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Saving The Planet Begins With Saving The Coral Reefs

By: Marla Maconochie

Picture Taken By Marla Maconochie in Curacao 2017
Introduction

Have you ever seen a coral reef? Perhaps you have been fortunate enough to go snorkeling on a family vacation. Maybe, you have only seen a picture of a coral reef. But no matter how you might have come to see a coral reef, there is no denying its beauty. Coral reefs not only provide beauty to our world, but they are a significant component in our ocean’s ecosystems. In this book, you will learn about the importance of coral reefs, things are threatening their existence and what can be done to help save them. You will also discover ways that you, yourself, can do positive things that will help contribute to saving our world’s beautiful coral reefs.
Chapter 1: What’s The Big Deal About Coral Reefs?

Coral reefs are one of the most beautiful marine ecosystems. Every physical feature of a certain environment, like sand, rocks, and water for example, and all of the living creatures in that area make up an ecosystem. So what exactly is a coral reef? A coral reef is a group of corals. Corals are the branchy, tree-like, structures that you would see in oceans while snorkeling or scuba diving. An individual coral is called a polyp and they grow with other polyps to make up one of the treelike structures. Most corals have a hard outside protecting their soft insides, but there are many different species of coral, so they come in all shapes, sizes and colors. When all of the different types of corals grow together, a beautiful coral reef is formed. The reef then provides a place for other sea creatures to live.

Although coral reefs look like tree-like structures, they are living organisms. And like all living organisms, they need to eat. Although some corals do eat small sea creatures like plankton, many corals rely on their symbiotic relationship with zooxanthellae. A symbiotic relationship is when two organisms work together to survive so that both organisms can survive.

Zooxanthellae is an algae that lives inside of the tissues of the corals and create nutrients and energy for the corals. In the same way we eat food, the nutrients and energy from the zooxanthellae feed the corals so they can survive. If the corals are using the zooxanthellae for a food source, why would the zooxanthellae want to stay inside of the corals? The zooxanthellae enjoys living inside the coral’s tissues and helping the coral because the coral provides the zooxanthellae a home and Carbon Dioxide (CO₂) to do photosynthesis, a process where plants turn light and CO₂ into energy. It is the zooxanthellae, inside the corals, that make the corals have such beautiful colors to them.

Now you may be wondering, where are coral reefs found? Coral reefs are found in parts of the ocean where they can grow the best. Corals like shallow and clear waters because the water temperature is warmer and they can get enough sunlight where the sun’s light rays can pass through the shallow water much easier. Corals need sunlight to survive, like many other living organisms.

Corals can be found in waters up to 100 feet deep, but they do not grow as well in waters that are deeper than 60 feet. So, coral reefs are found wherever the ocean waters become shallower and this is typically near the shore.

But what exactly makes coral reefs so important? What is the big deal? Coral reefs are important for so many reasons, such as, providing homes and resources for many species of sea life, Coral reefs also provide important opportunities for research in science and medicine. Coral reefs provide a safe haven for many ocean ecosystems. But coral reefs also create a safe haven for the shoreline because they provide a barrier which protects the coastline. Coral reefs also provide the ocean with much needed oxygen through photosynthesis. And lastly, coral reefs help the world’s economy by providing a good environment for fish to thrive. A plentiful fish population creates a good fishing industry to feed our world’s populations.
Coral reefs have a lot of biodiversity. **Biodiversity** means that an ecosystem has many different types of species living together in the same environment. Coral reefs have hundreds of thousands of species living around them. Having high biodiversity is a really good thing for an ecosystem and creates environments for many different species to all live together. There is a wide range of species from plants to different animals, including fish that live in and around coral reefs. Some reefs have over 4,000 species of fish and 800 species of hard corals and hundreds of other kinds of species like sea turtles, sharks and sting rays. This means that without the reefs, all of these species would not have a home or resources to live and survive. So coral reefs are very important to keep all of these species from becoming endangered or extinct.

