

# FISH, FINS, FORMS, AND FUNCTION

# ACTIVITY ONE

**Time:** 1-2 Sessions  
**Grade(s):** PK - 4  
**Vocabulary:** Dorsal, Caudal, Pectoral, Pelvic, and Anal fins

## Materials

- Cutouts of basic shapes
- Photos or illustrations of marine animals
- Marine Life Activity Cards
- Crayons or pencils
- Erasers
- Plain white paper

## Key Concepts

- Recognizing and making connections between lines and shapes in nature and art.
- Fish have a variety of fins: dorsal, caudal, pectoral, pelvic, and anal. Each fin has a function.

## Overview

Students will learn to recognize common shapes within nature and use combinations of simple shapes and lines to draw fish and other marine animals. Students will learn the fins on a fish.

## Teacher Background

Artists and animators use basic shapes to help them paint and illustrate. For examples of how to demonstrate this process in your classroom, you can take a look at Wyland's "Learn to Draw and Paint with Wyland" art kit or any other Walter Foster drawing book. Start with basic shapes, connect those shapes with lines, add details, and erase the lines you don't need (or for children using crayons, color over them):

Fish have a variety of fins that serve different purposes. Many fish will have all of the fins discussed here, while some (like a moray eel) may not. The 5 basic fins and their functions are as follows see the fish, fins, forms, and function activity cards for a diagram:

- **Dorsal fin** - located on the back of the fish, this fin helps the fish stay upright when it swims through the water.
- **Caudal fin** - otherwise known as the tail fin. Most fish use this tail for swimming power.
- **Pectoral fins** - a set of fins on the each side of the fish near the head. These fins can be used to steer, provide lift, and to brake. Some fish also use them for swimming.
- **Pelvic fins** - a set of fins on the underside of the fish near the head. Pelvic fins help provide stability when swimming. Some bottom or reef dwelling fish will "sit" on their pelvic fins.
- **Anal fin** - a fin on the underside of the fish located near the back that helps with stability while swimming.

# FISH, FINS, FORMS, AND FUNCTION

## Procedure

1. **Engage** – Have the students draw a set of simple shapes such as circles, ovals, etc. with you as you draw them on the board. Introduce the idea that these shapes are “hidden” in many animals and objects. Give an example by showing a picture of a marine animal and then drawing the “hidden” shapes on the board (choose one with a few simple shapes such as ovals, circles, squares, and triangles). Connect and refine the shapes by using lines to form the animal. Now give the students an opportunity to name some marine animals and their “hidden” shapes. Illustrate some of the better examples on the board.

Ask students to suggest what shapes they could use to draw a fish. As they give suggestions, you can have them come up to the board one by one and each use a shape to draw one part of a fish (it is really helpful to have a good illustration of a fish at hand for them to look at as they draw). Include as many children as possible by having them draw the entire fish and all of its parts (fins, eyes, scales, gills, etc.). As each fin is added to the fish, write the name of the fin on the board and talk about its function.

2. **Challenge** – Students should create their own fish by using shapes and lines. Ask students to make sure they include all of the fins they learned about and properly place them on their fish.
3. **Develop** – Discuss with students if using basic shapes and lines made the process of drawing easier or more difficult for them. Why? Have them evaluate if using shapes and lines made their drawings better.
4. **Extend** - Each student can create a collage of a fish using basic shapes made out of different materials (tissue paper, cellophane, pipe cleaners, etc.) and drawn lines. Students should compare and contrast their drawing and their collage. Why would an artist choose one technique over the other?

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ACTIVITY ONE

# CAMOUFLAGING CRITTERS

**Time:** 1-2 Sessions  
**Grade(s):** PK - 4  
**Vocabulary:** Texture, Pattern, Camouflage, Habitat

## Materials

- Marine Life Activity Cards
- Photos or illustrations of different marine animals in their habitats
- Variety of brushes, sponges, and miscellaneous objects to use in painting (examples: felt, pine needles, sandpaper, leaves, string, bark, etc...)
- Washable tempura paint or finger paints
- Cups of water for rinsing
- Paper

## Key Concepts

- Texture, colors, and patterns can help animals camouflage with their habitat.
- Artists can use different techniques and materials to illustrate textures and patterns.

## Overview

Students will investigate how animals have different textures, colors, and patterns that help them camouflage or otherwise survive in their habitat. Students will explore different methods of illustrating these textures and patterns in their artwork.

