Natural Resources - Water

CATCH A WAVE: HOW WAVES ARE FORMED

Activity Plan – Science Series ACTpa042

Project Skills:
- To observe wind waves and how they are formed.
- To understand why some waves are larger than others.

Life Skill:
- Critical thinking

Academic Standards:
- Science C.4.2 Use the science content being learned to ask questions, plan investigations, make observations, make predictions and offer explanations.
- Physical Science NS.5-8.2 All students should develop an understanding of properties and changes of properties in matter, motions and forces, and transfer of energy.

Grade Level(s): 3-5
- Activity is appropriate as an out-of-school activity (after school or day camp) or classroom lesson on water properties.

Time: 45-60 minutes

Supplies Needed:
- 1 shallow, rectangular tray or pan (2-3 inches deep and at least 14 inches long) per team – preferably a glass baking dish or another see-through container
- 1 gallon jug of water
- 1 electric desk fan (with low, medium and high

BACKGROUND

Surf's up … but why? Although many young people think that waves originate from inside the water, the water doesn't actually move with the waves. Instead, waves are formed by "wind friction," i.e., wind energy moving across the water's surface. In this lesson, youth take part in a series of activities to see how waves are formed and why some waves are bigger than others. So put on the surfing tunes and get ready to catch some waves!

Words to know:
- *Prevailing winds:* winds that blow consistently from one direction.
- *Ripples:* very small waves that appear on the surface of smooth water when the wind blows, but die once the wind stops.
- *Swells:* huge, smooth waves that are often created by storms thousands of miles away.

Note to Helpers: Science facts are provided in brackets throughout this document. These facts are intended for helpers – not to be read aloud to youth participants. Please keep the facts in mind as you lead youth in the "Talk it Over" discussions.

WHAT TO DO

For the best results, do the following three activities in the order they are listed.

Activity: What are Waves?

[This activity shows that waves do not carry water with them. Rather, the energy from the wind moves through the water.]

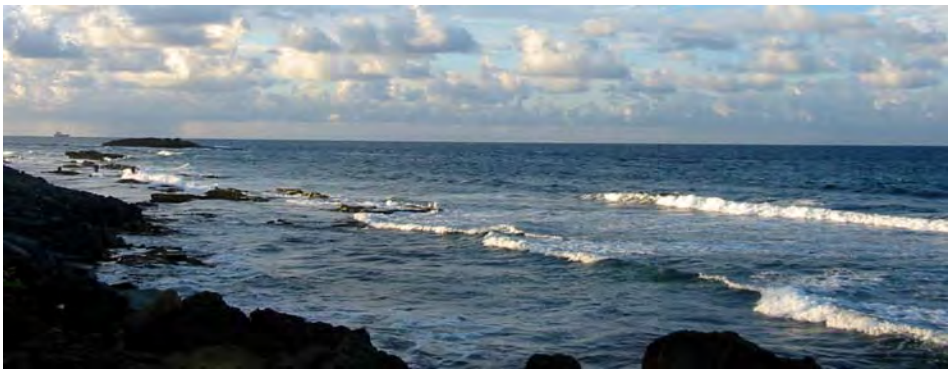
1. Divide the group into as many teams as you have desk fans and trays/pans.
2. Provide each youth with a *Catch a Wave* handout sheet, as well as a pen or pencil.
3. Have one person from each team close their eyes and point to a spot on the map or globe. Then, name their team after the ocean, lake or sea they pointed the closest to. Tell everyone to write their team name on the top of their handout sheet.
4. Set a rectangular pan on a table in front of each team. Fill each pan about 1/2 to 3/4 to the top with water.
5. Place a desk fan at a narrow end of each pan; the head of the fan can be level with the pan or pointed slightly downward, if adjustable.
6. Ask youth to predict what will happen to the water once they turn the fans on. Have them record their predictions in the "What are Waves?" section of their handout sheet. Will it splash out of the pan? Will it collect at one end of the pan? Will it stay in place?
7. Have one person from each team turn their fan on LOW. Be sure to instruct all youth not to touch the water while the fan is running.
8. Ask youth to observe the waves and record their observations on the handout sheet.
9. Ask someone from each team to turn the fan on MEDIUM, then HIGH. With each new setting, have youth record their predictions and observations.

