Name_____Date_____Period 1 2 3 4 5 6 Assn #_____

Human's Impact on an Ecosystem

***Directions**: Read and highlight the passages (all the paragraphs of text). Answer the questions in your own, complete, academic sentences.*

Human's impact all ecosystems on Earth either directly or indirectly. Your actions also directly and indirectly impact ecosystems all around the world. Choosing to grow a non-native plant garden impacts the ecosystem in your yard and cross-pollination can impact the greater ecosystem of your city. Choosing to buy clothing that is produced in other countries impacts the coral reef ecosystem though ocean acidification. Choosing to drink coffee impacts the Amazon Rainforest ecosystem through deforestation. Choosing to consume corn syrup impacts the ecosystems of the midwest and central United States through monocultures and pesticide toxins.

Your final project will be to research an impact you are having on an ecosystem. Below you will work through an example of what that might look like.

Example: My impact on the Marine Ecosystem

Product: Plastic
Ecosystem: Marine Ecosystem

My Source for the Problem

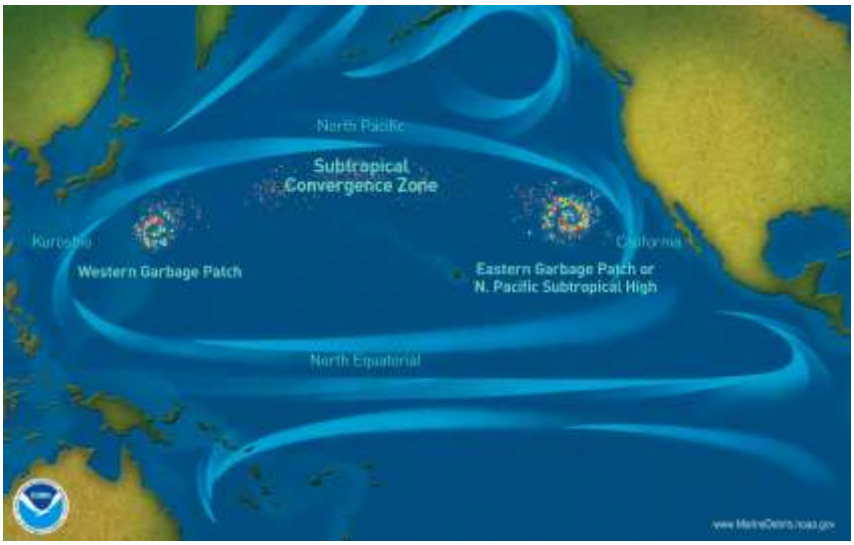
1. What types of plastics do you use regularly?

2. How might these plastics (accidentally) end up in the ocean? (You learned about this in Earth Science).

Plastic has helped humanity progress in ways unimaginable only a century ago. It has revolutionized healthcare, made homes more energy efficient, and reduced pressure on the extraction of natural resources, such as wood and cotton, by creating plastic alternatives. Its durability means we should be wasting less, not more; plastic takes hundreds – potentially thousands – of years to degrade. And herein lies the best, and the worst, property of plastic: it lasts forever.

Plastic is devastating to nature. Natural ecosystems operate on a cycle of renewal: plants and animals grow, die, and become food for the next generation. These ecosystems have no place for substances that do not degrade. Our wonder material has now escaped the urban environment and is reaching every corner of the natural world, from the deepest point of the Mariana trench to the top of Mount Everest.

The ocean is perhaps the most vulnerable environment to plastic waste. Once plastic enters the sea, it has no boundaries – waves and storms can carry plastics to even the furthest reaches of the ocean, where they accumulate into large gyres on the high seas or become embedded in shorelines and delicate coastal ecosystems; they've even been found on uninhabited islands. After some months or years at sea, plastic breaks down into smaller and smaller pieces, battered by waves and storms, eventually to sizes smaller than a grain of sand. This makes retrieving plastics from the ocean extremely difficult – almost impossible.



3. Where in the ocean do they go? What is it called? How big is it? (You should have learned this in Earth Science, so you might need to look it up now).