Even though there are hundreds of thousands of different species found on the reefs, there are still many that have not been discovered. This makes the reefs valuable to scientists because the coral reefs are always providing opportunities for scientist to keep discovering new species and this provides new research through the discovery of new plant specimens. These new species along with parts of the coral reef can be used for valuable medical research. Some researchers are searching for new medicines through the science of the reefs that may help cure things like cancer, arthritis, viruses, bacterial infections and other diseases. So the coral reefs are very important to science and medical research as well.
Now let’s talk about how the corals provide protection for the coasts and coastal ecosystems. Most corals are found in shallow waters, they are near the coasts and beaches. As waves move towards the shore, the corals slow down the waves and reduce their intensity. A good example of how coral reefs can help by slowing down the waves is to look at the mangrove ecosystem. Mangroves are similar to a type of tree that grows along a coast in water and their ecosystems are also extremely important because they also have many different species living in them. Corals protect this ecosystem by lessening the impact of waves on the mangrove ecosystem. Corals also protect the coastal land as well because big waves tear away at the sand, dirt or rock along the coasts, which causes coastal erosion. Coastal erosion is bad because it wears away at the land features around the coast and can permanently destroy them. So the coral reefs are extremely important in helping slow down waves and protect the coastal ecosystems.

The next reason coral reefs are so important is for their high productivity. As we discussed, the zooxanthellae and other algae living inside the coral tissues go through photosynthesis. Just like plants, providing oxygen for our earth, corals do the same. Typically, deep oceans do not have a lot of plants producing oxygen, so coral reefs produce much needed oxygen for the oceans to keep many species that live in the oceans alive. An interesting and important fact concerning oxygen production is that land plants only produce about 1/3 of the oxygen we breathe, and corals are producing the rest of the oxygen breathe.

Lastly, let us talk about the economy. If you have ever traveled to a coastal region to snorkel or dive on a coral reef, you are using the reefs to support the economy. As we have learned, coral reefs have thousands of different species of fish and coral types and other creatures, so many people love to take tours, snorkel and dive on the coral reefs. This means that the coral reefs are supporting the economy by providing jobs for people in order to have tourists enjoy the beauty and diversity of the reefs. One reef in particular called The Great Barrier Reef in Australia brings in about $3.9 billion each year and provides jobs for around 70,000 people. The coral reefs are very important in that they provide money and jobs for the economy to flourish.

Another economic benefit of the coral reefs is how the reefs contribute to the fishing industry. Because the reefs provide valuable habitats for the fish, fish can flourish and this provides fish that can be caught and then sold for food. The fishing industry creates millions of jobs and contributes billions of dollars to the economy each year.
Chapter 2: Survival of the Coral Reefs is Being Threatened

Thus far, you have learned about what coral reefs are, where they are found and what makes them so special. We know exactly why coral reefs are an important ecosystem for not only us, but keeping the ocean’s ecosystems and coastal ecosystems functioning properly. However, there are many things that threaten the existence of coral reefs. Corals are being threatened by certain human activities and along with natural activities, and these things combined, have already started to destroy the coral reef ecosystems. If the reefs are being threatened, the ocean and its species are being threatened, as well. And if these ecosystems are being threatened, then humans are at risk too, because we rely on these ecosystems for our survival as well.

Everything is interconnected in the environment and if one ecosystems begins to fail, there will be what is called a “domino effect.” If you have ever played with dominos, then you know when they are all lined up and one falls down, each domino lined up behind the next begins to fall causing the entire row to fall. This is how ecosystems work. One system relies on the next for survival. If one fails, they all begin to fail as each affects the next ecosystem. This is just like how our actions on land cause a ripple effect on other ecosystems, like our oceans.

Some of the threats that corals face that are threatening their ecosystems are overfishing, global warming, poor water quality and conditions, toxic chemicals and disease. One major stress factor the corals have to battle is excessive algae growth which is smothering and suffocating the corals. The extensive algae growth is caused by overfishing the areas surrounding the reefs. Although it was previously mentioned that the fishing industry is a positive thing brought on by the abundant fish that live near coral reefs, overfishing is a problem that is damaging the reefs. Overfishing is exactly like it sounds, it means that too many fish are being caught and removed from the ecosystem. The overfishing along with an abundance of algae growth are becoming a threat to the reefs.

