ANSWER KEY

Become a CCMI Oceanographer: Our Physical Ocean

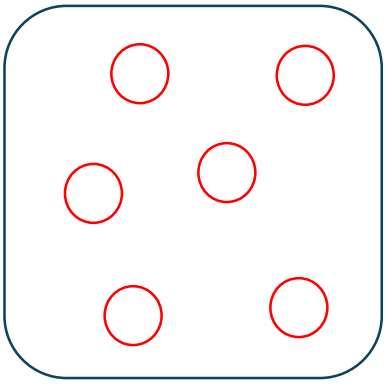
The physical processes of our ocean are the foundations of life in the sea. Once we jump under the waves, everything changes, from how gravity affects us to how we see and hear. Scientists that study these changes are called **oceanographers.**

Oceanography can tell us how life underwater differs from life on land and how these factors drive what species and habitats exist underwater.

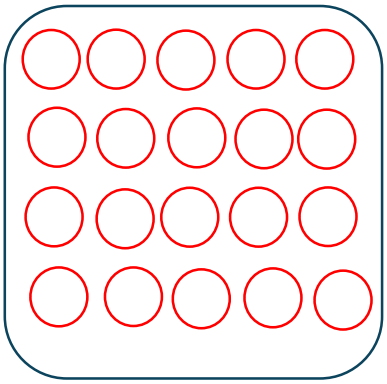
Become a CCMI Oceanographer: Understanding water density

As we've learned in today's episode, the density of water is much greater than the density of air. And this is to do with how **tightly packed** the water molecules are, compared to air molecules. Let's imagine molecules as jellybeans. In the spaces below, draw how you think a container full of air molecules would look compared to a container full of water molecules.

Container full of air molecules:



Container full of water molecules:

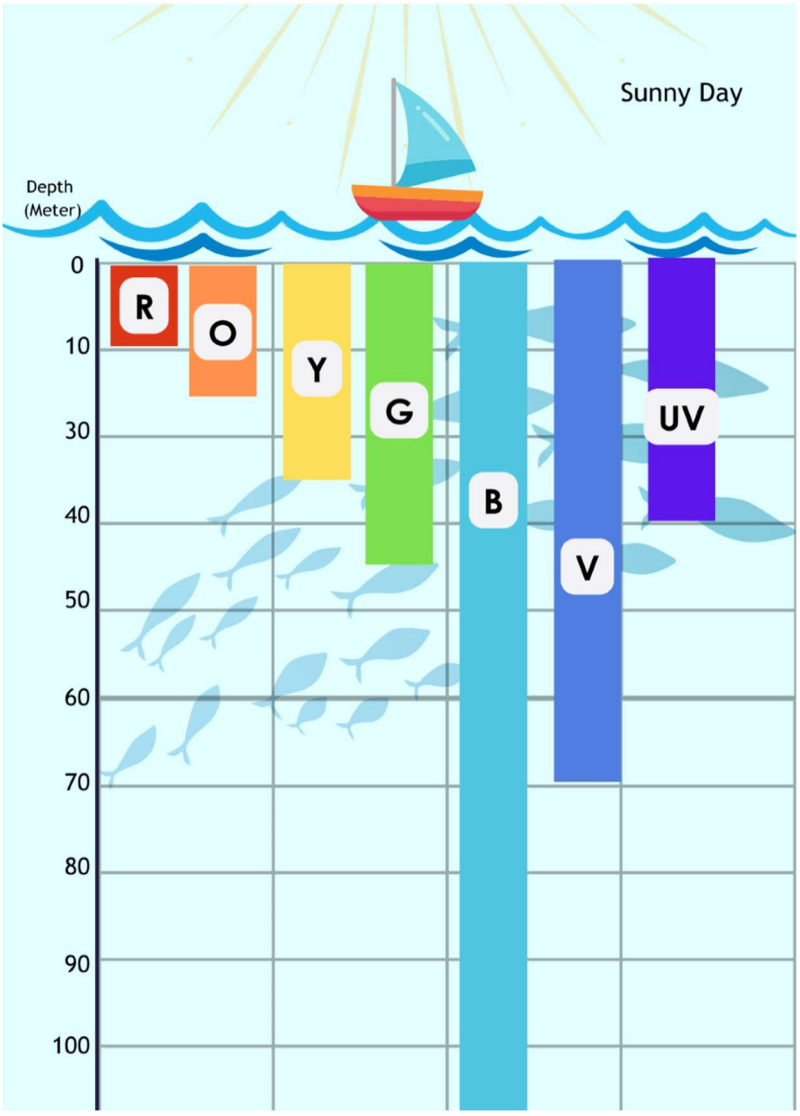


Note:

