Microplastics Group Annotated Bibliography

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Works Cited

Akpan, Nsikan. "Microplastics Lodge in Crab Gills, Guts." *Science News*, vol. 186, no. 3, 2014, pp. 9–9. *JSTOR*, JSTOR, www.jstor.org/stable/24366141.

This source highlights the longevity of plastics not only in the environment as a whole, but within afflicted marine organisms themselves. Filter feeds especially suffer from long term effects of microplastic pollution as they continually intake and process water. Experiments have shown crabs living in clean water to continue exhaling microplastics for more than 3 weeks following a short exposure time. This source also explains water treatment plant's inability to remove microplastics from waste water. Using this we can know to map high concentrations of filter feeders for displaying environmental impact and water treatment plants for large sources of debris. Runoff channels from these water treatment plants can also be mapped to track the passage of PMDs through waterways.

Brooks, Andrew, et al. "Fashion, Sustainability, and the Anthropocene." *Utopian Studies*, vol. 28, no. 3, 2018, pp. 482–504. *JSTOR*, JSTOR, www.jstor.org/stable/10.5325/utopianstudies.28.3.0482.

This source details the intake process of chemical pollutants and their relationship with microplastics. Microplastics adsorb to chemical pollutants and concentrate them, increasing the uptake of harmful chemicals and heavy metals by marine wildlife. This data can be used to map high concentrations of microplastics and chemical pollutants in conjunction to show the compounded effects of these wastes on wildlife. The impact of the fashion industry on microplastic pollution is also explained in this article. Synthetic fibers contribute significantly to the concentration of microplastics in the ocean. Synthetic clothing factories can be mapped along with their runoff systems to trace microplastic abundance in waterways.

Duis, Karen, and Anja Coors. "Microplastics in the Aquatic and Terrestrial Environment: Sources (with a Specific Focus on Personal Care Products), Fate and Effects." *Environmental Sciences Europe*, vol. 28, no. 1, 6 Jan. 2016. *Springer Open*, doi:10.1186/s12302-015-0069-y.

This source provides information providing a plethora of primary and secondary microplastic sources, including personal care products, plastic mulching, drilling fluids, car tire abrasions, and much more. Detailing such a large number of sources gives the ability to create a nearly comprehensive map of sources. Fishing industries and synthetic textile industries are shown to have a large impact on microplastic pollution with the average contribution of a singular product being calculated. Not only are sources of microplastics tracked and measured, but samples were collected from many areas, from beaches to ocean floor sediment beds, to track microplastic

concentration and classification. The life line of plastics from land to ocean was tracked as well, explaining chemical adsorption, fragmentation rates, accumulation and interaction with wildlife. This can be used to both map numerous primary and secondary sources of microplastics and to show the interaction of microplastics with wildlife and marine environments as a whole.

Fela, Jen. "Ocean Cleanup Feasible, but Is It Worthwhile?" *Frontiers in Ecology and the Environment*, vol. 12, no. 7, 2014, pp. 372–372. *JSTOR*, JSTOR, www.jstor.org/stable/43187826.

We used this source to research whether or not it will be possible to contain the plastics in the ocean. This article reports on a possible solution to the microplastics issue proposed by a Dutch scientist which is purported to be financially viable. The plan involves using natural forces, like the wind and tides, to drive plastic into sections of the ocean enclosed by floating walls. The walls would keep the plastic contained and most of the wildlife would pass underneath, safe from the majority of the pollution. The article also covers some responses from skeptics, who say that merely containing the pollution will not do much and we should focus on preventing people from using and throwing out extra plastic in the first place. This article is important because it provides a possible plan for the future as well as data on possible solutions.

Hamid, Fauziah Shahul, et al. "Worldwide Distribution and Abundance of Microplastic: How Dire Is the Situation?" *Waste Management & Research*, vol. 36, no. 10, 2018, pp. 873–897., doi:10.1177/0734242x18785730.