You may wonder how fishing and algae growth are related, but it all traces back to the ocean’s coral reef food web. Large herbivore fish eat plants and algae. These large fish eat the algae that grow on the coral. When too many fish are removed, the algae grow on the corals and begin to suffocate them. Large herbivore fish play an important role in managing the algae on the reef, they keep algal blooms from growing excessively, by eating them to get valuable nutrients for their diet. So the problem is that in some areas there are little to no large fish eating the algal blooms and so they will keep growing until they cover the whole reef. This is very dangerous for corals ability to survive because their zooxanthellae will not be able to supply the corals with the nutrients they need through photosynthesis since the algae is blocking the sun from reaching the corals.

Studies have shown that where there were herbivores present, the algae coverage never covered more than 15%, but without the herbivores, the algae covered 80-100% of the corals. This research explains how important larger herbivore reef fish are to the survival of coral reefs.
Fishing companies are fishing on reefs and removing too many fish at a time and this does not allow for the fish to repopulate. If we keep taking too many fish from the reefs, the population will be too small to keep up with algal growth.
The next stressor to corals is coral bleaching. Now, think back to chapter 1 where we discussed the importance of zooxanthellae. Zooxanthellae provide corals with their amazing color, but they also help the coral get the nutrients it needs to survive. **Coral bleaching** is when the zooxanthellae and other algae leave the corals, causing the coral to turn white and eventually die. There are different degrees of coral bleaching. Some corals may only be partially bleached and can heal, but others face extreme bleaching and die right away. Coral bleaching is caused by a couple of different factors, but it is mainly due to increased water temperatures, increased ocean acidification, solar ultraviolet rays (UV), and disease. That is a lot to take in, so let’s break it down so that it is easier to understand.

**Global warming** is when the average global temperature is increasing because of the increasing emissions of greenhouse gases like Carbon Dioxide, Ozone, Methane and more. **Climate change** is considered the long term change in the Earth’s climate or a specific region. Together, they work to cause increased temperatures on land and in the water. **Ocean acidification** is the ocean’s pH levels moving from a normal level to a highly acidic level. This is because the ocean absorbs the carbon dioxide (CO₂) from the environment, and this lowers the pH, making the ocean waters more acidic.

If you have ever seen fish in a fish tank, you might learn that the water in the tank has to have its pH levels balanced so that the fish and other living organism do not die. If the water in the tank is too acidic, the organisms will die. Imagine that the ocean is a giant fish tank, the principles of balancing the water so that the organisms can survive is the same, no matter the size of the fish tank. So it does not matter if you have a twenty gallon fish tank or an ocean with billions of gallons of water, the water needs to be balanced
Coral reefs are very sensitive to climate change and ocean chemistry, so when the water becomes more acidic and warmer, their symbiotic algae leave the corals. The warming ocean temperatures and acidification also impact coral growth, oxygen production, and respiration rates. This means that higher temperatures reduced the ability for corals to produce oxygen through photosynthesis. Some studies show that higher temperatures can lead up to 46% reduction in respiration rates. This means that higher temperatures are causing corals to not function at their 100% best effort, and this can affect the corals ability to survive. Studies have shown that 70% of the reports of coral bleaching were linked to times when the water temperature conditions were higher than normal. Climate change increases the intensity and the frequency of bleaching events, which is highly dangerous to coral’s survival. So ultimately, the more we pollute our planet and contribute to global warming, the more danger the corals face.

The next factor that impacts corals is toxic chemicals. Certain companies and factories dump their waste water into the oceans and the waste water sometimes contains chemicals that are polluting the oceans. And it is not just the big companies that are adding toxins to the ocean’s waters, what if I told you that certain sunscreens are just as dangerous to corals. There are certain sunscreens that contain a chemical called Oxybenzone that harms corals. Oxybenzone is dangerous to corals because it causes coral bleaching, disrupts growth and reproduction rates and it leaves young corals deformed. It causes corals to develop deformities in their soft tissues and this causes the corals to become trapped inside its own skeleton.