settings) per team
- 1 small bag of rocks or sand per team
- 1 *Catch a Wave* handout for each youth
- Handful of toothpicks
- Pens or pencils for each youth
- Globe or world map

(Optional)
- Blue food coloring
- 5 large marbles per team
- Some water sounds or surf rock music

Do Ahead:
- Read through the entire activity and perform the experiments.
- Explore the Web sites listed at the end of this document.

Sources:
- Lead author: Eve Daniels, Senior Editor, CYFERnet/Center for 4-H & Community Youth Development, University of Minnesota Extension.
- Contributions by: Trudy Dunham, Program Director, CYFERnet/Center for 4-H & Community Youth Development, University of Minnesota Extension.
- "What are Waves?" and optional marble activity adapted from "Let's Make Waves" at https://www.hmhco.com/blog/hands-on-science-activities-for-the-classroom-lets-make-waves



TALK IT OVER

Reflect:
- What did you predict would happen to the water when you turned the fans on low? Medium? High? What actually happened?
- Why do you think the water didn't splash out of the pan?
- What would happen in a storm?
- Why is wave action important?

Apply:
- How are waves formed?
- How did this activity help you to understand how waves are formed?
- How was this activity similar to visiting a real beach? How was it different?
- What conditions would result in swells forming on a lake?
- What other kinds of wave action might form on a lake?

[At this point in the lesson, you may want to do the optional marble activity listed in the "Enhance" section below.]

Activity: Whirling Water

[This activity illustrates how water particles spin in the direction of the wind.]

1. Turn off the fans and let the water settle.
2. Drop a toothpick into each pan and wait a few seconds.
3. Ask each team to predict what will happen to the toothpick when they turn the fan on. Will it blow to the end of the pan? Will it sink?
4. Ask one person from each team to turn the fan on LOW. Have youth observe how the toothpick moves in the water. For this activity, they can share their predictions and observations aloud with the team, rather than writing them down.

TALK IT OVER

Reflect:
- In what direction was the wind and water moving?
- How and where did the toothpick move? Why do you think that is?
- How and where would an empty canoe move? A fish?

Apply:
- What do the pan of water and the fan represent in real life? [The water is the sea; the fan is the wind.]
- What does the toothpick represent? [The toothpick represents water particles.]
- Judging by what you learned in this activity, how do waves move? Do waves move water? [Waves lift water particles, rather than carrying them away. The particles travel forward, down and back in a circle, setting off smaller circling movements below the water's surface.]
- What does wave movement change in a real lake or ocean?

Activity: Surfin' Safari

[This activity shows that wave size is determined not only by wind speed, but also by how long and how far wind travels. The activity also illustrates how beach materials affect wave patterns.]

1. Have each team construct a "beach" at a narrow end of their pan using the rocks or sand you provide. The rocks or sand should be just higher than water level.
2. Ask youth to predict what will happen to the water when they turn the fans on and to record their predictions in the "Surfin' Safari" section of the handout. Will it splash over the rocks or sand? Will it cause their beach to move?
3. Have someone from each team turn the fan on LOW for 30 seconds, then MEDIUM for 30 seconds, then HIGH. Tell them to slowly move the fan closer and farther away from the water at each fan speed, and to point the fan at different angles. With each fan speed, angle and distance, have them record their predictions and observations on the handout.
4. Ask each team to choose one fan speed/angle/distance and to keep the fan at that setting. Have them record that speed/angle/distance and their observations in the last row of their handout. Now, have each youth flip their handout over to the blank side.
5. With the fan running at the setting they chose in the previous step, have each youth observe the water for 5 minutes and draw the pattern they see in the water.

TALK IT OVER

Reflect:

- What happened when the fan was close to the water? Farther away?
- How did the waves change when the fan speed and wind direction changed?
- What fan speed/angle/distance did your team choose to draw?
- Hold up your drawings and compare them with the rest of the group. Why does your pattern look that way?

