The Perseus Ambassador Competition: Pollution

Pollution is a huge threat to the environment and the whole world, especially to areas where little nature is found. In these places not much photosynthesis can occur, because of not having enough trees. This leads to these areas having less oxygen and more carbon dioxide, which encourages pollution. It even effects places which haven't been touched by humans for years, like the coldest bits of the North and South Poles. The effects are always negative, and an example is global change. In the poles, ice is melting due to severe changes in the temperature. This then leads to the sea water level increasing. Pollution has different types of forms which can all create severe damage to the environment, but with worse or less harsh consequences. At most times pollution created on land can also affect the sea, as most sources of marine pollution are land based, imposing a threat on both and sometimes also doubling the damage. Specifically, marine pollution occurs when harmful effects result from the entry into the ocean, of chemicals, particles, noise, agricultural, industrial and residential waste, or also the spread of invasive organisms.

Concentrating on marine pollution, a popular subject is that of oil spills. An oil spill is the release of a liquid petroleum hydrocarbon into the environment. These spills may happen on land but they usually occur in the sea, when sorts of accidents, like leakages, happen in sea structures and sea transport facilities involving drilling oil rigs, tankers, pipelines, refineries, barges, and storage facilities. These spills are usually caused by people making mistakes or being careless. When this happens a huge chaos occurs in the marine environment nearby. Many marine organisms are affected negatively. An example of this is when birds and other mammals get covered in oil and are unable to maintain their body temperature because of the oil. These mammals and birds die from hypothermia because of having a very low body temperature. Due to the birds losing the water repellency of their feathers, they are thus exposed to harsh elements. Also, meat-eating organisms might consume fish with oil particles on their skin, probably poisoning themselves. Furthermore, many of these animals may ingest oil and end up poisoning themselves. Plants at the bottom of lakes, the sea and other marine habitats may be affected by 'oiling' and are harmed, resulting into other organisms ending up without food, affecting food chains negatively. Some organisms might eat plants with oil remnants, toxicating them. Making things worse, a fire might light up in the middle of the ocean. The oil would be wasted, and would put at risk the people who have to put it out and those on the ship or on an oil rig. Also organisms who might have survived, might be burnt. Basically, food chains are disturbed and most of the marine environment of the area is destroyed.

Fish farms are very good sources for a better economy of a country. They are usually used to breed fish for economic reasons. These fish are sold both in that country and are also exported to other foreign countries who do not have that type of fish, are not in season or the countries are not surrounded with water. Obviously with every advantage there is a disadvantage, and despite these advantages there are worse consequences. Fish farms are set out at sea where they can usually only be reached by boats. To use these boats fuel has to be used resulting in polluting both the air and the sea, when burnt. This includes not only these boats but any other type of marine transport, because any type of mechanical transport usually uses fuel even if indirectly (like electricity), harming the environment. Also, when the fish are fed, the leftovers contaminate the sea with the concentration of it. Another thing is when fish are given medicines to prevent diseases. The leftovers of these chemicals which remain, also pollute the sea, because of the concentration of them. Another thing is when the paint coatings of the cages used to keep the fish in, slowly peel off. These coatings have many toxic chemicals in them, obviously not doing any good to the environment. When these pens are made drilling, dredging and other sediment and bottom habitat disturbances can cause chaos in this habitat of many species, due to the displacement of organisms and also other significant ecological changes. The fish in these pens are often fed other wild fish. These species of wild fish, like krill and squid, are vital to the marine ecosystem and with their loss, other wild animals which live naturally in the sea, cannot find enough fish to eat, confusing the whole food chain.

