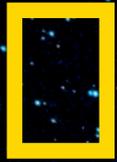


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**NATIONAL  
GEOGRAPHIC**



# Explorer

ADVENTURER

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# What the



Will the Tasmanian devil win its fight against a mysterious disease?

By Brenna Maloney

# Devil!

## Wildlife and Wild Places

### LIFE SCIENCE

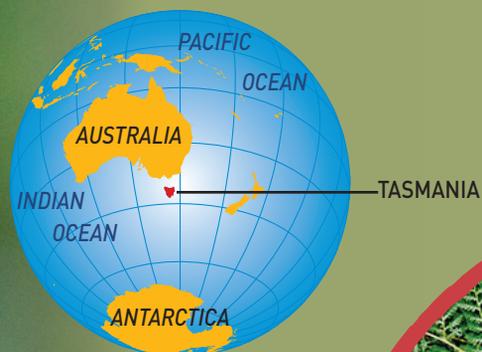
As you read, think about what Tasmanian devils eat and how their behavior when feeding may have affected how their disease spread.



## The sound is hard to describe.

It can be like a harsh cough. Or an angry hiccup. Or a high-pitched shriek. It all depends on what is being said and who is doing the talking. A typical conversation can escalate quickly. Most of it is just noise and bluff, but when a Tasmanian devil “speaks,” it’s best just to listen.

You’d have to go a long way to hear a Tasmanian devil. They are found in only one part of the world—Tasmania. It’s an island off Australia’s southeastern coast. And while you can find them in the wild there now, their fate was uncertain about 25 years ago. Tasmanian devils had fallen victim to a mysterious cancer that threatened to make them extinct. To understand their promising recovery, you have to understand a lot about this strange animal.



To start, Tasmanian devils are **nocturnal**. That means they are active at night. They are also **marsupials**. That's a classification of mammal in which the young must finish developing in their mother's pouch. You might know of another type of marsupial, the kangaroo. A mother devil's pouch helps her feed and protect her newborns, which are called imps. A mother devil can give birth to as many as 40 imps. Yet, there is only space for four in her pouch, so only four can survive.

When the imps are born, they are the size of raisins. They stay in their mother's pouch for four months. After six months, they are ready to begin eating solid foods. A Tasmanian devil's diet may not sound very appetizing. They are **scavengers**, and they eat **carrion**, or dead animals. Sounds gross, but scavengers play a vital role in ecosystems. They act as nature's cleanup crew.

When animals die, their bodies decay. The rotting bodies smell bad and take up space. They can pollute waterways and attract flies and other insects. Scavengers can eat the dead animals before any of this happens.

As the largest meat-eating marsupials in the world, Tasmanian devils will often eat dead wallabies, opossums, and wombats.

Tasmanian devils eat dead animals.

They are not picky eaters. They also will eat birds, lizards, frogs, and even dead farm animals. They can eat up to 40 percent of their body weight at one time.

Strong necks hold up their skulls. Their skulls are unusually large for their bodies in order to support their strong jaws. Devils eat their prey completely—bones, fur, and all. If you looked inside a devil's mouth, you'd see teeth for biting, teeth for tearing flesh, and teeth made for crushing bone. Devils can bite down with great force. Devils can bite down with the force greater than a Bengal tiger's bite.



actual size  
at birth



## From Imp to Devil

**At birth:** Each imp is the size of a raisin; four imps crawl to their mother's pouch.

**4 months:** The imps are old enough to leave their mother's pouch. They often ride on her back.

**6 months:** The imps stop drinking milk and begin eating solid food.

**8 months:** The young devils leave their mother to live alone.

**2 years:** The devils are old enough to have their own young.

**Adult life:** Devils in the wild usually live for five to eight years.

# All About Tasmanian Devils

**ears:** nearly hairless ears amplify sound; thin skin on the ears causes them to appear red when devils are excited or stressed



**eyes:** see in black and white, which is useful for detecting movement of prey

**whiskers:** positioned in clumps on top of the eyes and mouth; help devils feel for food in the dark

**teeth:** 42 large, sharp teeth; molars can crush bone and tear skin; canines often stick out of the mouth when it is closed

**claws:** used for digging dens and climbing trees



**pouch:** backward-facing pouch provides a safe space for newborns to grow

**skull:** large skull supports dense jaws



**front legs:** longer than back legs, which causes a loping gait

**fur:** dark brown or black, often with a white stripe across the chest and lighter markings on the shoulders and rump



**tail:** long and thick at the base; stores fat for times when food is scarce

During a typical night of hunting, a Tasmanian devil might travel 16 kilometers (10 miles).



