharged to waterways to not exceed nutrient pollution limits regulators set to achieve" [Chesapeake]"Bay restoration targets. This helps restoration officials understand the level of pollution reaching the Bay and as needed put in place methods such as tree plantings, stormwater controls or enhanced farm management to reduce pollution elsewhere." In the past, the state has gone around these requirements and pushed to have a new wastewater plant's spray irrigation system of apparent higher standards that would be sprayed onto about ninety acres of fields near hundreds of existing and proposed homes ("Opinion: Eastern Shore Development's Wastewater Treatment Plan"...). This proposal has left many skeptics as seen as being an "end-run around state requirement" ("Opinion: Eastern Shore"...).

Chicken Farming Industry Waste Runoff

Maryland currently has over five hundred active poultry operations that raise a total of about three hundred million chickens per year, of which produces more than six hundred million pounds of chicken manure, which leads to runoff that pollutes the Chesapeake Bay. (Lamm et al., 2021). There are two agencies that oversee the poultry industry and are responsible for ensuring that farms comply with regulations set in place to manage chicken manure are the Maryland Department of the Environment and the Maryland Department of Agriculture. A report from the Environmental Integrity Project has revealed that state oversight is minimal and ineffective at protecting water

quality. For example, more than half of the poultry farms whose records were available in 2019 admitted to over-applying chicken manure to their crops, violating state law and avoiding the fine. Despite the results of unchecked pollution and the effects to the Chesapeake Bay and local resident revealed in the report, the Environmental Integrity Project's Report remains hopeful and provides recommendations that will help Maryland improve accountability for the Eastern Shore's largest industry - the poultry industry -, and protect the health of people in the region and reduce pollution in the Chesapeake Bay.

The Rise Of Oceanic Garbage Patches

The local environmental challenges in the region are also having an impact upon us nationally with the rise of oceanic garbage patches. They are not on maps, but there are five floating plastic islands in our oceans that threaten to destroy and kill off much of marine life and contribute to climate change. Some of these garbage patches - such as the one in the North Pacific - are close in size to the countries of France, Spain, and Germany combined. The islands of plastic are the "five continents of shame", the result of more than six decades of spills into the ocean originating, mainly, from the mainland and from maritime traffic (Cho, 2019). In all these years, we have put over eight million tons of this polymer into circulation globally, according to estimates by the University of California, and the most worrying thing is that more than seventy percent is now waste that collapses the landfills and the seas of the planet (Geyer, Roland, et al., 2017; Cho, 2019).

According to the National Oceanic and Atmospheric Administration of the United States, "the term garbage island or garbage patch is not appropriate, because it is more about a concentration of microplastics that are suspended in columns under water" ("Great Pacific Garbage Patch"). The islands of garbage are essentially agglomerations of non-biodegradable waste that, due to the influence of oceanic gyrations - the system of rotating marine currents -accumulate in extensive floating rafts. These gigantic concentrations of garbage are made up mostly of microplastics smaller than five

millimeters that float inside the oceanic gyres - they get caught in these huge eddies and the internal currents group them. This makes the five largest plastic islands in the world coincide with the main oceanic vortices: the two in the Pacific, the two in the Atlantic and the other in the Indian Ocean. Plastic islands are also known in other seas on the planet, such as the Mediterranean or the Caribbean, although they are much smaller and more dispersed than the previous ones (Cho, 2019).

The largest found so far is the garbage island in the Pacific, but there are four others spread over the other oceans except for the Arctic and Antarctic. Contrary to what was believed since they were sighted for the first time in the late 80's and early 90's, their size is not as exorbitant as was initially believed, as various organizations and researchers have assured, however they do warn of the serious risk to the marine ecosystem and the lives of thousands of animals (Cho, 2019).

The existence of the garbage patches was described in 1988 in a publication of the National Oceanic And Atmospheric Administration, known as NOAA, of which was based on the results obtained in laboratories in Alaska between 1985 and 1988, which measured floating plastic in the North Pacific Ocean (Day et al., 1985; 88). These laboratories found high concentrations of fragments of marine debris accumulated in areas characterized by certain ocean currents. Extrapolating from the results in the Sea of Japan, the researchers concluded that conditions similar to these could occur in other parts of the ocean, where the prevailing currents were favorable to the creation of relatively stable bodies of water. They specifically indicated the turn of the North Pacific.

