# K-2ND

Teacher Resource Guide

## Introduction

- Delve into these activities and games to prepare your students for an animal encounter and engage them with new ocean topics!

## Contents



WAVE FOUNDATION AT NEWPORT AQUARIUM

**Science Standards:**

Kentucky Academic Standards (KAS)

K-LS1-1. Use observations to describe patterns of what plants and animals need to survive.

K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals and the places they live.

2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.

Disciplinary Core Ideas

LS1.A: Structure and Function

LS1.D: Information Processing

LS4.D: Biodiversity and Humans

Science and Engineering Practices

Analyzing and Interpreting Data

Developing and Using Models

Obtaining, Evaluating, and Communicating Information

Asking Questions and Defining Problems

Crosscutting Concepts

Patterns: Patterns in the natural world and human designed world can be observed, used to describe phenomena, and used as evidence.

Systems and System Models: Objects and organisms can be observed in terms of their parts.

NAAEE Guidelines

Strand 1A, Grades K-4: Questioning – Generate ideas and questions about objects, organisms, events, places, and relationships in the environment.

Strand 1E, Grades K-4: Organizing and analyzing information – Identify patterns and relationships in events, designs, organisms, and sets of numbers.

Strand 1F, Grades K-4: Working with models and simulations – Use models to summarize observations of the environment.

Strand 1G, Grades K-4: Drawing conclusions and developing explanations – Use models and examples to explain their thinking.

# TIDE POOL SCHOOL

Goal: Introduce tide pool animals and their adaptations used to survive in this ecosystem.

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**Useful vocabulary terms:**

Adaptation: the result of evolution; occurs when a gene mutates. This mutation makes it easier for the animal to survive and reproduce, and it passes the trait to its offspring.

Carnivore: an animal that solely relies on other animals for food.

Ecosystem: a biological community of organisms that interact with each other and their physical environment.

Herbivore: an animal that feeds on plants.

High tide: the state of the ocean tide when it is at its highest.

Low tide: the state of the ocean tide when it is at its lowest.

Observation: the action of looking or watching something or someone in order to gain more information.

Omnivore: an animal that eats both plants and meat.

Predator: an animal that eats another animal for food.

Prediction: a statement or guess about the future based on evidence or observation.

Prey: an animal that is eaten by another animal for food.

Scavenger: an animal that regularly consumes decaying animal flesh or plant matter.

Tide pool: a pocket of seawater that fills the intertidal zone at high tide and where water remains during low tide.

Activity #1

# Build a Tide Pool

- Introduction to ecosystem functions and water levels.
- Skills: using tools to construct a model, cause and effect

Adapted from: Tide Pool Science Experiment for Kids - Buggy and Buddy

Materials

- Tin dish pan
- Various rocks and pebbles
- Optional: sand
- Mini toy sea creatures, at least one for each student
- Water, enough to fill a majority of the dish pan

Activity Outline

1. It is best to start your students out with reading a book, such as *On the Seashore* by Anna Milbourne and Erica-Jane Waters. There is also a great Magic School Bus episode about tide pools (The Magic School Bus - Goes to Mussel Beach - Ep. 41 - YouTube).
2. Facilitate conversations with your students (questions found under *Teacher Background*). Have they learned about ecosystems before? Have they ever seen a tide pool in real life?
3. This activity can be done inside or outside. Have your students gather around you so that everyone can see and participate.
4. Assort the rocks and stones in the dish pan, ranging from smallest to largest.

5. Let each child choose a tide pool animal, and have them place is anywhere in the pan.
6. Once each child has placed their animal, talk about which animals are going to be covered with water first based off on their position. Ask if those animals would be able to survive without water. Could a fish survive out of water longer than a hermit crab?
7. Begin adding water slowly, one cup at a time. Have students make observations and talk about which animals will be covered with the water first.
8. Add water until every animal is fully submerged. Talk about how this represents high tide. Do your students know the difference between high and low tide?
9. Have your students make predictions about waves. What will happen when the water begins to move? Create waves by moving the pan from side to side. What are the students observing?
10. Before removing any water, talk about which animals are going to be exposed to air first. Talk about if those animals will survive without water when the tide becomes low.
11. Remove water until it is back to low tide. Talk about the different animals and how they can use their unique body parts to move from the bigger rocks to the smaller rocks? ("Does anyone want to talk about what adaptions their animal has that helps them move around tide pools?")

Teacher Background

When waves crash onto the shore, they leave behind many different animals before going back into the ocean. Those critters find homes in rock pools and sand holes. Sea animals, especially ones that live near rocky shores, have to deal with **low tides** and **high tides**. Sometimes the tide is high and the waves are bigger, or the tide is low and the waves are smaller. If the tide is high, more of the shore will be covered with water. This means that those animals living in tide pools are more fully submerged than if it was low tide. With changing water levels, animals are sometimes submerged in water, and sometimes out in the open air for long periods of time.

Discuss with your students:

1. What are some problems that tide pool animals may face?

When tide pool animals are swept out during high tide, they often times get stuck during high tide. In these periods, tide pool animals face many problems, the first being the sun. Without water, the sun can easily dry out these animals. Additionally, tide pool animals are more susceptible to predators when out of the water, especially birds of prey.

2. What are some tide pool animals you can think of?

Horseshoe crabs, small fish, sea stars, sea urchins, sea snails, sea cucumbers, octopuses, hermit crabs, mussels, clams, epaulette sharks, sand dollars, crabs, lobsters, more!

3. What is a predator? Are some tide pool animals predators of other tide pool animals?

A predator is an animal that naturally preys on others. For example, an orca is a predator of a penguin, and an alligator is a predator of small mammals! Some tide pool animals are carnivores (strictly meat-eating), therefore many tide pool animals would eat other tide pool animals! A horse conch, which is a type of sea snail, would definitely eat a mussel or clam! Epaulette sharks are one of the only species of sharks that can move on land, and are often found in tide pools. They love to snack on benthic crustaceans, such as small crabs.