## Teacher Background

A habitat provides food and shelter for animals. Many animals use camouflage to help them hunt or hide within their habitat. Camouflage can be achieved through color, pattern, texture or any combination of the three. Some marine animals such as an octopus can actually change their colors, patterns, and texture to camouflage in a variety of places. Other animals such as the red Simnia cowry (marine snail) cannot change at will, their camouflage is only effective in a specific part of the habitat (the Simnia lives and feeds on red gorgonians). Animals such as flatfish use camouflage to hide and to hunt. Flatfish are ambush predators and are well camouflaged on the ocean's sandy bottom. When prey wanders by, the flatfish will strike quickly and take the prey by surprise.

Texture, in addition to being used for camouflage, can give more insight about the animal and serve other survival purposes. For example, fur helps to insulate the California Sea Lion and indicates that it could be a mammal.

# CAMOUFLAGING CRITTERS

## Procedure

- 1. Engage** – Introduce the concept of a habitat and what a habitat provides for the animals that live there (food & shelter). Discuss how camouflage is a good strategy for obtaining both food and shelter. Use a few examples of marine animals that camouflage. Brainstorm with the students about how color, patterns, and texture help an animal camouflage. Besides camouflage, what can you tell about an animal from its texture? How might that texture help the animal survive? Talk about a few examples such as: furry seals, bumpy skinned turtles with hard smooth shells, rough shark skin, etc... With younger students you will need to explain texture and patterns.
- 2. Challenge** – Have the students pick an animal from the Marine Life Activity Cards or one of your photos that has a distinctive texture and/or pattern. Next, instruct the students to try to illustrate the color, texture and/or pattern of the animal using paint and some of the miscellaneous objects you've provided. Students don't need to draw the animal, just experiment on their paper with textures, patterns, and color. Students may go through several pieces of paper and try every object you have brought – this activity is all about experimentation, so let them have fun!
- 3. Develop** – Students should show their work and as a group, talk about what brushes or objects made the best textures or patterns for specific animals. Were they successful in imitating texture in their artwork? Discuss why it might be important for artists and/or scientists to accurately show the textures, patterns, and colors of animals.
- 4. Extend** - Now that students have figured out how to create the desired texture and/or patterns for their animals, they can create a small book about their animal by using folded paper and string or staples. The book should contain: the name of their animal, a drawing or picture of their animal, a sample of their texture/pattern painting, a short description of the animal's habitat and a short description of how the color, texture, and/or pattern of the animal helps it survive.

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ACTIVITY TWO

# ME TO THE SEA

## ACTIVITY THREE

**Time:** 1-3 Sessions  
**Grade(s):** K - 6  
**Vocabulary:** Watershed, Storm drain, Pollution

### Materials

- Globe or world map
- Map of local watershed or area ([www.epa.gov/surf/](http://www.epa.gov/surf/))
- Plain white paper
- Pencils
- Erasers
- Colored pencils, crayons, or markers

### Key Concepts

- Everyone has a connection to the sea, no matter where they live.
- Everyone lives in a watershed and therefore what we do in our daily lives affects the ocean.

### Overview

Students will create a picture communicating their connection to the ocean.

### Teacher Background

We don't often take the time to stop and think about how valuable the oceans are to each and every one of us. No matter where we live, we rely on the seas for many things: food, transportation, recreation, medicines, jewelry, and tranquility to name just a few. It is important for us to recognize how important the oceans are to us personally and that we also have a physical connection to the oceans.

Everyone lives in a watershed and watersheds connect us to the sea. A watershed is an area where water from snowmelt or rainfall runs from high lands down through rivers, lakes, and wetlands to a low lying body of water such as a lake or an ocean. As water runs this course, it can pick up all kinds of pollutants that eventually end up in the ocean. Rain washes things like oil, fertilizers, pet waste, trash, and sewage system overflows into the storm drains which lead to lakes and oceans. Unlike the water that goes down the drain in your home, this water is not treated or cleaned in any way. Theoretically, a candy wrapper dropped on a ski slope could find its way to the ocean floor. Many cigarette butts dropped in the street certainly make their way to the beach (they are the number one litter item found on beaches during clean-ups). You can locate your watershed on the EPA's website: <http://www.epa.gov/surf/> to find out where runoff from your community eventually ends up.

# ME TO THE SEA

## Procedure

1. **Engage** – Show the students a globe or a world map and ask them to tell you what they know about the ocean: Where is it, what does it look like, smell like, taste or feel like? Brainstorm as a group about connections between people and oceans – how do people use the seas? Write responses on the board. When a good list is compiled, ask the students to make a determination if the ocean is valuable to us. What might happen if we couldn't use the ocean anymore for the things on the list? Is the ocean equally as important to people living inland as on the coasts?

