EDUCATOR'S GUIDE

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we: evolve

WHAT ARE AQUATIC ECOSYSTEMS?

How do organisms interact within an aquatic ecosystem?

How does human activity impact the survival of an aquatic ecosystem?

How do marine mammals use sound waves for navigation and survival?

In Wild Ocean, we see life and death within the ocean waters along the KwaZulu-Natal Coast of South Africa. Survival within the aquatic ecosystem depends entirely on the food web and the relationships between predator and prey. Humans play a part, too, as diminishing resources make the struggle for survival even more intense.

Use the following resources and activities to learn more about the ocean ecosystem and the predator-prey relationship. Make your own aquatic ecosystem and observe how it changes over time. Think about ways to conserve energy and water—and protect the oceans. Learn about echolocation and how animals can use their ears to see. Find out how electronic devices impact our environment.

VOCABULARY

Baitball – a swirling mass of thousands of small baitfish that begins to look like a giant silvery ball as they swim in circles.

Breach – the act of leaping forcefully up out of the water, usually by Humpback Whales.

Capacitor — a device for accumulating and holding a charge of electricity.

Guano – seabird droppings, usually found coating the surface of their nests.

Parasites – organisms that attach to and depend on a host for their survival.

Pelagic – related to the open seas or oceans, far from land.

Predator – an organism that survives by preying on other, usually smaller, organisms.

Pods – groups of seals or whales.

Prey – an organism hunted or caught for food.

Resistor – a device designed to introduce resistance into an electric circuit.

Shoal – a large collection of things, especially a large school of fish.

CREATE AN AQUATIC ECOSYSTEM

Try This!
How does an aquatic ecosystem work?

An aquarium is a miniature aquatic ecosystem. Try constructing your own aquarium from the materials you have available. Some suggested ideas follow, but you can experiment with any combination of living (fish, plants) and non-living (shells, clay) aquatic populations.

THINGS YOU NEED:

- glass or clear plastic tank that has a cover (large hard plastic canisters also work)
- water
- small stones or gravel
- at least two small fish of the same species
- at least two small aquatic plants (any plant that grows well in water)
- fish food
- natural shells or very small clay pots

DIRECTIONS:

- Place the small stones or gravel on the bottom of your tank.
- Weight the shells (or clay pots) by putting a few stones inside them.
- “Plant” the aquatic plants by securing their bottoms in the stones.
- Fill the tank nearly to the top with de-chlorinated water.
- Allow the water to come to rest at room temperature.
- Carefully introduce the fish to their new habitat! Be sure to watch their behavior.
- Cover the tank. Make sure it is near a source of light, but not near extreme temperatures.
- Each day, keep a log of observations.
- Three times a week, add a flake of fish food for each fish and observe their behavior. You may also need to change the water so it remains clean and contains enough Oxygen.
- Continue observing your aquarium for at least two weeks. Ecosystems grow and change over time. To notice growth and changes, you’ll need at least two weeks of observation.
- Discuss how the fish survived (or, if necessary, didn’t survive) in the covered tank.

EXTENSIONS:

- After two weeks of observation, add other species of fish to the aquarium.
- How do aquatic ecosystems survive in the darkness at the bottom of the ocean? Place your aquarium in a dark closet for a week and see what happens.

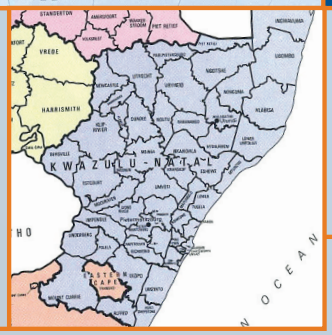
WHERE IN THE WORLD?

The dramatic scenes that we see in Wild Ocean take place in the Indian Ocean along the KwaZulu-Natal Coast of South Africa.

The Indian Ocean is the third largest ocean on Earth. The Pacific and Atlantic Oceans are larger, while the Southern and Arctic Oceans are smaller.

KwaZulu-Natal is a province within the country of South Africa and has a long coastline along the Indian Ocean. As in many countries around the world, the seashore is a destination for seasonal recreation. Towns along the coast draw tourists from throughout the country in search of sunshine and sea breezes. Some stretches of the KwaZulu-Natal coastline are among the world's most beautiful beaches.

After the Summer tourists return to their homes and Autumn turns to Winter, the coastal waters begin to cool. All eyes begin to watch for the telltale signs of the coming sardine run. Millions of sardines begin their migration Northward in search of warmer waters, following currents that bring them so close to the KwaZulu-Natal coast that many of the fish actually wash up on the beach. The huge shoal of sardines attracts thousands of predators in a remarkable demonstration of the predator-prey relationship within the ocean's food web.



Why is it called KwaZulu-Natal?

The KwaZulu-Natal province used to be two separate regions: KwaZulu and Natal. In 1994, the two regions were united into one province.

