

MAX AXTON

AND THE SOCIETY OF SUPER SCIENTISTS

ELIZABETH PAGEL-HOGAN
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OCEAN PLASTICS PROBLEM

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Summary: Plastic is everywhere . . . even in our oceans! But how did it get there, why does it matter, and what can we do about it? In this nonfiction graphic novel, Max Axiom and the Society of Super Scientists go on an exciting, fact-filled mission to find out.

Editorial Credits

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THE SOCIETY OF SUPER SCIENTISTS

MAX AXIOM

After years of study, Max Axiom, the world's first Super Scientist, knew the mysteries of the universe were too vast for one person alone to uncover. So Max created the Society of Super Scientists! Using their superpowers and super-smarts, this talented group investigates today's most urgent scientific and environmental issues and learns about actions everyone can take to solve them.





LIZZY AXIOM



NICK AXIOM



SPARK

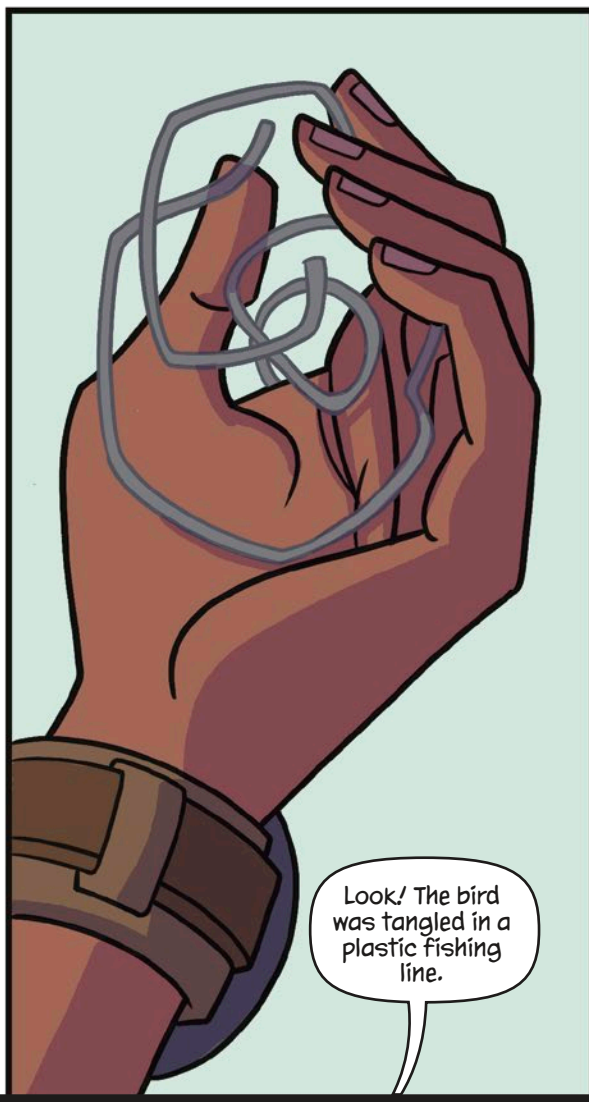


THE DISCOVERY LAB

Home of the Society of Super Scientists, this state-of-the-art lab houses advanced tools for cutting-edge research and radical scientific innovation. More importantly, it is a space for Super Scientists to collaborate and share knowledge as they work together to tackle any challenge.

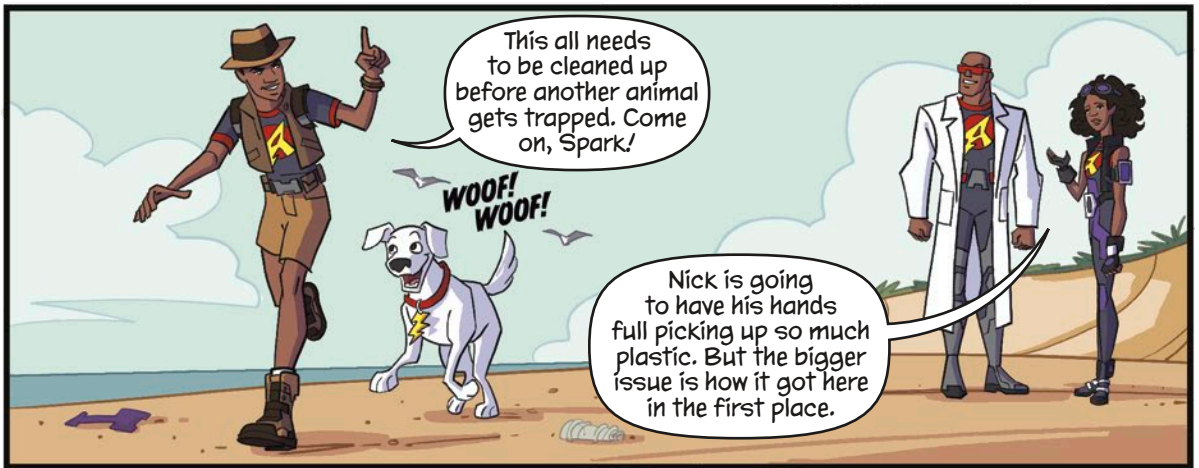
SECTION 1: A BEACH EMERGENCY

As the Society of Super-Scientists answers an emergency call at the beach, they discover an even bigger problem. . .





And there's even more plastic litter on the beach.



This all needs to be cleaned up before another animal gets trapped. Come on, Spark!

WOOF!
WOOF!

Nick is going to have his hands full picking up so much plastic. But the bigger issue is how it got here in the first place.



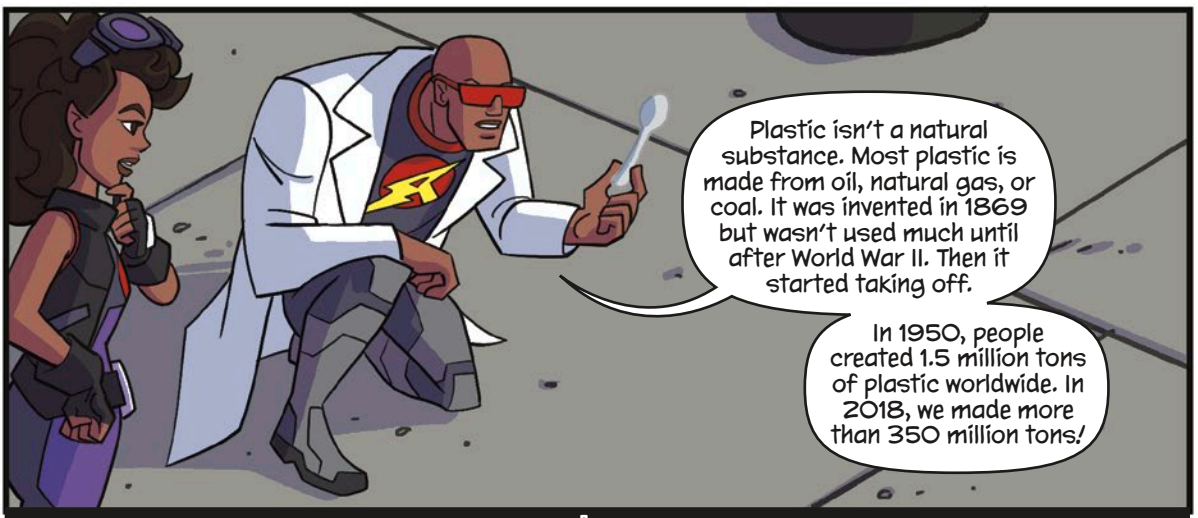
You're right, Lizzy, and it's not just this beach. Plastic is found on beaches and in oceans all over the world.