We decided to use this source primarily for the quantitative and qualitative information it provides on the microplastic composition of the marine and freshwater environments of North America. Areas with high concentrations of microplastics within their aquatic environment are correlated to large population and manufacturing centers on the coast. Additionally, the article goes in depth on the process by which microplastics make their way into various ecosystems, as well as the potential challenges of monitoring microplastic pollution. Microplastic monitoring in river ecosystems is primarily done by deploying nets into the current of the river and recording the microplastic concentration from the sample collected. As a result, the abundance of microplastic detected is dependent on the size of the mesh used in the net, and is one of the chief limiting factors in monitoring microplastic concentration. Using the data from this article, we can match high microplastic concentration areas to their respective industrial and population coastal centers on our map, as well as elaborate on some of the techniques used to detect microplastics within the environment.

"Land of Waste: American Landfills and Waste Production." *SaveOnEnergy*, www.saveonenergy.com/land-of-waste/.

This source has a variety of visual graphics which depict the location of Landfills in the United States, including the location of closed landfills in addition to active ones. This is useful to our project, because we can use the locations of the landfills in the US on the layer of our map which depicts how plastic gets to the ocean in the first place. This website discusses how landfills are a relatively new convention and how at first they were not sanctioned at all and completely

environmentally unfriendly. It brings up the point that though recycling is growing in popularity, literal tons of plastic still makes its way into landfills.

Lemonick, Sam. "Plastic Goes Missing at Sea." *Science News*, vol. 186, no. 3, 2014, pp. 9–9. *JSTOR*, JSTOR, www.jstor.org/stable/24366142.

This source details the things we still don't know about microplastics. In a study by a Spanish research team, the amount of plastic we know enters the ocean was compared to an estimate based on a sampling of ocean water, and a disturbing 99% of the plastic we know is there was unaccounted for. What this means is that although large amounts of plastic are entering the ocean, a majority of it being absorbed by something which we don't understand yet. The most plausible theory is that the missing plastic has found its way into the biomass of the ecosystem—the tiny plastics have left the water and been absorbed by the fish, plants, and other ocean denizens. This is especially concerning because not only for the wildlife affected, but for us humans who routinely consume products originating in the ocean. This source provides useful data to map, because we can show the known sources of plastic pollution and and unknown destination of the plastic, demonstrating the importance of more research and attention on the subject.

Miner, Meghan. "Phytoplankton Sinks Microplastics into the Ocean." *Frontiers in Ecology and the Environment*, vol. 13, no. 10, 2015, pp. 531–531., www.jstor.org/stable/44000902.

This source describes the process of how phytoplankton can interact with microplastics, explaining how the tiny organisms can accelerate many problems associated with microplastics. A common belief is that plastic pollution floats, and thus accumulates on the surface of the ocean allowing most ocean life to pass underneath. While this effect is definitely real, this article explains one of the ways that microplastics can spread throughout the deeper ocean. Phytoplankton, microscopic plant life, can accumulate small plastic particles into larger clumps, which then sink to lower depths. Through this process, the plastics localized at the top of the ocean can spread and cause problems throughout the layers of the oceans. This source provides important information on how plastics can spread between areas, demonstrating how difficult the problem will be to contain.

Parker, Laura. "Ocean Life Eats Tons of Plastic-Here's Why That Matters." *National Geographic*, National Geographic Society, 18 Aug. 2017, news.nationalgeographic.com/2017/08/ocean-life-eats-plastic-larvaceans-anchovy-environment/.

Parker outline the circulation patterns of microplastics between interactions with wildlife and movement with currents and upwelling. Microplastics are consumed on very large scales by very small filter feeding organisms called larvaceans. The larvaceans eat the microplastics, filtering them in while attempting to feed on plankton. These plastics being to accumulate over time, congregating in fecal pellets of the larvaceans and within colonial mucus excretion that acts as a habitat. The high concentration of these plastics causes the colony to quickly descend to the bottom of the ocean. This allows microplastics to reach deep sea ecosystems and impact wildlife there as well. From here, these PMDs also continue to circulate via deep sea currents.

Teuten, Emma L., et al. “Transport and Release of Chemicals from Plastics to the Environment and to Wildlife.” *Philosophical Transactions: Biological Sciences*, vol. 364, no. 1526, 2009, pp. 2027–2045. *JSTOR*, JSTOR, www.jstor.org/stable/40485980.