<u>Tide Pool Animal Introductions and Adaptations</u>

Sea star: Commonly known as starfish, sea stars are one of the most abundant organisms in tide pools. Most sea stars have five arms, although some sea stars can reach up to 50 arms. They have the ability to regenerate- if they lose an arm, it has the ability to grow back. In a few cases, regeneration can create a whole new individual organism. Sea stars have very simple eyes that help them navigate their surroundings and detect shades of light. Just like a sea urchin, sea stars have a mouth on the bottom of their body, and use their tube feet lining the underside of their arms to move around. Out of the nearly 2,000 species of sea stars, most are carnivores and eat mollusks and small pieces of fish.

Sea anemone: Sea anemones may look like a plant, but they are in fact a marine invertebrate. Sea anemones are harmless to humans, except for the few species that are highly toxic. Some species are free-swimming, while most have a foot that attaches to hard surfaces in the water, making them sessile. They can, however, still use that foot to slowly move. Sea anemones have nematocysts (stinging cells) that they use to capture and paralyze prey, such as small fish and crustaceans. There are around 1,000 species of sea anemones.

Hermit crab: Hermit crabs are invertebrates with an exoskeleton that they molt to grow. They occupy empty scavenged mollusk shells to protect themselves. There are around 800 species of hermit crabs with a large range of size variation. They have jointed limbs, claws, eyes on stalks, and two sets of antennae. Hermit crabs are scavengers and omnivores; their diet includes small fish, worms, algae, and excess food particles- pretty much anything they can get their claws on.

Sea snail: There are tens of thousands of species of snails, ranging from land to freshwater to saltwater. Sea snails are under Class Gastropoda. Their soft body is protected by a shell in which they create themselves and remain in their entire life. Most species are herbivores; however, there is a lot of diet diversity within this group of animals, as some are omnivores

and even carnivores. Sea snails use their “muscular foot” to move and use a “radulus” to eat, since they do not have teeth. WAVE focuses on two specific species of sea snail: the Florida Fighting Conch and the Horse Conch.

Sea urchin: Sea urchins are globular echinoderms with a mouth on the bottom of their body called and Aristotle’s Lantern. They have a set of jaws and five teeth that are used to scrape algae off of rocks. They lack eyes, relying on their tubular feet to feel around. These tube feet are also useful for movement- they have suctions like tentacles, and are used to pull the organism from one place to the next. Sea urchins have spines surrounding their entire body- they can move each spine individually, almost as if we could move every single hair on our head! There are around 950 species.

Horseshoe crab: Despite the name, horseshoe crabs are not a species of crab. They are, however, in the phylum Arthropoda, meaning they are more closely related to spiders and scorpions. Horseshoe crabs have five pairs of jointed legs and a shell made of chitin. There are four extant species found in North America along the Atlantic and Gulf coasts. Horseshoe crabs mainly eat worms and clams, however they will sometimes go for algae. Fun fact: they can lay up to 88,000 eggs annually!

Fish: There are many species of fish that have adapted to intertidal marine ecosystems. Some examples of bony fish that are adapted to the tide pool environment includes sculpins, opaleyes, northern clingfish, and monkeyface eel. One species of shark that has adapted to tide pools is the epaulette shark. They use their pectoral and pelvic fins to crawl around the sea floor and over rocks though the tide.

Activity #2

# Interactive Tides

- Introduction to life in a tide pool.
- Skills: crafting, constructing

Adapted from: Interactive Tides Activity – youvegotthismath.com

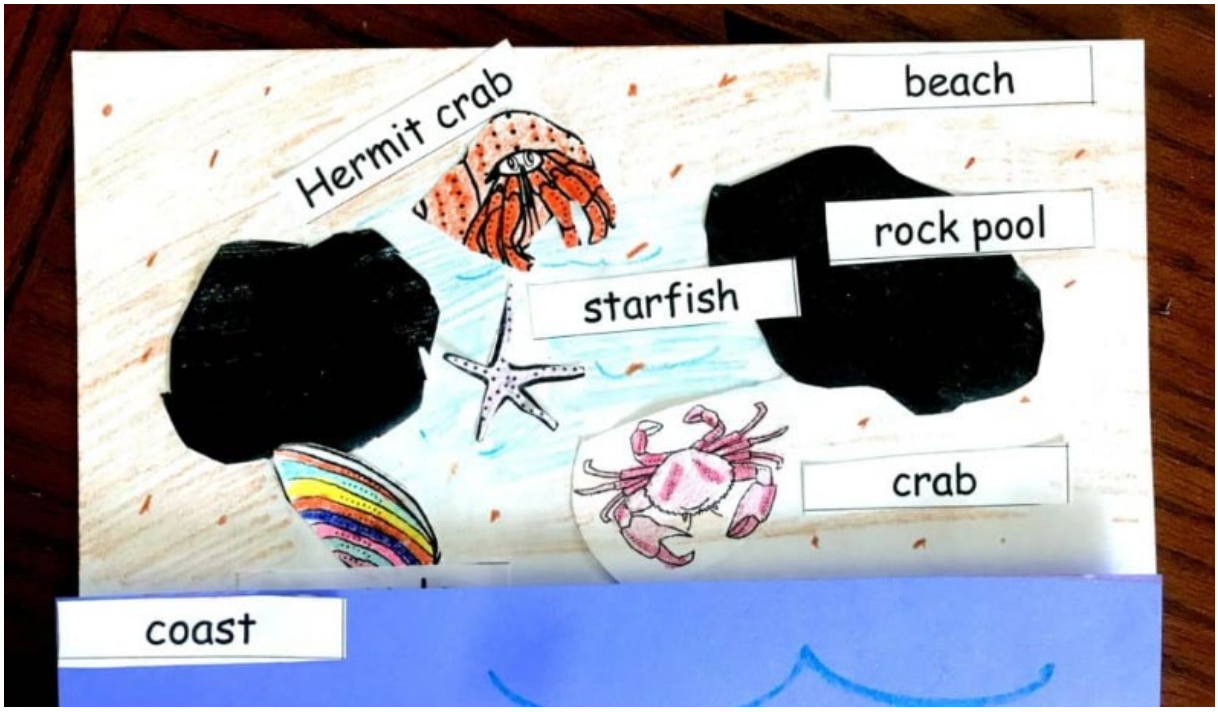
This activity can be either part of an interactive notebook, or an individual activity. Interactive notebooks are a great way to keep learners engaged in a specific topic; in this case, tide pools.