While Nick's cleaning up, let's see what we can uncover about this plastic problem.



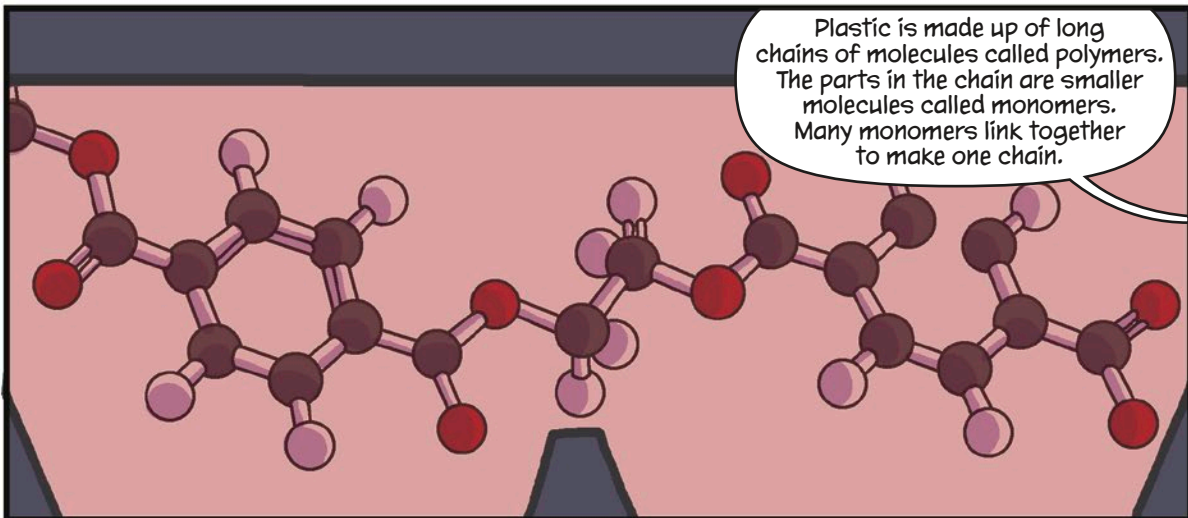
Look, Max! We're surrounded by plastic. It's in everything from sunglasses to cars, and even aircraft!

Plastic is a very useful material. It's strong and lightweight. It can be shaped into almost anything.



Plastic isn't a natural substance. Most plastic is made from oil, natural gas, or coal. It was invented in 1869 but wasn't used much until after World War II. Then it started taking off.

In 1950, people created 1.5 million tons of plastic worldwide. In 2018, we made more than 350 million tons!



The structure of the polymers determines a plastic's properties. Some plastics are hard and rigid.

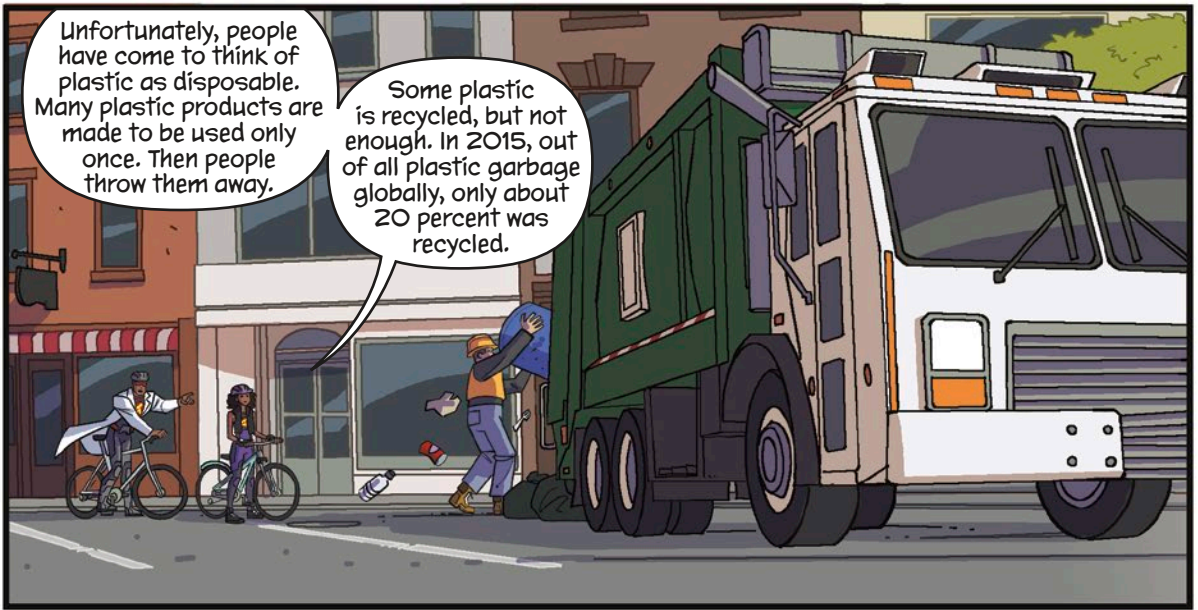
Some are soft and flexible.

Engineers can create different polymers to make many kinds of plastic. This is part of what makes the material so useful.

Using plastic is a cheaper way to make lots of products. It's used instead of wood, glass, and metal.

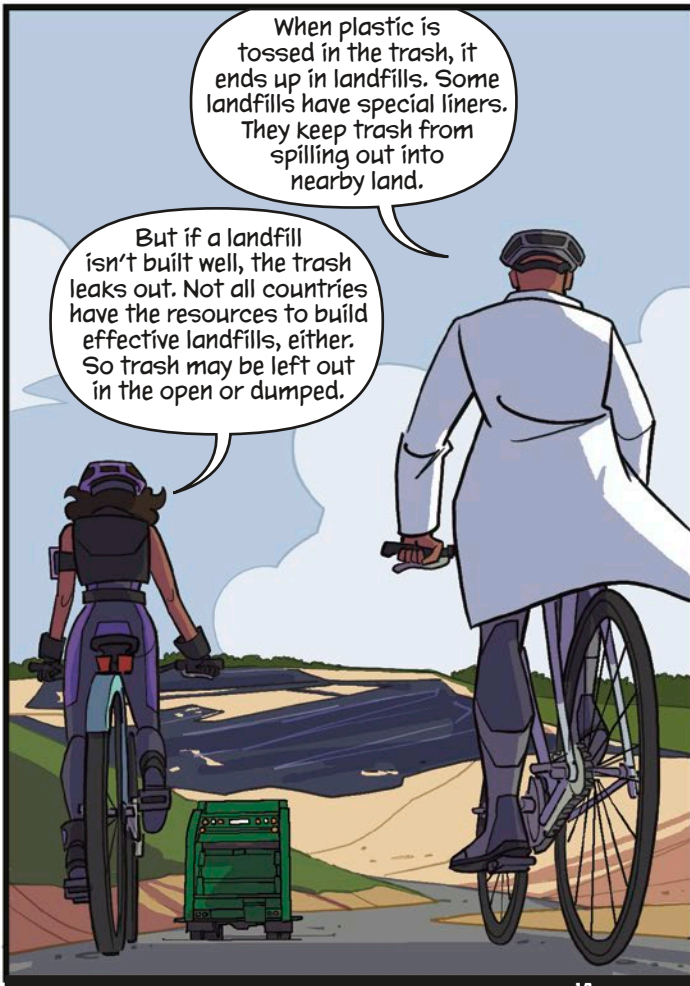
It replaced natural materials such as elephant ivory and tortoise shells.

