# Table of Contents

- “Introduction” Tanya Das (3)
- “Marine life on Coral Reefs,” Jemma Hovatter (4 - 6)
- “Why Do We Actually Have to Protect Coral Reefs?,” Evan Yoon (7 - 9)
- “Zooplankton and Their Place in the Marine World,” Michelle Fang (10 - 12)
- “Phoenix Island Dive Safari,” Simran Jasubhai (13 - 14)
- “Distorted Views on Reef Health,” Chloe Pu (15 - 17)
- “The Great Barrier Reef,” Becca Blum (18 - 20)
- “Something’s Fishy,” Harry Kim (21 - 23)
- “Why Does the Gulf Turn Red?,” Santana Khan (27 - 29)
- “The Stony Coral Disease,” Arianna Poston (33 - 35)
- “Bleaching and Discoveries in PIPA,” Claire Rhody (36 - 38)
- “The Chemistry of Seawater,” Zach Ben-Meir (39 - 41)
- “Underwater Robots,” Tanya Das (42 - 44)
- “Using Geoengineering to Reduce Ice Cap Melting,” Justin Feder (45 - 47)
- “Choices: Cognitive Dissonance and the Omnivorous Human,” Maia Dock (48 - 50)
- “Our Need to Navigate,” Ethan Wang (51 - 53)

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Introduction

Over the past two weeks, we have been on a journey. We have gotten to intimately know both our oceans and Kiribati, a beautiful island nation in the middle of the Pacific which faces losing all its land to climate change and rising seas. We even got to speak with a citizen of Kiribati live over Zoom!

Kiribati served to ground our learning about corals and climate change as the home of the Phoenix Islands Protected Area (PIPA), the largest UNESCO World Heritage Site. It has been inspiring to see such a small country fight for its rich ecological treasures, planting mangroves and protecting over 11% of its Exclusive Economic Zone (EEZ). And it has been a call to arms to take responsibility and fight for change ourselves. When we took a carbon footprint quiz in our Oceanography class and investigated Project Drawdown’s proposed climate solutions, we learned about the impact of our actions and how long plane trips, meat-heavy diets, and the efficiency of the appliances we use all contribute to our carbon footprint.

Throughout this journey, we have learned about the science behind climate change and corals, navigation, nautical leadership, and the history of our human relationship with coral reefs. We read Underwater Eden: Saving the Last Coral Wilderness on Earth, a green-covered book about the sapphire oceans of the Phoenix Islands. As we dissected all of the information presented to us, even colors had their own significance. Did you know that sometimes corals glow with breathtaking fluorescence before they bleach? But glowing can also be a sign of hope. These mystical coral behaviors are just a sliver of what you’ll learn about while reading our publication.

We also thought critically about our own role in conservation and why we conserve the ocean - is it for the marine life? The native citizens? Or do we conserve corals for the whims and fancies of Western tourists? We ask for you to also question yourself as you read about everything from underwater robots and engineering to combat climate change to discoveries in the PIPA coral reefs. Join us in our journey through why humans navigate, fish intelligence, marine biology and chemistry, and, of course, take a dive into your imagination as you read about corals and climate change.

SEA Quest “Coral Reefs and Climate Change” was a two-week online high school seminar offered in the summer of 2021 by the Sea Education Association in Woods Hole, Massachusetts. This group of students from all over the world connected online, putting together this magazine and taking three courses: Oceanography (Jess Donohue), Oceans and Society (Rich King), and Nautical Science and Leadership (Kevin Murray).
Marine Life and Coral Reefs

Coral reefs are no secret to the world. They are one of the most beautiful parts of the ocean that anyone can find. Many say that coral reefs are the rainforests of the ocean, and while they only cover two percent of the ocean floor, twenty-five percent of the ocean's marine species live part of their lives in coral reefs. The most common species to live inside the coral reefs are the corals themselves. Many people mistake corals for being plants, however, corals do not make their own food. They actually capture food from the water with tiny tentacles. Corals are related to invertebrates and jellyfish. Now, it's not just corals that live in these coral colonies, but corals have a symbiotic relationship with a single-celled zooxanthellae algae. The corals protect the zooxanthellae, and they provide food from their metabolic waster for the algae to live. In return, the zooxanthellae produce food for the coral to feed on. Therefore both organisms benefit.