Although you may not go to the beach that often or wear a lot of sunscreen overall, sunscreen is still very toxic even in small doses to those organisms that have a negative reaction to the chemical Oxybenzone. Some scientists say that even one drop in about 6.5 Olympic-size swimming pools will damage a coral. This means that even small amounts of sunscreen containing the toxic chemical will harm the corals. When you put on sunscreen, even if it is in a spray can, the sunscreen washes off in the ocean or gets on the sand and eventually ends up in the ocean. So, it is important to avoid sunscreen that has Oxybenzone in it because it is not reef friendly, and harms the sensitive corals.
important threats are natural disasters and disease, combined with poor water quality these things become a dangerous combination. A major natural disaster that plagues oceans and coastal areas is hurricanes. Hurricanes are large storms formed on the oceans. Hurricanes do not only threaten people that live and work on the coast, but they are also dangerous for corals living in shallow waters around the coast. Because corals slow down waves coming into the coast, they also have to battle and survive intense waves from hurricanes. Although corals can sometimes withstand the force of waves caused by hurricanes, coral can also be damaged by the wave as well, especially if corals are weakened by disease or other factors that have caused them harm. Hurricanes can wipe out parts of coral reefs and their destruction can be permanent.

As mentioned, if coral reefs have damage already, they are not strong enough to withstand hurricane force waves without becoming more damaged or destroyed. One of the things that can weaken an existing coral reef is Coral Disease. There is a type of coral disease called, White Band Disease. White band disease is a bacterial infection that spreads along the branches from the base of the coral to the tip and can kill entire colonies of corals. White Band Disease is a significant stressor to corals and is responsible for rapidly reducing the populations of coral reefs. Once corals are damaged by disease, they are now at a higher risk of further damage during a hurricane, these events are another example of how the domino effect works in causing destruction.
Another stressor that causes harm to corals is poor water quality. A poor water quality can be caused by pollution. Pollution is a term used when something is added to the water which is not beneficial. Often particles referred to as nutrients come into the oceans from waste water being dumped by companies, factories and agriculture. **Agricultural runoff** is when water that leaves farms due to rain, irrigation, or other means picks up pollution and carries it to places like our oceans. When farmers use fertilizers, large amounts of phosphorous and nitrogen travel into the oceans as nutrient pollution. Although nutrients sounds like a word that would bring something healthy into the water it is not healthy if the amount is too large or it is something that would be toxic to living organisms.

Particles and debris in the water can increase **sedimentation**. This makes the water appear cloudy and dirty, which is considered water with high **turbidity**. Studies have linked increased sedimentation and turbidity to coral diseases. Human activities cause nutrients and other toxins to run off into the water as well. For example, when families or business build and develop cities around the coast, there is more pollution running into the oceans, which decreases the water quality. Just like corals are sensitive to climate change and ocean chemistry change, they are vulnerable to poor water conditions. The reason high sedimentation and turbidity is so threatening to corals is because it begins to cover corals and smother them, and cloudy waters reduce the amount of needed sunlight that reaches the corals. This means that corals are not going through photosynthesis as efficiently, and their energy and nutrient levels decrease. Furthermore, if corals are not being as productive due to lack of sunlight promoting photosynthesis, they have less energy to fight off threats like algae smothering, coral bleaching, disease and toxic chemicals. Typically, corals can release a mucus to fight the sedimentation, but with reduced coral health, they have a hard time fighting back.
Now, let’s look at a specific example of how coral reefs are being affected by some of these threats we have learned about. In Australia, there is a very big and beautiful reef called the Great Barrier Reef. This reef is over 1,500 miles long. This amazing reef provides all of the benefits that were discussed in Chapter 1, like having high biodiversity, benefiting the economy, and providing protection for the coast. Let’s look into some of the specifics of this reef. The Great Barrier Reef, alone, contains 10% of the world's fish species. It has over 1,600 species of fish, 600 soft and hard corals, 215 species of birds, 133 species of sharks and rays, 30 whale and dolphin species, 14 different sea snakes, and has 6 of the 7 marine sea turtles. That is an outstanding amount of diversity in the amount and kinds of species are found on a single reef. Not only is it a great home for many species, it provides an immense amount of tourism and jobs. As we discussed in chapter 1, The Great Barrier Reef provides 70,000 people with jobs, and creates an annual income of approximately $3.9 billion. The reef is a beautiful ecosystem that does so many great things for us and its surrounding ecosystems.