Plastic has also been used to make artificial limbs and hearts... incredible innovations that save lives!



Unfortunately, people have come to think of plastic as disposable. Many plastic products are made to be used only once. Then people throw them away.

Some plastic is recycled, but not enough. In 2015, out of all plastic garbage globally, only about 20 percent was recycled.



When plastic is tossed in the trash, it ends up in landfills. Some landfills have special liners. They keep trash from spilling out into nearby land.

But if a landfill isn't built well, the trash leaks out. Not all countries have the resources to build effective landfills, either. So trash may be left out in the open or dumped.



It's also a sad fact that people litter. They just drop bottles, bags, candy wrappers, and more on the ground.



All that trash and litter doesn't stay put. Let's climb aboard!

Plastic is often blown or washed into streams . . .

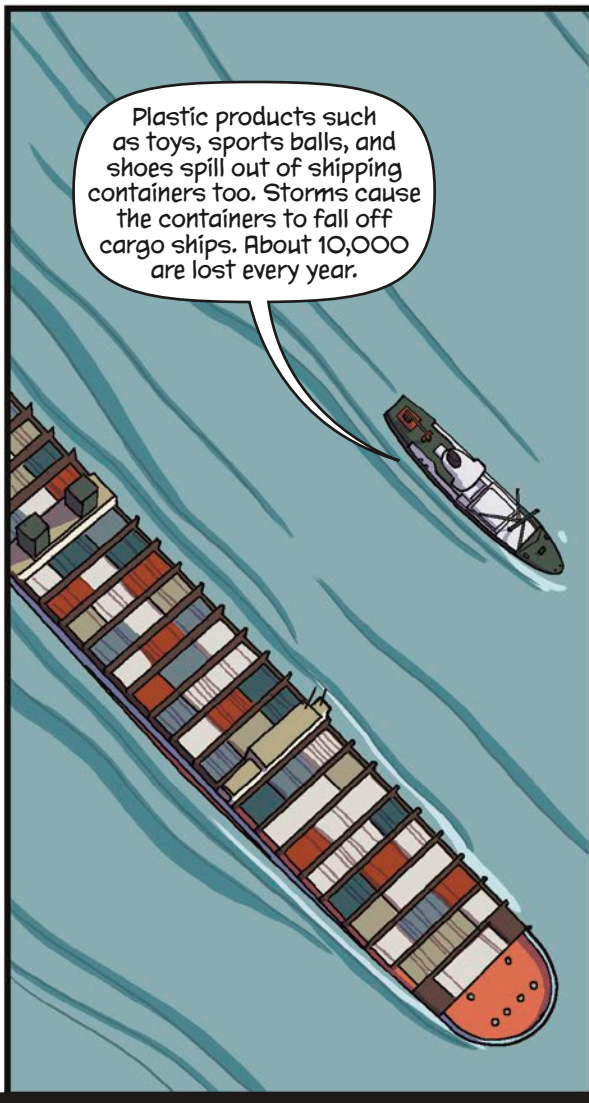


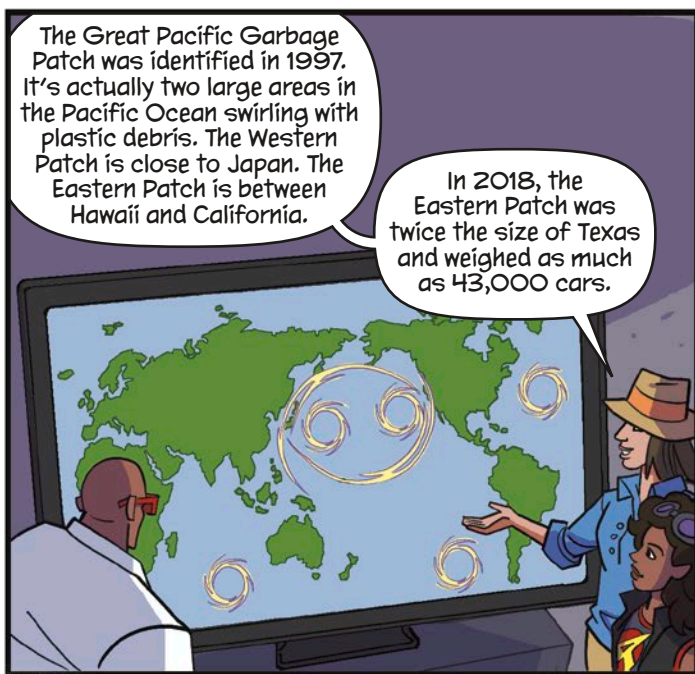
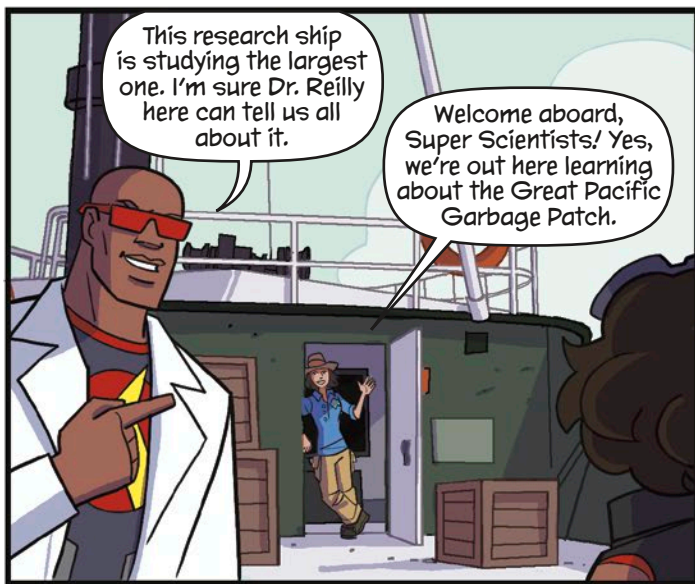
. . . then into rivers . . .



. . . and finally ends up in the ocean!

