

GET TO KNOW

Deep Ocean Ecosystems

What to expect from this educational packet

This worksheet will teach you more about the deep ocean! Through this packet, you will:

- Learn about different species
- Explore Indigenous cultural connections
- Do some fun activities including drawing, making a diorama, and doing a word search
- Reflect on what you've learned with our discussion questions

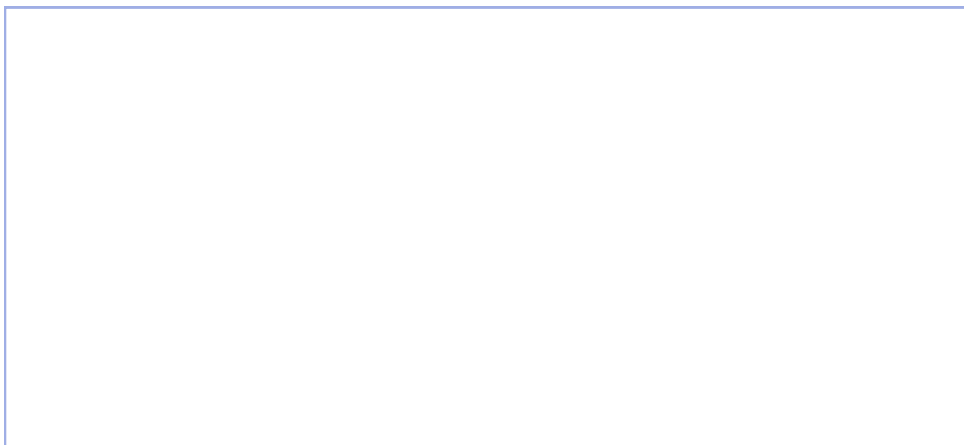
Introduction

The ocean covers about 70% of Earth's surface and contains more life than anywhere else on the planet. Its average depth is around 3,682 meters (12,080 feet). The deeper we go, the more sunlight fades away. One of the most mysterious and fascinating areas of the ocean is the abyssal zone, which lies between 3,000 and 6,500 meters (9,842 to 21,325 feet) below the surface. This zone makes up 83% of the total volume of the ocean.

In this dark and remote part of the ocean, beings rely on bioluminescence to navigate, communicate and avoid predators. The beings that live here are adapted to survive in high-pressure conditions, feeding on particles from dead plants and animals that drift down to the abyssal zone from the upper ocean. While the deep sea may seem distant from us, the ocean floor is a delicate ecosystem that faces harmful impacts from fishing, deep sea mining, and the oil and gas industry.

What do you know about the deep ocean?

Write down some facts you know about this ecosystem, and come back at the end of the worksheet to see what you can add!



Meet some deep ocean species



Ghost Octopus

The ghost octopus, also known as Casper, is a pale and mysterious octopus that was recently discovered in 2016. The ghost octopus has a ghostly white color and is said to have a gelatinous (jelly-like) consistency due to the difficulty of finding food and building muscle in the deep ocean. One of the most fascinating things about the ghost octopus is how they reproduce: they will attach a clutch (a group) of about 30 quarter-sized eggs to the stalk of a dead sponge. After the clutch is attached, they'll wrap their whole body around the eggs and stay there for several years. They'll forego food and slowly wither away until the eggs hatch and the octopus dies.



Black Dragonfish

The black dragonfish or stoplight loosejaw (*Malacosteus niger*) is a saber-toothed fish with an enormous mouth, and two different kinds of bioluminescent organs located below each eye. One of these light-producing organs is green and the other is red. There is very little light in the deep ocean where the black dragonfish lives, so producing green and red light increases their ability to see and attack their prey. The red organ is most important because most species at such a depth cannot see red light, giving this fish the unique ability to hide behind its long-wavelength red light.



Sperm Whales

Sperm whales (*Physeter macrocephalus*) live in all the deep oceans of world. Because it is so dark in these waters, sperm whales rely on echolocation to hunt. The special gland in their head that contains a waxy oil called spermaceti helps them focus sound. They have the largest brain and the longest intestinal system in the animal kingdom, which they need to digest their prey, which includes giant squid. Despite their 52 cone-shaped teeth, sperm whales can't chew!



Deep Ocean Anglerfish

There are over 200 species of deep-sea anglerfish, all of which have a few features in common. Food may be scarce and hard to see so far under the water's surface, but deep ocean anglerfish have evolved to survive in fascinating ways, such as using their bioluminescent lure to attract prey. The lure is an adaptation of the long dorsal fin ray that resembles a fishing rod extending from their head! The lure contains an organ called an esca, which contains glowing bacteria called photobacterium. The photobacterium live in the anglerfish's esca and, in exchange, gain protection and nutrients. By wiggling the esca, the anglerfish attracts prey into its large mouth. A few different types of anglerfish include the *Cerastias holboelli*, *Melanocetus johnsonii*, and the *Cryptopsarus couesii*.



