Climate Change Threatens Coral

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For many years environmentalists have stressed the importance of coral to the environment. Scientists estimate some kinds of coral have existed on earth for hundreds of millions of years. Currently, though, anthropogenic activity, especially CO_2 emissions, pose a significant threat to coral populations. Coral reefs are irreplaceable; by implementing conservation strategies, protection plans, and climate change mitigation strategies, we can help preserve some of the most invaluable organisms on the planet.

What is Coral?

Coral are polyps that create a hard limestone reef. "Coral polyps are tiny, soft-bodied organisms related to sea anemones and jellyfish. At their base is a hard, protective limestone skeleton called a calicle, which forms the structure of coral reefs." [1]

Figure 1: Source: NOAA

Polyps use the limestone to protect their soft and vulnerable bodies. Although coral and coral polyps are not one organism, polyps (actually considered an animal,) create the limestone coral as though they are one organism. This happens when "a polyp attaches itself to a rock on the sea floor, then divides, or buds, into thousands of clones. The polyp calicles connect to one another, creating a colony that acts as a single organism."[2] Coral polyps share a symbiotic relationship with the algae that grows on the limestone, known as zooxanthellae, which give the coral its vibrant colours.[3]

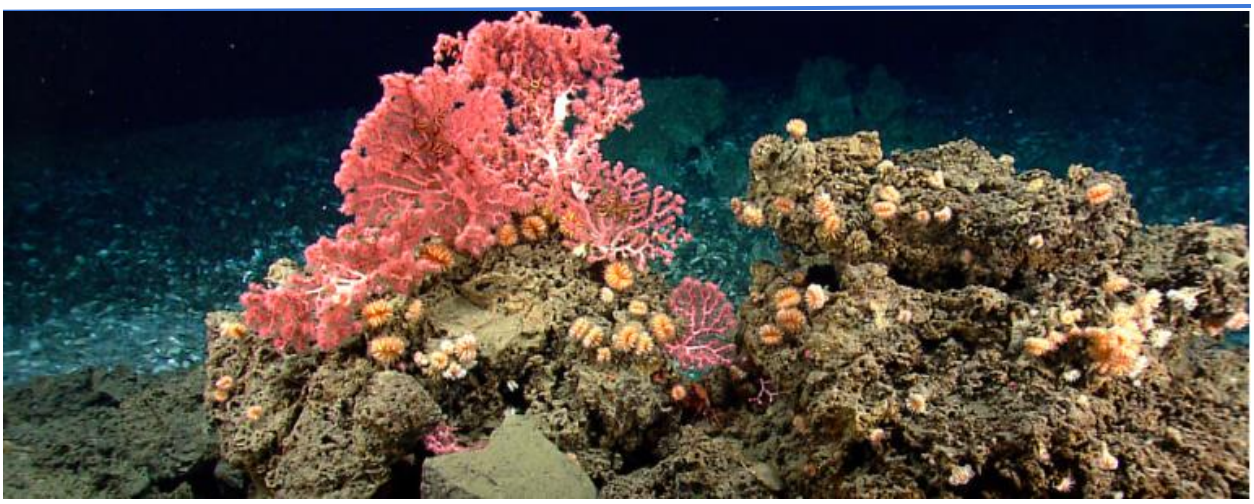

Figure 2: Source: NOAA

The polyps provide the hard limestone skeleton for the algae to grow on, and the algae provides oxygen to the polyps to thrive.[4]

Coral polyps remain in the limestone during the day, and at night they hunt for their food by sticking out their speared and poisonous tentacles to catch zooplankton. [5]

Coral tend to grow in warm and shallow waters in order to provide enough sunlight for the algae grow,[6] although this is not always the case. There are also coral in some parts of the world, off the coast of Canada for example, in both the West and East coast, called Rocky Reefs, and "Cold deep water coral." [7] which do not grow in warm and shallow water, but instead can survive in cold conditions.

Figure 3: Source: NOAA photo library

Although coral polyps are a small organism, they certainly do cast a long shadow. Not only do they support ocean life, but they also contribute to the support and enrichment of life on earth.

