

Worksheet - Coral Reef Restoration

Fill in the blanks using the keywords:

Fossil Fuels - Global Warming - Gas - Greenhouse Gasses - Bleaching Events - Temperature - 90% - Disease

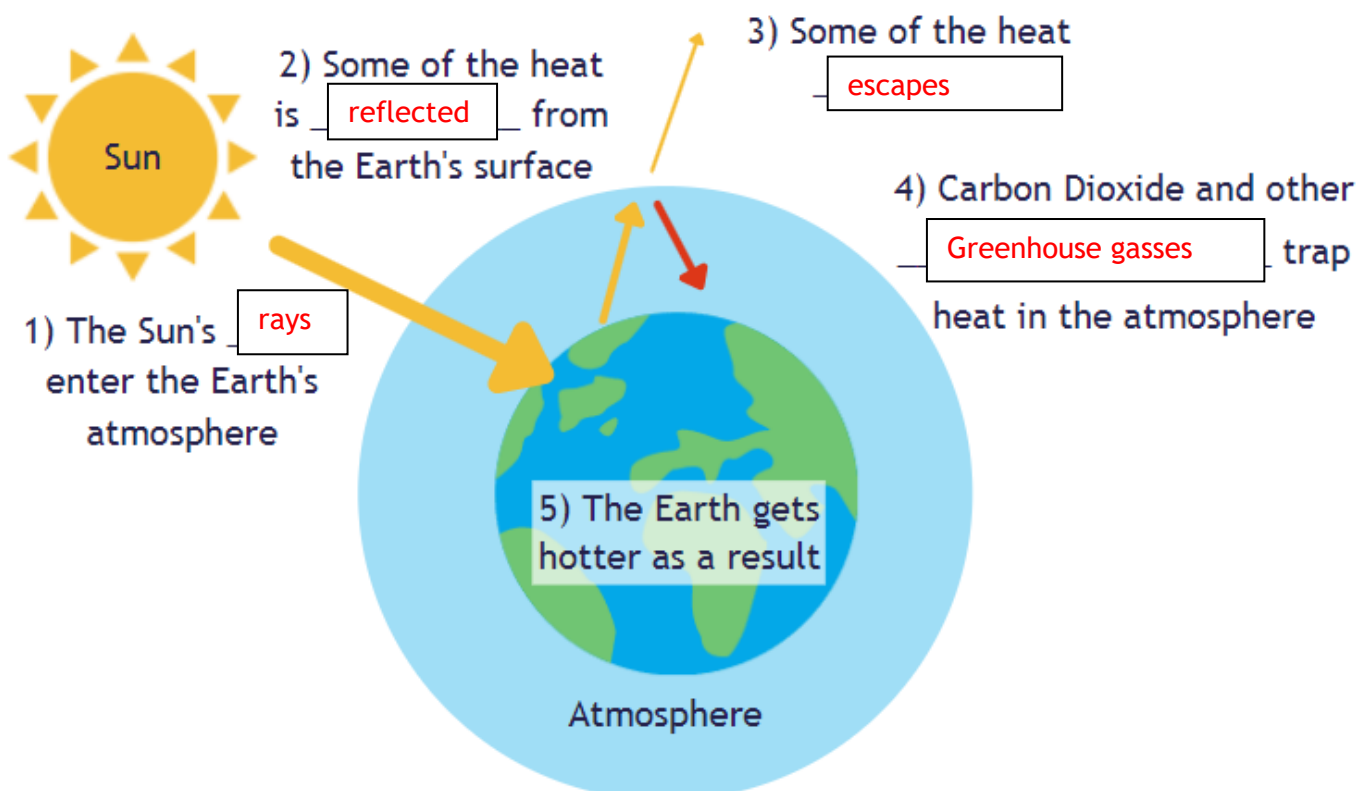
1) Burning fossil fuels such as coal, oil and gas, has led to high concentrations of greenhouse gasses in our atmosphere, including carbon dioxide. Greenhouse gasses trap heat in our atmosphere, causing the Earth's temperature to rise. This process is known as global warming.