Deep-Sea Skate

The deep-sea skate (*Bathyraja abyssicola*), is a relative of the shark and the ray. They have a flattened body with a pointy snout and swim with their large, wing-like pectoral fins close to the ocean floor. The tail is long and whip-like, used for balance and steering. Deep-sea skates lay their bright yellow egg cases near warm hydrothermal vents, where the warm water speeds up the development of the embryos inside. They will primarily feed around the abyssal plains where they can find seafloor-dwelling prey. With their burrowing behavior, these flat fish play an important role in moving, mixing and changing the soil and sediment of the ocean floor (a process called bioturbation).

Exploring Indigenous cultural connections

When learning about environmental science, cool places and the plants and animals that inhabit them, we believe it is equally as important to understand the ways humans have lived in relationship with these lands and beings since time immemorial. Indigenous stewardship has adapted in many ways with increased climate impacts across the landscape. Sierra Club BC aims to honor Indigenous voices and to ensure that unique Nations and worldviews are respectfully acknowledged.

While we've shared some publicly available resources below as a starting point, it's best to engage with local Indigenous communities. Each Nation has distinct perspectives, cultures and governance systems, meaning that different communities will have different connections with the ocean. Many Nations have websites with a wealth of publicly shared knowledge that you can check out, or you could attend a public event hosted by the community. If you don't know whose territory you live on, you can visit Native-Land.ca to learn more.



This next section includes website links for deeper learning. To explore these resources, please visit sierraclub.bc.ca/deep-ocean-resource



Intertwining stories and language

Different First Nations have different words and stories for the deep ocean. The Haida term for deep ocean is Tang.gwan. In the Nuu-chah-nulth language, the word ḥačxwíqak means “the deepest part of the ocean”. Many First Nations, such as the Heiltsuk People, have always understood the ocean as a sacred and vulnerable place. [λάλίyasila Frank Brown, the Heiltsuk Hereditary Chief, says](#), “The ocean covers 70 percent of the planet, it stabilizes our atmosphere, the air we breathe, it's the biggest carbon sink on the globe. Our people have always known and always said — ‘everything is connected’ — and it's not just a philosophical notion. It's based on a deep and profound understanding of the interconnectedness of life and our interdependency.”

Learn how to say fish in the language of the Indigenous community on whose territory you live

Visit FirstVoices.com to find words, songs and stories about the deep sea from different First Nations.

Activities

Draw the deep sea!

With this activity, we encourage you to draw deep ocean beings and their habitat. If you'd like a tutorial, you can watch our *Learn to Draw Deep Ocean Ecosystems* lesson with the QR code above or visit sierraclub.bc.ca/draw.

Watch a tutorial
on how to draw
deep sea species



Make an ocean mobile

We are bringing marine ecosystems to our homes by making deep ocean mobiles! Mobiles are sculptures made from suspended objects that balance and hang freely. For this activity, we are getting crafty and using materials we already have laying around!

For this activity you will need:

1. **A frame to hang your mobile.** Coat hooks, embroidery hoops, sturdy wire, and even sticks will work!
2. **String or wire to connect the creatures.** Fishing line, twine, or yarn also work great for this step.
3. **Attachments to connect your creatures to the frame.** There are several ways to attach your deep ocean creatures to the mobile frame. You can tape or glue the string wire to your creations or sew the creatures together with a needle and thread. For a more temporary mobile, you can use clothespins.
4. **Deep ocean beings.** Take inspiration from the deep ocean beings you learned about and try to create them with materials you have.
 - a. Cardboard cut outs: Cut out shapes from cardboard to create creatures like deep-sea corals, sponges, or even bioluminescent jellyfish. Paint them vibrant colors or use markers for intricate details.
 - b. Sewing: Repurpose old socks or unused clothing to sew together your very own anglerfish or octopus! You can draw extra details using markers, and stuff the material with fabric scraps (or another sock) to give it depth and dimension.
 - c. Plastic bottles: You can cut and paint empty plastic bottles to make sea anemones or sea urchins.
 - d. Plastic toys and figurines: Repurpose old plastic toys and figurines to resemble sea creatures. Simply paint over them to transform them!
5. **Optional Decorations:** Sequins, glitter or glass beads can mimic the shimmer of ocean waves or bioluminescence. Tissue paper can be used to create seaweed, kelp or deep-sea plants. Pompoms can look like jellyfish or bubbles!

