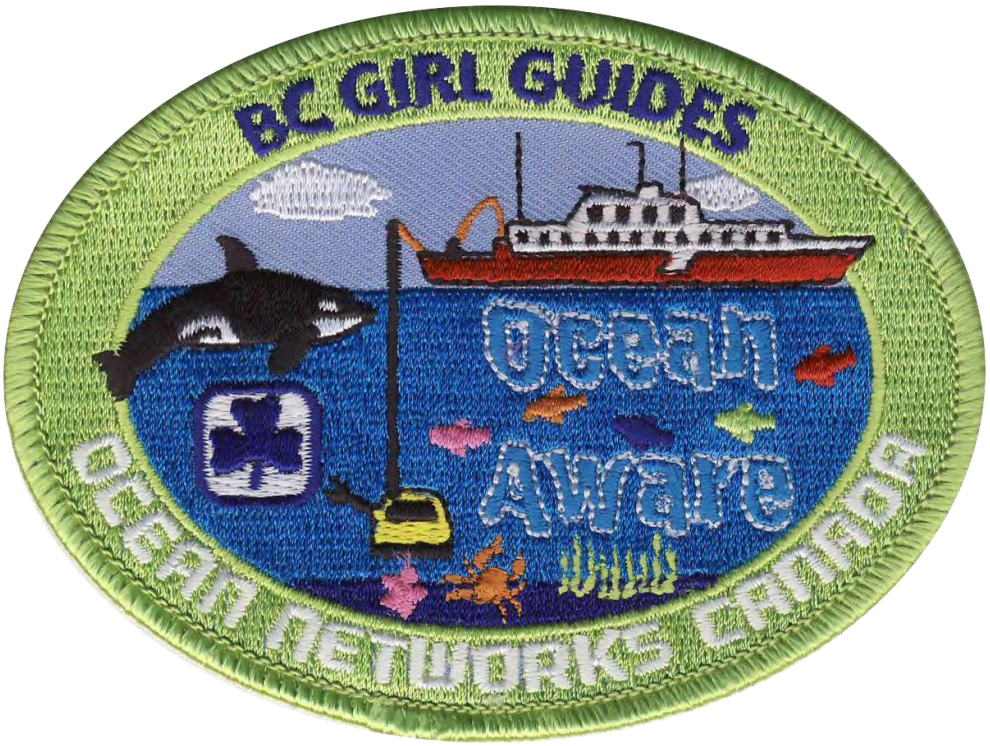
OCEAN AWARE CHALLENGE

AN OCEAN LITERACY CHALLENGE
FROMOCEAN NETWORKS CANADA &
THE BC PROGRAM COMMITTEE



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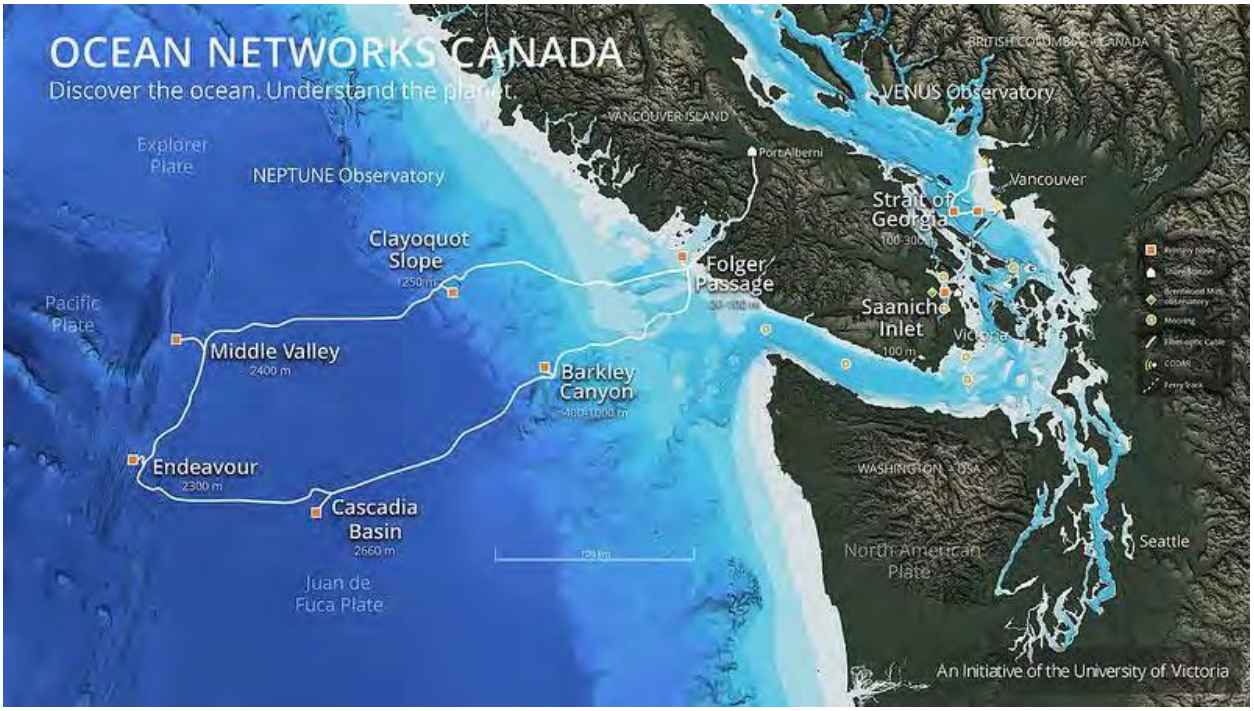
INTRODUCTION TO THE OCEAN AWARE CHALLENGE

Welcome to the Ocean Aware Challenge! This challenge is a joint project between Ocean Networks Canada and the BC Program Committee, Girl Guides of Canada - Guides du Canada. This challenge is designed to bring the ocean to girls and Guiders everywhere. Don't worry if you've never been to the ocean (or don't know a thing about it!) this challenge has been designed to help you explore the ocean in a fun, interesting and non-threatening scientific way, without needing any prior knowledge (or even access to the ocean!). A major part of this challenge is simply to get you thinking about the ocean in a new way, whether it's five minutes or five days away.

Who is Ocean Networks Canada?

Ocean Networks Canada operates the world leading NEPTUNE and VENUS ocean observatories for the advancement of science and the benefit of Canada. These observatories sit on the seafloor and collect data from the ocean over long periods of time (such as temperature and salt content). This data is used by scientists, teachers and students all over the world to better understand the waters off BC's coast. These observatories collect data continuously and are used to support ocean research in a way not previously possible.



Challenge Objective

This Ocean Aware challenge is designed to get girls and Guiders thinking about the ocean in new and innovative ways, while exploring the principles of ocean literacy. Through this challenge, we hope to create a growing awareness, understanding and curiosity about the ocean, Ocean Networks Canada, and the seven principles of ocean literacy – regardless of where you live. Everything you find in this challenge will help you explore marine science though hands-on activities, observations and exploration – without boats, life jackets or even having to visit the ocean (though visits are encouraged)!

About this Booklet

This booklet contains two activity sections. The first section outlines the principles of ocean literacy and suggests some activities to explore each principle. The second section contains detailed instructions for the activities, crafts, experiments and games which will help you to explore ocean science, marine conservation and the ocean environment. You are also welcome to substitute your own activities which meet the learning outcomes for each principle, or add your own ocean-themed activities, if they inspire you. Where possible, activities have been linked to specific elements of the Girl Guide program (see the *Program Connections* section below).

Ocean Literacy

An association of groups and people, interested in studying, protecting and conserving the ocean, created the principles of Ocean Literacy. Sponsors of Ocean Literacy include National Geographic, the National Oceanic and Atmospheric Administration and Oceans for Life Initiative. Ocean literacy is defined as "**an understanding of the ocean's influence on you and your influence on the ocean".** Each of the essential principles is supported with several different concepts and ideas to help understand the role of the ocean on Earth. In this challenge, girls and Guiders are encouraged to become 'ocean literate' by exploring each of the seven essential principles.

The seven principles of ocean literacy are:

Challenge Requirements

To earn this challenge, you are asked to complete activities from each of the seven principles of ocean literacy. All levels of Guiding must complete at least one activity from each of the seven principles, plus additional activities, from any of the principles, to meet the total requirements. Note that Rangers and Adults can also earn the challenge by leading a younger group through it.

The challenge can be completed over a couple of unit meetings, a day camp, a sleepover or a full weekend camp. Of course, you are also encouraged to explore the ocean in a way that works for you – either using the activities listed or completing other activities that meet the principles. How you choose to approach each meeting is up to you, just be sure to explore science and have fun!

If possible, you may also want to consider a trip to your local marine center, such as an aquarium or marine interpretative center. You may find that a visit will expose the girls to many of the principles of ocean literacy, allowing you to cover much of the challenge as well as learning about marine life.

	Sparks	Brownies	Guides	Pathfinders/ Rangers/ Adults
Minimum number of activities to complete. Include at least one per principle.	7	8	9	10

A tracking sheet has been included on page 5 to help you track your progress through this challenge.

When you have completed the activities, complete the BC Challenge Crest, Pin, and Camp To Go Order Form which can also be found on the BC Girl Guides website (click on Girl Engagement > Program > Program Challenges). Before filling out the Order form, please read the BC Challenge Crest, Pin, and Camp To Go Information document in order to understand the pricing and payment for the various crests, pins and merchandise.

PROGRAM CONNECTIONS

The Girls First program is girl-driven and designed to be highly flexible and agile. We encourage you to visit the Digital Platform to best determine how this challenge fits into the Program Areas and Themes.

You may want to start exploring the following Program Areas:

- Into the Outdoors
- Take Action
- Connect and Question

This is not a comprehensive list, and remember that you can apply your activities to the Girls First program as you see fit.

OCEAN AWARE CHALLENGE TRACKING SHEET

Sparks	Brownies	Guides	Pathfinders/Rangers/Adults
7	8	9	10

Principle 1: The Earth has one big ocean with many features.

- ❑ One Big Ocean
- ❑ How Much Water?
- ❑ What is a Watershed?
- ❑ How You Use Water
- ❑ Deep Ocean Comparison
- ❑ *other related activity of your choice*

Principle 2: The ocean and life in the ocean shape the features of the Earth.

- ❑ Explore Erosion
- ❑ Erosion Tag
- ❑ Erosion Cycle Race
- ❑ Erosion Target Practice
- ❑ Shape the Earth
- ❑ Beaches
- ❑ Sea Level Change
- ❑ *other related activity of your choice*

Principle 3: The ocean is a major influence on weather and climate.

- ❑ The Water Cycle
- ❑ Convection Currents
- ❑ Ocean Currents
- ❑ Heat Capacity of Water
- ❑ Hurricanes
- ❑ *other related activity of your choice*

Principle 4: The ocean makes Earth habitable.

- ❑ Ocean Air
- ❑ Plankton Game
- ❑ Plankton Craft
- ❑ Plankton Skimmer Net
- ❑ What's a Coccolithophore?
- ❑ *other related activity of your choice*

Principle 5: The ocean supports a great diversity of life and ecosystems.

- ❑ Learn About Ocean Animals
- ❑ How Big is That Animal?
- ❑ What WAS That?
- ❑ Predator and Prey
- ❑ Deep Sea Food
- ❑ Bioluminescence
- ❑ Blubber Glove
- ❑ What's a Hydrothermal Vent?
- ❑ *other related activity of your choice*

Principle 6: The ocean and humans are inextricably interconnected.

- ❑ Oceans of Plastic
- ❑ Become an Ocean Advocate
- ❑ Ocean Acidification
- ❑ Overfishing
- ❑ Sounds in the Sea
- ❑ Make a Sound Map
- ❑ Noise Pollution
- ❑ Ocean Food Web
- ❑ Bycatch
- ❑ The Ocean & Guiding
- ❑ Have I Used the Ocean Today?
- ❑ *other related activity of your choice*

Principle 7: The ocean is largely unexplored.

- ❑ Where is the Ocean From Here?
- ❑ Video Scavenger Hunt
- ❑ Become an HOV
- ❑ Make a Grabbing Arm
- ❑ Control the ROV
- ❑ Instrument Protection
- ❑ *other related activity of your choice*

ACTIVITY SUGGESTIONS

The principles of ocean literacy cover many ideas and concepts that are important for understanding the relationship between the Earth and the ocean, and the ocean and ourselves. Each principle and the general implication of the learning outcomes are listed in this section.

Each principle contains a list of suggested activities to explore the principle. **Bolded** activities can be found in the Activity Details section, or you can choose to explore each principle in your own way.

The suggested Guiding levels for each activity are only suggestions – you know the girls in your unit best, and so you can decide if the activities are appropriate for your group or not. As noted above, *you can choose to explore each principle in your own way* – this means that you can do other activities, not listed in this document, to fulfill the requirements of this challenge.

Principle 1: The Earth Has One Big Ocean with Many Features

The ocean is the most dominant feature on the planet and makes up almost 75% of the Earth's surface. All the oceans are connected to one another, meaning that it is really one BIG ocean, rather than several smaller oceans. Further, the ocean is connected to major lakes, rivers and watersheds. The majority of the water on Earth is stored in the ocean in the form of salt water, and fresh water returns to Earth via evaporation (e.g. when a liquid becomes a gas) and precipitation (e.g. rain, snow, etc.), which occurs in the largest scale in the ocean.

S B G

One Big Ocean

The ocean is the biggest feature on Earth, and all oceans are connected. Explore how all the world's oceans interact with one another. Try the activity "**One Big Ocean.**"

S B G

How Much Water?

Use measuring cups and spoons to see how much water there is on Earth. Use the activity "**How Much Water?**" or explore limited water resources in your own way.

S B G P R

What is a Watershed?

Explore how water travels through the environment from a raindrop to the river. Use the activity "**What is a Watershed?**"

S B G P

How You Use Water

Talk about how you use water every day. How much do you use brushing your teeth? Washing clothes and dishes? Gardening and doing yard work? Are there ways you can conserve the water and help protect the ocean? How can reducing the amount of water you use impact the ocean? Play "**Water Use Charades"** or **"Water Conservation Skits".**

S B G P

Deep Ocean Comparison

It can be hard to imagine how deep the ocean really is, but in this activity, you can compare it to an average double roll of toilet paper! The ocean is divided into 3 zones: the Sunlight Zone, the Twilight Zone and the Midnight Zone. Using toilet paper, you can see the relative size of each zone with the activity "**How Deep is The Ocean?**" Finish your deep-sea exploration with the game "**Deep Sea Sprint**".

Principle 2: The Ocean and Life in the Ocean Shape the Features of Earth

The Ocean helped shape most of the features of the land over millions of years of rock cycles and erosion. Many rocks and minerals found on land were formed in the ocean millions of years ago. The ocean also continues to shape the coastline through changes in sea level, erosion and plate tectonic activity.

S B G **Explore Erosion** The Ocean shapes the coast through erosion. Explore erosion. What is it, and how does it change rocks and coastlines? Try the activity "**Erode the Sugar Cube**".	S B G P **Erosion Tag** Erosion is a complex process that shapes the features of our earth. In this game of tag, girls can become a rock, a water droplet and even a plant – all key players in erosion. Play one of the two versions of "**Erosion Tag**".
B G **Erosion Cycle Race** Learn about the six stages of the erosion cycle with this "**Erosion Cycle Race**."	S B G P **Erosion Target Practice** Can you shape the coast like an ocean wave? Use this throwing/siding game to see how erosion can change the shape of the coast over time. What will your coast line look like after all this "**Erosion Target Practice**"?
S B G P **Shape the Earth** The ocean moves more than just water around the world. You might not realize it, but the ocean moves heat, water, food and even minerals all over the globe. In this "**Shape the Earth**" active game, girls become the ocean, moving all sorts of important things to different ocean zones.	S B G P R **Beaches** Beaches can be found all over the world, but they are all different. Where do they come from? Talk about beaches you know. What are they like? Try the snack activity "**Beach Sundae.**"
S B G P R **Sea Level Change** Sea level is not constant – it changes as much as the shoreline does. Explore how sea level has changed recently and in prehistoric times. What do you notice? How might sea level rise affect animals and people? Check out this resource online http://geology.com/sea-level-rise/ then try the "**Sea Level Change**" activity.	

Principle 3: The Ocean is a Major Influence on Weather and Climate

The ocean controls weather by moving heat energy, water and carbon. Energy from the Sun is absorbed by the ocean, which fuels the water cycle and storms. The ocean has, and will continue to have, a significant impact on the climate and changing climate of the Earth.

S B G P R

The Water Cycle

All of the water on Earth is part of the water cycle, a continuous recycling of all the worlds' water. See how evaporation in the ocean leads to rain on land with the "**Rain in a Jar**" activity or "**Parachute Water Cycle**" game or "**Water Cycle Shakeout**" game. Or make up a story/song/rap to describe a water droplet's journey through the water cycle and then share with the rest of the group.

S B G P R

Convection Currents

Water moves differently depending on the temperature of the water and other factors like wind. Try the activity "**Ocean Circulation**" or do another activity to see how water moves under wind and heat.

S B G

Ocean Currents

Ocean currents keep everything in motion! Food, heat, energy, plants and animals move around on ocean currents. Complete two of the following Ocean Currents activities: make a "**Current in a Bag**", create wind currents in "**Mini Ocean Currents**", or become a current in your meeting space with the "**Current Chain Game**." These currents are sure to keep your group moving through this ocean challenge!

S B G P R

Heat Capacity of Water

See how "**Water Holds Heat**" by trying one or both of the included demonstration activities. Then, show your learning with a game of "**Freeze Tag!**"

S B G

Hurricanes

A hurricane is probably the most famous type of storm, and they wouldn't exist without the ocean. Create a "**Hurricane in a Jar**" then complete your learning with the "**Hurricane Spins Game**."

Principle 4: The Ocean Makes Earth Habitable

Most of the oxygen in the atmosphere comes from organisms in the ocean, and the first evidence of life can be found in the ocean. Without the ocean, terrestrial animals would not have been able to colonize the land.

S B G P R

Ocean Air

Most of the air on Earth comes from the ocean. Try "**Take a Deep Breath**" to learn more about air on Earth.

S B G

Plankton Game

Plankton are some of the most important creatures in the sea. They play an important role in the marine food web. What do you know about plankton? Try the "**Plankton Game**" to explore these important, minuscule organisms.

As a supplement to this activity, try the "**Marine Maze**": get your plankton to safety before daybreak!

S B G P R

Plankton Craft

Plankton are some of the most important organisms in the sea. Try "**Plankton Hat Craft**" or a "**Jellyfish Craft**".

B G P R

Plankton Skimmer Net

Do you live near a lake, river, pond, stream or the ocean? Make a "**Plankton Skimmer Net**" and capture some plankton for yourself. Not near water? No problem! Follow the same activity, but use the materials from "Plankton Hat Craft" in a large bucket.

G P R

What's a Coccolithophore?

What's a coccolithophore and why are they important? Learn about these important creatures and make a "**Paper Model Coccolithophore**".

Principle 5: The Ocean Supports a Great Diversity of Life and Ecosystems

The ocean contains many ecosystems and animals that are found nowhere else on Earth. These animals and ecosystems exist in three dimensions, meaning that there is a vast amount of living space that exists – life can survive at the surface of the ocean, far into the sediments at the sea bottom and at any level throughout the water column. Deep-sea animals and ecosystems thrive independently of energy from the sun, using chemical energy, rather than photosynthetic energy, to support life. Life in the ocean can be greatly impacted by terrestrial actions and is defined by environmental factors such as temperature, living space, light and nutrients.

S B G P R **Learn About Ocean Animals** The ocean is full of amazing creatures. Learn about ocean animals by playing a game using the "**Ocean Animals Cards**" or "**Make an Ocean Animal**." Supplement your learning with additional activities, such as "**Ocean Animal Doodle Speak**," "**Ocean Animal Dot to Dot**" or "**Ocean Spot the Difference**."	S B G **How Big is That Animal?** The ocean is full of animals from the smallest microbes (e.g. bacteria) to the biggest animal (e.g. whale) ever to live on Earth. Try the "**How Big is That Animal?**" activity to explore how the animals stack up.
S B G P R **What WAS That?** Some of the animals that live at the bottom of the ocean are completely new to science, and others are just forms we've never seen before. Explore amazing animals and online videos of the seafloor with "**What WAS That?**"	S B G **Predator and Prey** The ocean is full of different predator and prey relationships. Try one of these games to see what it's like to be predator and prey: "**Anglerfish Catch**," "**Octopus Game**" or "**The Ocean is Stormy**."
S B G P **Deep Sea Food** What can you do for food if you live in the deep sea? Try the "**Deep Sea Food**" activity to see what it's like to try and catch enough food in the deep sea.	S B G P **Bioluminescence** What happens when you live in a world without light? You make your own, of course! Try the "**Bioluminescence Craft"** or the "**Bioluminescence Game**" to see how fish in the deep sea communicate with one another.
S B G **Blubber Glove** Some animals live in the coldest oceans in the world. How do these animals stay warm? Complete the "**Blubber Glove**" activity to find out.	S B G P R **Hydrothermal Vents** Tubeworms live at hydrothermal vents, special ecosystems that survive without sunlight. Make a "**Hydrothermal Vent Tubeworm**" to learn about the strange world of hydrothermal vents, or complete the "**Hydrothermal Vent Crossword**."

Principle 6: The Ocean and Humans are Inextricably Interconnected

The ocean affects us every day, providing us with rain, oxygen, food and medicine. Much of the world lives in coastal areas, and the ocean is a source of inspiration, recreation, rejuvenation and cultural significance. Humans continually affect the ocean through development of resources, pollution, shipping and much more. Everyone is responsible for caring for the ocean, as the ocean sustains life on Earth. Individual and collective actions can sustain the ocean and improve its health.

S B G P R **Oceans of Plastic** The ocean collects a lot of garbage, most of it by accident. Complete two activities from "**Oceans of Plastic**" to see how the plastic may have ended up in the ocean.	S B G P R **Become an Ocean Advocate** The ocean is an amazing place, and it needs your help. What do you think people need to know about the ocean? Try the activity "**Become an Ocean Advocate**."
S B G P R **Ocean Acidification** The ocean has a unique chemistry that is changing every day. What is ocean acidification, and why is it important? Try the activity "**Ocean Acidification**" to see an exaggerated example.	S B G P R **Overfishing** The ocean provides many people with their daily amount of protein. But will there always be enough fish for everyone? Try the snack activity "**Overfishing**" and see what you can learn about fishing in the ocean.
S B G P R **Sounds in the Sea** The ocean is a noisy place. But what does it sound like underwater? How do we record the sounds that are there? Try the activity "**Sounds in the Sea**" to hear some amazing underwater sounds.	S B G P R **Make a Sound Map** Whales and many other animals use sound as a way to "see" their environment. What would a map of your environment look like if you could only use sound? Try the activity "**Sound map**" and "hear" what your world "looks" like.
S B G P R **Noise Pollution** Explore noise pollution. How does extra noise become pollution, and how is it affecting marine animals? Try the activity "**Noise Pollution**" to see how extra noise can impact whales.	S B G P R **Ocean Food Web** Have you ever had seafood? Much of the world gets their principle protein from the ocean, but if we weren't eating that fish, what animal would be? Try the activity "**Ocean Food Web**" to find out who eats whom in the ocean.

continued next page…

Principle 6: The Ocean and Humans are Inextricably Interconnected (continued)

S B G P R

Bycatch

Catching fish can be a real challenge, especially when the fish you want swim with fish you don't want to catch. More fish are taken as bycatch than as the intended catch- this can have a huge impact on fish populations. Try the snack activity "**Bycatch**" to see what can happen if we don't fish selectively.

S B G P R

The Ocean & Guiding

Girl Guides and Scouts can be found in more than 140 countries around the world. Find a Guiding country that borders an ocean and explore how girls your age use or interact with the ocean as part of their daily lives. How does this compare to how you use the ocean every day? Play a game from that country.

G P R

Have I Used the Ocean Today?

The ocean may be a bigger part of your life than you realize! Try the activity **"Have I Used the Ocean Today**" to see what role the ocean might play in your life.

Principle 7: The Ocean is Largely Unexplored

The ocean is basically unexplored; only about 5% of the ocean is known to people. Over the last few decades, use of ocean resources has increased, resulting in a greater need for understanding those resources and their potential limitations. Technology has allowed researchers and scientists to get a better idea of the "big picture" understanding the ocean. Mathematical models help us understand the ocean and the relationships with Earth's climate and natural cycles. Ocean science is truly interdisciplinary, requiring the expertise of biologists, chemists, climatologists, computer programmers, engineers, geologists, meteorologists, social scientists and physicists.

S B **Where is the Ocean from Here?** Find your house on a map. Where is the nearest stream? Where is the nearest lake or river? Can you trace the river's path to the ocean? Where is the closest ocean to you? Have you ever been there? Have you been to any other ocean? Pretend all of your food comes from the ocean nearest you, how far would you have to go every day, and what route would you take to get there?	S B G **Video Scavenger Hunt** What can you see at the bottom of the ocean? More than you might think. Check out Oceannetworks.ca and explore some of the amazing animal images that have come back from the deep. Try the "**Video Scavenger Hunt.**" If possible for your unit, you can also go to the beach and complete a scavenger hunt for marine life or human impacts!
S B **Become an HOV** HOV stands for Human Operated Vehicle. In this activity, "**Become an HOV**,**"** explore the deep-sea terrain in your own meeting hall.	G P R **Make a Grabbing Arm** Become an engineer and build a deep-sea robotic arm. Can you pick up the sample without help? Can your instrument help deep sea scientists learn more about the ocean? Try the activity "**Make a Grabbing Arm**".
G P R **Control the ROV** How difficult is it to put a research instrument on the bottom? What is it like to drive an ROV (remotely operated vehicle) a few kilometers below the surface? Try the activity "**Control the ROV**" to see what it's like trying to control a ship, some scientists and an ROV.	G P R **Instrument Protection** Studying the Arctic or the deep sea is a challenge. Both environments create challenges. Try your hand at designing and protecting an Arctic instrument in the activity "**Arctic Protection**" or design a deep-sea instrument in the activity "**Protect the Deep Sea Instruments**".

ACTIVITY DETAILS

Principle 1: The Earth has One Big Ocean with Many Features

One Big Ocean

S B G

Although we called it planet Earth, the surface is actually mostly one big ocean, covering more than 70% of the surface of the earth. Each ocean has some differences in temperature, salt content, and life forms, but they are all connected in one big ocean. You can imagine this a bit like the rooms in your home. Each room is slightly different, but they are all part of the same big house. In this activity, explore how an interconnected ocean affects everyone, almost like one big house.

Purpose of this activity: to recognize that the Earth's oceans are all connected.

Directions

Part One

1. Take the inflatable globe and toss or roll it among the girls. Have each girl catch it once, and notice if her pointer finger lands on water or on land.

   Note: if an inflatable globe is not available, spin a standing globe and have each girl put her finger on the globe to stop it. Have her note where her finger lands, on water or on land.
2. Most of the group will likely land on water – this is because the Earth is ¾ water! Have the girls look at the globe, point out the Pacific Ocean, Atlantic Ocean, Indian Ocean, and Arctic Ocean.
3. Using a washable marker, have the girls draw in lines where they think one ocean ends, and another begins. For example, draw a line where the Indian Ocean ends and the Atlantic Ocean begins.

   Optional: instead of drawing on the globe, draw the lines on a world map (use your own, or the included map).

Supplies

- ❑ a cookie sheet or lipped plate or tray
- ❑ a map of the world
- ❑ inflatable globe
- ❑ washable marker
- ❑ water
- ❑ food colouring
- ❑ glitter
- ❑ Plasticine or modeling dough

Optional

- ❑ straws

4. The girls may have different ideas where one ocean starts and the other stops. Explain to the girls although the oceans have different names, they are all part of one global ocean. An analogy that might help them understand this concept is to look at their hand. Each girl's hand has fingers, a palm and a thumb, and although they are all a bit different, they're all part of one thing, her hand. The Earth's oceans are similar. Although each has different features, they are all part of the same global ocean.
5. Explain to the girls that because the Earth has one really big ocean, it means that anything that happens in the ocean in one area can affect other areas on the planet as well.

Part Two

1. Take out the cookie sheet, pie plate or lipped tray.

2. Hand out some Plasticine or modeling dough to each girl. Have each girl make a piece of land that can be added to the tray.
3. Spread the pieces of land out on the tray; tell the girls that this represents the world. If the girls are old enough, you could ask them to try and make a representation of each continent, but as long as no closed basins are created, any shapes will work.
4. Explain to the girls that the ocean floor has many features too, such as mountains, valleys, volcanoes and plains. Have the girls make a few of these features and add them to the map. Try and make them small enough so that the water will cover them when added to the "map".
5. Add a bit of water to the tray – just enough so that there is a thin layer of water surrounding all of the land and covering some ocean features. This represents the world with landforms and ocean.
6. Explain to the girls that they've just helped make a flat map of the world, and the water is the ocean.
7. Next add a few drops of food colouring to a few spots on the tray. Explain that this represents pollution entering the ocean. Next, in different areas, add some glitter. Explain that these are fish. Some fish are nomadic – which means they move from place to place their whole lives, while other fish are born in one area and then spread out to different areas over the course of their lives.
8. If possible, tilt the tray gently, to get the water to start swirling (otherwise, use straws or spoons). Explain to the girls that this is the ocean current moving water around. Have the girls notice how the fish and pollution move around. Do they notice that fish from one area can be found in all areas of the ocean? Do they notice that even small amounts of pollution from one area can affect the whole ocean?
9. Eventually, all the food colouring will mix into the water on the tray, just like all the ocean water circulates on the globe.

Conclude the Activity

- Talk about how the water moved all around the tray, and explain that this activity was just like the real ocean, because the water moves around constantly. Explore this big question with the girls. Why is it important to look after our ocean?
- Talk to the girls about how fish migrate, and ask why might a healthy fish be found in a polluted area? Why might a sick fish be found in an area with no pollution? How can we ensure ocean fish are safe for people to eat when they might travel around the world before being caught?

Tips and Hints

- Depending on the size of your maps/ globes, it may appear that the Mediterranean Sea, the Black Sea and the Red Sea are closed to the rest of the world's oceans. If the girls ask, you can explain that although it's hard to see on a map, all of these bodies of water are connected to the larger ocean by channels and straits.

World Oceans

Draw lines showing where you think the world's oceans start and end.

How Much Water?

SBG

More than 70% of the Earth is covered in water, but of this water a mere 3% is fresh water. Interestingly, of this 3%, most of it is locked away in glaciers and ground water. This leaves us with only about 1% of the Earth's total water supply for watering plants, drinking or using for our other needs. But what do these numbers really mean? What would 3% of all the Earth's water look like if you could fit the ocean in a glass? What would 1% look like?

Purpose of this activity: to identify water as a limited resource.

Directions

1. Start by talking about the water on Earth. What do the girls know about water, and water conservation? Have any of the girls seen the ocean? What does it look like? How much water do they think it holds? Brainstorm: what makes ocean water different from freshwater? Can we drink ocean water? Why or why not?
2. Together, measure out 6 ¼ cups of water into a jar or large bowl. Explain to the girls that this represents all of the water on Earth! Measure out 3 cups of soil. This represents the land. Have the girls compare the water to the land. What do they notice?

Supplies *(per group)*

- ❑ 5 jars (8 cups or greater) or large bowls.
- ❑ 12.5 cups water (about 200 tablespoons)
- ❑ measuring cups and measuring spoons (must have tsp. & tbsp.)
- ❑ 3 cups of soil

3. Give the girls the small jars and have them try and divide up the water. How much should represent just the fresh water in the world? How much of that represents what people can use? How much water should represent the water trapped in glaciers and in the air?
4. After some time exploring, fill another jar with 6 ¼ cups of water. Again explain to the girls that this represents all the water on Earth, and you are going to put fresh water into a different jar. Take three tablespoons out of the big jar and add this to a small jar. This represents all the fresh water on earth, a mere 3% of all the water! Have the girls compared this to their own prediction, what do they notice?
5. Next, take the small jar of fresh water and take out 1 teaspoon of water. This is about 0.3% of the remaining water. Explain to the girls the 2.66 tablespoons left in the fresh water jar is still fresh water, we just can't get to it because it is trapped in icecaps and glaciers. The smallest amount, the teaspoon you just removed, is the water we have in lakes, rivers, streams our hoses and taps.
6. Ask the girls: were any surprised by how little freshwater there was? Why might this make it even more important to protect the water we have on Earth?

Conclude the Activity

Have the girls brainstorm ways to conserve water in their everyday lives. What can they do to protect the Earth's limited water resources?

How can we keep that tiny teaspoon of water healthy for other generations to enjoy?

Take it a step further for Guides

What kind of rules should be put in place to protect the Earth's water? How should this be enforced? Do you think it's better to have rules that people must follow, or to give them information about what they should do?

What is a Watershed?

S B G P R

In the absence of wind and waves to move it, water flows downwards to the lowest possible point. When it rains, all the rainwater drains into streams, which run into rivers, which eventually reach the sea. The area including the rain, the stream and the river is called a watershed. Watersheds are important features of an ecosystem because they can help us understand how the water that it receives from rain, rivers and lakes affects an area. One of the best ways to help protect the ocean is to protect your local watershed. In this activity use a few simple pieces to explore a watershed, and what can be done to protect it.

Purpose of this activity: to explore how different water systems are connected to one another and to the ocean.

Directions

1. Start by asking the girls: when it rains, where does the water go? Ask them how water that falls in the mountains gets down to the ocean? During winter, we can see water as snow; when it all melts, where does that water go?
2. Either in groups or all together, have the girls fill the plastic freezer bag with newspaper, paper cups or other semi-ridged pieces. Push as much air out of the plastic bag as you can, so that the bag form fits around the paper lumps and shapes. By pushing as much air out of the bag as you can, the plastic will form around the paper and other pieces unevenly, creating bumps and ridges. The idea is that you are making a landscape with contours for the water to flow down and around.

   Tip: add some large thick balls of paper and some thin pieces of paper to get difference in height. Also, once most of the air is pushed out of the bag you can shape it a bit with your hands, re-establishing some of the high and low points.

   If the girls struggle with pushing the air out of the bag, push a straw into one corner of the bag and seal the bag up to the straw. Suck as much air out as possible through the straw and quickly pull the straw out while sealing the bag.
3. When you are happy with your landform, place it either in the large container or in an area that can get wet (i.e. outside on the grass).
4. Explain to the girls that your plastic form represents the land and the bin (or grass) is the ocean. Any rain that falls on your land will begin to collect in rivers and streams and will eventually make its way down into the ocean. During the activity, girls should look to see which part of the landform becomes a stream, river, pond, or lake. They should also note key areas where the water flows into the ocean.

Supplies

- ❑ a large zip lock freezer bag (can be one per girl or as a group)
- ❑ a few pieces of newspaper, scrap paper and paper/foam coffee cups for inside the bag
- ❑ permanent markers (to write on the plastic bags)
- ❑ spritz bottles
- ❑ a large bin (or area that can get wet)
- ❑ food colouring
- ❑ cocoa

5. Take the spritzer bottle and gently spray a few times above your landform. The water should mist gently down onto the landform like real rain.
6. Keep spritzing until rivulets start to form and the water begins to pool in the low areas. Keep adding water until some of the water runs into the ocean.
7. Ask the girls: where is an area on the land where the water started up high and ended up low? Where did lakes and ponds show up? Where did the water find its way to the ocean?
8. Look at the landform and notice where the rivers are. Use the markers to draw in the rivers and lakes. Notice if there are areas where water runs into completely different rivers and lakes. These are different watersheds. Optional: draw lines around the different smaller watersheds.
9. Explain to the girls that sometimes watersheds can become polluted by human activity. Dust, chemicals and garbage can sometimes get mixed into the water as it flows down into the ocean. In this next part of the activity, you are going to see what happens when pollution is added to the watershed.
10. Take some cocoa and food colouring and add it to the land in different areas. You only need a few drops of each in small areas, but you can let the girls choose where to add it to the landform.
11. Spritz the landform again to make it rain. Notice where the pollution goes, and where it collects. Ask the girls: how does the pollution get into the ocean? What could we do to prevent pollution?

Conclude the Activity

How does activity on land affect the ocean? For example, how did the pollution, which was spilled on the land, get into the ocean? How might this affect the ocean when it gets there? How did the pollution spilled in the high areas affect the areas downstream in the lower part of the watershed?

Take it a step further for Guides, Pathfinders and Rangers

Discuss

- If a chemical spill occurred in an area, how would you clean it up?
- How would you prevent the chemicals from reaching other areas of the watershed?
- Often, we can't directly observe pollution, what clues would we look for to know our watershed was healthy?
- What clues would lead us to think there might be something wrong with the watershed?
- What can you do to protect your watershed?

Water Use Charades

S B G

Talk about how you use water every day. How much do you use brushing your teeth? Washing clothes and dishes? Gardening and doing yard work? Are there ways you can conserve the water and help protect the ocean? How can reducing the amount of water you use impact the ocean?

Purpose of this activity: to illustrate ways we use water.

Directions

1. Basically, Charades is pantomime: acting out a word or phrase without speaking.
2. Charades can be played with any type of word or phrase. For this game, use the Water Uses cards.

Supplies

- ❑ Water Uses cards

3. Indicate how many words are in your phrase or title by holding up that many fingers.
4. Then, hold up the finger of the word you are going to act out - for example, hold up two fingers for the second word.
5. You can then divide a word into syllables by tapping your fingers on your forearm... for example: if you have a two syllable word you would tap two fingers onto your arm.
6. The person acting the phrase cannot talk - if someone guesses the correct word, you point at the person who got it right and nod "yes".
7. You can cup your hand to your ear to indicate "sounds like".
8. Bring your thumb and index finger close together to indicate a little word (such as on, in, the, and...)

Adapt the Game for Sparks

As many Sparks can't yet read, you can either whisper their Water Use word(s) to them, or you can randomly draw cards and have the girls act out the words all together. Let them be silly!

Water Uses Drinking Water	Water Uses Taking a Shower	Water Uses Having a Bath
Water Uses Washing Your Dog	Water Uses Watering the Garden	Water Uses Washing the Car
Water Uses Water Skiing	Water Uses Rowing a Boat	Water Uses Swimming
Water Uses Washing Your Hands	Water Uses Washing Your Hair	Water Uses Brushing Your Teeth
Water Uses Flushing the Toilet	Water Uses Water Balloon Fight	Water Uses Squirt Guns
Water Uses Scuba Diving	Water Uses Ice Skating	Water Uses Shaving
Water Uses Washing Dishes	Water Uses Putting Out a Fire	Water Uses Ice Cubes
Water Uses Dishwasher	Water Uses Washing Machine	Water Uses Canoeing
Water Uses Running Through the Sprinkler	Water Uses Making a Sandcastle	Water Uses Fishing
Water Uses Diving	Water Uses Boiling a Kettle	Water Uses Waterslide

Water Conservation Skits

BGP

Talk about how you use water every day. How much do you use brushing your teeth? Washing clothes and dishes? Gardening and doing yard work? Are there ways you can conserve the water and help protect the ocean? How can reducing the amount of water you use impact the ocean?