Although coral is the main organism that lives in coral reefs, there are millions of species that live in and around these underwater rainforests. Some of the more well-known species include different types of fish, lobsters, clams, seahorses, sponges, crabs, and sea turtles. As for the lobsters and crabs, coral reefs provide these creatures shelter from their predators and also provide them with food. Sea turtles help maintain the seagrass and the coral reefs, which allows for the other smaller creatures to be able to survive. Sea horses have a similar job to sea turtles. They help maintain the environments that they live in. Sea horses benefit from living in coral reefs because it keeps them away from their predators. They can use their hooked tails to link onto the corals, therefore the strong currents and tides cannot sweep them away, and they can live in the safety of the coral. As for the different fish that live in coral reefs, one particular fish might come to mind; the clownfish. As seen in the movie Finding Nemo, the clownfish are seen living in sea anemones. Sea anemones are often found to live within coral reefs or on the coral itself. Some fish are immune to the stinging polyps of the sea anemones, while others would be hurt if they came in contact with them. This allows for fish to protect themselves from their predators and allows them a place to live safe from danger.
As explained above, a majority of these different species of marine animals that live in and around coral reefs are there to protect them. The structure of a coral reef is seen as a buffer to shorelines to protect them from waves, storms, and floods. This helps prevent erosion, property damage, and even loss of life on land. But if these reefs were to become weak, damaged, or destroyed, the chance of damage to coastal communities increases.

We've already established that coral reefs benefit the small organisms living in them, along with the land that they are located near. Another job that coral reefs possess is helping to maintain the food chain and the marine ecosystem as a whole. Coral reefs help with nutrient recycling, filtrate the water, help with carbon and nitrogen-fixing, and provide nutrients for the different animals within the marine food chain. Because of the diversity of creatures that live in coral reefs, a complex food web is created that ranges from larger animals like sharks and dolphins at the top, and sponges, plankton, and tiny invertebrates at the bottom. Without coral reefs, these smaller organisms would not have a safe enough home to survive in, therefore throwing off the rest of the food chain.

So, if corals continue to be affected by the harms of climate change, what would happen to marine ecosystems across the globe? Would these smaller organisms decrease in population? Would the food chain have a drastic change? Will our coastal communities be in danger? This is why it is so important for the human race to put a stop to climate change, and save our reefs for the benefit of the world.
Sources – Jemma Hovatter


“My Writing Space: The View From the Reef.” Murder Is Everywhere, murderiseverywhere.blogspot.com/2015/04/my-writing-space-view-from-reef.html (seahorse pic)


Why Do We Actually Have to Protect Coral Reefs?

The phrase “protect coral reefs” conjures up vague ideas like “saving the turtles” and picturesque images of vibrant reefs pulled straight out of a children's book. But from the perspective of an average person, or even a powerful world leader, why should they care? Let’s be real, the idea that “animals have a right to this planet too” isn’t a good enough reason for many people. What makes coral reefs different from any other natural wonder? In addition, there is no shortage of pressing issues in need of attention at any given time. Threatened coral reefs might feel like just another thing on the very long list of problems caused by humans doing something wrong. However, healthy coral reefs actually provide many benefits to society and can have some of the highest biodiversity on the planet. Reefs around the world are currently under threat by many factors that stem from human actions, and are in need of our help.

One important benefit that coral reefs bring is protection against erosion. Healthy reef systems can absorb over 90 percent of the energy from incoming waves, defending shores and coastal cities. This is especially important in the case of a storm, when there is serious potential for major property damages. One estimate calculated that $94 million worth of flooding damages are prevented by coral reefs each year.

Coral reefs also greatly benefit local economies, in more ways than one. Reefs provide millions of dollars worth of value to fisheries, as they are home to many different species of fish. In fact, US fisheries get more than $100 million of commercial value from reefs, according to an estimate from the National Marine Fisheries Service. In addition, coral reefs attract tourists and visitors, and many of those people need lodging, food, and sometimes dive tours. All in all, businesses located around coral reefs generate billions of dollars for local economies. Taking all of these factors into account, coral reefs have a total economic value of more than $3 billion each year for the United States alone.

