The Depleting Undersea Forests: Staghorn Corals

Famous scientist, Sylvia Earle once said, “Ice ages have come and gone. Coral reefs have persisted.” [1] Although corals date back to more than 500 million years ago, during the late Cambrian period, a new dilemma is threatening their survival - climate change. [2] In the last century, the Earth has already warmed up by 2 degrees Fahrenheit and an even greater increase in the future would be devastating for coral reefs. [3] In fact, “the world has lost roughly half its coral reefs in the last 30 years and even if the world could halt global warming now, scientists still expect that more than 90 percent of corals will die by 2050.” [4] The population of the staghorn coral, known scientifically as *Acropora cervicornis*, has declined more than 97 percent from its former abundance. [5] Due to this, staghorn corals have been named a critically endangered species. Without our interference with climate change, the beauty of the coral reefs will not be seen again by our next generation.

When people think of corals, most do not realize that they are actually animals. Staghorn corals are marine invertebrates that are made up of colonies of thousands of polyps. Acting as one organism, polyps use calcium carbonate to build up a hard skeleton that grows over time as more polyps join the colony. [6] Staghorn corals live on coral reefs in the Caribbean. Staghorn corals are so important to their environments because it is a keystone species that plays an essential role in building reefs. Coral reefs cover less than one percent of the Earth’s surface, but are home to 25% of all marine species. [7] This makes coral reefs one of the most biodiverse areas on the planet.
Another characteristic that most people associate coral reefs with is their vibrant colors. Staghorn corals usually come in colors of yellow, brown, or gold. [8] However, climate change is causing the beauty of the reefs to be striped away, leaving completely white coral skeletons. This phenomenon is known as coral bleaching. Coral bleaching is mainly caused by a change in temperature. Corals can only live within an extremely precise temperature range and even a small change of 1 to 2 degrees Celsius would cause coral bleaching to occur. [9] As a result of a stress in temperature, corals eject the symbiotic algae, called zooxanthellae, that exist inside of them. [10] Without this algae, the coral loses both its major source of food and the substance that gives the coral its color. If the zooxanthellae never returns back into the algae, the coral dies, either because of a lack of food or succumbing to harmful diseases that cause the coral to lose tissue. Depending if they are given enough time, coral reefs can recover from these disastrous events. Normally, it takes around 15 years for corals to recover after experiencing coral bleaching, but after recent increases in climate change, severe bleaching events would take place every six years. [11] This now makes it nearly impossible for staghorn corals to come back. Before the 1980s, coral bleaching was almost unheard of. “The first global bleaching event occurred in 1998, when 16 percent of all corals died.” [12] If you thought that this was the most widespread coral bleaching event that occurred, think again. In the past five years, three-fourths of the world’s coral reefs experienced the most catastrophic bleaching event ever documented. [13] This was caused by El Niño, which greatly warmed the temperatures of the waters. Climate change is causing coral reefs to bleach more and more frequently. As a matter of fact, scientists predict another coral bleaching event to take place this year. [14]
In addition to coral bleaching, another factor that poses a threat to staghorn corals are rising sea levels. The main cause for rising sea levels is the melting of glaciers and ice sheets, adding more water to the ocean. The annual rate of water rise has been more than 0.1 inches since 1993 and will more than double by 2100. [15] Furthermore, all of the coral reefs will be at least 1.6 feet deeper underwater than today. [16] Slow-growing species like the staghorn coral will not be able to keep up with an increase in sea level. Staghorn corals get most nutrients from the sun. As stated earlier, corals have algae that live inside of them, called zooxanthellae. Through photosynthesis, zooxanthellae converts sunlight into sugar for energy. This energy is then transferred to the polyps. When sea levels rise, this causes the algae to become starved of the sunlight needed to survive, meaning that corals will not get food either. An alternative way staghorn corals are affected by rising sea levels is because of an increase in sedimentation due to coastal erosion. “Sedimentation runoff can lead to the smothering of coral.” [17] Scientists have already proven that coral are just barely keeping up with the current sea levels. The future situation is looking even worse. Only 9% of coral reefs will have the ability to keep up with even the most optimistic scenario for sea-level rise. [18]

Staghorn corals are also affected by an increase in ocean acidification. The amount of carbon dioxide in the air has increased by one-third since the start of the Industrial Revolution and 25 percent of the carbon dioxide emitted is then absorbed by the oceans. [19] “When carbon dioxide dissolves in seawater, it undergoes a series of reactions that boost the concentration of hydrogen atoms, increasing the acidity.” [20] Previously mentioned, staghorn corals use calcium carbonate to build their skeletons. Piling up more calcium carbonate on top of each other allows
the coral to strengthen the skeleton and endure damage. Normally, polyps “bring in seawater containing bicarbonate (HCO$_3^-$), carbonate (CO$_3^{2-}$), and calcium (Ca$^{2+}$) ions into a calcifying space between its cells and the surface of the existing skeleton.” In order to produce more CO$_3^{2-}$ ions, which forms calcium carbonate (CaCO$_3$) with the the Ca$^{2+}$ ions, the polyps have to take out the hydrogen in HCO$_3^-$. An increase of hydrogen atoms as a result of the ocean absorbing more carbon dioxide not only causes the water to become more acidic, but also causes more HCO$_3^-$ ions and less CO$_3^{2-}$ ions to form. [21] This means more effort needed for the coral to produce calcium carbonate. Thus, staghorn corals will have thinner skeletons that are more vulnerable. As a matter of fact, ocean acidification causes the density of coral skeletons to decrease by 20%. [22] Moreover, the dissolving process of corals is ten times stronger than the rebuilding process. For that reason, by 2080, coral reefs will dissolve faster than it can be rebuilt. [23]

There are numerous amounts of organizations and federal agencies that protect the future of staghorn corals. One of the most notable of these institutions is the National Oceanic and Atmospheric Administration, or NOAA. Their ultimate goal “is to recover the species so it no longer needs the protection of the Endangered Species Act.” [24] The NOAA is achieving this goal through a combination of conservation and scientific research. Through their conservation efforts, the NOAA is establishing coral nurseries to plant more staghorn corals in the wild, designating critical habitats to facilitate activities in specified areas, and rescuing damaged staghorn corals that have broken branches. Through their scientific research, the NOAA is also engaging in recording trends in population and causes for mortality, observing factors that
impact successful development of corals in gametes, and testing different genotypes that lead to the resistance of different staghorn coral diseases.

On top of supporting these phenomenal organizations, there are countless ways you can help save staghorn corals at home. A great way to contribute to conservation efforts is to reduce your carbon footprint. Ways to do this includes using environmentally-friendly transportation, purchasing energy-efficient appliances, reducing your waste, and planting trees. If you want to be directly involved with efforts to protect reefs, you can join volunteer programs, donate to organizations that are dedicated to the problem, and influence politicians to support additional actions that will ensure for the well being of staghorn corals. Another great way to help is to spread the word about this issue. Many people are not informed of this devastating problem and educating others is the best way to encourage friends and family to join the cause. If everybody assists in resolving this critical dilemma, it would be a tremendous step forward for a better outlook of what is to come for the staghorn coral.

Staghorn corals are in danger of becoming extinct and we must do as much as we can to protect them. We are the major cause for global warming so it is our responsibility to stop the harmful effects of coral bleaching, rising sea levels, and ocean acidification. [25] By taking action to protect the future for this critically endangered species, we will guarantee that staghorn corals will continue to persist for another 500 million years.
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