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Plastics in the ocean

Where is the plastic?

Toxins released by plastics are the most deadly part of the rising plastic pollution problem in the ocean

As I walk along the east coast of the North Sea in Denmark, I do not notice any plastic trash; not in the water or on the sandy beaches. I wonder whether all the statistics that my teachers have thrown at me about plastic trash was only to scare the class into recycling plastic containers and bags. Is it true that 9 billion tons of litter ends up in the ocean every year? Is there really a pile of trash the size of Texas in the Pacific Ocean? If so much plastic was ending up in these oceans, shouldn't I be able to see it as I stand here?

Eighty eight percent of all the plastic trash (containers, bags, etc.) in the ocean is 10mm or smaller (Reddy 1). To see something with your naked eye it needs to be larger than 500mm. Many people, including me before learning more, do not think that plastics are a problem in the ocean because they do not see it, but the reason it is so deadly is because these plastics degrade into such small pieces. Most people know that marine life eat big pieces of plastics and choke, or get strangled by rings of plastic. These are common facts that teenagers learn in their science classes to make them understand the harm that plastics cause. But what these people do not realize, because they are not taught this, is that the deadliest part about the plastic we put into the ocean is the toxins that it releases.

Thirteen thousand to fifteen thousand pieces of plastic are thrown into the ocean everyday (*Plastic Statistics*). All of the plastic that ends up in the ocean starts on land; the problem is human caused. The only reason plastic is created is for human use. Plastic is not a

necessity. The biggest problem, though, is how we dispose of the plastic that we produce. In many cases plastics are left or thrown away on the banks of lakes or oceans and find their way into the ocean or onto the ocean beaches. Even plastic bags, not left or thrown anywhere near water sources, may end up there since wind patterns blow them along the land. When they reach a water source, they become immobile, stuck in the currents. They then move with those currents out toward the water outlets, in many cases, this is the ocean. Once plastics are on the beach or shoreline, the waves from the ocean crash onto the beach, and the backwash and swash carry the plastics into the ocean (Trujillo 287). Gyres, circular ocean currents formed by wind patterns, makes the plastic unable to leave the ocean (Ivanova). Plastic is caught in the currents forever, releasing their toxins and being a toxic hazard to marine life for the whole duration of its life span.

Once in the ocean it takes plastic 40 weeks to start to degrade (O'Brine 1). This means the plastic is whole for 40 weeks, allowing marine life to eat it and choke. It then takes, on average, 50 years for one piece of plastic to completely break up. This long duration is because of the lack of oxygen and very low temperature in the ocean (Ivanova). All during this time the plastic is releasing deadly and harmful toxins. Plastics are releasing toxins for about sixty five times longer than the time the plastic is a direct harm (choking hazard) to marine life. This means the toxins that are released are much more important to understand (and more deadly) than the actual plastic pieces. Another way that toxins from plastics spread to different water bodies is by global distillation. The toxins evaporate into the atmosphere. Here they cool and condense with water, eventually coming down with the rain into other oceans and bodies of

water (Castro, Huber 415). Not only are the water bodies that the plastics are both directly and indirectly put into being affected, but nearby water bodies are as well.

Plastics contain many chemicals that were used to create the plastic and make it durable. Because plastics are meant to be durable for human use, they are also durable in the ocean. Many of these chemicals are very toxic and harmful to marine life and are continuously released into the ocean as the plastic breaks down. Plastics only degrade, they never fully go away. Particles that make up the plastic start splitting up and break away from the main piece of plastic, making the plastic piece smaller and smaller. Persistent Bioaccumulative Toxins (PBTs) and Bisphenol A (BPA) are just a few of the toxic chemicals that are released by plastics. Not only do the plastics directly release toxins into the ocean but they also absorb the toxins that are already in the water, including Polychlorinated biphenyls (PCBs), pesticides and other chemicals that runoff from land (*Plastic Debris in the Ocean*). The plastics accumulate poisons to levels as high as a million times their concentrations in seawater (Trujillo 337-338). Some manufacturing and processing facilities directly discharge 1463 kg/year of BPA into water and 6063 kg/year indirectly (Staples 17). Much of this is then absorbed by the plastic debris in the ocean once it starts to degrade. So marine life is not only consuming the toxins from the plastic, but also the pollutants that run off from factories, farmland, and other human land sources. Marine life is greatly affected by these toxins. Their reproductive system is the most affected (Castro 415-416). Some fish, after consuming these toxins, can no longer reproduce, and therefore hurt the chances of the species to continue its existence. This is a serious problem, especially in estuaries, where the offspring of marine life live. Also, six hundred thousand tons of PCBs were created in the last year and ten percent of it ended up in the ocean. The surface water has the largest

concentrations of large plastics and all of these toxins. Downwelling causes this water, containing the toxins and the smaller plastics, to be brought down to the bottom of the ocean where it is readily available to all of marine life to consume (*Tons of PCBs Reaching the Deep Oceans*).