Ignorance is a reason of pollution. How much awareness has been raised in the past years concerning marine pollution? A lot and mostly in vain. One is that of not throwing rubbish into the sea. Well, this still occurs, constantly, despite the persistency and big effort of environmentalists. Throwing rubbish in the sea, when the beach is packed with rubbish bins, is plain foolishness and selfishness. Water quality gets worse, as litter releases poisons and chemicals. If people and animals drink that water they would get poisoned. If we eat fish, which would have eaten organisms like jellyfish, which would have consumed pieces of plastic, we would possibly be poisoned. Also litter might block light from entering the sea, stopping the plants beneath in the sea from doing photosynthesis. Also some organisms might get tangled up in bits of rope or fishing nets. In addition, plastic pieces and bags might get consumed by organisms like turtles, due to having been mistaken for jellyfish. Many health problems are caused to these organisms because of us being irresponsible. Many turtles are saved yearly from dying, due to having consumed plastic and other harmful materials, and also having fishing hooks stuck into them, tearing at their flesh.

Another sign of ignorance, nonchalance and irresponsibility is when toxic waste is thrown in rivers and seas. This is obviously very harmful to the whole ecosystem of the river. Plants are poisoned and so are other organisms, again disturbing a whole ecosystem. Another thing is that if the waste is thrown into a river it will not only ruin the river's ecosystem but also the sea's ecosystem to where the river leads to. This act is often done to get rid of these toxic substances easily and for free. Whoever is caught doing the act is fined for breaking a law, which would be well deserved. These toxic substances may seep into the ground and spoil any water tables and ecosystems underground. Also, people would be unable to use the river's water, where before the water was used like for watering fields nearby or even as potable water.

Whenever it rains heavily, many particles are carried off with the water, often ending up in the sea. When roads are flooded with water, all the dirt is carried off towards the sea. All the exhaust becomes acidic creating problems, due to being acidic, while also polluting the sea. Also some countries have street drains which lead directly to the sea carrying all the dirt into the sea. Some sorts of implants must be created in these countries to purify or else at least to clean the water in a such way that the water does not harm the marine environment. An operation being carried out in Malta is the Rainwater Flood Relief Project which consists of big water galleries being dug underground, collecting water, so as to reduce the amounts of floods in the roads and at the same time to use that water as necessary, purifying it before. Something I find greatly annoying is when people wash the pavement in front of their residence, or their car in the street, using soap. The soap has many chemicals in it like surfactants, phosphates, enzymes and perfumes, which are all harmful. Surfactants attack the natural oils in the mucus membranes of fish, disabling the fish's gills and increasing the risk of attack from other harmful chemicals in the water, because of them being less resistant to these chemicals. Some of this substance's ingredients produce 'endocrine-disruptors', which can affect the hormonal balance of animals and humans, causing lots of health problems and sometimes also changing sex features of some fish. Although surfactants can be toxic to fish and other marine organisms, including some that may remain in the environment for many years without breaking down, most surfactants biodegrade relatively quickly in sewage treatment plants before they can do much harm to the marine environment. Phosphates contribute in the process called Eutrophication, in which the phosphates in detergents enter freshwater and act like fertilizers, encouraging the growth of tiny plants and animals. The biggest problem they may cause is a big growth of algae, known as an algal bloom, which kills fish life by reducing oxygen. Although phosphates may enter water in many different ways, detergents contribute significantly to the problem. Fragrances in detergents contain oils which may cause rashes and skin allergies, both to humans and other mammals. Another type of runoff is when non-organic fields flood and the water runoff containing pesticides and artificial fertilizers is carried off into the sea. Pesticides and artificial fertilizers can also be blown off into the sea or may seep into the soil, ending up in water tables full of groundwater, contaminating it, affecting the process of leeching. The water would be carrying

heavy loads of pollutants, mainly nitrates from artificial fertilizers. These nitrogen and oxygen molecules that plants need for them to grow, eventually make their way into marine ecosystems, fertilizing algae that deplete oxygen and leave vast "dead zones" in their wake. There, no fish or other marine life can survive. Denitrifying bacteria remove excess fertilizer from water through a chemical process known as denitrification, which enables them to convert nitrates to nitrogen which is then released into the atmosphere as a gas. The production of biofuels will continue to do harm as they denitrify, increasing nitrogen in the water and losing oxygen. Pesticides are just as bad as artificial fertilizers. The use of pesticides is to kill pests but unfortunately, other organisms may get killed at the same time. Like artificial fertilizers, they cause unnatural imbalance in several ecosystems. If a body of water becomes contaminated with the chemicals, many fish and other animals may get sick and die, throwing the whole ecosystem off balance. Also, when these chemicals turn to gas they may cause reproductive problems in some organisms, especially in frogs. Poison stored in some fish might also be passed on to humans through consumption.