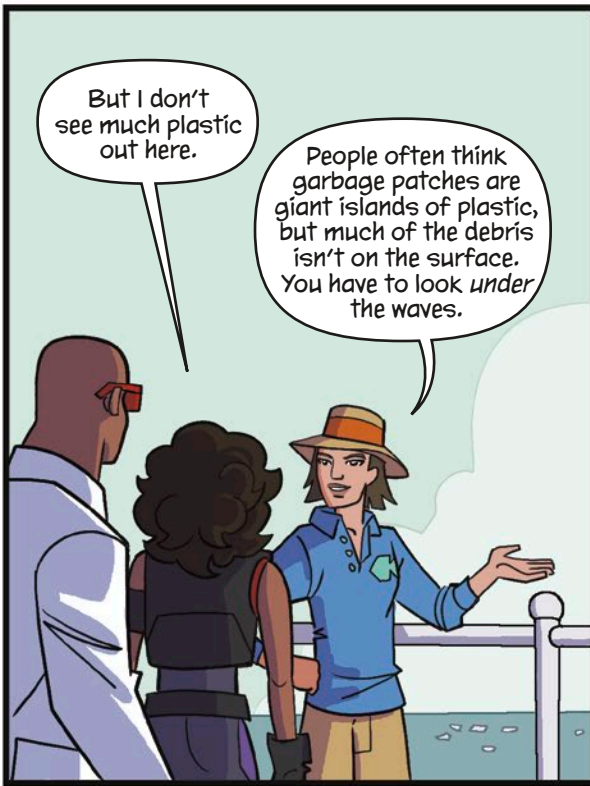
SECTION 2: PLASTIC IN THE OCEANS





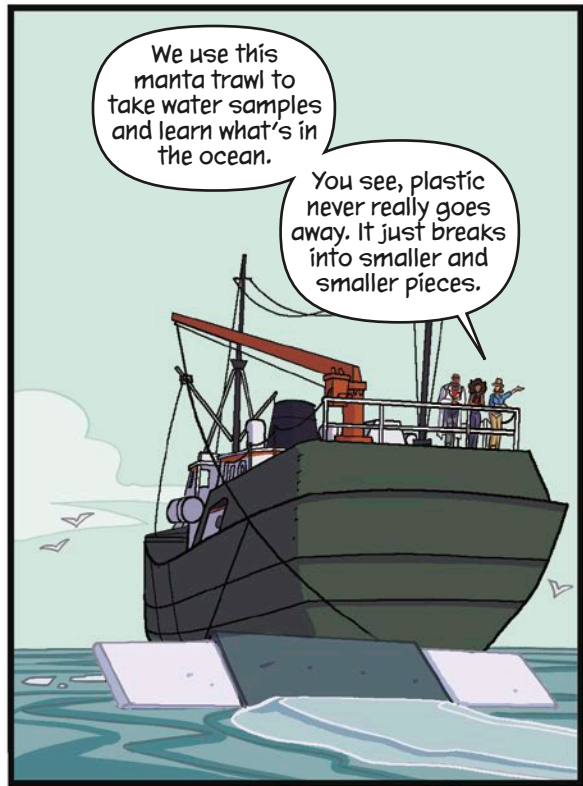
TRAVELING DEBRIS

On March 11, 2011, a 9.0 magnitude earthquake struck off the coast of Japan. A tsunami followed. The disaster killed many people and caused billions of dollars in damage. It also washed an estimated 5 million tons of debris into the Pacific Ocean. Ocean currents carried the plastic debris from the earthquake. The first plastic to reach North America was a soccer ball that washed ashore in Alaska in March 2012.



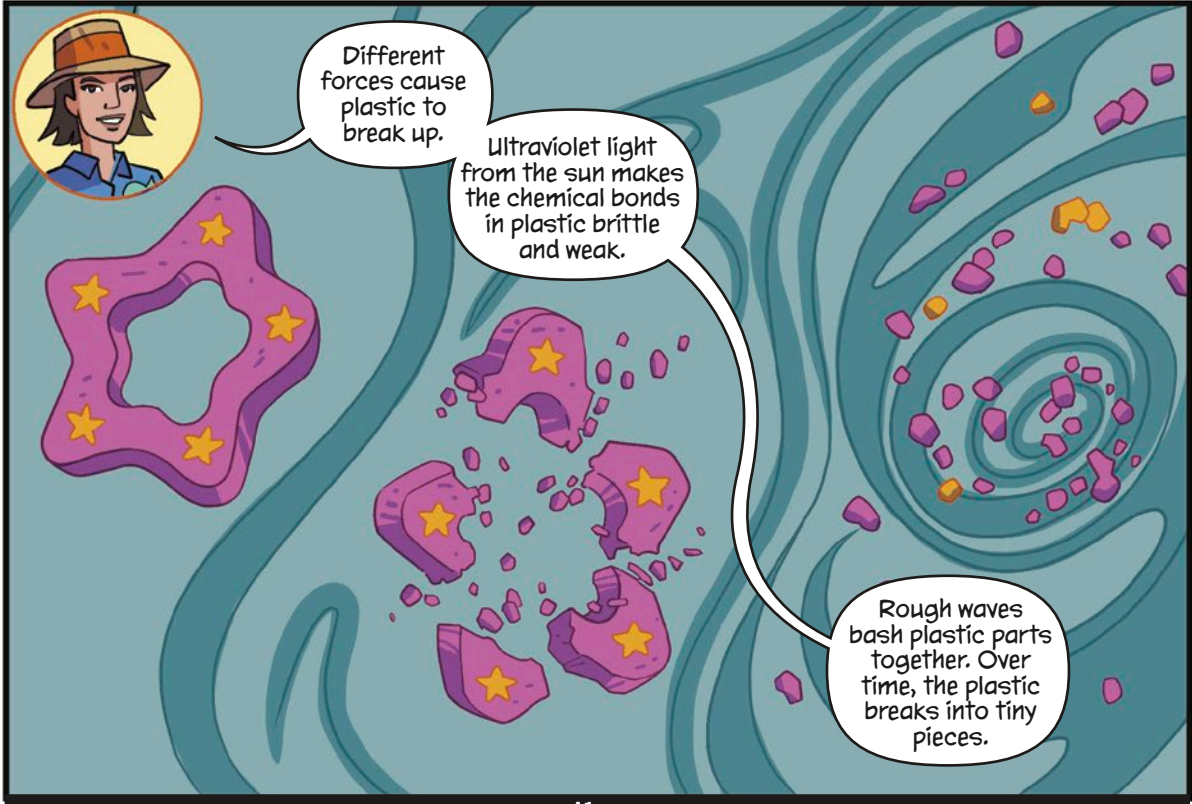
But I don't see much plastic out here.

People often think garbage patches are giant islands of plastic, but much of the debris isn't on the surface. You have to look *under* the waves.



We use this manta trawl to take water samples and learn what's in the ocean.

You see, plastic never really goes away. It just breaks into smaller and smaller pieces.



Different forces cause plastic to break up.

Ultraviolet light from the sun makes the chemical bonds in plastic brittle and weak.

Rough waves bash plastic parts together. Over time, the plastic breaks into tiny pieces.



We call these tiny pieces microplastics. The filter of the trawl catches them.



Microplastics make up over 90 percent of the plastic in garbage patches. They float around under the ocean's surface. They're smaller than 0.2 inches, or 5 millimeters.