The existence of the garbage patch received wide attention from the public and the scientific community after it was documented in several articles by Charles Moore, a Californian oceanographic researcher and sea captain who returned home via the North Pacific gyre after competing in the maritime race called Transpac. Moore claimed to have found a huge body of water with floating debris and alerted oceanographer Curtis

Ebbesmeyer to the phenomenon, who he called the Eastern Garbage Patch region. This area is frequently cited in the media as an exceptional example of marine pollution.

In 2017, the existence of the last one was confirmed, in the South Atlantic, and the other three were found in the North Atlantic (2009), the Indian Ocean (2010), and the South Pacific (2011) (Cho, 2019).

Regarding the weight calculation, it is estimated that the Pacific garbage island contains around eighty thousand tons of waste, mainly plastic ("Great Pacific Garbage Patch"). During three years of research, those involved in the study carried out surveys with boats and airplanes. Thus, they were able to draw a map of the area and the location, which is in the northern Pacific Ocean. In this place, due to rotating currents and winds, debris and many plankton organisms converge. Although these are not islands per se, the concentration of plastics intensifies as one approaches the center of this patch.

Like other areas where marine debris is concentrated in the world's oceans, the eastern garbage soup has gradually formed in recent times as a result of marine pollution clustered by the action of currents. The oceanic debris patch occupies a large and relatively fixed area of the North Pacific Ocean.

Photodegradation of Plastics in the Ocean

The eastern garbage patch has one of the highest levels of suspended plastic particles on the surface of the water, making it one of the oceanic regions in which researchers have studied its effects and the impact of plastic photodegradation of floating debris on the water layer. Unlike biodegradable waste, photodegradable plastics disintegrate into smaller pieces, although they remain polymers. This process continues until it reaches the molecular level. As photodegradable floating plastic debris turns into smaller pieces each time, it concentrates on top until it disintegrates, and the plastic eventually

becomes so small that it can be eaten by marine organisms living nearby. from the surface of the ocean. Therefore, garbage waste completely enters the food chain. Despite Charles Moore's description, the eastern garbage patch is not characterized as a visible zone of floating debris. The disintegration process means that the most dangerous plastic particles are too small to be seen.

Impact on Marine Life

Floating plastic particles resemble zooplankton, which is why they can be accidentally eaten by jellyfish. Many long-lived debris end up in the stomachs of seabirds and sea animals, including ocean turtles and black-footed albatrosses, these particles being a risk to marine life. Apart from the polluting residues of seawater, these floating residues bring other types of pollutants such as polychlorinated biphenyls, DDT (1,1,1-Trichloro-2,2-bis (4-chlorophenyl) -ethane) and polycyclic aromatic hydrocarbon (HAP or PAH), bringing with this toxic effects when consumed by mistake, in some cases, causing hormonal problems in animals. Jellyfish eat the toxins in plastics, and in turn, large fish eat jellyfish. Many will be fished and fed to humans, thus resulting in human ingestion of these toxins. Marine plastic also facilitates the spread of invasive species that adhere to the surface of this floating plastic and travel great distances, colonizing new ecosystems. Researchers have shown that this plastic waste affects at least two hundred and sixty-seven species around the world, and the vast majority live in the great garbage patch of the North Pacific ("Plastic Debris in the World's Oceans").

Further Consequences of the Plastic Islands on the Planet

The UN has long been warning the international community of the damage ocean litter causes to the economy and the environment. These residues decimate marine ecosystems by causing the death of more than a million animals a year and, in addition, they cost by billions of dollars the conservation of the oceans initially foreseen by the UN Convention on Biological Diversity.

Oceanic plastic, also, compromises the subsistence and prosperity of many small communities that make a living from fishing, harms air quality, pollutes the atmosphere, and contributes to global warming. In this sense, researchers from the University of Hawaii discovered in 2018 that polyethylene - one of the most widely used disposable plastics - emits greenhouse gasses such as ethylene and methane when it decomposes in the sun (Grabowski, 2018).

Proposed Solutions: Additional Preventative Measures by the United Nations: A Manifesto for a Clean Ocean

Reducing marine debris by 50-90% and developing a high-tech global monitoring system are the two essential goals set by a UN panel of international experts to achieve clean oceans by 2030.