But these majestic reefs and their many benefits are in danger. They currently face many threats, none of which are naturally occurring. As global warming continues to accelerate, ocean temperatures continue to rise. This causes corals to bleach, which can quickly lead to coral death. The mass bleaching from 2014 to 2017 was the longest and worst coral bleaching event on human record. Increased carbon dioxide levels are also responsible for ocean acidification, making it harder for corals and shell-building animals such as oysters to form their hard skeletons and shells. If the ocean gets acidic enough, the coral skeletons can actually begin to dissolve. More acidic waters can also make it harder for some fishes to detect predators, further disrupting the balance of the ecosystem.

A bleached coral reef. Image credit: CNN
Fishing is also a threat to coral reefs. For example, a popular fishing method known as trawling (which involves dragging a net across the ocean floor) can destroy corals as the net plows through the reef. Some boats anchor on coral reefs to fish, which can destroy reefs as well. Another fishing practice involves the use of cyanide to kill the fish, which results in poisoned corals. There is also dynamite fishing, also known as blast fishing, which not only kills fish but can be detrimental to the whole ecosystem that the fish are a part of.

Conservation efforts, including the establishment of Marine Protected Areas around reefs or the development of sustainable fishing practices, as well as attempts to slow the rate of global warming, are essential if we hope to save coral reefs around the world. Reefs provide coastal protection, a source of food and income, and provide a habitat for millions of species, but they will soon fade away if current trends continue. It is our job to work to save the reefs, if we wish to preserve their natural beauty and many benefits for future generations.
Sources – Evan Yoon


Zooplankton? No, I think you mean zooplanet

Imagine naturally drifting with the ocean currents. Being a microscopic creature of the boundless ocean and merely being the pawn to a bigger game. That is exactly what planktons are. There are 2 primary types of plankton: phytoplankton, and zooplankton. Phytoplankton are plants while zooplankton are other small marine creatures that traditionally eat phytoplankton for food and in common are food for mightier beings such as fish. Plankton plays a huge role in the ocean’s ecosystem; it provides the foundation for the whole marine food web.

The word zooplankton is from the Greek zoon (animal) and planktos (wanderer/drifter). The definition of zooplankton is “Plankton consisting of small animals and the immature stages of larger.” Showing that zooplankton consists of not only microscopic creatures (krill, sea snails, pelagic worms, etc.) but also the early stages of larger invertebrates and fish, and weak swimmers (Eg. Jellyfish). There are two major types of zooplankton: ones that devote their entire lives as part of the plankton (holoplankton) and ones that solely devote a larval or reproductive stage as part of the plankton (meroplankton).

Zooplankton have limited control over their movement and have short generation times; they respond to modifications in rapid and unambiguous ways. This makes them the perfect indicator for ecosystem change. Climate change affects zooplankton in many different ways. Since they are cold-blooded organisms, their metabolism is affected by temperature. Warmer waters can decrease their life-cycle, thus in turn the timing of annual seasonal abundance peaks becomes irregular. This, in turn, affects their predators (chaetognaths, jellyfish, etc.). This supports the fact they are the perfect indicators for ecosystem change. The more changes the fewer animals in the ocean.
In terms of ocean chemistry, shelled zooplankton are adversely affected by ocean acidification. Various species of zooplankton have different conditions for reproduction, growth, and different tolerances. As conditions change, so too will the numbers of each species, ensuing in variable zooplankton communities. Zooplankton predators will need to move to find their food source, or if they are inadequate to move they will have to switch to a prey less suitable for their diets. If the population of any of the zooplankton groups changes this will most likely change ecosystem interactions, altering the balance, and possibly cause more problems to occur. If the predators eat prey mainly consumed by another animal it could disrupt their population, causing them to change prey and so on and so on.

Ocean food chains are just as important as ones on land hence making each link imperative to the whole. Zooplankton fill a fundamental link between phytoplankton and larger, open-ocean creatures. Without zooplankton the entire ocean balance would collapse. There would be too many phytoplankton, though that may be beneficial for the environment for getting rid of greenhouse gases, it would be a catastrophe for the ocean ecosystem. There would be a decrease in the zooplankton predators causing there not enough food for their predators and so on. If the predators were to move, the rapid change in the biosphere would cause immense and unhealthy alterations not only to that specific area but to the habitats surrounding it as well.