Materials

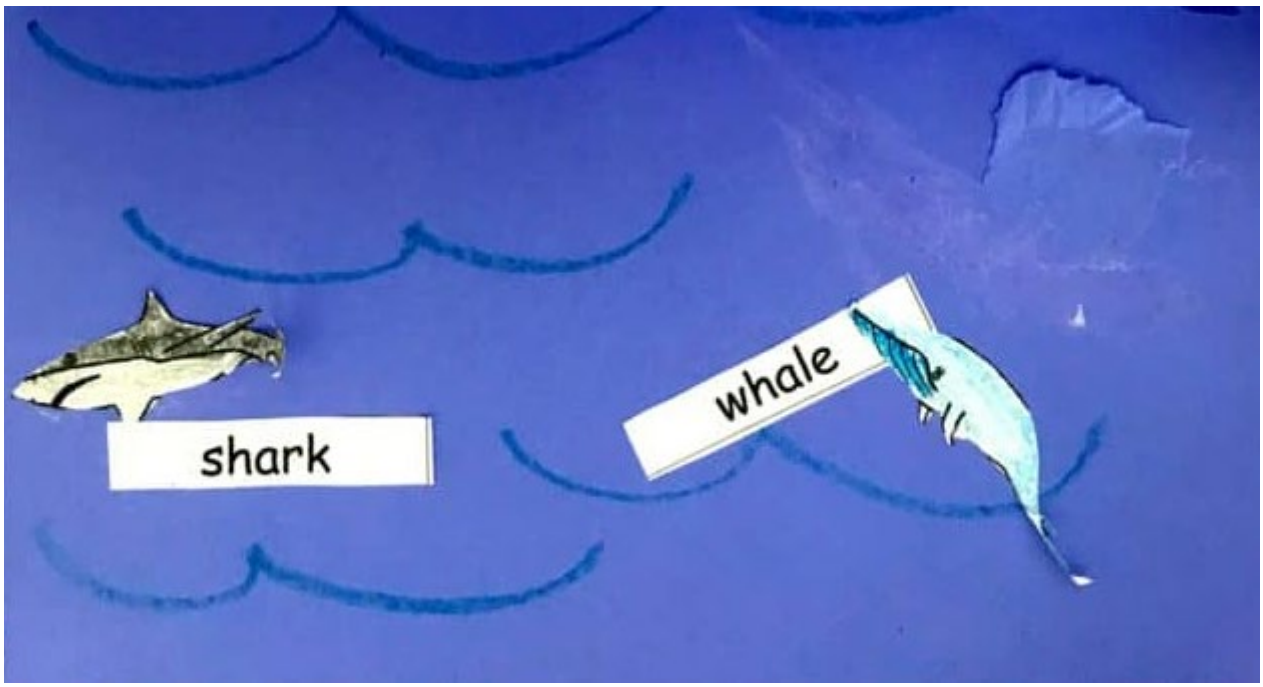
- Printable sheets on page 11
- Crayons
- Scissors
- Glue sticks
- Optional: tape
- Black, white, and blue paper

Activity Outline

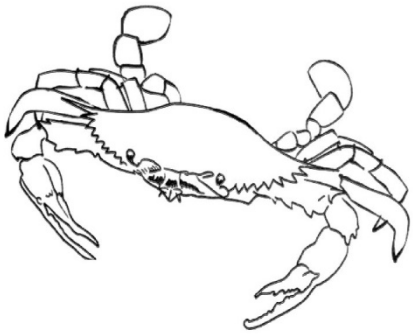
1. Print off the activity sheet that is on page 11; there should be one per student.
2. Gather all supplies, including crayons, scissors, glue sticks, black paper, white paper, and blue paper.
3. On the printable, allow the students to color the ocean creatures.
4. Use the black paper to cut out “rocks”. These can be circles, triangles, rectangles, or any rock-like shape.
5. Allow the students to cut out the ocean creatures and the names, and sort them with their coordinating names. Students may need help both with cutting and sorting.
6. Work together to sort the animals. For example, you wouldn’t find a whale in a tide pool, but you would find a sea star in a tide pool. Sorting in advance will come in handy when it is time to glue.
7. Attach the white sheet of paper and the blue sheet of paper side by side using either glue or tape. Encourage students to use a brown or tan crayon to create a sand effect on the white paper. They can also use a blue crayon to create the tide pool.

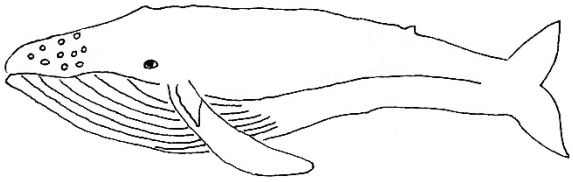


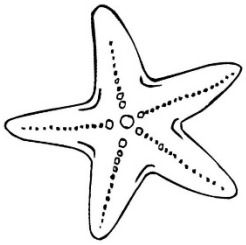

8. Once the white and blue sheets of paper are attached, the sand and tide pool is colored on, and the rocks are glued, it is time to add the animals and the labels. It is encouraged to add the *coast*, *rock pool*, *beach*, and *tide* label first, and then add the animals and their labels. The crab, hermit crab, starfish, and mussel all belong on the beach or in the tide pool. The whale and shark belong in the ocean. The octopus and eel, however, can be found both in the ocean and a tide pool, so it is up to the learner where they position those two animals.

