ANSWER KEY

Become a CCMI researcher: Researching on the Reef – The Importance of Investigation

You may have heard the saying "what you don't know can't hurt you". In science, this statement is very inaccurate. If it were true, we wouldn't live the lives that we do today.

Scientific investigation enables us to identify what needs protecting and how we can do this. Therefore, not knowing is actually a very bad thing when it comes to the conservation of our planet. As you join CCMI throughout this lesson, we dive into the importance of research on the reef.

Become a CCMI researcher: Ocean exploration

Although we have been studying the ocean for a very long time, over 80% of the world's oceans are still unexplored. Some scientists even believe that we know more about the surface of Mars than we do about the oceans on our own planet!

This is because the deep ocean provides some very significant challenges to exploration including the huge amounts of pressure from the water above, and the absence of light. We need advanced technology to explore its deeper parts. For this reason, it's easier to send a person to space than it is to send them to the bottom of the ocean!

We know much more about the surface oceans, although these only make up a small fraction of the ocean, and there is always more to discover!

Complete your ocean explorer identification card below – making you an official CCMI scientific researcher!

Photo ID:

Official CCMI Ocean Explorer: Identification Card

My name is ___[name]___ and I think ocean exploration is important because Any reasonable answer e.g., "without knowledge of what exists, and the way things work, we wouldn't know when species needed protecting or how to protect them.

Become a CCMI researcher: Understanding the benefits of our reef

Investigating the world around us is very important. If we didn't know how coral reefs work, we wouldn't know about the many benefits they provide to us or how vital they are for supporting healthy oceans.

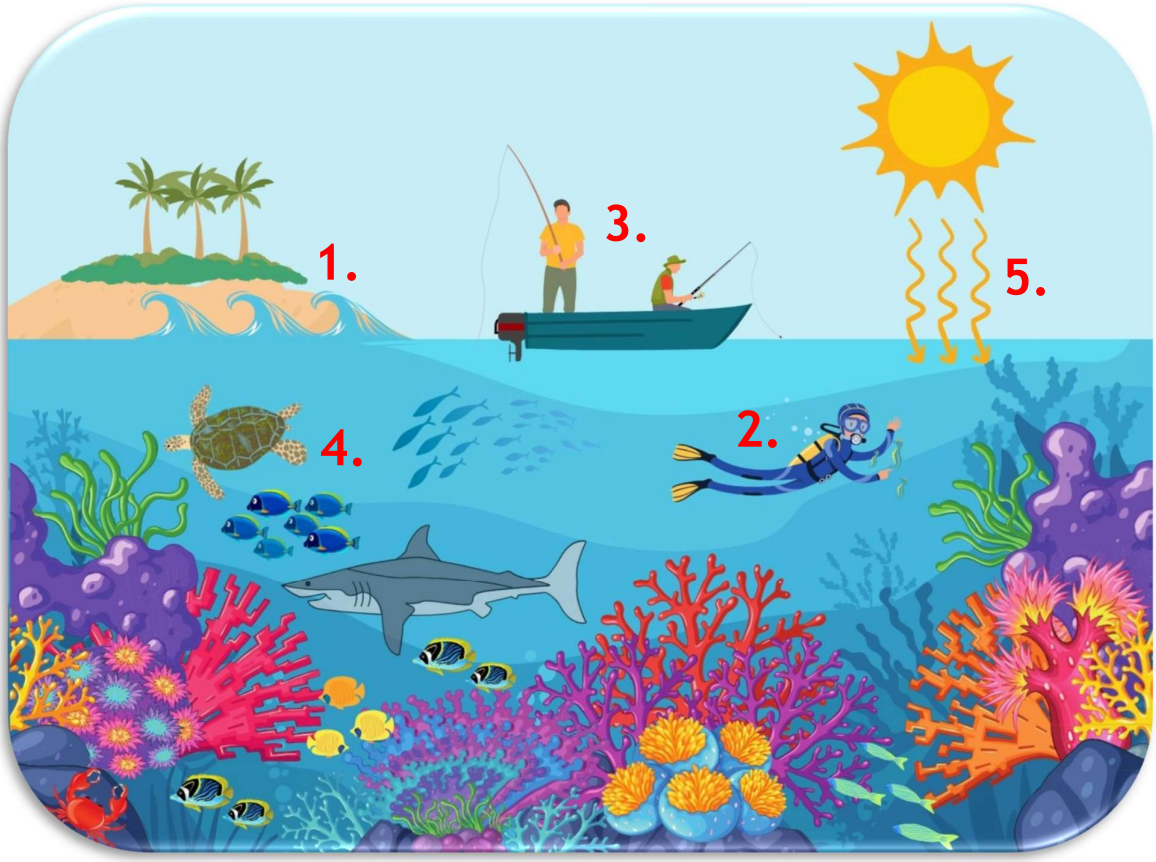
Without this knowledge, there might have been less urgency to protect coral reefs. We wouldn't even know *how* to protect them in the first place, and in fact, we may not know that they needed protecting at all!

