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AN UNDERWATER PANDEMIC IS WIPING OUT CARIBBEAN CORALS

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In many parts of the Caribbean, diving underwater will transport you to a colorful world of fish, sponges, mammals, and more. This dazzling undersea rainforest is created by rock-like animals called corals. But just like humans, corals can get sick—and right now a disease is spreading throughout the Caribbean, infecting and killing some of the world's oldest and largest animals at an alarming speed. The deadly disease is called stony coral tissue loss disease (SCTLD). This article explains what we know about SCTLD and how to spot it in the ocean, how far the disease has spread, what kinds of corals are getting sick, and how we can work together to stop it. We need everyone's help to save the corals and in turn save the homes of an incredible amount of sea life.

YOUNG REVIEWERS:

AYA
AGE: 11

TARIQ
AGE: 13

STONY CORALS

A marine animal that builds a hard skeleton out of calcium carbonate, leading to the creation of entire coral reefs! Corals are Cnidarians and are closely related to anemones and jellyfish.

CORALS ARE UNDERWATER ARCHITECTS

At first glance, some corals (called **stony corals**) look a lot like rocks. However, if you look really closely, you may see circles of tentacles, swaying with the water currents. Each circle of tentacles is a tiny animal

called a **polyp**. As stony corals grow, they slowly add one, two, or a few polyps at a time to their community, each one an exact copy of the last. Eventually, hundreds or even thousands of individual animals will live in harmony as a coral colony.

POLYPS

Small animals that can live by themselves or in community with many others. For example, a single coral colony is made of hundreds or thousands of polyps.

As stony corals add to their colony, the corals begin to take unique shapes. Some corals look like the horns of elk or deer, due to their extensive and intricate branches. Other corals create magnificent castles constructed of tall pillars. Some corals look like dinner plates, and others create massive mounds and boulders! Many of these shapes have grooves, ridges, and holes—structures that serve as perfect homes for fish and other sea creatures. As hundreds and thousands of coral colonies grow together, they create one of the most beautiful and diverse ecosystems in the world: coral reefs. Because of the role that stony corals play as architects and creators, they are often called reef builders.

Corals also come in many colors, including green, brown, yellow, red, and even purple! However, corals do not get to pick which color they would like to be. Rather, much of their color comes from the presence of another organism living inside of their tissues: **symbiotic microalgae**. Symbiotic microalgae are teeny-tiny cells that do more than provide corals with their colorful pizzazz. Like plants, these tiny algae perform photosynthesis, allowing them to create and share much of the food that corals need to survive. These tiny cells are grateful for the corals as well, because corals give them both a safe place to live and the nutrients that they need to carry out photosynthesis. This kind of relationship, in which two organisms live in close harmony with one another, is called **symbiosis**. This is why the tiny algal cells are called symbiotic microalgae!

SYMBIOTIC MICROALGAE

Tiny algae that live within the tissues of stony corals, providing the corals with up to 90% of the food that they need to survive.

SYMBIOSIS

A close relationship between two different organisms, which often helps one or both of the organisms involved.

Not only do corals play irreplaceable roles in marine ecosystems, but they are also really important in the lives of humans. Coral reefs provide food for billions of people around the world, protect the coasts from tropical storms, are tourism magnets, produce life-saving medicines, and are a fundamental part of many cultures. Plus, coral colonies can live for a very, very long time. In fact, some coral colonies can continue to grow for up to 5,000 years! This is longer than any other animal on Earth. Corals are amazing!

CORALS ARE IN TROUBLE

Corals are in serious trouble due to climate change and disease, and coral colonies are dying faster than ever before. When corals die, they leave their skeletons behind. Though dead corals can continue to provide homes for reef creatures for a little while, over time these skeletons start to erode due to water currents and wave pressure. As coral skeletons break down, the homes of the many organisms living on the reef disappear.

In the Caribbean, a new disease is relentlessly infecting and killing corals like never before. The disease is known as stony coral tissue loss disease (SCTLD), nicknamed "skittle-D." Of the 45 known species of reef-building corals in the Caribbean, almost half can catch this disease. Once infected, a coral colony that took hundreds of years to grow can die within a couple of weeks or months (Figure 1). However, coral species catch the disease at different rates. Species that catch the disease quickly once it has arrived at a reef are considered highly **susceptible** to SCTLD. Some of the most susceptible stony corals include brain, pillar, star, and starlet corals. SCTLD can exist on a reef for multiple years, and species with lower susceptibility are often infected later on.

SUSCEPTIBLE

Able to be infected with a disease or illness.