Instructions:

1. **Create your frame.** Choose your base and shape it to your desired size.
2. **Make your deep ocean creatures.** Use your imagination to craft a variety of creatures. Paint, sew or cut your materials into deep-sea dwellers, big and small. Aim for at least 5-7 different beings for a diverse and balanced mobile.
3. **Attach your creatures.** measure out lengths of string or wire and securely attach it to your creatures. You can either tape, glue, sew or use clothespins to secure them.
4. **Hang your mobile.** Once all your ocean creatures are ready and attached, hang them from the frame at varying lengths to create a balanced and dynamic look, just like floating fish in the ocean. You will need to do some balancing practice to hang your creatures so that the mobile is evenly balanced. Use more string or wire to hang the mobile from the ceiling.
5. **Add extra flair!** Add more decorations like glitter or tissue paper for more texture and detail.
6. **Now step back and admire the deep ocean coming to life in your home!** Your mobile will gently sway with the air flow in your home, just like the creatures of the sea moving with the current. Hang it above your desk, bed or window as a beautiful reminder of our mysterious and fascinating ocean friends!

Make a deep sea diorama

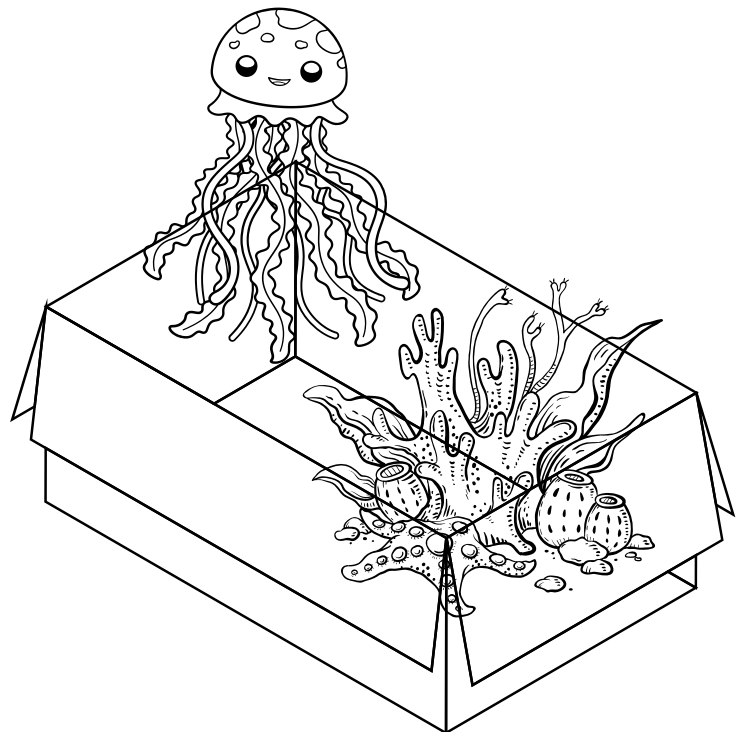
Try out this deep-sea diorama activity, on your own, with your family, or with your class! For this activity, you will need a shoe box, some craft supplies, and a deep-sea landscape in mind. Choosing between hydrothermal vents, cold water reefs, and abyssal plains, try to create a diorama of the landscape.

For this activity you will need:

1. **Recycled materials around your house.** Can an egg carton become the base of your cold water reefs? Can paper towel rolls become hydrothermal vents? Is there any old crumpled up paper for the sea floor?
2. **Try to recycle your plastics!** A lot of plastics can end up in sea ecosystems and harm plants and animals in the ocean. Try to use any plastics you find to create parts of your landscape.
3. **Old fabrics lying around your house!** These can bring color to your landscape! Try to find bits of bright blue for bioluminescence, and some light browns for the sand, and get creative!
4. **Try to make sea life through compostable paper mache.** There are many resources online that teach how to make zero-waste paper mache. Try to create sea life mentioned in this resource for paper mache building!

Instructions:

1. **Choose your landscape.** Choose between hydrothermal vents, abyssal plains or cold water reefs. Look up pictures online if you need a point of reference.
2. **Do a little research.** Read through this packet and find out any beings that live in the area of the sea.
3. **Start creating!** Try to be as creative as possible, start building up your base with your recycled materials.
4. **Add extra flair:** Adding more decorations like glitter, easy-bake clay, or tissue paper can add more detail to your diorama.
5. **Now step back and admire the deep ocean coming to life!** If you feel up for a challenge, try to add in multiple landscapes of the deep sea, with beings not listed in this worksheet! What can you change or add to make this a more dynamic landscape?