Apply:

- What is the link between wind and waves? [The greater the wind speed, distance and length of time the wind blows over a certain area, the larger the waves.]
- Imagine that you're a pro surfer in search of *killer waves, dude*! What three factors would make for the best surfing conditions?
- Think about lake shores, stream beds and ocean shores you have visited, read about or seen in movies and television: What might be the impact of wave actions on the shore?
- If you were building a dock or pier into a lake, river or ocean, how might wave properties impact your design?
- Bring your handouts home and show your family what you've learned!

ENHANCE

- For the activities, have each team select a reporter to report back their initial prediction and findings to the whole group. If predictions differed, have them explain their thinking to each other: What was the basis for their predictions? (experience, knowledge, intuition, wild guess). If findings differ: What might be the cause? (depth or temperature of water, length of pan, fan speed or position) What might a wave scientist do to further test? Youth should be able to facilitate themselves.
- Further questions for "Surfin' Safari" activity: Where and when have you seen the biggest waves? Name some of the different types of waves. What conditions are present with each type of wave?
- To add to the fun atmosphere, ask youth bring wave music (or you bring some). Possibilities include surf rock music like the Beach Boys or Jan & Dean, songs or stories about ship wrecks and "wave disasters" like the Wreck of the Edmund Fitzgerald, and music of the environment, such as waves lapping against a lake shore, babbling brook, or ocean.
- If you have blue food coloring, ask someone on each team to add a few drops to the water to create an ocean effect.
- Adapted from https://www.hmhco.com/blog/hands-on-science-activities-for-the-classroom-lets-make-waves: After the youth complete the "What are Waves?" activity, provide each team with 5 marbles. Have youth place 4 marbles on the table

in a row, with each marble touching the one beside it. Ask youth to predict what will happen if they roll the fifth marble into one end of the row. Then, have one youth on each team roll the fifth marble into the other four. Why did the marble at the end of the row move while the others stayed in place? [Because energy in the rolling marble transferred from marble to marble until finally reaching the last marble. Wind energy moves through water the same way.]

- Ask youth to go online and research tsunamis, or monster waves, and discuss how they are formed, the wind and water patterns, the impact on the shore.

SIMPLIFY

If you are limited on time, you can skip the "Whirling Water" activity. Instead, you may want to mention the "spinning water particles" concept with the group: Waves lift water particles, rather than carry them away. The particles travel forward, down and back in a circle, setting off smaller circling movements below the water's surface.

HELPFUL HINTS

In keeping with the Experiential Learning Model, allow the youth to make predictions, experience the activities, describe their experiences, and answer open-ended questions. But in order for youth to walk away with a solid understanding of waves, you may also have to review/reiterate a few science concepts. This is why facts are included for you in brackets throughout the document. You might find the following resources helpful as well.

ADDITIONAL WEB LINKS

- Why are the waves on the U.S. West Coast larger than the waves on the East Coast? Find out at HowStuffWorks: http://www.howstuffworks.com/question623.htm.
- Additional wave experiments from the Marine Education Society of Australasia (MESA): http://www.mesa.edu.au/cams/pdf/waves.pdf.
- Wikipedia offers comprehensive info on ocean surface waves: http://en.wikipedia.org/wiki/Ocean_surface_wave.

Reviewed by Wisconsin 4-H Curriculum Team: July 2008.

Catch a Wave!

My Name: _____

My Team's Name: _____

ACTIVITY: WHAT ARE WAVES?

Fan speed	**Your predictions**	**Your observations**
Low		
Medium		
High		

ACTIVITY: SURFIN' SAFARI

Fan speed (low, med. or high)	**Angle of fan** (level with water, downward, etc.)	**Fan distance from water** (close, far away, etc.)	**Your predictions**	**Your observations**
Record your team's final fan speed, angle, distance and observations here:				

Use reverse side to record additional notes, but save room for your wave drawing for the Surfin' Safari Activity.