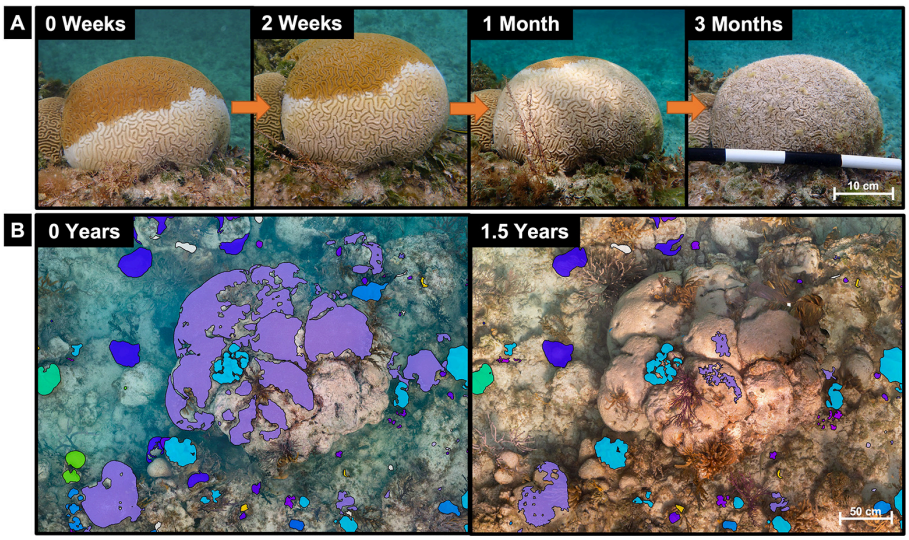

Figure 1

(A) A colony of grooved brain coral (*Diploria labyrinthiformis*) infected with SCTLD. The first signs of the disease are spots of white skeleton that expand over time. Live coral is yellow-brown in color and dead coral is white. Images are labeled with the time that passed since the first photo (Photo credit: Natalia Hurtado). **(B)** A top-down view of a coral reef in the Bahamas where SCTLD is present. All living coral is colored in, and the colors represent different species of coral. Images were taken 1.5 years apart (Photomosaic credit: Will Greene. Coral outlines created using TagLab).

Although the exact cause of SCTLD is still unknown, researchers believe that it is probably caused by either a bacterium, virus, or combination of the two.

THE RAPID SPREAD OF SCTLD THROUGHOUT THE CARIBBEAN SEA

SCTLD was first spotted off the coast of Florida in 2014. Scientists have since discovered the disease off the coasts of 20 more countries in the Caribbean, reaching from Mexico to Honduras to St. Lucia (Figure 2).

SCTLD spreads alarmingly quickly through the water. With the vast majority of new outbreaks occurring within the last few years (between 2019 and 2021), SCTLD seems to be picking up speed. For example, in the Bahamas, SCTLD has been estimated to travel at a rate of up to 50 meters (55 yards) per day [1]. Like COVID-19, SCTLD is now considered

Figure 2

Countries experiencing SCTLD outbreaks as of November 2022. You can see that the disease is common throughout Florida and the Caribbean region. Countries with SCTLD outbreaks are shown in red. [Map is based on available Atlantic and Gulf Rapid Reef Assessment (AGRRA) data].

Figure 2

PANDEMIC

An outbreak of disease that begins in one place and spreads across other countries and/or continents.

an underwater **pandemic** because of its quick and shocking spread across the Caribbean region.

However, SCTLD can be spread in more ways than just by water currents. For example, SCTLD was first spotted in the Bahamas in late 2019, in the area surrounding a major shipping port in Freeport, Grand Bahama. Just a couple of months later, in early 2020, the disease was identified on the reefs near a shipping port in another part of the Bahamas—Nassau, New Providence. The separation of 200 kilometers between these outbreaks—and the lack of disease around the islands between them—led researchers to believe that the disease arrived by way of commercial shipping vessels [1]. When commercial ships travel from one place to another, they take on large amounts of ocean water, known as **ballast water**, to make them more stable while they are moving. When the ships arrive at their destinations, they release their ballast water. While it may seem harmless, the release of ballast water containing diseases like SCTLD can cause outbreaks in new locations.

BALLAST WATER

A large amount of water that is taken up by and stored within ships. The added weight increases stability and maneuverability during travel.

After arriving in the Bahamas, SCTLD has likely spread between islands and reefs *via* local currents and smaller boats. Once present on a reef, SCTLD can spread quickly from coral to coral through the water column, through the movement of sediments across the sea floor, and through physical contact by underwater animals and divers [1].