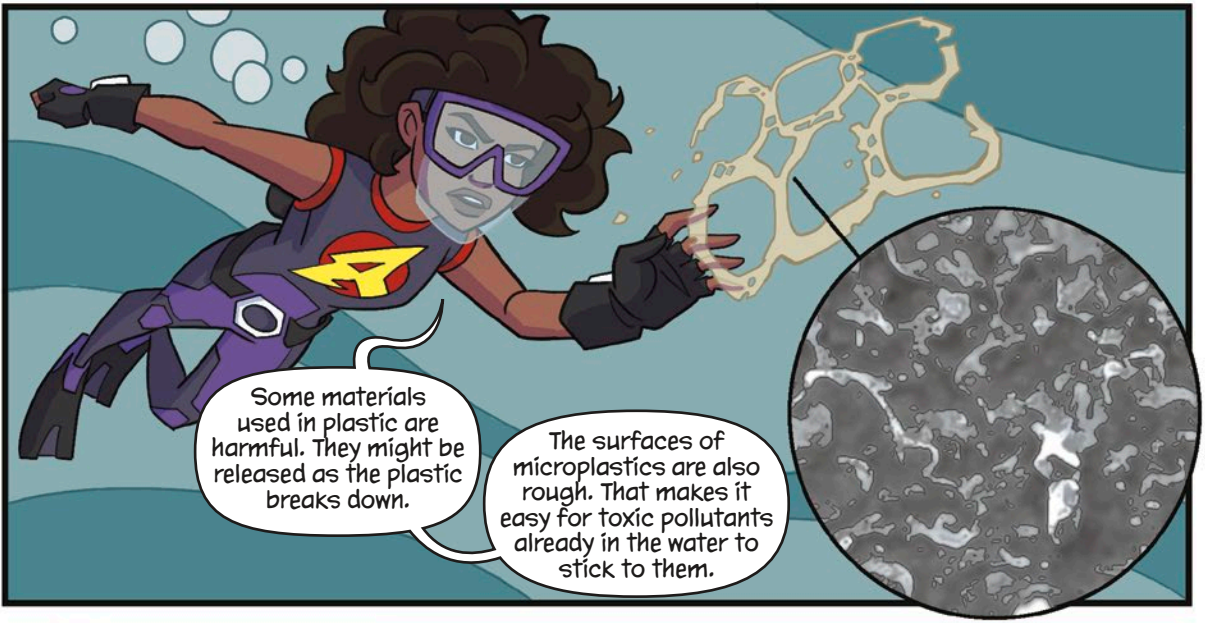
But microplastics don't have to break off from bigger plastic. Some are made that small, right?

That's correct. Microplastics are in toothpaste and soap scrubs. They even get rubbed off of synthetic clothing fibers like nylon or spandex in our laundry.



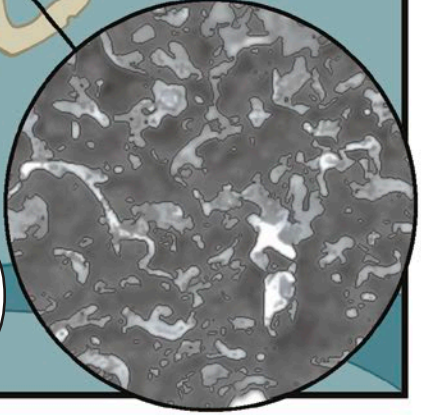
As plastics get smaller, the problem gets bigger.

I'm going to dive in for a closer look!



Some materials used in plastic are harmful. They might be released as the plastic breaks down.

The surfaces of microplastics are also rough. That makes it easy for toxic pollutants already in the water to stick to them.



But that's not all. Small sea creatures like plankton mistake microplastic for food. They eat up the plastic.

Then small fish eat the plankton ...

... and larger fish eat the small fish. Over time, the microplastics build up in the muscles of the large fish.



And soon, the fish end up on our plates.



Seafood is an important, nutritious food for people around the world.



But when we eat seafood, we are eating microplastics too. Scientists are still not sure how microplastics will affect us.

WARNING!
MICROPLASTICS
DETECTED



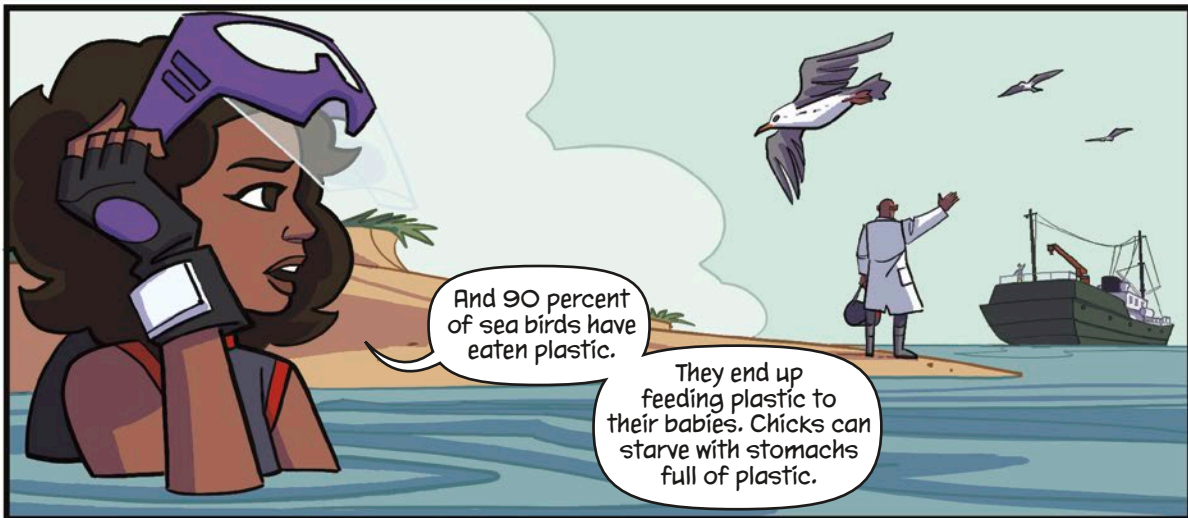
It's not just microplastics that get eaten. Animals can mistake large plastic for food too. Turtles think floating bags are their favorite food—jellyfish.



The bags get stuck in turtles' digestive systems. They can die. A study in 2015 found that 52 percent of sea turtles have eaten plastic.

Stay safe, little fella!

SWOOSH!



And 90 percent of sea birds have eaten plastic.

They end up feeding plastic to their babies. Chicks can starve with stomachs full of plastic.



A 2014 study showed there were over 5.2 trillion pieces of plastic trash floating in the oceans.