the 'jellybeans' can be in any arrangement, as long as there are fewer and they are more spaced-out in the air molecule container compared to the water molecule container.

Become a CCMI Oceanographer: Colour changes with depth

The light from the sun that shines down on us is made up of lots of different colours – red, orange, yellow, green, blue, indigo, and violet! As light passes through water, it is absorbed, and some colours are absorbed faster than others. Reds, oranges, and yellows are absorbed by the water fastest, meaning they are first to disappear. The picture below shows how far into the water each colour of light reaches before disappearing.



Using the picture to the left, answer the following questions:

1. What is the first colour to disappear, and at what depth does it disappear?
   Red, 10 m
2. What is the only colour we can see past 70 m?
   Blue
3. Why do you think some deep-sea animals are red in colour? Think about what benefits this would provide them.
   Red is a colour adaptation that deep-sea animals use as camouflage because red is no longer visible past 10 m. This enables red creatures to 'disappear' at depth.

Become a CCMI Oceanographer: How do we research sound?

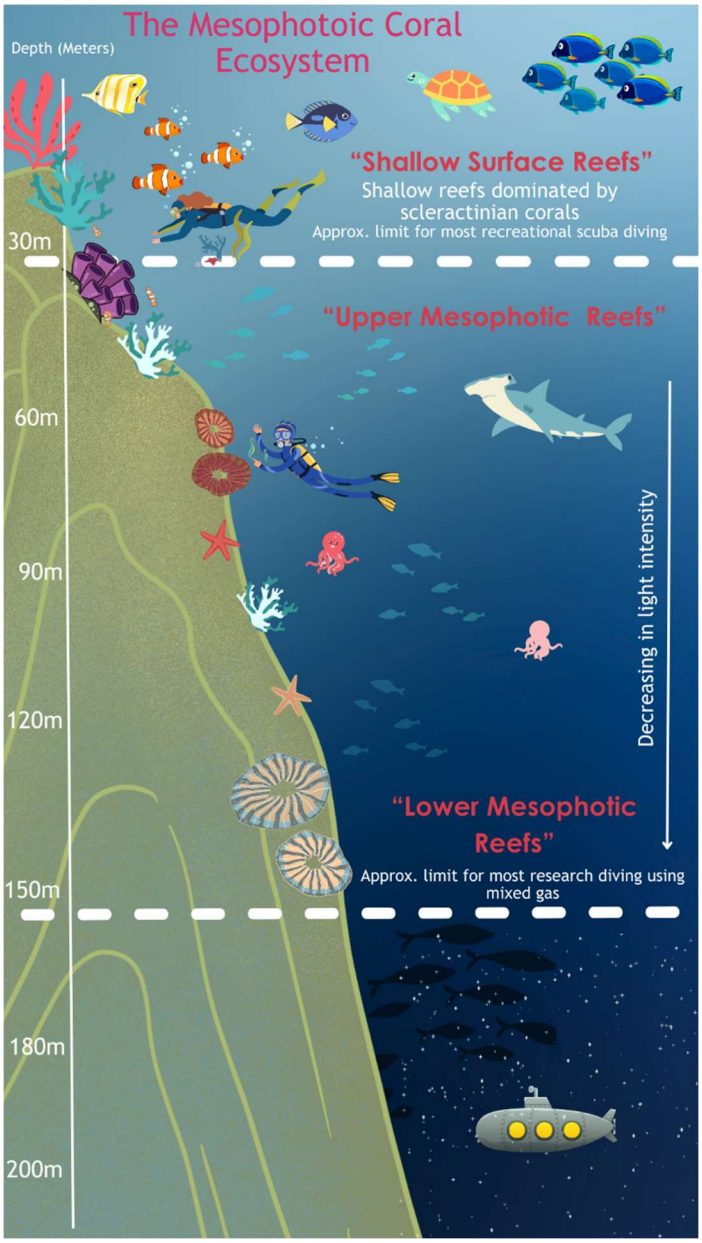
In this Reefs Go Live episode, we learned that light and colour decrease as depth increases. We also learned that the speed of sound has the opposite pattern - sound travels faster at increasing depths. This is because water becomes denser the deeper you go. Remember our tightly packed water molecules? Well, these become **even more** tightly packed in the deeper ocean due to the weight of water from above. Imagine a bag of jellybeans. And now imagine another bag of jellybeans being placed on top of it. The first bag of jellybeans will get squashed together. Sound travels faster in a denser (more tightly packed) bag of jellybeans because there is less distance for sound waves to travel from one jellybean to the next.