Zooplankton and phytoplankton both are plankton but they are both distinctly different. One produces its food and is a plant while the other eats and is heterotrophic. Many people think of plankton as useless critters floating around with the current but they couldn’t be more wrong. They hold the whole ocean food web and balance together. Plankton doesn’t only influence ocean creatures, it equally impacts land creatures and the whole earth. According to both earth sky and Newport Bay conservancy “Phytoplankton contribute 50 to 85 percent of the oxygen in Earth’s atmosphere.” Zooplankton may be little in size but still, possess some of the biggest and most important jobs.
Sources – Michelle Fang


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Phoenix Island Dive Safari

Close your eyes and imagine this...

You’re 25 meters underwater. As far as your goggled eyes can see, there is blue. Then, suddenly out of the blue, a grey figure appears. You see its pointed head first, its eyes lock onto you as it swiftly turns with a swish of its long, sharp tail and swims around you and away.

Mesmerized by the thresher shark, you continue to swim in the azure waters of the Pacific ocean. As you approach the reef, the bubbles pause as your breath catches in your throat at the beautiful sight in front of your eyes. The coral reef brims with vibrant colours and life. Corals the shape of a brain, corals branching out like trees, soft corals swaying with the gentle ocean currents. Corals in all colours imaginable, reds, pinks, oranges...as though a sunset melted onto the shapes to create art. The colours and crevices complement each other and house little fish.

You swim closer and see there’s more complexity to these creatures than you could’ve imagined. Each coral is made of tiny microcosms of life, working together to stay alive. A small movement catches your eye. You look and see small clownfish darting in and out of the bubble sea anemone. Playfully they weave their way in and out of its seemingly luminous tentacles.

Smiling through your regulator, you swim on only to be greeted by a wise green turtle, gliding through the water, almost like he’s flying. You admire the emerald green of his mosaic art shell in wonder. With a swish of his flipper, almost like a wave to say bye, he swims away and into the blue.

Your breathing is loud through your oxygen tank, but each breath is relaxed, meditative, as you continue to admire the vast variety of life around you. You are fascinated by these corals. They are neither plant, nor a quaint stone, but living marine polyps that have a unique limestone skeleton structure. The longer you look, the more intricacy reveals itself as you just float above it and gaze in awe. In a small crevice of the reef face, you see some movement and then an octopus darts out to greet you before shrinking back into its little crevice.
Next to your ear you hear a soft crunching. Curious, you turn your head to find a vibrant parrot fish munching away at some hard coral. You laugh internally as you remember your friend’s reaction at the beach when you told her that most of the sand is possibly parrotfish poop! This thought distracts you from the change you see in the reef as you swim further.

You see patches of dull, fuzzy dead corals, coated in turf algae. What was once brimming with life, now lies in subdued shades of grey and brown and the occasional bright white. It saddens you to see a lone fish swimming around listlessly as it wonders what happened to its home.

But then, amidst the patch of dead reef, you catch a glimpse of colour! A small coral has persevered and it gives you a spark of hope...maybe there is still a chance to save this beautiful underwater eden. Maybe future generations will get the chance to dive these beautiful reefs and witness what you have; this visual choir of colours in a coral reef, the dance of the fish and the stealth of the shark, the glide of a turtle and ray as it basks, The wilderness of the deep blue.

And as you surface, breaking through the sapphire water you are struck with the realisation that certain beauty is found only in the wild.
In our modern world, we often see unrealistic or heavily edited versions of actual commodities (food products, clothing, cosmetics, etc.). The same goes for coral reefs. We often see filtered photos and/or videos of organisms in nature. However, these pictures may not always tell the true story behind them. We usually think that colorful, luminescent colors can be a sign that they are healthy. The truth is, corals develop neon-like colors when they are stressed. So, in fact, colorful corals are a sign that they are unhealthy and it signals the beginning of the bleaching process. Corals become stressed when the temperature of the water increases by even just a few degrees. Global warming and climate change have been causing mass bleaching events in different coral reefs around the world. For example, the Great Barrier Reef that went through mass bleaching events through 1998 to 2020. When corals bleach and turn white, it doesn't necessarily mean that they are dead. Some corals can still be saved if the temperature of the water is decreased to a suitable temperature depending on the coral type. Healthy corals will usually have mild “olive green, yellow, blue, pink, and light/dark brown” colorations (Szaszi).