This is stated in the "Manifesto for a Clean Ocean", presented by the International Group of Experts of the Decade of Ocean Sciences for Sustainable Development of the United Nations, UN, in a series of conferences at the end of 2021 sponsored by the Ministry of Education and Research of Germany and by the United Nations Educational, Scientific and Cultural Organization, UNESCO ("A Clean Ocean"). The manifesto, which recalls that the oceans cover seventy one percent of the Earth's surface, advocates increasing the circularity of the economy in the face of the increasing industrialization of the oceans and promoting mobilization to manage marine pollution in ways that allow a balance between a profitable "blue economy" and a clean ocean.

The nine-member group, under the direction of biodiversity experts Angelika Brandt and Elva Escobar Briones, stresses that "this process should lead us to define and attract financial and other support to meet a set of initial objectives for 2025, followed by objectives for the end of the Ocean Decade in 2030 " ("Steps Needed to Achieve a Clean Ocean by 2030"). "By 2025, we want to identify possible ways to know what solutions are feasible. By 2030, we want to achieve measurable improvements in monitoring and a clear reduction in emissions and damages through a spectrum of technical and behavioral strategies ", the experts point out ("Steps Needed"...). The manifesto, which recalls that the oceans cover seventy-one percent of the Earth's surface, advocates

increasing the circularity of the economy in the face of the increasing industrialization of the oceans and promoting mobilization to manage marine pollution in ways that allow a balance between a profitable "blue economy" and a clean ocean. Experts identify the main pollutants that threaten the oceans: waste and plastics, oils and chemical spills, fertilizers and pesticides, sewage and pharmaceutical waste, radioactive materials or invasive species, among others.

Other improvements include the results of control measures (for example, decrease the amounts of mercury in tuna, the death of marine life and eutrophication); better monitoring of the oceans for more accurate, timely and comprehensive real-time monitoring of pollutant spills; and identifying and accelerating the development and adoption of technologies such as cleaner and more efficient engines and fuels are other goals. Better national mechanisms for the control and prevention of marine litter and facilitating behavior change that favors the motto of 'reduce, reuse and recycle' complete the list of objectives. With this framework, efforts such as the global agreement scheduled for next spring to protect thirty percent of the seas by 2030 could also be activated and that the high-resolution mapping of the seabed ends that year. In addition, experts advocate for interim targets for 2025, such as quantifying the global damage of marine pollution from all major sources on ecosystems and organisms and on human health, and studying all anthropogenic chemicals that flow into the oceans. Also, to define what are clean oceans, with acceptable thresholds of pollution, ecological limits or maximum levels of pollutants; identify high-priority geographic challenges, such as polar regions and urban coasts; develop economic scenarios related to the oceans over the next decade (such as tourism, seabed mining and wind farm development); and secure financial commitments are other goals for 2025.

Decade of the Oceans

Lead author of the manifesto and director of the Human Environment Program at Rockefeller University in New York, Jesse Ausubel, advocates a change in this decade from increasing the environmental problems of the oceans to decreasing them. This declaration is part of the "Decade of the Oceans", a UN initiative presented in January 2021 that is defined as a "once in a lifetime opportunity" for actors from around the world to come together to generate knowledge and promote alliances to seek scientific solutions that promote the sustainable development of marine ecosystems by 2030. This

initiative, coordinated by UNESCO's Intergovernmental Oceanographic Commission, IOC, seeks to lay the new foundations between science and policy in order to strengthen the sustainable management of the oceans and coasts, promoting international cooperation for the development of scientific research. and the application of innovative technologies.

In his presentation, the UN Secretary General, António Guterres, recalled that if action is not taken now, by 2050, there will be more plastics than fish in our seas. Marine litter is becoming a calamity for the oceans and the planet. This initiative is an important step in addressing the problem and will help protect ocean ecosystems, as well as the livelihoods of those who depend on them. The Decade of the Oceans aims to respond to these upcoming challenges such as marine pollution, the protection of ecosystems and biodiversity or sustainable food and fisheries through scientific innovations to lead to cleaner, more resistant and safer oceans.

Preventative Measures by the U.S. and other Nation-states

As of 2021, the United States is the second most waste producing country in the world creating over thirty-seven million tons of plastic waste each year (Richie and Roser, 2021). Currently, the United States does not enforce any form of national recycling or waste reduction measurements ("State Plastic Bag Legislation"). With global climate change rapidly increasing, the time to act and change these wasteful habits is now. Nationwide regulations are a necessity in order to succeed. A multitude of other nations follow efficient and successful waste management programs that could be utilized as models in the United States.