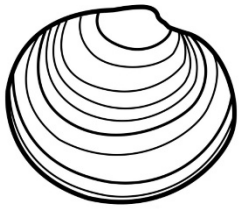


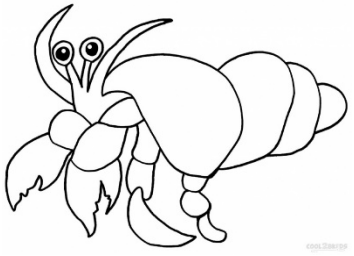
| | | |
|---|---|---|
| COAST | TIDE | ROCK POOL |
| WHALE | CRAB | HERMIT CRAB |
| BEACH | STARFISH | MUSSELS |
| OCTOPUS | SHARK | EEL |

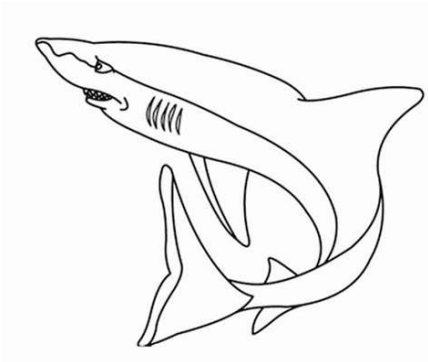


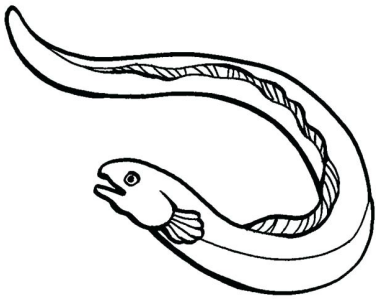


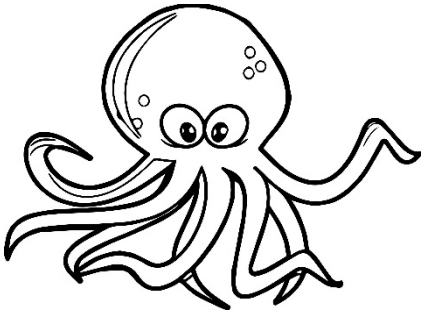












Activity #3

# Predator Prey

- Introduction to predator-prey interactions.
- Skills: motor

Adapted from: Project Wild curriculum book

Materials

- Food tokens (pieces of cardboard)
- Labeling devices to mark predators (5 bandanas)
- Chalk to mark corners of playing field (optional: cones)
- Temporary shelter (4 hula hoops)

Teacher Prep

Find a piece of cardboard and cut out multiple circular pieces. There should be three food tokens per student.

NOTE: This game is best played outdoors at a large, flat space.

Activity Outline

Background: Ask the students if they can define *predator* and *prey*. Ask the following questions for further discussion:

1. Are predators bad? Why or why not?
2. What happens to an ecosystem if predators are removed?
3. Are humans predators?

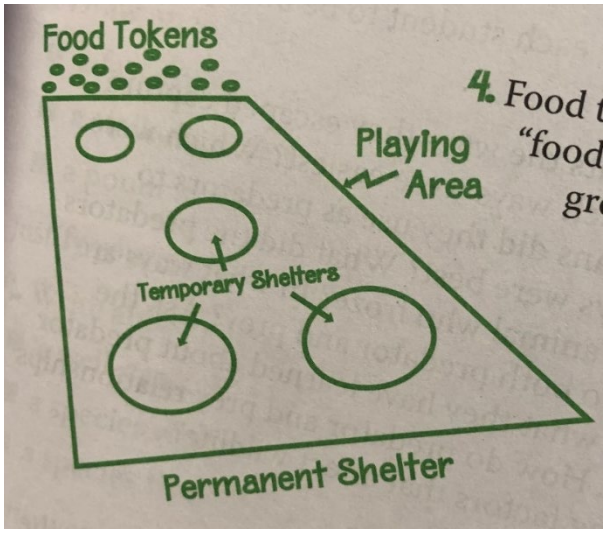
Let them answer these questions and discuss their thoughts.

1. Below is a list of tide pool animals that are considered predators in their ecosystem. Call out each animal one by one; after saying each animal, tell the students to raise their hand if they *think* that animal is a predator. Tell them to put their hands down, and ask them to raise their hands if they *do not think* the animal is a predator.
    - Sea star (starfish)
    - Sea snake
    - Epaulette shark
    - Hermit crab
    - Sea cucumber

- Octopus
- Sea urchin
- Eel
- Horseshoe crab

Most people understand that octopuses and epaulette sharks are fierce predators, but it is a new concept to many that small animals like hermit crabs and sea stars are considered predators, as well. Tell the students that all of the animals that were just called out are all considered marine predators. Talk to the students about why this might be. Explain that actively hunting out and killing another animal for food is considered predation.

2. Explain that animals display a variety of behaviors in predator prey relationships. Some prey behaviors include signaling to others, swimming away, posturing in a fighting position, scrambling for cover, or even "freezing" on the spot to escape detection or capture by the predator. This kind of behavior exhibited partly depends on how close the predator is when detected by the prey.
3. Now it is time for the game! Identify students as either "predators" or "prey". With however many students are participating, making ¼ of them predators. For example, if there are 20 students, 5 of them should be predators. Use the bandanas to identify the predators.
4. Use the chalk to identify the edges of the playing field. The food tokens are placed on one end of the playing field, and identify the other side as the permanent shelter for the prey.
5. Place the hula hoops throughout the playing field. These will act as temporary shelters.



6. The game will begin when the teacher yells “GO!” When the round starts, the prey begin moving from the permanent shelter. The goal of the prey is to move from the permanent shelter to the food source, collecting one token at a time each trip and returning it to the permanent shelter. To survive, each prey must obtain three food tokens.
7. The prey have two ways to prevent themselves from being caught: They can “freeze” any time a predator is within 5 feet of them, or they may run to cover (temporary shelters, at least one foot in the hula hoop). Frozen prey may blink, but need to be completely still otherwise. Remind the prey that they can remain frozen for as long as they would like, but if they do not have enough food at the end of the activity, they will starve.
8. The goal of the predators is to “capture” their prey by tagging them. They can only tag prey that is not “frozen” and is not in a temporary shelter.

NOTE: Establish a ground rule for student behavior. No pushing, hitting, or shoving. Behave in ways that are not harmful to other students, even when simulating predator behavior.

9. Set a time limit of seven minutes for each game, playing either four or five rounds (however many time permits). Make sure each student has the opportunity to be a predator.

<u>Post-Activity Assessment and Discussion</u>

Discuss with the students the ways they escaped capture when they were prey. Which ways were easiest? Which were more effective? What means did they use as predators to capture prey? Which ways were best? What did the predators do in response to a prey animal who froze? Do adaptations play a role in predator prey relationships?