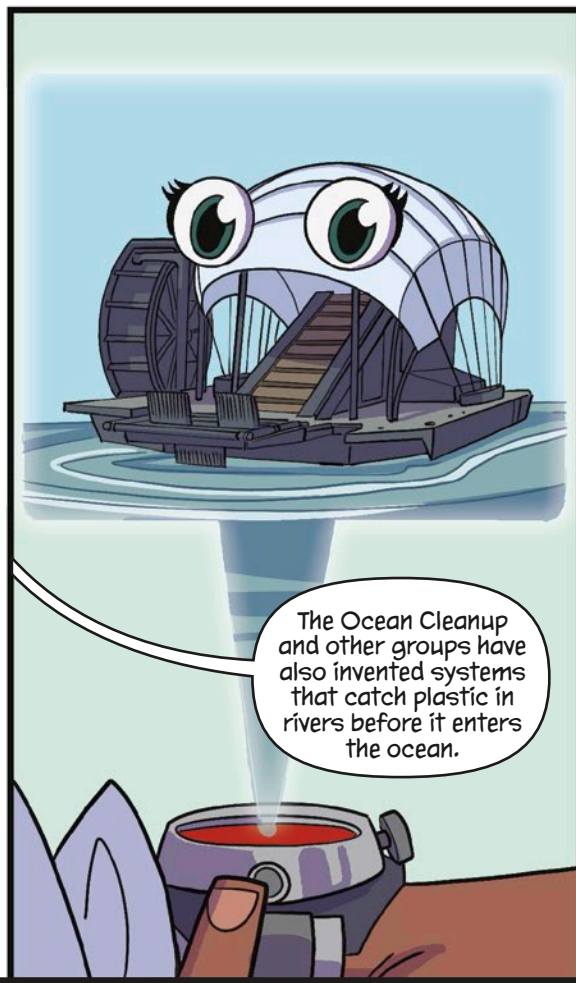
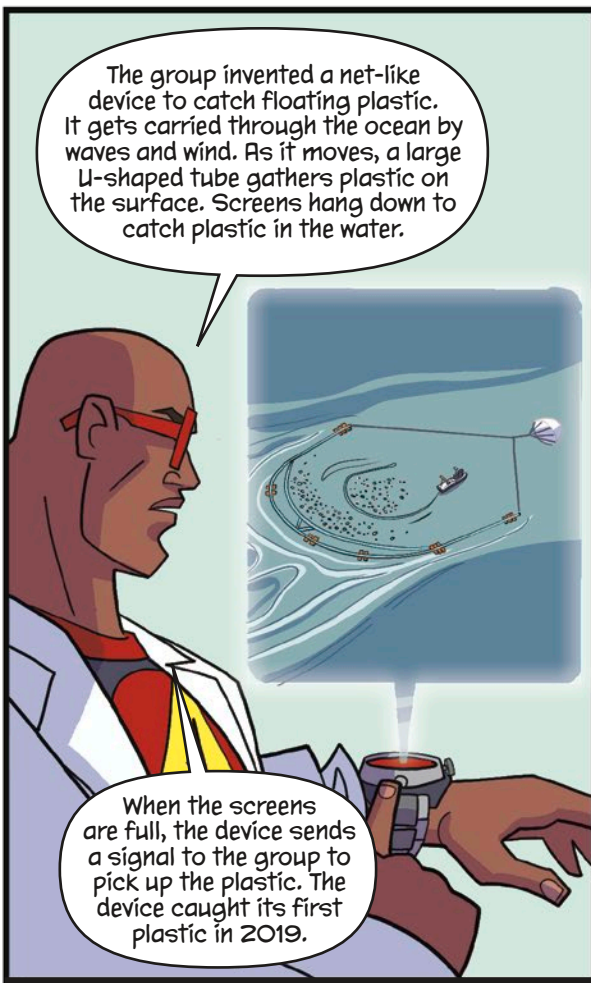
That's about 700 pieces for each person on the planet!



And the problem is only getting worse. What can we do to protect our oceans?

I'm glad you asked.

SECTION 3: FINDING SOLUTIONS





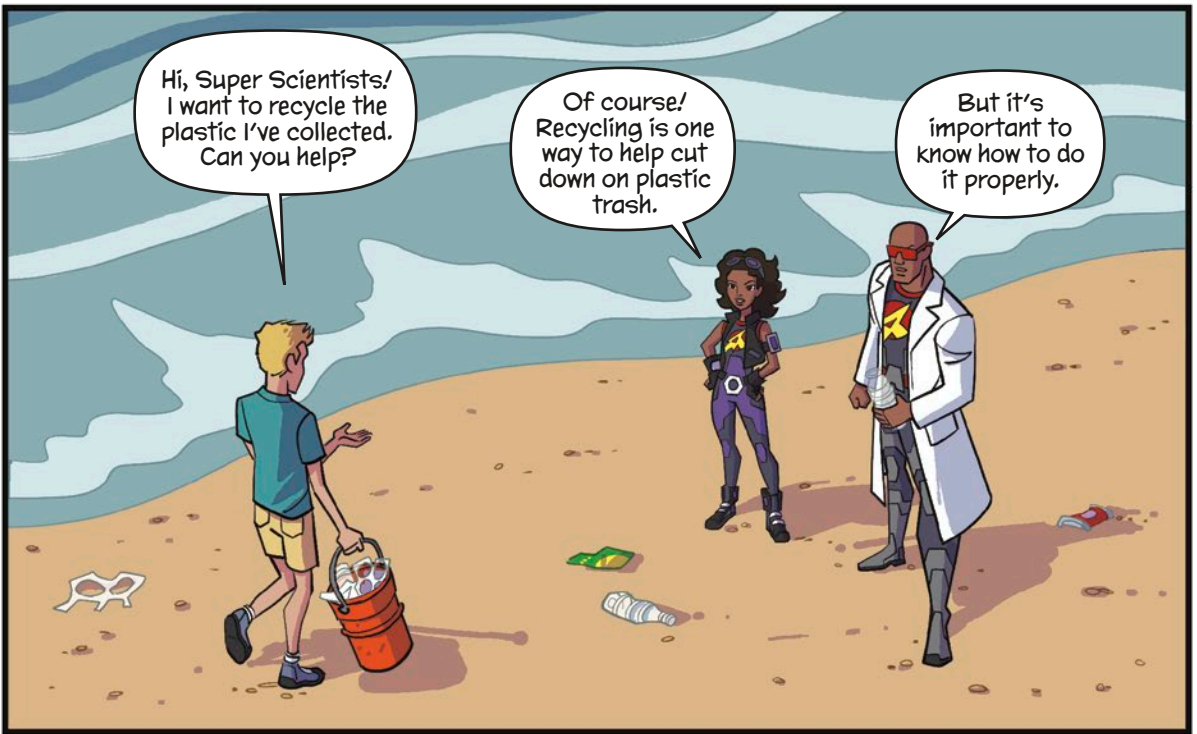
But is the answer that simple? Many researchers worry filters and nets meant to grab plastic will grab and harm sea life instead.

That's a good point.



Removing plastic from the water is important. But it takes a lot of time. It's expensive and difficult. We also need solutions that work in the long run.

We need to slow the flow of plastic.



Hi, Super Scientists!
I want to recycle the plastic I've collected.
Can you help?

Of course!
Recycling is one way to help cut down on plastic trash.