However, the Great Barrier Reef is not safe from all of the threats we discussed in this chapter. About 93% of the reef has suffered from some level of bleaching. The Great Barrier Reef has experienced bleaching events in the past and has tried to recover, but the intensity and frequency has increased. The reef was bleached back in 1998 where about 42% of the reef was affected, and then again in 2002 where about 54% of corals were affected. More recently, the reef was severely bleached in 2016, and instead of having some time to recover, another mass bleaching event occurred in 2017. The closer bleaching events happen, the more severe they are because corals are still vulnerable from the last bleaching event and do not have sufficient, or enough time, to recover. The Great Barrier Reef is suffering and is in danger of being lost if bleaching and other threats keep them from reproducing and surviving, and we already know the importance of keeping them around. So instead of just focusing on all of the problems the corals face, how about we talk about how scientists have been working to restore the coral populations and how you, yourself, can help at home or in your community.
Chapter 3: Save The Coral Reefs!

No need to give up hope, even though there are a lot of things that threaten the coral reefs, there are plenty of things you can do at home to help reduce the impact on the reefs. The best way to do this is to live an eco-friendly, and sustainable lifestyle. Ecofriendly means living a lifestyle that does not harm the environment. You need to be aware of the impacts your actions have. Also, living sustainably means you are using resources in a way that allows future generations to have and use the resources too. That means, we do not want to overuse resources or species until they are extinct or no longer usable. You can live an ecofriendly and sustainable lifestyle by just reducing your pollution, carbon footprint, and creating less waste. A carbon footprint, is a term used to measure how much of an impact an individual or group of individuals has on the planet. The goal is to make our footprint as small as possible. Just remember to reduce, reuse and recycle!

Some ways you can achieve goal of reduce, reuse and recycle is to conserve energy by turning off lights or electronics you are not using, share rides, bike or walk to your destination. You can save energy by using your cars less, you will reduce the air pollution that is harming our planet and destroying the oceans. You also want to make sure you are conserving water. Do not waste water because there is not an endless supply of clean drinking water. Also, plant more vegetation and gardens to help recycle our water back into the planet for our use, clean our air, and reduce the sun rays from getting trapped in our atmosphere and heating the planet up. By having more green space, grassy areas with vegetation such as gardens and parks, on the surface of the Earth, the sun rays will not be absorbed into surfaces like dark roofs, and concrete parking lots and roads. Furthermore, be careful about the products you buy and use, you want to make sure that the packaging is a non-toxic plastic, that it is biodegradable, which means it can decompose and use recyclable or natural containers as well.

These efforts to conserve will help reduce the waste and pollution on our planet. And lastly, you can avoid certain companies or brands that you know are purposefully not being careful or resourceful in efforts to manufacture and distribute their goods with sound environmental practices in place.

While you work to do your part there are scientist at work doing their part to save and restore the coral reefs. Scientists are also finding new ways to regrow and save the coral populations and restore the reefs. Scientists have found that they can regrow corals through coral propagation, and that it is successful for recovery of depleted coral populations. Coral propagation is when scientists collect corals from the ocean reefs, break off pieces of coral branches, place them in a nursery tanks to let them grow, and then plant them back into the ocean reefs. Studies have been done that prove that corals that are grown through this process grow faster than corals that have always lived in the ocean. So this demonstrates how successful this program is. Some scientists were worried that breaking the corals into pieces may kill the corals, but they actually grew quite well into full grown corals within 3-4 months. With changing technology, we are able to find new ways to combat the threats to our marine ecosystems.
In conclusion, the coral reefs are not only beautiful but extremely valuable. It would be a terrible loss and would affect us greatly if we lost the coral reefs to the many threats they face. Corals provide the coasts with protection, they produce 2/3 of the oxygen we breathe, provide homes to many species, help the economy, and even have uses for scientific discoveries. The possibilities are endless and the coral reefs are extremely important. Though the reefs face many stressors like overfishing, climate change, poor water quality, toxins and disease, there is still so much hope in restoring them. With change, the existing corals and the new corals we grow have a chance to survive. Just be conscious of your actions and look for ways to reduce your impact on the environment and encourage and educate others to do the same. The best way to solve a problem is to get the attention of others and work together to solve the issues. Now, get out there and SAVE THE CORAL REEFS!
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HNRS 4990  
8 December 2017  

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