Below we listed a few examples of coral reef ecosystem benefits, but some of the letters are missing! Help us fill in the blanks.

Clue: All missing letters are vowels!

1. C_O_AST_A_L PR_O_T_E_CT_I_ON - Coral reefs act as a natural barrier from storm surges and strong waves by absorbing wave energy.
2. R_E_CR_E_ATI_O_N AND TO_U_R_I_SM – Coral reefs provide exciting opportunities for snorkelling and scuba diving, attracting lots of people to come and see its beauty.
3. F_O_OD S_O_URC_E_ - Coral reefs support an abundance of fish and other seafood species.
4. B_I_ODIV_E_RS_I_TY H_O_TSP_O_T – Coral reefs are home to countless different types of plants and animals, attracting a wealth of different organisms.
5. CLIM_A_TE REG_U_LATI_O_N – The ocean absorbs heat from the atmosphere, helping to regulate the Earth's temperature.

Once you've filled in the blanks in the words above, label the image below with the numbers 1-5 where you can spot each of the matching ecosystem services.



Become a CCMI researcher: Threats to coral reefs and human impacts

In today's lesson, we learnt that coral reefs are sensitive ecosystems and they are impacted by human activities. As the human population grows, we need more food and water, more land for houses, and more energy to keep everything running. This can put a lot of strain on the environment and have negative impacts on the reefs.

What is causing our oceans to warm at a dangerous rate? Fossil fuels, including carbon dioxide, being released into our atmosphere, which gets trapped and causes the plant to warm up. The ocean absorbs this excess heat from the atmosphere.

Complete the crossword puzzle below about some of the major threats to coral reefs.

Down:

1. When increased levels of carbon dioxide from the atmosphere are absorbed by the oceans, making it more acidic

5. When corals get sick, like how we get sick

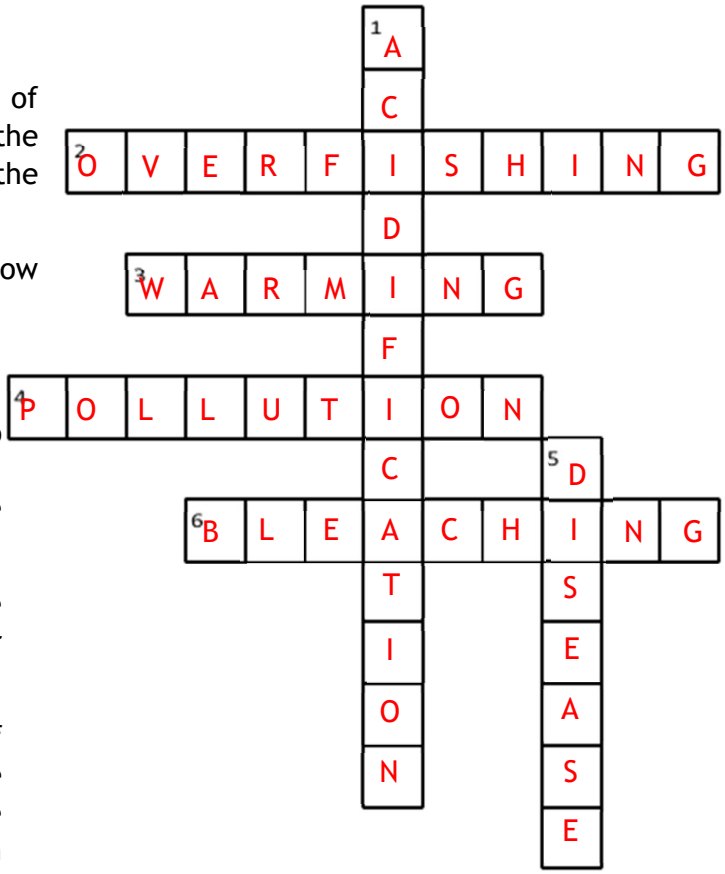
Across:

2. When humans take too many fish from the oceans, leading to population collapse of that species or area

3. A significant increase to the 'normal' temperate of our oceans

4. The introduction of contaminants into the environment which have negative effects. These can come from different sources such as faming runoff, plastic litter, chemical waste and sewage

6. The process of corals appearing white, due to the loss of algae living inside them



What is something you can do to have a ***positive*** impact on the reef?