Purpose of this activity: to illustrate ways we can conserve water.

Directions

1. Divide the girls into groups and provide them with instructions for their skit, as follows.
2. Timing: give the girls a set amount of time for their skit – for example, each skit should take no more than 3 minute to perform, and they have 10-15 minutes to develop and practice their skits.
3. Topic: each group must first decide on the topic of their skit. In this case, they are to come up with a way that they can demonstrate how to conserve water.
4. Setting: each group must decide where their skit will take place (At the beach? At school? At home? Inside or outside? Etc.)
5. Characters: each member of the group should act out a different character. Make sure that everyone has a part!
6. Design and practice: as a group the girls will develop a script and stage directions for their skit. They can write it out, or just practice several times. Whether written or not, they do need to practice!
7. Refine: as the girls practice their skits, they will find that adjustments need to be made. Make sure that the girls get equal amount of time to speak, with not just one character dominating the dialog!
8. Props: do the girls need props for their skit? Whatever they use, it should be easily accessible in the meeting place. Skits emphasize the connection between the actors and the audience, so props should be minimal.
9. Present: have each group present their skits, reminding them of their time limit before they begin, and giving a warning as they approach the time limit. Girls who are not presenting should demonstrate good audience skills.

How Deep is the Ocean?

SBGP

Have you ever been to an ocean, lake or river that was so deep you couldn't see the bottom? Sometimes, it can be hard to imagine how deep the ocean really is – after about 200 meters, sunlight can't penetrate the water, so we can't see if it is getting deeper or remaining the same depth. The bottom of the ocean is just like the land, in that it has hills, valleys, mountains, ridges and other features that result in different measurements of depth. The deepest part of the ocean, the Mariana Trench, is 11 km (11,000 m) deep, but, on average, the depth of the ocean is about 4000 meters.

Purpose of this activity: to explore the depth of the ocean using a relatable unit of measurement (a roll of toilet paper).

Note to Guiders: This activity uses one average double roll of toilet paper of 250 sheets; don't worry if your roll has a few less or a few more sheets, just get as close as possible. You can also multiply your roll by each percentage to create more accurate numbers (i.e. – the Sunlight Zone is 5% of the ocean, so if you are using a roll that has 167 sheets (167 x .05 = 8.3) - tear off 8 squares to represent the Sunlight Zone). As each part of the ocean is a little different, it's okay if numbers are rounded.

Directions

Supplies

- ❑ a roll of toilet paper (any double roll with approximately 250 sheets)
- ❑ long hallway or space

1. Discuss with the girls, how deep do they think the ocean is? Have they heard of any special places such as the Mariana Trench or Challenger Deep? These are some of the deepest parts of the ocean – almost 11 km deep! As we go deeper, the ocean gets less and less light from the sun. To help explain where different animals and plants live, marine scientists divide the ocean into 3 zones – **the Sunlight Zone, the Twilight Zone** and **the Midnight Zone**. In this activity, we can compare how big each zone is – if the average depth of the ocean where the same length as a roll of toilet paper!
2. The first ocean zone is known as **the Sunlight Zone**. This is where most animals and fish live, because plants can grow in the Sunlight Zone. Tear 12.5 squares off your roll; this represents 5%, or about 200m, of the total average depth (4000m) of the ocean. This is the zone where you find most animals and all plants that use the sun to create food – after this depth, not enough sunlight gets through the water to allow plants to grow. This makes it hard for most fish and animals to find enough food, so, rather than live too deep, they stay in the Sunlight Zone.
3. The next zone of the ocean is known as **the Twilight Zone**. This zone gets its name because it's a lot like twilight on land – not quite dark, but not very light, either. Tear 50 sheets off your roll; this represents 20%, or about 800m, of the total average depth of the ocean. This is the zone where you find animals that have adapted to live in semi or total darkness.
4. The final zone takes you to the sea floor – this is known as the **Midnight Zone** because it exists entirely without light. Animals that live here never see daylight; the environment is very cold and there is a lot of pressure here from all the water above

it. Unroll the rest of the toilet paper; this represents 75%, or about 3000m, of the average overall depth of the ocean.

Using this example, your girls can see that the ocean is very deep, but only a small part of it has most of the plants and animals that we are most familiar with. The deeper sections, such as the twilight zone and the midnight zone, take up the most depth, but we know very little about these zones or the animals that live there. Some of the animal kingdom's best divers (see below) can't even reach the bottom! Consider adding a few of the creatures below to your toilet paper ocean.

Take it a step further

Some animals can dive very deeply into the ocean. Mark the depth that these animals can dive to on your toilet paper depth chart (remember to start with the first sheet, at the surface):

- The Emperor Penguin can dive to 500m (12.5% ~31 sheets)
- The Leatherback Turtle can dive to 1280m (32% ~ 80 sheets)
- The Southern Elephant Seal can dive to 1620m (40%~100 sheets)
- The Sperm Whale can dive to 2000m (50% ~ 125 sheets)

Using this scale, we can also imagine how deep some of the deepest parts of the ocean are.

The deepest known part of the Mariana Trench is approximately 10,911 meters deep. To show this using toilet paper, we would need 681 sheets or 2.7 rolls of paper! It would stretch almost 70 meters long!

Conclude the Activity

Finish your deep-sea exploration with the game "**Deep Sea Sprint**".

Deep Sea Sprint

S B G

This activity is an extension of "**How Deep is the Ocean?**"

Purpose of this activity: to further familiarize the girls with the various zones of the ocean.

Directions

Supplies

- ❑ masking tape to mark zones
- ❑ optional: signs for each zone

1. Mark 4 consecutive sections on the floor – each section should be a bit bigger than the one before it.
2. Name the sections "The Sunlight Zone", "The Twilight Zone", "The Midnight Zone" and "Deep-Sea Trench". The edge of the Sunlight Zone play area is the surface; the edge of the Deep-Sea Trench play area is the bottom.
3. Optional: create signs for each section.
4. Secretly assign one or more girls to be "sea monsters" – only the girls themselves should know that they are sea monsters!
5. Girls start at one end of the play area (the surface) and the leader yells one of the areas (sunlight zone, deep sea trench, etc.). The girls run to the area called by the leader as fast as they can. The leader should randomly call the zones, and it can be quite fun to say them quickly together or to change the zones before the girls get there (i.e.: run to the sunlight zone, no wait, the trench, no wait, the midnight zone).
6. When the leader is ready, she can yell "SEA-MONSTER!" – this is the girls' cue to run back to their starting position while the secret sea monsters try to tag them. If a sea monster tags any girls, those girls become the sea monsters the next time the leader yells "SEA MONSTER".
7. Play resumes when the leader starts randomly calling out zones again.

Principle 2: The Ocean and Life in the Ocean Shape the Features of Earth

Erode the Sugar Cube

S B G

The ocean is constantly wearing away at rocks and coastal formations (but don't worry, it's also forming new ones at the same time) continuing the rock cycle and shaping our planet. Even if you don't live in a coastal area, the rocks around you may have been formed underwater long ago. As wind, water and weather erode the rocks around you, those little pieces get carried to the sea where they become part of the beach. But how does erosion shape the seashore? Try this activity to find out.

In this activity, use "wind", "water" and "waves" to erode a sugar cube and see what happens.

Purpose of this activity: to explore how different forces erode rocks and minerals.

Directions

1. Give each girl a paper plate and four sugar cubes. Observe the sugar cubes: What do they look like? How are the edges? Are there any dings or bumps in the sugar cubes?
2. Have the girls put one sugar cube in the jar (all the unit's cubes can go in the same jar at the same time), close the lid and then pass the jar around and have each girl shake the jar three times. After each girl has had a turn, return one sugar cube to each girl. Now look at the cube you have been given. How has it changed compared to the other cubes that were not in the jar?

Supplies

- ❑ large jar with a lid
- ❑ 4 sugar cubes per girl
- ❑ sandpaper/steel wool
- ❑ straws
- ❑ eyedropper
- ❑ water
- ❑ paper plate to work on

3. Take the second sugar cube and rub it gently with sandpaper or steel wool. Try and rub all the sides of the sugar cube at least a few times. After rubbing, blow through the straw onto the cube. How much sugar blows off the cube? How did the rubbing affect the cube?
4. Take the third sugar cube and the eyedropper. Slowly drop 5-10 drops of water on the cube. What happens to the cube? Add 5-10 more drops. What happens?
5. Compare all four sugar cubes. How have the three "eroded" sugar cubes changed from the beginning of the activity? How much of the sugar cubes has eroded away?

What's happening here?

Each of the cubes has been eroded by a different method. The cubes in the jar got bumped and jostled together the same way that a rock might get tumbled rolling down a hill or being tossed in the surf of the beach. By shaking the jar, the girls are acting like a stormy beach, tossing the rocks together and, over time, polishing them to have smooth edges. Given enough time and enough shakes, the sugar cubes would turn back into loose sugar (just like rocks turning into sand).

When the girls rubbed the cubes and blew on them with the straws, they were emulating a strong wind blowing on the rocks of the shore. Just like in nature, rocks can be shaped and smoothed by wind and other particles rubbing against them.

Rocks are also eroded by water. When the girls dripped the water on the sugar cube, it washed away tiny particles of sugar, just as water washes away tiny pieces of rocks. Over time, all of these pieces of eroded rock make their way back into the rock cycle as tiny rock fragments, or they get washed seaward to become beaches.

Conclude the Activity

- Discuss with the girls, why do you think the ocean is important in shaping the coastline?
- Why does it take years (even millennia) for the elements to shape the coastline?

For the older girls: discuss with them, how might sea level rise increase shore erosion? How might sea level rise change the shape of the coast?

Coastal erosion occurs when natural processes erode part of the beach or shoreline: including wind, rain and storms. As climate change occurs, this process can be accelerated, causing damage to property and greatly changing the coastal landscape.

Check out these links for more information:

https://oceansolutions.stanford.edu/focal-area-climate-change

https://www.whoi.edu/main/topic/changing-shorelines-erosion

Erosion Tag

S B G P

Erosion describes the process that changes rocks and landscapes over time by wearing them down. Wind, weather and erosion all cause landscapes and rocks to change over millions of years. Erosion is often too gradual to observe directly, but we can see the results of erosion in the landscapes around us. For example, river and beach rocks become smooth and round over time because the water slowly washes away small parts of the rock. Many cave formations are also caused by water running through rocks over very long periods of time. Wind can also shape rocks, breaking them down into smaller and smaller pieces. Erosion helps minerals cycle through the earth, so that they, in time, can become new rocks and minerals. As wind, water and waves break down minerals and rocks, those tiny pieces enter the ocean where they can be used by plants and animals. Tiny eroded pieces of rock can also become new rocks over time. For example, sandstone is made of thin layers of sand and mud laid down over thousands of years. Given several hundreds of thousands of years, these layers can become compacted by overlaying rock and cemented by minerals, making sandstone. If that sandstone ends up at the beach, it can break down into sand again, continuing the cycle.

Purpose of this activity: to explore how water shapes the coast and is a leading force in erosion. Further, to explore how plants can help show erosion by holding rock particles in place.

Directions for Sparks and Brownies

1. First, explain to the girls how to play Rock-Paper-Scissors. Girls play in pairs. On the count of three, each girl makes their chosen sign – either rock (a fist), paper (a flat hand) or scissors (index and middle finger spread apart like a pair of scissors).
    - rock beats scissors (because a rock can smash the scissors)
    - paper beats rock (because paper can wrap around a rock)
    - scissors beats paper (because scissors can cut paper)
2. Practice this before beginning the game.
3. Assign a few girls to be water droplets, and the rest to be rock particles. The rock particles spread out in the playing area. These girls are part of the coast, and can be anywhere in the playing space, as long as they have some space around them.
4. When the “rock particles” are ready, call ‘Go!’ and have the water droplets enter the playing space. “Water droplets” challenge the rock particles to a game of Rock-Paper-Scissors.
5. If the water droplet wins, the rock particle joins the water droplet by standing behind the droplet and putting her hands on her shoulders similar to a conga line. If the water droplet loses, she simply carries on to the next particle, and the particle stays where she is.
6. The water droplet then continues to the next particle of her choice. When she finds a new particle, if she wins again, that “particle” changes places with the one behind the water droplet. (Particle one is now in a new spot, and particle two is now following the water droplet around). If the water droplet ‘loses’ Rock-Paper-Scissors, to the second particle, she (and her current particle) simply carries on to the next particle and tries again.

7. Keep the game going so that everyone has a few turns. You can also switch out water droplets with particles so that everyone has a turn.
8. In this game, the water droplets are changing the landscape of rock particles by moving them around. Every time they win at Rock-Paper-Scissors, the different particles of rock find a new position. By the end of the game, the water droplets will have completely changed the original rock landscape!

Optional Instructions

If a water droplet loses to a second particle (B), the particle she has with her (A) joins the second particle instead (A and B particles are then joined together and the water droplet has no particle). If another water droplet then comes along and beats particle B, she wins both particle A and B to add to her collection. If she loses though, any particles she has collected also stay behind! Play continues until one water droplet has all the particles!

Directions for Guides and Pathfinders

Supplies

- ❑ scarves the girls can use as armbands
  OR
- ❑ Erosion Cycle images
- ❑ scarves or spring-loaded clothespins

1. Ask a few girls to be water droplets, a few to be plants and the rest to be rock particles. You can use any method to mark each group, but some ideas are:
2. Give each group a different coloured armband to differentiate teams.
3. Pin a picture (found in the “Erosion Cycle Race” activity) to each girl’s shirt.
4. Give each rock a scarf and have her tuck it in the back of her waistband (It should mostly stick out, like a tail) or clip a spring-loaded clothespin to the back of each girls’ shirt (if scarves are too hard to find).
5. All girls can move around, and rock particles try to prevent water droplets from eroding them. Plants can protect rock particles from erosion.
6. Water droplets can ‘erode’ a rock particle by taking her scarf or clothespin. If a rock particle gets “eroded” she sits out, off to the side.
7. A rock can protect herself from erosion by finding a plant. Each plant can be anywhere in the play area (they can be stationary or moving) and the plant protects a rock by holding her hand. Rocks can only stay with a plant for a count of five (rocks must count out loud) – and each plant can only help two rocks at a time, (plants don’t completely prevent erosion, they only slow it!).
8. The game continues until all the rocks have been eroded or your water droplets are too out of breath to continue!

Erosion Cycle Race

BG

Erosion describes the process that changes rocks and landscapes over time by wearing them down. Wind, weather and erosion all cause landscapes and rocks to change over millions of years. Erosion is often too gradual to observe directly, but we can see the results of erosion in the landscapes around us. For example, river and beach rocks become smooth and round over time because the water slowly washes away small parts of the rock. Many cave formations are also caused by water running through rocks over very long periods of time. Wind can also shape rocks, breaking them down into smaller and smaller pieces. Erosion helps minerals cycle through the earth, so that they, in time, can become new rocks and minerals. As wind, water and waves break down minerals and rocks, those tiny pieces enter the ocean where they can be used by plants and animals. Tiny eroded pieces of rock can also become new rocks over time. For example, sandstone is made of thin layers of sand and mud laid down over thousands of years. Given several hundreds of thousands of years, these layers can become compacted by overlaying rock and cemented by minerals, making sandstone. If that sandstone ends up at the beach, it can break down into sand again, continuing the cycle.

Purpose of this activity: To explore how water shapes the landscape by destroying and reforming rocks in the erosion cycle.

Directions

Supplies

- ❑ erosion cycle cards, printed on cardstock and, if possible, laminated (for durability)

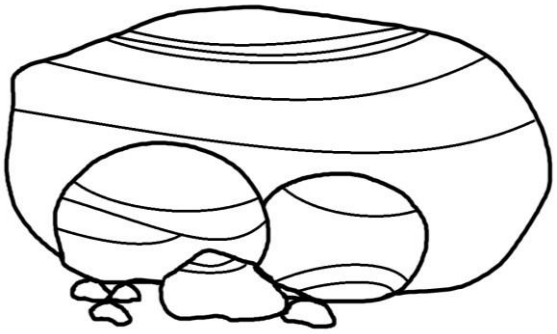
1. In advance, prepare the erosion cycle cards so that you have enough sets of cards for each girl to have one card. For example, if you have 12 girls you should use two sets of cards, but if you have 20 girls you will need 5 sets of cards.
2. Explain to the girls what is happening in each picture, and that this is the order of the erosion cycle.
    a. Large rocks and boulders can break away from cliffs or mountains through the process of weathering. These large rocks can be changed by wind, rain, or even waves depending on where they are.
    b. Over very long periods of time, these large boulders become smaller and smaller rocks. Wind, water, ice and even plants can break these larger rocks into tiny pieces by working their way into cracks in the rocks. As the ice freezes (or the plants grow), it forces the rock apart, and eventually it will break into smaller pieces. Wind and water can also take away microscopic pieces of rock over time.
    c. Water droplets can carry tiny pieces of rock to lakes, rivers and oceans. During heavy rain or flooding, water can carry lots of mud, rock and sediment into rivers, lakes and oceans too. Water helps keep rock moving around so that it can get to the next part of the cycle.
    d. Plants can slow erosion by holding onto rocks and dirt with their roots, or by absorbing the water carrying the tiny pieces of rock. Plants can't completely

stop erosion, but they can help keep rocks and minerals trapped in an area for a long time, and keep nutrients from being washed away too quickly.

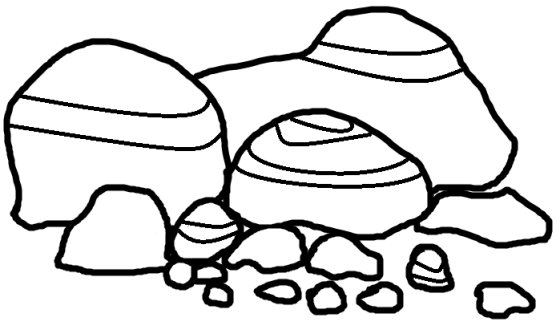
e. Any sediment that makes it to lakes, rivers or oceans can be laid down in thin layers of rock and minerals. Over many millions of years, these layers of sediments can build up into thick layers of rocks.

f. Sometimes, as the lakes and rivers change course or recede, these sediments can become exposed as new rock. As wind and weather erodes theses layers of sediment, large rocks can break off, starting the cycle all over again!

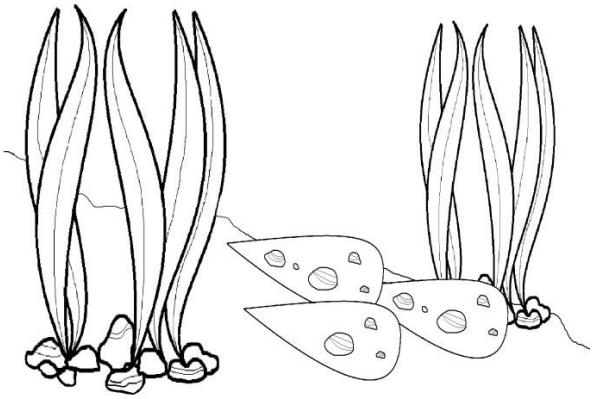
3. Line the girls up along one end of the playing area.
4. Distribute the cards, face down on the ground, at the far end of the playing area.
5. On GO, the girls must run to the far side of the playing area and retrieve just one card each. If you do not have an exact multiple of 6 girls, there will be leftover cards on the ground. Leaders could play to make up the difference.
6. When each girl has a card, she must complete the erosion cycle by finding girls with the other cards from the cycle. Girls are to form groups of 6, then stand in a circle in the order of the erosion cycle.
7. When a team has formed a full erosion cycle, they call out “WE ROCK!” and sit down. The leaders then check to see if they are sitting in the correct order.
8. The first team to sit down in the correct order wins.
9. Repeat the game, telling girls they must retrieve a different card with each subsequent round.



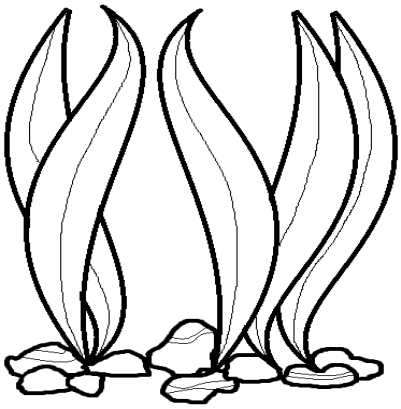
Large rocks break away from cliffs or mountains.



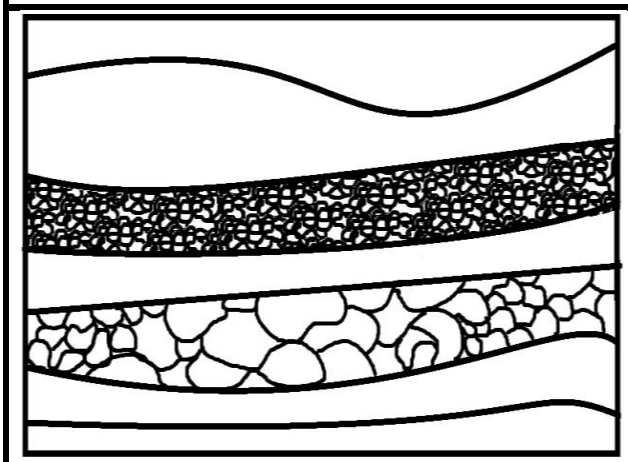
Wind and water break large rocks into smaller rocks.



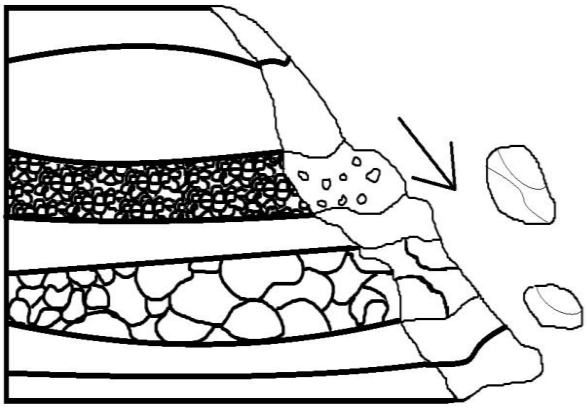
Water droplets carry tiny pieces of rock, called sediment, into lakes, rivers and oceans.



Plants help slow erosion by holding small rocks and sediment in their roots.



Tiny pieces of rock and sand collect at the bottom of waterways as sediment layers.



After millions of years, sediment layers become exposed to weathering and large rocks can break away.

Erosion Target Practice

SBGP

Erosion describes the process that changes rocks and landscapes over time by wearing them down. Wind, weather and erosion all cause landscapes and rocks to change over millions of years. Erosion is often too gradual to observe directly, but we can see the results of erosion in the landscapes around us. For example, river and beach rocks become smooth and round over time because the water slowly washes away small parts of the rock. Many cave formations are also caused by water running through rocks over very long periods of time. Wind can also shape rocks, breaking them down into smaller and smaller pieces. Erosion helps minerals cycle through the earth, so that they, in time, can become new rocks and minerals. As wind, water and waves break down minerals and rocks, those tiny pieces enter the ocean where they can be used by plants and animals. Tiny eroded pieces of rock can also become new rocks over time. For example, sandstone is made of thin layers of sand and mud laid down over thousands of years. Given several hundreds of thousands of years, these layers can become compacted by overlaying rock and cemented by minerals, making sandstone. If that sandstone ends up at the beach, it can break down into sand again, continuing the cycle.

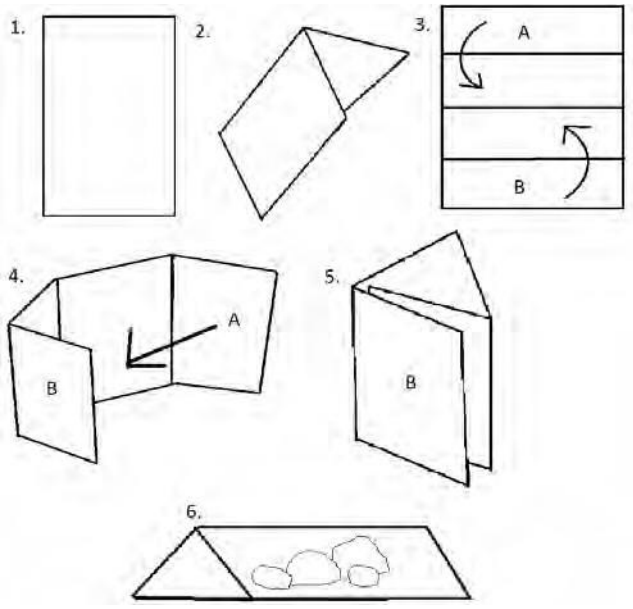
Purpose of this activity: to observe how the ocean shapes the coast and continues the long-term process of erosion.

Directions

1. Ask the girls to think about the beach. Have they ever seen waves at the beach? Waves at the beach are very special because they can change the shape of the beach. As the waves lap against the shore, they tumble rocks and sand around, which can change the beach over a very long time. For example, a rocky beach could someday become a sandy beach, or big rocks can become smaller rocks. In this activity the girls will act like ocean waves, moving the beach around.
2. Distribute the paper to the girls (1). Have them fold the paper into half (2), and then fold the top and bottom into the fold line (3), making a piece of paper with four creases. Fold the paper into a triangle by overlapping the last to folded edges (like a name or place card) (4-5) for a desk. On each face of the card, have the girls draw some rocks or beach features such as sand, plants or shells (6) then tape the ends together to help it stay solid.
3. Mark a line with masking tape about ¼ of the way into the playing space.

Supplies

- ❑ bean bags/ soft throwing items (rolled up socks work well)
- ❑ paper/ pencils
- ❑ a large play space
- ❑ masking tape



When the cards are ready, spread them out on the other ¾ of the play space, lying on the long side (like name cards) to show the drawings.

4. Explain to the girls that the cards represent different parts of the beach. The line of tape is the tide line, and they are the waves. The girls will try and move their own cards around by sliding the soft throwing items towards the cards (think curling or bowling). Don't worry if the cards get knocked over – this would just represent a rock flipping over or changing shape.
5. The object of the game is to bump the paper cards around using the soft throwing items. Once a girl has thrown her soft item, she can go collect it only after everyone has had a chance to throw. The girls can then throw again. Remind the girls that they can only touch the paper pieces with their beanbag or sock, not with their hands.

Allow the girls to have a few throws each, and then talk about how the shape of the beach changed from the original setup.

Optional extensions

- You can move the "throwing line" closer to the cards to represent a sea level rise. Have the girls notice that it is easier for them to hit and move items the closer they are to them. As sea level rises, different parts of the coast could be more easily affected by the wind and waves.
- Use the girls' coats to create a barrier (it will be important to remind the girls not to throw the bean-bags over the barrier) to represent a breakwater or other costal management device. In some areas, where coastal erosion is happening very quickly or could damage valuable property, constructions like seawalls and retaining walls are used to help protect the coast from further erosion.

Shape the Earth

S B G P

The ocean shapes the features of the Earth; it may not seem like it, but the ocean keeps a lot of important earth cycles in motion. You can imagine the ocean a bit like a traffic light – the ocean keeps everything moving in order, directing different minerals, energy, even plants and fish, all over the world. For example, every day, we get a lot of heat from the sun that warms up the water near the equator. The ocean moves some of this warm water to parts of the ocean and coast that don't get as much direct sunlight. This helps warm up cooler areas, and keep warm areas from getting too hot. Just like a traffic light, the ocean lets some cars (warm water) get through an intersection (to a different part of the ocean) but it also stops everything from going at once.

Many winds are also created because of the ocean, which helps things move, too. For example, the ocean causes the air to heat or cool, moving it around the world. At the same time, currents within the ocean can move sand and gravel to different areas of the ocean, changing or creating beaches. Sometimes, these changes can be small everyday changes, or they can be sudden, massive changes that are seen after ocean storms. In this activity, see how the ocean shapes the features of the Earth.

Purpose of this activity: to mimic how the ocean changes the landscape.

Directions

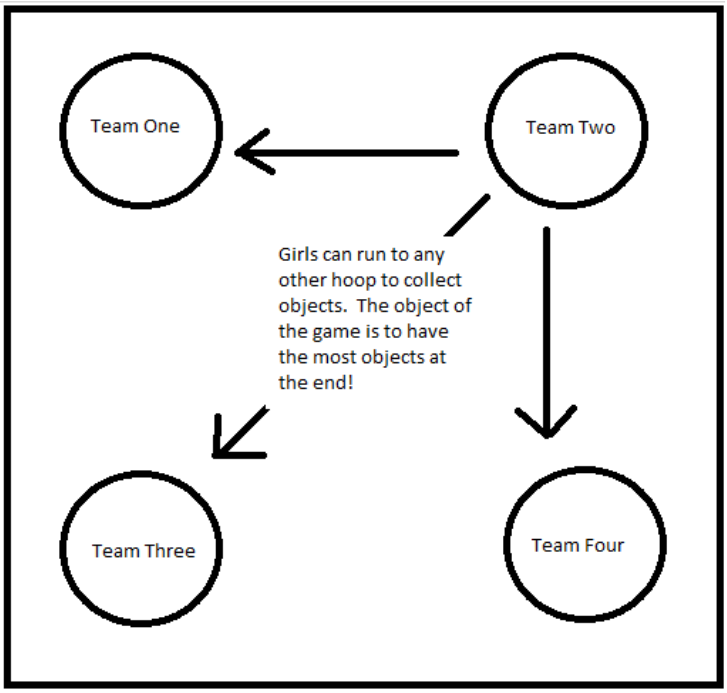
1. Place the 4 hula-hoops (or boxes) evenly around the space. Fill each one with a handful or so of the objects that the girls will grab. All the objects should be the same for each space.
2. Break the girls into four teams – each team is assigned a hoop of objects. Explain to the girls, that each hoop represents different areas of the Earth and the supplies in the hoop are the different features of that area such as water vapour, minerals, animals, or even heat from the sun.
3. The girls represent the ocean – their job is to run (one team member at a time, like a relay) to another hoop to collect an object and bring it back to their hoop. It doesn't matter if the runners from other teams pick the same or different hoops – they simply have to come back with one object to add to their own hoop. Runners can also pick the same hoop over and over again: their only goal is to get as many objects as possible.
4. Once a runner has returned to her hoop, the next girl in line can run to any hoop of her choosing and take an object back to her team's hoop.
5. Allow the game to cycle through a few runners, and then, when you are ready, yell "storm"! During a storm, ALL the girls can run to a hoop and collect an item to move to their hoop. Once they return with their object, they play one at a time again.

Supplies

- ❑ a large play space
- ❑ small objects the girls can grab (pompoms and beanbags work well)

  Note: younger girls may have an easier time discussing the objects and the movements of the objects if they are all different.
- ❑ 4 'spaces' i.e. hula-hoops, tape circles, small boxes (something to keep the objects in one place)

6. Conclude the game by talking with the girls about how the ocean (the girls) changed the different areas. For example,
   - Did each hoop stay evenly filled? Or did some hoops have less at the end?
   - Did each object move to each hoop or did some stay in the same hoop for a while? For example, did some girls move the same object back and forth between hoops, or did every object get taken at least once?
   - If the objects represented fish for food, how might the ocean bring food to people who need it?



Take it a step further for Guides and Pathfinders

- Tell the girls each hoop is one element – water, heat, food and minerals. They'll need to get one of each type in their own hoop – they can take the part they need from any hoop, they don't need to go to the source.
- Reverse the game by having the girls try and empty their hoop. Each runner takes an object from her own hoop and drops it in the hoop of another group. The first group to drop all their objects into the other hoops, yells "STORM" to win.

Beach Sundae

S B G P R

Often, one of the first things we think of when we think about the ocean is the beach! A beach is a narrow strip of land that touches a body of water. Rivers and lakes have beaches too, and each beach is made of unique particles. In this activity, explore different types of beaches and have a snack too!

Purpose of this activity: to explore how beaches can be formed over time.

Directions

Part One

One of the things we associate most with the ocean is the beach and the materials that it is made up of (i.e. sand, rocks, mud, etc.); every beach is different, depending on the materials around to make it. Some areas have rocky beaches covered in boulders and gravel, while other areas have beaches made of fine, powdery sand. Erosion causes tiny particles of rocks, sand and even shells to move all over the world, resulting in to some wonderful beaches.

1. Start by talking about the beaches you know. Even if the girls have never been to the ocean, think about a local river or lake. Talk about how some beaches have fine sand while others are rocky and gravelly.
2. Give the girls a small amount of sand and a magnifying glass. Have them look at the sand and tell you what they notice about it. Is it made of big pieces of material or small pieces? Are there pieces of shell or other natural materials in the sand? Are there pieces that appear more often than others under the magnifying glass? Does all the sand look the same colour under the magnifying glass?

Part Two

1. After exploring the real sand, explain to the girls that sand is usually made of particles that have been eroded by the ocean, wind, water and weather. For the next part of the activity, you're going to make a big bowl of "sand."
2. Take a large bowl and have the girls gather around so they can see what you are doing. Explain to the girls that some sand is a result of the ocean wearing away at large cliffs or rock faces. Take the chocolate bar and begin to crumble it into the bowl. This will make large uneven pieces. Explain to the girls that the chocolate represents

Activity Supplies

- ❑ sand, collected locally if possible (note: you can often find sand at craft stores, pet stores, or hardware stores if there is none locally available)
- ❑ magnifying glasses

Snack Supplies

- ❑ sprinkles (nonpareils, the round, multi-coloured sprinkles work well)
- ❑ chocolate bar that is easy to crumble with your fingers (for example, Cadbury Flake or other)
- ❑ optional: Girl Guide cookies
- ❑ wafer sticks/ wafer cookies
- ❑ cinnamon
- ❑ optional – ground nuts (if no allergies)
- ❑ ice cream
- ❑ spoon and bowl for each girl

the big rocks that have eroded from cliffs and hillsides and have tumbled down to the beach. Because they are quite large and heavy, it takes a long time for them to move to other areas.

Tip: You can also cut the chocolate into pieces if you find it difficult to crumble or flake. Girl Guide cookies also work well for this stage.

3. Next, take out some wafer cookies and explain that these represent corals and shells. Compared to rocks, they are much more fragile and can be broken by waves crashing against them. Use your hands to crush the cookies up as much as possible, and talk about how when shelled animals die, their shells are often battered by wind and waves, which causes them to break down and mix into the sand, too.
4. Take a few scoops of sprinkles and explain that some of the sand on a beach comes from another area and has been washed down to the river or ocean by water. Explain that some areas, such as lakes, have beaches that are made of fine sand that has come from far way. The fine rocks and sand are so small that water can carry them to many different places. Sprinkle in the nonpareils and explain that this represents really tiny pieces that have been washed from the land onto the beach.
5. Take out the cinnamon (or other spice you enjoy, such as cocoa powder) and explain that some sand and particles are carried by wind to the ocean, lakes and rivers. Sprinkle the cinnamon into the bowl, noting that this represents fine sand that can be carried by the wind.
6. Finally, if possible for your group, add some ground nuts to the bowl explaining that sometimes sand is also made of other particles such as silica, quartz, or other minerals, it really depends where the beach is, and what is around the area.
7. Mix the ‘sand’ together and explain that the movement of the water (ocean, river or lake) will cause all the pieces of ‘sand’ to get mixed together.
8. Spoon out a scoop of ice cream for each girl. Explain that the ice cream is like a shoreline or bay. Sand collects here and becomes a beach. Spoon a few scoops of ‘sand’ over the top of the ice cream. Before eating the treat, make observations of the melting ice cream and the topping. As the ice cream melts, it will carry some of the topping with it. What do the girls notice about the movement of the topping?
9. Before it melts too much, enjoy your treat!

What’s happening here?

In this activity, the girls explore how erosion and water move around rocks and mineral particles. Also, the girls observe why some beaches (such as those found on the coast of BC) are generally rocky and some beaches (like those in the Caribbean) have fine soft sand from coral reefs.

Take it a step further

Coastal erosion occurs when natural processes erode part of the beach or shoreline: including wind, rain and storms. As climate change occurs, this process can be accelerated, causing damage to property and greatly changing the coastal landscape.

Check out the link for more information: https://www.whoi.edu/main/topic/changing-shorelines-erosion

Sea Level Change

S B G P R

Take a look at the coastlines of the world. Notice some of the different shapes of bays, fjords and inlets. These features didn't always (and won't always) look this way. Sea level has changed regularly throughout history, and can greatly shape the features of this planet. As the Earth's tectonic plates move around and erosion occurs, the features of the Earth can change. For example, inland seas can be created, reshaped or destroyed. Equally, coastlines are dynamic places that can change over time depending on water levels, winds and tides. During the last Ice Age, a larger percentage of seawater was frozen as glacial ice. This meant that sea level was much lower than it is now.

Today, sea level rise is a concern because of melting glacial ice due to climate change. But which is more of a concern, the ice melting in the ocean, or ice melting on land? Do this simple experiment to find out.

Purpose of this activity: to observe how sea level changes due to melting ice.

Directions

1. Use the Plasticine or small objects to make two landmasses that are about the same size and shape.
2. Put one landmass at the bottom of each jar.
3. Add a bit of water to each jar to make an ocean around the landmass.
4. In one jar, add one of the ice cubes to the water (there needs to be enough water that the ice cube will float freely). Mark the waterline with a piece of tape or whiteboard marker.
5. In the second jar, add the ice cube to the land only. Mark the waterline with a piece of tape or whiteboard marker.
6. Observe the water level in each jar. What do the girls notice?
7. Leave the jars alone until all the ice melts (approximately 1 hour).
8. Return to the jars and observe. What happened to the water level in each one? How did the melting ice change sea level (or did it)?

Supplies

- ❑ 2 ice cubes per girl (or group)
- ❑ 2 tall jars
- ❑ whiteboard markers or masking tape
- ❑ Plasticine or small objects to make a landform
- ❑ water

What's happening here?

In this experiment, the melting glacial ice (the one on land) caused a rise in sea level because water that was previously trapped on land entered the ocean.

When the floating ice melted, this water was already in the ocean as ice. The ice displaced (pushed aside) a similar amount of water to the amount that would have been there when the ice melted. This meant that sea level would not change very much because the water was already being "pushed" to the level it would be when the ice melted. In real life, salt water in the ocean is denser than fresh water in ice, so the

melting fresh-water ice would contribute slightly to sea level rise, though this is going to be much less than the contribution of land based ice. When land based ice melts, it can add quite a lot of water to the ocean, causing sea level to rise.

