The Effects of Plastic on Marine Animals

By: Madeleine Villanueva

"Plastics. There's a great future in plastics" (Hoffman). Those words spoken in the 1967 film *The Graduate* predicts the succeeding boom in plastic use. Today, one does not have to look far to find the material, which is "in everything from car parts to doll parts, from soft drink bottles to the refrigerators they are stored in" (The Uses of Plastics). Prized for its "health, safety, performance, [and] value" (The Uses of Plastics), plastic rightly justifies its prevalence in modern society. But it is its durability that poses a risk to marine animals.

Plastic's toughness can be attributed to its structure. It is composed mainly of a binder and enhanced with additives. Organic substances, such as cellulose or casein, sometimes form the binder, but it is often made up of synthetic resins that are constructed to create long chainlike molecules called polymers. Chemicals and colorants are then added to improve the product. Plasticizers strengthen and elasticize the plastic, while fillers refine its properties and pigments provide color (Composition and Types of Plastic). It is this durability that explains its popularity among consumers. In the United States alone, more than a billion pounds of the material is sold annually (The History of Plastic). Last year, more than 300 million tons of plastic was produced worldwide (Knoblauch).

Plastic may ease and benefit human life, but it has the opposite effect on marine life. The material's durability that many individuals treasure is the cause of suffering for numerous aquatic animals. Plastic does not biodegrade, meaning that microbes do not break it down, and so it stays on the planet for an indefinite period of time. It does, however, photodegrade, splitting into smaller and smaller pieces due to exposure to sunlight (McLendon). And so, the plastic trash

dumped on streets often washes out to oceans, where they either stay afloat or fracture into microscopic bits that remain suspended in the water. According to Greenpeace, of the 300 billion pounds of plastic created yearly, "about 10% ends up in the ocean" (Great Pacific Garbage Patch: Cancer of the Ocean). Most of the minute debris accumulates in an area called the Great Pacific Garbage Patch in the North Pacific Ocean between California and Japan (De-mystifying the "Great Pacific Garbage Patch"). Caused by the North Pacific Subtropical Gyre, a large whirlpool created by several circular ocean currents, it gathers all plastic trash runoff from Asia and the west coast of North America into a region called North Pacific Subtropical Convergence Zone (McLendon). This extensive garbage dump and the rest of the ocean's contents; which include plastic bags, plastic bottles, bottle caps, bottle rings, and other plastic fragments; can kill and injure marine animals.

Plastic fishing nets and bottle rings strangle and incapacitate aquatic creatures. Discarded nets can continue fishing for several months after their owners have abandoned them. This event, called "ghost fishing" (McLendon), can ensnare and drown seals, sea turtles, and dolphins (Impact of Plastic). Even small plastic rings greatly affect sea animals. Mae West, a female common snapping turtle, got caught in a milk jug ring as a hatchling and was forced to grow around it. Due to the simple human action of littering, she now suffers from disfigurement. Like the 1930s American actress for whom she is named, she has a tiny waist and an hourglass shape. Mae's backbone never developed properly, causing her to walk with a gait. Her disability also prevents her from returning to the wild, and so she resides in an animal care facility in New Orleans (Buck).

Ingestion of plastic poisons and starves marine wildlife. Plastic contains chemicals and colorants, such as phthalates and bisphenol-A, that are toxic to animals (McLendon). Intake of

the material can impede growth in crustaceans and adversely affect reproduction in other aquatic creatures (Knoblauch). As plastic photodegrades, it also absorbs natural contaminants, such as polychlorinated biphenyls (McLendon). These microscopic fragments are eaten by plankton, which then pass on the toxins to other animals that ingest them (Impact of Plastic). Small floating debris, such as bottle caps and plastic resin pellets, even kill birds that feed on water animals. Plastic weighs animals' stomachs down, creating the illusion that they are full without consuming nutrients. It can then either pass through the digestive tract or clog the intestinal tract, killing the animal. This cycle continues again as others feed on the deceased creature or on the expelled plastic (FAQs). Artist Chris Jordan chronicles the deaths of albatrosses on Midway Atoll with a series of photographs showing their remains with stomachs full of plastic (Harrison). The birds often mistake surface plastic trash for fish eggs, and so they feed them to their waiting chicks, who then die of "starvation or ruptured organs" (McLendon). These albatrosses live in isolation from civilization, about "2000 miles from the nearest continent" (Harrison), yet they still suffer for humans' mistakes.