The Importance of Coral

The many ways in which coral are important are qualitatively incalculable. Although their worth can be counted, not measured, as coral affects the entire planet, not just the seas in which they are found.

First, coral plays an important role in the biodiversity of life in the ocean. Although coral reefs cover 0.02% of the ocean floor, they still provide a home to a whopping 25% of sea life.

Coral is also home to many different species of animals, for example, the Great Barrier Reef alone is home to;

- Approximately 1500 fish species
- Approximately 5000 species of mollusks
- 17 different species of sea snakes
- 6 different species of turtles, including the hawksbill turtle which are critically endangered
- 215 different species of birds and more.[8]

Second, coral plays an integral part in the global economy. Coral is estimated to contribute approximately $30 billion to the global economy through means such as tourism and fishing.[9] Many people around the world rely on this income in order to feed their families and to sustain their livelihood.

Coral also aids in the protection of coastal land by disrupting waves that are produced during storms, and other natural disasters such as "hurricanes, typhoons, and even tsunamis"[10]

This not only prevents economic loss in property damage, but it also prevents the risk of injury and loss of life.

Both the economic contribution and the protection that coral offers are especially helpful in economically struggling communities that rely on tourism for their livelihood, and that may not be able to easily rebuild their community should a natural disaster (which could have been avoided with the preservation of coral) hit their community.

There are also health benefits to the protection of coral, which is currently being studied in order to test their effectiveness as use as a medicine, to help cure diseases or improve survival rates of illnesses such as cancer[11] and HIV.[12] This is in addition to other diseases scientists are currently trying to utilize coral to treat, such as "arthritis, human bacterial infections, Alzheimer's disease, heart disease, viruses, and other diseases."[13]

The Decline of Coral

Coral is declining at an alarming rate. In fact, in the past few days, scientists have discovered that the rate at which coral in the Great Barrier Reef is dying has already exceeded the estimates they had predicted would happen 30 years from now.[15]

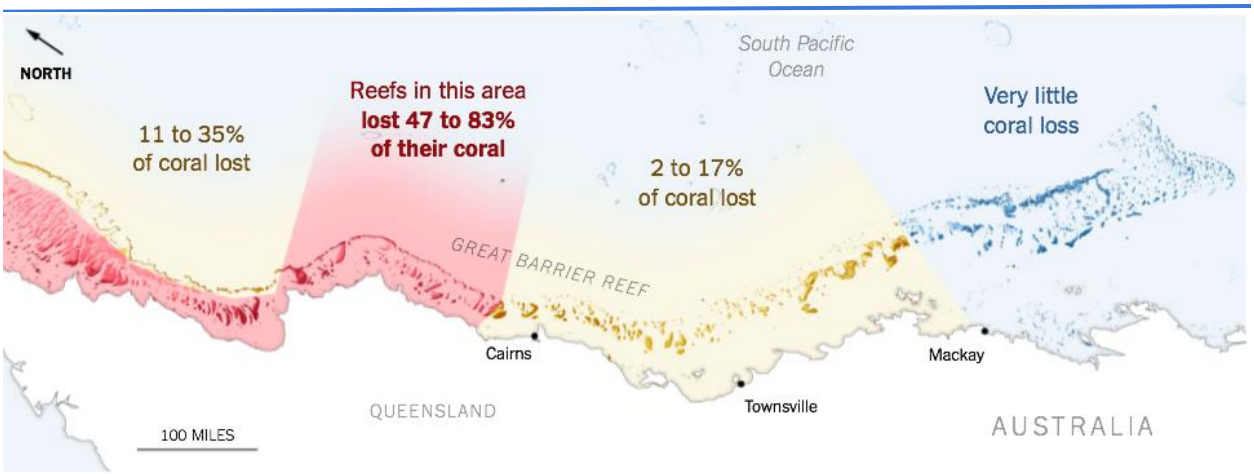

Figure 4: Source: New York Times. Large Sections of Australia's Great Reef Are Now Dead, Scientists Find

As you can see in the figure above, the degradation of the Great Barrier Reef has been devastating. With an astounding 47-83% loss in the most severely degraded parts of the reef, we see a decline at a faster rate that scientists originally thought.