In the Zulu language, KwaZulu means "place of the Zulu." Indeed, the Zulu kingdom still exists within the province. The Zulu people are an African tribal culture still lead by a ceremonial king.

In Portuguese, Natal means "Christmas." On Christmas Day 1497, the Portuguese explorer Vasco da Gama came ashore and decided to name the area Natal.

How Can We Protect the Wild Ocean?

As *Wild Ocean* shows us, the magnificent ocean ecosystem is endangered. Even if the Indian Ocean is half a world away from where you live, you can make choices that will help to protect the wild oceans around the world.

What's for Dinner?

Seafood can be a nutritious and delicious meal. The growing popularity of seafood, however, has impacted the natural balance in the oceans through overfishing and other practices that impact the aquatic ecosystem. You can help protect the oceans by making smart seafood selections.

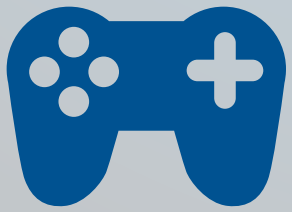
For example, albacore tuna, anchovies, and wild Alaskan salmon are all tasty choices that are also ocean friendly. Mussels, mackerel, and sardines also make the list of sustainable seafood. At their website, Environmental Defense [environmentaldefense.org] offers an Eco-Friendly Seafood Selector. There's even a handy pocket guide that you can print and carry with you when grocery shopping or dining in restaurants.

Paper or Plastic?

One of the greatest dangers to ocean animals comes from plastic bags and other plastic waste that finds its way into the oceans. Plastic does not deteriorate in salt water, so plastic trash sometimes travels around the world, riding on ocean currents. Sea birds and ocean animals become tangled in the trash, unable to fly, swim, or break free.

Paper bags are a better choice because they will biodegrade in water. The very best choice, though, are reusable canvas bags. Plan ahead! Take tote bags with you to carry your groceries home from the store. If you must use plastic bags, recycle them and dispose of them carefully so that they don't end up ruining the oceans.

Game Over?



Saving energy will help save the oceans. The oceans stay healthy and thrive when the ecosystem is in balance. Help keep the environment balanced by conserving electricity in your home and school. Turn off lights when you leave a room. Make sure your computers are powered down when nobody isusing them. Power down video games when the game is over.

ENERGY CONSERVATION

When we conserve energy in our homes, schools, and lives, we help to protect the global environment. The opposite of conservation is waste, so when we waste energy, we help to damage the global environment. To understand how these conditions balance themselves, we have to consider the ecosystem. An ecosystem is defined as a self-sustaining community of interdependent organisms (plants, insects, animals, etc.) and their natural environment. It provides the food chain through which energy flows, and the biological cycles that recycle essential nutrients and wastes. Notice that waste is included as part of the definition of ecosystem, telling us that not all waste is bad. We need to understand that it occurs as a natural part of our world but, in a healthy ecosystem, waste is kept to a minimum and as much of the waste as possible is recycled. In fact, in a naturally functioning healthy ecosystem, the amount of waste which is not recycled is very, very small.

Too much waste creates many problems which result in damage to our ecosystems. The ocean is made up of many ecosystems, which—when operating correctly—maintain a balance. In other words, all the parts of the ecosystem operate together and our oceans thrive.

Most of us understand that to waste is not a good thing. Waste occurs whenever we throw something away before gaining as much of the benefit from it that we could. For example, we know that throwing away unspoiled food is wasteful. We also know that leaving a light burning in an empty room is wasteful or that stepping hard on the gas to race ahead of the traffic wastes fuel. Most of us understand these things and realize that to waste causes us to consume the earth's natural resources faster than we should. Waste represents a loss of energy and, while it may not appear obvious at first, saving energy can protect ecosystems and, ultimately, help save the oceans. So if energy is the key, how can we learn to use energy efficiently? What can we do to reduce the loss of energy as waste?

CELL PHONE RECYCLING

It can be fun and exciting to buy a new cell phone, updating to the newest model with the coolest features. As soon as the new phone arrives, the old one is quickly set aside and forgotten, tossed in a drawer somewhere.

Did you know that surveys show that only three percent of people worldwide recycle their unwanted cell phones? Far too many people toss them in the trash, adding to the world's pollution problems. However, as many as forty-four percent of older model cell phones may be in desk drawers and closets around the world. While it's better for unwanted phones to be in drawers than in landfills, the best solution is recycling!

Cell phones and accessories are made from valuable resources such as precious metals, copper, and plastics—all of which use energy to extract and manufacture. Recycling cell phones reduces greenhouse gas emissions, keeps valuable material out of landfills and incinerators, and conserves natural resources. Recycling one million mobile devices saves enough energy to power more than 1,936 homes for a year.