Because the particles are so small, marine life are able to easily consume it without meaning to. Algae are the most sensitive to the toxins released by the plastic, especially BPA (Staples 12). Algae is a producer, the lowest on the food chain. Primary consumers then eat the algae. When organisms eat algae that have toxins in it, they then get the toxins too. Since they eat many algae to survive, each primary consumer ends up having more toxins in them than one algae (Friedland, Relyea, Courard-Hauri 292). This, bioaccumulation, is why toxins are so bad in the ocean. The toxins do not just affect whoever eats the plastic or absorbs the toxins directly, but instead affect the whole food chain, including humans. Two hundred areas have been declared as dead zones where no life can live (*Plastic Statistics*). This is because the pollutants cause the algae to grow tremendously in a little time (algae bloom), forcing them to use all of the oxygen available. This situation kills many species and hurts the food chain and biodiversity greatly.

All of the toxins released have negative impacts on the marine life. Many are endocrine disrupters. The body thinks the toxin, BPA and others, is an estradiol, a female sex hormone. This can cause great problems when it comes to reproduction. The males seem to no longer have an interest in the females and they start to grow female parts. This makes them unable to reproduce, causing a decrease in the size of the next generation and its diversity (Castro 415-416). PCBs are one of the main types of pollutants in the ocean at the moment. PCBs affect

the reproductive system in marine life (*Plastic Debris in the Ocean*). This is a serious problem because of the estuaries that are present. The estuaries are on the coast so they are being affected most by the immediate additions of chemicals from the plastics. Estuaries hold the offspring of the animals, so if they can no longer reproduce, then the next generation will have less variation. Since PCBs affect reproduction, a whole generation can have reproductive issues, making them unable to pass on their genes and continue that species (Trujillo 337-338). This causes a decrease in biodiversity among the next generation, if there even is a next generation. Even once an organism eats or consumes the piece of plastic, it can still affect other marine life. Once that organism dies and decomposes, the piece of plastic is still there, allowing it to, again, be eaten by other marine life and therefore affecting them, too.

Extinction of marine life is going to be common in the near future because of all of plastic that we have been putting into the ocean. Toxins in marine life were first noticed in the 1960's. All of the fish that were caught were killed and forbidden to use as food because of the unknown harms that the toxins could cause humans (Castro 415). Now, as we eat larger fish, we think we are avoiding the toxins that are affecting the smaller fish (farther down on the food chain), but in fact we are getting even more chemicals because of bioaccumulation. Many people do not know about this because of the lack of education and the dependency on fish that we have created in the last few decades. Many groups are trying to ban plastics and regulate the disposal of them. MARPOL, a group for marine pollution, want to ban all disposal of plastics (Trujillo 340). PCB's were banned in 1979 and yet we still see them in the ocean. Even if we stop manufacturing plastics with all of these deadly toxins in them, marine life will be affected for many years to come because of the persistence of the plastics. It can take one piece of plastic up

to 1000 years to completely break up. Plastics never fully degrade, though. They will break up into very small pieces or into polymers/toxins (*Plastic Statistics*). They will always be present in the ocean. We might be too late, for all of marine life could be extinct because of this even if we do not add any more plastic into the ocean.

Another factor contributing to the problem is that no one owns the ocean. , either. Coasts are owned by the country that surrounds it, but only 200 miles into the ocean (Trujillo 313). There is not one person or country that has the decision over how to or if to clean up the plastics. Without this authority no country wants to spend so much money on cleaning up something that they did not fully cause. Nothing will be done to save the marine life unless all the countries agree and understand how big of a problem this is. The only thing countries can do at the moment is to prevent more plastic from going into the ocean. Countries will not do anything until the majority of the population realizes that this affects them, too. The toxins that the fish are consuming are passed on to us humans. All of these toxins we are consuming might end up hurting our reproductive abilities. Not until people understand this will they want something to change about the way we are treating our oceans.

Now, as I walk along the same beach in Denmark, I no longer question why my teachers were so adamant about the correct disposal of plastics. Just because I cannot see the plastic along the beach, does not mean it is not there and that it is not doing very harmful things. The Pacific/Atlantic garbage patches can hardly be seen by boaters sailing right through it, for the particles are microscopic. This is the problem. This is what is killing the species of sea food that humans eat and those that humans do not even know exist but that are so important to the food chain. Maybe we would start to actually do something about this when people realize that the

fish that is on their plate, the fish that they are about to put into their mouth, has many different chemicals that they would not otherwise let get near them. Most people know about tuna and the high levels of mercury in them. Other fish have the same levels of toxins, we are just not as informed about them because it would hurt the economy. We need to be more educated. We need to save our oceans.

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Reflection

Many people know about large pieces of plastics and how that strangles marine life. This is what teachers focus on in the classroom. People tend to focus on what they can see and what is obvious to them. The fact is, this is not what is most deadly in the ocean. The toxins that are released and accumulated on the plastics after the plastics have been degraded to smaller than 10mm is what is the most harmful. The population needs to be more educated about what the actual problem that is going on is. I hope to persuade the reader into finding out more about what they can do to prevent plastics from getting into the ocean and how to prevent the destruction of our oceans. The fact that one piece of plastic can stay in the ocean for hundreds of years is something that needs to be common knowledge. Maybe then people would think twice before throwing away plastic, or even buying it at all.