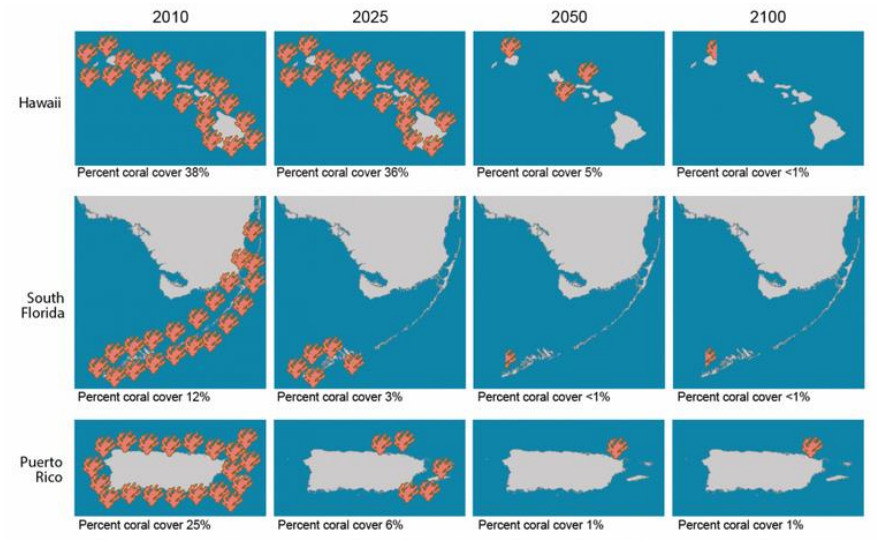

Figure 5: Source: Natural Environmental Education Foundation. U.S Coral in a Warming Ocean

It is clear that the numbers of coral are quickly dwindling, the next question is why?

Reasons for the Decline

Tourists come from far and wide to see coral and all that it entails. Beautiful waters, a diverse array of aquatic animals, and the beauty and magnificent color of the coral itself. However, a very common reason for the decline, and one which can be stopped very easily, is the removal of coral as a souvenir. Although this is not a leading cause of the decline of coral, it is still a contributing factor.

Figure 6: Source: NOAA. What Can I do to Protect Coral Reefs

Crown of thorns starfish are a major problem to some reefs depending on their location. Crown of thorn starfish, or COTS, eat coral polyps, which in low numbers actually aid in maintaining the biodiversity of the coral. However, in large numbers, these starfish can be disastrous for coral. "Dense aggregations of COTS can strip a reef of 90% of living coral tissue. In the 1970s on the northern Great Barrier Reef, a COTS outbreak occurred that lasted eight years. This outbreak peaked with about 1000 starfish per hectare, leaving 150 reefs devoid of coral, and 500 reefs damaged." [16]

Figure 7: Source: AIMS. Government of Australia. Managing Crown of Thorns Starfish on the Great Barrier Reef

Additionally, harmful fishing practices also greatly contribute to the decline of coral. Specifically, a fishing practice called "trawling," in which a large weighted net is dropped into the ocean, and drags along its floor, capturing anything in its path.[17] This is harmful because the trawler often times catches unwanted species of fish called "by-catch" which upon being caught usually die before they are thrown back into the ocean as they are of no use to fishermen looking to catch another species. Trawling also contributes to over-fishing. In 2007, 800,000,000 pounds of ocean life was caught using this method in the U.S alone.[18] Trawling often destroys the coral in its path.