## In the Wild

Devils are largely solitary animals, but that changes when food is involved. Devils have an excellent sense of smell. They can detect carrion from 0.8 kilometers (about half a mile) away. Once they smell it, they can track it fast. Devils have been “clocked” at 25 kilometers (15.5 miles) an hour for as far as one kilometer (0.6 miles).

Things can get a little tricky once they find what they are smelling. Devils quickly establish an order about who eats what and when. Tasmanian devils have 11 distinct vocalizations, which include: “snort,” “humf-growl,” “bark,” “clap” (snapping of the jaws), “growl-whine,” “screech,” “sneeze,” and “shriek.” Each sound means a different thing. A “conversation” over a dead wombat might start out with snorts and humf-growls. But, it can quickly become full-on shrieking.

At a carcass where a number of devils all want to eat, these sounds establish an order to the chaos. Devils combine their sounds with biting. They use their powerful jaws to snap at each other. And this is where the Tasmanian devil’s trouble as a species began.

These Tasmanian devils have a “discussion” over dinner.

## Trouble in Tasmania

As far back as 1996, a photographer took a picture of some devils on the northeastern end of the island. Their faces were distorted by large tumors. He’d never seen anything like it. He quickly shared it with some scientists he knew. They had never seen it before, either.

By 2002, scientists were observing these tumors regularly. They began to study the tumors and discovered it was a type of cancer. Cancer cannot typically be “caught.” The cancer cells from one individual are not the same as they are in a different individual. Yet, scientists learned that what was attacking devils is one of only eight known cancers that can spread from one animal to another. It is called devil facial tumor disease. And it is fatal. If one devil has it and bites another, both devils will have the disease and both will die. Because devils often bite each other on the face during their fights over food, the disease began to spread quickly.



Captive breeding programs ensured a population of disease-free devils.



This devil is released from a trap that helps scientists monitor devil health.

What was going on? An infected devil's body did not fight the cancer cells. It took scientists a long time to understand why. It turns out that this type of cancer can “hide” from a devil's defense system. The devil's body thinks the invading cancer is part of its body. So, its body doesn't fight back. The cancer continues to grow. For an infected devil, this can lead to starvation because the cancer grows so large on the devil's face, the devil can no longer eat.

Devils were dying in great numbers. Many scientists feared the devil would become extinct. But, that's not what happened.

## Progress With Protection

Almost immediately, wildlife officers on Tasmania began forming what they called “an insurance population.” They removed healthy devils from the wild and began a captive breeding program. By doing so, they were ensuring that a large and healthy population of Tasmanian devils would continue to thrive.

Another ongoing step was to monitor wild devils. Wildlife officers set up safe traps for catch and release. They recorded the health of each devil before releasing it. They also monitored devils with remote sensor cameras.

In the lab, they studied the disease itself. Could they create a vaccine to protect devils? This research is ongoing, but scientists are hopeful. At the same time, they are seeing some cases of previously infected devils that are regaining their health. How? The scientists suspect that the bodies of some devils are beginning to adapt to fight off the disease.

Tasmanian devils are an important part of their ecosystem. Devils play a huge role as scavengers, but they also hunt introduced animals, such as feral foxes, cats, and ferrets, which hunt local wildlife. Tasmanian devils are a national icon to Australians and are much loved around the world. Their recovery is important!

## WORDWISE

**carrion:** a dead animal that a scavenger eats

**marsupial:** a mammal (an animal that has fur or hair and feeds its babies milk) whose young finish developing in a pouch on their mother's abdomen

**nocturnal:** active at night

**scavenger:** an animal that feeds on dead animals



# Make the World a Better Place



# World Face!

## The Human Journey

### INFORMATIONAL TEXT

As you read, identify two main ideas and explain how the author supports these ideas with details.

**Creating positive change in our world comes in all shapes and sizes. Wherever and whoever you are, the world needs you. We are all here to help—but you must lead!**

**By Lisa M. Gerry**





what's  
your  
story ?

## Think Globally

To make the world a better place, it's important to know about the places in the world. Knowing more about geography—having an idea of where different cities, countries, and continents are—will help you make sense of stories you read and news you hear.

When you hear about a new place, make a habit of finding it on a map. See what continent it's on, what big cities are nearby, and if it's close to a body of water. Then look up what language or languages are spoken there, some of the most popular foods or dishes eaten there, and popular modes of transportation. Getting a sense of the people who live there and what daily life might be like for them will help make that place more than a dot on a map in your mind.