Acid rain is created when pollution particles in the air react with water. Whenever it rains these pollution particles change to acidic compounds. So the process of erosion takes place whenever it rains and is especially persistent in countries with high levels of pollution, because the more pollution there is, the more acidic compounds are formed, and the more erosion takes place. The effects of acid rain are most evidently seen in the aquatic, or water, environments, such as rivers, streams, lakes, and marshes. Acid rain flows into streams, lakes, and marshes after falling on forests, fields, buildings, and roads - well, on land. Obviously, acid rain also falls directly on aquatic habitats. Acid rain primarily affects sensitive bodies of water, which are located in watersheds whose soils have a limited ability to neutralize acidic compounds (also called the “buffering capacity”). These environments become acidic when the water itself and its surrounding soil cannot buffer the acid rain enough to neutralize it. When acid rain falls in the sea, lakes and rivers, the water becomes acidic. Many species of fish are not able to survive in acidic water. There are two types of acidification - Chronic and Episodic. Chronic acidification may reduce the levels of nutrients such as calcium, which, over time, may weaken the fish and other organisms and animals in an aquatic ecosystem, making them less able to compete for food and habitat. Generally, the young of most species are more sensitive to environmental conditions than adults, usually dying earlier than the adults. Episodic acidification is a sudden change in the acidity of the water, and refers to brief periods during which pH levels decrease due to runoff from melting snow or heavy downpours. Episodic acidification can cause sudden changes in water chemistry. This may lead to the increase in concentration of substances such as aluminium, which may be lethal to fish and other aquatic organisms. Their death can be a result of the acid damaging the fish's gills. With damaged gills it's not possible for them to breathe, so they would die because of the lack of oxygen. Because fish and other organisms are dying, the populations of different types of fish decrease, again, disturbing a whole food chain as the plants and animals living within an ecosystem depend a lot on each other (are interdependant). For example, fish eat other fish and also other organisms which live in that marine environment, which would have eaten from marine plant sources. If acid rain causes the loss of acid-sensitive plants and animals, then fish that rely on these organisms for food may be affected. Acid in the water may make marine plants more vulnerable to some diseases and pests, weakening them, although this is not very harsh as at most times the amount of acid in the water would be very dilute. Acid rain deposits nitrates in the water that can lead to an increase in nitrogen in that environment. Excess nitrogen may cause Eutrophication (over nourishment) in areas where rivers enter the sea, and also other marine environments. This may lead to unwanted growth of algae (algal bloom) and other unwanted plants, as mentioned before. Well - acid rain decreases biodiversity.

Mining for resources such as metal ore, gold and silver has been done for thousands of years. It was only until a few decades ago, in the 1950's, that people started mining for oceanic resources. Some materials are more frequent in the sea bed rather than on land, such as diamonds. This leads

to more hunger for these precious materials, by humans, leading to more mining. Ocean mining usually involves a sort of dredge that brings sediments to the surface where workers and machinery separate the diamonds from the gravel. After the diamonds are removed, the sediments are then returned to the sea bed. Sometimes some of the remaining sediments are kept. Undersea mining is also possible for other resources such as coal, metal compounds, gas hydrates and gravel for construction purposes. As in everything, there are disadvantages in underwater mining. This process of dredging does not only happen in mining but also to keep navigation 'corridors' open for boat traffic, but the worst impacts would probably come from dredge mining for these precious materials. During the dredging process, the ocean floor is dug up, ruining all the habitats of the organisms living there and killing them. Plants are uprooted from the sea bed, resulting to being very difficult for them to grow again, after the process is over. Repairing damage of this kind is nearly impossible. The whole ecosystem there is ruined. Other typical happenings when mining, are sediment plumes, which are still a problem. As the sediments sink back to the ocean floor, they cloud up the water, reducing the amount of sunlight available for photosynthesis for marine plants. Sediments may also infuse dissolved heavy metals in the water that can accumulate in the food chain, harming marine animals even more. As land based minerals are becoming increasingly scarce, the popularity of undersea mining stands to increase. Even if certain resources are not accessible at the moment, continuous technological advancements suggest that humans will soon be able to extract these additional resources from the ocean floor. From the perspective of marine conservation, we must ensure that any such developments do not come to the detriment of the marine organisms that depend on clean and healthy ocean ecosystems for them to survive.