Take it a step further for Pathfinders and Rangers

Discuss: how would changes in sea level change the world we know today? How would your community be affected if sea levels rose 30 meters? Check out sea level rise projections for the coastal area nearest to you, how might this change the area around your home? Many people around the world live near coastlines. Where might people go if sea level rose significantly?

Check out https://www.nationalgeographic.com/environment/global-warming/sea-level-rise/ to learn more, and http://flood.firetree.net/ to see how rising sea level might affect you.

Principle 3: The Ocean is a Major Influence on Weather and Climate

Rain in a Jar

S B G P R

All the water on Earth is connected. Streams, rivers, and lakes drain into the ocean where the water evaporates and goes into the sky. From here, the water returns to the Earth as rain, where it runs into a watershed and back to the ocean, keeping the cycle going. In this activity, explore how rain is formed and make rain in a jar.

Purpose of this activity: to help visualize the water cycle.

Directions

1. Explain to the girls that all the water in the world is connected by the water cycle. Water falls to the Earth as rain, and this rain returns to the ocean via rivers and streams. Eventually, the water in the ocean is evaporated by sunlight, where it returns to the sky as clouds. Rain falls from the clouds to Earth and continues the water cycle. There are many great visuals for this available online, and can be added to help girls understand.

Supplies

- ❑ a large jar
- ❑ blue food colouring
- ❑ a kettle of boiling water
- ❑ ice cubes
- ❑ a plate or cup that will sit on top of the mouth of the jar.

2. Boil the kettle, and explain to the girls that water vapour is water in the form of steam. Water is in a gas state. As the water in the kettle boils, it will turn into water vapour. You can further explain that water vapour is also caused when water evaporates. For example, on a hot day after you get wet, your clothes dry because the water evaporates and becomes water vapour. When we use a kettle, we can sometimes see a small cloud, which is created when warm water vapour meets cold air. Although it looks like we can see the steam, we are really seeing a mini cloud created by the difference between the hot vapour and cold air.
3. Fill the cup or plate with ice cubes, and explain that we need to cool the water vapour down in order for it to come out of the air as rain. The ice will act like the high part of the atmosphere where it is very cool, and where water can come out of the atmosphere as droplets. Normally, in the sky, the water needs a small piece of dust or ice to ‘condense’ around. Condensation is the process in which a gas turns into a liquid, in this case, water vapour turning into water.
4. Once the water in the kettle has boiled, add about 2 inches of boiled water and some food colouring to the jar. Quickly place the cup or plate of ice over the mouth of the jar, and ask the girls to observe what is happening.
5. Fairly quickly, the girls should notice water condensing around the mouth of the jar and the bottom of the plate. After a few minutes, the plate or cup should drip as the water droplets condense on the cold surface and fall back into the water. To help show this, you can carefully lift the plate a few times. There should be a few droplets stuck to the bottom of the plate. These droplets have condensed out of the steam from the kettle.
6. Explain to the girls that the cycle that involves precipitation, evaporation, and condensation, goes on forever and is very dependent on the ocean. The ocean acts

as both a collection site for the fallen rain, and as an evaporation site for new water vapour to enter the atmosphere. This is important because most of the water that falls as rain, even in inland areas, evaporated over the ocean and was carried inland by a breeze. This means that even if you don't live near the ocean, the rain you experience probably came from the sea.

Conclude the Activity

Discuss with the girls, what would the Earth be like without rain? How does the water cycle move water around the world? To help with this question, ask the girls if anyone has seen clouds moving fast high in the sky? Where do you think they are going? If these clouds started over the ocean, how might the water in them help somewhere else?

Parachute Water Cycle

SB

All the water on Earth is connected. Streams, rivers, and lakes drain into the ocean where the water evaporates and goes into the sky. From here, the water returns to the Earth as rain, where it runs into a watershed and back to the ocean, keeping the cycle going. In this activity, explore the water cycle with a fun game.

Purpose of this activity: to help visualize the water cycle.

Directions

1. Put the water droplets in the center of the bed sheet or parachute – this is the ocean.
2. The girls hold onto all sides of the sheet/parachute and gently toss the water droplets up and down – this is when the Sun heats up the water and it evaporates into the sky, to form clouds. When water changes from a liquid to a gas, this is known as evaporation.
3. At the shout of "Rain!" the girls toss the sheet high into the air, making the water droplets fly – the clouds are now full of water – shake the parachute to make all of the water drops fly off like raindrops.
4. Have the girls collect all the raindrops – they are like the rivers and streams bringing the water back to the ocean.

Supplies

- ❑ cut out about three dozen water droplets using blue construction paper
- ❑ bed sheet or parachute

Water Cycle Shakeout

GP

Have you ever heard of the water cycle? The water cycle is the process that brings rain and water to different parts of the Earth. The water cycle is always happening, and has happened for millions of years. (That means that rain that falls on you may have once fallen on dinosaurs!) This is because the Earth's water cycle has no start or stop. Instead, it is a continuous loop of evaporation, condensation and precipitation that moves water all over the world. Because the ocean is so large, much of the water that evaporates from the surface of the planet does so from the ocean. This water vapour can then be moved (in the form of clouds) to areas far from the ocean. Even if you don't live near the ocean, the water in the clouds above you may have started in the ocean!

Purpose of this activity: to explore the water cycle.

What is the water cycle

Ask the girls if they know where the rain comes from? Many might answer "the sky" and they would be right, but how does the water get in the sky? Rain is part of the water cycle, and this is how much of the water on Earth moves around. There isn't really a "start" or "finish" to the water cycle as it is always happening, but it can be helpful for girls to imagine it like this:

1. The water cycle begins with water on the surface of the Earth; this could be a single drop of water on a leaf, or it could millions of drops in a pond, lake, or the largest source, the ocean.
2. Heat and the sun cause the water to evaporate into water vapour. Water vapour is water in the form of gas and is invisible. This is known as evaporation.
3. The water vapour enters the atmosphere where it cools down and becomes drops of water again. This is visible to us as clouds. This is known as condensation.
4. When a cloud gets really cold, the water falls out of the cloud as rain. When that rain falls to Earth, it can start evaporating all over again, continuing the cycle. This is known as precipitation.

Directions

1. Have the girls take off and roll up their socks to make sock balls – these will represent the water droplets. Instruct the girls to throw their socks randomly into the playing area - for this activity the floor of the playing area represents the ocean (any extra socks can be spread out, as well).
2. During this activity a few girls and leaders will need to be **rainclouds**. Rainclouds work in teams of two to hold up the edges of a blanket so that they are stretched taught. You should have one raincloud team for every five girls.
3. The rest of the girls are the **evaporators** – their job is to collect the balls of socks (one ball at a time) from the ocean and deposit them on the blankets (rainclouds) being held up by the leaders or girls. The evaporators want to get as much rain out of the ocean as they can, so they move as fast as they can.

Supplies

- ❑ socks (it can be helpful to bring some extra balled socks)
- ❑ 2 or more blankets

4. There is a catch – at any time, leaders can yell – “Rainstorm!” As soon as the rainclouds hear “rainstorm” they shake and wave the blanket (without letting go) so that all the water droplets fly off (making it rain), and continuing the water cycle.
5. Continue the game until everyone is out of breath! Then find your socks and put them back on!

Tips and tricks

- If your unit has lots of leaders, they can be the clouds with all the girls as evaporators!
- You can switch teams of clouds after every rainstorm, so that everyone has a chance to shake the blanket and make a “sock rain”.

Ocean Circulation

S B G P R

Have you ever gone swimming in the ocean? In some places near the equator, like the Caribbean, the water is as warm as bathwater. In places further north, like Hudson's Bay, the water is always icy cold. The ocean does not have one temperature. Depending on the temperature and salinity (the amount of salt in the water), water can behave very differently than you might think. Some areas have water that is warm, while other areas have water that is cool. There is salt water (e.g. in oceans) and fresh water (e.g. in lakes). Because of all the differences in temperature, water is always moving in what's known as a convection current. Warm water rises to the surface, while cool salty water sinks deep into the ocean.

In this activity, you can see a convection current in action and make a water 'layer cake'.

Purpose of this activity: to help visualize ocean currents and convection.

Directions

1. Prepare for the activity by heating water in a kettle.
2. Fill the tote halfway with room temperature water. Explain to the girls that the water in the container represents the ocean.
3. Putting the half-full tote aside, fill one of the jugs with cold water, ice and blue food colouring. This will represent the cold water found in the polar oceans.
4. Fill a second jug with water from the kettle and the red food colouring. This represents the warm water at the equator, where the sun heats the water.
5. Have the girls predict what will happen when the different temperature waters are added to the large tote.
6. Slowly add the warm, red coloured water to the container. It's recommended that you slowly pour the warm water into the container near a corner. The warm water will flow over the room temperature water and stay on the surface.
7. Have the girls predict what will happen when you add the cold, blue water to the container.
8. Slowly pour in the cold, ice water and it will flow along the bottom of the container under the room temperature water.
9. If you pour slowly and gently, the water will settle into three distinct layers of warm, room temperature and cold water.
10. Fill the third jug with cold water, ice, several heaping teaspoons of salt and green food colouring.

Supplies

- ❑ large clear plastic container, about 5 gallons (a clear plastic tote works well)
- ❑ room temperature water to fill the tote about half way up
- ❑ 3 water jugs
- ❑ a kettle
- ❑ food colouring: red, blue and green
- ❑ ice
- ❑ salt (several heaping tablespoons)

11. Slowly pour the cold salt solution into the tote of water. The cold, salty water will settle along the bottom of the container, flowing under the fresh cold water and pushing it, and all the other layers up out of the way.
12. Enjoy your water layer cake as long as you can. If possible, let your water layer cake sit over the course of the meeting. As all the water reaches the same temperature, what happens?

What's happening here?

In this activity, it is the different densities of water that allows the layers to sit on top of one another. Cold salty water is denser than all the other solutions (e.g. has the highest density) and therefore settles to the bottom of the container. Cold fresh water is less dense than the cold salty water and therefore sit on top of that layer. Warm, fresh water is the least dense of the three solutions and therefore forms the top layer above the other two.

In the ocean, different densities of water allow the water to circulate around the Earth. This allows for the movement of nutrients (e.g. carbon, nitrogen, and phosphorus) and oxygen around the world. You can imagine it like a long conveyor belt that begins at the equator, where water is warmed by the Sun. The warmed water is pulled towards the poles because the polar water has become too cold, salty and dense, causing the cold water to sink. As the cold, salty polar water then sinks deep into the ocean (because it is denser than the warm water), the warm water is able to flow into the space left by the cold water. At the bottom, the cold dense water begins to slowly move towards the equator, where it is warmed by the Sun, causing it to become less dense. The warmer, more buoyant water then begins flowing back to the equator, continuing the cycle.

In this demonstration, you can see how the different ocean layers stratify (forms layers) based on their salinity, density and temperature. In the ocean, the layers are always changing due to the differences in temperatures and depths of the ocean around the world. This moves the water in a long slow conveyor belt around the world. This is important because it moves heat and nutrients around the Earth, which has a big impact on fish and weather. If not for the ocean conveyor belt bringing heat to North America and Europe, it would be a much colder and snowier place than it is today.

Current in a Bag

SBG

Sometimes the ocean looks like a big still basin of water, but really, the ocean is full of currents. Currents are flows of water that move in different directions. Currents can be caused by heat, wind or density and are very important for moving nutrients and energy in the form of heat around the world. Ocean currents even help stabilize the Earth's temperature and provide food for marine animals and plants. Currents can also exist in the air, moving wind and water vapour around, too – ocean and land currents keep everything in motion! In this activity, you can make your own currents and even carry them around with you in a bag.

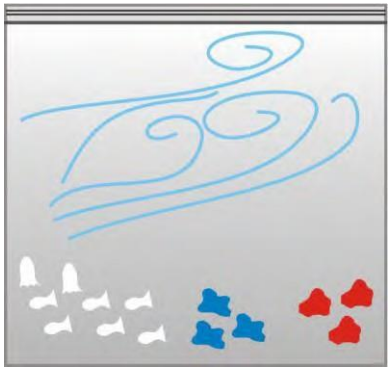
Purpose of this activity: to explore how currents in the ocean move heat and nutrients around.

Directions

Supplies

- ❑ a Ziploc freezer bag
- ❑ thin paper, such as tissue paper or paper napkins, in white, red, and blue
- ❑ scissors
- ❑ a straw
- ❑ pencil crayons
- ❑ optional: permanent markers (i.e. Sharpie)

1. Using a Sharpie or other permanent marker, add some swirling designs to the outside of your "current bag". The designs can be anything you like; we suggest swirls and loops will give a current-like effect. Let the marker dry for a few seconds.
2. With the craft paper, cut out small animals that can be moved by currents. For example, you could cut out baby fish, tiny jellyfish and even plankton. Just make sure your animals are cut from one layer of napkin or tissue – they have to be very thin to move around in the current. Older girls can add detail to their animals using pencil crayons. For younger girls, they can simply tear small pieces of white tissue paper into their bag.
3. Add some red paper to represent heat in the ocean – tear the tissue into small pieces and add this to the bag.
4. Next add some blue pieces; this represents nutrients in the ocean.
5. Put the straw ½ way into the bag and zip the bag closed around the straw. The straw should stick out a bit, so the girls can blow into it.



6. Have the girls hold the bag near the straw, and blow into the bag through the straw. It will take a few blows for the bag to inflate, and it's okay if some of the air escapes around the straw as the girls blow; some of the air will need to escape or the bag could pop!
7. To create a current, the girls blow into the straw. This will cause the pieces of paper inside to blow around. It may take a few tries for the girls to figure out where to blow, but generally, if they aim the tip of the straw at the pieces (heat, nutrients and animals) in the bag, they will start to blow and swirl around.

8. This blowing represents an ocean current moving all the different pieces (food, heat and animals) around in the ocean. As each girl blows into her bag, she creates a different current for the materials.

This activity shows how currents can carry different things around in the ocean. When the girls blow into the bag, they create a moving, swirling vortex, not unlike an ocean current. In the ocean, there are large gentle currents, deep powerful currents and small, fast currents. Currents also help move food to animals that always live in one place (like corals or filter feeders, such as barnacles). Without currents, animals and plants would struggle to get the right food and nutrients. Because currents keep everything moving, animals and plants have a better chance of getting the things they need to survive and thrive.

Mini Ocean Currents

S B G

Sometimes the ocean looks like a big still basin of water, but really, the ocean is full of currents. Currents are flows of water that move in different directions. Currents can be caused by heat, wind or density and are very important for moving nutrients and energy in the form of heat around the world. Ocean currents even help stabilize the Earth's temperature and provide food for marine animals and plants. Currents can also exist in the air, moving wind and water vapour around, too – ocean and land currents keep everything in motion!

Purpose of this activity: to explore how currents in the ocean move heat and nutrients around.

Directions

1. Add water to the pie plate, so that it is about an inch deep – (girls can share a pie plate, if needed).
2. Add a few drops of food colouring to the pie plate. Watch the food colouring for a few minutes, it may swirl a bit on its own. This swirling resembles tiny currents that could be caused by the movement of the two fluids (the food colouring and the water), gentle air currents in the room, or maybe even differences in temperature between the two fluids.

Supplies

- ❑ a shallow dish or pan, such as a pie plate
- ❑ water
- ❑ drinking straws
- ❑ food colouring
- ❑ glitter

3. Using the straws, have the girls gently blow on the surface of the water (if they blow too hard it will spill! Emphasize that they must blow gently). This acts just like an air current above the surface of the ocean. Have the girls notice how the air can push the water around, and how each current can be different.
4. Sprinkle in some glitter – this could represent small animals, nutrients or heat. Using the straws to create currents, can they get the glitter all around the pan?

Take it a step further

If the glitter represented human pollution (such as, for example, an oil spill), how might currents make it difficult to clean up? How might a current help to dilute (weaken) a pollutant in the water? How might a current disperse (move it far away) the pollutant?

In this activity, the girls are demonstrating a wind driven current. Wind driven currents are important for moving heat and nutrients around the world.

Current Chain Game

S B G

Sometimes the ocean looks like a big still basin of water, but really, the ocean is full of currents. Currents are flows of water that move in different directions. Currents can be caused by heat, wind or density and are very important for moving nutrients and energy in the form of heat around the world. Ocean currents even help stabilize the Earth's temperature and provide food for marine animals and plants. Currents can also exist in the air, moving wind and water vapour around, too – ocean and land currents keep everything in motion!

Purpose of this activity: to explore how currents in the ocean move heat and nutrients around.

Directions

Supplies

- ❑ a large space

1. Have the girls all join hands in a long chain. Select one girl (or leader) to be at the start of the chain.
2. The leader begins walking in one direction, and as she goes, she pulls on the girl she is holding hands with. This girl goes with her, and pulls on the girl behind her and so on… younger girls occasionally struggle to wait until they feel a pull – remind girls that they need follow the leader one behind the other, if they clump up it won't work.
3. Have the leader take some creative routes around the room. For example, they can go around a chair, make a circle or even zigzag from one side of the room to the other. Explain to the girls they are acting like an ocean current – as the leader pulls them, they move around the room differently than they would on their own. Together they make a current because they are acting like a flow of water moving in one direct.

Optional

Break the girls into patrols or small groups so that they can be different currents (each patrol has one leader, and the whole patrol is a different "current"). Have the girls try and take the most creative route around the room (and the other currents).

Water Holds Heat

S B G P R

Water is really good at absorbing and holding heat. When we try and warm up water to make tea or hot chocolate, it can take a while before the water starts to boil or get hot because the water is holding on to all that energy. Equally, the kettle will stay hot for a long time after it has boiled because the water holds heat.

The oceans hold heat too. When the sun warms the Earth, a lot of that heat energy goes into the ocean, which helps keep our planet at a nice warm temperature all year round. Although the ocean doesn't feel hot, it, along with the atmosphere, helps keep the Earth warm by distributing heat and energy. Without the ocean and atmosphere, our planet would be very cold, especially at night when we don't have sunlight to warm us up.

Purpose of this activity: to demonstrate the heat capacity of water.

Directions

Option 1

Supplies
- ❑ 2 tall drinking glasses
- ❑ food colouring
- ❑ water
- ❑ kettle

1. Fill the kettle with water and bring it to a boil.
2. Fill one of the glasses with the hot water from the kettle, and fill the other with cold water.
3. Ask the girls, when we add the drop of colour to the glasses, what do they think will happen? Give the girls some time to guess.
4. Add a few drops of food colouring to the cold water, without stirring. The colour will swirl near the surface and slowly dissolve into the water.
5. Next, add a few drops of colouring to the hot water, without stirring.

What's happening here?

The girls will notice that this time, the food colouring dissipates (moves into the water) much more quickly than the cold water. This is because the hot water contains more energy than the cold water. Water molecules are always moving, but, in this demonstration, we can see that the warmer the water, the faster they move. The colour dissipates more quickly into the glass of warm water because the warm molecules of water bump and jostle the food colouring molecules. You can actually observe the water holding heat!

Option 2

Supplies
- ❑ 2 balloons
- ❑ candle
- ❑ matches
- ❑ basin (to help clean up)

WARNING, this demonstration uses a candle and matches, thus should be done under supervision or by an adult.

1. Blow up one balloon with air. Explain to the girls that this balloon of air represents the air of our atmosphere.

2. Fill the other balloon half full with water, and half full of air. Explain to the girls that this balloon represents the water in the ocean.
3. Light the candle, and explain that the candle will represent the heat from the sun. Encourage the girls to make predictions about what will happen to the balloons.
4. Move the air-filled balloon over the candle flame. The balloon will quickly (and loudly!) pop. Encourage the girls to predict/discuss why they think the balloon popped.
5. Move the water filled balloon over the flame so that the flame settles under an area that is full of water. The balloon will not pop. Allow the girls to discuss why they think the balloon did not pop. You are advised to move the balloon through the flame rather than placing and holding it in the middle. (If held in one place long enough, the rubber will heat enough to break).

Warning: if the flame touches the water filled balloon where there is no water, (for example, near the knot) the balloon will pop just as it did when it was full of air, sending the water inside everywhere!

What's happening here?

After the demonstration, explain to the girls that the air-filled balloon popped because air has a lower heat capacity than water. Basically, the air cannot protect the balloon from the energy (in the form of heat) from the flame. It takes a very small amount of energy to warm the air, so once the air is warm, all the energy from the flame goes into the rubber. The water, on the other hand, has a very high heat capacity, so it would take a very long time to heat to the point that it would allow the rubber to get hot. Basically, the water was able to hold the heat of the flame and thus protect the rubber of the balloon. Because of water's high heat capacity, it takes a lot of energy for the water to change temperature even a small amount. When the balloon is exposed to the flame, the water protects the balloon from the energy by slowly heating and protecting the rubber from the extra heat.

On Earth, the oceans do the same thing as the water in the balloon. The oceans slowly take in the heat of the sun, and moderate the temperature of our environment by keeping the area around them from heating very quickly. This also means that when water is heated, it takes a long time for the heat to disappear. So, in the winter the oceans slowly release some of the heat they collected over the summer. This helps our planet maintain a relatively normal temperature, and to make our weather more consistent.

Conclude the Activity (for Sparks, Brownies and Guides)

Finish your exploration of the heat capacity of water with the game "**Freeze Tag**".

Freeze Tag

S B G

This activity is an extension of "**Water Holds Heat**"

Purpose of this activity: to demonstrate the heat capacity of water.

Directions

1. Explain that the girls are all heat energy; they move really fast around the playing space. Choose one girl to be 'it'. She is water, and can take some of that heat energy away!
2. On **GO** "it" can tag the heat energy, making them slow down and stop moving (freeze). Girls can be unfrozen (get more energy/ heat) by having another player shake her hand.
3. Continue until you are all out of your own energy!

Hurricane in a Jar

SBG

Ocean storms are important part of the world's weather, the most famous of which is a hurricane.

A hurricane is an intense, destructive ocean storm that is defined by catastrophically powerful winds, a high storm surge (very big waves of water that can cause flooding), and torrential rain. In simple terms, a hurricane is a massive, powerful storm that strikes the coast. As a tropical storm develops, it begins to suck up warm, moist air near the equator. As the storm picks up the warm air, it begins to spin and to suck in more air. This feeds the storm and causes the winds inside to become very powerful and fast. This, in turn, causes the hurricane to pick up vast amounts of water in both a storm surge and as rain. If this massive storm reaches land, it causes huge amounts of damage and destruction as winds and water rip through the area. Hurricanes can be very powerful and destructive ocean driven storms, but they also look pretty cool in a bottle. Try this activity to make a hurricane you can take with you.

Purpose of this activity: to demonstrate the swirling motion of a hurricane.

Directions

1. Fill the jar ¾ full with water.
2. Add a squirt of dish soap and a splash of vinegar.
3. Optional: add some glitter, pieces of felt or beads as debris in your storm.
4. Screw the lid tightly onto the jar.
5. Shake and swirl the jar very quickly (this will take some practice) and then suddenly stop. The water in the jar will keep swirling, making a spinning vortex like a hurricane. The glitter and debris can help you see the swirling shape. Try a few different shaking methods to get the biggest hurricane.

Supplies

- ❑ a small jar with a sealable lid
- ❑ water
- ❑ dish soap
- ❑ vinegar
- ❑ optional: glitter or felt, beads or other pieces of debris.

Conclude the Activity

Finish your exploration of hurricanes with the "**Hurricane Spins Game**".

Hurricane Spins Game

S B G

This activity is an extension of "**Hurricane in a Jar**"

Purpose of this activity: to demonstrate the swirling motion of a hurricane.

Directions

Supplies

- ❑ chairs or mats to designate players' spots in the circle

1. Have the girls form a large circle of chairs or mats (spaced out!). One girl ('it') stands in the middle of the circle. The rest of the girls sit on a chair or mat.
2. On GO, "it" will ask a question or make an observation. Starting with "the wind is blowing…(observation)" Anyone who meets the criteria stated has to quickly move to a spot vacated by another girl. While the girls are moving, if "it" can tag someone, they switch places and the tagged girl becomes the new "it."
2. For example, "it" might say: "the wind is blowing for someone wearing glasses" or "the wind is blowing for someone with a cat." Any girl that has glasses (or a cat) has to move to a new spot in a circle, without getting tagged. If there are no spots available (i.e. only one person wears glasses), she switches places with "it" in the middle of the circle.
3. If "it" has had a few rounds where she can't catch anyone, she can say "the wind is blowing… into a hurricane". Then every girl in the circle must run around the outside of the circle (like a spinning hurricane!). "It" can take any spot while the girls are running around, and a new girl becomes "it".

Principle 4: The Ocean Makes Earth Habitable

Take a Deep Breath

S B G P R

Most of us know that oxygen comes from plants, but did you know that only a small amount of the air we breathe comes from land plants? The vast majority of our air comes from ocean plants called phytoplankton. These tiny ocean plants contribute so much oxygen to the environment that 7 out of 10 of our breaths come from the ocean! If you've been breathing today, you've used the ocean, even if it's very far away!

Purpose of this activity: to learn how important the ocean is for Earth's breathable air.

Directions

Supplies

- ❑ watch or stopwatch

Optional

- ❑ computer or mp3 player with speakers
- ❑ ocean sounds, found online https://www.google.ca/#q=ocean+waves+mp3

Part One

1. Have the girls sit quietly and close their eyes. Optional: have gentle ocean sounds playing while you do this activity.
2. Explain to the girls that 7 out of 10 breaths come from the ocean. Ask them to breathe deeply as they listen to the ocean.
3. Tell the girls to count how many times they breathe in one minute. Tell them when to start counting, as you begin timing them. Time for one minute.
4. At the end of the minute, ask the girls to think about how many breaths they took. If they took 10 breaths, then 7 of them were from the ocean. 13 breaths means 9 were from the ocean. 16 breaths means 11 were from the ocean. If they took 20 breaths, then 14 of them were from the ocean. (You can calculate the amount of ocean breaths by multiplying by 7 then dividing by 10).

Part Two

Complete one of the following air experiments, or do an air experiment appropriate for your age group, recognizing that some of the air you use is from the ocean (find additional air experiment instructions online https://www.google.ca/#q=air+experiment).

Option 1: Move Items with Air

Directions

Supplies

- ❑ a few large, heavy books
- ❑ an air tight plastic bag

Optional

- ❑ balloons

1. Stack your books on a table or chair, with the plastic bag (or balloon) underneath (the open part of the bag/balloon should be sticking out from under the books so it can be inflated later).
2. Ask the girls if any of them can move the books using air. They can't touch the books directly or remove the plastic bag/balloon, they'll have to think of a solution that uses air.
3. If nobody thinks of it, ask a volunteer to blow into the plastic bag to inflate it. Remind the volunteer to go slowly, so they don't get lightheaded, and have them keep blowing into the

bag/balloon until the books tip over. *Optional: use a balloon pump to inflate the bag/balloon*. Count the number of breaths the volunteer uses, and calculate how many came from the ocean (multiply by 7, then divide by 10).

4. If all your girls want to try, you can give each girl a balloon and a book to repeat the experiment in pairs. Have each pair record the number of ocean breaths it took to move the books!

Conclude your experiment by explaining to the girls that we were able to move the books using air because air takes up space. Although air is invisible, it has volume. We can see this when we trap the air in the plastic bag/balloon. Because the air can't escape the plastic, that volume of air has to push the books out of the way to make room for itself. This causes the books to tip over as the bag inflates.

Option 2: Balloon in a Bottle

Directions

Supplies

- ❑ 2 empty plastic drink bottles
- ❑ 2 balloons
- ❑ a thumbtack

1. Put one balloon into the bottle, and slip the mouth of the balloon over the opening of the bottle. The balloon will be hanging open inside the bottle.
2. Ask a volunteer to blow up the balloon inside the bottle. It's going to be much harder than it sounds!
3. Ask the girls if they have an idea as to why it might be hard to blow up the balloon inside the bottle. Some girls might say that there is not enough room for the balloon inside the bottle, and in a way, they are right. The balloon does not inflate because the bottle is already full of invisible air. When we try and blow up the balloon, we are pushing against the air, but it has nowhere to go. This air pushes back against the balloon, making it hard to inflate.
4. Take the second bottle, and poke a small hole in the bottom using the thumbtack. Ask the girls if they think this will help the balloon inflate. Put the second balloon over the neck of the second bottle, just like the first
5. Ask a volunteer to inflate the balloon. It will be much easier this time, as the air inside the bottle can now exit the bottle through the small hole. This shows that the balloon moves the air in the bottle "out of the way" as it inflates inside the bottle. This helps us see that air, although it's invisible, takes up space!

Conclude your experiment by explaining to the girls that although the air is invisible, it has volume. This means it takes up space. When we try and blow up the first balloon, the volume of air already in the bottle keeps the balloon from inflating, as there's no space left in the bottle for the balloon. When we poke a small hole in the bottle, the air is now able to escape. When we blow up the balloon an amount equal to the amount in the balloon will get pushed out of the bottle, so the balloon now has 'room' to inflate.

Plankton Game

S B G

Plankton, aquatic organisms (see the end of this activity for a full definition) that play an important role in the ocean food web, undertake one of the longest migrations on Earth every single day! Where are all those tiny organisms going? They travel from the deep dark water, where they spend the day, up to the surface, to feed on tiny plants called phytoplankton, at night. They use the darkness to protect themselves from predators, but because of their tiny size, it means that plankton make the longest migration of any animal relative to their body size, every night and day.

Purpose of this activity: to explore daily plankton migrations.

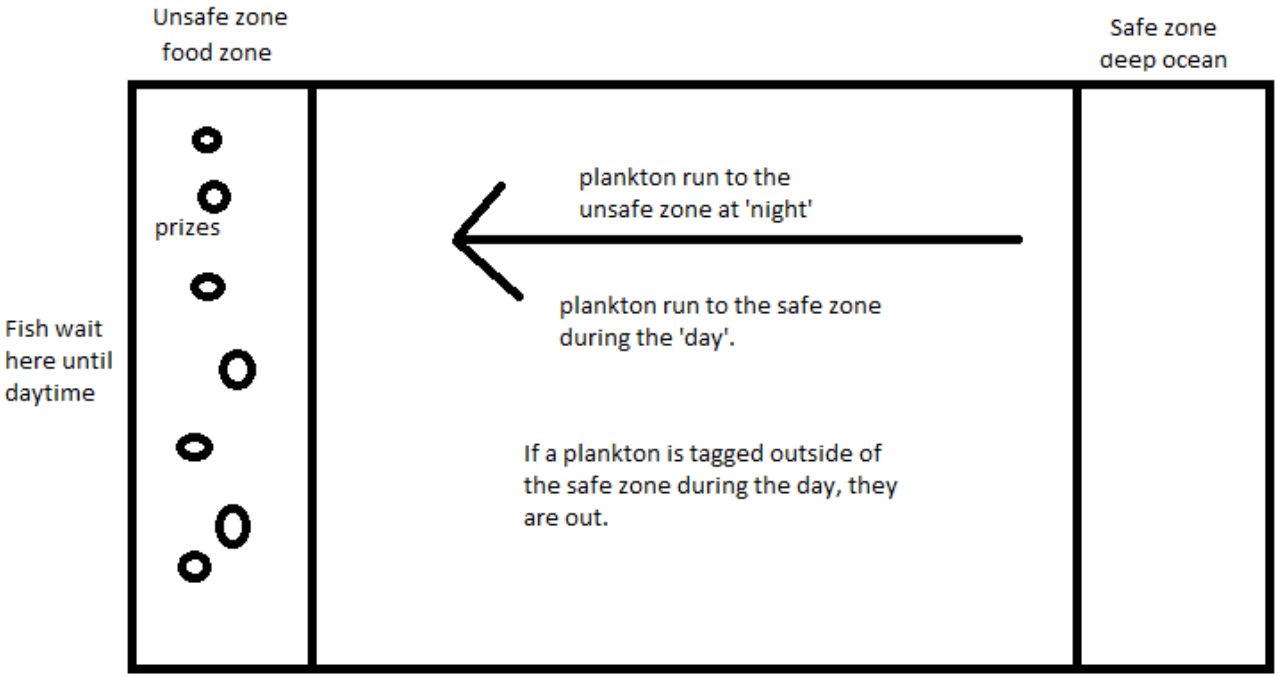
Directions

1. Select one or two girls to be fish. The fish eat the phytoplankton, but only during the day.
2. Have the rest of the girls line up along one side of the playing area in the marked off safe zone. These are the plankton, in the deep ocean.
3. Sprinkle the far end of the playing area with "phytoplankton" (if you are using very small items as phytoplankton, you can place small bowls out in the playing field) – this is the unsafe zone. Glow sticks work well if you are dimming the lights!
4. Tell the girls that it is nighttime. It is helpful to dim the lights, if you can. When the lights are dimmed or the signal is given, have the plankton run (safely!) to the far side of the playing area where they can begin collecting the "phytoplankton".
5. Tell the girls that they can stay on the far side of the playing area (where the "phytoplankton" are) collecting pieces as long as they like. However, warn them that when it's daylight, the fish will come out and try and catch them. When the lights are on, the only safe zone is in the dark part of the ocean (furthest area from the "phytoplankton").
6. As soon as the lights come on, or the 'day' signal is given, the fish are able to tag any plankton that is not in the deep-sea safe zone. Tagged plankton are out of the game and have to give the fish their "phytoplankton".
7. Play a few rounds of day and night and then discuss with the following questions with the "plankton" and the "fish": What strategies did you use to keep yourselves safe/catch more plankton? How might this be true in the wild? What strategies worked and which didn't? Why?

Supplies

- ❑ image from Neptune Canada's acoustic profiler (ZAP), at the end of the instructions
- ❑ a long playing field or area with two safe zones marked one at each end (see example)
- ❑ a "phytoplankton" station of small pieces (could be pompoms, bingo chips, or beads or glow sticks– use your imagination)

Example Playing Area



Tips and extensions

- Rotate the fish often so that they don't get tired!
- Introduce other elements – for example, have even bigger fish that can eat the little fish – how long does the game last?
- Explain that the prizes are nutrients for the plankton, and they will need a specific amount to survive. Limit the amount available, and discuss how this changes the game for the girls.

Take it a step further for Guides

What's a Zooplankton Acoustic Profiler? Visit http://venus.uvic.ca/data/data-plots/ and download data from the Zooplankton Acoustic Profiler (look for ZAP on the page). Find out online, and check out the cool data. Show the girls one of the images from the ZAP (sample on the next page). This device uses sound to detect particles in the water. This is very similar to how whales use echolocation. A sound is produced by the sensor, and as it bounces off the particles, the sensor can hear the return echoes. Some of the tiny particles are actually animals called Zooplankton. The image shows one day in April 2007. Notice at the bottom of the picture, there is a bar showing if it is daytime or nighttime. During the day, the plankton (seen as the red, yellow and green fuzzy bar) are in the deep part of the ocean. At night, the bottom of the graph is clear because all of the animals are near the top of the graph at the surface of the ocean. Show the girls that scientists can see the tiny animals moving towards the surface at dusk and away from the surface at dawn. In the game, the girls explore why the plankton move this way, and where they are going.

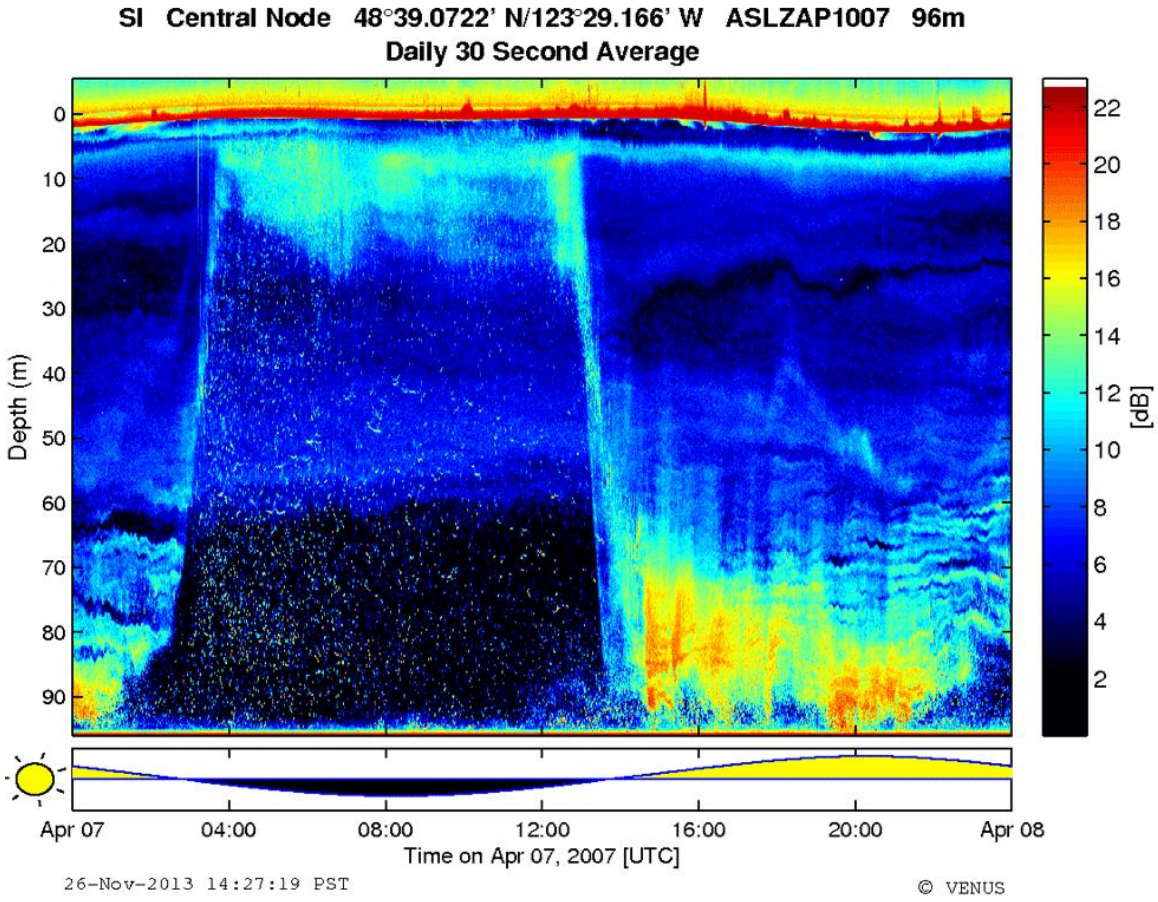
Conclude the Activity

Complement your exploration of plankton with the "**Marine Maze**".

PLANKTON: The word “plankton” comes from a Greek Word meaning “drifter”, so plankton can refer to any plant or animal that lives by drifting in the ocean. Usually, this means plants and animals that are too small to swim against the current, but it can also include larger animals like jellyfish or even fish eggs and larva animals. Plankton are sorted into two big groups; Phytoplankton, which are plants, and Zooplankton, which are animals.