## Listen

Every person has a story. It might be a story about their past. It could be about their hopes and their dreams for their future. Their story could be about their fears or what makes them sad. No matter what words they use when they share their story, what they are really telling you is who they are.

Being a good listener means being genuinely curious about other people and caring about their thoughts and feelings. And, being a good listener can make the world better by helping you have more compassion, avoid misunderstandings, and learn about new people, places, and issues.

L I S T E N

## HERE ARE FIVE WAYS TO BOOST YOUR LISTENING SKILLS:



- 1. TRY TO UNDERSTAND.** Don't worry too much about having a response ready. Instead, really try to figure out what it is they are trying to say.
- 2. FOCUS.** That means putting away all distractions and really giving whoever's talking your full attention.
- 3. DON'T INTERRUPT.** Give whoever's talking the space and time to express themselves the way they want to.

- 4. BE OPEN-MINDED.** When someone is telling you something personal, they're trusting you with their truth. They're giving you a little glimpse into their heart and their mind. Be respectful of that and try not to rush to judgment.
- 5. LET THEM KNOW THAT YOU UNDERSTAND.** (Or that maybe you don't.) When you want to make sure someone knows you are hearing them, you can say something like, "It sounds like what you are saying is..." Or, "Do you mean...?" If you don't understand, try, "Could you say that in another way?"



## Think About Things Critically

Being a critical thinker means that before you believe something or someone, you consider the facts and evidence. For example, take something you might read on the internet. A lot of the information you find there is not fact-checked. So, you have to be your own info investigator. Double-check! Find another reliable source that can verify, or confirm, the information.

When trying to determine whether or not to trust a source, or the information provided, consider these questions:

- 1. Who is the information coming from? Who is the original source?**
- 2. Is this source reliable? Why or why not?**
- 3. Does this source have an agenda or a motive for sharing this information?**
- 4. What does this source gain from my belief in this information?**
- 5. Do other reliable sources confirm or agree with this information?**



**TRUTH**



## Join a Team

So, you want to change the world. Chances are you probably can't do it alone—nor would you want to. After all, most things are more fun when you do them with other people. The best way to practice working together is by joining a team. You'll make new friends, feel part of the group, and have some fun. You'll learn how to be a gracious winner or loser, share with others, handle it when you don't get your way, be there for others when they need it, and get along with people who you might not normally hang out with.

There are many sports teams you could try out, but don't get down on yourself if you're not the athletic type. There are also dance teams, academic teams, student governments, newspapers, choirs, volunteer organizations, and many others. Or, start your own club!

## Stand Up for Justice

Have you ever gotten into trouble for something you didn't do? Then you've experienced injustice, or something that isn't fair. Injustice happens every day, in small ways and in big ways, like when entire groups of people are treated unfairly or unequally due to things like their race, gender, or religion.

It takes real courage to speak up when you see injustice, when that little voice inside you says, "Hey, that's not right." So, if you see someone being picked on or treated like they're different or less than other people, find a safe way to say or do something. That might mean speaking to a teacher, coach, parent, or school counselor. Or it might mean saying to whoever's being mistreated, "I'm sorry that happened. You didn't deserve it. I support you."

STOP



## Ask Questions

Think of yourself as an investigator—someone whose job it is to figure out how stuff works and why things are the way they are. Always be on the lookout for new leads, new explanations, and new information.

Curiosity is a seed, which when watered with research, blooms into discovery. Let yourself wonder and ask all the questions you have—like “How?” “Why?” “Who?” “What?”—until you find the answers you’re looking for.