2) The dramatic rise in Earth's temperature is harming the environment. About 90% of the excess heat in our atmosphere caused by our human activities, is absorbed by the ocean!

3) Corals and many other organisms that live on coral reefs, have a very small temperature range. When waters are too cool or too warm, this causes stress to the corals, which can lead to massive bleaching events, and eventually death. When corals are stressed, they are more susceptible to disease.

Complete the Greenhouse Effect Diagram using the keywords:

Reflected - Greenhouse gasses - Escapes - Rays



Worksheet- What are corals?

Fill in the blanks using the keywords:

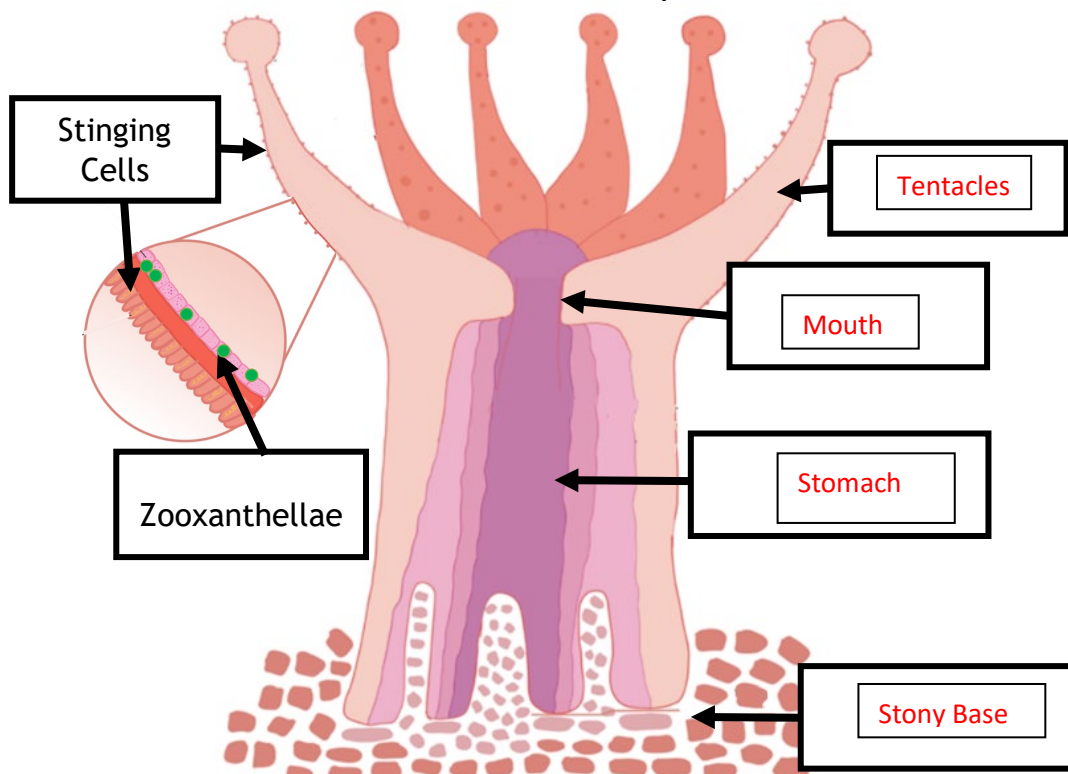
Thousands - Animals - Polyps - Symbiotic - Tentacles -
Photosynthesis - Zooxanthellae

- 1) Corals are tiny, soft-bodied Animals related to jellyfish and sea anemones.
- 2) When viewed close, you can see that corals are made up of Polyps, each one has a mouth, stomach and tentacles. Polyps are generally grouped together by the Thousands, forming large colonies.
- 3) Corals often have a Symbiotic relationship with a special type of algae called Zooxanthellae (pronounced 'zoo-zan-thel-ay').
- 4) Zooxanthellae live inside the cells of the coral and provide up to 95% of the coral's food through Photosynthesis. The other 5% of nutrients comes from the coral polyps using their Tentacles to reach out and grab food that floats by in the water column.