In 2016, scientists conducted an experiment to see how biased people's views on what “healthy” corals look like. The scientists created virtual reality scenes of different corals from the Great Barrier Reef before the mass bleaching events. “Groups of marine scientists, experienced divers, and regular citizens” (Conroy) were asked how visually appealing each image was based on “water visibility, color diversity, reef damage, and the presence of different fish” (Conroy). In some cases and images, the divers, scientists, and citizens all agreed that the diversity of fish and corals were both healthy and visually appealing. But in others, people thought that the bright colors in the corals were beautiful even though it was a sign that the coral was in danger of bleaching. The citizen group also claimed that most of the corals in the images were “bleached” because they lacked the stereotypical colors of edited corals that appear in magazines and TV shows. The corals that the citizens labeled as “bleached” were actually healthy corals that were just dull and not visually vibrant. The saying, “don't judge a book by it's cover” can apply to people, but it can also apply to the health of a coral. Just because the coral does not look healthy does not mean that it is sick and/or bleaching.
There are many organizations that advocate coral reef restoration, but it is hard to decide which one to donate your money to. Because people have false ideas of what healthy corals look like, they are more susceptible to fund the wrong organizations. Some organizations show images of heavily bleached and/or dying corals to demonstrate the actual plight, however, this type of advertising may give people the wrong perception. They may think that since the corals look so far gone, they are therefore beyond saving. If people don’t think that the reefs are pretty anymore, they don’t believe that they are worth the money and worth saving. Thus they are discouraged to donate to the coral cause. Conversely, if an organization shows aesthetically pleasing corals, donors may believe that the corals don’t need saving because they look “healthy” already.

We need to change people’s perspectives about what “healthy” and “unhealthy” really means. In addition, we need to educate the public to not only rely on visual aspects, but really investigate the actual data. It is important to preserve corals beyond images that capture just a single moment in time, because we need to learn how to sustain this “healthy image” for the long term.

In addition to monetary donations, some simple things individuals can do to help corals is to wear eco-friendly sunscreen while swimming in the ocean, avoid touching or taking home coral fragments, reducing your waste at the beach and at home, and continuing to educate yourself about modern coral issues. We only have so much time to save the beautiful underwater gardens, so we should all do our part to preserve these beauties for future generations to appreciate.
Sources – Chloe Pu


Global Warming and the Great Barrier Reef

One of the world’s greatest natural wonders is under threat by a dangerous and rapidly progressing phenomena: global warming. The Great Barrier Reef is the biggest coral reef system in the world, stretching over an area of approximately 133,000 square miles off the coast of Australia. It contains some of the most diverse ecosystems in the world and is home to thousands of species of fish, sharks, dolphins, rays, seabirds, corals, and other marine plants and animals. The Great Barrier Reef, along with reefs all around the world, plays a key role in maintaining balance in marine ecosystems and protecting the coastline from damaging effects of storms. The Great Barrier Reef is in danger from ocean acidification and rising water temperatures, and it is crucial that efforts are taken to protect it.

Although the first recorded discoveries of the Great Barrier Reef were by the English and French in the 1770's, the Aboriginal and Torres Strait Islanders have explored the reef for tens of thousands of years. The Indigenous Australians are known as the reef’s original inhabitants and its cultural significance is represented through their stories and songs that have been passed down over many generations. They fish in the waters and use the reef’s natural resources that were required for their survival. The Great Barrier Reef’s history doesn’t just start when the French and English discovered it. It has deep cultural ties to indigenous Australians and is a significant part of their heritage. This is yet another reason why it is critical to protect the reef and make efforts to save it.

Due to global warming, oceans are becoming increasingly acidic which causes coral stress and can be dangerous for other marine life. As more carbon dioxide builds up in the atmosphere from greenhouse gas emissions, it is getting absorbed into the ocean. This alters the sea water’s chemistry and causes the pH to drop, in turn making the water more acidic. Ocean acidification reduces the availability of carbonate ions which are essential for coral to build their limestone skeletons. This makes it harder for reefs to grow and recover from bleaching events.
Along with ocean acidification, rising seawater temperatures are an extreme threat to coral reefs. According to the Citizens of the Great Barrier Reef (a group of individuals and organizations dedicated to educating people about the Great Barrier Reef), the reef has lost over 50% of its corals since the 1980s due to stress from warmer temperatures than the corals are accustomed to. Corals rely on a symbiotic relationship with algae called zooxanthellae for their survival. The coral provides shelter and resources the algae need to perform photosynthesis, and in turn the algae produces oxygen and removes waste. When water temperatures rise, the symbiotic relationship is disrupted and the algae is expelled from the coral. Without the ability to perform photosynthesis, the corals become translucent which exposes their limestone skeleton, hence the white color. In 2016, there was a massive bleaching event that affected around two thirds of all the coral in the Great Barrier Reef. There are thousands of unique species that call the Great Barrier Reef home and the threat to their habitat is serious. According to National Geographic, if drastic measures aren’t taken to reduce carbon emissions, it is predicted that by 2050, the damaging effects of global warming on the Great Barrier Reef will be irreversible.