Deep Ocean Ecosystem

WORD SEARCH

U A I B M W O X V R W R R E D E P T H G X C O S X S U V R T
X L R O C B H A U F B S I O X E P J Y Q V R E B R E L R D Y
Y T K W R D T R O C I W J D Q U C W N R Q E Y K J A C K Z N
C Q X H Q K K K X D O I Y Y L Z R K G Y X A J J K F Q Z X U
Q M P A K I I J X S L M K O C G S G Q B T T Q F U L M J U T
V F F L L U E J R Y U M E O C E A N I C K U X G B O A T O M
G P I E A R K B H I M I F S O O J N Q D V R U S R O B S P G
K J N H W I A Q C R I N L I C S M Q R R L E G W S R Y S R X
A N E U C R U U N U N G D R A G O N F I S H G T W C S A E A
Z I K L N V I J C R E D D S T P D E E P S E A V A D S L S B
S U G Q L G T G S K S B P Q E H B T E N T A C L E S O T S Y
U C R R C Y D M K P C E N H B T T E R Y A D Q G Z L P W U S
N M K P K F F M R T E J J P W E Y O D N K P J A Q I E A R S
L O B Q U W U I R G N R Q P Y V Y V Y P I L F L M I L T E Z
I S B H R W U O S E C L M F A K D I M A G Y R U N M A E E R
G V Q S H I L X X H E J F A H Q A I F D H L L D W Y G R A W
H O U U A H W J A N U D T X C R A N G L E R F I S H I I X E
T O Z Z I T B L H F R B Z W S E U P M J I M U V U Y C R S U
V Y Y D F D O Z O N E J I Q E B T R L B E V F B U E H Y Q V
B V Z Q K J S F W J W P Z B A Q K I Y J N F I T D B T O J P

Bioluminescence: The ability of deep ocean organisms, such as anglerfish and jellyfish, to produce light through chemical reactions

Abyssopelagic: The oceanic zone that extends from 3,000 to 6,500 meters below the surface, where no sunlight reaches and only a few creatures are found

Spermaceti: A waxy oil created in the special gland of the sperm whale that helps them focus sound

Tentacles: Appendages, often on squid, for grasping and moving about

Swimming: Motion that allows animals to move underwater

Depth: A measure of distance from the top to the bottom of something

Oceanic: Of, or relating to the ocean

Abyss: A deep or seemingly bottomless chasm

Jellyfish: Sea animals with a soft, jelly-like body and no bones

Sunlight: Light from the sun

Creature: An animal, distinct from a human being

Deepsea: The point in the ocean where light starts to fade (approximately 200m deep)

Squid: A soft-bodied ocean animal with six tentacles

Zone: Another word for a specific area, in terms of the ocean it refers to depths

