Educator's Guide:

Looking For Life In The Deep Ocean

How would you study the mysterious creatures living in the deepest, darkest parts of the ocean?

Total Time: 60-90 minutes (Can be broken into 2-3 sessions.)

Ages: All ages; children under ten years of age should have an adult or teen helper

Hook

What do you do if you need to understand and identify something without using your sight? How would you do that?

- **Time:** 5 minutes instruction. 10-15 minutes of exploration. 5-10 minutes discussion. Total 20-30 minutes, depending on the age of participants, the complexity/number of the objects, and the total time available.
- **Summary:** Learners will try to identify and describe all the items in a bag using only their sense of touch.
- **Materials:**
    - Paper lunch bags (one per team of 2-3 learners). *Note: You may want to staple or clip the bag closed.*
    - 5-10 small objects
    - Blindfold (optional)
    - Paper and pencils to record observations
    - *Safety note: Make sure nothing is sharp. No pins or scissors, for example.*
- **Preparation:** Prepare lunch bags (1 per team of 2-3 learners) with 5-10 small objects, such as a toy car, a pink eraser, a marshmallow, a capped pen or marker, a house key or car key, coins, etc. Ensure all the items are everyday items kids are familiar with. Try to vary the textures and sizes of the objects.

- **Activity:**
    - Distribute the bags to each group. Tell them not to open the bag at this time.
    - *Explain:* There are several items in your bag. You need to identify them all as precisely as you can. To do this, you can only use your sense of touch. You may not look inside the bag at any time. You will each take turns reaching into the bag, grabbing an item gently, and describing it to your team. Your team will take notes, and you will try to figure out what you are holding. The following person will attempt to identify something in the bag without removing the item. Try to figure out how many things there are and what each one is in the time you have.
    - Learners will take turns trying to identify items. Encourage them to take notes or make sketches. They can use previously collected information to help them gather more information. Encourage them to be as specific as possible. Suppose they discover a key. Ask them to describe the bow, tip, and blade in as much detail as possible. If they discover a coin, ask if they can determine the denomination.
    - After the allotted time has passed, reveal what was in the bag.
        - How close did learners come to identifying everything?
        - What was easy to identify? Why?
        - What was challenging to identify? Why?
        - What would have made it easier to accomplish this task?

Design

95% of the ocean is unexplored. After 1,000 meters, there is no light, the temperature drops to 39 degrees F, and the pressure is up to 110 times that on land. These ecosystems are incredibly specialized, but they are also in danger. Many species in the deepest parts of the ocean are at risk of extinction. So scientists want to understand them and how they live before they are gone forever. Imagine you are a marine biologist and want to study the Giant Squid and other animals that live in the deepest, darkest, and coldest parts of the ocean. How would you do that? What would you build to make it possible to explore those dangerous waters?

- **Time:** 5 minutes instruction. 5 minutes of research (questions and/or video). 25-35 minutes design and build. Total 35-45 minutes, depending on the age of participants and the time available.
- **Summary:** Design and prototype or model a piece of equipment that will allow you to study organisms on the ocean floor at least 10,000 feet (about 3,000 meters or just under 2 miles) below the surface
- **Materials:**
    - Video
        - The Giant Squid's Biggest Mystery (Science Friday, 5:09 min)
        - Deep Ocean Creatures (NOAA, 1:48 min)
        - Deep Sea Dive (NOAA, 3:37 min)
        - The Deep Ocean (NOAA, 2:03 min)
        - Additional NOAA Marine Life videos
    - Diagram of the ocean floor (optional)
    - Blank or graph paper
    - Pencil
    - Ruler (optional)
    - Scissors
    - Safety cardboard cutter (optional but suggested; older learners may use a craft knife)
    - Tape (clear, masking, duct)
    - Glue (white craft glue or hot glue, depending on the age)
    - Scrap cardboard
    - Upcycled or scrap items such as toilet paper tubes, drinking straws, paper plates, plastic water bottles, chopsticks, leftover yarn or string, etc. Get creative!
    - Foil and/or plastic wrap (optional)
    - Paint and/or markers (optional)
- **Preparation:** Prepare the video clip if desired. Prepare an image of the ocean floor to demonstrate depth, if desired. Cut the cardboard into manageable pieces. Set up safety zones for cutting and hot glue gun use. If working with younger learners, precut tape into manageable lengths and attach it to paper plates.

- **Discussion:** After the engagement activity and a short video, ask learners questions, such as:
    - What kinds of organisms might you find deep in the ocean?
    - What types of things would you want to know about them?
    - How can you safely collect information (data) about these organisms?
    - How can you collect samples of these organisms? Would it be ethical and safe to collect samples of these organisms? Why or why not? How can you collect samples ethically?
    - How can you get that information or those samples from the ocean floor to the surface? What form would that information take?
    - What aspects of the deep ocean may make it challenging to collect data or samples?
- **Activity:**
    - **Requirements:** Your invention must collect either data about deep ocean organisms or samples of them. It must be able to send that data or samples to the surface so scientists can analyze the information. You must create a drawing, model, or prototype of your invention. (*Note: You can set expectations based on age, time available, and inclination.*)
    - **Constraints:** You may only use scrap or recycled materials for your model or prototype. It should be large enough to demonstrate your idea clearly. You do not have to do a sketch first, but it is recommended. You will have up to 25-35 minutes to build.

Share

- **Time:** 5-15 minutes to share and discuss.
- **Summary:** Learners will share what they designed and offer feedback to one another. Try the two stars and wish method: Have learners offer two things they like about another team's design and one thing they wish was better.
- **Activity:**

- If time permits, encourage learners to visit other teams to see what they have designed and built.
- Ask questions about the process:
  - What was the hardest part of the challenge? Why?
  - What was the easiest part of the challenge? Why?
  - What is your favorite thing about what you made?
  - What would you improve if you were to keep designing?

Deeper Dive

Want to keep learning about the deep ocean's mysteries (and science)? Try these activities next!

- High Pressure in the Deep Ocean: Everything in the deep ocean is under a great deal of pressure. At any depth in the ocean, the weight of the water above pushes on any object below it. To explore the ocean floor, scientists and explorers must first overcome one of the biggest challenges of deep ocean exploration: extreme pressure.
- ROVs: The Swiss Army Knife Of The Ocean: The deep blue ocean is dangerous and hard to get to for humans. Remotely operated vehicles, or ROVs, are robots specially created for ocean exploration that are tethered with steel and fiber optic cables to a control vehicle on the ocean's surface. These versatile machines keep deep sea explorers above water where it's safer, but is operating an ROV really just like operating a big remote control car?
- Design A Device That Can Safely Collect A Jellyfish: The jellyfish in the ocean share a number of characteristics with the jelly in your refrigerator. And that's a pretty big problem for scientists who study jellyfish. How do you catch and hold a fragile blob creature without crushing, squishing, or damaging it in some way?
- How Do We Keep Microplastics Out Of The Ocean? Filtration, Naturally.: Model a bioretention cell! Experiment to understand how microplastics are getting in the ocean—and the ocean food chain.
- Interpret The Impacts Of Rising Ocean Temperatures On Ecosystems: Where do fish go when the water gets warm? It depends on the species.