

EARTH'S BEATING HEART

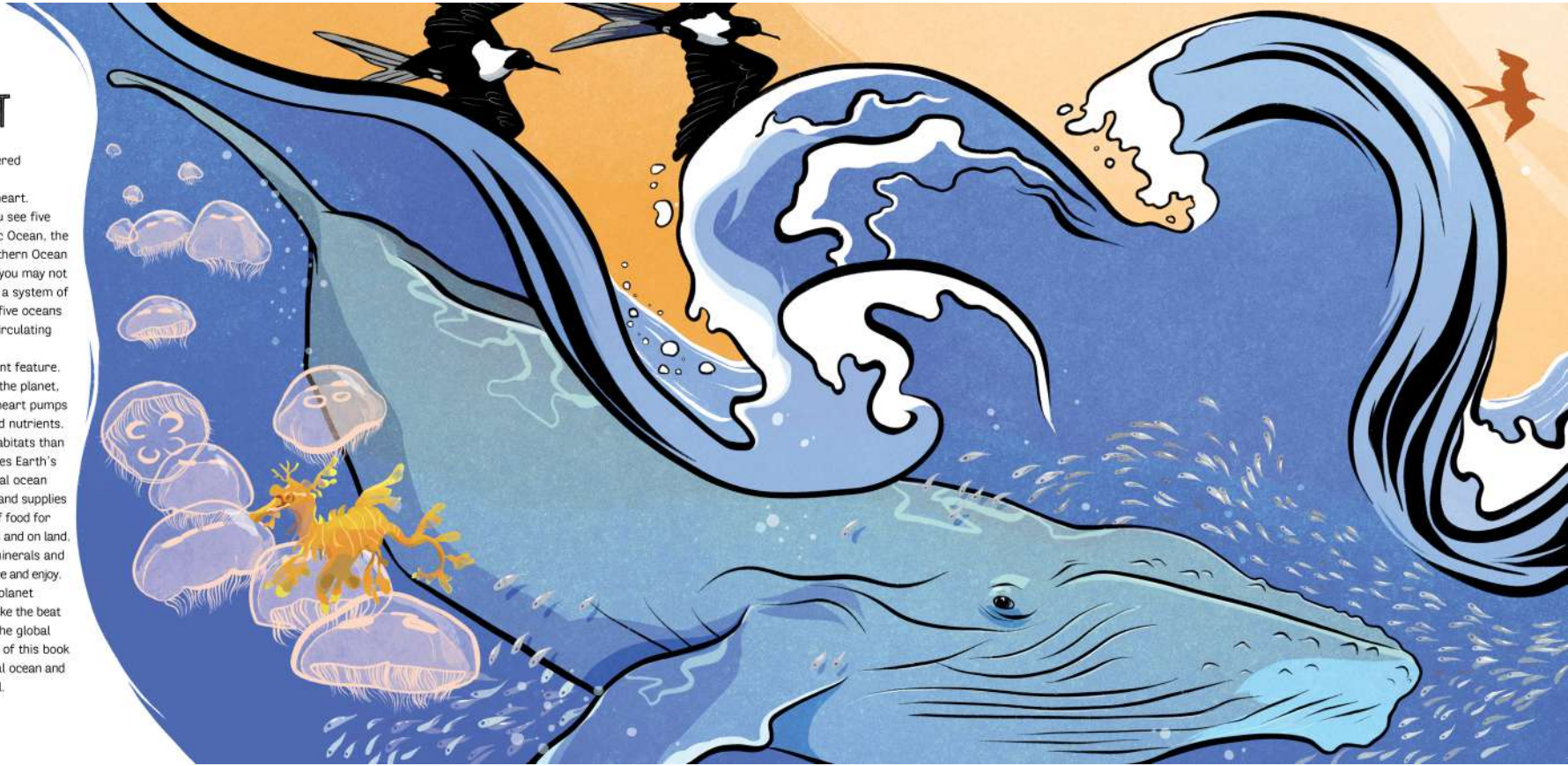
What if Earth had a beating heart that powered everything on the planet?

In a way, the global ocean is like Earth's heart.

When you look on a map of the world, you see five great oceans: the Atlantic Ocean, the Pacific Ocean, the Indian Ocean, the Arctic Ocean and the Southern Ocean (also called the Antarctic Ocean). But what you may not realize is that these oceans are all linked by a system of water that moves between them. So, these five oceans are actually connected to form one single circulating ocean — the global ocean.