## Walk the Talk

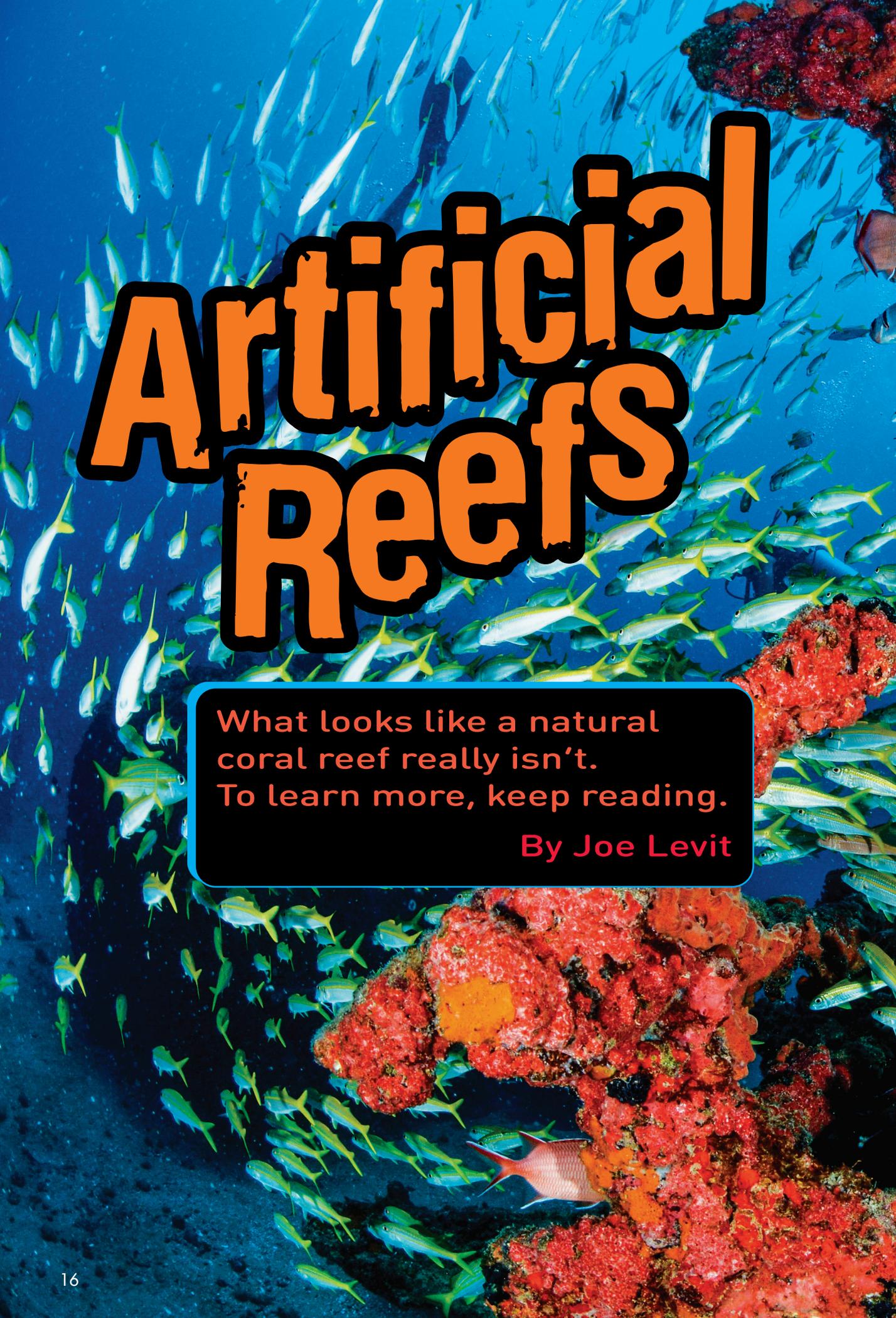
This is simple. Avoid saying one thing and doing another. For example, have you ever been kind to someone’s face, but then talked about them behind their back? Do you know anyone who says they’re a friend to the environment but then throws gum wrappers on the ground? If you say something, make sure your actions back it up, and vice versa.

Want more suggestions on how to change the world? Read “100 Ways to Make the World Better!” by Lisa M. Gerry

**“Be the change that you wish to see in the world.”**

—Mahatma Gandhi,  
social activist





# Artificial Reefs

What looks like a natural coral reef really isn't. To learn more, keep reading.

By Joe Levit

# Wildlife and Wild Places

## LIFE SCIENCE

As you read, think about how people are protecting an ocean environment by building artificial reefs.





**It's midday** off the coast of Cancún, Mexico. You're on a boat getting ready for a reef dive. You check your gear one last time, then tip backward off the boat into the clear, cool water.

As you swim down, you start to see something—something near the seabed. You continue your descent to nearly 10 meters (32 feet). And there, you come face-to-face with ... another face. Not another diver, but a face made of stone! It is part of a statue, and it is covered in clumps of algae and crusty bits of coral.

This is not the only statue you see. There are many here, all covered in and surrounded by sea life. What's going on here?

You dove into the middle of MUSA, a 500-sculpture underwater museum. This place is an **artificial reef**. It was created to protect some of Mexico's natural reefs, which have been damaged by storms, boat anchors, and tourism.