Ask the students to summarize what they learned from this game.

# PENGUIN PALS

Goal: Explore the amazing adaptations that make penguins different from other birds.

**Useful vocabulary terms:**

Adaptation: behavior characteristic or body structure produced over millions of years of evolution developed to increase survival and reproduction rates.

Camouflage: also known as cryptic coloration, a defense mechanism that animals use to disguise their appearance.

Countershading: a form of camouflage; the animal's dorsal side is dark and its underside is light. Countershading is found in alligators, penguins, sharks, and many other aquatic animals.

Crustacean: a mostly aquatic arthropod with a chitinous exoskeleton, such as crabs, lobsters, shrimp, or barnacles.

Hatching: the process of the breaking of the egg shell in which the animal will exit the egg.

Incubation: the process of keeping eggs warm and safe while the embryo develops until hatching occurs.

Monogamy: a mating system in which an animal will have a single partner throughout their reproductive season.

Overfishing: the depletion of fish populations in a body of water due to an unnecessary and excessive amount of fishing.

Piscivore: a carnivorous animal that primarily feeds on fish.

Predator: an animal that eats another animal for food.

Preening: a bird straightening or cleaning feathers with its beak.

Prey: an animal that is eaten by another animal for food.

Uropygial gland: also known as the preen gland, is an organ located on the back of the tail that secretes an oily substance. Penguins will spread the oil on their feathers to make themselves waterproof.

Activity #1

# Waterproof Penguin

- How do penguins stay dry in freezing weather and cold water?

Adapted from: How Do Penguins Stay Dry? Penguin Science Experiment – abcsofliteracy.com

Materials

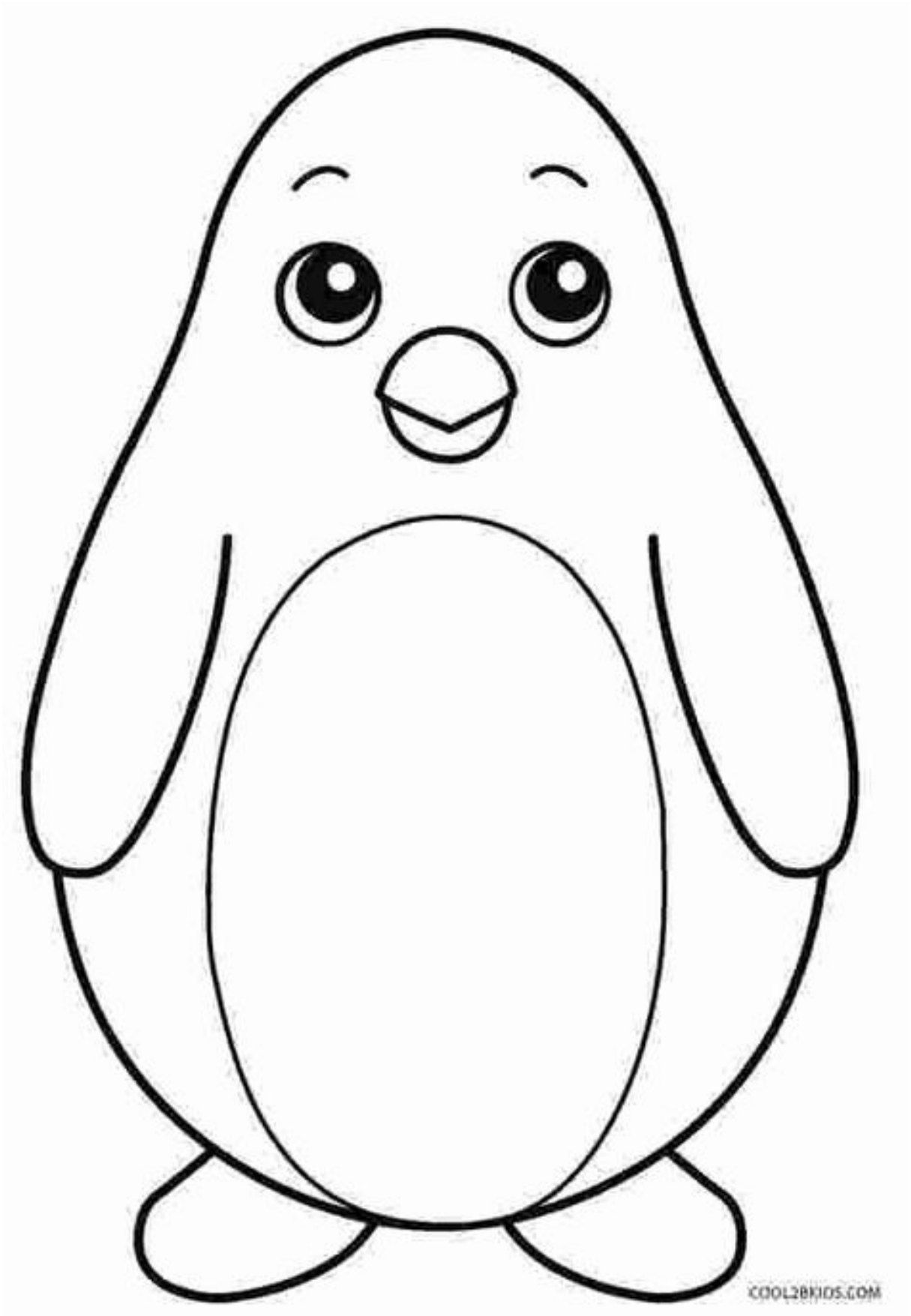
- Picture of the penguin on page 19 on white cardstock, one for each student
- Crayons
- Spray bottle with water
- Optional: blue food coloring
- Artificial feathers
- Glue

Activity Outline

1. Penguins don't use their wings to fly, they are simply too heavy. Penguins, instead, use their wings, or flippers, to swim through the water. Penguins have evolved many adaptations to keep themselves warm in harsh weather conditions. Talk to students about these adaptations found in the *Teacher Background* section.
2. Using the white cardstock, students can either draw their own penguin or color in the provided outline. This activity requires crayons, and no other coloring utensil should be used.
3. When students are coloring, remind them to **leave no white space**. The goal of this activity is to show how oil (wax) can be used to keep a penguin waterproof, so the more crayon, the better. If students want part of their penguin to be white, have them color that space with a white crayon. Encourage students to glue on feathers, as well!
4. Once the students are finished and their penguins are 100% covered in crayon, spray each penguin with water in a spray bottle. Wait until all glue is dry before spraying water. The blue food coloring is optional, but helps show where the water is on the penguin and how it drips off the paper versus soaking in.
5. Explain the concept of "waterproof" to students. Penguins have a gland on their tail that they use to spread oil all over their body. Using vegetable oil in addition to crayons is another way to show that their feathers keep water away from their skin.