Another type of pollution is noise pollution. Noise pollution is when certain loud noises, disturb a whole ecosystem, usually rising at harmful or annoying levels. The animals most affected by these noises are dolphins and whales as they have great hearing senses. For most species of dolphins and whales, sound is their primary sense. They use it to hunt down their prey, navigate, and communicate in the environment where the sense of smell is nearly useless, any trace of a smell being lost in the depths of the sea and where the sense of sight nearly as much. Sound is greatly magnified in the sea in comparison with air. Until little over 100 years ago the oceans were barely affected by human related noise. Nowadays, modern propeller driven ships and smaller vessels are very noisy and increasingly abundant in many parts of the world, particularly in highly populated areas. Here shipping noise is continuous and severe, and is considered likely to interrupt communication and food-finding especially in cetaceans, a group of sea mammals which consists of whales, dolphins and porpoises. Some organisms have suffered damage to the brain and other tissue associated with hearing and sound transmission, as well as other organs. Meanwhile some have suffered 'the bends' (nitrogen bubbles in the bloodstream) as a result of them surfacing much too rapidly from great depths, presumably as a panic in response to the noise. Less acute, but nonetheless critical, is the displacement of animals during these operations, forcing them to abandon important foraging habitats. As observed, cetaceans are absent from large areas where many ships and vessels are, like harbours, which possibly points to significant displacement levels. Oil, gas and other under-sea mineral expeditions commonly use seismic surveys which create many pulses of intense noise, in the search of new mineral reserves. Cetaceans, especially, are known to be displaced by seismic survey activity. Offshore construction keeps on increasing, especially the construction of wind farms, but also the building of bridges and other structures, which require prolonged pile-driving and even the use of explosives, underwater. This can cause severe changes in the behaviour of marine mammals up to 10km distance.

Another cause for the sea to get polluted is when the wind blows debris and dust. This also includes rubbish like plastic bags. The dust is picked up from all around the world while the sand comes from deserts around the world. Malta, for example is often hit with lots of dust and sand from the Sahara desert, especially when it rains. When the dust and sand fall into the sea or other marine environments, the water clouds up, reducing the amount of sunlight available for

photosynthesis for marine plants. When all sorts of rubbish is blown too, like plastic, it releases poisons and toxics chemicals.

The final source of pollution in the sea and other marine environments is when leakages occur, with the substance being leaked travelling through the earth, ending up in these marine environments or sometimes also directly. Fuel providers have fuel stored in big underground wells or chambers. At times not enough care is taken and some cracks may form in these chambers which may lead to the fuel seeping through these cracks into the rocks beneath. If the fuel keeps on travelling, it might end up in a water table, ruining the whole natural storage of groundwater. If water is extracted from these water tables crops might be affected negatively, as well as humans or other organisms who would either consume that water or eat organisms which would have consumed that water. These organisms may be poisoned and probably killed. Another example of a leakage is when sewage treatment plants have some kind of defect in the mechanisms and pipes and sewage leaks, passing through the land and, if near enough, into the sea, lakes or rivers. If this happens, these environments get contaminated with sewage, polluting the sea, and possibly poisoning fish. If it passes through the ground, it can contaminate groundwater storages called water tables, as mentioned before with leakages of fuel.

To conclude, I must say that we must do something to resolve these serious problems. More awareness must be raised about these topics, until it’s too late. People should be more careful, less ignorant and less lazy as this is what causes all these happenings which destroy the environment.