The Synapse: Intercollegiate science magazine

Volume 11 | Issue 1 Article 9

2016

Coral Reefs

Julia Utset

CORAL

"The Great Barrier Reef passed away in 2016 after a long illness. It was 25 million years old. #RIP." —Rowan Jacobsen, journalist.

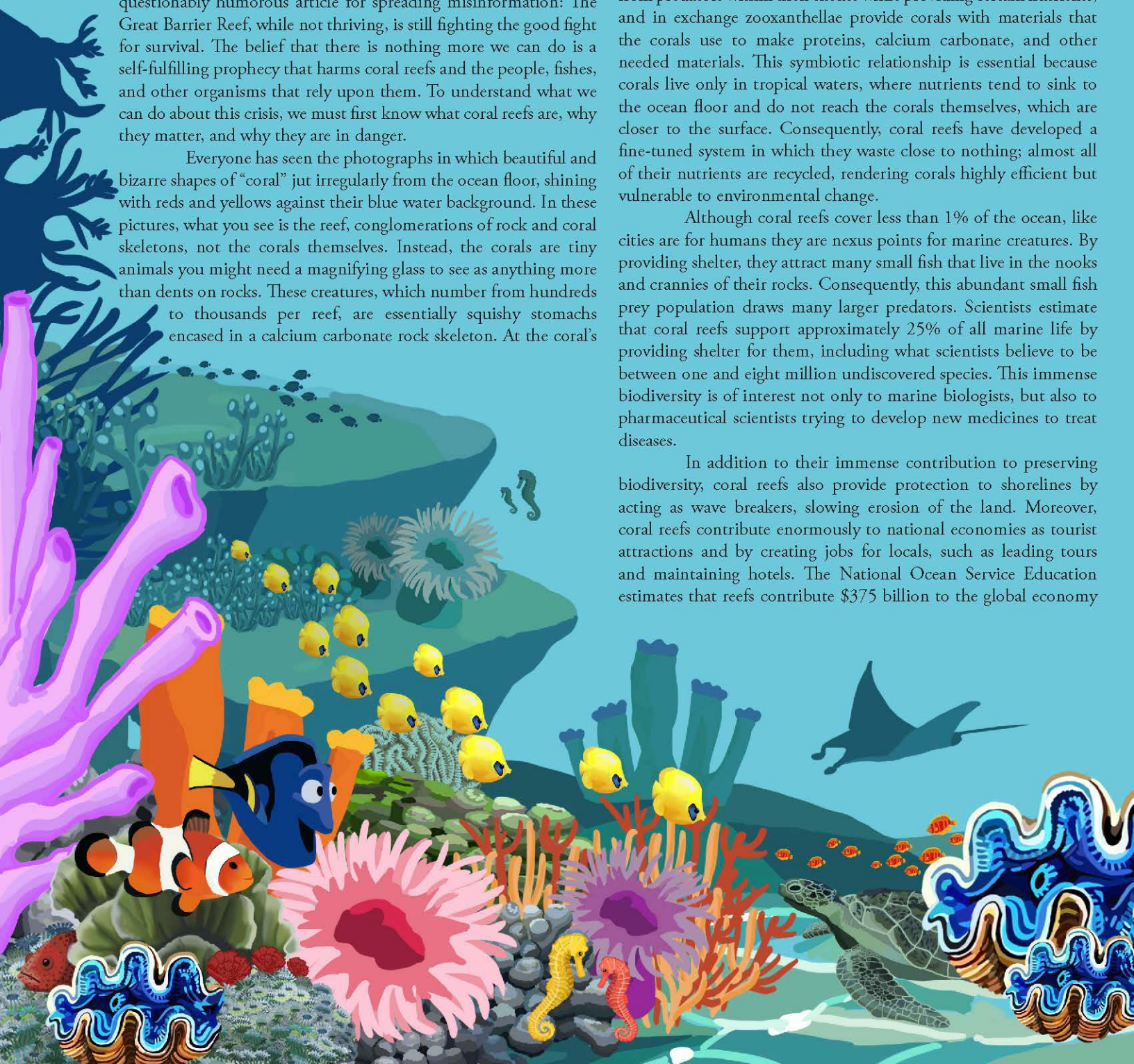
Jacobsen's viral obituary drew attention worldwide to the decline of coral reefs, a gorgeous and integral part of the global ecosystem — and many national economies. Scientists have criticized Jacobsen's questionably humorous article for spreading misinformation: The Great Barrier Reef, while not thriving, is still fighting the good fight for survival. The belief that there is nothing more we can do is a self-fulfilling prophecy that harms coral reefs and the people, fishes, and other organisms that rely upon them. To understand what we can do about this crisis, we must first know what coral reefs are, why they matter, and why they are in danger.