Teacher Background

Penguins have multiple adaptations that help keep them warm in rough weather and in the water. The first useful tool is their feathers. All penguins have two layers of feathers: the downy layer which acts like a winter coat keeping the penguin warm, and the top waterproof layer that keeps the penguins water resistant as they swim through the water. In the wild, penguins spend about 75% of their time in the water, so it is important that they are able to keep warm and stay dry. They have thousands of feathers that are tightly packed together, helping keep water off of the skin. In addition, penguins have an oil gland near the end of their tail called an uropygial gland. This gland produces preening oil in which the penguin uses its beak to spread all over its feathers. This oil prevents water from getting through their already tightly packed feathers. A good reserve in fat helps reduce heat loss, especially in cold-weather species.


COOL2BKIDS.COM

Activity #2

# Pledge to Penguins

- Make a promise to help save penguins!

This activity is a great way to end the day or week following a penguin program. The students have learned some awesome facts about penguins and cool conservation tips.

Before signing a pledge, review with your students key points and actions mentioned during the program. Penguins play a key role in their ecosystem, and the environment would suffer without them. There are ways that humans may be negatively impacting our penguin populations directly and/or indirectly. This includes, but is not limited to, overfishing, habitat destruction, oils spills, and marine pollution. Although we may be far away from the ocean, there are actions we can take to prevent or lessen these impacts from landlocked states! Some easy actions we can take are:

- Make sure we throw our trash away and are not littering. We can also clean up trash if it is safe to pick up. This helps keep trash pollution out of local waters that are connected to our oceans.
- We can recycle if available.
- Use reusable items instead of single use plastics to reduce the amount of trash we produce.
- Try to eat fish/seafood that is caught sustainably. There is an app called ‘Seafood Watch’ that explains which fish are safe and sustainable to eat.
- Educate others! The more people know about penguins, the more they care, and the more than can do to help them.

These actions are easy, affordable, and helpful! Now, they can make a pledge to take action! Print off the pledge on page 20 and hand one to each student. With the help of their teacher, they will write their name and even stamp their thumb print on the penguin to pledge to protect penguins.

There are more warm-weather penguins than cold!

Penguins have 2 pairs of eyelids!

Penguins have webbed feet!

# My Penguin Pledge

I pledge to do my best to protect our penguins! I will treat my environment with respect because I know it affects the rest.

Name: _____

Thumb Print Here!

There are around 18 species of penguins!

A penguin's diet mostly consists of fish!

All penguins live in the Southern Hemisphere!

Penguins' wings are called flippers!

Penguins poop every 10-15 minutes!

Activity #3

# Rock Hoppers

- How do penguins hunt for their food?
- Skills: motor, teamwork

Adapted from: PE Games: Cross the River (thepespecialist.com)

Rock hopper penguins are one species of penguin out of the 18 species. Can you guess how they got their name? They are known for hopping across rocks along the shore. Although their absolute favorite food is fish, they enjoy the occasional crustacean as well. They have long sharp beaks that are able to break through the tough shells of crabs, lobsters, and more. Crabs are an easy meal for rock hoppers, as they often do not need to get in the water to catch one and risk being eaten by an aquatic predator, such as sharks. During this activity, students are going to put their rock hopping and team work skills to the test.

Materials

- Spot dots (or any circular, flat surfaces that can stick to the floor)
- Something to represent a crab (could be toy animals, balls, etc.)
- A mat or bags of sorts (needs to fit two kids standing on it)
- Masking or duct tape

Activity Outline

1. Split students into teams of four or five.
2. Each team will get the same number of spot dots as students in their groups (four spot dots if there are four students, etc.) and a mat. Set up each team by placing the mat down with the four spot dots lined up.
3. Have the players start behind the mat. Use a piece of tape behind the mat to indicate the starting point. On the other side of the room, or wherever the obstacle will end, place a piece of tape to indicate the ending point. In addition, place the crabs near the end.
4. When the game begins, players must have both feet on a spot dot or the mat once they cross the starting line. The spot dots are considered the rocks, and the goal is that the students (the rock hoppers) must stay on the rocks to avoid the surrounding waters and any aquatic predators. If at any point the students do not have both feet on a rock, the whole team must start over and go back to the starting point.

5. Students are allowed to move the spot dots or mat if no one is standing on it. This way, they can move it in front of them to hop forward and get across.
6. Once the whole team has made it to the other side, meaning no rock hopper is left in the water, they may grab the crab and begin to cross back over.
7. The team that makes it back to the starting point with their crab wins!

Post-Activity Discussion

Ask the students their thoughts about this activity. Did they have a hard time moving from rock to rock? Do the students think penguins might struggle as a group to hunt for food? How else might penguins try to avoid predators?

# AQUATIC

Includes: Shark Tales and Stingray Studies

Goal: Introduce sharks and stingrays as fish and explore various species.

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**Useful vocabulary terms:**

Adaptation: behavior characteristic or body structure produced over millions of years of evolution developed to increase survival and reproduction rates.

Ampullae of Lorenzini: sensory receptors in the head of sharks and other cartilaginous fishes that detects electrical pulses in the water.

Buoyancy: the force that allows an object to float or ruse when submerged in a liquid.

Camouflage: also known as cryptic coloration, a defense mechanism that animals use to disguise their appearance.

Carnivore: an animal that solely relies on meat for food.

Cartilage: connective tissue forming the skeleton of sharks, rays, and skates.

Countershading: a form of camouflage; the animal's dorsal side is dark and its underside is light. Countershading is found in alligators, penguins, sharks, and many other aquatic animals.