Contrary to what many media platforms portray, there is still hope for the Great Barrier Reef and other reefs around the world. Techniques like coral nurseries, gene banks, and microfragmentation have been developed to help reefs recover and thrive again. In 2018, The Great Barrier Reef Foundation launched the Reef Islands Initiative which is the biggest reef rehabilitation project in the Southern Hemisphere. They have brought together Indigenous Australians, scientists, local tourism agencies, governments and communities to help protect and restore the struggling reef habitats. Their main goals include building a knowledge base to help educate communities, taking meaningful action and measuring their impact, supporting local reef stewards, and promoting sustainability to reduce carbon emissions through local action.

The Great Barrier Reef Foundation is an example of just one organization that is working to save reef habitats; there are so many more around the world! Research is being done every day to better understand coral reefs and the effect global warming has on them. It is our duty to make an effort to protect and conserve marine life that relies on coral reefs for survival. Even people living their everyday lives can make a difference. Small things like wearing reef-safe sunscreen when visiting beaches and picking up trash can help keep reefs healthy. Also making an effort to reduce our individual carbon footprints contributes to the effort to stop global warming. We must keep researching ways to protect corals and educating communities and future generations in order to save the Great Barrier Reef and other coral reefs around the world.
Sources – Becca Blum


“Something’s Fishy”: Fish Intelligence and Sentience

If an alien species descended upon the Earth, what would they think of humans? Would this alien race believe that *Homo sapiens* is the most successful species on the planet, or would they believe that this blue planet has already been colonized by a colony of intergalactic beings? Humanity has always considered itself to be at the forefront of intelligence compared to the vast array of life contained on the Earth. However, intelligence is not confined to human beings, nor to primates and other mammals. Despite their stark differences, fish possess intellectual capabilities and sentience far beyond what most people are willing to believe.

The words “intelligent” and “fish” are rarely heard together, and the idea of a fish being stupid is well embedded in much of human culture. Perhaps fishes’ exclusion from the animals we consider intelligent is due to how different they are from humans: these limbless creatures lack expressions on their faces or tails to wag, and live in a completely different environment than most animals that humans consider intelligent reside within. However, fish are indeed intelligent, and they share many similarities with humans. Many fish species that live in water penetrated by sunlight have eyes that function similarly to those of humans and are able to access the light spectrum. In addition, fish pain receptors are very close to human pain receptors (The Humane League, 2020). A cleaner wrasse has been proven to have self-awareness, recognizing itself when it sees itself in a mirror (unfortunately, such tests on other fish species are limited). In addition, most fish possess long-term memory, thus debunking the belief that goldfish have a very short memory span.

Another sign of intelligence is learning. Fish can, indeed, learn, and appear to remember past situations to act in a way that benefits them. Archerfish, who use jets of water to capture their prey, are inaccurate when young and learn to be more accurate from both experience and watching other, more experienced, archerfish hunt. Fish can also cooperate, and have even been found to work together on the interspecies level; there have been instances in which a grouper hunts alongside a moray eel. The grouper finds prey hiding in the rocks or coral, and then points its head like an arrow, showing the eel where the prey is located. The eel, using its thin and flexible body, squeezes into the prey’s hiding spot and forces it out. This sort of interspecies communication is usually only reflected by animals like gorillas, dogs, dolphins, and humans (all of which have been proclaimed intelligent).