Germany continuously leads the world in recycling and waste management due to their strictly enforced policies and protocols. Germany's main system, additionally followed by other European countries, is called The Green Dot System ("Der Grüne Punkt Partner Des Onlinehandels"). With this system, manufacturers and retailers have to pay an extra price to put a green dot on their products that are packaged with recyclable materials. The green dot signifies that the company contributed to a national waste

management program by paying that extra packaging fee. This system operates successfully in tandem with waste separation policies. Waste such as glass, paper or plastic is categorized by material that coordinates with a colored bin or bag. Biological waste is to be composted or placed in brown bins. Any waste that cannot be composted or does not apply to one of the categorized bins is considered toxic, and placed in gray bins collected by council trucks to be disposed of properly. Implementation of the Green Dot system, in addition to categorized waste disposal, would be extremely beneficial to reducing plastic waste in the United States. This starting point of proper disposal methods creates a snowball effect towards cleaning up coasts and oceans.

Our Recommendations

Unfortunately, solving the problem of water pollution caused by plastic is not as simple as collecting everything. While a large amount of plastic pollution is concentrated in the gyres, it does not float in a single mass on the surface. Chunks of plastic are found at all depths. Plastic also breaks down into tiny particles in the ocean, making cleanup efforts very difficult. Additionally, it is challenging to remove plastics from the ocean without removing or harming marine life. With these difficulties in mind, it is important that we work to find solutions that prevent plastic from entering the waste stream in the first place.

A nationwide regimen for waste disposal could potentially take time to implement, so in the meantime, immediate action can be taken in local communities. The Ocean City municipality could enforce a ban on all single use plastic products, introducing and mandating the usage of environmentally friendly, biodegradable products. Companies such as Green Paper Products offer every kind of food service product that is biodegradable, compostable and eco-friendly. This company also provides the service of free carbon neutral shipping. Every aspect of Green Paper Products seeks to promote sustainability and inclusion of organic material. Ocean City could make the switch to utilizing biodegradable tableware, as it is just as readily available and affordable as plastic products. The substitution of compostable cups and cutlery would reduce the

risk of harm to marine habitats, because even with the possibility of improper disposal, the products will still break down and contribute to the environment in a positive manner.

However, biodegradable products are not the solution. The term bioplastics is increasingly used to refer to a wide range of products thought of as alternatives to traditional plastics. However, the term does not necessarily mean that a material is fossil fuel-free, compostable, or ecologically preferable. Some bioplastic products are completely derived from plants, while others are made, at least in part, from fossil fuels. Some of them are compostable, while others are not. In some cases, plastics claim to be biodegradable, which is not the same as compostable. Biodegradable can only mean that a product will eventually break down, but not necessarily within a specific time or frame or down to a specific particle size. While these products offer the promise of "green" alternatives to traditional plastics, the reality is more complex. Even plant-based plastics that are certified compostable are often designed to break down efficiently only in commercial composting systems. And even if plastics that are plant-based and compostable, if turned into trash, they can persist long enough to harm water systems and wildlife. The production of some bioplastics is also potentially problematic. Replacing some current plastics with plant-based bioplastics (especially those made from agricultural waste, which would otherwise be treated as waste) is a promising way to reduce our use of fossil fuels. However, the most widely available bioplastics today are based on corn. While these represent a positive step towards finding alternatives to non-renewable fossil fuel-derived plastic, they are based on corn production, raising concerns about agricultural impacts related to land use, food production and global warming. More research is needed to develop better products that will reduce our dependence on non-renewable resources and address concerns associated with plastic pollution in the oceans without causing harm in other areas.

Conclusion

This article has addressed regional environmental challenges and efforts faced by the Eastern Shore and Delmarva Peninsula, the spread of pollutants and formation of garbage patches nationally and internationally, national and United Nations endeavors, and proposed recommendations and solutions to mitigate the oceanic catastrophe that is unfolding right now. The Delmarva Peninsula faces a series of challenges that impact its sustainability. Traditional farming practices and the chicken industry are vital to the local economy and yet these practices, while improving, continue to impact the water quality of the bay, tributary rivers and streams. Clean water is critical not only to the tourism industry but to watermen's livelihood as both depend on clean water. Larger environmental challenges, including rising sea levels and land loss, are literally eating away at the peninsula at an accelerated rate. Taken together, these challenges pose further several social conflicts that are already impacting the region but through local collaborative problem-solving measures these needs could be addressed better.

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