When you recycle a cell phone, nearly all of the materials can be recovered and used to make new products or generate energy. Saying goodbye to your old phone might be hard but it's worth it. If every mobile phone user recycled just one unused phone, together we would save nearly 240,000 tons of raw materials. We could save lots of energy—and help protect the oceans—if we could get all of those old cell phones out of drawers and into a recycling center!

Try This!

Organize a cell phone recycling drive at your school.

- Have students brainstorm slogans and design posters to publicize the drive. Have them include information about how recycling a cell phone can make a big difference for the environment.
- Students can decorate cardboard boxes to use to collect the unwanted cell phones.
- Several classrooms might want to compete to see which class collects the most.
- Set a date by which the cell phones must be received. Then, mail your boxes for free to Nokia's recycling center.

Nokia provides free recycling of cell phones, batteries and accessories. Simply visit www.nokiausa.com/recycle to print your postage paid label, attach it to any box or envelope and mail it through the United States Post office.

You can also find lots of information about the environment and cell phone recycling at www.nokiausa.com/environment

Nokia is a proud partner of the Environmental Protection Agency's "Plug-in to eCycling" program. More detailed information is available online: www.epa.gov/cellphones

HOW CAN WE HELP THE OCEAN IN OUR OWN NEIGHBORHOODS?

Water Conservation Ideas and Activities

While the coastal waters of South Africa may seem a world away, even your local water supply is connected to the global water system. The way you use water does impact the Earth's oceans and the creatures that call it home. It is easy to take water for granted, especially if you live in a home with running water. But, every drop of water that you use counts. We all need to use water to survive, but we also need to be careful that we don't waste water. These tips can help.

CONSERVE WATER

- Take a shower instead of a bath.
- Leave a bottle of water in the refrigerator so you'll always have cold water to drink instead of letting the water run to get cold.
- Collect rainwater to use on plants.
- If you have a lawn at your house, water it early in the morning or in the evening. In the heat of the day, water will evaporate before the ground can drink it up.
- Make sure the sprinklers are not watering the driveway or sidewalk.

STOP POLLUTION

- If you have a stream near your house, help the Earth by keeping the stream bank clean.
- When you visit the beach, make sure you don't leave any trash behind to pollute.
- Animal waste can pollute water, too. Don't let your pet leave its waste in or near a stream.

FAST FACTS

- One person uses about 123 gallons of water a day!
- You are about 65% water. If you weigh 60 pounds, that means you are 40 pounds of water!
- About 80% of the Earth is covered by oceans and seas.
- About 97% of the Earth's water is in the oceans and seas.
- About 2% of the Earth's water is ice (from the frozen glaciers.)
- A person can live for weeks without food but can only live a few days without water.
- Apples are 80% water.
- Earthworms are also 80% water.
- A person consumes 2 1/2 quarts of water per day from water and food to stay healthy.
- If a faucet drips one drop per second, it wastes about 888 gallons of water a year.

Try This!

Can you conserve water by turning the water off when you are brushing your teeth?

THINGS YOU NEED:

- toothbrush
- water
- bowl, pot, basin, or small bucket
- measuring cup

DIRECTIONS:

Day 1

1. Put bowl, pot, basin, or bucket under faucet to collect water.
2. Turn water on.
3. Brush teeth as you usually do.
4. Use measuring cup to measure water in pot.
5. Pour the collected water down the drain.
6. Record results in chart below.

Day 2

1. Put pot or bucket under the faucet to collect water.
2. Turn water on.
3. Wet toothbrush.
4. Turn water off.
5. Brush teeth.
6. Turn water back on to rinse toothbrush and mouth.
7. Use measuring cup to measure water in pot.
8. Pour the collected water down the drain.
9. Record results in chart below.

Try these other activities at home!

1. Turn liquid water into solid water.
2. Turn solid water into liquid water.
3. Turn liquid water into water vapor. (Hint: use a tea kettle.)

How teeth are brushed	How much water did you use?	If you brush 3 times a day	How much water used per day?	If you brush 3 times every day for a year	How much water used per year?
If water is left running during brushing		x 3		x 365	
If water is turned off during tooth brushing		x 3		x 365	

How much water can you save in a year by turning off the water while you brush your teeth?

ENERGY AUDIT

In order for our oceans to thrive, we have to maintain a healthy balance in our ecosystems by only using energy when and where we really need it. That means that we need to stop wasting electricity in our homes. Nobody wastes electricity on purpose. Most of our homes have electrical circuits that supply energy to every room. We know that we can just "plug it in" when we need power for something. It's so easy to forget that the energy we use costs money and impacts the environment.

Many of today's modern electronic devices use energy even when nobody is using them. If we all remember to unplug them when we're finished using them, we can make a big difference!

Try This!
What's using energy in your house?

Go room to room within your home and observe what's plugged in.

What's Plugged In?	What's it Doing?	Unplug it?
Refrigerator	Keeping food cold	NO!
Cell phone charger	Nothing	YES!

Make a list of everything you see that's plugged in.