WHAT DOES SCTLD MEAN FOR THE FUTURE OF CORAL REEFS?

Due to SCTLD, Caribbean corals are dying faster than they have ever before. In a matter of months, reefs are transforming from coral-dominated havens to algae-covered graveyards. This rapid decrease in live coral is creating an imbalance between the rate that the remaining stony corals can build new reef and the rate that ocean currents are eroding the coral skeletons that are left behind. This imbalance will affect the structure of Caribbean coral reefs in the coming years, as water pressure erases cracks, crevices, and other critical habitat—flattening the reef as a whole [2]. Sea creatures are already starting to lose their homes, and before long, humans will begin to notice the effects as well—especially when it comes to reduced fishing, tourism and coastal protection.

WE CAN STOP THE SPREAD, TOGETHER

Despite this bad news, we have not lost hope! By working together, we can stop the spread of SCTLD and reverse the decline of Caribbean coral reefs. One way to slow the spread of SCTLD is through **antibiotic** treatments, similar to medicines the doctor gives you when you are sick! Trained scuba divers will put an antibiotic paste right on the line separating living coral tissue from the newly dead skeleton. For many coral species, this will hopefully stop SCTLD in its tracks, preventing it from spreading to the rest of the coral colony [3]. However, treated corals can get reinfected with SCTLD, so the same corals and reefs must be continually monitored over time, and more antibiotic paste must be applied if necessary.

ANTIBIOTICS

A medicine that fights infections caused by bacteria. They work by either attacking and killing the bacteria or by preventing the bacteria from growing and multiplying further.

Additionally, all boaters, divers, fishermen, and ocean-lovers can help stop the spread of SCTLD. The first way to contribute is by learning how to identify the disease. If you think you see SCTLD while snorkeling, fishing, or diving in the Caribbean, snap a picture, record the location, and report it to a local conservation organization. This helps us monitor the spread between reefs within a country and between countries in the Caribbean.

Next, do your best not to spread SCTLD from infected reefs to healthy reefs. If you are going scuba diving, fishing, or snorkeling in the Caribbean, it is important to disinfect your gear before traveling to a new site (Figure 3). Boat drivers should be careful to not carry any water between reefs—they should make sure to pump out any bilge water at reefs where SCTLD is present, and to disinfect any remaining bilge water before releasing it into open water. Bilge water can be disinfected by adding 1 cup of natural detergent (for example Seventh Generation, Earthbound Elements, Tru Earth, or another natural detergent that contains sodium percarbonate) for every 20 liters (approximately 5 gallons) of water and letting it soak for 10 min. It

is critical that commercial ships also take the proper steps to disinfect their ballast water.