Humans have almost always been separated from other species of the world by the usage of tools. In fairly recent years, however, animals such as chimps, birds, and insects. Fish, too, have been found to use tools, but their distinct lack of limbs results in some very different uses of tools. Tuskfish and wrasses have been observed using hard surfaces to break open their meals, similar to how a chimpanzee might use a rock to break open its food.
The cognitive abilities of fish beg the question: can fish feel pain? With a nervous system capable of self-awareness, it does not seem like too far a stretch to say that fish are able to feel pain. In order to feel pain, an animal must have the necessary nervous system components, and fish, indeed, have those components. In a study on fish pain, the facial nerves of anesthetized trouts were observed. The nerves contained A delta fibers, which are known to cause the “sharp initial pain of an injury”, and C fibers, which cause “the duller, throbbing pain that follows” (Balcombe, 77). Those fibers also exist in humans and serve the same purposes. In addition, because these fibers were discovered in a major cranial nerve in the trouts, trouts most likely do feel pain when penetrated by hooks from both commercial and catch-and-release fishing. Furthermore, catch-and-release fishing, when the fish is handled improperly, can rupture the fish's swim bladder, causing swimming difficulty.

Unfortunately, both fish intelligence and pain are more than often overlooked by people in the fishing business and hobby. So, how can people buy fish intelligently? Unfortunately, humane fish slaughter is not at all a wide practice. However, there are a few ways to find humanely killed fish. Fish that are stunned and then immediately killed have been treated much more humanely than fish that suffocate or are bled to death. Asking a local fishery or restaurant if their fish are humanely slaughtered could result in some more clear ideas on what fish you should eat, or those questions may open a business’s mind about the creature which they serve. Fish have long been treated as nothing more than plants for a harvest, but by educating others of fishes’ intelligence, these creatures may get the credit (and humane treatment) which they deserve.
Sources - Harry Kim


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The keystone species and its effect on the environment

Corals are a marine organism that help their environment in many ways and have a positive effect on society today. Corals are going through drastic environmental changes and without protection the world could lose the species entirely. Carbon emission and warming ocean temperatures have a negative effect on this incredible group of species. Knowing why these organisms are so important to the world is the first step in trying to help them succeed. Corals have important roles that they play and without them there would be a rippling effect on the environment.

Coral reefs help the marine environment in a variety of different ways. The species helps the ocean be more diverse and healthy, 25% of marine species rely on coral reefs for their survival. Since the reef is so diverse with organisms it’s a perfect place for animals to thrive. Furthermore, reefs are important because they provide a home for organisms to reproduce and nurse their young. Without this structure, organisms like tropical fish would have a difficult time finding food and hiding from predators. Corals are also important because they have the ability to take in the sun’s energy to make oxygen. Since fish rely on oxygen to survive, coral reefs are able to make more oxygen in the ocean and keep it stable. Without protecting the coral’s marine environment many different species would have a difficult time living. Corals help the ocean in many ways but they also have an effect on day to day life on land.

[Image of a healthy coral reef in Hawaii. Image by James D. Watt/Ocean Stock.]

Corals do not only help the marine environment but they help life outside of the ocean, on the land, as well. Corals are mostly found close to shore in big groups and have very strong skeleton structures or bodies. This causes the shore line to be protected from erosion and strong rapid waves that are headed toward the shore. Furthermore, corals are important for pharmaceutical purposes and health issues. Scientists have found that some corals have substances that can help with alzheimers and some cancers. Not only do corals help in the medical field but they help grow the economy. Corals provide jobs for fishermen, scientists, and bring money into countries for tourism. Without corals, the effect on people would be drastic. Corals face the threat of warming waters everyday and without intervention the world faces to loose them as a resource.
Humans have a positive and negative effect on the environment around them and corals are directly impacted by the activity of people. The amount of emission being put into the environment impacts many organisms and coral being included. The amount of carbon in our atmosphere is warming the earth’s oceans which bleaches and destroys coral reef ecosystems. Without change there would be a decrease in species, economy’s money, and shore protection. More drastic changes would happen to the world without these organisms and helping these environments would benefit the globe. Understanding why corals are important and what people can do to help is the first step in making a difference.

The effect coral has on the ocean and peoples’ environment is underrated and can change the world in many ways. The reasons above are all examples why coral reefs are important and why they should be protected. Without the help of people, corals will continue to go through warming waters and destruction. To prevent this life changing problem people have to cut back on the emission going into the atmosphere and make their day to day lives more sustainable. People can eat plant based meals, use less electricity, and travel without emitting fossil fuels. If these steps are not taken swiftly, the coral reefs resource will be lost.
Sources – Makayla Carrafiello


Why Does the Gulf Turn Red?