The Problem Globally

100,000

marine mammals estimated to be killed by plastic every year

12,700,000

tonnes of plastic reaches the ocean every year

It is estimated that marine plastics are contributing to the death of more than 100,000 marine mammals every year. Plastic can affect marine species in a variety of ways, from entanglement and injury to ingestion and toxic contamination. The major determining factor is the size of the plastic, which can adversely affect different species in different ways – and on different timescales.

MACROPLASTICS

Size: Plastics larger than 20mm
Examples: Fishing gear, six-pack rings, plastic bottles
Threats: Large items of plastic can capture and entangle marine mammals and fish and stop them from escaping, usually leading to starvation, injury and predator vulnerability. Discarded fishing nets can also smother and break coral reefs, preventing healthy growth.

MESOPLASTICS
Size: Plastics between 5-10mm
Examples: Plastic pellets, fragments of broken-up larger plastics
Threats: Small but visible plastic fragments can sit on the surface of the water and be mistaken for food by seabirds and other marine species, leading to issues including suffocation, starvation and toxic contamination over time.

MICROPLASTICS AND NANOPLASTICS

Size: Plastics smaller than 5mm, small microscopic particles
Examples: Granules in face scrubs and toothpaste, microfibres from textiles, disintegration from larger plastics
Threats: Microplastics are invisible to the naked eye, making them easy for wildlife to consume. They also have the ability to absorb toxins, which can transfer to the fatty tissues of the organisms that ingest them. Because microplastics are a reasonably new discovery, their long-term impacts are yet to be determined.

4. Which type of plastic (macro, meso, or micro/nano) do you contribute the most to?

5. What are the major threats you are contributing to?

The Problem for the Ecosystem

Large marine mammals are highly vulnerable to plastic entanglement, particularly from ghost fishing gear. Fishing ropes, nets and pots that have been discarded or abandoned at sea are often made from plastic, and can trap and entangle a variety of marine life, from blue whales to small crabs. An estimated 300,000 whales, dolphins and porpoises a year die from ghost gear entanglement. Marine megafauna are also vulnerable to plastic ingestion; in 2019, one whale was found washed up with 40kg of plastic in its stomach, predominantly comprising plastic bags.

Turtles often mistake plastic for food. Plastic bags look similar to jellyfish, the staple diet of leatherback turtles, and fishing nets can look like delicious seaweed. When turtles eat plastic bags, it can make them feel full, eventually leading to starvation. A recent study found that all seven species of sea turtle from the Atlantic and Pacific Oceans and the Mediterranean Sea had traces of microplastics in their gut. Sea turtles also fall victim to entanglement from six-pack rings, which can get caught around their shells and necks.

California banded single use plastic bags in 2016. This did not ban "multi use" plastic bags. These are the plastic bags you can get at Safeway or other grocery stores. They are thicker plastic with the intent of being used more than once.

6. How often does your household use multi use plastic bags as single use plastic bags?

For millennia, seabirds have fed from the surface of the ocean, swooping down and scooping up small fish and algae. It's no surprise, then, that seabirds are now mistaking small plastic fragments that sit on the water's surface for food. When ingested, these small pieces of plastic can lead to starvation or suffocation. Some seabirds are able to regurgitate pieces of plastic, but petrels, for example, find this difficult. Northern fulmars are known to ingest plastic pellets and consequently the species is now monitored as an indicator of pellet pollution levels in the North Sea. Many species of seabird have also been found feeding plastic pieces to their young. Plastic debris is said to cause the deaths of more than a million seabirds each year.

Hundreds of fish species, including many that humans consume, have been found with traces of microplastics in their bodies. In a study summarizing over 100 research papers on fish and plastic ingestion among 500 fish species, over two-thirds had consumed plastic. Fish often mistake small plastic pieces, such as pellets, for food.

When molluscs such as mussels and oysters filter seawater to feed, they also take in human-created pollutants, including microplastics. In a recent study of mussels sourced from UK waters, 100% of samples were found to contain microplastic pieces.

7. The images of marine life being stuck in fishing nets and plastic bags get the most publicity but that is not the majority of damage. Where does the majority of damage come from?