- Think about what each thing is doing.
- If it isn't doing anything, it might not need to be plugged in.
- Unplug it and save energy! You'll save money and also save the oceans!

Caution: Not everything that's plugged in is wasting energy! If it's doing work, then it needs power! It's important to recognize the difference.

Some things are plugged in all the time because they are doing work all of the time. A common example is an electric refrigerator. It's plugged in all the time and using energy, but it's doing important work—it's keeping your food cold and safe.

Some other things like electric stoves and lamps only use a tiny little bit of energy when they're idle. Your family has to decide how important it is to have them plugged in and ready to be turned on.

Many modern electronic devices—and ESPECIALLY their chargers—require energy whenever they are plugged in, even if turned off. We have to learn to unplug them when we're not using them in order to save energy. Help spread the word: tell your friends and family to unplug their electronic devices and their chargers when not in use. You'll save energy and help save the environment too!

ENERGY AUDIT

Do The Math

In the United States, there are as many as 1.5 billion chargers currently in people's homes. The total energy used by them is estimated at 300 billion kilowatt hours per year. That accounts for eleven percent of the total national electrical usage!

While the price Americans pay per kilowatt hour varies by location and throughout the year, it averages at about ten cents.

How much money do Americans spend per year to power cell phone chargers?

300,000,000,000 kilowatt hours x .10 = $_____

That's a lot of money! And, a lot of energy! Let's make sure we don't waste either.

Fast Facts

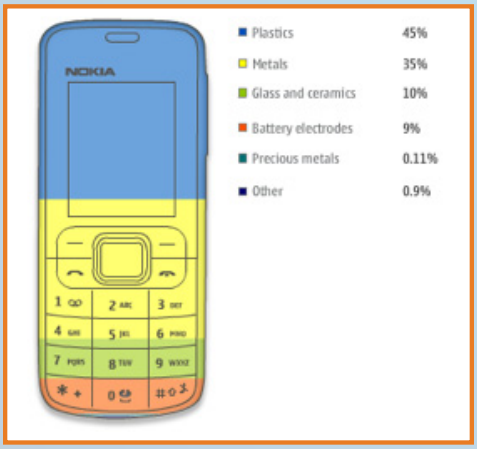
- If just ten percent of cell phone users unplug their chargers when their phones are fully charged, we would save enough energy to power 60,000 homes per year!
- A typical household uses between five to ten adapters for its electronic devices, and each year, more than one billion new adapters are shipped worldwide. Save energy by unplugging adapters when they're not actively recharging a device!
- Two-thirds of the energy consumed by a mobile phone, during its usage, is lost when a fully charged phone is disconnected from the charger, but the charger is left plugged in to the wall socket. This is energy lost in "no-load" or "stand-by."

Extension:

Your school may want to invest in a meter like the Kill-A-Watt device. Older students can use it to measure how much energy your classroom uses. Have classrooms take turns using it and then add up the results.

For more information about the Kill-A-Watt: www.p3international.com/products/special/P4400/P4400-CE.html

WHAT'S IN A CELL PHONE?



www.nokia.com/environment

ENERGY!

Cell phones are made of many materials and substances. Some of the materials come from the earth. Other materials are man-made. And, every step in the process of making a cell phone requires energy. Minerals like copper, silicon, and tantalum need to be mined from the earth using powerful equipment. Materials like plastic and ceramic need to be made in factories where machines use lots of energy to work. Of course, if other sources for these materials are available—like from old cell phones—then we don't have to dig or make more. Every time we recycle a cell phone, therefore, we save the energy it would otherwise take to get the raw materials to make the next new phone.

This diagram shows the kinds of materials that are used to make a typical Nokia cell phone.

THE ELECTRONIC EARTH

Did you know that many electronics use raw materials that come from the Earth? Metals from the Earth's crust are mined and then used to manufacture components. This is just one more way that our electronic devices impact the planet and use energy. Most mining today is done using powerful equipment that requires a lot of energy. When metals are recycled and made available for other uses, it saves the energy that would be spent to mine for them.

Each of these metals comes from the earth before it becomes part of your cell phone.

Tantalum is a chemical element with the symbol Ta and the atomic number 73. Tantalum is used to make capacitors and resistors which regulate the flow of electricity in electronic devices like cell phones, laptop computers, and digital cameras. Today, Tantalum is mined mainly in Australia, Canada, Brazil, and central Africa.

Copper is a chemical element with the symbol Cu and atomic number 29. Copper conducts electricity and heat very well and has many uses today including piping, coinage, household items, and electronic device components. Most copper is mined or extracted from large, open pits in the Earth's crust. Today, most copper comes from Chile, but copper mining operations are also found in the USA, Indonesia, and Peru.

Iron is a metallic chemical element with the symbol Fe and atomic number 26. Iron has countless applications when combined with other substances. Just a few products include pigments, dyes, inks, fertilizers, glass, and ceramics. The leading iron producers today are China, Brazil, Australia, and India.