This source helps our project because it describes how plastics can introduce toxins into their environment by either absorbing them from different places or serving as the toxins themselves. This can be used to help us with our layer of the map which addresses what happens to the plastics once they enter the ocean and how they are harmful to the ecosystem and environment. Additionally, this source discusses how plasticizers and monomers can leech from landfill sites into ground or surface water. This will help show our point that landfills are not necessarily sealed waste sites and are potentially and entryway for plastic into the oceans.

Thompson, Richard C., et al. “Lost at Sea: Where Is All the Plastic?” *Science*, vol. 304, no. 5672, 2004, pp. 838–838. *JSTOR*, JSTOR, www.jstor.org/stable/3836916.

This source shows the potential for microplastics to carry harmful toxins in their environment as well as the potential for wildlife to ingest these microplastics. One of the main points of the article involved keeping various forms of aquatic wildlife in a controlled environment which was gradually exposed to small quantities of microplastics. All of the wildlife was observed to ingest the microplastics within a few days, showing the how easily microplastics could find their way into the diets of aquatic food sources, and by extension, the diets of humans. As microplastic pollution continues to increase, many people believe that this issue hardly affects them at all. Using this data however, we could emphasize the severity of microplastic pollution and also

showing that it has the it could severely impact a large portion of the human population by making its way into our diets.

Thompson, Richard C., et al. “Plastics, the Environment and Human Health: Current Consensus and Future Trends.” *Philosophical Transactions: Biological Sciences*, vol. 364, no. 1526, 2009, pp. 2153–2166. *JSTOR*, JSTOR, www.jstor.org/stable/40485988.

We used this source to research how plastics can reintegrate with the environment in harmful ways. The article presents several arguments on why our current use of plastic is unsustainable. It outlines the processes that spread harmful plastics through the environment. Although ocean pollution is a major problem, plastics cause a whole host of other issues when they interact with wildlife. In addition to destroying habitats, plastics (when ingested) can carry harmful chemicals through the ecosystem. Once chemicals are ingested, they can be passed through the food chain and effect humans. Chemicals caused by microplastics have been correlated with increased risk for type 2 diabetes and cardiovascular disease in human subjects. I think this is important information to display on our map because it relates plastic pollution directly with our human health. Not all people care about animals or the environment, but everyone has to recognize the dangerous effects plastics can have on our population. Additionally, it is important to realize that nothing we put in a landfill really goes away, especially plastics. Even plastics far out in the Pacific can work their way through the food chain and cause problems.

Worm, Boris. "Silent Spring in the Ocean." *Proceedings of the National Academy of Sciences of the United States of America*, vol. 112, no. 38, 2015, pp. 11752–11753. *JSTOR*, JSTOR, www.jstor.org/stable/26465114.

This article is particularly helpful to us because it because it goes into detail on the various locations in which the effects of microplastic pollution can be found as well as potential solutions to. In addition to coastal areas, microplastics have also been found in deep sea samples, and large amounts of mid-ocean subtropical gyres (trash islands) have been detected within both the Atlantic and Pacific oceans. The distributions of these gyres has been correlated to factors such as population density, economic status, and quality of waste management systems. The article also provides potential solutions that we could include within our map, such as creating integrated waste management systems. These systems would have the infrastructure in place to safely collect, transport, store, or dispose of plastic and microplastic waste in a way that would minimally impact the surrounding environment.

"Visualizing How Ocean Currents Help Create the Garbage Patches." Office of Response and Restoration, 22 Oct. 2015, response.restoration.noaa.gov/about/media/visualizing-how-ocean-currents-help-create-garbage-patches.html.

We have decided to use this source to help display what happens to the plastics once they do enter the oceans. This website describes a research study completed by the NOAA over the course of 35 years, where they placed buoys into the oceans from a wide variety of starting points in order to map ocean currents and see what paths human pollution could be taking in the

oceans. From their research they discovered that there are a few gyres that have been nicknames "garbage patches" though they are not legitimately visible collections of trash. Instead they are large, constantly changing locations where small microplastic particles will circulate in higher concentrations. We can use the locations of these gyres on our acetate layer that describes what happens to the plastics once they enter the ocean.