Apex predators are species that sit at the top of the food chain. A large, yet understudied, threat to marine apex predators such as great white sharks and orcas is the cumulative impact of microplastics in the food chain and the bioaccumulation of toxic chemicals found in plastics. A recent study has shown that a single plastic particle can adsorb up to one million times more toxic chemicals than the water around it.

Biomagnification occurs when chemicals build up in the fatty tissues of animals that have eaten other contaminated species. The higher up the food chain you go, the greater the concentration of toxins. Orcas have been found with some of the highest deposits of chemicals in their fatty tissues and in their breast milk, which is fed to their young. Academics around the world are working hard to understand the link between microplastic pollution and biomagnification of toxic chemicals.

8. In your own words, what is biomagnification?

9. How is it similar but opposite of the 10% rule? Explain how this would happen.

10. Why is biomagnification so bad?

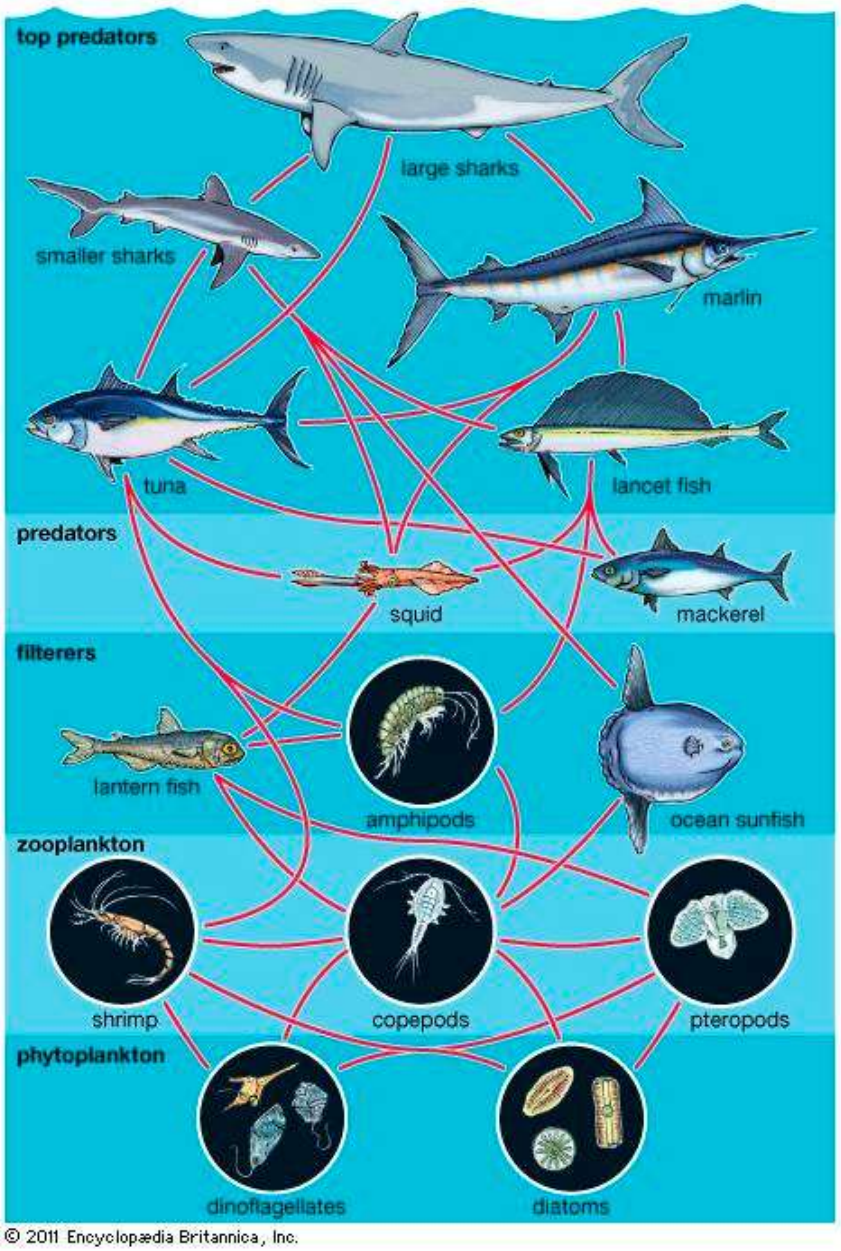
Problem's Effects on the Food Web

Microplastic is known to absorb chemicals from ocean water. When marine creatures consume microplastic, they're also getting a dose of toxins. Kristian Syberg, a professor of environmental risk at Roskilde University in Denmark, has studied this so-called "vector" effect where microplastic acts as a transporter of toxic chemicals. He says persistent organic pollutants, called "POPs" for short, are most worrisome because, once consumed, they tend to adhere to organisms' fat cells where they are metabolized by the body and cause health problems.

Throughout history humans have released huge amounts of POPs into nature, where they persist and spread for decades without degrading. These chemicals, which include pesticides, industrial chemicals and unintentional pollutants such as DDT, PCBs and hexachlorobenzene, are considered highly toxic to humans and wildlife. They are proven to cause health problems such as allergies, reproductive and hormone problems, immune system disorders and cancer.

For this reason, and because there's still so much scientists don't know about how plastic acts inside the bodies of living things, Sarah Nelms, a Ph.D. student at the Cornish Sea Sanctuary in the United Kingdom, Plymouth Marine Laboratory, says, "I would consider any amount of plastic inside an animal to be too much."

Plastic's movement up the marine food web appears to start with the ocean's smallest animals, and even in these creatures can cause severe harm. Independent plankton scientist Richard Kirby recently filmed a common plankton species called an arrow worm found off Plymouth, in the U.K., eating a tiny plastic microfiber. The fiber blocked the worm's gut, stopping the movement of copepods — its food source — through its body. Eventually this would kill the worm — though Kirby pointed out that doesn't always happen with microplastic.