Not all plastic breaks down, and those that remain afloat on the ocean surface carry as much threat as minute fragments. Large floating debris can act as "vectors for exotics to move throughout the [oceans]" (Algalita Marine Research Foundation), like a plastic stripping which housed ten species of invertebrates that was found along the coast of Adelaide Island near the Antarctic Peninsula (Knoblauch). Animals and plants often use the suspended objects to travel to new areas far from their normal habitat, where they can threaten indigenous species (The Trash Vortex). Author and researcher David Barnes notes that these "ocean hitchhikers" (The Trash Vortex) endanger an area's biodiversity. He even found floating plastic in the secluded

Amundsen Sea in the Pacific Sector of Antarctica, showing that previously unlivable regions can now be inhabited by invasive animals (Knoblauch).

A simple cleanup of the plastic debris does not seem possible as it "would bankrupt any country and kill wildlife in the nets as it went" (Knoblauch). There are about 120,000 floating plastic fragments for every square kilometer of the ocean (Great Pacific Garbage Patch: Cancer of the Ocean), and so this claim does not seem so far-fetched. A sweep of the water surface would catch as much plankton as garbage, killing the food source of many marine animals. Stiv Wilson, a member of the conservation group 5 Gyres, asserts that one would need 630 supertankers, or about 17% of the world's oil tankers, to capture the 315 billion pounds of trash that litter the ocean (Reilly). Despite these grim statements, scientists are still working to rid the world of this problem. The National Oceanic and Atmospheric Administration (NOAA) continue to collect water and debris samples from the Great Pacific Garbage Trash in order to gain more understanding of the effects of plastic in the ocean. Project Kasei conducts research in order to find a way to recycle or convert the rubbish into fuel (McLendon). Scientists are also examining plastic additives in an effort to combat the harmful substances that leech into the water, and attempting to raise the accessibility of biodegradable plastic and the practice of recycling (Knoblauch).

As an individual, one can control the amount of marine trash by reducing his or her plastic use. "Plastics are very long-lived products that could potentially have service over decades, and yet [the] main use of these lightweight, inexpensive materials is as single-use items" (Knoblauch). Using more reusable items helps alleviate the problem. Investing in a reusable shopping bag and water bottle can save the one million birds, sea turtles, and marine mammals that are killed yearly by plastic consumption and entanglement (Impact of Plastic).

Recycling all plastic items can prevent that bottle from floating in the ocean and introducing invasive species to new habitats. Ensuring that all trash is properly disposed lessens the amount of waste that washes into the oceans. Since many of the rubbish wash back ashore, beach cleanups can effectively eliminate some of the plastic debris (Reilly). Educating others can also play a big role in alleviating oceans of waste. Marcus Eriksen and Anna Cummins, the founders of 5 Gyres, constructed a ship called JUNKraft out of 15,000 empty plastic soda bottles. They plan to sail from Hawaii to California in order to build awareness for the Great Pacific Garbage Patch (Palacio). But one does not have to build a boat to make a statement. A student can create a club in his or her school that warns of the dangers of plastic and devises ways to reduce waste. An office worker can start a recycling program in his or her company or instruct co-workers on the benefits of reusable utensils. Such simple actions can help mitigate the problem humans have incited.

After World War II, plastic signaled the start of peacetime and "throwaway living," "which would liberate the housewife from the drudgery of doing dishes" (Heimbuch). Today, over 315 billion pounds of plastic litter our oceans, killing millions of marine animals yearly. Previously a symbol of wealth and productivity, it is now a nuisance that the world cannot dispose of. But it can still be the beacon of hope it once was if individuals learn to recycle and moderate their use of the material and embrace reusable goods. Maybe then, it can create the "great future" that Mr. McGuire envisioned in *The Graduate*.

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