## The Value of Reefs

Our oceans cover 71 percent of Earth's surface and hold 97 percent of the planet's water. No matter where we live, we rely on our oceans for the air we breathe. Ocean plants produce half of the world's oxygen, and ocean waters absorb almost one-third of human-caused carbon dioxide emissions. The oceans also regulate the weather and play a role in Earth's water cycle.

**Coral reefs** are often called the rainforests of the ocean. They are the largest living structures on Earth and play a key role in keeping our oceans healthy. Reefs also protect shorelines from storm surges and high tides.

Reefs provide food, shelter, protection, and spawning areas for thousands of species of fish and other marine organisms. Reefs are study areas for scientists, such as those who study climate change. Reefs may hold the key to new types of medicine, too. Compounds taken from coral reef species have already been used to treat many infections and diseases. And millions of people worldwide count on coral reefs every day to provide some food or income from fishing.

## Reefs in Trouble

Unfortunately, increased human pressures are putting a tremendous strain on the health of our oceans and reef systems. Threats include fishing methods that damage reefs, careless tourism, pollution, and climate change.

Here in Cancún, Mexico, the tourism industry was bringing more than 400,000 people to the natural reefs every year. Many of them were beginning divers who typically caused more damage to the reefs than experienced divers.

Mexico's National Marine Park created the underwater museum, MUSA, in an attempt to draw people away from natural reefs and toward artificial ones instead. It's working. Forty percent of the people who would have visited the natural reefs now visit MUSA, including 95 percent of the beginners. That's a lot less wear and tear on natural reefs. When natural reefs are in trouble, there are things we can do!

This natural reef in the Red Sea is full of marine life.

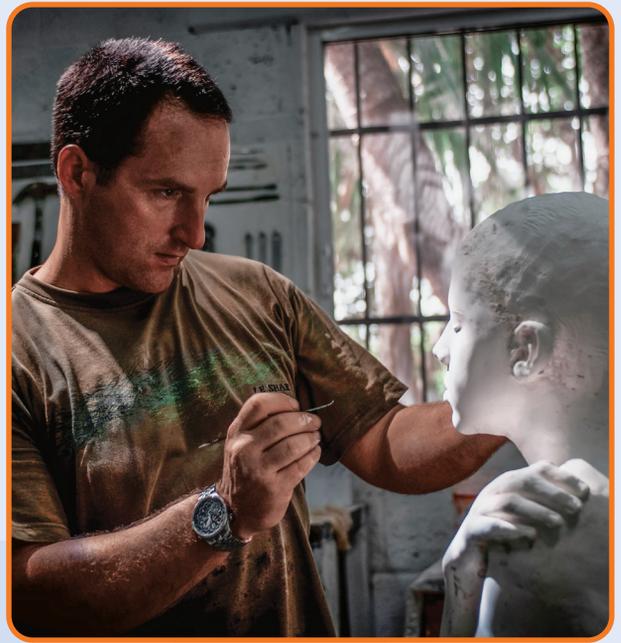


## Getting Started

To protect natural reefs, we can build new reefs, artificial ones. Artificial reefs mimic, or copy, natural ones, but they can be created for different purposes. Some artificial reefs prevent coastal erosion. They force waves to deposit their energy offshore rather than directly on the coastline. Other artificial reefs are meant to hold sediment on beaches. Still others simply provide a habitat for fish and other aquatic life.

To build an artificial reef, a large object is usually installed in an area where the sea bottom is flat and featureless. When ocean currents encounter a large enough object, a plankton-rich upwelling occurs. That becomes a good spot for small fish to feed. This, in turn, draws larger fish to the area.

The object may also make a good hiding place for hole- and crevice-dwellers like snapper, eels, and triggerfish. Over months and years, the object provides hard surfaces to which algae and invertebrates such as barnacles, corals, and oysters can attach. As time passes, the community of sea life connected to the object becomes more and more complex and diverse.



Artist Jason deCaires Taylor carefully crafts the face on one of the underwater statues.

## Seeding Solutions

Creating an artificial reef takes time, and it's not as simple as tossing an old tire into the ocean and waiting for it to sprout life. MUSA president Roberto Abraham says that one of the greatest challenges they faced in creating the underwater museum sculptures was using the right cement.