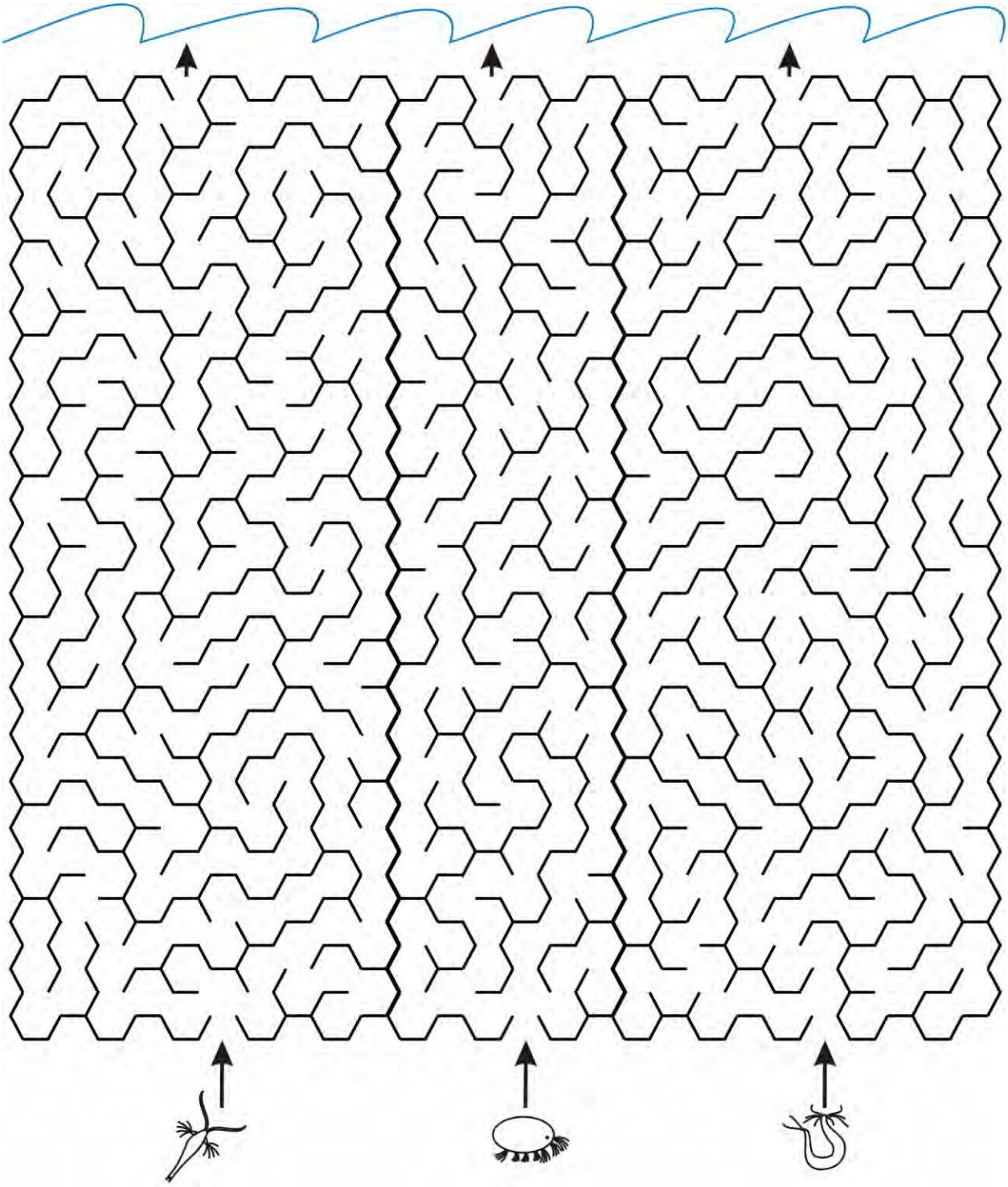
Check out http://www.nhptv.org/natureworks/nwep6d.htm for more information.

Zooplankton Acoustic Profiler (ZAP) image for the Plankton Game



Marine Maze

It's nighttime!
Help the zooplankton reach the surface of the ocean so they can eat.



Plankton Hat Craft

BG

Plankton are some of the smallest, yet most important, organisms and plants on Earth. Much of the oxygen we breathe comes from plankton living in the ocean. Plankton are also the base of the ocean food web, feeding millions of animals every day. The biggest animal on Earth, the blue whale, eats only tiny plankton! In this activity, make yourself some play plankton to carry around on your hat. Without them, you wouldn't have food to eat or air to breathe, so why not celebrate these tiny organisms and plants.

Purpose of this activity: to help visualize plankton.

Directions

1. Each of the tiny pieces represents a type of plankton and is about the same size. Use the attached image to show the actual plankton that each piece represents.
2. The sesame seeds represent copepods, small swimming crustaceans that fish love to eat.
3. The poppy seeds represent tiny fish eggs that have not yet hatched. Many fish cast their eggs into the ocean where they float as plankton until they hatch and grow into big fish.
4. The split peas represent tiny jellyfish.
5. The rice grains represent baby octopus and squids that have just hatched.
6. Paper punches represent baby crabs called Megalops. This is the stage right before they settle to the bottom and start looking like real crabs.
7. Seed beads represent small phytoplankton too difficult to distinguish with the naked eye. Their green colour reminds you that they are plants.
8. To make your craft, take the salt and mix in 7-10 drops of blue food colouring. Mix the salt with the food colouring as evenly as you can.

   Tip: put the salt in a big bag with the food colouring and toss it around during a passing game. As the salt and food colouring mix, it dyes the salt blue. Add as much food colouring as you like to make a nice blue colour.

Supplies

- ❑ 4 tbsp. sesame seeds
- ❑ 4 tbsp. poppy seeds
- ❑ 4 tbsp. split peas or lentils
- ❑ 4 tbsp. rice
- ❑ 4 tbsp. green seed beads (the very tiny ones)
- ❑ hole punches (the little circles of paper that come out of a hole punch)
- ❑ glue
- ❑ a strip of cardboard, about the size of a business card
- ❑ ½ cup of salt
- ❑ blue food colouring
- ❑ printable labels
- ❑ optional: a small baggie that will fit over the card

9. Mix the seeds and other pieces (but NOT the green beads) with the blue salt – now you have plankton floating in blue salt water.
10. Spread your card with glue (it should be tacky, but not dripping) and sprinkle it with your plankton and salt mixture. Press the salt and seeds into the glue to help it stick.

11. Put a little more glue along the top edge of your card. Sprinkle on the green seed beads and press into the glue. These are your phytoplankton for your plankton to eat! They are at the surface because they need sunlight to survive.
12. Allow your craft time to dry, and, if you wish, put it in a plastic baggie to protect it on your hat.
13. Optional: label each type of plankton on the back of your card.

Creature Labels

Copepods (sesame seeds)

Fish eggs (poppy seeds)

Jellyfish (split peas)

Baby octopus (rice)

Megalops (hole punch)

Phytoplankton (green seed beads)

Take it a step further for Guides

The word “plankton” comes from a Greek Word meaning “drifter”, so plankton can refer to any plant or animal that lives by drifting in the ocean. Usually, this is means plants and animals that are too small to swim against the current, but it can also include larger animals like jellyfish or even fish eggs and larva animals. Plankton are sorted into two big groups; Phytoplankton, which are plants, and Zooplankton, which are animals.

Check out http://www.nhptv.org/natureworks/nwep6d.htm for more information.

Conclude the Activity

Complement your exploration of plankton with the “**Marine Maze**”.

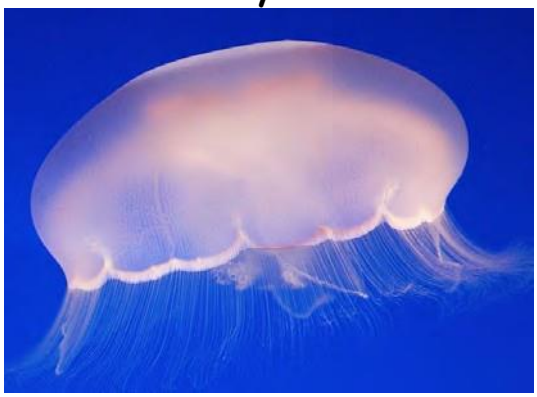
Copepods

(sesame seeds)

Fish Eggs

(poppy seeds)

Jellyfish

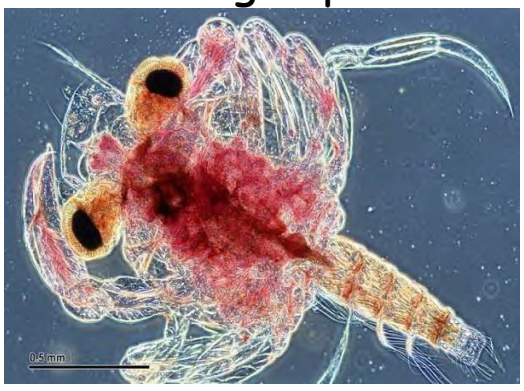


(split peas)

Baby Octopus

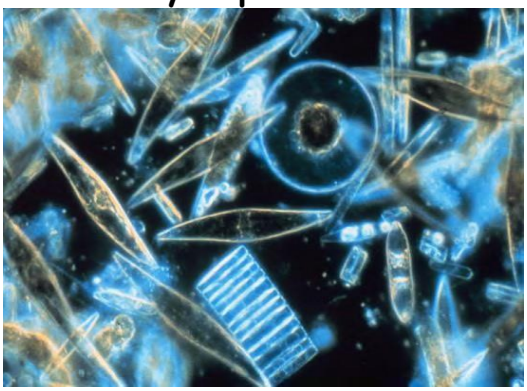
(rice)

Megalops



(hole punch)

Phytoplankton



(green seed beads)

Jellyfish Crafts

S B G P R

Plankton are plants and animals that drift, rather than swim, through water – a bit like fluff in the wind. Plankton usually drift because they are not very good swimmers. This could be because they are too small to swim against the ocean currents, or because they have very soft bodies that aren't very good for swimming. Jellyfish, a drifting animal with a soft body, is actually a type of plankton! Some jellyfish are very tiny, and some are very large, but all jellyfish have a soft body that is much better at drifting than swimming. A jellyfish might swim a little bit by pulsing its body a bit like an umbrella opening and closing, but usually it just lets the current carry it through the ocean.

Jellyfish have no bones, no brains and no hearts! A jellyfish looks like an umbrella or bell made of clear or coloured jelly. Jellyfish also have tentacles hanging from either the middle or edge of their bodies. A jellyfish's tentacles are covered with special stingers they use to catch food. Some jellyfish stings feel very painful to humans, and some jellyfish stings don't feel like anything at all. A jellyfish uses its stingers to catch other plankton or even small fish, depending on what they drift into as they float through the ocean. Jellyfish are an important link in the food chain, as lots of fish, and even some types of turtles, think of jellyfish as an important snack! Try making one of these jellyfish crafts, or find other ideas online.

Purpose of this activity: to create a familiar plankton example.

Directions

Option 1 (for Sparks and Brownies)

1. Sponge-paint the outside of the bowl with 1 colour. Let dry for a few minutes before adding a second or third colour.
2. Set aside and let dry thoroughly.
3. Cut a variety of coordinating ribbons to various lengths from 7 to 10 inches.
4. When the bowl is dry, glue or tape the ribbon randomly on the inside of the bowl so that when it is turned upside down, the ribbons will fall down from the underside of the bowl.
5. Add eyes and attach the fishing line.

Supplies

- ❑ paper or Styrofoam bowl
- ❑ sponges
- ❑ paint in 2 or 3 colours
- ❑ various types of coordinating ribbons (curly ribbon, organza ribbon, etc.)
- ❑ fishing line or thread for hanging
- ❑ googly eyes
- ❑ scissors
- ❑ glue or tape

Option 2 (for Guides, Pathfinders and Rangers)

1. Cut a square of organza ribbon (the same length as the width of the ribbon).
2. *Caution: adult supervision is required for this step!*

   Light a candle and hold the organza close to the candle, but don't touch the flame with it. The heat of the candle will cause the fabric to curl up in itself by starting to melt it. This seals the ribbon so it won't fray.
3. Once your ribbon is curled in on all edges, put the glass stone in the centre of it and wrap an elastic around the open end of the ribbon so it closes over the bottom (or flat side) of the stone, leaving the ends dangling down.
4. Cut narrow ribbons to various lengths from 3 to 5 inches. Tie together and attach to the centre bottom of the organza ribbon so the narrow ribbons fall out from the middle of the tied organza ribbon
5. Trim ribbons to desired length. Ribbon can be curled, if wanted.
6. Attach a pin and voila, you have a jellyfish hat craft!

Supplies

- ❑ flat glass stone (the kind that are put in vases)
- ❑ plain colour organza ribbon – about 3-5 inches wide
- ❑ variety of narrow ribbons – sheer, curly, sparkly etc.
- ❑ small hair elastics (½" to ¾")
- ❑ safety pin
- ❑ candle & matches

Plankton Skimmer Net

BGPR

You can thank plankton for quite a lot! In fact, you can thank them for seven in ten breaths you take, almost every fish we eat and just about everything else in the ocean. Plankton are amazing, and they are everywhere. In this activity, see if you can find some plankton near your own home. You'll be surprised by your microscopic (yet important) neighbours!

Plankton live in most bodies of water, even freshwater, and can be easily caught in the right net. Even if you don't live near the ocean, you can still explore plankton firsthand by visiting your local lake, pond or stream (as long as the water isn't moving too fast). If there is no water near you, you can recreate this activity using the plankton in the hat craft. Sprinkle this "pseudo-plankton" into a large bucket and have the girls make and use smaller versions of their plankton net.

Purpose of this activity: to explore how researchers study plankton and observe plankton in your environment.

Directions

1. Your plankton net needs to have a long funnel-like shape to collect the tiny plankton. Cut off one leg of the pantyhose.

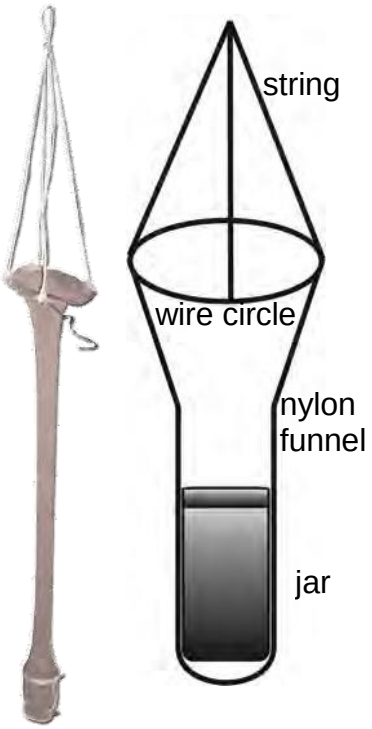
2. Make a wide ring with your wire or coat hanger.

3. Open one leg of the pantyhose/nylons. The gusset, leg and foot will make a long funnel.
4. Drop the jar into the leg with the opening facing up, and tie the jar in place by tying a string around the neck of the jar. This will keep the jar from falling over when the net is in the water.

Supplies

- ❑ old pair of pantyhose/nylons - cut in half (you only need one leg) or piece of mesh
- ❑ wire, about 50cm long
- ❑ jar
- ❑ duct tape
- ❑ string

5. Roll the top of the nylon several times around the wire ring. Secure the ring in place with duct tape.



6. Use duct tape to attach strings to the top of the net, at the wire circle. Be sure that your net hangs open evenly. The strings will be used to tow your net through the water.
7. Take your plankton net to a local body of water and skim the plankton net through the water. After a few passes, bring the plankton net to the surface and hold it with the jar resting on the ground (mouth up).
8. Take the jar out of the net and, without spilling any water, look inside the jar.
9. Do you see anything moving? Are there any tiny creatures hanging out in your jar? If so, these are plankton!
10. Try looking at some water samples under a microscope or with a magnifying glass. What do you see? Are there tiny creatures you couldn't see before? Can you see any details with the microscope (or magnifying glass) you couldn't see before?
11. If you don't catch anything the first time, try casting your net again until you do. Don't worry, unless you're at a backyard swimming pool, you'll probably find something.

Optional Extensions

- Try taking samples at different depths – do you get different creatures at the surface or in deeper areas?
- See if you can find the creatures in a science book – can you identify the zooplankton that lives near you?
- Explore your local food chain. What animals feed on the plankton you caught?

Take it a step further for Guides, Pathfinders and Rangers

Plankton and phytoplankton:

Plankton is defined as organisms that live in the water column that float freely, unable to resist the movement of the current. This group includes both animals, such as jellyfish, and microscopic, single-celled plants. Plankton is subdivided into two groups: zooplankton, the animal group, and phytoplankton, the plant group. What we sometimes call algae phytoplankton is vital to all life on Earth. Like all plants, they take in carbon dioxide and produce oxygen during photosynthesis and are responsible for as much as one half of the Earth's primary production.

Phytoplankton help remove carbon dioxide from our atmosphere and produce oxygen in the process. Some researchers believe that plankton take in so much carbon and produce so much oxygen that one in five of our breaths can be attributed to phytoplankton.

Phytoplankton also makes up the basis of the ocean food chain. They are essentially the grass and plants of the ocean food web, and provide food for the smallest ocean creatures. These, in turn, are food for slightly larger ocean creatures, which feed even bigger organisms.

See Real Plankton

Visit http://venus.uvic.ca/data/data-plots/ and download data from the Zooplankton Acoustic Profiler (look for ZAP on the page). What's a Zooplankton Acoustic Profiler? Find out online, and check out the cool data.

Conclude the Activity

Complement your exploration of plankton with the "**Marine Maze**".

Paper Model Coccolithophore GPR

A Coccolithophore (cocoa-lith-a-four) is a type of phytoplankton (phi-toe-plank-ton). Phytoplankton are tiny marine plants that live in water. Phytoplankton can be found in lakes, rivers, streams, ponds and the ocean. Phytoplankton are the basis of the marine food web; you can almost think of them as the grass or leaves of the ocean. Tiny animals eat these tiny plants, and these animals are then, in turn, eaten by bigger animals, which are eaten by even bigger animals, and so on. Because phytoplankton are plants, they are extremely important to our oxygen cycle. These plants take in carbon dioxide and expel oxygen, which all animals need.

Coccolithophores are single celled plants that live near the surface of the ocean. Coccolithophores are unique because, unlike any other plant in the ocean, they cover themselves with microscopic plates of limestone. These scales are called coccoliths (cocoa-liths), and this is how coccolithophores get their name. Coccoliths are shaped a bit like hubcaps on car tires, but they are microscopically thin, much less than the thickness of a human hair.

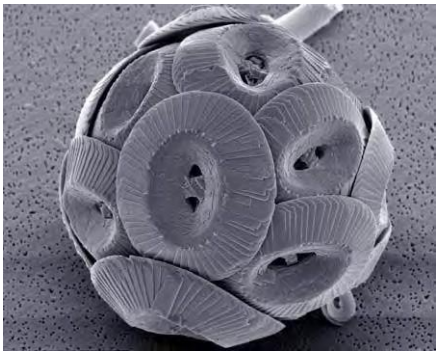
Coccolithophores are microscopic, but what they lack in size, they make up for in large numbers. In some areas, so many coccolithophores will bloom at one time; the water will turn a cloudy green that can be seen from space.

Most plants like nutrient-rich waters, but coccolithophores are special. They can survive in slow moving, nutrient-poor ocean water, long after other types of phytoplankton have died. Many types of fish and Zooplankton (tiny animal plankton) eat coccolithophores when no other food sources are available, and depend on coccolithophores for nutrition.

When coccolithophores die, their limestone plates sink to the bottom of the ocean where they can collect and compress. The White Cliff of Dover in England is an example of millions of years of coccolithophore plates that have collected in the ocean and become exposed over time. Sometimes we even use coccolithophores – fossilized plates is what classroom chalk is made from!

Make a paper model of a coccolithophore.

Purpose of this activity: to learn about coccolithophores.



By Richard Lampitt, Jeremy Young, The Natural History Museum, London (http://planktonnet.awi.de/) [CC-BY-2.5], via Wikimedia Commons

Directions

1. Discuss the features of coccolithophores and their importance in the marine ecosystem, refer to the information provided above.
   - what are they made out of?
   - how big are they?
   - what eats them?
   - can they be seen from space?
2. Cut out the coccolithophore along the solid lines.
3. Fold all dashed lines.
4. Glue or tape tabs in place.

Supplies

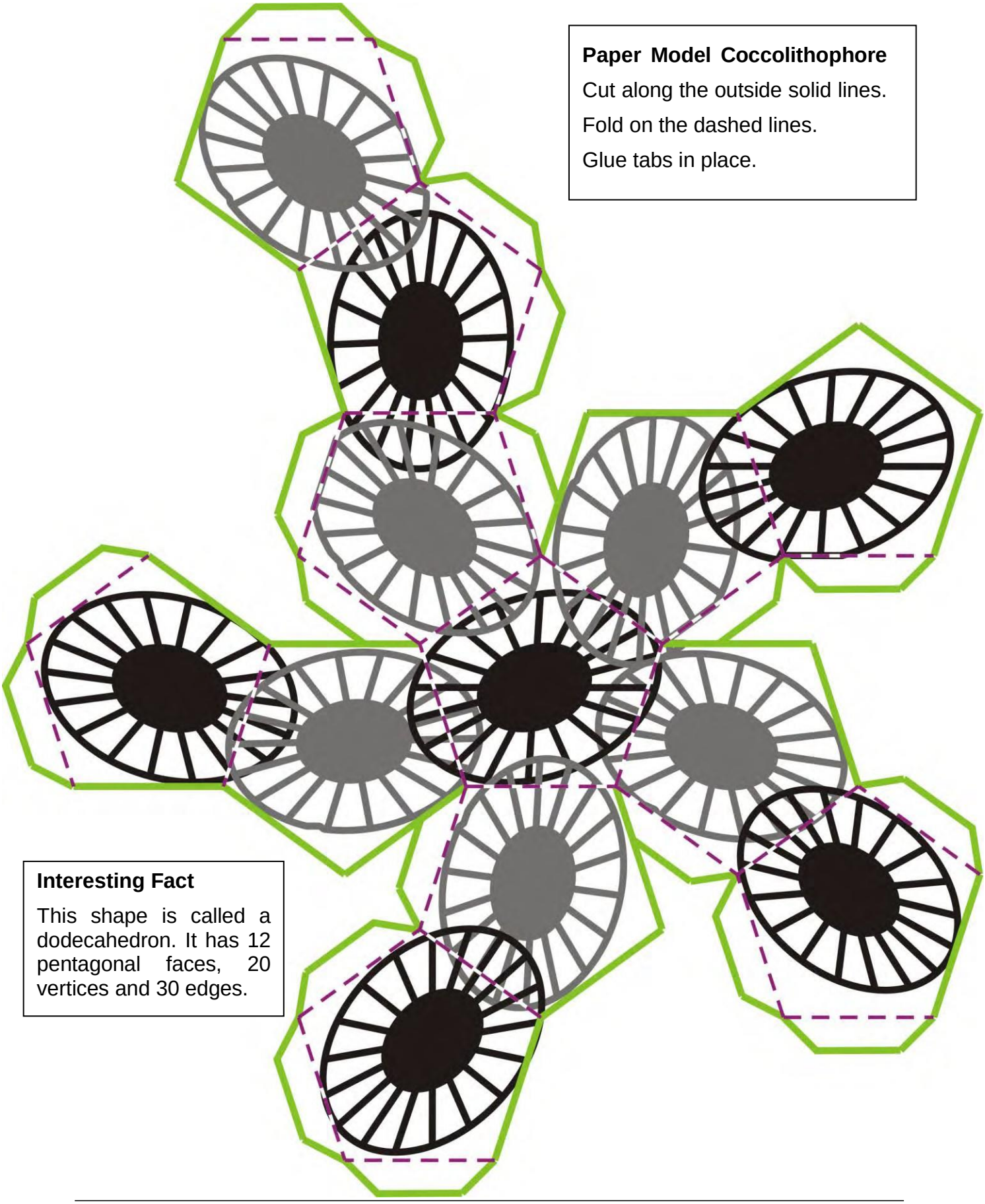
- ❑ coccolithophore model template
- ❑ scissors
- ❑ glue or double-sided tape

Paper Model Coccolithophore

Cut along the outside solid lines.

Fold on the dashed lines.

Glue tabs in place.



Interesting Fact

This shape is called a dodecahedron. It has 12 pentagonal faces, 20 vertices and 30 edges.

Principle 5: The Ocean Supports a Great Diversity of Life and Ecosystems

Ocean Animal Cards

S B G P R

The ocean is full of amazing creatures. Learn about ocean animals by playing a game using the attached cards. You can use the cards in any way that you find suitable for your group. Some activity ideas follow.

Prepare the cards by printing them on heavy cardstock and cutting them apart. To protect the cards, laminate them before use.

Purpose of this activity: to explore the diversity of life in the ocean.

Supplies (for all)

- ❑ Ocean Animal Cards (included, next pages)

Activity 1: Concentration

1. For this game, you will need to print two copies of the cards that you will use. You can choose how many animals you wish to use based on the age group. For younger girls, you could start with 12 animals, for a total of 24 cards per group.
2. Divide the girls into small groups (2 to 6 girls per game).
3. Lay the cards out face down in a pattern, for example, 4 rows of 6 cards (if using 24 cards).
4. Choose one girl to go first. She flips over two cards (one at a time) and identifies the ocean animal on each card. If they match, she keeps the cards and plays again. If they do not match, she flips them face down again and play moves to the next girl (clockwise).
5. Continue play until all cards have been made into pairs.
6. The winner is the girl with the most pairs.
7. Increase the difficulty of the game by adding more animal pairs to the mix.

Activity 2: Go Fish

1. For this game, you will need to print two or four copies of the cards that you will use, depending on how difficult you want the game to be. You can choose how many animals you wish to use based on the age group. For younger girls, you could start with 12 animals, for a total of 24 or 48 cards.
2. Divide the girls into small groups (2 to 6 girls per game).
3. Shuffle the cards then deal 5 cards to each player. Put the remaining cards in a face down pile.
4. Each player then takes turns asking another player for a specific animal card that matches one in her hand. For example, Sally could ask: “Jane, do you have a Polar Bear?” If Jane has a Polar Bear card, she must hand it over. If not, she says “Go Fish” and Sally picks up a card from the draw pile.
5. Play proceeds around the group as in step 4.

6. When you have collected all of the cards for an animal (either a pair, or all four cards, depending on how many cards you are playing with), you can lay the matching cards down in front of you.
7. Play continues until all matches have been made.
8. The winner is the girl with the most animals at the end. Have each girl identify the ocean animals that she has collected to her group. Older girls can read out the facts on the cards.

Activity 3: What Am I?

1. For this game, you need to print one copy of the cards, with enough animals for each girl in your group.
2. Attach a card to each girl's back – you can use either a clothespin or tape.
3. Girls mingle and try to figure out what animal they are. They can ask any question that can be answered with "yes" or "no". Some questions could be: Do I breathe air? Am I larger than a human? Do I have fins? Do I live in the Arctic?
4. Girls must mingle, and cannot ask the same girl two questions in a row.
5. Once a girl has correctly guessed her animal, she can continue in the game by answering questions for girls who have not yet figured out what they are.
6. Hints are only allowed if a girl is really stuck and can't guess what she is.

Activity 4: Size Up!

1. For this game, you need to print one copy of the cards, with enough animals for each girl in your group.
2. Hand out one card to each girl.
3. Have the girls line up in order from smallest animal to largest animal.
4. When the girls are lined up, ask them to read out their card. The smallest animal should be the plankton and the largest the blue whale!

Activity 5: Truth or Lie?

1. For this game, you need to print one copy of the cards.
2. Divide girls into pairs and give each pair several cards.
3. Shuffle the cards and place them face down in a pile.
4. The first player picks up a card and reads out the type of animal. She then reads aloud 2 or 3 facts from the card and adds in one "lie" (something she makes up about the animal). If the other girl guesses which "fact" is, in fact, a lie, she claims the card and earns a point. If she is incorrect, the first player keeps the card and earns a point.
5. Take turns reading out facts and creating lies until all cards are gone.
6. The winner has the most claimed cards at the end.

Conclude the Activity

Complement your exploration of ocean animals with the "**Make an Ocean Animal**" activity.

Anglerfish

- Size: adults are up to 2 m long.
- Species: More than 200 species - most are dark grey to dark brown with huge heads and enormous mouths with sharp teeth.
- Habitat: Lives in deep continental shelf regions, down as low as 20-1000 m.
- Diet: consists of fish and invertebrates. They have large stomachs so will swallow prey larger than themselves.
- Threats: caught accidently as bycatch. Commercial overfishing of smaller fish (their food) will put them in danger of losing their food source. Damage to habitat through trawling.
- Interesting Fact: Lure above the head is only on females and is used to attract prey. The male has adapted by fusing itself with its teeth to the female. He then connects to her bloodstream to get nutrients, then loses his eyes and most internal organs.

Blue Whale

- Size: largest mammal on earth. It can weigh up to 150 tons and be up to 35 metres long.
- Habitat: found mostly in cold and temperate waters preferring deeper ocean waters to coastal waters.
- Diet: Carnivore – eats small shrimplike creatures called Krill.
- Natural Predators: occasionally sharks and killer whales.
- Human Threat: many get injured when they run into large ships.
- Conservation Status: It is endangered. Estimate that there are only 10,000 to 25,000 blue whales living.
- Interesting Fact: Spend summers in the Arctic and migrates towards the equator in the winter.
- Interesting Fact: Their tongue can weigh as much as an elephant.
- Interesting Fact: The whale breathes air. When it expels air, it can shoot a vapour cloud from it's blowhole up to 9 metres high.

California Sea Cucumber

- Size: up to about 40 cm long.
- Habitat: Can be found from Alaska to Baja California. Lives on rocky & soft seafloors from intertidal to about 100m deep.
- Diet: Eats detritus (organic waste) and small organisms.
- Natural predators: large sea stars, but are sometimes eaten by sea otters.
- Human Threat: Now considered a delicacy in Asian countries. Harvesting sea cucumbers has become very popular
- Conservation status: not threatened, but in danger of being overfished. Plans are being put into place to protect them by limiting quantities caught.
- Interesting fact: Sea Cucumbers are nocturnal.
- Interesting fact: Sea Cucumbers breathe from their anus

Clam

- Size: they begin life the size of a grain of sand. A giant clam can grow up to 120 cm.
- Species: there are more than 2000 varieties. There are two main kinds – hard shell and soft shell.
- Habitat: They live in shallow coastal waters.
- Diet: They are herbivores that eat plankton.
- Natural Predators: include medusa, jellyfish, filter-feeding fish like herring.
- Human Treat: rising acid levels in the ocean due to increased carbon dioxide in the atmosphere.
- Interesting Fact: Clams have no eyes, ears or noses so cannot see, hear or smell.

Flying Fish

- Size: 15 to 30 cm.
- Habitat: open ocean or on the outskirts of coral reefs.
- Diet: Eat plankton, bacteria and other tiny marine creatures.
- Natural Predators: marlin, tuna, swordfish, mackerel.
- Human Threat: over fishing. These fish are attracted by light, so fishermen use light to guide the fish towards their ship at night.
- Conservation status: least concern.
- Interesting Fact: Shaped like a torpedo with pectoral fins that can be spread into a shape like wings.
- Interesting Fact: Can fly 6m into the air and glide for up to 400m before going back into the water again. Can travel at speeds of more than 70 km/hr.

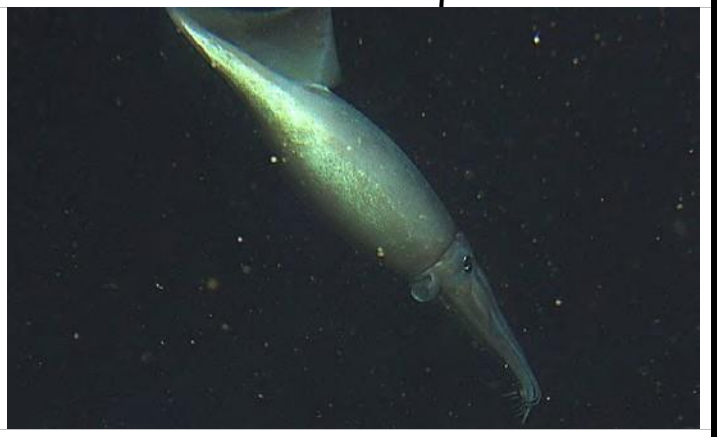
Harbor Seal

- Size: up to 1.85m long and 132 kg.
- Habitat: Semiaquatic marine mammals – although they spend most of their time in the water, they can also be found on docks, rocks, etc.
- Diet: Carnivorous – dive for fish, crustaceans, penguins, etc. Use their whiskers to help detect prey in the water.
- Natural Predators: mainly whales and sharks.
- Human threat: accidental bycatch along Norwegian coast accounts for 48% of pup mortality.
- Conservation status: least concern.
- Interesting Fact: Also known as the common seal.
- Interesting Fact: Part of the Pinniped family.
- Interesting Fact: Molt or shed their skin once a year – takes 6 weeks.

Herring

- Size: varies between subspecies: Atlantic Herring up to 46 cm, Pacific Herring up to 38 cm and Baltic Herring up to 18 cm.
- Habitat: Found in the temperate water of the Pacific and Atlantic oceans.
- Diet: They feed on phytoplankton, zooplankton, small copepods, worms, krill, fish eggs and larvae of snails and mollusks.
- Natural Predators: dolphins, porpoises, orca whales, seals, sea lions, sharks, salmon, tuna, cod, halibut, billfish, swordfish and striped bass. Seabirds and humans are also predators.
- Human threat: threatened by overfishing and pollution.
- Conservation Status: Some species are threatened.
- Interesting fact: a North Atlantic herring school can be up to 4.8 cubic kilometers with a density of between ½ and 1 fish per cubic

Humboldt Squid

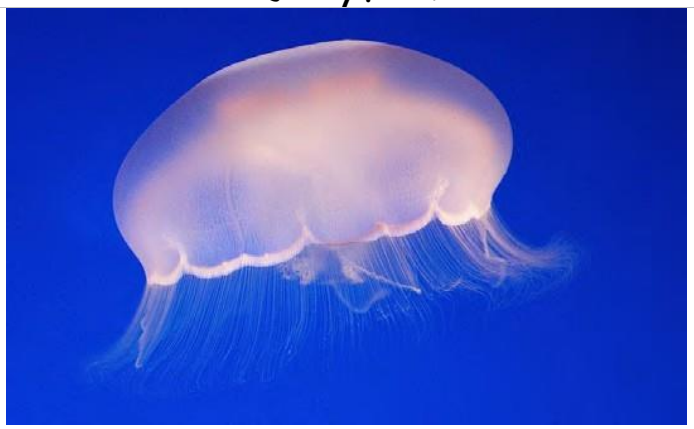


- Size: can reach up to 3.6m and weigh as much as 100 pounds.
- Habitat: Humboldt squid live at depths of 200-700m in the eastern Pacific, ranging from Tierra del Fuego north to California.
- Diet: hunt lantern fish, shrimp, mollusks, and other cephalopods. The squid use the sharp suckers on their tentacles to pierce the flesh of prey and drag it to their mouths where a, baseball-sized beak rips it to shreds.
- Natural Predators: sperm whales, sharks, seals, swordfish, and marlin feed on Humboldt squid of all sizes, while gulls and large fish often capture juveniles.
- Human Threat: ocean acidification lowers its metabolic rate
- Interesting Fact: Can change colour from red to purple to white. They used to think it was to help them hide, but now scientists

Humpback Whale

- Size: 12-16m long and weigh about 36,000 kg.
- Habitat: Found in most of the world's oceans.
- Diet: Feed on small schools of fish such as herring, capelin, sand lance and pilchard as well as krill.
- Natural Predator: thought to be the Killer Whale.
- Human threat: entanglement in fishing gear, collision with vessels and pollution in the ocean.
- Conservation Status: Endangered.
- Interesting Fact: Easy to tell apart by the markings on the underside of their tail fins that are distinctive to each individual humpback.
- Interesting Fact: Only eat in the summer – feed off their fat reserve in the winter.

Jellyfish

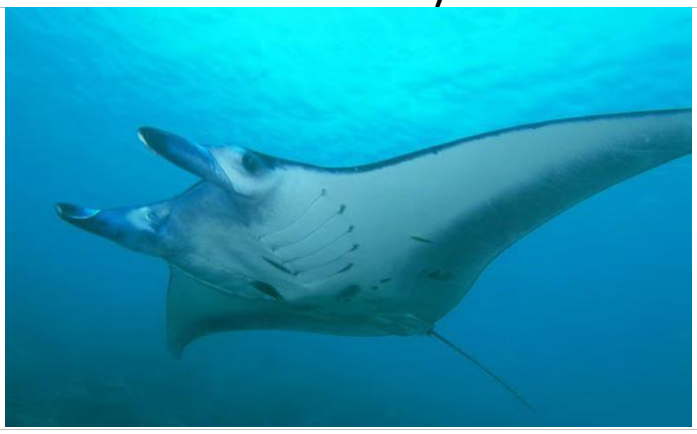


- Size: can be bigger than people, but smaller than the head of a pin.
- Habitat: found from cold arctic to warm tropical seas of Pacific and Indian Ocean.
- Diet: Feeds on phytoplankton, fish eggs, larvae and other marine creatures in early stages of their life – catches by injecting toxin through one of its tentacles.
- Natural Predators: tuna, swordfish, moonfish, triggerfish, some types of sea turtles.
- Human Threat: Global warming favours the jellyfish because it increases their food source and expands the area they live in.
- Conservation Status: no threat. Overfishing of the predators makes it hard to keep the jellyfish population under control.
- Interesting Fact: When millions of jellyfish swarm together, they are called a "bloom."