Aluminum is a chemical element with the symbol Al and atomic number 13. Aluminum is used in many industries and has many applications. One of the most commonly known is the food and beverage industry. Aluminum is easily recycled and has one of the most successful recycling rates. Aluminum is produced in many locations around the world, with China, Russia, Canada, and the United States as top producers.

Lithium is a chemical element with the symbol Li and atomic number 3. Lithium is used to make glass and ceramic materials which are then used in the production of electronic devices. Most lithium today comes from the Andes Mountains in South America, with mines located in Bolivia, Chile, and Argentina.

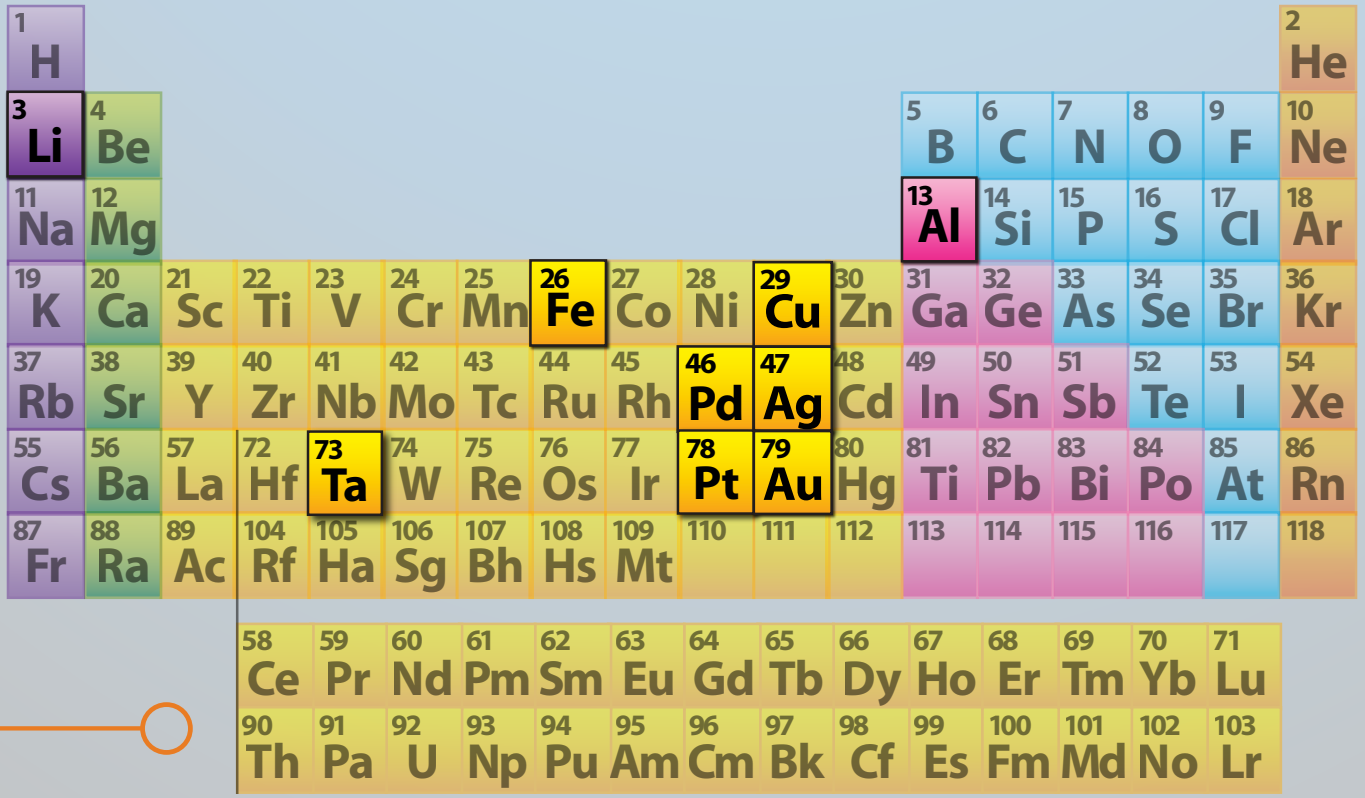
THE ELECTRONIC EARTH

Gold is a chemical element with the symbol Au and atomic number 79. Gold is commonly used in dentistry and the production of electronic devices, but its most familiar application is jewelry and decorative items. Because of its value, gold mining has been tried in many locations around the world throughout history. Today, most gold comes from mines in China, South Africa, Australia, Russia, Peru, South Dakota, and Nevada.

Silver is a chemical element with the symbol Ag and atomic number 47. Silver has long been used in the production of jewelry, coins, tableware, and other household items. Today, silver is also an important component of electronic devices. Most silver today comes from mines in Mexico and Peru, but also from Australia, Russia, and Alaska.