If the cement isn't strong enough, the statues crumble over time. If the surface is too acidic, corals and algae can't take hold and grow. Once the MUSA staff and artists found the right mix, they were able to create the statues. Then, they hand-seeded many of the statues. They placed young staghorn coral polyps on the surface of the statues to give the growth a head start. The transformation is slow but miraculous. "When we place these sculptures underwater they start out like a blank canvas," Abraham says. "But soon nature paints them and provides textures. They evolve every day."

These statues have been underwater for several years. Corals and algae grow on them. Fish swim among them.



## Repurposing Rigs

Art isn't the only architecture that can be used to make an artificial reef. Abandoned oil rigs can also double as reefs! Oil rigs are enormous structures built in deep water. Typically, they are built on the continental shelf, which is made up of clay, mud, and sand. There, they drill for oil.

When these rigs are no longer in use, the Rigs to Reefs program turns them into deep-sea artificial reefs. In the United States, many of the Gulf States participate in this program. To date, more than 500 rigs have been converted, mostly in Texas and Louisiana. The rigs can be cut off at the base and tipped over. Or, they can be cut in half and the pieces arranged side-by-side. The rig can even be cut into pieces and hauled to a different location.



Surrounded by fish, these corals grow on an artificial reef.



This rig may one day become part of an artificial reef.

## Helping Out a Giant

A typical rig can provide a habitat for as many as 14,000 fish! Per square foot, the rigs can support more marine life than natural reefs do. Creatures come to these rigs because the steel is a good surface for corals and sponges. Red snapper, hogfish, and barracudas make the rigs their home.

These rigs are helping revive a species that was once severely threatened. Goliath groupers have been protected since 1990 but are still vulnerable. These fish can grow to more than 2.4 meters (8 feet) long and can weigh almost 363 kilograms (800 pounds). In recent years, they have been most abundant near deep, artificial reefs. Keith Mille with the Florida Fish and Wildlife Conservation Commission has observed them on some of his dives. To him, it's first-hand evidence that the artificial reefs are supporting key species.

## Accidental Reefs

Some artificial reefs are not planned. These reefs are born from objects that don't belong in the ocean at all. Planes that crash or ships that sink sometimes become reefs by default.

There's a place in the Red Sea called Sha'ab Abu Nuhas. It is a triangular-shaped coral reef off the coast of Egypt. Navigating this reef by ship can be quite dangerous, and for this reason, this place is also known as a ship graveyard.

You'll find four large shipwrecks on the north side of this reef. These ships all struck the reef and met the same fate. They sank and slid down a steep slope and became partially buried in sand. The *Giannis D* was such a ship. It was a large, Greek transport ship hauling timber from Croatia to Yemen. It met its end in 1983 by accidentally running full speed into Sha'ab Abu Nuhas. The crew abandoned the sinking ship, which floated there for about six weeks. Then a storm broke the ship's back and sent its pieces to the bottom.

A lot has changed in the almost 40 years since the *Giannis D* went down. To dive there now, you'd see the bones of a ship covered in coral formations. The corals attract hawksbill turtles, which like to snack on corals. A visit to the engine room might reveal a school of glassfish. Eels and Napoleon fish drift by in the passageways. From the outside, dolphins patrol the wreck. Maybe the *Giannis D* doesn't belong there, but it doesn't matter. The sea has claimed it for its own.

## Creating a Home

You'll find the S.S. *Thistlegorm* at the bottom of the Red Sea as well. It was a cargo ship for the British merchant navy. It was sunk by German forces during World War II, near Ras Mohammed, off the coast of Egypt.

At the time, the ship was filled with supplies for soldiers and weapons of war—bombs, anti-tank mines, rifles. It also carried trucks, armored cars, more than 100 motorbikes, and two steam locomotives. All of which still lie at the bottom of the sea.



## A Future Hope?

How strange these items look now, encrusted with corals. The wreck is alive with fish: tuna, barracuda, batfish, moray eels, lionfish, scorpionfish, and turtles. This ship has become their home.

Nothing can replace a natural coral reef in the ocean. Yet, artificial reefs can make up for some of the loss of natural reefs. Over time, marine communities can thrive in these unusual environments.



Clockwise from left:  
The wreck of the *Giannis D* lies on its side, now encrusted with corals and algae; a scuba diver looks at part of the *S.S. Thistlegorm*; a hawksbill turtle feeds on red soft corals attached to the wreck of the *Giannis D*.



## WORDWISE

**artificial reef:** an underwater structure made by people, typically built to promote marine life in an area

**coral reef:** an underwater ecosystem characterized by reef-building corals



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NOVEMBER–DECEMBER 2020

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