Lobster

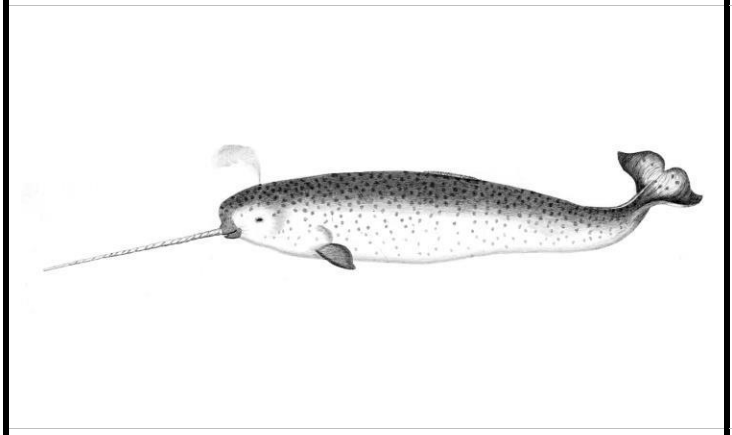
- Size: in general, 25-50 cm long, but some are very small.
- Habitat: Found in all oceans. They live on rocky, sandy or muddy ocean floors from the shore to the continental shelf.
- Diet: Feed on crabs, sea stars, sea urchins, fish, mollusks.
- Natural predator: many different predators during larval, post-larval and juvenile stages. Cod are the most likely predators.
- Human threat: pollutants and warming ocean water.
- Conservation Status: Not on any endangered list and limit of catch in most areas are based on size, not quantity.
- Interesting Fact: Can regenerate legs, claws and antennae.
- Interesting Fact: A lobster's brain is in its throat. It breathes and listens with its legs and tastes with its feet.
- Interesting Fact: Molt their shell 4-5 times a year in order to

Manta Ray



- Size: up to 7m wide and 1,350 kg.
- Habitat: Live in tropical waters of the Pacific & Atlantic, Red Sea, Arabian Sea & Bay of Bengal. They stay close to the coral reefs.
- Diet: Primary food is plankton. They also eat crabs, shrimp & small fish.
- Natural Predators: sharks, orcas.
- Human Threat: Humans hunt for meat, skin and oil. Efforts to preserve their natural habitat include reducing effects of pollution and global warming.
- Conservation status: Larger species less likely to become endangered. Smaller ones are at more risk. Habitats are drying up and commercial fishing industry catches them as bycatch.
- Interesting fact: they are a close relative of the shark. This is

Narwhal



- Size: 4-6 metres in length and 800 to 1600 kg.
- Habitat: Found in the ice covered Arctic Ocean.
- Diet: squid, fish and shrimp.
- Natural Predators: polar bears and orcas.
- Human threat: habitat is threatened by climate change and pollution from drilling and mining.
- Conservation Status: Considered near-threatened.
- Interesting Fact: Travel in pods.
- Interesting Fact: Called the unicorn of the ocean and is one of the rarest whales in the world.
- Interesting Fact: It doesn't have a dorsal fin.

Octopus

- Size: the giant Pacific octopus has an arm span up to 4.3m, and weighs about 15 kg.
- Habitat: There are two types of octopus – those that inhabit deep waters and those that live in shallower waters. They live in tropical and temperate parts of the ocean. You can find them around coral reefs.
- Diet: Carnivores: feed on crabs, other mollusks, prawns, fish. And Invertebrate with no bones.
- Natural Predators: moray eels, sharks.
- Human threat: widely used for food in Asian and Mediterranean cuisines. Caught mostly by trawling. If trawling takes place at the same time as breeding season, or if overfished, populations could be in danger.
- Conservation Status: Not considered endangered or threatened.

Orca Whale

- Size: 6 to 8 m long and weight more than 6 tonnes.
- Habitat: Found in all oceans.
- Diet: Eat mostly fish, but also hunt seals, sea lions and walruses.
- Natural predators: none
- Human Threat: boats, oil spills, pollution, habitat disturbance, overfishing.
- Conservation Status: Threatened but not endangered.
- Interesting Fact: Belong to the oceanic dolphin family.
- Interesting Fact: Also known as a killer whale.
- Interesting Fact: Highly social and travel in pods.

Otter

- Size: range from 0.6 to 1.8 m long and weigh 1 to 45 kg.
- Habitat: Otters live on every single continent in the world except Antarctica and Australia.
- Diet: fish, small invertebrates, birds, frogs, crayfish and crabs.
- Natural Predators: eagles, sea lions, sharks and killer whales.
- Humans Threat: Commercial fishermen don't like their daily catch to be reduced, so they trap and kill them so they can't consume the fish. They also get caught in the nets that fishermen use. Pollution and global warming are also a threat to them.
- Conservation Status: Some species are endangered including the Giant Otter, the India Smooth Coated Otter and the Hairy Nosed Otter.
- Interesting Fact: Eat 20% of their body weight every day.

Pacific Oyster

- Size: 80 to 400 mm long.
- Habitat: Native to Asia, but have been introduced to many other countries. Prefer to attach to hard or rocky surfaces in shallow water up to 40m deep.
- Diet: Feed on phytoplankton.
- Natural Predators: crabs, seabirds, sea stars.
- Human Threat: Pollution.
- Conservation Status: not threatened.
- Interesting Fact: Oysters are alternating hermaphrodites meaning they can switch sexes from time to time.
- Interesting Fact: A group of oysters is called an oyster bed or an oyster reef. Many animals, like mussels, barnacles and anemones, inhabit oyster reefs.
- Interesting Fact: Can live for up to 30 years.

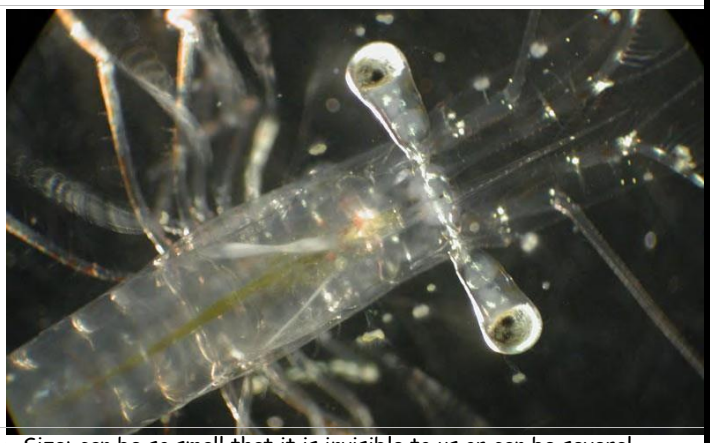
Pacific White Sided Dolphin

- Size: can grow to 2.5m and weigh up to 200kg.
- Habitat: Found in the Pacific Ocean from the Gulf of Alaska to Baja California.
- Diet: herring, sardines, anchovies, squid, capelin and cephalopods.
- Natural predator: bull shark, dusky shark, tiger shark and great white shark.
- Human Threat: May be affected by pollution, noise pollution and entangling in nets or fishing gear to become bycatch. Certain nets have been banned in the USA, which has decreased the number being killed by nets. Some are still killed by Japanese hunters.
- Conservation status: not threatened.
- Interesting Fact: Swim together in groups of ten to one hundred.
- Interesting Fact: Each dolphin identifies itself with a unique name-whistle.

Penguin

- Size: Emperor penguin is the largest species weighing up to 45kg & 122cm tall. The fairy penguin is the smallest: 1.5 kg & 33cm.
- Species: There are 18 species of penguins in the world. Habitat: Found in the Southern Hemisphere in South America, South Africa, Australia and New Zealand as well as Antarctica.
- Diet: Carnivore. They eat fish, squid, shrimp, krill and other crustaceans depending on where they live.
- Natural predators include leopard seals, sea lions, orcas, skuas, snakes, sharks and foxes, depending on where they live.
- Human Threats: Oil spills, pollution, global warming, illegal poaching and egg harvesting.
- Conservation Status: 13 have declining populations and 5 are considered endangered, facing extinction.

Plankton

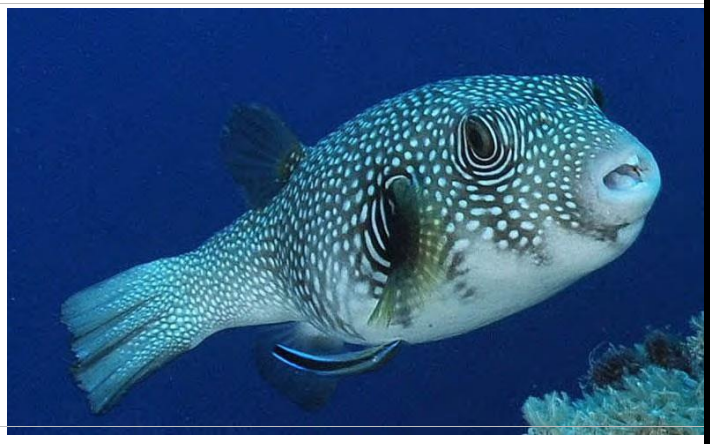


- Size: can be so small that it is invisible to us or can be several meters long, like the giant jellyfish.
- Habitat: in the waters of all oceans in the sunlight zone
- Diet: bacterioplankton & phytoplankton use sunlight and seawater nutrients. Zooplankton feeds on phytoplankton.
- Natural predators: whales, seals, birds and fish eat zooplankton.
- Human Threats: Scientists believe that the radiation from the sun is killing off many species of plankton.
- Conservation status: not threatened at this time.
- Interesting fact: There are 3 types of plankton: phytoplankton (plant plankton), zoo plankton (animal plankton), and bacterioplankton (bacteria plankton).
- Interesting Fact: Plankton is Greek for wanderer or drifter.

Polar Bear

- Size: adult males weigh up to 700 kg and can be up to 3m long. Females are about half the size of males.
- Habitat: Live in the Arctic region.
- Diet: mainly seals.
- Natural Predators: none.
- Human Threat: impact their environment and habitat. Climate change is causing ice to melt and the sea ice they live on to become less. Industry dumps pollutants which end up in the food the polar bears eat.
- Conservation Status: on their way to becoming endangered
- Interesting fact: Polar bears can swim up to 160 km at a time and swim at about 10 km per hour.
- Interesting fact: Fur appears white, but is actually transparent.

Pufferfish

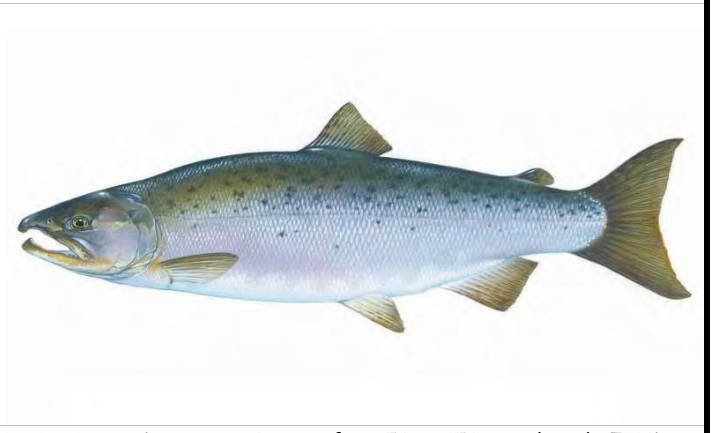


- Size: varies by species, from 2cm to 100cm.
- Species: There are at least 120 species of pufferfish.
- Habitat: Live in shallow waters and coral reefs near the equator.
- Diet: mussels, clams, shellfish, algae, worms and crustaceans.
- Natural Predators: large fish and sharks. Sharks are the only species immune to the toxin.
- Human threat: pollution, global warming.
- Conservation Status: Not considered threatened.
- Interesting Fact: Fills its stomach with water to become spherical in shape. Predators see a spiky ball rather than a slow, tasty fish.
- Interesting fact: Generally believed to be the second most poisonous vertebrate in the world, after the golden poison frog. Contains enough toxin to kill 30 adult men.

Red Rock Crab

- Size: can measure up to 16 cm wide.
- Habitat: Found in northeast Pacific coastal waters in shallow water and in sand or gravel bays.
- Diet: Carnivorous: eats mussels, clams, snails, barnacles, smaller crabs, dead fish.
- Natural Predators: rockfish and other large fish, octopus, marine mammals.
- Human Threat: Too small for commercial harvest, but caught in sport fishing.
- Conservation Status: Not considered threatened.
- Interesting Fact: Molts its shell to grow.
- Interesting Fact: they are nocturnal, feeding at night. They hide during the day.

Salmon

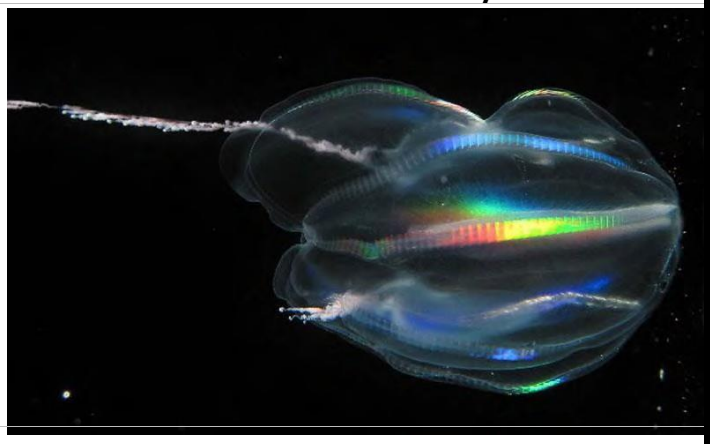


- Size: varies by species. Ranges from 50 to 150cm in length, 7-61kg.
- Habitat: Atlantic salmon are found in Quebec and the Maritimes while Pacific Salmon are found off of BC.
- Diet: Young salmon eat insects, invertebrates and plankton. Adults eat other fish, squid, eels and shrimp.
- Natural Predators: seals shark, cod, lamprey eel, sea birds.
- Human threat: degradation of habitat by manipulation of rivers, chemical pollution, organic pollution, over-fishing, bycatch.
- Conservation Status: Salmon are protected by the quantities you are allowed to catch and when you're allowed to fish.
- Interesting Fact: Return to where they were born to spawn by smell. Salmon die after they spawn.
- Interesting Fact: Anadromous, meaning they live part of their life

Sea Anemone

- Size: most are 1.8 to 3 cm but some are as small as 4 mm and others as big as 2 metres.
- Species: More than 1000 species in the world.
- Habitat: Most live in tropical reefs, but there are some that have adapted to some other environments like cold waters.
- Diet: Carnivorous with a diet of mostly plankton, small fish, worms and crustaceans.
- Natural Predators: Have very few predators. They are the grey sea slug and the tompot blenny.
- Human Threat: Global warming and human activity.
- Conservation Status: Could be endangered, eventually.
- Interesting Fact: Eject poisonous stinging threads that paralyze their prey.

Sea Gooseberry



- Size: Most are between 3 mm and 15 mm.
- Species: There are about 90 species of gooseberries.
- Natural predator – salmon, other jellies, sea turtles.
- Habitat: Found worldwide in water from very shallow to fairly deep.
- Diet: Carnivorous: zooplankton, such as arrow worms.
- Conservation Status: Not considered threatened.
- Interesting Fact: Only live for about 4-6 months.
- Interesting Fact: Has 2 long tentacles to catch food.
- Interesting Fact: If touched, they produce flashes of light that can be seen several meters away.

Sea Star

- Size: Usually between 12 to 24 cm long and can weigh up to 5kg.
- Species: Approximately 2000 species.
- Habitat: live in the ocean from intertidal to deep water and tropical to cold water.
- Diet: Carnivores with a diet of mailing clams, shells, mussels
- Natural Predators are sea otters, rays, sharks, seagulls and various fish.
- Human Threat: pollution and changes in water temperature caused by global warming.
- Conservation Status: currently most are not endangered.
- Interesting fact: Not all sea stars have 5 arms. Some have up to 40. They can regenerate arms if they lose one.
- Interesting fact: Sea Stars do not have blood.

Sea Urchin

- Size: range from 3-10 cm.
- Habitat: Rocky ocean floor and coral reefs.
- Diet: algae, fish and barnacles.
- Natural Predators: fish, birds, crabs, sea otter.
- Human Threat: destruction of habitat due to dredging on the ocean floor and pollution in the water.
- Conservation status: Threatened with extinction.
- Interesting Fact: It has Small stinging structures and a claw like mouth.
- Interesting Fact: sea urchin bodies have radial symmetry. That means that they can be divided into 5 equal parts.
- Interesting Fact: sea urchins have a mouth called an "Aristotle's Lantern". It has 5 very sharp teeth strong enough to drill a hole in

Seahorse

- Size: from 1.5 to 35.5 cm long.
- Species: 54 species.
- Habitat: Live in temperate and tropical water throughout the world. Their favourite habitats are coral reefs, mangrove forests and seagrass.
- Diet: Eat constantly. They eat plankton and small crustaceans. They have no stomach so food passes through their bodies quickly.
- Natural Predators: crabs, stingrays, tuna, penguins, tiger fish.
- Human Threat: harvesting for aquariums or Asian medicine, habitat destruction and pollution.
- Conservation Status: Headed towards extinction.
- Interesting Fact: Seahorses are really fish.
- Interesting Fact: They are poor swimmers preferring to rest in one location, sometimes for days.

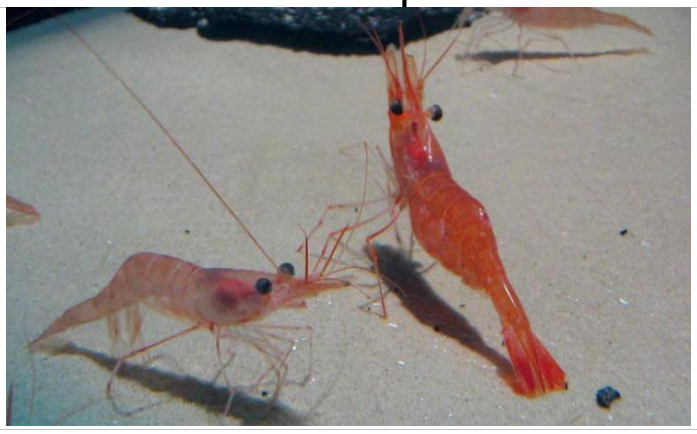
Sea Turtle

- Size: Range from 60cm to 2.1 m in length, and the largest sea turtles can weigh up to 590kg.
- Species: there are 7 different species of sea turtles.
- Habitat: live in every ocean, except the Arctic, nesting on tropical and subtropical beaches.
- Diet: Some are omnivores, eating both plants and animals, others are carnivores. Their food depends on their environment.
- Natural Predators: Crabs, birds and other marine animals eat turtle eggs and baby turtles.
- Human Threats: bycatch, coastal development, global warming, poaching and pollution.
- Conservation Status: most are either threatened or endangered.
- Interesting fact: surrounding temperature affects sex of babies. Warmer temperatures mean more females.

Shark

- Size: Range in size from 17cm to 12m and up to 21.5 tonnes.
- Habitat: Live in a wide range of habitats with various temperatures. Some live in shallow coastal regions while others live in deep water on the ocean floor or in the open ocean.
- Diet: fish, crustaceans, mollusks, plankton, krill, marine mammals and other sharks.
- Natural Predators: other sharks.
- Human Threat: Population is decreasing due to heavy commercial fishing and the perception that they are a nuisance. A shortage in sharks will drastically affect the ocean's food chains.
- Conservation Status: Most sharks are vulnerable while some are critically endangered.
- Interesting Fact: Great White Sharks are picky eaters only eating

Shrimp



- Size: A shrimp averages 3 to 9 inches long. The longest was about 16 inches.
- Species: 2000 species of shrimp worldwide.
- Habitat: Found in nearly all areas of the world. Usually found burrowing into muddy or sandy ocean bottoms or into rock or coral.
- Diet: Omnivorous so digest both plant and animal matter. Feed on algae and other plant particles as well as tiny fish and plankton.
- Natural Predators: fish, crabs, sea urchins, starfish, seabirds, whales, dolphins, sharks and humans.
- Human Threat: clearing and overharvesting of mangrove forests, climate change, change water flow with dams & irrigation, pollution.
- Conservation status: some species are threatened.
- Interesting Fact: Every shrimp is born male and then becomes

Snail

- Size: They range from .5 to 80 cm and weigh .01 to 18 kg.
- Species: There are at least 12 different kinds of sea snails.
- Habitat: They live on the ocean floor, especially close to coral reefs.
- Diet: They are primarily herbivores. Their favorite food is Algae, but also tiny plankton and parasites.
- Natural predators: octopuses, sea anemones.
- Human Threat: acidification of the ocean.
- Conservation status: least concerned.
- Interesting Fact: Sea snails breathe with gills.
- Interesting Fact: Most snails have 2 tentacles on top of their head and spirally coiled shelves.

Sperm Whale

- Size: Males can grow to 20m and weigh 57 tonnes.
- Habitat: Found in many open oceans – both tropical and cool waters. Live at the surface of the ocean, but dive extremely deep for food.
- Diet: mostly giant squid but will also eat fish, octopus and skate.
- Conservation Status: Has one of the most stable whale populations in the world. It is the only whale species that is not endangered.
- Interesting Fact: The largest toothed whales on the planet.
- Interesting Fact: They are deep divers, spending 90% of their lives down in the deep. They "see" and hunt in the deep sea darkness by using echolocation (a series of loud clicking noises that travel through water and bounce off objects).
- Interesting Fact: One of the loudest creatures on Earth.

Walrus

- Size: largest flippered marine mammals. Males grow up to 3.6m long and weigh up to 2,000 kg.
- Habitat: shallow ice shelves in frigid Arctic and sub-Arctic waters. Most live in the Arctic waters in summer and Siberian waters in winter.
- Diet: wide variety of seafood including clams, snails, soft shelled crabs, shrimp, sea cucumbers and slow moving fish. Some also prey on seals, small whales and seabirds.
- Natural Predators: Orca and polar bear.
- Conservation Data: not enough data. Signs of declining population though which is probably due to climate change and less sea ice.
- Interesting Fact: Walruses tusks are long canine teeth. They are up to 1 metre long.

Wolf Eel

- Size: Can grow up 2.5m long and 18.6 kg. They have 200 spinal vertebrae.
- Habitat: They are found in Pacific Coastal waters from Baja California to Alaska, also in Russia, and the Aleutian Islands of Japan. They live on the surface until they're about 2 years old when they need less air, then they move deeper into the ocean to live in rocky reefs where they build their dens.
- Diet: snails, scallops, mussels, clams, anchovy and abalone.
- Natural Predators: sea urchin and green crab.
- Human threat: pollution or accidentally caught in fishing gear.
- Conservation Status: belongs to the endangered wolf fish family. Often bycatch in fish and crab traps.
- Interesting Fact: It's not a real eel, just a long skinny fish.

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Make an Ocean Animal

S B G P R

The ocean is full of amazing creatures. Learn about ocean animals by making one of your own!

Purpose of this activity: to explore the diversity of life in the ocean.

Directions

1. Make an ocean animal craft of your choice. It could be a hat craft, paper model, stuffed animal, made using modeling clay, sewn with felt pieces or any other idea.
2. Learn where your ocean animal lives.
3. Find out why your ocean animal is important to the ocean ecosystem.
4. How is your ocean animal connected to people?

Ocean Animal Doodle Speak

G P R

This is a fun game that shows how we interpret written words and pictures differently. Put an "ocean twist" on the game by drawing ocean animals.

This activity is an extension of the Ocean Animals activities.

Purpose of this activity: to explore the diversity of life in the ocean.

Directions

1. On the top sheet of each stack of paper, write the name of an ocean animal. Each stack should have a different animal on top. Examples include: anglerfish, clam, crab, dolphin, eel, flying fish, frog, jellyfish, lobster, manta ray, narwhal, octopus, otter, oyster, penguin, plankton, polar bear, puffer fish, salmon, sea anemone, sea star, sea urchin, seagull, seahorse, seal, shark, shrimp, snail, squid, turtle, walrus, whale.
2. Hand out a stack of paper to each girl, each with the different animal on top. Each girl then secretly looks at the name of her animal, places the top piece of paper with the writing on it onto the bottom of the paper stack (face up) and then DRAWS what she thinks that animal looks like.
3. After a specific time set by the Guider, the girls all pass their piles of papers to the left (or right).

Supplies

- ❑ Stacks of paper for each girl, with as many pieces of paper in each stack as there are girls in the group. If there are eight people in the group then each person must get 8 pieces of paper. The papers are kept in a stack and do not have to be big - index cards work well.
- ❑ pencils

4. Now each girl has a stack of papers with the picture drawn by the girl next to her showing on top – she is not to look at any of the other papers in the pile. They look at the picture, determine what they think it represents, put the picture to the bottom of the pile (face up) and, on the new top piece of paper, write down a word saying what they believe the picture is of.
5. When the paper piles are passed again, there will now be a word (or words) on the top of the pile. The girls move the word to the bottom then draw that animal.
6. This continues around the circle of the group until everyone has handled all the sets of papers. Each time a stack is passed they will alternate between writing and drawing.
7. When the piles of paper have made it around the whole circle, reveal what the initial word was and how it has changed through the exchange around the circle. It is great fun for each girl to show how her word evolved throughout the game.

This is a variant of **Telephone** where a whispered phrase is repeated around the circle until it reaches the end and then the original and final phrase is compared to see how much discrepancy there is in the exchange.

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Ocean Animal Word Search

Find all the words listed below to reveal a secret message.

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

ANGLERFISH	CLAM
DOLPHIN	FLYING FISH
FROG	HARBOR SEAL
HERMIT CRAB	HUMPBACK WHAL
JELLYFISH	MANTA RAY
NARWHAL	ORCA WHALE
OTTER	PELICAN
PENGUIN	PUFFERFISH
SALMON	SEAGULL
SEAHORSE	SEA URCHIN
SHARK	SPERM WHALE

_ _ _   _ -   _ _ _

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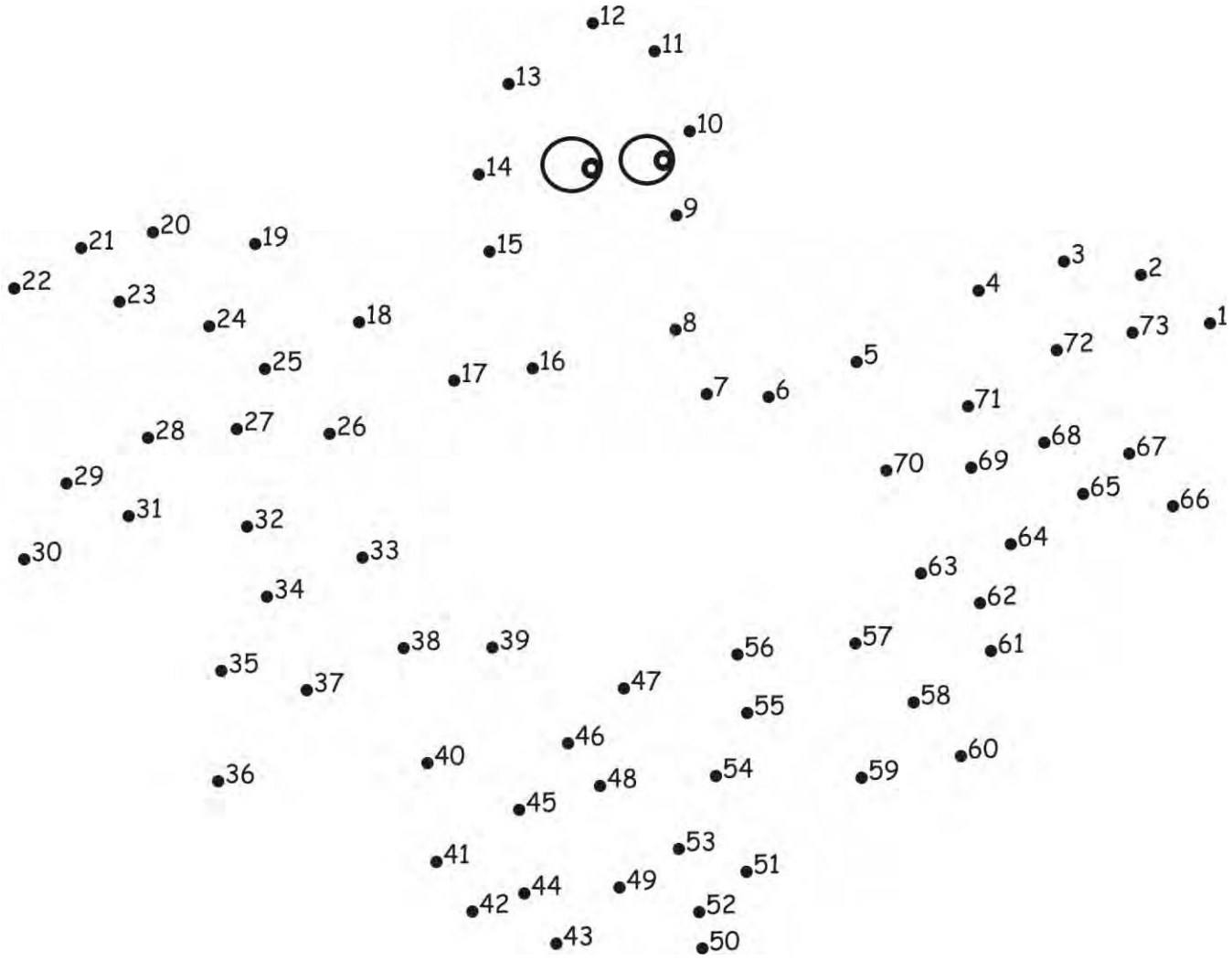
_ _ _ _ _ _ _   _ _ _   _ _ _ _ _ _   ~*Wyland*

Ocean Animal Dot to Dot



Riddle: How do you make this animal laugh?
Answer: You give it ten tickles.

Ocean Spot the Difference

Can you find 10 things different in these ocean pictures?

How Big is That Animal?

SBG

The ocean supports the greatest diversity of life on our planet. It has more animal species than all of the land combined, and supports the smallest and largest animals on Earth. From Diatoms (small, single celled animals) to the blue whale (the largest animal ever to live), the ocean is home to millions of amazing types of animals. In this activity, explore the size of only a fraction of these amazing animals. As you go, can you find any the same size as you?

Purpose of this activity: to explore the diversity of life in the ocean.

Directions

1. Take the rope and the measuring tape, and begin measuring out different sea creatures. The list below is only a suggestion; you can add your own or make it specific to where you live.
2. Starting at one end of your yarn, measure out the first creature. Mark it with tape. Next, take the measurement for the next creature, subtract the first, add the difference to the string and mark with tape. For example, measure the plankton, and mark 1mm. Then add 9 mm for the sea gooseberry. Then, add 4.5 cm for the shore crab. (Each animal is measured from the end of the string, rather than between pieces of tape.) Alternately, you could measure from the starting point each time.

Supplies

- ❑ a ball of yarn or string (you'll need quite a lot: 30m or so)
- ❑ measuring tape
- ❑ masking Tape
- ❑ markers
- ❑ animal pictures (from Ocean Networks Canada and Wikimedia commons – next pages)

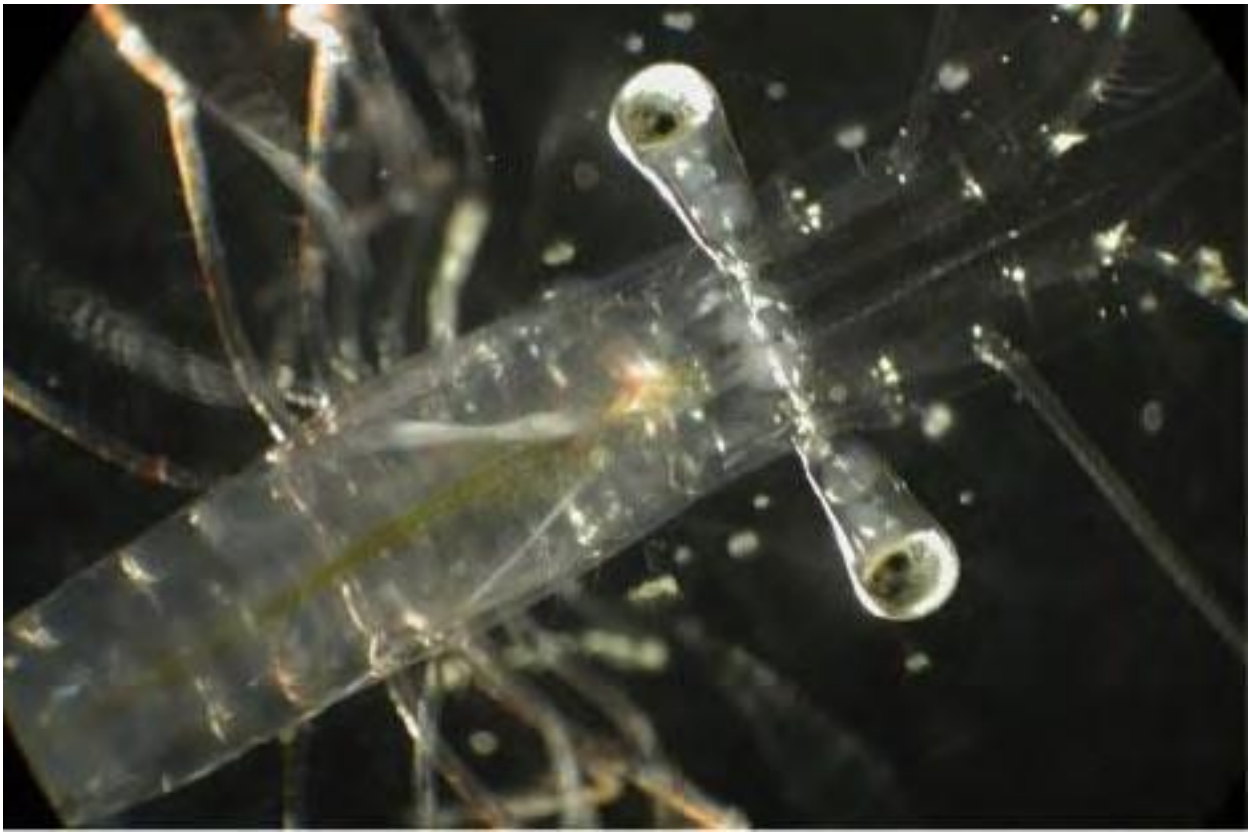
3. As you go, it can be fun to have the girls guess the length of the next animal to be added. When you are finished, your string will be 30 meters long! This is the size of a blue whale – the largest animal ever to live.

   Tip: If your string isn't long enough to reach 30 meters, measure 30 - 1 meter spaces on the ground and mark with tape. You may even have to go around a corner or back and forth – blue whales are huge!

