NAME _____ DATE _____

PLASTIC IMPACTS: PRIMARY CONSUMERS

Read the following article, then answer question 1:
https://education.nationalgeographic.org/resource/coral-reef-food-web/

This resource carousel at the top contains more information about predators and prey in the ocean. Scroll to the third image, with the caption Coral Reef Food Web Primary Producers to First Order Consumers. (Note that *first-order consumers* is another name for primary consumers.)

1. Find the numbers at the ends of the blue arrowheads. (For example, #1 is at the end of a blue arrowhead, but #3 and #4 are not.) Write these numbers below.

1, 15, 18, 24, 25, 29, 32, 39

Now scroll to the eighth and final image, with the caption *Coral Reef Illustration Key.* Use the key to name each of the species you wrote down for Question 1.

#1 elkhorn coral / #15 purple sea fan / #18 Atlantic blue tang / #24 brain coral /
#25 purple sea sponge / #29 staghorn coral / #32 queen conch /
#39 orange sea sponge

Read the following article, then answer Questions 2 and 3:
https://blog.nationalgeographic.org/2016/02/23/more-plastic-fewer-oysters/

2. What effects did microplastics have on the oysters that ingested them, and why?

The oysters digested algae more quickly and efficiently because they spend extra energy to pass plastics through their digestive systems. Because they used energy in digestion, they had less energy for reproduction. Their eggs and sperm were fewer in number, smaller, and slower-moving.

3. Adult oysters, like many shellfish, are sessile—their shells are planted to the seabed and they do not move. Do you think that plastic entanglement could affect oysters and other sessile organisms? If so, in what ways?

If a sessile organism becomes surrounded by plastics, it could limit the organism's ability to feed and reproduce, or block these functions entirely.

Read the following article, then answer Question 4:
https://www.nationalgeographic.com/environment/2019/06/these-corals-choose-to-eat-plastic-over-food/?ngscourse

4. The article states that most corals that ate plastic spat it out after 48 hours. So why did these corals die?

The plastic was coated with *E. coli* bacteria, which passed disease to the coral.

Complete this side when you return to your project group.

Trophic Level	Example Organisms	Ingestion Impacts	Entanglement Impacts
Primary Consumers	#1 elkhorn coral #15 purple sea fan #18 Atlantic blue tang #24 brain coral #25 purple sea sponge #29 staghorn coral #32 queen conch #39 orange sea sponge	Eating plastics can cause primary consumers to spend more energy in digestion and to reproduce less. If the plastics carry bacteria, they can also infect the primary consumers with diseases that can kill them.	If plastics surround a sessile organism, they could limit the organism's ability to feed and reproduce, or block these functions entirely.
Secondary and Tertiary Consumers	#10 bar jack #12 black grouper #16 flamingo tongue snail #19 sergeant major #21 Caribbean lobster #20 stoplight parrotfish #33 cushion sea star #35 southern stingray	A straw blocking a sea turtle's nostril can make it difficult to breathe. A sharp piece of plastic can pierce a bird's intestine. Eating too much plastic can cause animals to feel full even when they have not eaten any food.	Seals can get caught and become unable to swim, catch food, or avoid predators. A turtle can have its shell deformed by a sixpack ring.
Apex Predators	orcas (killer whales), sperm whales, giant octopus, sea lion, leopard seal, marlin (swordfish), polar bears, and various types of seabirds	Predators can mistake plastic bags for prey. These plastic bags don't break down in their stomachs, so their stomachs fill up with plastic and the predators can no longer eat real food. They starve to death.	Predators need to be able to hunt to survive. When they are entangled in plastic, the predators will slow down. They have a harder time catching food, grow thinner and weaker, and may die if the plastic is not removed.
Decomposers	bacteria, fungi, Christmas tree worm, sea urchins, sea lilies, sea cucumbers, feather stars, sea stars, lobsters, shrimp, crabs, water fleas, barnacles, mollusks (snails, clams, and sea slugs)	The full impact is still unknown or unconfirmed. However, plastics have been found in the hindgut of amphipods in the deep ocean trenches. These plastics could make their way up the food chain.	The full impact is still unknown or unconfirmed. However, it is reasonable that animals could get stuck under or inside plastics that sink to the bottom of the ocean.