Everyone has seen the photographs in which beautiful and bizarre shapes of "coral" jut irregularly from the ocean floor, shining with reds and yellows against their blue water background. In these pictures, what you see is the reef, conglomerations of rock and coral skeletons, not the corals themselves. Instead, the corals are tiny animals you might need a magnifying glass to see as anything more than dents on rocks. These creatures, which number from hundreds to thousands per reef, are essentially squishy stomachs encased in a calcium carbonate rock skeleton. At the coral's mouth is a circle of tentacles that nab prey such as zooplankton and small fish by stinging like jellyfish. When threatened, a coral withdraws into its skeleton like a turtle tucking into its shell.

However, corals do not only get their energy from predation. They also obtain energy through their symbiotic relationship with zooxanthellae, a photosynthetic algae. Corals shelter zooxanthellae from predators within their tissues while providing certain nutrients, and in exchange zooxanthellae provide corals with materials that the corals use to make proteins, calcium carbonate, and other needed materials. This symbiotic relationship is essential because corals live only in tropical waters, where nutrients tend to sink to the ocean floor and do not reach the corals themselves, which are closer to the surface. Consequently, coral reefs have developed a fine-tuned system in which they waste close to nothing; almost all of their nutrients are recycled, rendering corals highly efficient but vulnerable to environmental change.

Although coral reefs cover less than 1% of the ocean, like cities are for humans they are nexus points for marine creatures. By providing shelter, they attract many small fish that live in the nooks and crannies of their rocks. Consequently, this abundant small fish prey population draws many larger predators. Scientists estimate that coral reefs support approximately 25% of all marine life by providing shelter for them, including what scientists believe to be between one and eight million undiscovered species. This immense biodiversity is of interest not only to marine biologists, but also to pharmaceutical scientists trying to develop new medicines to treat diseases.

In addition to their immense contribution to preserving biodiversity, coral reefs also provide protection to shorelines by acting as wave breakers, slowing erosion of the land. Moreover, coral reefs contribute enormously to national economies as tourist attractions and by creating jobs for locals, such as leading tours and maintaining hotels. The National Ocean Service Education estimates that reefs contribute $375 billion to the global economy



REEFS

Written by Julia Utset & Illustrated by Rachel Dan

both in tourism and as local fisheries. Developing countries in particular rely on fish caught in reefs to feed their populations.

Coral reefs are vulnerable to a number of factors — both natural and human-induced factors. Coral reefs have survived the slow, natural climate change that has been occurring over their past millions of years of existence, but accelerated sea level changes are dangerous to them. Reefs grow calcium carbonate at a rate of up to 10mm a year, but due to erosion most reefs grow only 3.3mm per year or less; when sea level rises faster than this, coral reefs can "drown" because their zooxanthellae are covered by too much water for them to receive adequate sunlight. On the other hand, when sea levels drop, coral reefs can become exposed and die from being out of water. Severe storms and hurricanes also present danger to reefs by inflicting physical damage, breaking chunks off of them.

> Scientists estimate that coral reefs support approximately 25% of all marine life.

Humans also damage reefs when they break off pieces as souvenirs. More controversial is the danger of overfishing. When people pick off the predators of the reef, the biggest fish, the ecosystem is upset, allowing algae to overgrow and block the coral's access to sunlight. In particular, dynamite fishing damages reefs badly by killing many organisms and physically cracking the reef. Water pollution also presents a serious threat to reefs by clouding the water and blocking access to sunlight or by introducing excessive nutrients to the water, causing an overgrowth of algae.

Perhaps the most famous threat to reefs is bleaching. Bleaching is when corals expel their zooxanthellae for unknown reasons in response to changes in water temperature (primarily when water temperature is too high). Without their zooxanthellae, corals turn ghostly white. They can no longer benefit from the photosynthetic products of zooxanthellae and consequently are more susceptible to disease. Bleaching is not a death sentence; if corals regain their zooxanthellae, they will return to a healthy state. Some scientists believe that if a coral reef survives a bleaching event, it will be more resistant to changes in water temperature in the future. It was in reference to bleaching that Jacobsen referred when he declared the Great Barrier Reef dead — 93% of this enormous reef has undergone bleaching, and it has not yet shown signs of recovery. Scientists predict that without a change in conditions, over 90% of the reef will die.

Jacobsen's article is therefore premature; it would be a devastating loss if coral reefs are driven to extinction after twenty-five million years by humanity's disregard for other life, but Jacobsen's implication that the Great Barrier Reef has no chance of survival is inaccurate. Protection of coral reefs can be enacted on the local and the global level. Locally, establishing Marine Protected Areas (MPAs) has been shown to significantly improve the health of reefs by prohibiting fishing and other types of interference on reefs. Decreasing water usage and deforestation reduces polluted runoff from the land, runoff that can include harmful chemicals from inorganic fertilizers. Lastly, of critical importance is combatting global warming by cutting back carbon emissions. Global warming contributes to rising sea levels which kill corals, as well as warming water which causes bleaching. In fact, some corals have proven remarkably resistant and may yet adapt to modern climate change so long as the rate of global warming is not too rapid. While the outlook for coral reefs may seem bleak, it is not hopeless so long as protection and restoration efforts are sustained.