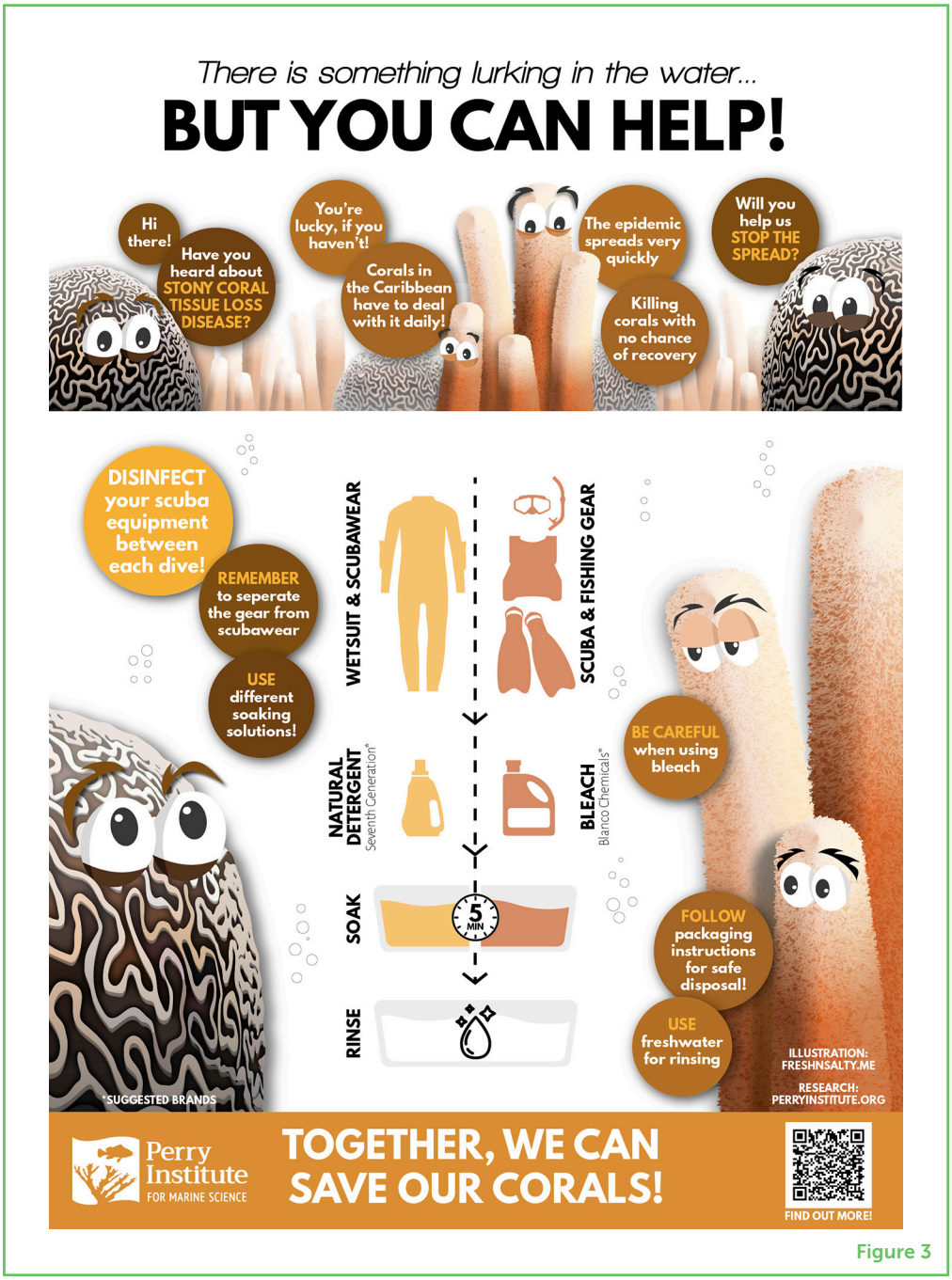

Figure 3

A guide for decontaminating scuba, snorkel, and fishing gear. To disinfect wetsuits and other scubawear, fill a bucket with fresh water and add natural detergent according to the manufacturer's instructions. Soak all wetsuits and scubawear for 5 minutes before rinsing with fresh water and air drying. To disinfect other scuba, snorkel, and fishing gear, add 3–4 caps of bleach for every 1 gallon of water (fresh or salt). Soak the gear for 5 minutes before rinsing with fresh water and air drying. Leave the bleach solution in the sun for a day to break down before disposing of it (Illustration by Freshnsalty.me).

With your help, we can slow the spread of SCTLD and discover its root cause, eventually stopping the spread altogether and saving the world's coral reefs!

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CONFLICT OF INTEREST: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Aya wants to study marine biology. She wants to specialize in sharks and rays. She does not have a favorite subject in school since she likes all of them. In her free time she likes to read books, speedcube, build in roblox, play violin, and draw mythical creatures.

TARIQ, AGE: 13

Tariq has a passion for Engineering and Geopolitical history. In his spare time, he loves to watch YouTube videos about history and technology, and read about history and politics.

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Maya Gomez is a research associate at the Perry Institute for Marine Science (PIMS). As part of the coral team, Maya's work focuses on data collection and analysis to monitor Caribbean coral reefs and inform conservation/restoration efforts. She is also part of a team working to track and treat stony coral tissue loss disease outbreaks in the Bahamas. Maya began her Ph.D at the University of Southern California in the fall of 2022, and currently she studies stony coral growth formations and calcification in the face of climate change and disease, and in collaboration with PIMS. *mgomez@perryinstitute.org

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An ocean-lover at heart, Lily Jane Haines is a marine biologist, graphic designer, and journalist. A specialist in coral reef restoration, she received her master's degree from Simon Fraser University in 2018 while working as a researcher at the Cape Eleuthera Institute in The Bahamas. As a scuba divemaster, wilderness first responder, and first aid instructor, her technical experience in ocean science paired with her journalism background give her a unique skillset as communications director at the Perry Institute for Marine Science. Above all, she is passionate about saving the world's reefs—one coral at a time.

VALERIA PIZARRO

Valeria Pizarro (Ph.D) has been studying corals and coral reefs for over 20 years. She began her research in her home country, Colombia, while working on her master's degree. Since then, she has led and participated in many projects including research on coral biology and ecology, the design and implementation of marine protected areas, and coral restoration. Currently Valeria manages the coral program at The Perry Institute for Marine Science and, since 2019, one of her main projects is on stony coral tissue loss disease—assessing the spread and treating corals around the Bahamas.