Anglerfish: A deep sea creature that attracts prey through a bioluminescent lure

Dragonfish: A deep sea creature with two types of bioluminescent organs

Saltwater: The type of water found in oceans and seas

Seafloor: The bottom, or "ground", beneath the sea

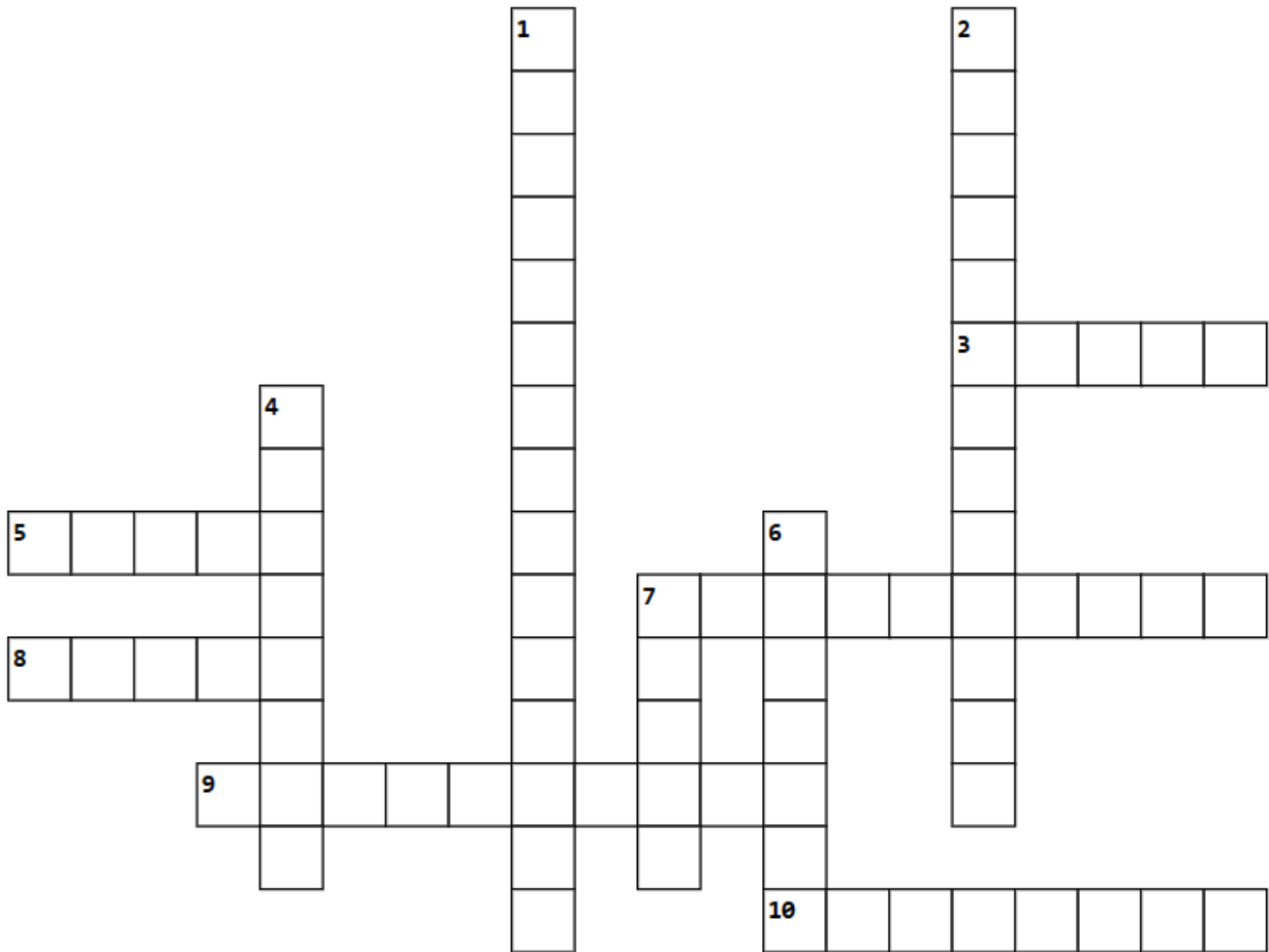
Whale: A large marine mammal, notable for their size and calls

Pressure: The force exerted by the weight of the water column above a certain depth

Fin: An appendage useful for mobility of underwater animals

Deep Ocean Ecosystem

CROSSWORD PUZZLE



Across

- 3. The body of saltwater that covers approximately 70% of Earth's surface
- 5. The largest and oldest animal on Earth, has a horizontal tail fin and a blowhole on the top of the head for breathing
- 7. A waxy oil created in the special gland of the sperm whale that helps them focus sound
- 8. A deep or seemingly bottomless chasm
- 9. A black saber-toothed fish with an enormous mouth and two different kinds of bioluminescent organs
- 10. The solid ground at the bottom of an ocean or sea

Down

- 1. The ability of deep ocean organisms, such as anglerfish and jellyfish, to produce light through chemical reactions
- 2. The oceanic zone that extends from 3,000 to 6,500 meters below the surface, where no sunlight reaches and only a few creatures are found
- 4. The force exerted by the weight of the water column above a certain depth
- 6. Animals that live on the seafloor, most of these animals lack a backbone and are called invertebrates
- 7. An elongated, fast-swimming sea creature with large eyes, eight arms and two tentacles

Answers: 1. Bioluminescence 2. Abyssopelagic 3. Ocean 4. Pressure 5. Whale 6. Benthos 7. Spermaceti (across) 7. (down) Squid 8. Abyss 9. Dragonfish 10. Seafloor

Discussion questions

Write down your thoughts and reflections to the questions below.

- We are all connected. In what ways are you connected to the deep sea?
- There are many misconceptions about deep sea life. How does learning more about deep sea life change your perspective on it?
- When something goes missing, who is going to take its place? If all the life in the ocean were to disappear what would happen to our systems?
- Every being in the deep ocean ecosystem matters. What is our collective responsibility to these beings? What can we do to help ensure they are safeguarded?
- What lessons can you learn from animals like anglerfish, sperm whales, and ghost octopuses?
- What is a belief or worldview you have that helps to make room for a caring future?

Keep learning with us!

We wanted to express our sincere gratitude to all those who helped breathe life into this work.

To explore our resource list and additional learning materials, we invite you to visit sierraclub.bc.ca/deep-ocean-resource.