Palladium is a chemical element with the symbol Pd and atomic number 46. Besides being used in electronic devices, palladium is used in automotive parts, fuel cells, and dental appliances. Scrapped automobiles provide a source for recycled palladium, helping to control the need for mining palladium. Today, those mines are located in South Africa, Russia, Canada, and Montana.

Platinum is a chemical element with the symbol Pt and atomic number 78. Platinum is commonly used in jewelry, thermometers, dental appliances, and electronic devices. Platinum deposits have been found in Columbia, Russia, South Africa, Canada, and…the Moon! Lunar missions have found evidence of platinum in moon rocks.



ECHOLOCATION:
DO YOU SEE WHAT YOU HEAR?

Dolphins use echolocation to navigate around objects in ocean waters, to locate prey, and to avoid predators. Their bodies have adapted to the ocean environment in order to help them survive. They make clicking noises to create sound waves which travel easily through the water. When the sound waves bump into objects, the waves "echo" back to the dolphin. The dolphin recognizes echo patterns which help it "see" what lies ahead.

It is difficult to simulate underwater dolphin echolocation, but this activity will help you understand how, sometimes, we can see by using our ears.

Try This!

How do dolphins use sound to see?

THINGS YOU NEED:

- an empty space
- at least 4 students
- one blindfold

EXTENSIONS:

- Once the students have tried the basic activity, allow the prey, predators, and objects to assume different positions like sitting, squatting, and lying down. The dolphin will hear sounds coming from many different levels, adding to the challenge.
- For an advanced variation, allow the prey and predators to take one step each time they respond to "click, click, click." Prey should move away from the dolphin, while predators move toward it. (Objects should remain still.)

FAST FACTS

- Echolocation is also called biosonar.
- Bats use echolocation to navigate and hunt in the dark night skies.
- An American Zoologist named Donald Griffin coined the term "echolocation" in 1944.
- Underwater vessels, like submarines, use SONAR to navigate in ocean waters. The ideas for SONAR systems were inspired by animal echolocation.
- Both echolocation and SONAR work so well because water is an excellent conductor.

DIRECTIONS:

Note: This activity is a little bit like the game of "Marco Polo."

- Define the boundaries of your empty space. If you are inside, an empty class room or gymnasium works well. If outside, be careful to make sure all of the students know the safe area for play and that they know not to allow the blindfolded student to go beyond the boundaries.
- Select a student to be the dolphin.
- For each 3 students, assign 1 to be "prey," 1 to be "predator," and 1 to be "object." For example, if there are 26 students in your group, 1 will be the dolphin, 8 will be prey, 8 will be predators, and 9 will be objects.
- Blindfold the dolphin.
- Have the prey, predators, and objects spread out and arrange themselves within the empty space.
- Once the simulation begins, only the dolphin can move. Everyone else stands still in their place.
- The dolphin must now locate and "tag" its prey while avoiding its predators.
- The dolphin begins by calling out "click, click, click."
- Everyone else responds in unison by calling out their role: "prey," "predator," or "object."
- The dolphin can call out "click, click, click" as many times as it wants.
- The dolphin moves throughout the space until it has tagged all of its prey, or, until it tags a predator.
- Tagging an "object" has no effect on the dolphin. Once it "tags" prey, the prey stops calling out. (This simulates the dolphin having eaten its prey.) Once the dolphin stops hearing "prey" in response to its "click, click, click," the dolphin removes its blindfold to end the activity.
- If the dolphin tags a predator, the activity ends, as the dolphin has perished.
- With a small group, the activity should continue until the dolphin either perishes by tagging a predator or successfully tags all of its prey. With a larger group, you may want to set a time limit for the dolphin. Perhaps each student who takes a turn as the dolphin has just 5 minutes to feed.

THE FOLLOWING WEBSITES OFFER MORE INFORMATION ABOUT THE TOPICS EXPLORED IN WILD OCEAN.

Animal InfoBooks from SeaWorld
www.seaworld.org/animal-info/info-books
SeaWorld Adventure Parks offer a chance to see marine animals up close. Their educational outreach efforts include this collection of InfoBooks related to aquatic ecosystems and the species that inhabit them.

Environmental Protection Agency
www.epa.gov/cellphones
The EPA's "Plug-In to eCycling" program has identified a national network of partners for free recycling of unwanted cell phones.

Florida Museum of Natural History
www.flmnh.ufl.edu/Fish
The Ichthyology department at the Florida Museum of Natural History curates this online collection of resources for learning about marine biology. The Image Gallery, Biological Profiles, and Education areas of their website are particularly useful for extending your *Wild Ocean* experience.

KwaZulu-Natal Coast
wikipedia.org/wiki/KwaZulu-Natal_Province
Find out more about the KwaZulu-Natal Province of South Africa where the Wild Coast is located. It is along the province's shoreline that the Wild Ocean movie and the magnificent feeding frenzy take place.