Filter feeder: an aquatic animal that feeds on suspended nutrients in the water, such as plankton.

Herbivore: an animal that feeds on plants.

Hypothesis: a proposed explanation of a phenomenon.

Lateral line: a system of tactile sensory organs that is unique to aquatic vertebrates; detects movement and pressure changes in the water.

Omnivore: an animal that eats both plants and meat.

Predator: an organism that obtains food by the capture and killing of other organisms.

Prey: an animal that is hunted or killed by another for food.

Venomous: an animal that is capable of injecting venom by a bite or sting.

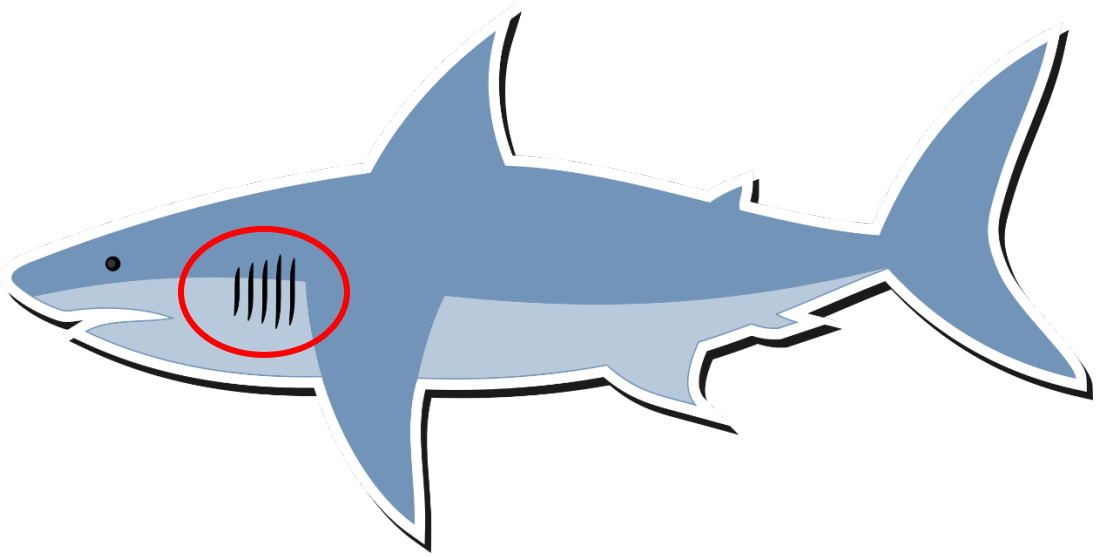
Activity #1

# How Do Gills Work?

- Introduction to breathing mechanisms of fish and how it differs from mammals.

Adapted from: www.littlebinsforlittlehands.com

A marine biologist is someone who works with and studies animals that live in the ocean. Many marine biologists study sharks and rays, which are types of fish! Fish can breathe underwater using their gills. Keep in mind that water, also known as $H_2O$, is made of two hydrogen atoms and one oxygen atom. Mammals, such a humans, have lungs that require oxygen the same way that fish have gills that require oxygen. In order to breathe, sharks and rays either take in water through their mouth to pump over their gills or they can pump their gills which helps water filter through.



How it works: As water moves through the fish gills, oxygen from the water is captured in the bloodstream where it can then be transported throughout the body.

Fun fact! All sharks have ten or more gills! If a fish has less than ten gills (five on each side), it is most likely not a shark.

Materials

- Warm water
- Coffee grounds (1 tablespoon)

- Spoon
- Coffee filters
- 2 clear cups
- String or hair tie

Imagine that the coffee grounds are oxygen and that the coffee filter is a fish gill!

Activity Outline

1. Add warm water to one of the clear cups. Next, add in a tablespoon of coffee grounds and mix.

2. With the second clear cup, place the coffee filter upside-down over the top and secure with the hair tie.

3. Pour the water and coffee mixture over the top of the coffee filter.

4. Observe what happens. You should notice that the coffee filter was able to catch all of the coffee grounds.

What does this tell us?

This experiment shows how sea water (represented by the coffee/water mixture) is pushed through the gills of the shark (coffee filter) to capture oxygen molecules so the shark can breathe (coffee grounds).

Post-Activity Assessment and Discussion

1. How many gills do sharks have?

ANSWER: Sharks have 10 gills, 5 on each side. There are a few species of sharks that have 12 to 14 gills, but it is not as common.

2. What are other characteristics of sharks and rays that make them fish?

ANSWER: In addition to gills, all sharks and stingrays have scales and fins. These are characteristics that all *fish* have in common.

3. Are fish cold-blooded or warm-blooded?

ANSWER: Most fish are cold-blooded, meaning they have no internal body temperature and they rely on a constant supply of oxygen from the water. This is also true for sharks. However, there are some species of fish (including sharks) that have evolved warm-bloodedness. There are many reasons for this, the most prevalent being that they need to be able to control their body temperature. Scientists have concluded that warm-blooded fish are faster and more powerful than cold-blooded fish because they possess warmer muscles.

Activity #2

# Buoyant Sharks

- Explore why sharks don't sink in the water.

Adapted from: www.seadeepni.org

This experiment illustrates how sharks have adapted to maintain buoyancy in marine environments. We know that **gravity** is a force that pulls objects down towards the Earth. If we didn't have gravity, we would all be floating in space. Gravity works on both land and sea. However, sharks are not pulled to the bottom of the seafloor. They maintain **neutral buoyancy**, which is when an object has a buoyancy that allows them to neither sink nor rise.

Materials

- Large, clear bowl
- 2 bottles (of the same volume)
- Water
- Vegetable oil
- Towel (to clear any spills)
- Pen
- Paper

Activity Outline

1. Fill the bowl and one of the bottles with water. Fill the other bottle with vegetable oil.
2. Let each student feel both of the bottles. Allow them to hold one bottle in one hand, and the other bottle in the other hand. Ask: Do they feel the same? Do they feel different? Do you think they will both float? Both sink? Why or why not?
3. As a group, come up with a hypothesis. Ask the students what they think will happen and write it on the board. (A hypothesis is a proposed explanation for an observation). Alternatively, you can help the students write out their own individual hypotheses.
4. Test each bottle by placing them one by one in the bowl of water. Have the students make observations.
5. Did the bottle of water float or sink? Did the bottle of oil float or sink? Write the results on the board, or next to the hypothesis.