NAME _____ DATE _____

PLASTIC IMPACTS: SECONDARY AND TERTIARY CONSUMERS

Read this article, then answer question 1:
https://education.nationalgeographic.org/resource/coral-reef-food-web/

The resource carousel at the top contains more information about predators and prey in the ocean. Scroll to the fourth image, with the caption *Coral Reef Food Web First Order Consumers to Intermediate Predators*. (Note that *intermediate predator* is another name for secondary and tertiary consumers.)

1. Find the numbers at the ends of the yellow arrowheads. (For example, #17 is at the end of a yellow arrowhead, but #1 is not.) Write these numbers below.

10, 12, 16, 19, 20, 21, 33, 35

Now scroll to the eighth and final image, with the caption *Coral Reef Illustration Key*. Use the key to name each of the species you wrote down in question one above.

#10 bar jack, #12 black grouper, #16 flamingo tongue snail, #19 sergeant major, #20 stoplight parrotfish, #21 Caribbean lobster, #33 cushion sea star, #35 southern stingray

Read this article, then answer questions 2 and 3:
https://www.nationalgeographic.com/magazine/2018/06/plastic-planet-animals-wildlife-impact-waste-pollution/?ngscourse

2. How many species of animals so far have been reported to be affected by plastic entanglement and/or ingestion?

700

3. Name four ways that plastics impact wildlife as mentioned in this article.

A straw blocks a sea turtle's nostril; an albatross has no space in its stomach for real food; a turtle is stuck in a six-pack ring and its shell is deformed; a seal is caught in a fishing net; a sharp piece of plastic can pierce a bird's intestine.

Read this article, then answer questions 4 and 5:
https://www.nationalgeographic.com/environment/2018/09/news-jellyfish-plastic-cigarette-wrapper/?ngscourse

4. Why do so many marine animals eat plastic?

They look and smell like their food. Turtles eat plastic bags because they look like jellyfish. Fish eat microplastics because they look like their regular food source. Also, some plastics may release a chemical odor, caused by decomposing algae or by the plastics, that smells appetizing to marine animals.

5. What impact could this plastic have on the jellyfish and on other animals?

Eating too much plastic could take up space inside the jellyfish, causing it to starve because it cannot digest the plastic and cannot fit any more food inside. The plastic can also end up in the jellyfish's predators, such as tuna, which also serve as food for humans.

Complete this side when you return to your project group.

Trophic Level	Example Organisms	Ingestion Impacts	Entanglement Impacts
Primary Consumers	#1 elkhorn coral #15 purple sea fan #18 Atlantic blue tang #24 brain coral #25 purple sea sponge #29 staghorn coral #32 queen conch #39 orange sea sponge	Eating plastics can cause primary consumers to spend more energy in digestion and to reproduce less. If the plastics carry bacteria, they can also infect the primary consumers with diseases that can kill them.	If plastics surround a sessile organism, they could limit the organism's ability to feed and reproduce, or block these functions entirely.
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Apex Predators	orcas (killer whales), sperm whales, giant octopus, sea lion, leopard seal, marlin (swordfish), polar bears, and various types of seabirds	Predators can mistake plastic bags for prey. These plastic bags don't break down in their stomachs, so their stomachs fill up with plastic and the predators can no longer eat real food. They starve to death.	Predators need to be able to hunt to survive. When they are entangled in plastic, the predators will slow down. They have a harder time catching food, grow thinner and weaker, and may die if the plastic is not removed.
Decomposers	bacteria, fungi, Christmas tree worm, sea urchins, sea lilies, sea cucumbers, feather stars, sea stars, lobsters, shrimp, crabs, water fleas, barnacles, mollusks (snails, clams, and sea slugs)	The full impact is still unknown or unconfirmed. However, plastics have been found in the hindgut of amphipods in the deep ocean trenches. These plastics could make their way up the food chain.	The full impact is still unknown or unconfirmed. However, it is reasonable that animals could get stuck under or inside plastics that sink to the bottom of the ocean.

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PLASTIC IMPACTS: APEX PREDATORS

When we think of apex predators in the ocean, we often picture large sharks like the great white. However, there are many other apex predators in the ocean!

1. Search online to find other examples of ocean apex predators. Can you name at least five that are not sharks?

Answers may vary, but may include orcas (killer whales), sperm whales, giant octopuses, sea lions, leopard seals, marlins (swordfish), polar bears, and various types of seabirds.