Take students on a walk to a storm drain at your school. Ask students questions such as: Where do they think a storm drain goes? Why is it there? What happens to things that wash down storm drains? Is there any litter near this storm drain? Have students seen litter near storm drains in their street at home? Other places?

Back in the classroom, have students look at a map of the school's watershed and trace its path from the highest point to its outlet. Ask students where they think the storm drain you visited earlier leads? Pose the question of whether or not the students' actions have an impact on the oceans.

2. **Challenge** – Students should create a drawing to show their connection to the sea. Drawings can illustrate their interactions with the ocean, feelings about the ocean, or why the ocean is important to them personally. Challenge students to create their picture with the purpose of eliciting an emotional response in the people who view it.
3. **Develop** – Organize students into small groups and discuss each other's drawings. How does each drawing make them feel? Can they understand the other students' connections to the sea? Have each student explain the emotions or feelings they were trying to communicate with their drawing. Did they succeed? What might they try differently based on feedback from the other students?
4. **Extend** - Get permission from your school and/or the local neighborhood to label the storm drains so that everyone knows where they go. Conduct a contest in the classroom for students to create art and text for a storm drain stencil that will motivate people to keep pollutants out of the storm drains. This can be an individual or group activity. The classroom or school can vote on the winning design. Create the stencils as a class and label the storm drains with environmentally friendly paint.

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ACTIVITY THREE

# SIZING UP THE SEAS

**Time:** 1-2 Sessions  
**Grade(s):** 3-6  
**Vocabulary:** Scale, Proportion, Relative, Size, Charting

## Materials

- Marine Life Activity Cards
- String and scissors
- Rulers/measuring tapes
- Masking tape for labels
- Pencils
- Erasers

## Key Concepts

- Animals in the ocean differ in size.
- How artists can scale marine life correctly.

## Overview

Students are challenged to cut string in sizes representing all of the animals on the Marine Life Activity Cards.

## Teacher Background

Animals in the ocean come in a variety of sizes. Most of the plants and animals are very small and cannot be seen without the aid of a microscope. On the other end of the size scale, the 120-foot long blue whale swims gracefully beneath the ocean's surface.

All of these wet and wild creatures arrive in the classroom in textbooks with pictures and illustrations only a few inches wide. It is hard for students to get a feel for the relative size of different animals. Size and scale information is important in the development of marine art. This activity is designed to familiarize students with the methods for developing accurate scale and structure models for six marine animals.

## Procedure

1. **Engage** - Ask students to imagine a blue whale swimming over their school. Now imagine your classroom filled with tiny krill.
2. **Challenge** - Challenge student teams to read the size section of each Marine Life Activity Card and create a chart of relative sizes. Next, based on the scale of one inch = one foot, ask student teams to cut paper proportionate to each animal.
3. **Develop** - Students should compare their relative size charts. Discuss methods for scaling the size to fit on different sized surfaces. How would you scale the animals so that they all fit on the blackboard? Cafeteria wall? A sheet of paper?
4. **Extend** - Students should pick three additional animals to research, cut different size strings and label for a classroom string display of twenty marine animals.

# EVERYTHING IS RELATIVE

**Time:** 1-2 Sessions  
**Grade(s):** 3 - 6  
**Vocabulary:** Scale, Proportion, Relative, Size, Charting, Ratio

## Materials

- Marine Life Activity Cards
- Magazines with marine photos
- Graph paper
- Rulers
- Glue sticks
- Poster board or butcher paper
- Pencils & erasers
- Scissors

## Key Concepts

- Animals in the ocean differ in size.
- Artists can scale objects to fit into distinct spaces.

## Overview

Students are challenged to develop correct proportions for all of the animals on the Marine Life Activity Cards to fit on one page.

## Teacher Background

Information on size and proportion is important in the drawing, painting or sculpting of marine life. Variations in the relative sizes may communicate different things to the viewer. Is the whale small compared to the boat because it is a baby? Is the squid as large as the sea lion because it is in a fun science fiction “what-if” drawing? Is the sea lion bigger because it is a different species; a Steller Sea Lion rather than a California Sea Lion?