“It was so difficult to breathe today when I was jogging on Naples beach, Santana” Ashley texted me one Saturday afternoon. “Oh my!” I replied, “Smoke from a forest fire?” I inquired while referring to a common seasonal environmental hazard in Southwest Florida. “No, it was Red Tide!” Ashley responded. “Red Tide?” I asked, “What do you mean?”

After doing some research, I learned that Florida Red Tide is a type of harmful algal bloom that occurs nearly every summer in Southwest Florida and is caused by *Karenia brevis* (a type of single-celled organism known as a dinoflagellate) which is persistent on the coast of Florida. While large annual Florida blooms are quite common, super blooms have been occurring more frequently due to an increased nutrient load in the Gulf of Mexico caused by increased urbanization and agricultural practices. Red Tide received its name from the discoloration that it causes on the surface of the water due to photosynthetic pigments that can vary in color from brown to red (see photo 1). Interestingly, on sunny days, the red tide organisms swim toward the surface and become concentrated causing an intense, reddish color change. However, sometimes when the Red Tide organisms are agitated by waves at night, they emit a dazzling neon blue glow (see photo 2).

Algal blooms are relatively common in coastal regions throughout the world and are often beneficial by providing a major source of energy for the marine food web. However, harmful algal blooms can produce powerful neurotoxins that can kill fish, birds and mammals while making shellfish dangerous for human consumption. In 2018, 66 tons of dead fish were removed from Sarasota beaches over the course of just a ten day period when Red Tide was particularly prevalent.
Algal blooms are often caused by excess nutrients in coastal waters due to runoff from fertilizer, sewage, and livestock waste. An excess of nutrients can also occur more naturally from river floods that carry natural soil nutrients into the sea or ocean and upwelling of nutrients from the cold, nutrient-rich sea floor. The extent of algal bloom growth and persistence often depends on factors such as ocean currents, wind direction and strength, air temperature and water salinity. Decomposition of the dying algae in these large blooms consumes huge amounts of oxygen which can cause hypoxic or “dead zones” as marine animals suffocate or move to areas with more oxygen. Also, a harmful algal bloom may become so dense that it blocks sunlight from reaching the photosynthetic, symbiotic algae in coral reefs so that photosynthesis ceases causing the death of the coral. In addition, movement of the water can break open karenia brevis cells and release the neurotoxins into the air causing respiratory irritation in humans, trigger asthma attacks in susceptible people and difficulty breathing in completely healthy people like Ashley. Fortunately, human illness from Red Tide is rare but can, at times, be fatal. Red Tide is not only a local problem but also a national concern as it can adversely affect regional economies due to significantly decreased revenue from fishing and tourism.

Recent studies, using a state of the art technique known as TRAQ-based quantitative proteomics analysis, at the University of North Florida have demonstrated that coral reefs may initially appear normal in response to a Red Tide event but may show proteomic alterations (protein changes such as protein folding) that indicate cell stress without the death of the organism.

In a study in the Gulf of Oman, coral reefs at Dibba initially covered 53% of the Gulf’s seafloor prior to a harmful algal bloom. After the bloom, the coral reef coverage decreased to only 6% and some coral species at Dibba were completely eliminated during the harmful algal bloom event! Events like this can even lead to coral reefs being completely replaced by other marine organisms.

It behooves us to re-examine the human activities that contribute to harmful algal blooms such as Red Tide and to make enduring and sustainable changes particularly in the area of agricultural techniques to help prevent these harmful blooms from occurring. Some of the areas that need to be studied, and possibly adjusted, in this regard include: Nutrient management techniques where the amount, method and placement of fertilizer is rigorously monitored. Ensuring year round ground cover with crops or perennials to prevent or minimize soil erosion and runoff.

Planting agricultural field buffers of shrubs, trees and plants to absorb and filter out excess fertilizer. Conservation tillage techniques to reduce the frequency and intensity of tillage in order to decrease the amount of soil erosion and runoff. In addition, many scientists are calling for an Integrated Ocean Observing System to map and monitor harmful algal blooms 24/7 to provide advance warning to communities that will soon be affected. It is believed that this forewarning will allow people to adjust their activities accordingly and may prevent unanticipated asthma attacks and even deaths. Surely, if my friend Ashley had known of the potential for having difficulty breathing from Red Tide that day she would not have made the decision to go jogging on the beach!
Santana Khan