This global ocean is Earth's most important feature. It moves heat, oxygen and nutrients around the planet, supporting all life on Earth, much like your heart pumps blood through your body to move oxygen and nutrients. It is also home to more species and more habitats than anywhere else on the planet. Its water shapes Earth's climate and influences its weather. The global ocean stores carbon dioxide from the atmosphere and supplies oxygen for us to breathe. It is also a source of food for many of Earth's inhabitants living in the ocean and on land. And for humans, it provides food, energy, minerals and transportation, as well as a place to play, explore and enjoy.

A healthy global ocean is what keeps the planet flourishing and sustains all life on Earth, just like the beat of your heart keeps you alive and well. But the global ocean is in trouble. Let's dive into the pages of this book to learn about the issues affecting the global ocean and what we can do to help it, and the planet, heal.



ABOUT THE GLOBAL OCEAN

Over 4.4 billion years ago, Earth cooled and water vapor, or gas, in the atmosphere condensed into rain. The rain fell for hundreds of years, filling the basins — large depressions in Earth's surface — that eventually became the global ocean. Today, the global ocean holds 97 percent of Earth's water. That's about 1 300 000 000 000 000 000 000 liters (352 000 000 000 000 000 000 gallons) of water!

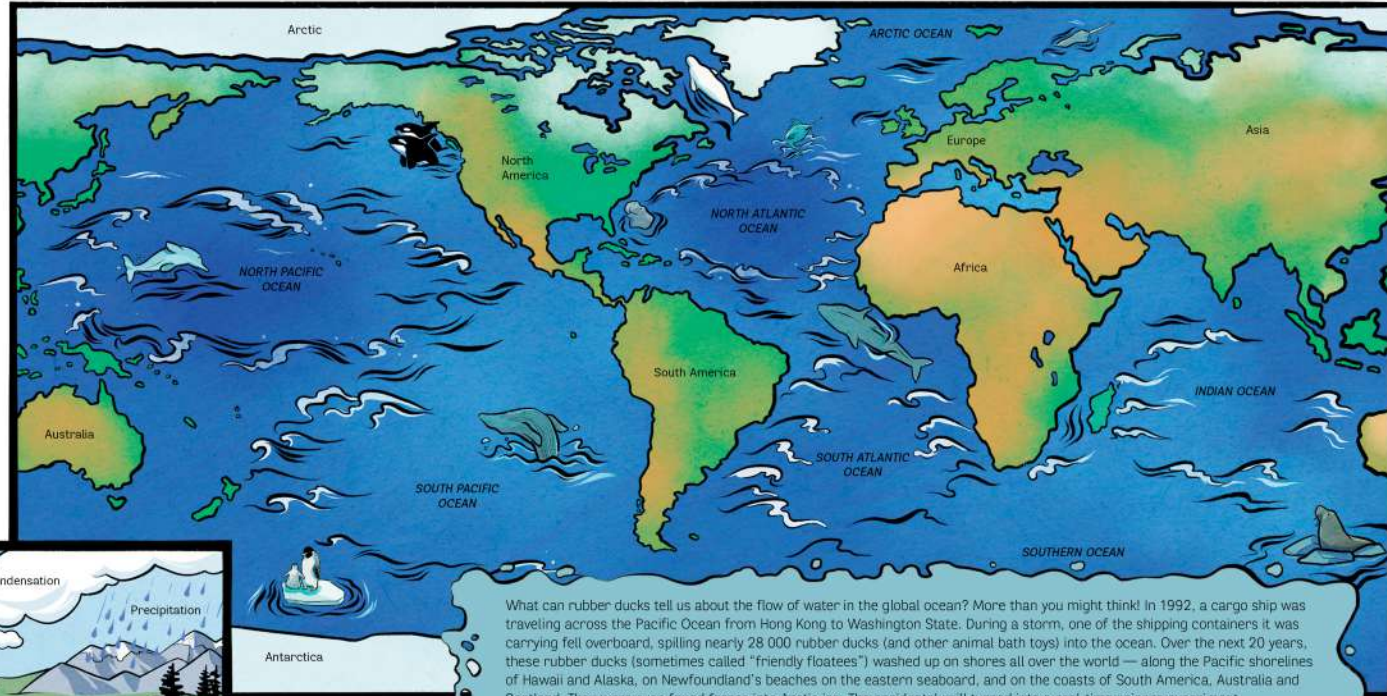
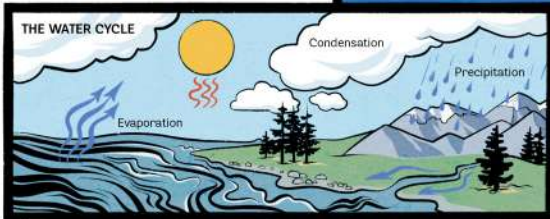
The global ocean is where you'll find Earth's highest peaks, longest mountain ranges and deepest valleys. But perhaps its most significant feature is that it connects all water on Earth, not just ocean water. It does this in two ways: through the water cycle and through the flow of its currents.