MarineBio Conservation Topics
marinebio.org/Oceans/Conservation.
Ocean conservation can be a challenging subject for K-12 classrooms, particularly if you don't live near an ocean. This site provides some suggestions for getting started with a simple focus on how to consider the issues that impact the health and survival of Earth's oceans.

Monterey Bay Aquarium Conservation Programs
www.montereybayaquarium.org/cr
The Monterey Bay Aquarium in California suggests ways that you can get involved in protecting the oceans. Some activities are based along the California Coastline, but others are relevant no matter where you live.

NOAA Education
www.education.noaa.gov
The Education Office at the U.S. National Oceanic and Atmospheric Administration provides an educational gateway to its vast array of ocean-related resources.

Nokia
www.nokiausa.com/environment
Learn about how to recycle unwanted products for free.

Oceanlink
oceanlink.island.net
Provided by the Bamfield Marine Sciences Centre in Canada, Oceanlink offers a variety of resources for students and adults who want to learn more about marine biology.

SeaWeb Resources
www.seaweb.org/resources.php
Dedicated to preserving healthy oceans, SeaWeb publishes a monthly newsletter and other resources that can help you stay informed about happenings in ocean conservation science and activities.

SUGGESTED READING FOR CHILDREN AND YOUNG ADULTS

A SEA FULL OF SHARKS by Betsy Maestro and Giulio Maestro (1997) ISBN: 0590431013

ALL THE WAY TO THE OCEAN by Joel Harper (2006) ISBN: 0971425418

BENEATH BLUE WATERS: MEETINGS WITH REMARKABLE DEEP-SEA CREATURES by Deborah Kovacs and Kate Madin (1996) ISBN: 0670856533

COME TO THE OCEAN'S EDGE: A NATURAL CYCLE BOOK by Laurence P. Pringle (2003) ISBN: 1563977796

DIVE! MY ADVENTURES IN THE DEPP FRONTIER by Sylvia A. Earle (1999) ISBN: 0792271440

DOLPHINS by Sylvia M. James (2002) ISBN: 1590340108

EARTH'S WATER CRISIS: WHAT IF WE DO NOTHING? by Rob Bowden (2007) ISBN: 0836881540

JACQUES COUSTEAU by Lesley A. Dutemple (2000) ISBN: 0822549794

LIFE IN THE OCEANS by Lucy Baker (1999) ISBN: 1854340433

MARINE MAMMAL PRESERVATION by Peggy Thomas (2000) ISBN: 076131458X

MEETING DOLPHINS by Kathleen Dudzinski (2000) ISBN: 0792271297

OCEAN FOOD CHAINS by Emma Lynch (2007) ISBN: 0431119023

OCEANS: HOW WE USE THE SEAS by Dana Desonie (2007) ISBN: 0816062161

PENGUINS! by Gail Gibbons (2000) ISBN: 0439061326

SEA CRITTERS by Sylvia A. Earle (2000) ISBN: 0792255844

SEA SOUP: ZOO PLANKTON by Mary M. Cerullo (2002) ISBN: 0884482197

SEAS OF LIFE: OCEAN WORLD by BBC D iscovery Channel (2002) ISBN: 0606222758

SEASHORE LIFE ON ROCKY COASTS by Judith Connor (1993) ISBN: 1878244051

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STANDARDS CORRELATIONS

***Wild Ocean* supports the practice of formal science education in the following areas as outlined in the National Science Education Standards.**

CONTENT STANDARDS: K-4

CONTENT STANDARD A: SCIENCE AS INQUIRY

Activities meet this standard when students:

- Ask a question about objects, organisms, and events in the environment.
- Plan and conduct a simple investigation.
- Employ simple equipment and tools to gather data and extend the senses.
- Use data to construct a reasonable explanation.
- Communicate investigations and explanations.

CONTENT STANDARD C: LIFE SCIENCE

Activities meet this standard in part when students learn the following fundamental concepts and principles.

- Organisms have basic needs. For example, animals need air, water, and food; plants require air, water, nutrients, and light. Organisms can survive only in environments in which their needs can be met. The world has many different environments, and distinct environments support the life of different types of organisms.
- The behavior of individual organisms is influenced by internal cues (such as hunger) and by external cues (such as a change in the environment).
- An organism's patterns of behavior are related to the nature of that organism's environment, including the kinds and numbers of other organisms present, the availability of food and resources, and the physical characteristics of the environment.
- Humans depend on their natural and constructed environments. Humans change environments in ways that can be either beneficial or detrimental for themselves and other organisms.

CONTENT STANDARD F: SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES

Activities meet this standard in part when students learn the following fundamental concepts and principles.

- Resources are things that we get from the living and nonliving environment to meet the needs and wants of a population.
- Some resources are basic materials, such as air, water, and soil; and some resources are nonmaterial, such as quiet places, beauty, security, and safety.
- The supply of many resources is limited. If used, resources can be extended through recycling and decreased use.
- Changes in environments can be natural or influenced by humans.