How Big is That Animal Size List

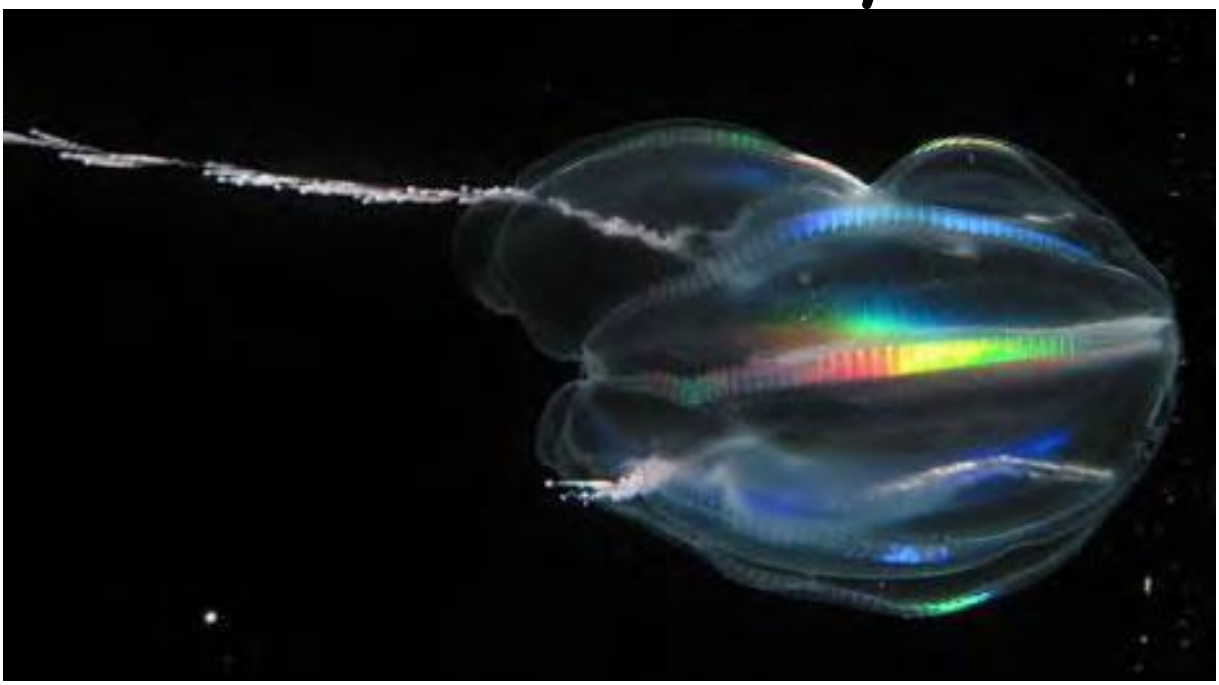
Animal	Approximate size
Plankton	<1 mm
Sea Gooseberry	1 cm
Shore Crab	5.5 cm
Herring	23 cm
Red-rock Crab	25 cm
California Sea Cucumber	50 cm
Salmon	71 cm
Otter	1.5 m
Wolf Eel	2.5 m
Harbor Seal	1.8 m
Pacific Whitesided Dolphin	2.5 m
Humboldt Squid	3.6 m
Orca Whale	8 m
Sperm Whale	16 m
Blue Whale	30 m

Plankton



Zooplankton. Photographer: Matt Wilson/Jay Clark, NOAA NMFS AFSC [CC-BY-2.0]. via Flickr.com

Sea Gooseberry

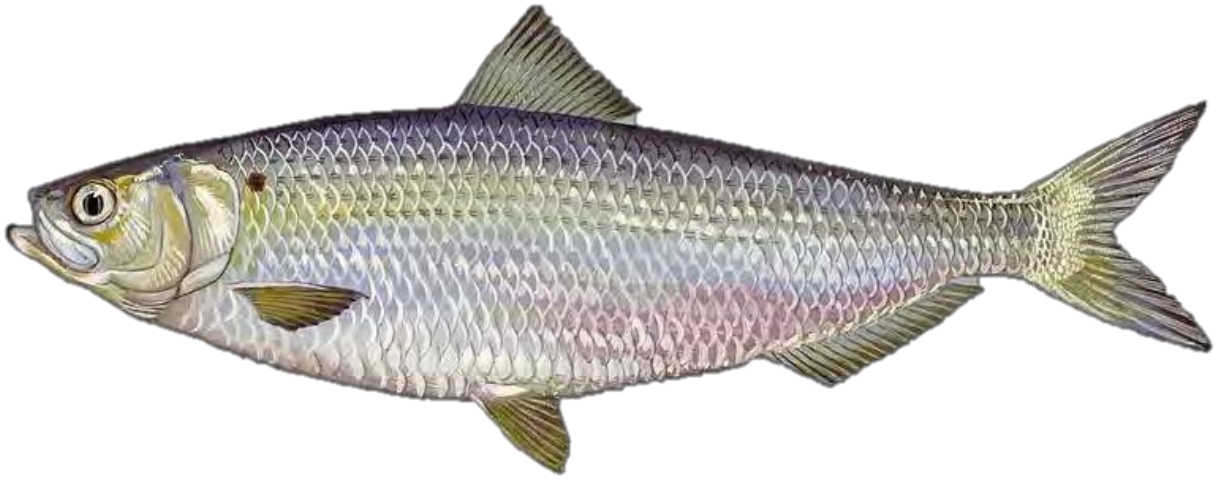


Kevin Raskoff, NOAA Photo Gallery [Public Domain], via Wikimedia Commons

Shore Crab

Matthew Zalewski (Own work) [CC-BY-SA-3.0], via Wikimedia Commons

Herring



Duane Raver, U.S. Fish and Wildlife Service [Public domain], via Wikimedia Commons

Red Rock Crab

VENUS; Ocean Networks Canada

California Sea Cucumber

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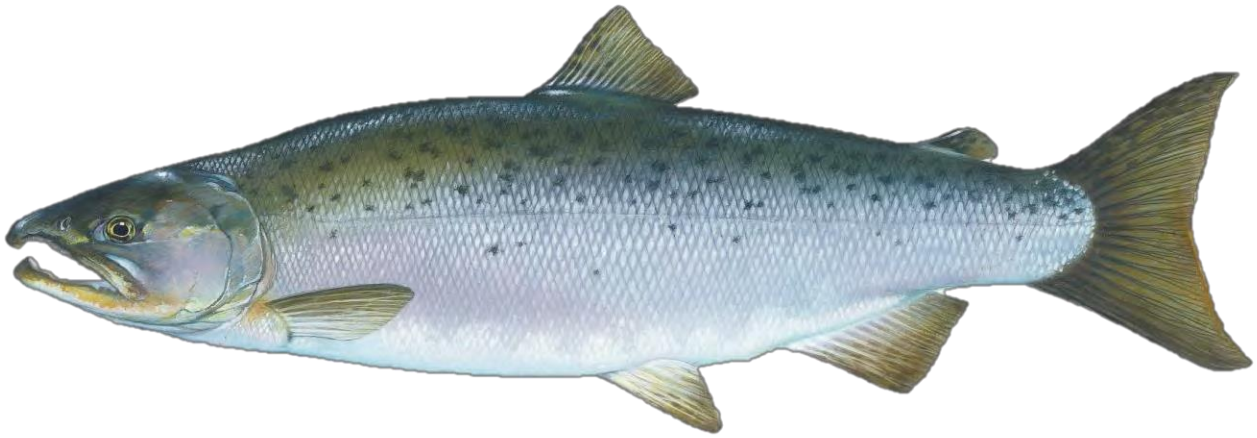
Salmon



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Otter

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Harbor Seal

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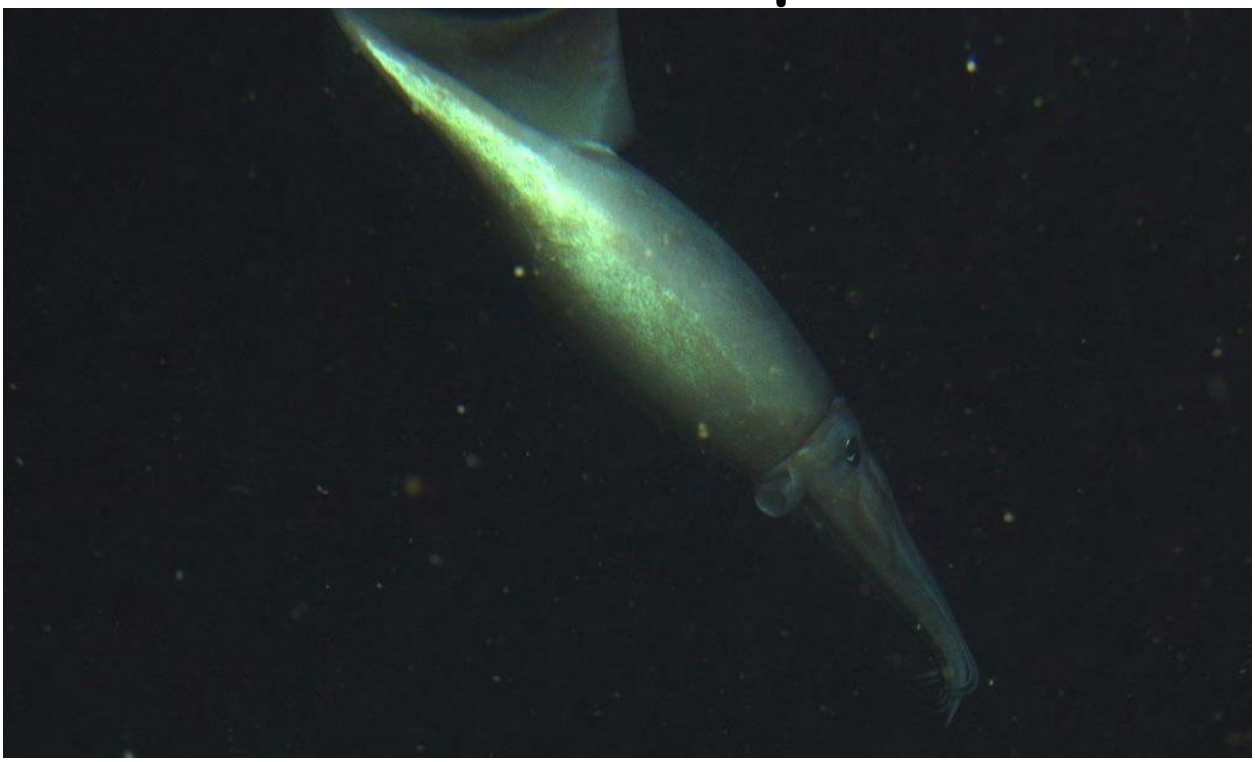
Pacific Whitesided Dolphin

Pacific Whitesided Dolphin: (cropped), Françoise Gervais, [CC BY-NC-SA 2.0],via flickr.com

Humboldt Squid



Rick Starr: NOAA/CBNMS (NOAA Photo Library: sanc1686) [Public domain], via Wikimedia Commons

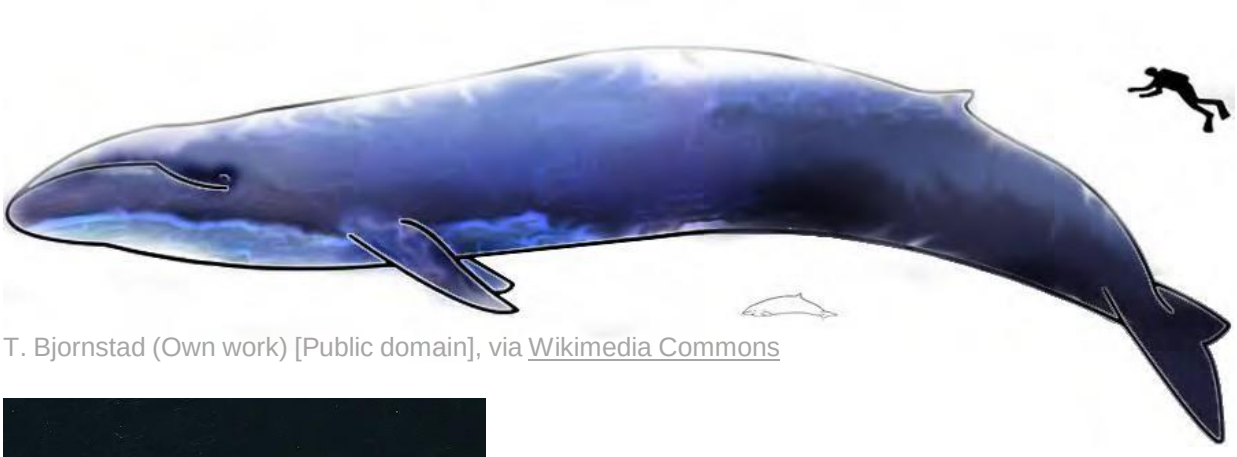
Orca Whale

Mlewan (Own work) [Public domain], via Wikimedia Commons

Sperm Whale

Gabriel Barathieu, [CC-BY-SA-2.0], via Wikimedia Commons

Blue Whale



T. Bjornstad (Own work) [Public domain], via Wikimedia Commons

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What WAS That?

S B G P R

When you explore Ocean Networks Canada's video of the deep ocean, you may come across organisms that you have never seen before, and wonder "what WAS that?" Researchers and scientists often wonder exactly the same thing! Have they found a new animal or have they just found the same animal in a different colour? (Just like some sea stars come in different colours but are the same species). Understanding what you've found under the ocean can be an interesting challenge, especially when all you have are pictures. But just because something is challenging, it doesn't mean it's impossible. In this activity, have a look at some amazing deep-sea animals (both in video and picture form) and ask "What is that?"

Purpose of this activity: to explore the diversity of life in the ocean.

Directions

If your meeting place does not have an Internet connection, you can download videos to playback while not online. See http://www.wikihow.com/Download-YouTube-Videos for instructions.

1. Talk with the girls: when they see a strange animal, what clues do they use to figure out what it might be? Do they think that scientists are still discovering new animals or is everything already known? What makes an animal newly discovered? What makes an animal known or unknown to science? Remember, you don't have to have the right answers for these questions, just think about them and consider your own answers. What is important to you when you identify an animal?
2. To help focus the discussion, create a list of key features we look for when we identify animals. This can include: colour, size, habitat, food, body shape, body covering (skin, scales, fur, and feathers), limbs (wings, arms, legs, etc.), eye and mouth placement. As well, we can often use other animals that look similar for comparison. For example, we know what wolves might be related to dogs because they look so similar.

   Brainstorm, what resources we can use to help us identify animals (answers may include books, the internet, other people (experts) and TV programs).
3. Watch the video "Batman of the Deep"

Supplies (some, or all)

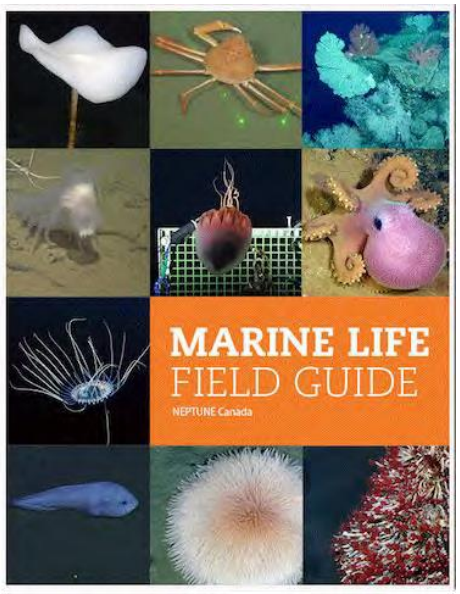
- ❑ Video: "Batman of the Deep" by Neptune Canada http://youtu.be/2ZecJYKWksU
- ❑ EBook "Marine Life Field Guide" http://www.oceannetworks.ca/science/publications/general-interest/marine-life-field-guide
- ❑ Video: "Hagfish" by WorldofOcean http://youtu.be/05GasKiM4l4
- ❑ Video: "Teen Spots Hagfish-Slurping Elephant Seal" by Neptune Canada found at http://youtu.be/_iNM8uVrsbI
- ❑ Cruise Highlights http://youtu.be/nx0b32Khhy0 and http://youtu.be/mZqpOBlxCbc
- ❑ Images from Neptune Canada: pick your favourites, even if you don't quite know what they are! Found at http://www.flickr.com/photos/neptunecanada/sets/ or http://www.oceannetworks.ca/sights-sounds/images

… and discuss this strange creature be? What features does it appear to have? What features appear to be missing? How would you figure out what it is? Have a look in the free eBook "Marine Life Field Guide" to see if you can learn more about it and answer the question, what is it? Once you've had a while to think about it, look in the description of the video. Does the answer surprise you?

4. Watch the video "Hagfish" by WorldofOcean. The long, snaky fish in the middle of the video is a hagfish. But what is the creature that slurps it up? Brainstorm among your group, what might this be? What features does this animal have that you can see? How would you find out what this animal is? How can a limited view impact our assessment of the animal? If you were a scientist, what more would you need to know?
5. Watch the video "Teen Spots Hagfish-Slurping Elephant Seal" by Neptune Canada. Were you able to guess what the creature was?
6. Watch a Neptune Canada/Ocean Networks Canada video such as Highlights 2011, Highlights 2012 or scroll through Ocean Networks Canada's image gallery. Find a creature that looks interesting to you. What might it be? Look in the "Marine Life Field Guide" – can you find it? Even if you can't find it, what section do you think it should go in? If you're still not sure, brainstorm a list of people you could ask, and ask them! What did you find out? Share your findings with the rest of the group.

Conclude the Activity

- Which animals where the girls favourite? Which were the most interesting? Which were the hardest to talk about? Which were the easiest?
- Make a craft – using leftover craft supplies, anything you have on hand, or even just pen and paper – make a creature that could be featured in the Marine Life Field Guide. What section would you put it in? Is your animal new to science or has it been discovered before? What would you call it?



Anglerfish Catch

BG

Water doesn't allow light to pass through as well as air does. This means that as we get deeper and deeper into the ocean, less and less light gets through. At about 200 meters down, the ocean is known as the "twilight zone" because it is just like twilight time on land; it is mostly dark with only a little light. After that, everything becomes known as the "midnight zone" because it is as black as midnight. Animals that live in this dark zone have evolved to use light, rather than sound or smell to communicate, camouflage or find a mate. As an animal in the dark ocean, small lights in the darkness might be a mate or food for you, or it might be something that wants to make you into food! This means you have to be really careful as you swim around and try and find food or communicate; sometimes lights are tasty treats, and sometimes lights are dangerous monsters. In this activity, try and get the glow stick without getting caught in the wrong light.

Purpose of this activity: to explore a relationship between predator and prey in the ocean.

Directions

1. Ask the girls if they have heard of an anglerfish (image on the next page). If any of the girls have seen *Finding Nemo*, the monster fish at the bottom of the ocean in this movie is an artist rendering of an anglerfish. Anglerfish are special because they have a lighted lure on their forehead which they use to catch food. The anglerfish has special bacteria in its body that lights up a tiny lure right above the fish's mouth. The anglerfish moves the lure to look like a tiny glowing shrimp – a tasty morsel for another fish. Any unsuspecting fish that tries to eat the anglerfish's lure ends up being eaten instead!

Supplies

- ❑ a glow stick
- ❑ a flashlight covered with red cellophane
- ❑ a blindfold or a dark room
- ❑ a chair

2. To play this game, have everyone sit in a large circle, with a chair in the middle.
3. Ask one girl to be the anglerfish. She will get the flashlight covered in red cellophane.
4. Under the chair, put the glow stick.
5. Have the anglerfish sit on the chair, blindfolded, with her hand over the flashlight. (Putting red cellophane on the flashlight will help, but not completely, protect your eyes if the flashlight is very bright.)
6. Dim the lights and silently pick one of the girls from around the outside circle. Her task is to try and sneak in to grab the glow stick without being caught or heard.
7. The anglerfish uses her ears to listen for the fish sneaking up on her lure. She wants to catch the fish as much as the fish wants to catch the tasty treat! In the ocean, a real anglerfish would use vision or touch to catch their food, but in this activity, sound will work in place of touch.

8. The anglerfish can catch a fish sneaking up on her by shining the flashlight on the girl trying to get to the glow stick or treat. The anglerfish only has three tries to shine her light on the fish. (The anglerfish will need to point the light directly on the girl and hold it there for 2 seconds; it doesn't count if she just swings the flashlight wildly.)
9. If the sneaking fish gets caught, she trades places with the anglerfish. If she gets the glow stick, she heads back to the outside to the circle and another girl takes a turn.
10. You can also have more than one fish sneaking up on the anglerfish. This method works well for younger girls who might have trouble waiting for their turn.

Anglerfish

Edith Widder. [CC-BY-NC-3.0], via Encyclopedia of Life.

Octopus Game

SB

The girls will enjoy flapping their tails, making fish faces and waving their "tentacles" as they move through the "ocean."

Purpose of this activity: to explore a relationship between predator and prey in the ocean.

Directions

1. Tell the girls that they are "fish" trying to escape from a big octopus.
2. Designate a playing area as the "ocean."
3. Choose one player to be the octopus.
4. The other girls are the "fish" and must move to one end of the ocean.
5. The Octopus yells, "Swim, little fishes" and the fish try to swim across the ocean without being tagged by the octopus.
6. If a fish gets through, she is safe. If she is tagged, she becomes one of the octopus's tentacles and must help catch the other fish. The tentacles join hands to make the octopus grow.

Supplies

- ❑ stones, sticks or chalk to mark boundaries

The Ocean is Stormy

SB

Purpose of this activity: to explore a relationship between predator and prey in the ocean.

Directions

Supplies

- ❑ hula hoops, skipping ropes, string, or chalk - something to make circles on the floor

1. Distribute circles around the playing area (hula hoops, string circles, chalked circles on the ground, etc.). Each circle must be large enough for two girls to stand inside.
2. Divide the girls into pairs. All the pairs, except one, must find a circle to stand in.
3. Each pair chooses a type of fish to be. Some examples are anglerfish, angelfish, bass, blowfish, catfish, carp, clownfish, cod, flounder, guppy, halibut, mackerel, mahi-mahi, salmon, trout, etc. The two girls who do not have a circle are the Orca whales.
4. The whales walk around the outside of the circles and call out the fish names.
5. When a fish name is called, those girls step out of their circles and follow behind the whales.
6. After all of the fish have been named, the whales call out “The ocean is stormy!”
7. The girls then all run for a circle – any two girls can be in any circle, but only two girls per circle.
8. The two girls left without a circle become the whales for the next round of the game.
9. To make the game more challenging, tell the girls they must be with a new partner each time, and cannot return to the same circle they have already been in.

Deep Sea Food

S B G P

When you live in the deep sea, finding enough to eat can be a real challenge. Because plants don't grow here, animals are dependent on food coming to them. Most deep sea animals depend on 'marine snow', a steady fall of organic materials, such as kelp, animals and animal poop, that comes from the surface. Each animal has adapted differently to find food. Some are nomadic, like sea stars, and wander across the sea floor looking for things to eat. Others, like sea anemones, put themselves in the current where they can catch little bits that float by. Some fish use lights to try and attract food to them. Sometimes in the deep sea, dinner can be a long, cold wait!

Purpose of this activity: to explore how deep sea animals get their food without light.

Directions

1. Explain to the girls that many animals that live in the deep sea get their food from 'marine snow'. Marine snow is organic matter that falls from above. Most animals that feed on marine snow are detritivores. This is the name we give animals that eat a special diet of already dead things, poop, and other normally inedible bits. Some land examples of detritivores include worms and beetles.
2. For this activity, girls will try and be a deep sea detritivore by trying to collect enough food to eat.
3. If working with younger girls, you may want to consider putting each girl in their own hoop/space to make it a bit safer for them. If working with older girls, make a large circle and have 2 or 3 detritivores enter the circle, sit on the floor and close their eyes, or put a blindfold on.
4. The rest of the group stands in the circle and, without making noise, begins to gently toss cotton balls into the circle towards the detritivores. The detritivores use their hands to try and grab as many cotton balls as they can, without opening their eyes! Any cotton balls that fall in their lap are counted as collected, as well. The deep sea doesn't have any light, so the girls can't see where the food might be, they just have to hope they catch some.
5. Have the girls around the circle continue to pick up any wayward cottons balls and toss them back towards the detritivores. They should be trying for low steady tosses, just as the current drops food in a light 'snow'.
6. Depending on your group, you may choose to allow the detritivores to crawl around in the space, or, if you prefer, have them remain seated in one spot.
7. Switch detritivores to make sure everyone has a turn.

Supplies

- ❑ a private space for each girl; if doing this with younger girls, hula hoops work well
- ❑ optional: blindfolds
- ❑ a package of cotton balls - the more cotton balls the longer the activity!

Discuss

- Did everyone get the same number of food pieces? Why or why not?
- How might an animal get more food pieces if it can see them?
- Some animals that live on the bottom go a long time without food. Why might it help them survive to go a long time without food?

BioluminescenceCraft

S B G

Light doesn't penetrate very deeply into the sea. Dive down more than 200m, and it begins to get as dark as twilight. After about 1000m, it's as dark as midnight. Sunlight simply can't get deep enough into the water to illuminate anything. But that doesn't stop some animals from living there; instead, they just make their own light. This light is called "bioluminescence" because animals make it inside their bodies. What does bioluminescence look like? Complete this craft to find out.

Purpose of this activity: to explore the diversity of life in the ocean.

Directions

1. Have the girls brainstorm what they know about bioluminescence. The word "bioluminescence" might not be familiar, but the girls probably already know examples of what it is. The most common example that many people know is fireflies. Fireflies get their glow from bioluminescence. Perhaps the girls have seen "*Finding Nemo*"; the large predatory fish they find at the bottom of the ocean is an anglerfish – a fish that uses a lighted lure to attract food.
2. Have the girls think about how important light is to them. How hard would it be to go to camp without a flashlight or a lamp?
3. Brainstorm: How could having a light on your body protect you from a predator? How can having a light on your body help you find food? How can having a light help you find a friend in the darkness?
4. Show some different pictures of bioluminescent fish, jellies (jellyfish), squids and deep-sea animals.
   Examples are attached in this document. Have the girls notice where the animals emit light.
5. Have each girl fold one sheet of construction paper in half, and then rotate it so the folded edge is along the bottom.
6. Being sure to preserve the fold, cut your paper into a fish shape, with the fold along the bottom of the body (the fold will become the fish's tummy).
7. Poke some holes in the fish along the body- this can be done with a hole punch, a pushpin or a toothpick. Be careful, and be sure to punch though both sides of your fish. (You can make any pattern you like).

   Tip! If you lay your paper on a small ball of clay or corrugated cardboard, you can use a tooth pick to safely poke through the paper.
8. After poking the holes in your fish, you can add more details such as fins, a

Supplies

- ❑ construction paper (suggested colours: blue, grey, brown, black and red)
- ❑ glow sticks (1 per girl)
- ❑ pushpin, thumbtacks or sharp toothpicks (the rounded kind)
- ❑ glue, scissors, tape, googly eyes, sequins and other crafty bits
- ❑ paperclips
- ❑ pictures of bioluminescent animals (included)

tail, googly eyes and any other decorations you like.

9. When each girl is finished, add a glow stick to the inside of each fish.
10. Before cracking the glow stick, tape up the fish and tape the paperclip along the back for hanging. Some long thin fish might need two paperclips along the back to hang properly.
11. When the fish are ready, use the paperclips to hang them up around your meeting space. Crack the glow sticks to make the fish glow.
12. Dim the lights and take a deep-sea walk around all your fish. How different do they look in the dark?
13. Have the girls make observations of the fish. Do any look different? Which patterns in the fish are the most obvious? Which patterns are the hardest to see?

Extensions and ideas

- This is a great activity for a night activity! Make the fish early in the day, and have a leader hang them along a hiking trial for later that evening. (You can even crack the glow sticks early, even medium quality sticks will glow for several hours). After dark, take the girls for a hike along the fish trail.
- For young girls at their first sleepover, use a glowing fish friend to help the girls through the night. Have each girl make a fish as above, and use them as nightlights in their cabin or sleeping rooms.

Take it a step further for Guides

Bioluminescence is light created by animals and plants. A very familiar example in insects is fireflies. These small insects use chemicals in their bodies to create a glowing light. Bioluminescence is much more common in the ocean than on land, as many fish and other species live in parts of the ocean where there is not much natural light.

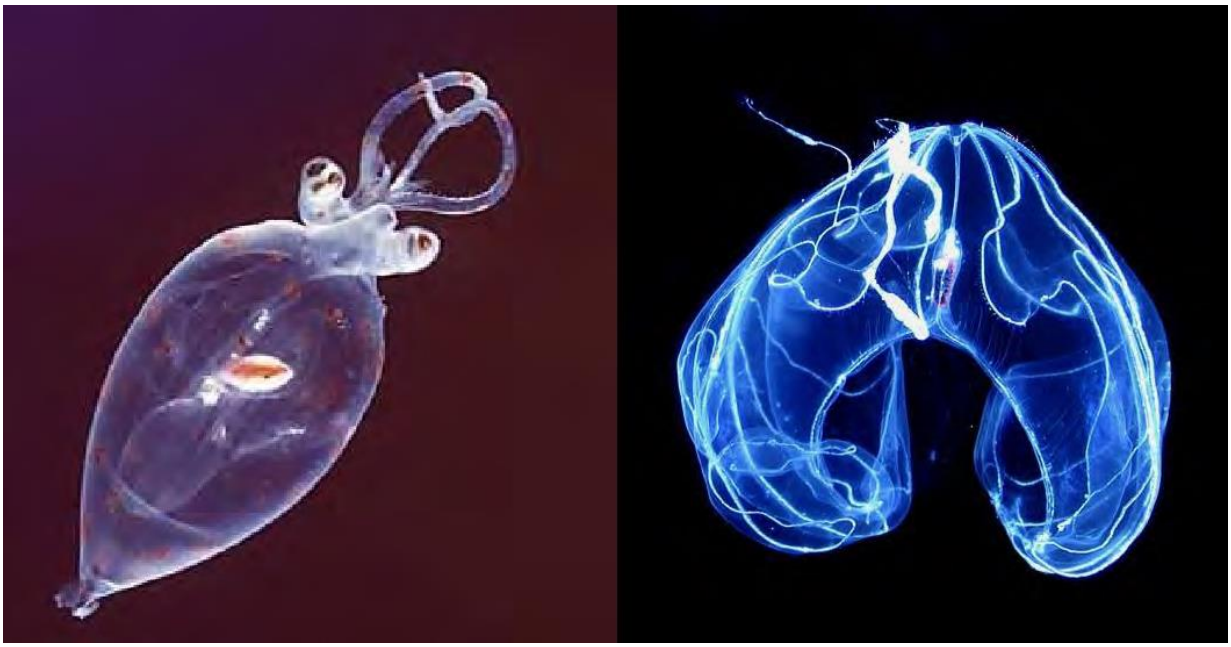
Bioluminescence can have many different purposes, depending on the animal that is making the light. For example, some animals, like anglerfish, use light to attract and trap food, while some others, like squid, and use it to communicate. Some fish also use bioluminescence for camouflage. When an animal looks down into water it can be very hard to see something below them. However, when an animal looks up towards the surface, they can see fish above them because the fish's body blocks some of the light from above, making a nice dark silhouette. If the fish has light organs along its body, it makes the fish as bright as the water above it. This can make the shape of the fish blurry or even invisible. This special camouflage is called counter-illumination.

For more information, check out this link:

http://science.howstuffworks.com/zoology/all-about-animals/bioluminescence2.htm

Bioluminescence Examples

Zooplankton Beroidae. By Shane Anderson [Public domain], via Wikimedia Commons.



Glass squid. By Kils at en.wikipedia [CC-BY-SA-3.0], via Wikimedia Commons.

Bathocyroe fosteri is a bioluminescent species of ctenophore, or comb jelly. Photo courtesy of Marsh Youngbluth, Public domain, via Wikimedia Commons.

Bioluminescence Game

GP

Light doesn't penetrate very deeply into the sea. Dive down more than 200m, and it begins to get as dark as twilight. After about 1000m, it's as dark as midnight. Sunlight simply can't get deep enough into the water to illuminate anything. But that doesn't stop some animals from living there; instead, they just make their own light. This light is called "bioluminescence" because animals make it inside their bodies. What does bioluminescence look like? Complete this tag game to find out.

Purpose of this activity: to explore the purpose of bioluminescence.

Directions

Supplies

- ❑ glow sticks (1 per girl)
- ❑ darkened playing area

1. Have the girls brainstorm what they know about bioluminescence. The word "bioluminescence" might not be familiar, but the girls probably already know examples of what it is. The most common example that many people know is fireflies. Fireflies get their glow from bioluminescence.
   Perhaps the girls have seen "Finding Nemo"; the large predatory fish they find at the bottom of the ocean is an anglerfish – a fish that uses a lighted lure to attract food.
2. Have the girls think about how important light is to them. How hard would it be to go to camp without a flashlight or a lamp?
3. Brainstorm: how could having a light on your body protect you from a predator? How can having a light on your body help you find food? How can having a light help you find a friend in the darkness?
4. Show some different pictures of bioluminescent fish, jellies, squids and deep-sea animals. Have the girls notice where the animals emit light. (Note: sample images are included with the "Bioluminescence Craft" activity.)
5. Give each girl a glow stick.
6. Select a few girls to be predators – in a group of 24 girls, choose 4 predators. Adjust the number of predators for your size of group. Have the predators leave the playing area while the rest of the girls prepare.
7. Divide the remaining girls into groups of 4. Each group represents a different bioluminescent organism. The girls within each group must come up with a secret code to identify themselves… using only the glow sticks! It could be the way they wave the glow stick, or they could make it "flash" by covering it and uncovering it with their hand. Each group will have a different code.
8. Explain to the girls that when the lights go out, they will need to avoid being tagged by a predator. When they are tagged, they must sit down on the floor/ground and can only be released if two of their same organism comes to release them by making the group's special code.
9. All girls must scatter throughout the playing area, then darken the playing area (if indoors) and introduce the predators to the game.
10. The predators try to tag as many organisms as they can.

11. Remember that organisms can re-join the game if two other girls with the same secret code release them.
12. The game ends when all organisms have been tagged.

Blubber Glove

S B G

The ocean can be pretty cold most of the year, especially the ocean that surrounds Canada. So how do ocean mammals, like seals and whales, stay warm when they are in cold water all the time? By covering themselves in a layer of nice warm fat called blubber! In this experiment, you can test the value of blubber using a fat you probably have in your kitchen. Try it out and see how warm you can be.

Purpose of this activity: to explore how mammals insulate themselves from cold water.

Directions

1. Empty the box of shortening into one of the large plastic bags.
2. Take the second plastic bag and turn it inside out so the zipper part is on the outside.
3. Put your hand inside the inside-out bag, like a glove, then stick the inside-out bag inside the bag with the shortening and zip the two of them together. Warning: this is a bit trickier than it sounds. Use the duct tape to make a nice solid seal along the top of the two bags (leaving the center of the "glove" open).
4. When you're done taping, you should have two bags zipped together with a block of shortening in the middle, and a clean pocket to stick your hand in.
5. Use your hand inside the pocket to spread the shortening around so that it there is an even layer of shortening between the bags.
6. Put the blubber glove into the ice water and have the girls put one hand in the ice water and the other in the blubber glove in the ice water.
7. Allow each girl to compare the temperature they feel on their unprotected hand compared to the one in the blubber glove.

Supplies

- ❑ a large basin of ice water
- ❑ 1-2 packages of shortening, such as Crisco
- ❑ 2 resealable plastic zipper bags (large freezer size is recommended)
- ❑ duct tape
- ❑ a few towels

What's happening here?

Vegetable shortening is made of fat, just like blubber. When you place your hand in the blubber glove, the fat protects your hand from the cold water and keeps it warm. The other hand, in the cold water, has very little fat to protect it, so it feels cold much quicker. Marine mammals, such as whales, dolphins, seals and walruses, protect their bodies by growing a layer of fat called blubber. The blubber acts just like the special glove in this experiment. It protects the animal's body from the cold water. It's important that marine animals get enough food so that they can grow the extra layers of fat they need to protect themselves from the cold of the ocean.

Hydrothermal Vent Tubeworm SBG

Tubeworms are the dominate species at hydrothermal vents, and are some of the most unique animals on the planet. They have no mouths, no anus, and no guts. Instead, their bodies consist of a tube of chitin, a material similar to our fingernails, a body cavity filled with bacteria called a Trophosome, a bright red plume, and one tiny muscle called a vestimentum that holds it all together. Hydrothermal vent critters are pretty neat! Why not make a few puppets with your unit?

Purpose of this activity: to explore the diversity of life in the ocean.

Directions

Supplies

- ❑ 2 toilet paper rolls
- ❑ red craft feathers or paper
- ❑ one sheet of white paper, cut in half widthwise
- ❑ clear tape
- ❑ chopstick/bamboo skewer
- ❑ crayons, markers or pencil crayons

1. Take one of the toilet paper rolls and cut the tube open down one side. Overlap the edges and seal with tape. This makes the tube a bit smaller so that it will fit inside the other tube. Try not to overlap the edges too much. The smaller tube should fit easily, but not loosely, in the uncut tube. This smaller tube will become the worm's trophosome. Colour this greenish brown. In a tube worm, this is full of sugar-making bacteria.

2. When you are finished colouring your tube, tape some craft feathers (or cut some out of red paper) to one end of the tube and the chopstick/skewer to the other end of the tube. The feathers represent the bright red plume of the tubeworm. The red colour comes from hemoglobin, the same compound that makes our blood red too. The worm uses the plume to collect compounds like oxygen from the water around it.

3. Take one of the ½ pieces of paper and cut it into a long thin strip. Use the colours to draw on a heart and a brain. When you are done, wrap the paper strip around the tube at the top under the feathers. Trim any excess paper away and tape on the paper strip. This represents the vestimentum, a specialized muscle that holds the worm in its tube. It also holds the heart and brain of the worm.
4. Wrap the second piece of paper around the second uncut toilet paper tube and tape it in place. This will be the outer tube of your tubeworm. You can add lines and other details to make your tubeworm tube more realistic.
5. Slide the trophosome into the tube of the tube worm to complete your craft. Use the chopstick to pull the plume of the worm down into the tube, just like a real tubeworm does when it is in danger.

Hydrothermal Vent Crossword

G P R

Find out about hydrothermal vents, the only known ecosystem that exists without using energy from sunlight. What is a hydrothermal vent, and how do the animals survive at the vent? How do they live in such an amazing environment?

Purpose of this activity: to explore a unique ecosystem in the ocean.

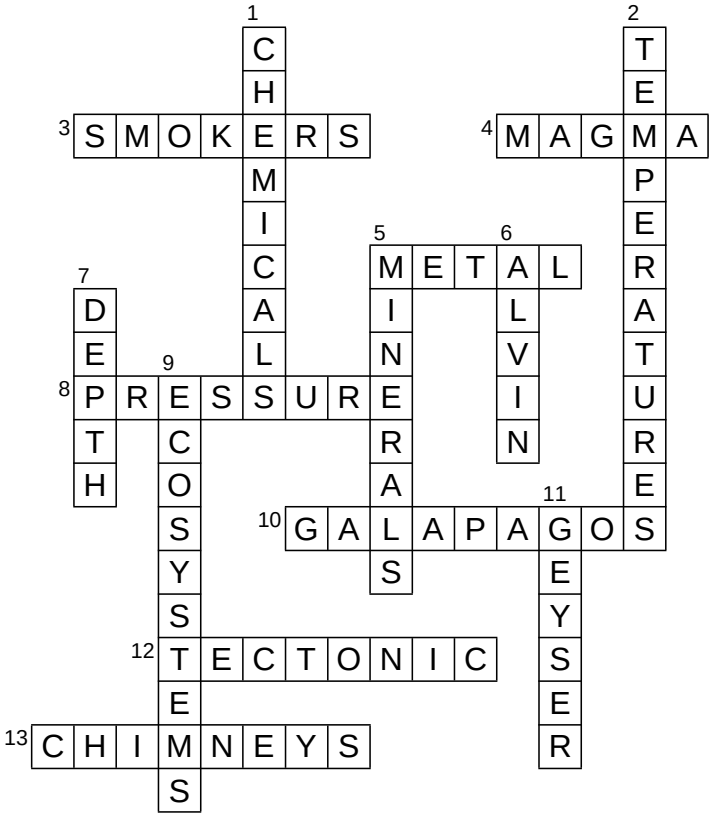
Directions

If your meeting place does not have an Internet connection, you can download videos to playback while not online. See http://www.wikihow.com/Download-YouTube-Videos for instructions.

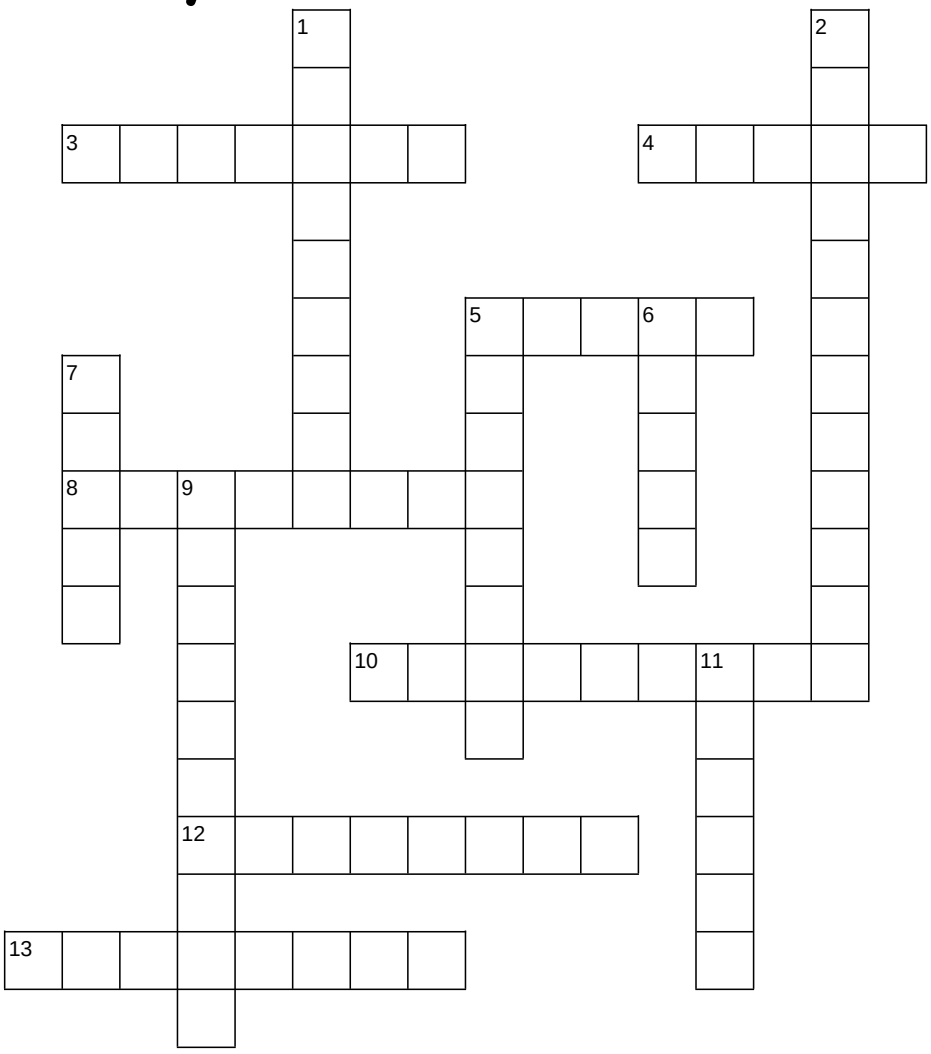
Supplies

- ❑ online research material
- ❑ crossword puzzle
- ❑ pencils

1. Research hydrothermal vents.
2. Search online for hydrothermal vents, or watch online videos. Some suggested videos are:
   - "Hydrothermal Vents" from The Science Channel
   - "Evolution Deep Sea Vents and Life's Origins" http://www.youtube.com/watch?v=5JzUgi6YNlY
   - "The Strange World of Hydrothermal Vents" from Ocean Networks Canada http://youtu.be/mBD80c6-bPY
3. Complete the attached crossword puzzle (next page; solution below).