Stony Coral Polyp Anatomy

Label the diagram below using the keywords to help you:

Mouth – Tentacles – Stony Base – Stomach



What is a Coral Nursery?

A coral nursery is a place where scientists grow corals underwater on specialized structures. These structures allow corals to grow quicker. When corals grow large enough, they are then outplanted back onto the reef. This helps corals recover and heal after their numbers have declined after major environmental disturbances or diseases. Below are the steps involved in coral restoration, fill in the missing words:

Safe - Fragment - Cleaning - Outplanting

1 Fragmenting
 CCMI started the first coral nursery in the Cayman Islands back in 2012! To start a coral nursery scientists use garden clippers to take a small branch of coral from the reef. This is called a coral fragment.





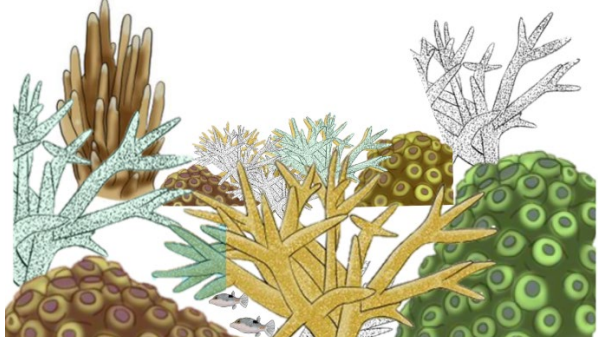
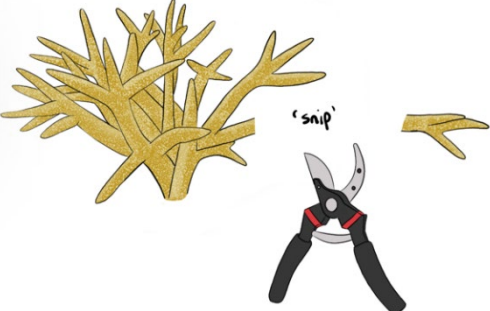
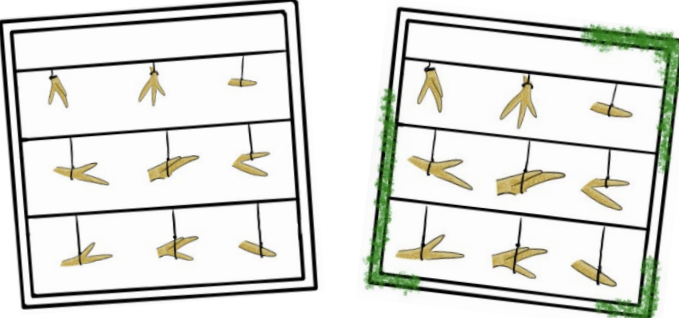
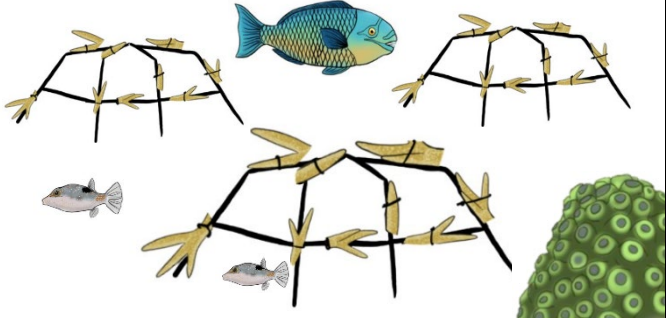
2 Coral Nursery
 The coral fragments are then taken to the coral nursery. Scientists use fishing wire to hang the corals onto the nursery structures. This provides a safe environment for corals to grow with reduced **predation and competition**.