Students should understand the methods for representing different animals in the same drawing. To achieve this they will have to do a little research and be familiar with some simple math. Once the scale is determined (e.g. 1 ft. = .25 in; 1 ft. = 1 in.) multiply each animal's actual size by its scaled size. For example a 60 foot whale at 1 ft. = .25ft/in. scale would be 60 ft. x .25 ft./in. = 15 inches. By using the same scale for all animals in a picture, students will have developed correctly proportioned artwork.

## Procedure

1. **Engage** - Student teams search through magazines to find pictures of marine life. Cut and paste a variety of pictures onto a poster board. Imagine what the sea would be like if animals really had these relative proportions?
2. **Challenge** - Challenge students to redraw all of the animals on the Marine Life Activity Cards so that they are correctly proportioned to fit on a standard 8 1/2" x 11" paper. Help them to determine the correct scale. Hint: Take the biggest animal and proportion it to just fit on the paper. (The solution will be approximately 1ft. = .1 in. making a 100' whale = 10 inches).
3. **Develop** - Ask students to compare their drawings. Discuss the concept of ratios and proportions. Under what circumstances would an artist want to violate scaling rules?
4. **Extend** - Using the Marine Life Activity Cards, carefully measure each animal and estimate the scale that Wyland used.

# INS AND OUTS OF WATER: OPTICS AND ART

**Time:** 1-2 Sessions  
**Grade(s):** 5-8  
**Vocabulary:** Refraction, Absorption, Wavelength

## Materials

- Marine Life Activity Cards
- Large glass container or aquarium
- Miscellaneous objects: marble, toy, rock
- Light source
- Colored pencils or pastels
- Pencils and erasers
- Access to water

## Key Concepts

- Water affects the way objects look (light refraction).
- Light interacts differently with objects in water.

## Overview

Students are challenged to compare observations of objects in and out of water.

## Teacher Background

Artists creating underwater scenes should have an understanding of the way light, water and submerged objects interact. Your underwater scene might be affected, for example, if you know that the red light from sunlight only penetrates to a depth of about 30 feet. So, technically, you can not depict any deep water organisms with red unless you also depict an artificial light source.

In addition to colors slowly disappearing with depth, size and perspective can also change underwater. In general, when viewing an animal through a dive mask it will appear 25% bigger than it looks out of water. Thus, an object four feet away will appear to be three feet away underwater. This is due to the way your eye interprets light passing through air differently than light passing through water.

As most underwater scenes are near the surface, artists should be familiar with the patterns of light produced when sunlight penetrates the surface of the ocean.

## Procedure

1. Engage - Ask "Who has been underwater before?" Solicit observations on the way things look underwater. Pass around a glass jar with a marble inside and ask for specific observations.
2. Challenge - Allow students to select a small object. Challenge them to do a realistic drawing of the object out of water. Then have each student submerge their object in a large glass container or aquarium and draw the object again.
3. Develop - Ask students to compare their drawings. What changes did they notice?
4. Extend - Using an external light source, shine the light down through the water. How does the appearance of the object change? Disturb the surface (with fans, bubble, friend with a straw) and draw the underwater pattern.

# ANIMAL BEHAVIOR AND ART

## ACTIVITY SEVEN

**Time:** 1-3 Sessions

**Grade(s):** 5-8

**Vocabulary:** Ecosystem, Adaptation, Food web, Producer, Consumer, Scavenger, Decomposer, Bacteria, Detritus

### Materials

- Marine Life Activity Cards
- Paper
- Pencils
- Watercolors, marker pens, or crayons

### Key Concepts

- A habitat is the place where an animal lives.
- Animals have adapted to live in a specific habitat.
- An ecosystem is the living and non-living things in a habitat and their complex interactions and dependencies.

### Overview

Students will design an underwater scene that will include two animals appropriately interacting with each other in their habitat.

### Teacher Background

A habitat is a place where organisms live. An ecosystem is the complex interactions of both living and non-living things – the animals and their habitat. An understanding of these interactions will help students place an animal in the appropriate context.

Where does the animal live? Is it a bottom dweller, or does it swim in the water column? Does it like kelp forests? An understanding of an animal's habitat will help place the animal in appropriate surroundings. The habitat will also give clues about an animal's adaptations, like coloration, shape, and size.

What does the animal eat? What are its predators? Ecosystem food webs begin with producers (plants) that make their energy from sunlight. Consumers eat producers or other consumers. Scavengers feed on detritus (waste and dead matter) and then bacteria acts as a decomposer, breaking everything down to where the cycle can begin again. An understanding of where the animal fits in the food web and the ecosystem will assist an artist in correctly positioning the animal in a scene relative to other sea life. For example, a sea lion in a scene with a school of squid would likely be feeding, whereas a sea lion with a garibaldi might appear indifferent.