Widespread deaths of plankton caused by microplastic would certainly disrupt the marine food web. But their consumption is already changing the health of the oceans: Microplastic has been found in middle-ocean and deep-sea fish, which, like mackerel, are prey to ocean top predators, like seals or mahi-mahi. With each bite, plastic is moving up the food web, all the way to fish sold for human consumption in markets across the world. Kirby says scientists must urgently perform more research to gain a better understanding of the quantity and geographical distribution of microplastics in order to get a clearer picture of its effects on the oceans.

11. Describe how plastics eaten by plankton can harm large sharks?

12. How do plastics in the ocean disrupt the food chain? Which species is most impacted by them? How does this harm the other organisms?

Solutions to the Problem: Global and Personal

Efforts should be made to adhere to and strengthen existing international legislative frameworks that address marine plastic pollution. The most important are the 1972 Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter (the London Convention), the 1996 Protocol to the London Convention (the London Protocol) and the 1978 Protocol to the International Convention for the Prevention of Pollution from Ships (MARPOL).

Regional and national governments should also explore national legislative frameworks on Extended Producer Responsibility. These are emerging as innovative, low-cost solutions, as are policies to promote circular economies.

Governments, research institutions and industries need to work collaboratively to redesign products, and rethink their use and disposal to reduce microplastic waste from pellets, synthetic textiles and tyres. Consumers and society must shift to more sustainable consumption patterns. This will require solutions which go beyond waste management and consider the whole lifecycle of plastic products; from design to infrastructure, and household use.

More funding for research and innovation should be made available to provide policymakers, manufacturers and consumers with the evidence needed to implement technological, behavioral and policy solutions to address marine plastic pollution.

13. What could you do to reduce the effect of plastics coming from your home?

14. What could you do to help move the world forward in reducing the effects of plastics globally?

Sources:

1. https://www.fauna-flora.org/news/how-does-plastic-pollution-affect-marine-life/
2. https://therevelator.org/toxic-plastic-pollution-food-chain/
3. https://www.iucn.org/resources/issues-briefs/marine-plastic-pollution#:~:text=Impacts%20on%20marine%20ecosystems,stomachs%20become%20filled%20with%20plastic.