The water cycle is the constant movement of water between the ocean, the land and Earth's atmosphere — the layers of gases around the planet. As warmed ocean water evaporates, pure water vapor rises into the sky. When the vapor cools, it condenses into tiny droplets and forms clouds that drift around the planet. Eventually the droplets get heavy enough to fall to Earth as rain, snow, sleet or hail, which then runs into lakes, rivers, streams and ponds. These bodies of water link together to form watersheds — systems of waterways that lead back to the global ocean.

In the ocean, currents are formed by wind patterns, gravity and the rotation of Earth.

Some currents flow across the ocean's surface, others deep beneath it, and some flow from the surface down to the deep and back up again. Gyres are currents that move in a circular pattern. The global ocean has five major gyres — the North Atlantic, South Atlantic, Indian, North Pacific and South Pacific. These gyres drive what scientists call the ocean conveyor belt — the currents that move water between the ocean's basins, controlling the temperature, amount of salt and flow of nutrients throughout the global ocean.

So, you see, thanks to the global ocean, Earth's water is always on the move — flowing between ocean basins, swirling up from the depths to the surface and back down again, and shifting between the ocean's surface and the atmosphere. All life relies on this constant circulation of water, just as you need your beating heart to keep the blood pumping through your body.



What can rubber ducks tell us about the flow of water in the global ocean? More than you might think! In 1992, a cargo ship was traveling across the Pacific Ocean from Hong Kong to Washington State. During a storm, one of the shipping containers it was carrying fell overboard, spilling nearly 28 000 rubber ducks (and other animal bath toys) into the ocean. Over the next 20 years, these rubber ducks (sometimes called "friendly floatees") washed up on shores all over the world — along the Pacific shorelines of Hawaii and Alaska, on Newfoundland's beaches on the eastern seaboard, and on the coasts of South America, Australia and Scotland. They were even found frozen into Arctic ice. The accidental spill turned into a real-time science experiment. Tracking the ducks allowed scientists to test their theories about the global ocean and learn more about ocean currents. Today, this story still reminds us how all the ocean basins are connected to form one global ocean.





AN OCEAN OF DIVERSITY

The very first life-forms on Earth were ocean-dwelling microbes — tiny organisms that lived over four billion years ago. About 450 million years ago, plants were likely the first living things to wash ashore and begin life on land. Then 30 million years ago, prehistoric fishes left the oceans to live life on land. Every plant, animal and even bacteria species on Earth can trace its roots back to the ocean.

Today's global ocean is home to the greatest diversity of life on Earth. It's also home to the greatest number of living organisms on the planet. In fact, more than 50 percent of all life on Earth lives in the ocean. But the real number could be as high as 80 percent, because humans have explored only about 20 percent of the global ocean. Among the ocean's inhabitants are more than 242 000 different species of fish, invertebrates, plants, birds, reptiles and mammals — from the tiniest species, such as bacteria, to the largest mammal (and animal!) on the planet, the blue whale.

About 90 percent of Earth's habitats are also found in the global ocean. These habitats include the open ocean, hydrothermal vents, coral reefs, oyster reefs, seagrass meadows, kelp forests, saltwater marshes, mangrove forests, intertidal zones (where the ocean meets land) and estuaries (where rivers meet the sea). Many marine species are specially adapted to conditions in their habitat, such as water temperature, salt levels and light.

This incredible diversity of species and habitats in the ocean is very important for the overall health of the global ocean. That's because everything works together as part of an enormous, interconnected system. Without thriving habitats, species would struggle to survive. And since all species are part of food chains (who eats whom) and food webs (how food chains interconnect), a loss or change in the population of even one species will affect other species, including humans.

Many animals that live in intertidal zones are adapted to live out of the water at low tide. Barnacles, for example, trap seawater in their closed shells, which keeps them from drying out as they wait for the tide to roll back in.

Some animals with the longest life spans live in the ocean. Among the record-setters are the volcano sponges of the Southern Ocean, which can live to be 15 000 years old!

Seagrass meadows are important habitats that help prevent erosion along the ocean shore. Seagrass roots trap sand and mud, keeping the currents from washing it away.

Hydrothermal vents are underwater geysers similar to hot springs on land. They release gases that can reach nearly 400° Celsius (752° Fahrenheit) — nearly as hot as the surface of Venus. Amazingly, marine animals such as feather duster worms and yeti crabs can be found living around these vents.