# ANIMAL BEHAVIOR AND ART

## Procedure

1. **Engage-** Brainstorm 10 different ways that living organisms can interact with each other and non-living things in an ecosystem.
2. **Challenge-** Ask students to randomly choose two of the Marine Life Activity Cards. Next, challenge students to develop a thumbnail sketch showing both animals in the same scene. Students should consider the animals' potential interaction (e.g. Do they have a predator/prey relationship?) In addition, students should consider the habitat of each animal. Are they really found in the same habitat? If not, how can they design the scene to include both animals?
3. **Develop-** Students work in teams of four to share their sketches. Did anyone select the same animals? Compare the animals' interactions with one another. Are they in the appropriate habitats?
4. **Extend –** Research a food web for the habitat(s) previously portrayed. Choose three to four organisms to add to your sketch so that you have representatives of producers, consumers, and scavengers. How can these animals be effectively added to the scene? Does the addition make the scene more complete and accurate? Does your resulting sketch communicate a better sense of the ecosystem?

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ACTIVITY SEVEN

# I'D LIKE TO BE UNDER THE SEA

**Time:** 1-3 Sessions  
**Grade(s):** 5-College  
**Vocabulary:** Ecosystem, Interdependence, Human impact

## Materials

- Marine Life Activity Cards
- Paper
- Pencils
- Colored pencils, markers, crayons, pastels, or paints

## Key Concepts

- An ecosystem is the living and non-living things in a habitat and their complex interactions and dependencies.
- Humans are a part of marine ecosystems and can affect their delicate balance.

## Overview

Students will create an illustration based on an underwater description from literature.

## Teacher Background

An ecosystem includes the complex relationships and interdependence between living and non-living things. The ocean contains many varied habitats and ecosystems including the kelp forest, coral reef, sandy bay, and deep sea. For many people, the thought of the ocean brings to mind images of the surface of the water and the waves. Only a small percentage of people will go under the surface and dive into its depths to explore first hand. For those who have never experienced it, the beauty and diversity of the ocean is hard to comprehend. Many people are also unaware of the effects humans have upon ocean ecosystems. We are a part of ocean ecosystems when we dive, fish, and alter habitats by building. Ecosystems have a delicate balance and removal of even one seemingly insignificant organism can have disastrous results.

Students planning the scene of an underwater picture (or a story) have a challenge to depict a world few people see. They should take into consideration the interactions and balance between living and non-living things – the ecosystem. For this activity, students are challenged to also communicate effects of human interaction in an ecosystem. Some interactions are benign and observatory, some show a more dramatic impact.

## From Peter Benchely's "The Deep":

"They swam to a patch of clear sand several yards seaward of the reef, sat on the bottom and peered at the rocks and coral, looking for the cave where the ampule had been found. The sun was almost directly overhead, and its light cut vertical rainbow shafts through the water. Shadows shifted, appearing and disappearing as spots of darkness in the reef. Sanders moved to the right. At the end of his vision, where the blue water darkened and the shapes of rocks grew fuzzy, he saw a shadow that seemed to remain constant. He tapped Gail and pointed to the shadow. She took the flashlight from her weight belt and pressed the switch. A beam of yellow light flashed on the sand."

# I'D LIKE TO BE UNDER THE SEA

## From Jules Verne's - "Twenty Thousand Leagues Under the Sea":

"... Beyond that, the ocean depths were tinted with delicate shades of ultramarine which turned to a purer blue as the distance got greater, and then disappeared in the midst of a vague shadowiness. ... The sun's rays struck the surface (of a rocky reef) at a rather oblique angle, and, refracted by this contact as if passing through a prism, they tinted the edges of rocks, plants, shells and corals with the seven colors of the solar spectrum. It was a marvelous feast for the eyes; colors crisscrossed one another in a veritable kaleidoscope of green, yellow, orange, violet, indigo and blue."

## From Sylvia Earle on kelp forests:

"Lush submarine forests of giant kelp nurture animal life as abundant and diverse as that in a terrestrial forest. Hundreds of blacksmith fish surround a diver swimming past a column of kelp."

## From Rod Fujita's "Heal the Ocean"

"Vast areas that once harbored rich kelp beds are now barren, save for large populations of purple sea urchins. Many of these urchins are sick and starving, having overgrazed the forest. The sheephead and lobsters have been depleted, releasing the sea urchin population from the checks and balances provided by its predators and allowing the purple urchin population to explode."