Hydrothermal Vents



Across

3. The two main types of hydrothermal vents are called black or white _____.
4. Water is heated to a high temperature by _____ under the earth's crust.
5. The water is so hot that it can melt solid _____.
8. Even though the water is very hot, it doesn't boil because of the very high _____ in the deep ocean.
10. In 1977, hydrothermal vents were first discovered near these islands.
12. Hydrothermal vents are found along mid-ocean ridges, where _____plates spread apart.
13. When the superheated water from the hydrothermal vent meets the near-freezing seawater, minerals precipitate out and form _____.

Down

1. Life at the hydrothermal vent communities derives energy from ___ instead of ___. of sunlight.
2. The water at these locations is superheated and can reach very high _____.
5. The superheated water is rich with _____.
6. The name of the deep submersible vehicle that discovered the first hydrothermal vent. (Hint: one of the "Chipmunks")
7. Hydrothermal vents are found at an average _____ of about 2,100 meters.
9. Hydrothermal vents support unique_____ and their communities of organisms.
11. A hydrothermal vent is like __ , or hot springs, on the seafloor.

Principle 6: The Ocean and Humans are Inextricably Interconnected

Oceans of Plastic

S B G P R

How much plastic do you use in a day? What do you do with it when you're finished? Rinse it out and use it again? Recycle it? Throw it in the garbage? No matter what you do with your plastic, it never really goes away. Plastic is a forever product because it never breaks down into anything other than microscopic pieces of plastic. Have you ever heard of the Great Pacific Garbage Patch? In these activities, explore how plastic can get into the ocean and how this plastic can impact wildlife and our environment.

Purpose of this activity: to explore the human impacts on the ocean.

Complete Activity One and at least one other of the following activities.

Activity One: How much plastic do you use every day?

Supplies

- ❑ pencil and paper

Directions

1. Give each girl a pencil and a piece of paper then ask the girls to think about what they do each day. Examples are: getting ready for school in the morning, going to school, coming home, eating dinner. Have each girl think about how many plastic items she uses in one day.
2. Have each girl make a list of every plastic item she used on that particular day. For example, did she use a plastic toothbrush that morning? Brush her hair with a plastic brush? Carry her lunch to school in a plastic lunch container? Use a computer? Watch TV with a plastic remote? Use a plastic water bottle for a drink?
3. After a few minutes, compile all the lists together; as a group, see how many more entries you can list.
4. **For older girls:** with the master list, have the girls sort the list into categories: plastic that has one use, plastic with five uses, plastic with 100 uses, plastic that will be used for less than six months, plastic that will be used for more than a year. You might find that the girls will have lively discussions about how much they use the plastic in their lives. For example, some girls might use the same lunch container for weeks, while others use a new one each day.
5. When the girls are finished, have a discussion about how we look after the plastic in our lives. Some possible discussions:
   - Can you increase the number of times you use your single use plastic? For example, can girls use lunch baggies again?
   - How much of the throwaway plastic can they recycle instead of throwing it away?
   - How many of the plastic items can they recycle and replace with metal, glass or biodegradable materials such as "corn plastic"?
   - How many of the plastic items can they eliminate all together? For example, can they get a reusable coffee mug instead of a plastic cup?

Remind the girls that plastic isn't inherently evil or bad. Instead, we just need to careful of how much we use, and what we do with the pieces we are finished using. By refusing to use the extra plastic in our lives, recycling our plastic and ensuring what can't be saved safely enters the landfill, we could save millions of tons of plastic from entering the oceans each year.

Activity Two: Plastic Scavenger Hunt

So how does plastic make its way into the ocean, anyhow? Aren't the majority of people responsible with their plastic? Most likely they are, but 80% of the plastic that ends up in the ocean is there because it escapes proper handling (recycling and garbage) and gets carried to the ocean. Do these experiments to find out how plastic travels to the ocean, and then go intercept as much plastic as you can!

Directions

Part One

1. Some plastic will get carried towards the ocean because it gets blown around in the wind. Have the girls try and move each piece of plastic using different wind methods, such as blowing or waving a piece of paper. What do they notice about their plastic pieces? How might they end up in the ocean during a windy day?
2. Some plastic gets into the ocean because rivers and streams carry it down to the ocean. Fill a bin of water and slosh the water around using cups or another bin. What happens to the plastic? How easy is it for the plastic to get washed down stream?
3. Have the girls share the results of their experiment. How does plastic move around? How does each piece behave under the different conditions? How might the results of the experiment explain how plastic ends up in the ocean? How might the conditions where they live explain how plastic from their community gets to the ocean? For example, if it is really windy where you live, how might that move the plastic around? If there are lots of lakes and rivers near you, how might plastic getting into the river result in plastic getting into the ocean?

Supplies

- ❑ two large plastic bins, one that fits inside the other with a bit of room around it for overflow
- ❑ water to fill the smaller of the two plastic bins
- ❑ a few pieces of plastic – perhaps something you can recycle from the day, such as old yogurt containers, a plastic milk jug, some plastic bottle caps, coffee cup lids, plastic shopping bags, some crumbled Styrofoam pieces (be sure to take care of these!) and old straws.
- ❑ rubber gloves (for Part Two)
- ❑ plastic bags (for Part Two)

Part Two

1. Go for a walk around your community. Look for routes that plastic might take to the ocean and other waterways on your walk. Hint, where do you think storm drains lead?
2. On your walk, be sure to pick up any plastic you find, and put it safely in the recycling or garbage where it belongs!

Activity Three: Lunching on Plastic

Although the plastic is unsightly and gross in the ocean, what's the actual harm it's doing? Why is all this plastic a problem? Unfortunately, the plastic looks an awful lot like plankton and food for fish and birds, who eat it rather than the actual food they should be eating. Fish and birds that eat plastic can't get it out of their stomachs, and their bellies fill with plastic. The birds and fish then starve to death because their tummies feel full, but they have no food in them. Also, baby birds depend on the food their parents bring them. If the parent bird brings them plastic for dinner, the baby birds fill with plastic and don't survive. In this activity, see what it's like trying to get a meal when the ocean is full of plastic.

Directions

1. Mix the plastic pieces with the sand or salt, beads and felt.
2. Give each girl a spoon, and a baggie.
3. With their eyes closed, have the girls take scoops of the "food" and plastic mixture and put it in their baggie (this represents their stomach). After a few minutes, or when the mixture is all gone, have the girls stop "eating."
4. Optional: have some of the girls be baby birds. Only the adult birds have spoons. Then have the adult birds pour some of their food out of their stomach into the stomach of the "baby birds".
5. Have the girls close their bags and pass them to another girl in the group.
6. From here, have the girls empty the contents of their "stomach" into a bowl and examine everything inside. How many pieces of food (green felt or beads) does your "stomach" contain? How much plastic? If you needed 10 pieces of food to survive, did you get enough to eat? Why or why not?
7. Be sure to take care of all your plastic pieces when you've completed this activity! We wouldn't want any of it to get into the ocean. You can do this by straining your mixture through a colander. The sand or salt will go through and the plastic will remain in the colander.

Supplies

- ❑ large plastic bin to mix all the ingredients
- ❑ plastic bottle caps
- ❑ small pieces of plastic from your recycling
- ❑ plastic pony beads (any colour)
- ❑ plastic beads or pieces of felt (green - this is the food you actually want to get!)
- ❑ pieces of Styrofoam
- ❑ a spoon for each girl (use metal, if you can!)
- ❑ a paper baggie for each girl
- ❑ a bowl for each girl
- ❑ sand or salt (something to suspend the plastic in, you can use water, but sand or salt makes for a more interesting challenge)
- ❑ colander

Activity Four: Beach and Plastic Cleanup – at home and far away!

All water in the world makes its way to the ocean at some point or another. Through rivers, lakes and streams, everything eventually, ends up in the ocean. To help keep the ocean clean, you can do your part in your own backyard.

Directions

Find a local park or stream and clean up as much plastic and garbage as you can. Be sure to take care to look out for sharp or dangerous objects as you are doing your clean up. Also, be sure to take care of the garbage and recycling as best you can.

If you live near the beach (this could include a wetland, river, lake or ocean), arrange a beach cleanup and collect as much garbage as you can. Make it a district event and see which unit can collect the most garbage and plastic by weight. Challenge local schools and community centers to join you. How many kilometers of beach can your community clean up together?

Supplies

- ❑ plastic gloves
- ❑ garbage bags
- ❑ tongs or grabbers for garbage
- ❑ optional: "Coastbuster" app from Ocean Networks Canada

If you are at an ocean beach, you can help keep our West Coast clean and safe by reporting marine debris via the Coastbuster app for Android. Use this app to report large, unusual and potentially hazardous marine debris – especially items that may have been swept into the sea by Japan's devastating March 2011 tsunami. Simply photograph the debris you find, enter some descriptions, and upload to Ocean Networks Canada. Your report will be forwarded to authorities. The photos will also be uploaded to Flickr, where you can browse, share and comment on the full collection of marine debris snapshots. The information and photos you share may also help scientists to better understand how winds and currents carry marine debris across the oceans. The app is available in the app store, and you find more information online: http://www.oceannetworks.ca/learning/citizen-science/coastbuster.

Or participate in the Great Canadian Shoreline Cleanup. Find out more at: http://www.shorelinecleanup.ca/

Take it a step further for Pathfinders and Rangers

The Great Pacific Garbage Patch is one of five or more patches of garbage that are currently growing in our oceans. Plastic from land gets blown out to sea where it floats around in large currents called gyres. These garbage gyres are hundreds of kilometers across (often said to be the size of Texas), and many meters deep. If we were to scoop all the garbage out of the ocean, it would make a literal mountain of plastic. Because it's floating around in the ocean, it's nearly impossible to clean up. Frighteningly, it seems like the only thing we can do about it right now is to try and stop it from getting any bigger!

Encourage the girls to research as much information as they can on *the* Great Pacific Garbage Patch. There are many resources online, including video, articles, TED-talks and webpages, which explore this issue. Encourage the girls to find three pieces of

information on the Garbage Patch and to each present something about it at your next meeting. Alternatively, you can consider printing some articles and, if possible, downloading some video for the girls to discuss at the meeting.

The videos and articles listed here are only suggestions, and you should choose clips that you feel are appropriate for your group. (Note: to download YouTube videos, see http://www.wikihow.com/Download-YouTube-Videos).

https://www.thoughtco.com/trash-islands-overview-1434953

This page contains information about the Great Pacific Garbage Patch and other oceanic garbage patches as well as information about trash islands and the impact on wildlife.

http://youtu.be/XxNqzAHGXvs

This clip is approximately 7 minutes and explores how plastic pieces in the ocean resemble oceanic plankton. The clip is intended for an older audience, and may be best used as background information for leaders.

http://vimeo.com/16915737/

5-minute clip from the documentary *Plastic Paradise*. This clip centers on the host's trip to one of the most plastic polluted beaches in the world. While here she explores the plastic debris she finds on the beach. This clip may be appropriate for Guides, though it may depend on your group.

https://www.youtube.com/watch?v=xf5JI0b1L7k

Another clip from the documentary *Plastic Paradise.* This clip is an overview of the plastic-based pollution in the ocean, and many of the repercussions of plastic litter. The clip does include some strong/graphic images of animals that have been killed or harmed by plastic. This clip is likely appropriate for Pathfinders and Rangers, though it will depend on your group.

Become an Ocean Advocate

S B G P R

Tip for leaders: for younger girls, combine this activity with other activities in this resource such as "**Oceans of Plastic**," "**Ocean Acidification**," "**Overfishing**" and "**Bycatch**". This will give them the background knowledge to make an informative piece.

The ocean is a vast resource, but it is one that needs to be respected and taken care of. The ocean influences humans and we influence it. Thus, the relative health of the ocean can directly affect the overall health of humans. The ocean provides us with food, medicine and oxygen, and is an important part of many cultures. Furthermore, taking care of the ocean is something anyone can do, no matter where they live. In this exploration, use your artistic skills to get the word out about taking care of the ocean.

Purpose of this activity: to explore human impact on the ocean.

Directions

The ocean needs our help. The ocean faces many threats to its health including climate change, overfishing, poor fishing practices (such as bottom trawling), habitat destruction, poor aquaculture practices (fish and shellfish farming), oil and gas extraction, pollution, plastic, whaling, bycatch and, worst of all, unawareness. Most people simply don't know or recognize that they have an influence on the ocean.

Supplies

- ❑ pencil crayons or markers
- ❑ recycled cardboard and paper (use what you have around)
- ❑ any other craft supplies you choose

Educating people about the state of the ocean and what they can do to help is one of the easiest ways to influence a change. Use your creative skills to get the word about an ocean health topic that is important to you. In your message be sure to include important information about what the issue is, how it will impact us in the future and what people can do to improve or even correct the problem.

Ways to get your message out:

- make a poster, advertisement or booklet
- make a skit, radio play, speech or silent flash mob message

When you are finished, present your project to your unit, your school or class. What can you teach others about the ocean?

Ocean Acidification

S B G P R

The ocean is the largest carbon sink on the planet. A carbon sink is an area that absorbs the carbon in the atmosphere. So, for example, a forest absorbs carbon because the trees 'breathe in' carbon dioxide and 'breathe out' oxygen. The carbon the trees take in then stays in the tree for the life of the tree, thus the tree is a carbon sink. The ocean, through the movement of wind and wave, absorbs some of the carbon that is put into the atmosphere from burning fossil fuels. Unfortunately, when the ocean absorbs carbon, it can cause the ocean water to become more acidic than normal. Unlike the tree that uses the carbon, the ocean pulls the carbon in where it combines with oxygen and hydrogen (H_2O, water) and becomes carbonic acid, H_2CO_3. This causes hydrogen to be further released into the water. As hydrogen ions increase, this causes the pH of the ocean to decrease, making it more acidic. What does this mean for the animals that live there? Try this experiment to see an example of ocean acidification gone to extremes!

Purpose of this activity: to explore human impact on the ocean.

Directions

Supplies

- ❑ chalk (2 pieces per girl)
- ❑ vinegar
- ❑ water
- ❑ plastic cups

1. Give each girl a plastic cup and fill it with water.
2. Give each girl a small piece of chalk. Observe the chalk and make notes about it, such as the size, shape, colour and texture. Explain that many ocean plants and animals protect themselves by growing shells of calcium carbonate, one of the main ingredients of chalk. A special type of plankton called a coccolithophore (coca-LITH-o-fore) grows protective plates of calcium carbonate to protect itself, and when the coccolithophore dies, these plates sink to the bottom of the ocean and build up in layers. After millions of years, these shells become fossilized and can be made into chalk. Chalk is collected from areas that were underwater millions of years ago.
3. Place the chalk into the cup of water. Wait 2 minutes and record observations as to what happens to the chalk. Wait another 2 minutes and record again. Have the girls discuss any changes.
4. Fill a second cup with vinegar.
5. Optional: take another cup and fill it with half water, half vinegar.
6. Take a second piece of chalk, and, as before, make observations about the size, shape, colour and texture. Explain to the girls that as the ocean absorbs more carbon from the atmosphere, it becomes more acidic. This can make it hard for the tiny coccolithophores to properly form their protective plates. It can also make it hard for other shelled animals, such as snails, crabs and bivalves (mussels, clams etc.), to properly form their shells. Have the girls predict what might happen when the chalk is added to the acidic vinegar.
7. Place the chalk into the vinegar and wait 1 minute. Record your observations of the experiment. Wait 1 minute and record again. What happens this time? Have the girls

discuss the differences they see in the chalk. Why might this make it difficult to grow if you are a marine animal?

Conclude the Activity

Be sure to remind the girls that this experiment is designed to highlight a specific event, in a very extreme way. Right now the oceans are not as acidic as vinegar, but the acidity is rapidly changing, and even small changes can affect these tiny plants and animals. In this experiment, we can use the chalk and vinegar to provide an extreme example of what would happen if the ocean were to continue to become acidic.

Take it a step further for Pathfinders and Rangers

The ocean absorbing carbon from our atmosphere causes ocean acidification. Activities, such as burning fossil fuel, add carbon dioxide to the atmosphere, while deforestation takes away trees that could help remove carbon dioxide from the atmosphere. Reducing your carbon footprint by walking, riding your bike, carpooling, turning off unneeded electronics and lights can all help to reduce the amount of carbon that goes into the atmosphere and into the ocean.

Check out the following links for more information and to calculate your carbon footprint:

https://www.nationalgeographic.org/projects/pristine-seas/

https://www.nature.org/en-us/get-involved/how-to-help/consider-your-impact/carbon-calculator/

Overfishing

S B G P R

The ocean provides millions of people around the world with their principle protein source. Without the ocean to provide fish, millions of people would go hungry every day. However, fishing standards around the world have not been well looked after. Many of the species in the ocean are dangerously overfished. Overfishing is when too many fish are taken from a population of fish. If we take too many, there aren't enough fish left to reproduce and make new fish. Some examples of overfishing include Atlantic Cod, Wild Pacific Salmon and Blue Fin Tuna. Too many of these large fish were taken from the ocean and not enough remain to breed, make new fish, and sustain the population. Because of overfishing, our children, and their children, may not have access to the same fish (or the same amount) that their grandparents once fished.

So how many fish is the right number? Explore this ocean activity to see how many 'fish' are too many fish.

Purpose of this activity: to explore human impact on the ocean.

Directions

1. Choose two girls to be the *grandparents*. This is the first generation to fish.
2. Next, choose 4 girls to be the *parents*. This is the second generation to fish.
3. Next, choose 8 girls to be the *children*. This is the third generation to fish.
4. Any remaining girls will be the *grandchildren*. This will be the last generation to fish.
5. If doing the snack options, make sure that everyone has washed their hands. Give each girl a napkin. Empty some, but not all, of the items into a big bowl (the big bowl is the ocean). Cover the bowl with a napkin or cloth before giving it to the first girls and explain that we can't see how many fish are in the ocean, so they will need to get their fish by reaching under the napkin and not peeking.
6. Invite only the *grandparents* to 'fish' for the pieces they want. Tell them to think of the mixture as different types of fish, and tell them that they will need to take as many fish as they think they would need in their lifetime.
7. Let the first fishers take as much as they like – you may have to remind the other girls not to say anything (i.e. "save some for me!"). Don't let the first fishers eat anything, as the pieces will be used later.

Supplies (object option)

A mix of small objects:

- ❑ buttons
- ❑ coins
- ❑ sequins
- ❑ other small, mixed objects

Supplies (snack option)

A mix of small snack items that your group enjoys:

- ❑ mini pretzels
- ❑ dried cereal
- ❑ dried fruit
- ❑ Goldfish crackers
- ❑ small crackers/animal crackers/ teddy grahams
- ❑ a large bowl for all the items
- ❑ a napkin or cloth to cover the top of the bowl
- ❑ a napkin for each participant

8. When the grandparents are finished fishing, add a few more pieces to the bowl. Explain to the girls that this represents the fish breeding. Be sure to add only about one quarter of the remaining fish in the bowl.
9. Give the bowl to the four *parents*. They may need to take turns reaching under the cloth, but like the first girls, they should be allowed to take as much as they like.
10. When the *parents* are finished, add a few more fish (again, only about one quarter of what remains) and give the bowl to the *children*. If there are enough fish remaining, repeat with the *grandchildren*. At this point, it is likely that there will not be enough fish for everyone to take some. Discuss with the girls why this happened. Discuss with the girls why it got harder and harder for the next generations to get enough fish (be sure to mention that the number of people in each generation got successively larger, that they could not see how many animals were left in the ocean, that the fish were not able to breed enough to restore the population).
11. Optional: repeat the activity, with the understanding that fish need to left for the next group. How does the activity change?

Conclude the Activity

- Have the girls discuss and implement a few fishing regulations. For example, each person is only allowed to take 15 pieces. Return all the fish to the bowl and try again with this method. Discuss why this changed the outcome of the game.
- Optional: Tell some girls that the fishing regulations have not come into effect where they live, thus, they do not need to follow them. How does this change their choices and the amount of fish taken?

Take it a step further for Pathfinders and Rangers

One of the best ways to help prevent overfishing is to change our habits as consumers. By choosing not to buy certain types of fish and seafood, it limits the demand for this fish, and thus limits the amount that will be caught. Equally, choosing local sustainable varieties of seafood can help limit the amount of foreign fish that are taken from other areas.

Check out the Oceanwise Program developed by the Vancouver Aquarium at http://www.oceanwise.ca/ for more information.

You may also want to talk with the girls about the concept of “fishing down the food web.” This occurs when larger, predatory fish are removed from a food chain, forcing fishermen to collect other fish – often the prey species that are no longer being eaten by all of the (removed) top predators. This makes it much harder for any remaining top predators to return to the area – there isn’t enough to eat. At the same time, it can drastically alter the food web as more animals are removed.

Check out the following resource with the girls and discuss: how can we prevent overfishing and fishing down the food chain from happening?

http://www.seaweb.org/

Sounds in the Sea

S B G P R

It may not seem like it at first, but the ocean is full of sounds! Ocean scientists use audio data collected from hydrophones to help understand what is going on in the ocean. Hydrophones, underwater microphones, can be deployed in the ocean as listening devices so that scientists can hear what is happening. It's not just the animals that make noise; scientists can hear earthquakes, ships and even reefs!

Purpose of this activity: to explore human impact on the ocean.

Directions

If your meeting place does not have an Internet connection, you can download videos to playback while not online. See http://www.wikihow.com/Download-YouTube-Videos for instructions.

Supplies

- ❑ computer with speakers
- ❑ Ocean Networks Canada "Sounds of the Deep" playlist: http://www.youtube.com/playlist?list=PLD01ED3024EAE9A3F (select the ones you'd like to hear)

1. Discuss with the girls: what would their life be like without sound? How important is sound in their lives?
2. What information can we get from sound (help guide thinking: If we hear footsteps getting louder behind us, what might this tell us? When we push the keys on a phone or keyboard, what tells us we've pushed hard enough? If our pets need something, how do they communicate with us?)
3. Ask the girls: what sounds might you hear in the ocean? Guide the girls to think about whales, ships, seals and earthquakes. What do they think each will sound like?
4. Play one of the clips from the "Sounds of the Deep" playlist, or from the Audio Highlights page on the Ocean Networks Canada website: http://www.oceannetworks.ca/sights-sounds/sounds/audio-highlights. Ask the girls to guess what it might be. After the girls have had a chance to guess, explain what the sound is.
5. Some clips you may enjoy playing are:
   - Humpback Whale Solo
   - Haida Gwaii Earthquake Rumbles
   - Humpback Quartet
   - Sperm Whale Clicks
   - Clear Recording of Inner Coast Bigg's Killer Whales
   - Any others you enjoy!

   Encourage the girls to guess what the sound might be (the answer and a brief description are found below each clip).
6. Ask the girls, why is it important to listen to an environment as well as observe it visually? How can sound (such as a whale song) help us understand how whales live in an environment?

Conclude the Activity

Explore with the girls: how is sound important to them in their daily lives? What key sounds would researchers listen for if they were studying your meeting? What sounds would they expect to hear from a group of Guiders?

Take it a step further for Pathfinders and Rangers

Noise greatly affects whales in the ocean. People using the marine environment cause some of the most problematic noise. Shipping, oil and gas exploration, sonar and even marine construction can cause extra sounds that can disturb or harm whales. By being informed, we can make better choices about which noises occur in the marine environment.

Are you a boater or do you know someone who is? Check out the “Be Whale Wise” guidelines to help you better protect whales from marine noise:
http://www.bewhalewise.org/

Sound Map

S B G P R

In the ocean, light doesn't travel as easily as sound. Many animals (especially whales and dolphins) make a sound map of their environment using listening and echolocation. In this activity, explore your environment with sound, a little like a whale.

Purpose of this activity: to explore how marine mammals use sound in the ocean.

Directions

If your meeting place does not have an Internet connection, you can download videos to playback while not online. See http://www.wikihow.com/Download-YouTube-Videos for instructions.

Supplies

- ❑ a space for each girl
- ❑ a mapping grid (one per girl)
- ❑ a few different noise makers, identifiable sounds (for example, a radio playing music softly, some plates and dishes being tapped together, a ringing phone, a door being used, a broom being swept, etc.)
- ❑ sound clips from Ocean Networks Canada "Sounds of the Deep" playlist: http://www.youtube.com/playlist?list=PLD01ED3024EAE9A3F

1. Ask the girls to think of all the sounds they heard today. What kinds of noises help them during the day? (the alarm signaling time to get up, listening for traffic before crossing the street, their mom calling them for dinner, etc.)
2. Give each girl a copy of the attached sound grid to draw her map on. Then have each girl find a space alone from the other girls, but still in one big area (if possible).
3. Have each girl put a drawing of herself in the centre square on the grid. She will use the other spaces to draw the sounds she hears around her, as best she can.

   Tip: the girls don't need to draw the map realistically. The girls can draw how the sound makes them feel or what they think the sound means to them. For example, if the radio is pleasant, they might draw a heart or a star in the space. The moving sweeping sound of the broom might be represented by a long swoosh, or a few swish marks.
4. Have the girls close their eyes, and as they sit and listen, the leaders will begin to use some of the noise makers around the space. If you can, have the leaders make a few sounds at once, and a few sounds one at a time. Be sure to spread out, or move some of the sounds (for example, sweep around a few girls) to make the sound scape a bit dynamic.
5. After a few minutes of listening, have the girls open their eyes and draw a map of the sounds they heard around them. You can let the girls talk about some of the sounds they heard if they need help identifying them.
6. Play some of the sound clips from Ocean Networks Canada. What do you think these sounds might be? After listening a few times, explain each sound to the girls. (Each sound comes with a description on the webpage).

7. Explore the question: How might hearing a sound help a researcher make a “map” of what ocean animals are doing?

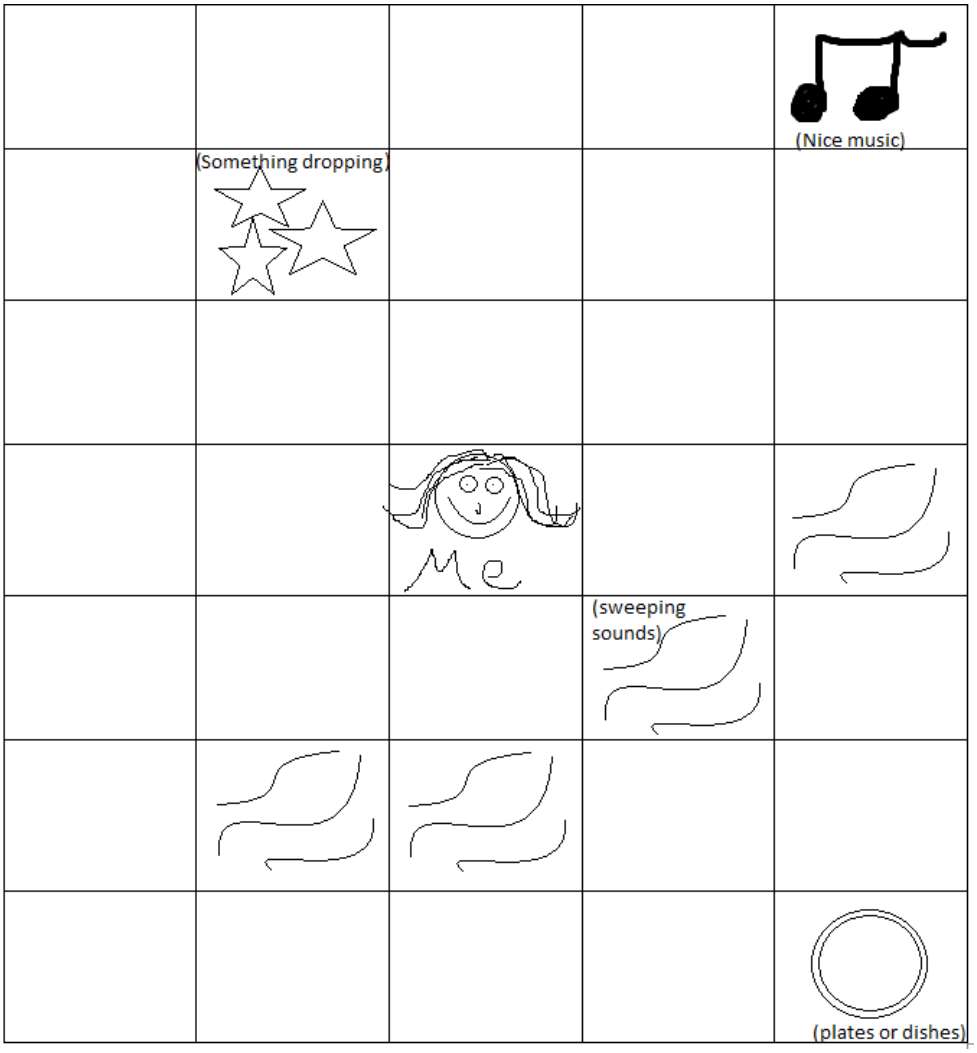
Conclude the Activity

Have the girls share their maps, what is the same and what is different?

Think about what it might be like to be a whale, where they rely mostly on sounds to find the things they need. How would a sound map help you “see” where your food is?

Think about increasing noise pollution. How might this extra noise pollution make it difficult for the whales to make a sound map of their environment?

Sample Sound Map Grid:



Sound Map Grid

		Me		

Noise Pollution

S B G P R

The ocean is becoming a noisier and noisier place. Not only are animals making sounds to communicate, but boats, construction projects and even sonar creates a lot of extra ocean noise. This extra sound is often very loud and very frequent, and can be a disruptive intrusion in the marine habitat. For some animals, such as whales, noise pollution can impact how they live in their environment and how they communicate. Because they depend on sound to 'see' and often communicate with one another over long distances, noise pollution can greatly impact them. In this game, explore what it's like to be a whale in a noisy environment.

Purpose of this activity: to explore human impact on the ocean.

Directions

Supplies

- ❑ A large playing space
- ❑ optional: blindfold

1. Discuss with the girls: what does pollution mean? How would they describe noise pollution?
2. Explain that noise pollution is excess, disruptive noise in an environment. Noise pollution in the human environment can include loud music, a loud road or engine noise or even repetitive sounds like cell phones ringing, computer noises and other sounds. In the marine environment, boat engines, oil and gas exploration, and large ships all cause noise pollution.
3. Discuss with the girls: whales "see" underwater by sending out sound and listening for the return echoes. How might a loud ship engine impact a whale?
4. Discuss with the girls: grey and humpback whales sing to members of their own species over very long distances. How might motorboats and oil drilling sounds impact the whales' ability to hear one another over long distances?
5. Explain to the girls: they are going to try an experiment/game to see what it would be like to be a whale in a noisy marine environment.
6. Arrange the girls in a large circle. Select one girl to enter the circle as the *whale*. Have the whale close her eyes (or put the blindfold on) and select a girl in the circle to be the *baby whale*. The baby whale remains unknown to the whale, but makes a clicking noise with her tongue or by snapping her fingers.
7. For the first round, the whale seeks the baby whale by listening for the noise of the baby whale. The other girls around the circle should not make any noise – they are there to make a safe playing area. When the whale finds the baby whale, the round is over and a new whale and baby whale can be selected.
8. For the second round, the girls around the circle start making a small amount of noise. For example, the girls around the outside could say "motorboat" over and over again at a normal speaking volume; gently shake a rattle or play a bit of soft music. Again, the baby whale continues to make a clicking noise and the adult whale continues to look for it without opening their eyes. After this round, discuss how the noise in the environment changed how long it took for the whale to find the baby and if the baby had to make a louder sound to be heard.
9. For the third and fourth rounds, continue to increase the volume of noise made by the girls around the outside of the circle. For example, by the final round, the girls

around the circle should be shouting (or nearly shouting) “motorboat”, while the baby whale continues to make a clicking noise.

Conclude the Activity

Discuss with the girls how the increased noise affected the whale and the baby whale. Discuss how increased shipping noise could possibly have long-term effects on whales. Discuss what could be done to help protect whales from noise pollution.

Take it a step further for Pathfinders and Rangers

Noise greatly affects whales in the ocean. People using the marine environment cause some of the most problematic noise. Shipping, oil and gas exploration, sonar and even marine construction can cause extra sounds that can disturb or harm whales. By being informed, we can make better choices about which noises occur in the marine environment.

Check out WWF-Canada’s “Protecting Quiet Oceans”

Are you a boater or do you know someone who is? Check out the “Be Whale Wise” guidelines to help you better protect whales from marine noise:
http://www.bewhalewise.org/

Ocean Food Web

S B G P R

Have you ever tried seafood? Many people get the protein in their diet from the ocean. For example, many Inuit and First Nations communities have traditionally eaten diets that depend heavily on fish and other ocean foods. But have you ever wondered if humans weren't eating that fish, what would be? The ocean food web is a complex tangle of animals and plants that depend on one another to survive. In this activity, explore how ocean animals are connected by a food web. Don't forget to include humans in the ocean food web; we're part of the great tangle too!

Purpose of this activity: to explore connections within the ocean.

Directions

Supplies

- ❑ food web animal cards (included)
- ❑ a ball of yarn or string

1. Talk with the girls: do they know what a food web is? If they are having trouble, try asking them: what does a shark eat? When they answer fish or seals, ask again: what does the seal eat? (Likely answer: fish), ask them again: what does the fish eat? Keep going until the girls can't answer anymore.
2. Explain to the girls: a food chain is a way of organizing animals by the different things they eat, and a food web is an organization of different food chains. Explain that a food chain is a simplified way of understanding how animals are related to one another in an environment. For example, a scientist might understand that plankton (animals and plants that float, rather than swim) are important to seagulls because the seagull eats shrimp, and the shrimp eats the plankton. Without the plankton, there would be no shrimp, without the shrimp, there would be no seagull. Because of the food chain, the scientist can see that the seagull is dependent on plankton too.
3. Ask the girls, what other animals eat shrimp? Their answers may include: humans, larger fish, otters or seals. Explain to the girls that this is a food web, because more than one animal is dependent on the shrimp. Also, otters don't eat seals, so even though they have the same food source, they are not part of the same food chain, but they are however, part of the same food web.
4. Explain to the girls that they are now going to make a food web. Have each girl choose a food web card. On the card will either be an animal she can eat, an animal that eats her, or both.
5. Explain to the girls, each person will announce what they are and then pass the string to someone they are connected to. This means they can pass the string to someone they eat, or someone who eats them.
6. Stand all the girls in a circle. Starting at the phytoplankton, have this girl hold part of the string and toss the rest of the string to one of her predators. This girl holds the string too, connecting her to the plankton. From here, get the girls to pass the string around from one animal to the next. Each time a girl receives the string, she holds on to it, keeping her attached to the animals around her. Keep the string going as long as possible (until it is used up, or until every girl has made a connection and there are many connections). The string can be passed to a girl more than once, making a large web.

7. Once all the girls have some string, explain that they have made an ocean food web. Tug gently on a few strings and ask girls to put their hand up if they feel a tug. A few girls should put their hand up. Explain these are the animals that would be affected by a change in the food web. For example, if pollution hurt any of them, the other animals they are connected too would be hurt, too.

Optional Extensions

1. Once the food web is made, have everyone pull the strings taut. Then, a few people, such as a salmon or herring, drop the string. The food web will sag or collapse. Explore with the girls, how would a 'hole' in the food web (no salmon or herring), affect all the other animals?
2. Explain that sometimes fish and other animals can get contaminated from chemicals, such as methylmercury, or other harmful substances. As the larger animals eat the smaller animals, they get higher and higher doses of contaminates, which can make them sick, or even unsafe for people to eat. For example, a shrimp might contain a small amount of methylmercury, but a salmon will eat thousands of shrimp, causing it to have high levels of methylmercury accumulating in the tissues of its body. This is called bioaccumulation because the toxins (eg. methylmercury, pesticides, etc.) accumulate within an animal's body from the foods it eats. A seal might then eat hundreds of salmon, making the seal accumulate more contaminates than the fish. This is known as bio-magnification. The higher up in the food web the organism is, the more concentrated the toxin. If people try to then eat these animals (the fish or the seal), we could become very sick, too. By protecting the ocean from chemicals and poisons, we are protecting ourselves from eating these poisons, too.

Conclude the Activity

- Ask the girls if there was any part of the food web that was not attached to another in some way?
- Ask them how the environment might affect the food web? For example, if one part of the food web lost its habitat, what would happen to the other part of the web?
- Ask the girls, when we are protecting an animal, why is it also important to protect the animals it depends on? For example, if we are trying to protect whales, why would it be important to also protect salmon?

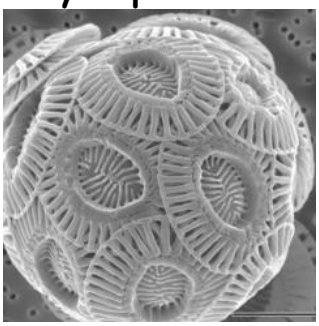
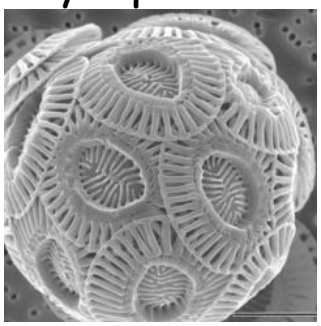
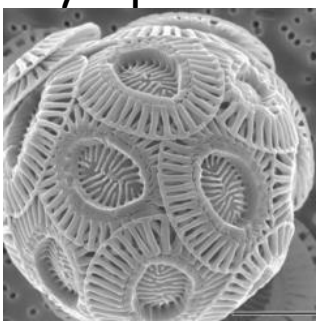
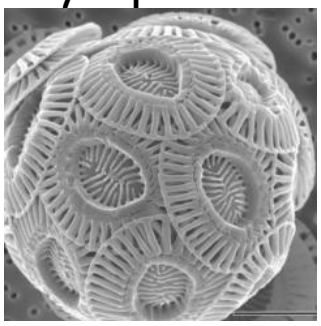
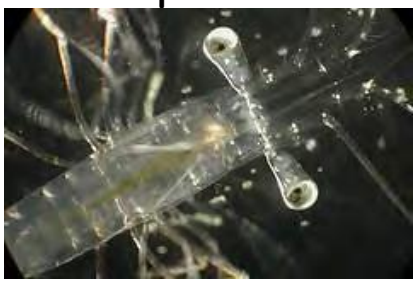
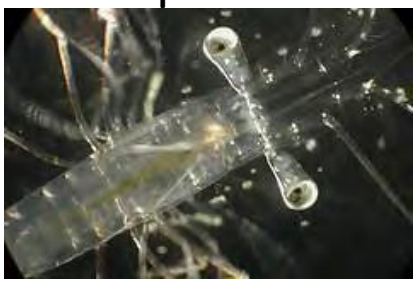
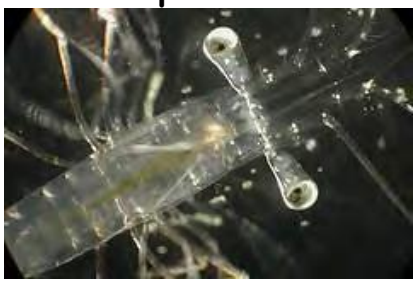
Take it a step further for Pathfinders and Rangers

Learn about how you can make sustainable seafood choices as part of your role in the food web. Check out: http://ocean.nationalgeographic.com/ocean/take-action/seafood-decision-guide/ for more information about sustainable seafood.