3 Maintaining the Nursery
 The nursery needs cleaning once a month to stop macro algae from growing over the coral. If fragments grow too big, they can damage the structure or nearby corals. Therefore, corals have to be outplanted or fragmented before they grow too big.



4 Outplanting
 Once the corals are large enough, they are then put back onto the reef. Scientists call this outplanting. At CCM,I we found using dome structures was the most successful way to outplant corals.

The Story of ACER the Staghorn Coral!

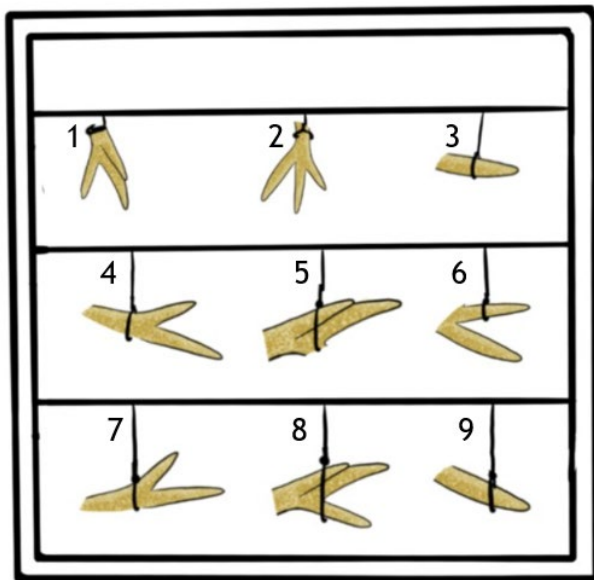
		
<p>Hello! My name is ACER, I am a staghorn coral. The scientists call me <i>Acropora cervicornis</i> (now I bet you can't say that three times fast!) but you can call me ACER for short. I want to tell you all about my life on the reefs of Little Cayman!</p>	<p>For a long time, life was great! I had lots of staghorn friends around me, the water was the perfect temperature, and the reef was healthy and in balance. Unfortunately, in the 1980s, lots of my friends died from a coral disease called White Band Disease.</p>	<p>After the disease it was hard to grow, a lot of my energy was spent on recovering and the water was getting warmer. I had macroalgae constantly trying to take over my space on the reef, and lots of predators, like worms and slugs, picking on me.</p>
		
<p>Thankfully, the CCMI scientists found me on the reef and helped me out! They took a small fragment or piece and made me into two corals! One ACER stayed on the reef and one ACER went to their coral nursery.</p>	<p>The coral nursery is awesome! The CCMI scientists make sure I don't have any predators by removing worms and slugs, they keep annoying macroalgae away by cleaning my beautiful frame structure. I am also raised off the reef which means more water flowing past my polyps, which means more food for me! This allowed me to grow BIG and STRONG!</p>	<p>Now, the scientists are putting me back onto the reef on a beautiful dome structure with some of my new coral nursery friends. I will have to keep macroalgae away and deal with predators without the scientists, but I am now large enough and have friends around me. I also provide shelter for lots of my fish friends too! Life on the reef of Little Cayman is good again!</p>

Become a CCMI Marine Biologist: Identifying SUPER CORALS!

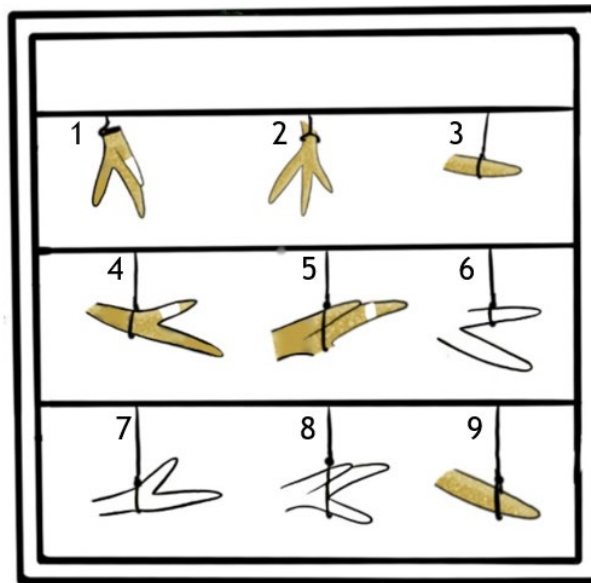
CCMI Scientists take coral restoration one step further by picking the best corals to use in our restoration projects. We need your help to identify which corals in our nursery are the best corals to outplant! We need corals that can handle warm temperatures and survive the increase in ocean temperature, which we call **thermotolerant corals**. However, we also need our corals to be able to fight against disease, so they do not get wiped out the next time a White Band Disease outbreak happens.