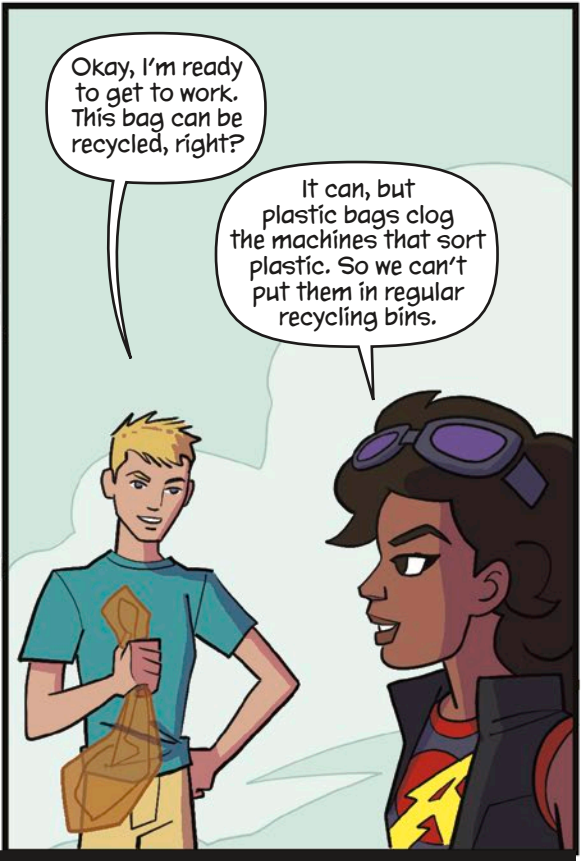
But it's important to know how to do it properly.



Many plastic household items have a number on them. This shows what kind of plastic it is.

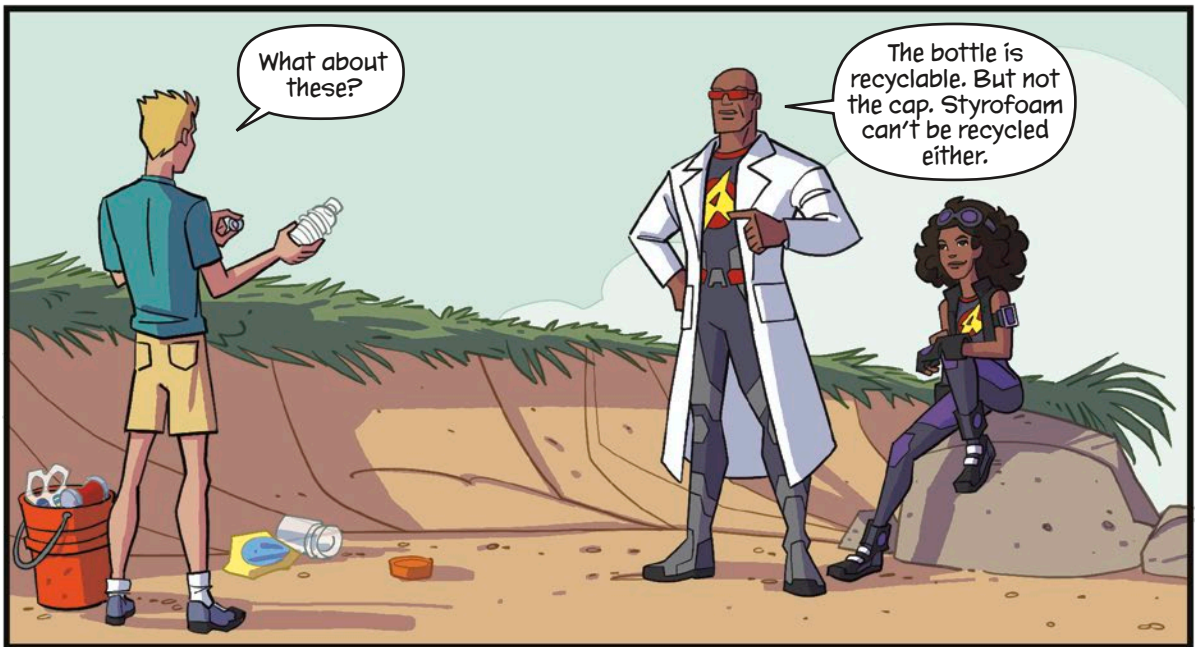
Not all plastic items can go into the recycling bin. First, check what plastics your local recycling program accepts.

Recyclables then have to be sorted by their numbers. They also have to be clean of food.



Okay, I'm ready to get to work. This bag can be recycled, right?

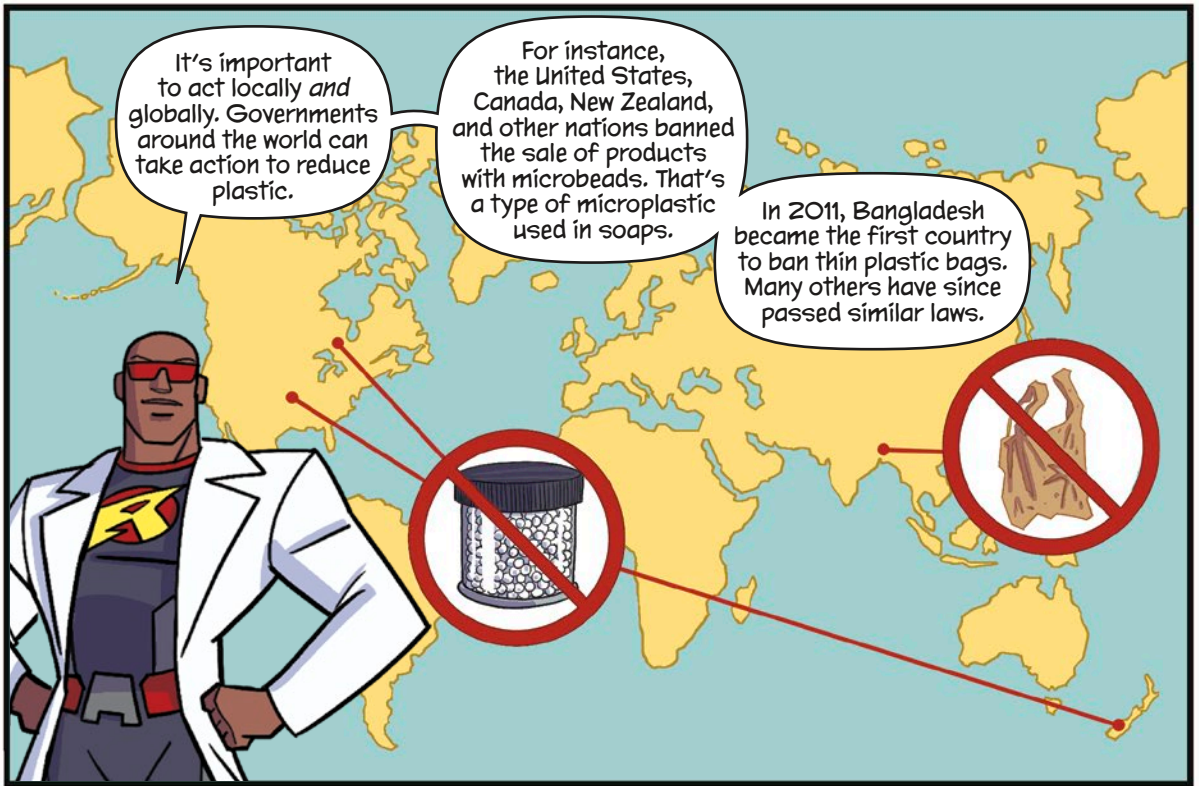
It can, but plastic bags clog the machines that sort plastic. So we can't put them in regular recycling bins.