Other damaging fishing practices that exist which threaten coral also include; dynamite, cyanide fishing, and "muro-ami (banging on the reef with sticks)."[19]

Pollution is another factor in in degradation of coral. Polluting the water with harmful chemicals often adds excess amounts of nitrate into the water. Nitrate can cause algae to rapidly grow, which, in turn, blocks sunlight to the zooxanthellae that grow on coral and provide them with oxygen, essentially suffocating the coral.[20]

Finally, one of the most impacting factors, and the one which reaches varied forms of destruction for coral, is climate change. There are a variety of different ways in which climate change harms coral.

First, a phenomenon called "coral bleaching" can occur if the water temperature becomes too warm. When this happens, coral removes the zooxanthellae on its surface and becomes white in color. Although this does not immediately kill the coral, it does make survival less likely, and adds more stress and potential issues for the coral. [21]

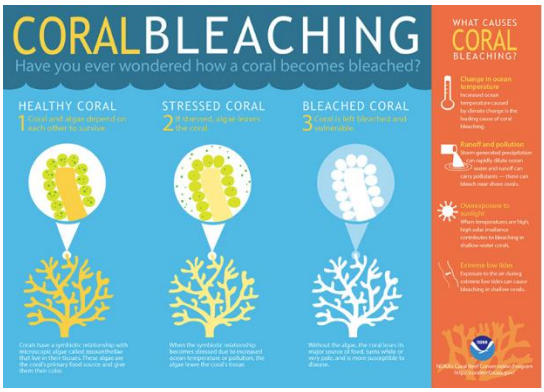

Figure 8: Source: NOAA. What is Coral Bleaching

Ocean acidification, brought on by the carbon emissions caused by anthropogenic activity also threaten coral. "It is believed that the resulting decrease in pH, (i.e. making the water acidic), will have negative consequences, primarily for oceanic calcifying organisms such as coral reefs."[22]

Furthermore, rising sea levels caused by climate change are another threat to the survival of coral. Coral lives in warm and shallow waters in order to allow plenty of sunlight to reach the zooxanthellae. When sea levels begin to rise, it means that coral living in shallow waters will continuously get deeper, and therefore darker, threatening the success rate of the zooxanthellae's photosynthesis.[23] It is unknown exactly what the reaction and success rate of coral in deeper waters, but scientists are not hopeful.

What is being done?

There are efforts being made in the conservation and protection of coral around the world. Most of the focus for many protection plans include monitoring and conservation. For example, monitoring sea levels, water temperature, algal blooms, sustainable fishing practices, public outreach [24] and monitoring Crown of Thorns starfish outbreaks. [25]

Although these practices are helpful when implemented, it will not ultimately solve the problem, or ensure with certainty the success of coral in our oceans.

Having said that, there is hope. In fact, there is a scientist by the name of Dr. David Vaughan who accidentally discovered a way to re-grow coral, now termed, "microfragmenting." By accidentally breaking a piece of coral in the middle, Dr. Vaughan made a discovery. "I picked up the coral, expecting to see, maybe, it festered worse, and it had completely grown over that quarter-sized hole," Vaughan says. From birth, it took that coral two years to grow to that size and it had grown back in two weeks."[26] This revolutionary discovery could mean a spike in the number of coral we see today. If healthy coral can be grown in labs, and introduced into the sea, we could start seeing healthier numbers of coral where coral has died.

However, this is not a fix-all solution. Many changes still need to be made in order to save coral. One of the most complex and impactful issues concerning the protection of coral is climate change. Climate change is a complex issue because it means that geographical locations that have coral off their coasts are not the only ones that need to make changes. Climate change is a global issue.

The only way to ensure long term and more permanent survival of coral is to cut down on global emissions. The amount of greenhouse gas emissions that are released into the atmosphere every day contribute to the rate at which the planet is warming. If nothing is done, nothing will change, and the rate of global warming, rising ocean temperatures and rising sea levels will only continue to

worsen. Once we reach the tipping point, there will be no amount of monitoring, conservation, or laboratory regrowth that will save our coral, and our oceans.

Although there is much that needs to be done globally in order to ensure coral reef survival, there is also much interest in this endeavor. If these changes can be made at the rate at which coral preservation interest grows, there is a good chance that we can see coral regrowth.

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Notes

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