## Procedure

1. Engage – Read the first quote aloud. Then ask students to imagine what it would be like to actually be in that place. What was the light like? What were the textures like? How were humans involved in this scene? Based on the description, what living and non-living things make up this ecosystem?
2. Challenge – Students should select any one of the above quotes and illustrate the scene that is described.
3. Develop – How did students interpret the words differently? Discuss how an understanding of habitats and ecosystems can assist artists and writers in describing underwater scenes.
4. Extend – Students can select any Wyland or other marine art poster and write three paragraphs describing the scene.

ACTIVITY  
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# SAVE THE OCEAN POSTER

**Time:** 1-3 Sessions  
**Grade(s):** 5-College  
**Vocabulary:** Environment, Human impacts, Conservation

## Materials

- Marine Life Activity Cards
- Poster board
- Colored markers or paint

## Key Concepts

- Humans have impact on the environment that scientists can measure.
- Scientific findings should be communicated to the public and art can be a powerful communications tool.
- Environmental and conservation groups often take communication one step further and motivate the public to take actions to reduce human impacts on the environment

## Overview

In a poster format, students are challenged to communicate an environmental message about a marine animal.

## Teacher Background

Many scientists are engaged in studies that result in meaningful information about how humans are impacting marine animals and the environment, but important findings from these studies often don't reach the general public. Even when they do reach the public, the findings may not be easily understood if they are contained in a lengthy report. Art can be a valuable tool in helping scientists to communicate with the general public in a visually appealing way.

Scientists, conservationists, environmentalists, and artists are starting to understand that they can help each other get important messages to the public. Many take it a step further than just communication; they educate and ask the public to take an action to get involved. In some cases art can be aesthetic or inspirational. In other cases, as in a textbook, the art may be descriptive or used to illustrate text.

In this activity students are challenged to create art that communicates an environmental message. The posters should be designed to be hung in a public place and should be both educational and motivational. There should be a call to action!

# SAVE THE OCEAN POSTER

## Procedure

1. **Engage - Brainstorm** about the ways in which posters can affect peoples' behavior. Solicit examples of posters seen in your community at the movies, your school, post-office, library and concert hall.
2. **The Challenge - Students** should pick one Marine Life Activity Card and, referring to the Human Impact section, produce a poster that has a call to action.
3. **Develop - Display** posters in the classroom or on the school grounds. Discuss the perceived messages for each poster. Which were most effective? Why?
4. **Extend - Choose** an animal from one of the Marine Life Activity Cards and illustrate a web page, a science fiction story or an encyclopedia entry. How will your images differ?

WYLAND  
FOUNDATION

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ACTIVITY NINE

# PATTERNS IN NATURE

## ACTIVITY TEN

**Time:** 1 Session  
**Grade(s):** 7 - College  
**Vocabulary:** Lens, Diffraction, Wavelength

### Materials

- Six Marine Life Cards
- Large glass container or aquarium
- Bubbler or fan to disturb surface
- Light source

### Key Concepts

- Water can bend (refract) light

### Overview

Light traversing the ocean's surface displays patterns on objects just below the surface.

### Teacher Background

The patterns of light and dark that cover objects below the surface are explained by the physics of light and water. Unlike light that travels through a window to broadly illuminate a room, light through the ocean's surface is bent (diffracted) by the lens-like nature of a moving ocean wave. Light ripples are caused by surface waves concentrating light rays on the bottom. Wave crests act as lenses focusing rays together, while troughs disperse light, causing shadows. The clarity of the water will dictate the depth that the light patterns will be displayed.

The familiar patterns on the bottom of swimming pools show lines and shapes reflective of disturbances at the water's surface. A single stone thrown into the middle will create a series of expanding circular patterns. Children at play, however, will create waves resembling wind waves in the ocean. The generated pattern shows brighter-than-normal areas where wave peaks have bent sunlight rays together. The darker areas are generated from the spaces between the wave peaks that have spread the light out.

### Procedure

1. Engage- "Who can describe in words the patterns of light observed in a swimming pool?" What causes the familiar patterns on the bottoms of home aquaria?
2. Challenge- Students are challenged to illustrate a pattern of light on the bottom of an aquarium or large glass container.
3. Develop- Can you explain what is happening to light as it enters the water? Discuss how knowledge of light and physics can assist you in the production of underwater art.
3. Extend- Play with the light source and types of water disturbances to generate different underwater patterns. Could any of these patterns be generated under natural conditions?