Sound is a very important tool used for marine species to communicate with each other, to find prey, navigate, and avoid danger.

In this episode, we discuss how fish have different ears to humans. After this section in the episode, describe the difference between human ears and fish ears.

Human ears are external whereas fish have internal ears called otoliths. They also have a lateral line across their body that detects sound waves.

Become a CCMI Oceanographer: Exploring deep and remote waters



As a scientific community, we know a lot about shallow, near-shore corals because they are easy to access and study. However, we know much less about coral reefs in deeper, remote waters. Special equipment and training are needed to access these areas, and so they are less understood. The picture to the left shows you where **mesophotic reefs** are found.

Questions:

With '**meso**' meaning 'middle', and '**photic**' referring to 'light' - what do you think the **mesophotic** zone is? And what do you think mesophotic corals are?

The mesophotic zone is the 'middle-light' zone – the area of ocean between brightly lit shallow waters, and deep, dark waters. Mesophotic corals are corals found in the mesophotic zone.

Do you expect water temperature to be warmer or cooler in the mesophotic zone compared to shallow reefs? Explain why.

Cooler because temperature decreases with depth

_____

_____

There is less research conducted on mesophotic reefs than shallow reefs. If you had the chance to ask our researcher Dr. Goodbody a question about the deep reefs, what scientific question would you ask?

_____

_____

Fun Fact:

At CCMI, researchers are exploring unchartered waters on seamounts around Grand Cayman. Seamounts are like underwater mountains rising from the seafloor, with their peaks as deep as 50 meters! These seamounts might be home to rich biodiversity with fewer impacts from human activity because they are further from the shore - potentially offering a safe space for Cayman's corals in the future!

Become a CCMI Oceanographer: Adaptations to ocean habitats.

Marine animals are adapted to the environments that they live in, and the specific conditions in those environments.

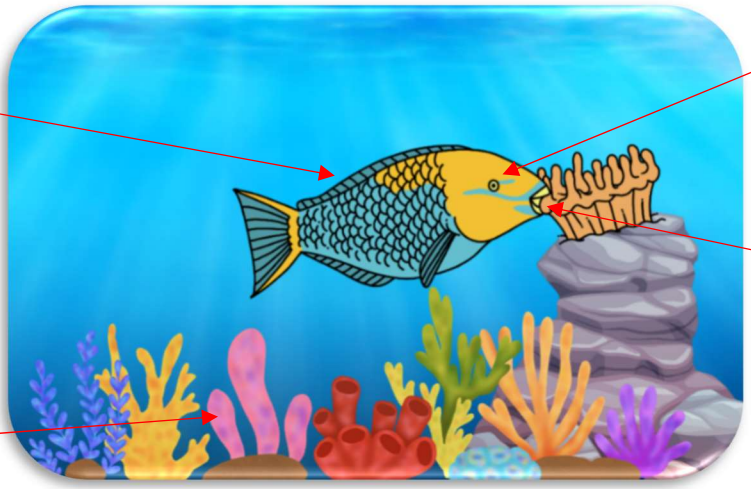
Let's play **Spot the Adaptation**. In the images below annotate the pictures with the adaptations that each creature has, to help them survive their habitat.

Spot the Adaptation – Reef fish

Hint: Reef fish are shallow-water animals, where light is abundant.