CONTENT STANDARDS: 5-8

CONTENT STANDARD A: SCIENCE AS INQUIRY

Activities meet this standard when students:

- Identify questions that can be answered through scientific investigations.
- Design and conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze, and interpret.
- Develop descriptions, explanations, predictions, and models.
- Think critically and logically to make the relationships between evidence.
- Recognize and analyze alternative explanations and predictions.
- Communicate scientific procedures and explanations.
- Use mathematics in all aspects of scientific inquiry.

STANDARDS CORRELATIONS

***Wild Ocean* supports the practice of formal science education in the following areas as outlined in the National Science Education Standards.**

CONTENT STANDARDS: 5-8 CONT.

CONTENT STANDARD B: PHYSICAL SCIENCE

Activities meet this standard in part when students learn the following fundamental concepts and principles.

- Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical.
- Electrical circuits provide a means of transferring electrical energy when heat, light, sound, and chemical changes are produced.

CONTENT STANDARD C: LIFE SCIENCE

Activities meet this standard in part when students learn the following fundamental concepts and principles.

- All organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment.
- An organism's behavior evolves through adaptation to its environment. How a species moves, obtains food, reproduces, and responds to danger are based in the species' evolutionary history.
- A population consists of all individuals of a species that occur together at a given place and time. All populations living together and the physical factors with which they interact compose an ecosystem.
- Millions of species of animals, plants, and microorganisms are alive today.
- Biological evolution accounts for the diversity of species developed through gradual processes over many generations. Species acquire many of their unique characteristics through biological adaptation, which involves the selection of naturally occurring variations in populations. Biological adaptations include changes in structures, behaviors, or physiology that enhance survival and reproductive success in a particular environment.

CONTENT STANDARD D: EARTH AND SPACE SCIENCE

Activities meet this standard in part when students learn the following fundamental concepts and principles.

- Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.
- The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle.

CONTENT STANDARD F: SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES

Activities meet this standard in part when students learn the following fundamental concepts and principles.

- When an area becomes overpopulated, the environment will become degraded due to the increased use of resources.
- Causes of environmental degradation and resource depletion vary from region to region and from country to country.

CONTENT STANDARDS: 9-12

CONTENT STANDARD A: SCIENCE AS INQUIRY

Activities meet this standard when students:

- Identify questions and concepts that guide scientific investigations.
- Design and conduct scientific investigations.
- Use technology and mathematics to improve investigations and communications.
- Formulate and revise scientific explanations and models using logic and evidence.
- Recognize and analyze alternative explanations and models.
- Communicate and defend a scientific argument.

STANDARDS CORRELATIONS

***Wild Ocean* supports the practice of formal science education in the following areas as outlined in the National Science Education Standards.**

CONTENT STANDARDS: 9-12 CONT.

CONTENT STANDARD B: PHYSICAL SCIENCE

Activities meet this standard in part when students learn the following fundamental concepts and principles.

- Waves, including sound and seismic waves, waves on water, and light waves, have energy and can transfer energy when they interact with matter.

CONTENT STANDARD C: LIFE SCIENCE

Activities meet this standard in part when students learn the following fundamental concepts and principles.

- The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms.
- Organisms both cooperate and compete in ecosystems. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.
- Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite. This fundamental tension has profound effects on the interactions between organisms.
- Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.
- Like other aspects of an organism's biology, behaviors have evolved through natural selection. Behaviors often have an adaptive logic when viewed in terms of evolutionary principles.

CONTENT STANDARD D: EARTH AND SPACE SCIENCE

Activities meet this standard in part when students learn the following fundamental concepts and principles.

- Heating of earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents.
- Global climate is determined by energy transfer from the sun at and near the earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and the earth's rotation, and static conditions such as the position of mountain ranges and oceans

CONTENT STANDARD F: SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES

Activities meet this standard in part when students learn the following fundamental concepts and principles.

- Natural resources have been and will continue to be used to maintain human populations.
- The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and it depletes those resources that cannot be renewed.
- Human activities can enhance potential for hazards. Acquisition of resources, urban growth, and waste disposal can accelerate rates of natural change.
- Some hazards, such as earthquakes, volcanic eruptions, and severe weather, are rapid and spectacular.
- But there are slow and progressive changes that also result in problems for individuals and societies.

WILD OCEAN

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Wild Ocean tells the story of an unbelievable feeding frenzy that takes please each year in the oceans of South Africa as billions of sardines migrate up the KwaZulu-Natal Coast. The migration triggers an epic underwater struggle for survival as African Penguins, Cape Gannets, Cape Fur Seals, Sharks, Dolphins, and even Humpback Whales are drawn to the scene, suddenly finding themselves enmeshed in the web of predators and prey that determines if they eat—or get eaten.

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