Read this article, then answer Questions 2 and 3:
https://www.nationalgeographic.com/news/2018/06/whale-dead-plastic-bags-thailand-animals/?ngscourse

2. How is it possible for something as small and flimsy as a plastic bag to kill a whale?

Many plastic bags clogged up the whale's stomach and made it impossible for the whale to eat real food.

3. How many other species of animals have died from ingesting plastic?

More than 300 marine animals are known to have died after eating plastics, but we may never know the real number because many of these animals are never seen or found by humans.

Read this article, then answer Questions 4 and 5:
https://www.nationalgeographic.com/environment/2019/01/digit-sperm-whale-saved-from-rope-entanglement-ghost-net-fishing-gear-off-dominica/?ngscourse

4. What kind of plastic got caught around Digit, and how did this entanglement affect her?

The plastic was a quarter-inch cord from a fishing net. It weighed down Digit's tail, preventing her from diving for food, cutting through her flesh. It could possibly cause an infection or even amputate her tail.

5. What eventually happened to Digit?

She grew weaker and thinner and less energetic. Her mother even began nursing her again. Human divers tried to save her, but only succeeded in cutting the rope shorter. Finally, Digit was seen freed from her plastic entanglement and having gained weight, but scientists are not sure how. They think other whales may have freed her, or she could have been attacked and her predators bit off the plastic.

Complete this side when you return to your project group.

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Apex Predators	orcas (killer whales), sperm whales, giant octopus, sea lion, leopard seal, marlin (swordfish), polar bears, and various types of seabirds	Predators can mistake plastic bags for prey. These plastic bags don't break down in their stomachs, so their stomachs fill up with plastic and the predators can no longer eat real food. They starve to death.	Predators need to be able to hunt to survive. When they are entangled in plastic, the predators will slow down. They have a harder time catching food, grow thinner and weaker, and may die if the plastic is not removed.
Decomposers	bacteria, fungi, Christmas tree worm, sea urchins, sea lilies, sea cucumbers, feather stars, sea stars, lobsters, shrimp, crabs, water fleas, barnacles, mollusks (snails, clams, and sea slugs)	The full impact is still unknown or unconfirmed. However, plastics have been found in the hindgut of amphipods in the deep ocean trenches. These plastics could make their way up the food chain.	The full impact is still unknown or unconfirmed. However, it is reasonable that animals could get stuck under or inside plastics that sink to the bottom of the ocean.

NAME _____ DATE _____

PLASTIC IMPACTS: DECOMPOSERS

Read this article, then answer Questions 1 and 2:
https://biologydictionary.net/decomposers-in-the-ocean/

This resource contains more information about decomposers in the ocean. (Note that decomposers may also be called *scavengers* or *detritivores*.)

1. List six examples of decomposers from the article. If you are not sure about the definition of some of the words, find their definitions and write those as well.

Bacteria, Fungi, Marine worms (such as the Christmas tree worm), Echinoderms: invertebrates with a hard and spiny skin or covering (examples: sea urchins, sea lilies, sea cucumbers, feather stars, sea stars), Crustaceans: mostly aquatic invertebrates with an exoskeleton made of chitin, antennae, and segmented limbs (examples: lobsters, shrimp crabs, water fleas, barnacles), Mollusks: soft-bodied invertebrates, usually wholly or partly enclosed in a shell, including snails, clams, and sea slugs

2. Decomposers tend to live on the ocean floor. How could this affect their relationship to plastics?

They would mostly be exposed to plastics that sink.

They may be more likely to become entangled if they are trapped between sinking plastics and the sea floor.

They may be more likely to ingest plastics that are littered on the ocean floor where they are feeding.

Read this article, then answer Questions 3-5 below:
https://www.nationalgeographic.com/environment/article/deep-sea-creatures-mariana-trench-eat-plastic?ngscourse

3. Were you surprised to learn that there are plastics in the deepest parts of the ocean? Why or why not?

Answers may vary.

4. According to this study, where did the plastic fibers in the amphipods ultimately come from?

The fibers were the same used in textiles, and the study suggests they entered the ocean after coming off of clothes in the washing machine (like lint comes off in the dryer) and draining out with the wash water.

5. Summarize what the scientists said about the impact of plastics in amphipods and on the ocean floor in general.

The amphipods are a food source for larger organisms, so the plastics make their way up the food chain. There is nowhere deeper for the plastics to go, so they keep accumulating.

Complete this side when you return to your project group.

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