On the following pages you will find the animal cards. Note that you will need more animals from lower in the food chain and fewer apex predators. The number of cards for each animal are the suggested number for a group of 20 (or 40, in brackets); you may need to adjust for the size of your group.

- 4 (8) Phytoplankton
- 3 (6) Zooplankton
- 3 (5) Shrimp
- 2 (5) Herring
- 2 (4) Small squid
- 1 (3) Crab
- 1 (3) Salmon
- 1 (2) Seagull
- 1 (2) Seal
- 1 (1) Orca
- 1 (1) Human

Food Web Cards

Phytoplankton  Eaten by: Zooplankton	Phytoplankton  Eaten by: Zooplankton
Phytoplankton  Eaten by: Zooplankton	Phytoplankton  Eaten by: Zooplankton
Zooplankton  Eats: Phytoplankton Eaten by: Shrimp	Zooplankton  Eats: Phytoplankton Eaten by: Shrimp
Zooplankton  Eats: Phytoplankton Eaten by: Shrimp	Shrimp  Eats: Zooplankton Eaten by: Humans, Crab, Seal, Salmon

Food Web Cards (continued)

Shrimp

Eats: Zooplankton
Eaten by: Humans, Crab, Seal, Salmon

Shrimp

Eats: Zooplankton
Eaten by: Humans, Crab, Seal, Salmon

Herring

Eats: Shrimp, Zooplankton
Eaten by: Seagull, Salmon, Orca, Seal

Herring

Eats: Shrimp, Zooplankton
Eaten by: Seagull, Salmon, Orca, Seal

Small squid

Eats: Shrimp, Zooplankton
Eaten by: Salmon, Seal, Seagull, humans

Small squid

Eats: Shrimp, Zooplankton
Eaten by: Salmon, Seal, Sea

Crab

Eats: Shrimp, Zooplankton, dead animals
Eaten by: Humans, Seals, Seagull

Crab

Eats: Shrimp, Zooplankton, dead animals
Eaten by: Humans, Seals, Seagull

Salmon

Eats: Shrimp, Squid, Herring
Eaten by: Human, Orca, Seal

Salmon

Eats: Shrimp, Squid, Herring
Eaten by: Human, Orca, Seal

Seagull

Eats: Shrimp, Squids, Herring, Crab
Eaten by: Crab, when dead

Seal

Eats: Herring, Salmon, Crab, Small Squid
Eaten by: Orca

Orca

Eats: Salmon, Seal
Eaten by: Crab, when dead

Human

Eats: Crab, Salmon, Herring, Shrimp

Food Web Cards Photo credits:

Phytoplankton: Alison R. Taylor / CC-BY-2.5 / Wikimedia Commons
Zooplankton: Matt Wilson/Jay Clark / CC-BY-2.0 / Wikimedia Commons
Shrimp: Alaska Fisheries Science Center / Public domain / Wikimedia Commons
Herring: By Gervais et Boulart, 1877 [Public domain], via Wikimedia Commons
Squid: George Berninger Jr. / CC-BY-SA-3.0 / Wikimedia Commons
Crab: © Hans Hillewaert / CC-BY-SA-3.0 / Wikimedia Commons
Salmon: Knepp Timothy, U.S. Fish and Wildlife Service / Public Domain / Wikimedia Commons
Seagull: Sid Mosdell from New Zealand / CC-BY-2.0 / Wikimedia Commons
Seal: Boyd Amanda, U.S. Fish and Wildlife Service / Public Domain / Wikimedia Commons
Orca: Mlewan (Own work) / Public domain / Wikimedia Commons
Human: Girl Guides of Canada – Guides du Canada

Bycatch

S B G P R

Every day, millions of pounds of fish are pulled from the ocean and much of it is bycatch – animals and fish that we don't intend to catch, but are caught and killed in the process of getting the fish we do want. For example, when a gill net catches salmon, it can also catch sharks, turtles and other fish. Although the fishermen did not intend to catch these animals, they have become bycatch of the salmon fishing industry. Bycatch accounts for many of the animals killed during fishing, and can cause the destruction of species of fish that we have no interest in catching or eating. Much of the bycatch that is caught is simply thrown back into the ocean dead or injured. In this activity, explore how certain types of fishing methods can help reduce or even eliminate bycatch.

Purpose of this activity: to explore human impact on the ocean.

Directions

1. Empty the mixed objects or mixed snacks and the rice into a big bowl. If you have a large group, empty the mix onto the cookie sheet. You should have a mixture of tasty things or objects and rice. The rice will represent bycatch, any fish or animals that are undesirable, inedible or not the target of the fishery.
2. Explain to the girls that the setup represents the ocean, and the fish they want to catch are everything except the rice. For an added bonus, you can use treats that you know are a particular favourite for each girl. The idea is to have each girl going after a different type of treat (It's alright, and even encouraged to have a few girls vying for the same type of treat). For more realism, you may want to have different amounts of each treat – just as the ocean has an uneven number of each type of fish.
3. Hand out the various tools without letting the girls pick the one they want. These are the fishing tools they can use to get their treats.
   - straws with tape represent long line fishing
   - the spoons represent nets of various sizes
   - slotted spoons represent specialized gill nets
   - eggcups represent trawling nets
   - tongs & tweezers represent single line fishing
4. Tell the girls they will have three minutes to use their tool to fish whatever type of treat they would like. Each girl is to keep her chosen treat a secret. Tell all the girls they must fish for the full three minutes – even if they can't catch their chosen treat with their tool.

Supplies

- ❑ small mixed objects, for example: buttons, coins, sequins, beads, etc.
- ❑ OR a mix of snacks, for example: dried fruit, wrapped candies, mini pretzels, Goldfish crackers, small crackers/ animal crackers/ teddy grams, etc.
- ❑ a large bowl or cookie sheet for all the items
- ❑ a large bag of rice

Tools

- ❑ straws with tape on the end, sticky side out
- ❑ spoons of various sizes
- ❑ eggcups/ small bowls
- ❑ slotted spoons
- ❑ tongs/tweezers/pincers
- ❑ timer
- ❑ 'catch bowl' for each girl (napkin, cup etc.).

5. When the time is up, ask each girl to count out how many of her selected treat she was able to catch, and how much rice she has.

   Discuss and explore
   - Both the rice, and any treat the girl did not intend to catch, is bycatch.
   - How much of the intended treat each girl caught and how much bycatch she has.
   - Although the bycatch treats may have been wanted by another girl, it was caught by someone who didn't really want it or wasn't allow to capture it and, thus, it was wasted and thrown away.
   - Discuss which tools resulted in the most bycatch, and which took in the least amount.
   - Discuss how some girls caught bycatch that could have been given to another girl, but was wasted because the wrong person caught it.

6. Discuss with the girls which tools they would prefer to use for their chosen treat, and how they think this might help them limit the amount of bycatch they have.

7. Have the girls throw back their bycatch and try fishing again with the tool they think will work best for their treat.

   If you completed steps 6 and 7, here are some additional discussion points.
   - How did this equipment change alter the amount of bycatch that was caught?
   - Were there any methods that were completely avoided due to bycatch?
   - Where there some methods that were avoided because they couldn't get enough treats in time? For example, did the girls choose not to use a tool because they got fewer treats than the other girls?
   - Why may this situation (using a general tool) reflect why some fishermen choose to use more destructive methods even though another method may work?

8. Have the girls share the treats as fairly as they can!

What can we do?

Sometimes choosing the right type of fish can be difficult because you may not know how it was caught. The best thing to do is to choose fish that are caught using sustainable or limited bycatch methods. For example, choosing to buy fish from local fishermen, rather than larger commercial fishing vessels, can reduce the amount of bycatch needed to get a certain fish.

Take it a step further for Pathfinders and Rangers

Explore how money plays a large part in decision-making around fishing practices. For example, if it is too costly to get equipment that limits or greatly reduces bycatch, how might this affect the choice to use these items?

How does the amount of work to keep bycatch from happening affect the final product? For example if each long line needs to be baited and hooked, which takes time, how might this affect what consumers pay for their fish? Why might this lead to consumers choosing fish that are caught with a lot of bycatch?

Also, you may want to talk with the girls about how much time and energy it takes to find good fish amongst the bycatch. For example, if a fishing boat brings a net full of fish, but only 30 or 40 of the 200 fish are valuable, is it worth paying people to sort through all the other fish to find the good ones? How might this impact the cost of the fish the

consumer buys? Alternatively, if you were a fisherman and you knew you had to sort through hundreds of fish you didn't want to get the few you did, how would this change your fishing practices?

To help protect our oceans, some countries, such as Australia, the United States of America and Canada, use *Observers at Sea* programs to monitor fishing practices. The observers at sea are people that record data on many important aspects of fishing, such as how fish were caught, how big they were, which fishing practices were used and where the fish were found. Observers at sea can also make sure that fishing boats limit their bycatch and handle it responsibly.

To learn more about fisheries observers and by catch, check out:
https://www.st.nmfs.noaa.gov/st4/nop/

One of the best ways to help prevent overfishing is to change our habits as consumers. By choosing not to buy certain types of fish and seafood, it limits the demand for this fish, and thus limits the amount that will be caught. Equally, choosing local sustainable types of seafood can help limit the amount of foreign fish that are taken from other areas.

Check out http://www.oceanwise.ca/ for more information.

Try the activity "**Overfishing**" for more information and activities.

Have I Used the Ocean Today? GPR

It may not seem like it, but you've used the ocean today – seven in ten breaths comes from the ocean! Where does this oxygen come from? You can thank tiny ocean plants for all that oxygen. But are there bigger connections to you and the ocean? Do you use the ocean in ways you didn't even realise? Maybe it rained today? Maybe you saw some clouds in the sky? Most likely, that rain and those clouds came from water that was evaporated over the ocean. But how else have you used the ocean today? The answer may surprise you. Try this activity to find out.

Purpose of this activity: to explore the human connection to the ocean.

Directions

1. Share with the girls: we are all connected to the ocean because of the air we breathe and the water in our atmosphere. Most of the water in the atmosphere that we see as clouds, rain, wind or snow evaporated from the ocean. Equally, much of the air we breathe comes from the microscopic ocean plants, called phytoplankton.
2. Brainstorm with the girls: do you have any other connections to the ocean that you know of? Look for obvious connections first, such as: did you see it today? Did you have ocean fish as part of your lunch/dinner? Did you visit the beach today? Do you have any ocean-themed items in your home? Lastly, ask them: did you eat something made with an ocean plant today?
3. Most will likely say "no". Explain that they may be surprised where they find the ocean in their food. Have the girls brainstorm a list of all the things they ate today. Can they see any ocean connections at all? Did anyone have ocean fish? Seaweed snacks? Sushi, a popular food, is wrapped in a thin sheet of algae that comes from the ocean. Toasted nori sheets are also a popular snack. Maybe one of the girls has had something seasoned with bonito flakes? All of these products are made from ocean resources.

Supplies

- ❑ pen and paper
- ❑ food packaging (save your labels from the week): aim for snack foods, dairy products, chocolate mixes (cake, hot chocolate etc.), ice cream, toothpaste, anything that lists "carrageenan", "agar" or any kind of "alginate". (tip: you may be surprised where you find it… check processed meat, canned soups and packaged goods carefully)
- ❑ any body lotions, makeups or creams that have a shimmer, lustre or shine

4. Ask if the girls have ever heard of carrageenan, agar, or alginate. All these are thickeners and stabilizers that are made from seaweed. We eat from the ocean every day and probably didn't even realise it.
5. Look at the packaging and see how often you can find any of the stabilizers. Knowing that all three are used in yogurt, toothpaste, and many things with a smooth, creamy texture, explore how much ocean you eat every day. How many girls in your group brushed their teeth today? How many had some ice cream that week? If you've done either of these things, you've had some seaweed!

6. Look at the lotions, lipsticks and creams. Do any of them have a shiny glittery quality? This is often (but not always) created by pearl essence, a material created from fish scales. Using scales gives a shiny quality to products and is helpful because it uses materials that might otherwise be wasted.
7. Discuss with the girls: there is nothing wrong with using materials from the ocean, instead, it's important to be aware of where these materials come from and how often we use them. Equally, it's important to know what impacts they might have on the environment.

NOTE: This activity is not meant to scare the girls away from products and foods they like, but instead to create awareness around our connections to the ocean. These products are all safe to use, and are a way of integrating otherwise wasted materials into other sources. As consumers, we often don't realize the whole story behind goods and products. In this activity, girls can "scratch the surface" and understand the connections they have with the ocean that they may not have been aware of in the past.

Conclude the Activity

- Discuss with the girls, how has their understanding of their connection to the ocean changed? Could they say they are connected to it every day? If not, what would lead them to change their thinking?
- Discuss with the girls, why is it important to know where the additives in our food come from? Why is important to know that the ocean is so connected to us in the air we breathe and the foods we eat?
- Discuss, why might the health of the ocean be of concern for people who don't know how much they are connected to it?

Principle 7: The Ocean is Largely Unexplored

Video Scavenger Hunt

SBG

One of the first ways that scientists study a foreign environment or animal is to make observations of them. Making observations usually allows scientists to observe behaviours and interactions with minimal disruptions to the animals. Cameras are often used because it allows the scientists to record what is happening without having to be there to make observations firsthand. Deep-sea cameras are particularly useful to Ocean Networks Canada as they can be connected to our deep-sea observatory and are able to send footage back to researchers in real-time. Also, because Ocean Networks Canada sends unmanned robots to the bottom (called ROVs), rather than human driven ones, cameras allow us to see what the robot is doing, and what the landscape looks like. As the robots don't need air or sleep, they can spend hours at the bottom exploring the ocean and collecting footage. Every year, Ocean Networks Canada scientists sift through the video and collect the best moments for everyone to see. Check out video highlights from 2011 and 2012, and go on a scavenger hunt as you do.

Purpose of this activity: to explore how technology informs us about the ocean.

Directions

If your meeting place does not have an Internet connection, you can download videos to playback while not online. See http://www.wikihow.com/Download-YouTube-Videos for instructions.

1. Discuss with the girls: what do they think they might see if they were to go to the bottom of the ocean?
2. Have the girls look over the scavenger hunt sheet. What do they think each of the pictures (or descriptions) might be? Brainstorm what they think they might see in the video. What ideas shaped their thinking?
3. Play one (or both) of the scavenger hunt clips. Allow the girls to check off the ones they see. See something more than once? Simply mark it off again – you can count each item as many times as you like.
4. Girls can also interpret each clue as they like- there are many answers to each, and if they have spotted something in the video that matches the description in their mind, it can be counted.

Supplies

- ❑ Youtube videos: UVic "*ONC Highlight reel 2011"* http://youtu.be/mZqpOBlxCbc or Ocean Networks Canada "*Selected dive highlights from 2012"* http://youtu.be/nx0b32Khhy0
- ❑ scavenger hunt sheets (one per girl – based on your choice of video and the age of the girls)
- ❑ pens, pencils or markers

Conclude the Activity

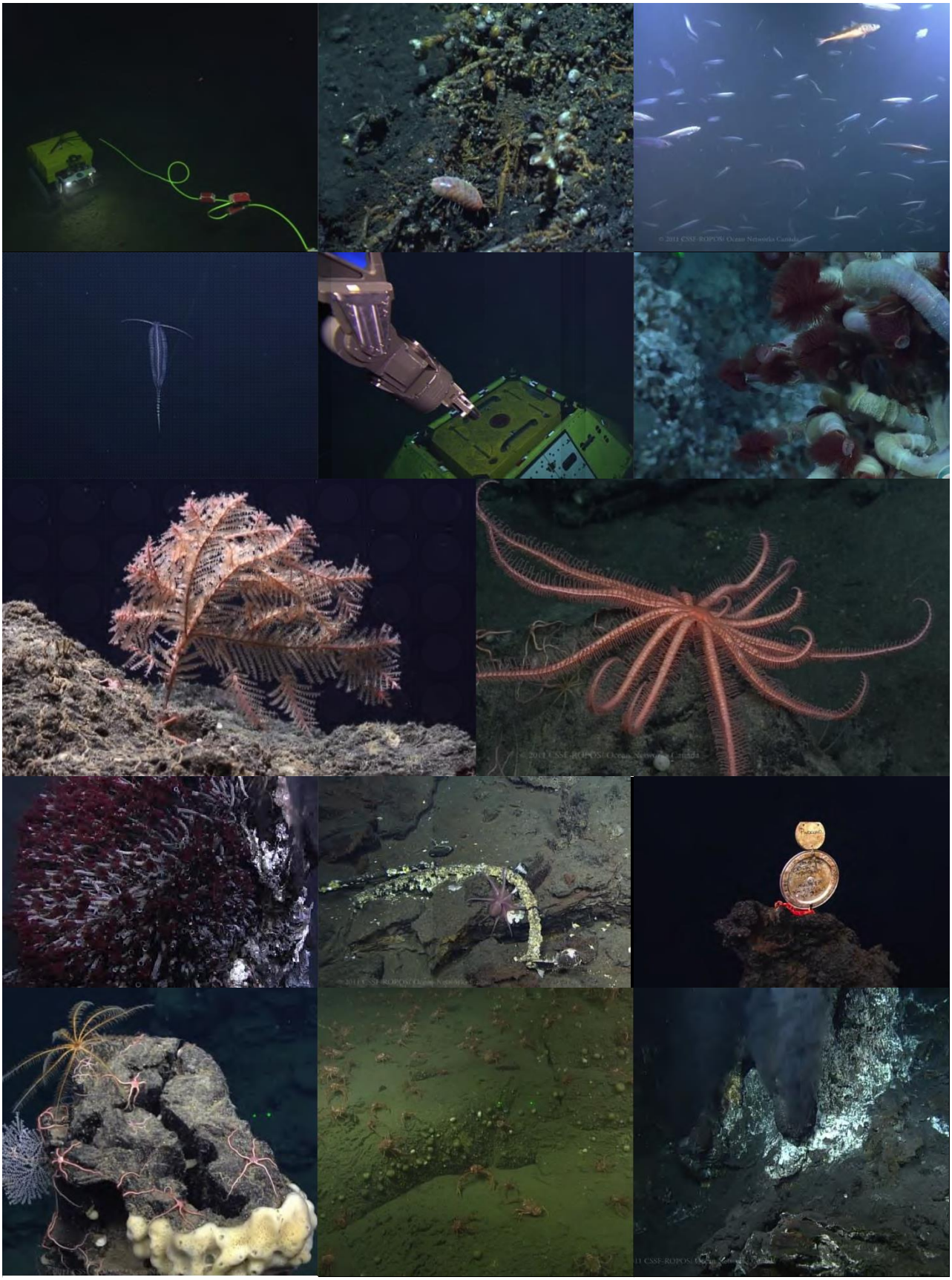
The girls may wonder what some of those creatures in the video were. Extend your exploration by looking up the animals in the free Ebook, *The Marine Life Field Guide* found at http://www.oceannetworks.ca/science/publications/general-interest/marine-life-field-guide. Looking up an animal will also complete the "**What WAS That?**" activity.

2011 Cruise Highlight's Scavenger Hunt

Find as many of these items as you can in the video. You can check off items more than once, and don't worry if someone's choice for each item is different than yours! There are almost no wrong answers. Your idea of "something with many arms" or a "silver flash" can be a unique as you are. Plus, these are only clues, there aren't really dragons in the ocean, but can you see something that could be described that way?

- ❑ A ship
- ❑ Something green
- ❑ Bubbles
- ❑ Something that looks like a floating and swimming dragon
- ❑ A golden coin
- ❑ Something with many arms
- ❑ Something man-made
- ❑ A robot on a string
- ❑ Something you can name (and what is it?) _____
- ❑ Something yellow
- ❑ Something that looks like a bug
- ❑ A red puff
- ❑ A silver flash
- ❑ A sunset
- ❑ Something the same colour as your clothes today
- ❑ An animal that looks like a dead cedar branch
- ❑ A climbing crab
- ❑ A plume of black "smoke"
- ❑ An octopus
- ❑ A red and white forest
- ❑ A school of fish

2011 Cruise Highlight's Picture Scavenger Hunt



2012 Cruise Highlight's Scavenger Hunt

Find as many of these items as you can in the video. You can check off items more than once, and don't worry if someone's choice for each item is different than yours! There are almost no wrong answers. Your idea of "something with many arms" or a "silver flash" can be a unique as you are. Plus, these are only clues, there aren't really dragons in the ocean, but can you see something that could be described that way?

- ❑ A flashing light on a swimming animal
- ❑ A long, flowing tail
- ❑ A "scarf in the wind"
- ❑ A fish dance
- ❑ A skate
- ❑ A strange floating animal
- ❑ A long chain of pink "beads"
- ❑ A robot hug
- ❑ A floating "tomato"
- ❑ A rocky tower
- ❑ A slow fish
- ❑ A swimming fern in a blizzard
- ❑ A ruler
- ❑ A climber
- ❑ A swimming bristle brush
- ❑ Crabs and bubbles
- ❑ A star
- ❑ A fish hiding under a crab
- ❑ A snowy bush (that's really lots of animals)
- ❑ An octopus

2012 Cruise Highlight's Picture Scavenger Hunt

Become an HOV

SB

The deep sea is an amazing place, yet one that is very hard to get to. Exploring the deep sea is done with robots, as it is too cold, deep and dark for people to go without equipment. People from a ship control some of these robots. Because the humans are not directly inside the robot, we call them ROVs – this stands for Remotely Operated Vehicles. If people are actually inside (like a car), then we call them HOVs – this stands for Human Operated Vehicles. In this activity, become your own HOV.

Purpose of this activity: to explore how technology informs us about the ocean.

Directions

For this activity, you'll need to do some setting up beforehand. Get the girls to help you set up this activity, to help save time.

Supplies

- ❑ 10 to 20 meters of string or rope (to help keep everyone safe)
- ❑ fish stickers or fish toys (or other similar objects) for the girls to look for
- ❑ coats, boots, shoes, chairs and other objects to make your "terrain"
- ❑ toilet paper tubes
- ❑ various craft supplies to decorate the tubes

1. Lay the string along the ground in a wide curving pattern. This is the path the girls will follow to keep themselves safe.
2. Have the girls put the "terrain" objects along one side of the rope (for example, all on the left). The more "terrain," the better. For safety, keep the other side of the rope clear so that as the girls walk with their viewfinder they won't stumble or walk into anything.
3. Give each girl a toilet paper tube. This is her viewfinder in the HOV. Have the girls decorate the viewfinders while one leader hides the scavenger hunt items in the terrain (the small fish stickers or fish toys). The girls should be able to see the items without having to touch anything else.
4. When the terrain and the viewfinders are ready, take the girls to the bottom of the ocean. Explain to them: you are in an HOV, and you will be looking for animals and fish down at the bottom.
5. Have each girl look though the tube and follow the rope path from one end to the other. As she walks down the rope path, have her look for and count the fish and animals she sees.

   Optional: if you have very young girls, you can do this with a leader walking beside the girl using the viewfinder to help them stay on the path and stay safe.
6. Give each girl a turn to walk down the path and note what she sees.
7. After everyone has a turn, have the girls walk down the path again without their viewfinders. Explore with them, how much more can they see without the viewfinders? How is having a viewfinder both good and bad?

Conclude the Activity

Ask the girls what it was like to go to the bottom of the sea. What kind of animals did they see? What other things did they notice at the bottom? What was it like to look

though the small window/viewfinder? Why might it be hard to be a scientist at the bottom at the ocean where you can only look at the bottom through a small window?

Make a Grabbing Arm

G P R

Exploring the ocean is like exploring deep space. We can't breathe at the bottom of the ocean, there's no light to see by, it's freezing cold and our bodies would not be able to function properly (the pressure alone would squish us flat!). We're just not built for the bottom of the sea; so instead, we build machines and robots that are. In this challenge, see if you can make a robot arm in just a few minutes.

Purpose of this activity: to explore how technology informs us about the ocean.

Directions

1. Divide the girls into groups (4-6 per group is best).
2. Divide the building supplies into the same number of groups.
3. Give each group a bag of supplies and explain that they are tasked with building a grabbing arm for their deep-sea robot.
4. The girls will have only 30 minutes to build their grabber, and the challenge is to build something that can collect an animal from the ocean floor without damaging it (the gummy fish). Give the girls their supplies, and a list of building rules. The suggested rules are:
   - Your grabber needs a grabbing arm and a collection bin.
   - Your hands cannot directly touch the grabber to make it move.
   - The creature must be 30 cm away from the grabbing hand before you start.
   - You can use anything in the bag, any way you like – if you cut or break something, you may not have a new one. The only thing you cannot take apart are the scissors.
   - The creature can't be thrown or tossed into the collection bin, it must be placed safely in the collection receptacle.
5. Give each group time to build their grabber and try to collect the creature. If you wish, you can limit the amount of "tries" each group gets.
6. Optional: allow each group to make a few tries to grab their creature, and then reassess their design with more or new supplies.

Supplies

Use what is available. Some suggestions:

- ❑ popsicle sticks
- ❑ zap straps (cable ties)
- ❑ tape
- ❑ earplugs
- ❑ tissue
- ❑ elastic bands
- ❑ small piece of Plasticine
- ❑ sponge
- ❑ scissors
- ❑ paperclips
- ❑ bulldog or binder clips (large black fold-back ones)
- ❑ plastic baggies
- ❑ required: gummy fish

There are no right answers to this activity, and you can change the rules to suit your group as much as you like. The intention is to explore the challenge of building something as a team with the materials you have available.

Conclude the Activity

- Allow the girls to share their designs with one another. What worked and what didn't work?

- Encourage the girls to think about how we explore the deep sea, and how their robot could help them locate and collect new animal species.
- Have the girls think about how it was to work on a team. Why might teams of scientists (instead of just one person) come together to build a piece of research equipment?
- If they could do this activity over again, or even a third time, what things would they incorporate and what would they leave out? How do their designs change over time?

Take it a step further for Pathfinders and Rangers

Search for the video “Kat Roberts on deep sea communities” How does she study the deep ocean?

Watch “Daphne Cuvellier and TEMPO-mini” at http://vimeo.com/69633205. What is tempo mini? Where does it sit? What would you need to design to protect TEMPO-Mini and grab samples?

Control the ROV

G P R

Exploring the bottom of the ocean can be a lot harder than it looks! When scientists want to explore the bottom, they need to use remotely operated vehicles or ROVs. These specialized robots are used for exploration because they can withstand far more than a human can. The robots don't need oxygen and are built to withstand the crushing pressure of the water above, as well as icy cold ocean temperatures. All this combined means that they can spend lots of time at the bottom (sometimes days at a time) without needing to come up for air, food or bathroom breaks. A special driver, called a pilot, controls the robots. The pilot is onboard the ship and sees what the robot sees on a computer monitor. But how does the ROV pilot actually work with the ROV?

ROVs are controlled by a long cord that runs from the ship all the way down to the ROV at the bottom of the ocean. This cord is called an umbilical cord, because it gives the ROV its power supply and important information and instructions from the pilot. The umbilical cord always has to be as straight as possible so that it doesn't break or get tangled. This means that the ship is always floating above the ROV. In this activity, make sure to keep the umbilical cord straight on your ROV as you try and collect samples from the bottom of the ocean.

Purpose of this activity: to explore how technology informs us about the ocean.

Supplies

- ❑ obstacles for the bottom of the seafloor
- ❑ coat hanger or stick
- ❑ string (long enough to go from the girl's waist to just above the floor)
- ❑ small ball of sticky tack, or ball of tape, sticky side out
- ❑ small weight (attach your sticky tack or tape to this to give it some weight)
- ❑ scavenger hunt list (you will need to create your own)s
- ❑ scavenger hunt pieces that can be picked up by a magnet or a small piece of sticky tack (e.g. paperclips, magazine pictures, sequins, beads or coins)

Directions

1. Before the activity, set up the seafloor. Mark off a large space and scatter some items around the floor as obstacles. The girls' shoes and coats make excellent obstacles, but you can also use chairs, kitchen equipment (upside bowls) or anything else you have in your meeting space to make a seafloor with lots of different textures and objects.
2. Scatter your scavenger hunt pieces around the space, making sure there are some available for each girl (rather than having them compete for only one or two).

   Optional: you can do this activity outdoors, too; just scatter the items in the grass or in a wooded space. If you choose this, be sure to pick up all the pieces at the end as wildlife could mistake them for food!
3. Divide the girls into groups of two or three. Tie the string to the weight and cover the weight in tape (sticky side out) or sticky tack so that you have a long string with a sticky object at the end.
4. Tie the other end of the string to the hook on the coat hanger. The coat hanger represents the ship, and the long string is the umbilical cord. The ball of sticky stuff is your ROV.
5. Have one of the girls hold the coat hanger to her

tummy (the long flat side should lie along her tummy, from side to side, with the string attached to the hook sticking out in front of her). This girl is the ship and the ROV pilot. She can't touch the ROV directly, but she needs to make sure it is always hanging down from the coat hanger. If it gets pulled too far left or right, it might get lost!

6. The other girl(s) are the ROV drivers. They can touch the ROV's string to help control it, but they can't touch the ROV directly. They can lift up on the string to go around objects or to retrieve scavenger hunt items from the ROV, or they can pull left or right to pick something up. They can also tell the ship where it needs to go to help them get to the objects they want. The ROV drivers need to be careful though, they can't pull the ROV so far left or right that it goes past the edge of the ship (the bend in the coat hanger).
7. Give the girls a few minutes to get used to working as a team. It can be helpful to give the girls some objects to practice picking up before they head to the obstacles. Make sure the "ship" and the ROV drivers are working together!
8. When the girls are ready, have them go "out to sea" into the obstacle course with a list of objects you would like them to pick up. For example, have each team collect two paperclips, several different colours of beads, a coin, specific magazine pictures and some sequins.
9. When the girls have collected all of their scavenger hunt items, have them return to shore.

Conclude the Activity

- Take a few minutes to talk about the challenges that some of the girls faced controlling their ROV and working as a team. Relate this to what it might be like to control a real ROV at sea.
- Brainstorm: why is it important to know what's going on at the bottom of the ocean?
- Brainstorm: what skills do you think you would need to have to drive an ROV for real?

Arctic Protection

G P R

The Arctic Ocean is a unique and interesting part of the world's ocean. The Arctic Ocean is the coldest body of water on the Earth, and has some of the most uniquely adapted animals. Also, we can see many changes happening here as the Earth changes and becomes warmer. Covered by ice most of the year, both animals and scientists have to be prepared to deal with conditions we don't experience anywhere else. Scientists studying the Arctic sometimes need to think about the same things the animals do. How will they protect their research instruments from the cold ocean water? How will they protect it from ice? How will they keep other animals from damaging it or hurting it? How will they know which spot to return to each year to look after it? In this activity, take your inspiration from Arctic nature, and protect your research instrument.

Purpose of this activity: to explore how to protect technology in the ocean.

Directions

1. Talk with your girls: when it gets really cold, what do they do to keep warm?
2. Ask them: if you were an animal that lived in the cold Arctic, what could you do to protect yourself from the cold? Optional: show some pictures of Arctic animals and explore some of the features of each – for example, are they covered with a layer of fat, thick hair, thick fur or do they make themselves a den for sleeping through the cold winter?
3. Ask the girls: if you were an ocean animal, how would you protect yourself from the cold water around you? Optional: continue this discussion using the activity "**Blubber Glove**".
4. Ask the girls: what types of data are important to gather in the Arctic? For example, would it be important to know the temperature every day? Would it be important to know how thick the ice is? What other things are important to learn and know?

Supplies

- ❑ an egg or water-filled container
- ❑ insulation, such as cotton balls, newspaper, foam, fluffy feathers, felt, wool and anything else you might have on hand
- ❑ tape or glue
- ❑ scissors
- ❑ wire or string
- ❑ pictures of Arctic animals; not included – find some online

5. Explain to the girls that when scientists are studying the Arctic, they sometimes need to borrow ideas from the animals. When they deploy their research instruments they need to be sure to ask themselves: how will this instrument be protected from the cold? How will I connect it to shore so I can find it again? How will it be protected from animals that might want to harm it?
6. Divide the girls into teams. Each team will be challenged with protecting an Arctic instrument (the egg or water-filled container).
7. Give the girls materials such as newspaper, cotton balls, felt or wool, and ask them to build something that will protect their instrument from the harsh Arctic environment.

Each team will have the same instrument, but how they choose to protect it from the cold can be different. Equally, you can ask girls to be mindful of other challenges involved in Arctic research. For example extra challenges can include (but are not limited to):

- Can your instrument fit through a small space? (Demonstrating that if it was deployed in winter, you might only be able to drill a small hole in the ice.)
- Is your instrument stable if a book pushes it around? (Demonstrating that if the ice moves, it will not tip or move, damaging the instrument.)
- Can your instrument survive for ten minutes in the freezer/in a bucket of ice? (Demonstrating that it is very cold in the Arctic, sometimes as cold as -40C!)
- Can others find your instrument? If the teams of girls hide and seek the instruments, which group hid theirs the most effectively? (Demonstrating that the instrument is part of the environment so that animals or other people won't disturb it.)
- Can your instrument survive 1 minute of being picked at by a leader using tweezers? (Demonstrating that your instrument can survive animals picking at or disturbing it.)

8. After all the challenges (or the ones your group chooses to do), discuss what features of the instruments kept them safe. What helped them be prepared for a stay in the Arctic?
9. Discuss with the girls why it might be important to collect Arctic data. You may choose to guide the discussion by having the girls think of ways in which the Arctic has changed in recent decades due to global warming. How will scientists know if these changes are human-caused or natural cycles in the Arctic? How will they be able to understand if we are having a continued impact on the Earth?

Protect the Deep Sea Instruments GPR

Monitoring the deep-sea can be a tricky process. Not only is it dark in the deep sea, there are lots of other concerns engineers need to overcome. For example, as you go deeper into the ocean, the pressure around your instrument increases and pushes down on your machine. Anything you add will need to be strong enough not to crush under pressure. Don't forget, it's also very cold at the bottom of the ocean, so your machine will need a way to stay insulated from the extreme temperature. If you're taking any pictures or video, you'll also need lights for the dark. In this activity, see if you can protect your sensitive instrument from the ocean.

Purpose of this activity: to explore how to protect technology in the ocean.

Directions

1. Explain to the girls that not many people study the deep-sea because it is an extreme environment. In order to place an instrument on the seafloor, researches need to be sure that their sensors and instruments can survive the environment while still sending back usable information.
2. For this activity, each girl (or team of girls) will get a sugar cube and a candy (or a tissue and an egg). This represents her instrument that she will place on the seafloor. If the sugar cube (or tissue) gets wet, it will melt, meaning the instrument was damaged by a seawater leak. If the gummy candy (or egg) squishes, this means the instrument was not well protected from the deep-sea pressure.
3. Give the girls access to the building materials. Challenge them to think about how their instrument will interact with the sea. They will need to have something connecting it to the outside environment as it won't be sufficient to place the two items in a container and seal it. For example, the girls may choose to insert a wire into the sugar cube that will continue through the protective case to the outside environment. Or the girls may choose to put the gummy on a stick that extends outside the packaging to represent a camera, with the gummy as the digital components. Really, the possibilities are endless.
4. Allow the girls some building time. Remind them that they only get ONE sugar cube and ONE gummy. Have them build outside components (things that are supposed to get wet) and seal them off from the inside components (things that should stay dry).
5. After building, use the books to simulate the

Supplies

- ❑ a sugar cube and "Gushers" candy for each girl (if you don't want to use candy, you can do this with an egg wrapped in a tissue)
- ❑ a basin or bin of cold water
- ❑ blue food colouring
- ❑ 5-10 large books or other heavy objects
- ❑ slotted spoon
- ❑ tongs
- ❑ string

Building materials
(these are suggestions)

- ❑ plastic containers (old yogurt containers, cups, bottle caps)
- ❑ glue
- ❑ scissors
- ❑ string
- ❑ wire
- ❑ pipe-cleaners
- ❑ plastic wrap
- ❑ electrical tape

pressure of the deep sea. Carefully (watch your fingers!) stack the books on top of the unit. What happens? Does the gummy squish or the sugar crush? Do any of the components outside the unit change?

6. After the pressure test, the unit will need to go into the water.
7. Tie a string around the unit. From here, tie the string to the spoon and then grab the spoon with the tongs. This is your ROV setup that will get the instrument to the bottom of the ocean.
8. Using the ROV, lower the instrument into the sea and wait 1 minute.
9. After a minute, remove your instrument using the ROV. Did it survive?

Conclude the Activity

- How did the instrument do under each test? What would the girls have done differently after experiencing their tests?
- What was the most difficult part for them? What was the easiest?
- How might this experiment replicate the difficulty of putting instruments on the seafloor?

Other options

- Explore the concept of cost benefit with the girls. For example, if the device has even more contact points with the water, it makes it more likely to leak, but may be more valuable to scientists because they can attach more instruments.
- You may also want to consider giving each group a budget, where they need to buy or trade for additional supplies.
- You may also want to limit the number of trial sessions in the water tank, or charge each group per trial. This will force groups to think of other ways to test their machine with minimal cost.
- Challenge the girls to think outside the box by including something that seems odd. For example, include a snack (with a water bottle, a granola bar or something else – be creative!) and see what the girls do with it. Do they incorporate it as part of the design or use it to test the device? Do they only see it as a snack to share (not that this is a bad thing.)

Take it a step further for Pathfinders and Rangers

Many groups are endeavouring to explore the deep ocean. Check out these links to get more information on deep-sea exploration and science.

Ocean Networks Canada: http://www.oceannetworks.ca/

National Geographic DEEPSEA CHALLENGE: http://deepseachallenge.com/