An example from the lesson might be… "I will cut down my use of single-use plastic, like straws, plastic cups, and plastic bags and support local shop owners that use earth-friendly products."

Below is an underwater scene from a healthy reef. The corals are abundant and healthy with plenty of diversity of other species. If you see any familiar species in the image, label them!

Imagine that some of the threats we discussed earlier have now impacted this reef. Draw what you think the reef might now look like in the space below.

Image should have signs of damage e.g., less species diversity/ abundance, bleached coral etc.

Students might include human activities such as power plants and factory emissions, litter in the ocean etc.

Become a CCMI researcher: Using the scientific method

When scientists carry out an investigation, they follow a set of steps known as the **scientific method**. An example is provided below in relation to the sea cucumber research at CCMI. Fill in the blanks using the answer bank to support you.

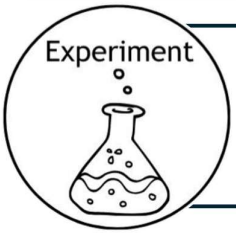
effect trap patterns investigation hypothesis exclude positive

Imagine you're on a dive. You notice lots of sea cucumbers around areas of large, healthy-looking coral. Now imagine you go to another reef that doesn't look so healthy. Here, you notice that there aren't any sea cucumbers. This is an **observation**.

After making this observation, you might want to **question** why this is, and whether there is a scientific explanation behind your observation. You might ask… "Do sea cucumbers have an effect on coral reef health?"

Once you have created a question, you need to find out whether other scientists have already answered it. If they have, you will want to identify gaps in knowledge and create new questions based on the missing information. If not, this is the perfect opportunity to begin the investigation!

Based on your **research**, you would formulate a **hypothesis** or prediction. This is where you suggest a likely answer to your question based off the information you already have. For example, we might hypothesise that sea cucumbers have a positive effect on coral health.



Now it's time to test your hypothesis by conducting an **experiment**! In our case, we use cages to either trap/ exclude or exclude/ trap sea cucumbers from an area of the reef and look at what impact this has on the coral.

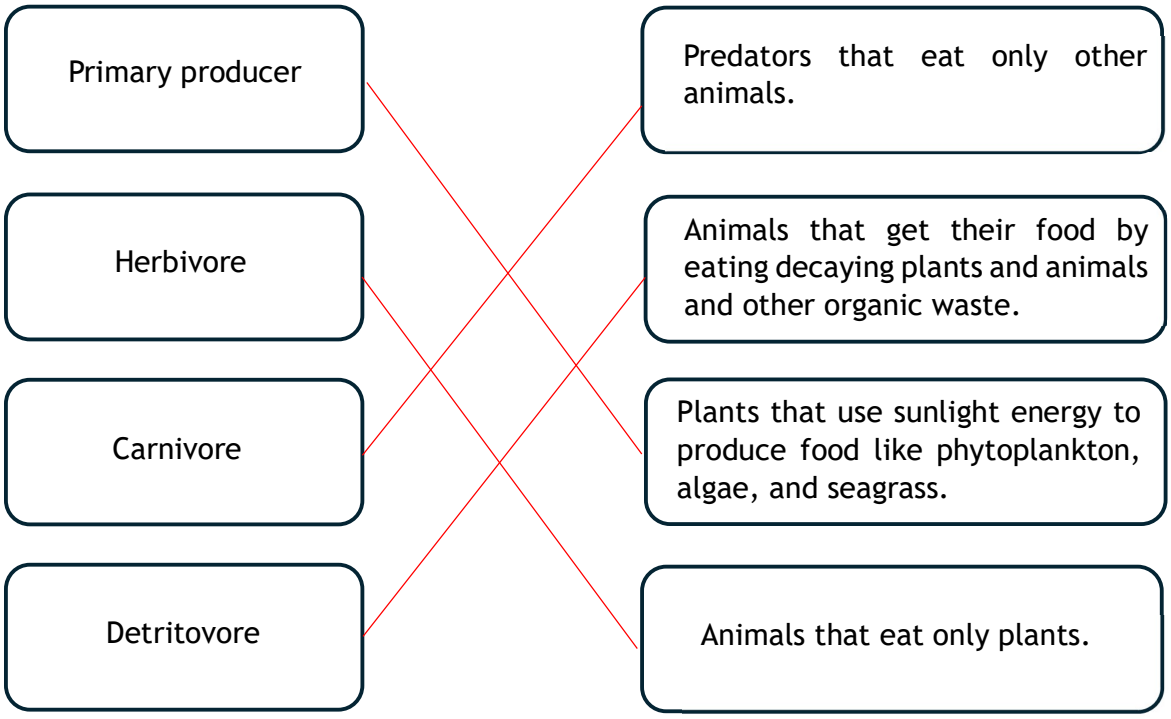
After we have conducted the experiment, we want to record and understand the **results**. This involves creating graphs and charts, which show us clearly any patterns that might be useful for us to see.