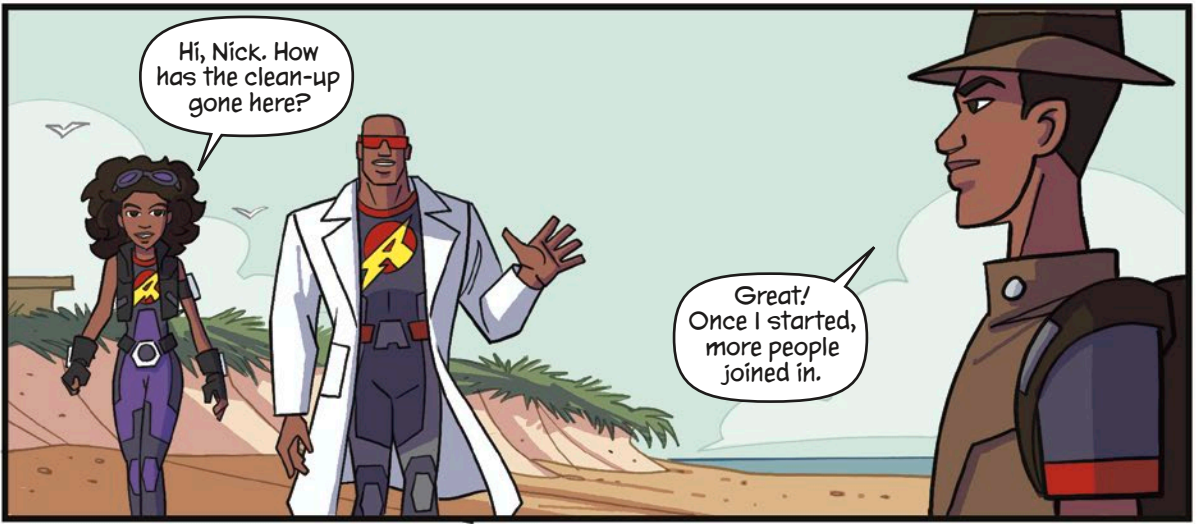


PLASTIC TYPES

Not all plastic is recyclable. There are two main types of plastic: thermoset and thermoplastic. "Thermo" means heat. Thermoplastics can be melted and made into new products. Plastic bottles are thermoplastics. But thermoset plastics can't be recycled. Their polymer bonds won't change with heat. Plastic table tops and Formula 1 race cars are made from thermoset plastics.









And a local artist is turning some of the trash into a sculpture to help raise awareness about the world's plastic problem. After all, people have to know about an issue before they can work to solve it.



Cleaning up the ocean and our beaches is important. But most scientists agree—that's only the start.

We need to reduce how much plastic we use so it never ends up in the environment in the first place.



It's time to make changes. We can all be a part of the solution.

TAKE ACTION!

Reducing plastic is a worldwide project. But you can start working on it now in your neighborhood.

- Plan ahead! Keep a reusable water bottle with you, have a set of utensils handy for on-the-go meals, and carry a reusable shopping bag.
- Don't trash plastic furniture or utensils. Donate them to a charity or a program like the Freecycle Network so others can use items you don't need anymore.
- Reuse plastic items for as long as you can. Clean plastic takeout containers and reuse them in your lunch. Grow plants in a plastic juice jug. Then water them with a watering can made from a clean plastic laundry detergent bottle.
- Get creative! Think of new uses for plastic items. Find out what plastics your town recycles. Make sure you always recycle those items.
- Write to your local government and ask them to help increase recycling in your schools and community. Encourage friends and neighbors to do the same.
- Start a poster campaign in your school or neighborhood. Teach people about why it's important to reduce, reuse, and recycle plastics.
- Pick up plastic in your neighborhood. If you can recycle it, do it! If not, cleaning up litter keeps it out of our streams, rivers, and oceans.
- When you are shopping, try to pick products with no packaging or recyclable packaging. If you can, shop at a farmer's market or community market. Buying local usually means less plastic packages.
- Try a plastic-free challenge! Can you go through a day without using plastic?

MORE PLASTIC FACTS

Some scientists think the plastic trash floating near the surface is only 1 percent of all the plastic in the ocean. It is also building up on the ocean floor. Recent studies discovered that there is more plastic on the ocean floor than is floating near the surface. The deepest piece of plastic was found in the Marianas Trench in 2018 at 36,000 feet (11 kilometers) deep!

Plastic is found around the world—even in places where humans don't live! Microplastics have been found in the snow in Antarctica. On uninhabited islands such as Milman Island near Australia, plastic is ruining what should be beautiful beaches. Sea turtle researchers collected more than 165 pounds (75 kg) of plastic from the shore.

Scientists and businesses are working on creative alternatives to plastics. One company in London is developing a plastic made from seaweed. This plastic is not only biodegradable—it's edible!

Scientists in Korea may have discovered a beetle larvae that can eat, digest, and break down a specific kind of plastic called polystyrene.



GLOSSARY



disposable (dih-SPOH-zuh-buhl)—made to be thrown away

gyre (JAHYUR)—a large system of rotating ocean currents

landfill (LAND-fil)—a place where garbage is buried

litter (LIH-tuhr)—trash that has been thrown on the ground or carelessly left somewhere

manta trawl (MAN-tuh TRAWL)—a netted device that is pulled through water to collect water samples

microplastic (mye-kroh-PLAS-tik)—a piece of plastic less than 0.2 inches (5 mm); microplastics can be made to be of small size or they are pieces that break off from large plastic

monomer (MAH-nuh-muhr)—a single molecule that can be linked to other molecules

plastic (PLAS-tik)—a strong, lightweight material created by people that can be formed into many shapes when heated and then set as it cools

pollutant (puh-LOOT-uhnt)—a material that can damage the environment

polymer (PAH-luh-muhr)—a group of many monomers linked together

recycle (ree-SYE-kuhl)—to make used items into new products

reduce (rih-DOOS)—to make something smaller in size or quantity



READ MORE

Howell, Izzi. *Pollution Eco Facts*. New York: Crabtree Publishing Company, 2019.

Hustad, Douglas. *Cleaning Up Plastic with Artificial Coastlines*. Minneapolis: Abdo Publishing, 2020.

Smith-Llera, Danielle. *Trash Vortex: How Plastic Pollution Is Choking the World's Oceans*. North Mankato, MN: Compass Point Books, 2018.

INTERNET SITES

National Geographic Kids: Kids vs. Plastic
kids.nationalgeographic.com/explore/nature/kids-vs-plastic/

National Ocean Service: A Guide to Plastic in the Ocean
oceanservice.noaa.gov/hazards/marinedebris/plastics-in-the-ocean.html

TIME for Kids: The Problem with Plastics
timeforkids.com/g34/the-problem-with-plastic/

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