Below we have a frame from our coral nursery. Can you sort the corals into the following categories:

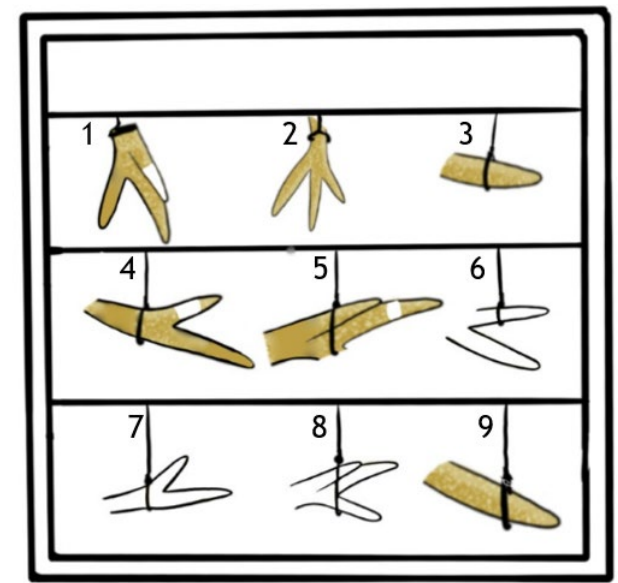
- **Resistant Corals** (no sign of disease)- Corals that are exposed to the disease but show no signs of the disease affecting them.
- **Resilient Corals** (recovered coral)- Corals which catch the disease will have parts of the coral infected with White Band Disease, but the coral is resilient and will not die from the disease.
- **Dead Coral** - When White Band Disease kills a coral, it will turn white all over.



Before White Band Disease Outbreak



During White Band Disease Outbreak



After White Band Disease Outbreak

Category	Dead coral	Resilient coral / recovered coral	Resistant coral / no signs of disease
Coral fragment number	6, 7, 8	1, 4, 5	2, 3, 9

CCMI scientists wanted to see which corals were resistant to warming, so they took small fragments of the corals in our nursery and carried out thermotolerance experiments. This involved exposing the coral fragments to increasing temperatures and seeing which corals were adapted to survive the higher temperatures. The results are shown below, compare your results from White Band Disease outbreak to the Thermotolerance experiment below.

Thermotolerance experiment results	Did not survive slight temperature increase	Survived a small temperature increase	Survived a large temperature increase
Coral fragment number	6, 5, 9	1, 3, 7	2, 4, 8

	Dead Coral	Resilient Coral / Recovered coral	Resistant Coral / No signs of disease
Did not survive slight temperature rise	6	5	9
Survived small temperature increase	7	1	3
Survived large temperature increase	8	4	2

Which coral fragment do you think is the best coral?

2

Why do you think it is the best coral?

Fragment number 2, had no signs or disease during the outbreak of White Band Disease and can withstand large temperature increase.

CCMI needs to outplant five of the coral fragments from the nursery frame, which five fragments would you recommend the scientists outplant (put back onto the reef)?

2, 4, 5, 3, 1

Explain why you have selected those five fragments:

These fragments are resilient or resistant to disease and can survive either a small temperature increase or a large temperature increase.



The Story of _____ THE SUPER CORAL