We now want to explain the results and draw conclusions from them. For example, the results from CCMI's sea cucumber study showed that corals growing in cages with sea cucumbers grew faster than corals growing in cages without. Your hypothesis was correct; you can conclude that sea cucumbers have a positive effect on coral growth.

Become a CCMI researcher: Food chains and food webs

Did you know sea creatures depend on each other to live and that they are connected in a **food chain**? A food chain is a visual image of who eats what. You can have more than one food chain in an ecosystem, and sometimes multiple food chains are connected. This is demonstrated through a **food web**. It gets its name because it looks like a big spiderweb, but instead of silk threads making the web, it's made up of arrows connecting various animals based on who eats whom.

In the lesson, we touched on some of the key players that make up a food web. Match the player (on the left) to its description (on the right).



With 'omni' meaning 'all' and 'vore' relating to eating, what do you think an omnivore is?
An animal that eats 'all food', meaning that they are not restricted to just plants or just animals – they can eat either/ both (like humans).

Next, cut out the cards on the next page and arrange them into a food web using string to connect each of the organisms.

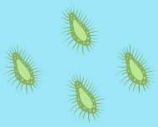
Once you've constructed a food web, imagine one of the species has been overfished. Demonstrate this by removing the card from the food web. What impact does this have? Think about what will happen to the organisms that eat that species and the organisms that are eaten by that species. Write your thoughts in the space below.

Predators of that species might decline as they have less food. Prey of that species might increase past natural levels because there is no natural predator keeping the population in check.

After you've completed this activity, feel free to use the cards to play snap with your friends at the end of the lesson!

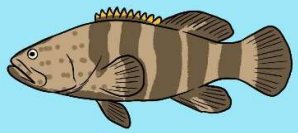
Instructions for snap: Take all the cards and shuffle them first. Hand out an equal number of cards to each player, without looking at what order they are in. Each player holds their cards face down and takes a turn to place a card face up in the middle of the table. If the same card gets put down twice, it's a race to see who can get their hand on the card pile first while saying 'SNAP!' This person gets to keep the cards, and you play again. If you run out of cards - you're out, and the winner is the only person left with cards at the end of the game.

Phytoplankton



Primary producer

Nassau grouper

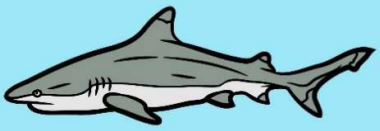


Carnivore

Algae

Primary producer

Caribbean Reef Shark

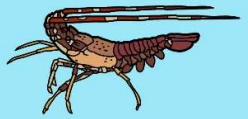


Carnivore

Moray Eel

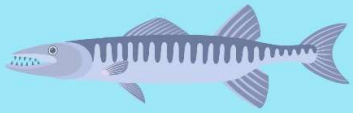
Carnivore

Spiny lobster



Omnivore

Barracuda



Carnivore

Stoplight parrotfish

Herbivore

Sergeant major

Omnivore

Shrimp

Omnivore

Yellow grunt

Omnivore

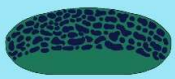
Barjack fish

Carnivore

Surgeon fish

Herbivore

Sea cucumber



Detritovore

Yellow-fin blue damselfish

Omnivore

Teachers note for food web construction:

Sharks should be at the top of the food web eating things such as moray eels and barracudas. The moray eels, barracudas, and Nassau grouper might prey on smaller fish such as the stoplight parrotfish, barjack fish, yellow grunt fish, yellow-fin blue damselfish, the surgeonfish, and the spiny lobster. These smaller fish and the spiny lobster should be shown as eating the shrimp and primary producers. The stoplight parrotfish and the surgeonfish should ***only*** *eat primary producers. Technically, sea cucumbers eat everything in the food web once it has died and decayed. Students might show this as being at the very top of the food web or they may connect it to all species.*