Small eyes as they live in well-lit areas

Flat, streamlined body to move through water, which is denser than air



Beak-like mouths to graze algae off corals

Bright colours to blend in with coral reef and hide from predators

Spot the Adaptation - Deep-sea fish

Hint: This is an anglerfish, which lives deep in the ocean. At depths of over 200 m, water is often dark and murky. Think about how this fish might find its prey and avoid predation in low-light environments.

Bioluminescent lure above its mouth to attract prey in food-deficient environments

Large eyes to see better in low-light conditions

Large mouths for prey-grabbing

Orangey-brown in colour – not visible at these depths so enables them to camouflage

Spot the Adaptation - Corals

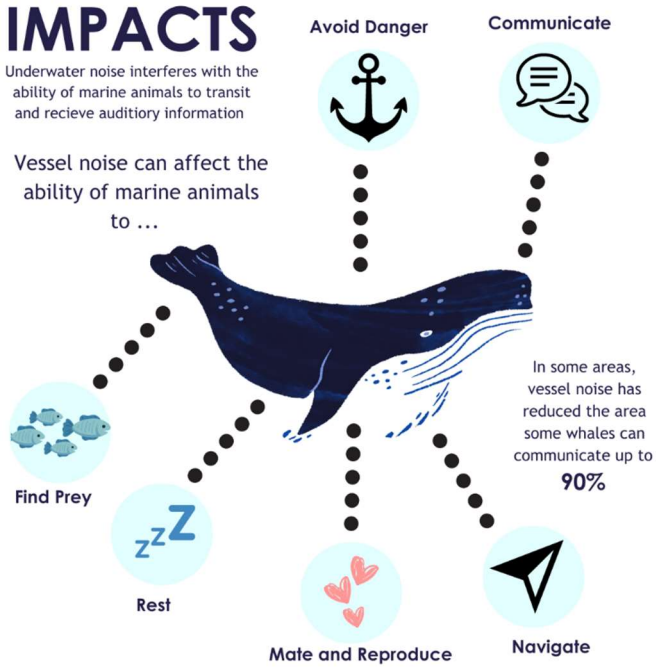
Hint: Shallow corals have plenty of light available to them, but mesophotic corals don't. Think about how they might change their body shapes to capture more light.

Flattened, plate-like shape to capture more light

Larger cells with chlorophyll to capture more light

Become a CCMI Oceanographer: Changes in species behavior in response to human activity

As we've seen throughout this episode, the ocean's physical properties, including light, colour, and sound all influence the adaptations of different marine creatures. Human activities, such as shipping, water sports, and pollution can interfere with these things.



Understandably, marine organisms prefer a quieter, relaxed ocean. CCMI demonstrated this during COVID, when human activity was greatly reduced in the George Town Harbour. It was found that fish health improved during this time, meaning that they fed, socialized, and reproduced better.

Let's pretend your classroom is an underwater habitat. Everything is normal. Draw your observations about the surrounding habitat as you currently see it:

Now let's imagine some sudden changes. All the electricity has suddenly gone out and you no longer have any light. Will this make class more difficult? **Make a note of the changes and draw your observations:**

Some more changes occur! The school bell is stuck on a loop with no way to turn it off. How will this affect your class? **Make a note of the changes and draw your observations:**

You might see that these changes to light and sound in the classroom can make learning more difficult and stressful. This is a comparison to how fish feel when there are changes to their environmental conditions.

The images the students draw should depict the classroom becoming more chaotic which would be more stressful for students.

Become a CCMI Oceanographer: Understanding the ocean's influence on weather and climate

As we come to the end of the episode, we now know that the ocean makes the world a habitable place to live. Can you fill in the blanks to the sentences below? Use the words from the answer bank to help you.

Ocean ecosystems are under threat from ___climate___ change and other ___human___ activities. Understanding our ocean helps us know how to ___protect___ it. Healthy marine environments reduce the impacts of climate change, protect our coasts from ___storms___, provide us with food, and maintain ecosystem ___balance___. Our ocean drives the planet's ___water___ cycles and controls global weather by absorbing ___heat___ from the sun. For this reason, we, as humans, need a healthy ocean to ___survive___.

storms		protect	balance	
	human			survive
heat		climate	water	