Post-Activity Discussion

The bottle of water should have sank to the bottom of the bowl, while the bottle of oil floated to the surface. This is because the oil is less dense than the water, meaning the water is heavier than the oil. Oil will float on top of water.

What does this have to do with sharks?

Think of the shark having that bottle of oil in their stomach. Sharks have a large oily liver (an organ in their body) that enables them to be neutrally buoyant and not sink to the ocean floor.

Activity #3

# Measure the Ocean

- Discover the size of different shark and ray species.
- Skills: measurements

This is a fun and easy way to get students outside and practice their measuring skills.

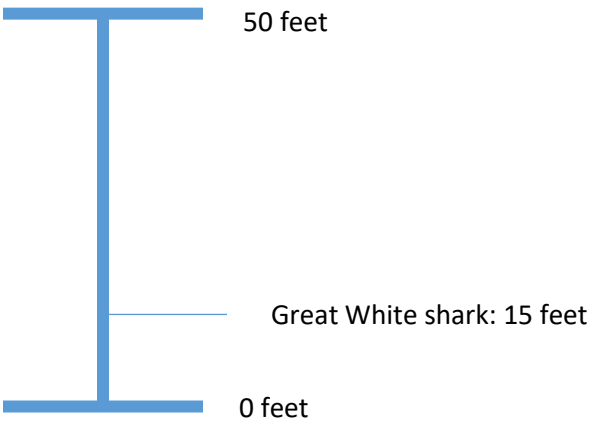
Did you know there are over 500 species of sharks and around 600 species of rays? From Dwarf sharks to Great Whites to Manta rays, all sharks and rays are predators. This activity uses a measuring tape to see just how small the smallest shark is, how big the biggest shark can get, and everything in between!

Materials

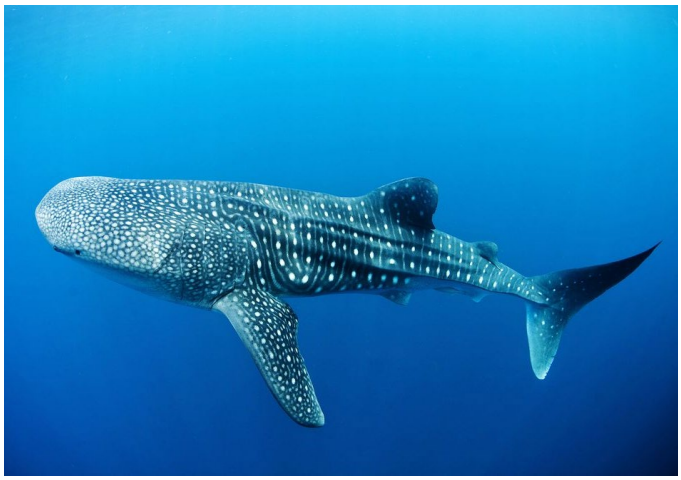
- Chalk
- Large measuring tape
- Shark and ray cards (pages 31-36)

Activity Outline

1. Print out the cards located on pages 31-36 and fold them in half.
2. Find a space outside that can measure out of 50 feet.
3. Have one student volunteer walk to the 50 foot mark on the measuring tape and mark it on the ground with chalk. There should now be a line at the 0 foot mark and the 50-foot mark.
4. Each student will take a turn picking out one of the cards which will name a species and its average length. Help the student measure out where their shark or ray fits on the 50-foot line. Once they have measured out the length of the animal, they can write the name of the species on the ground with chalk.



When kids think about sharks, they usually think about large hammerheads and tiger sharks. Ask them if they know that over 80% of sharks are four feet or smaller. In addition, not all rays have the ability to sting; many of the larger species do not have the barbs that allow them to sting. This activity is a great way to talk about the diversity among sharks and rays. Now that they have learned the many different species, ask them if they now have a new favorite.



**Whale shark**

Average length: 40 feet

Whale sharks are not only the largest shark species, but they are the biggest fish in the world.

**Dwarf Lanternshark**

Average length: 6 inches (0.5 feet)

Dwarf lanternsharks are the smallest shark in the ocean, and live in total darkness. They were given their name due to their ability to glow in the dark.

**Basking shark**

Average length: 26 feet

Although basking sharks are fairly large, they are considered filter feeders. They can filter up to 4,000,000 pounds of water every hour.

**Coral catshark**

Average length: 1.5 feet

Coral catsharks have elongated pupils, just like cats – this helps them see in the dark so they can hunt at night.

**Tiger shark**

Average length: 16 feet

Tiger shark pups are born with vertical stripes on their body; as they grow older, the stripes fade and become almost invisible.

**Common Thresher shark**

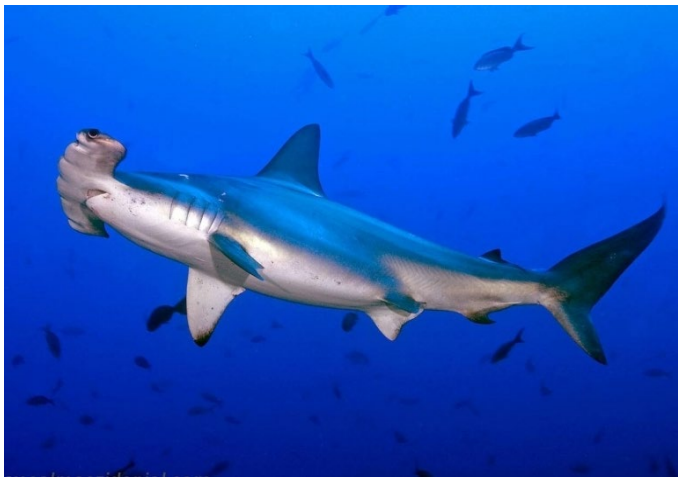
Average length: 18 feet

Common thresher sharks are the largest species of thresher – they can reach up to *20 feet*, half of that length being their long caudal fin used to stun their prey.

**White shark**

Average length: 15 feet

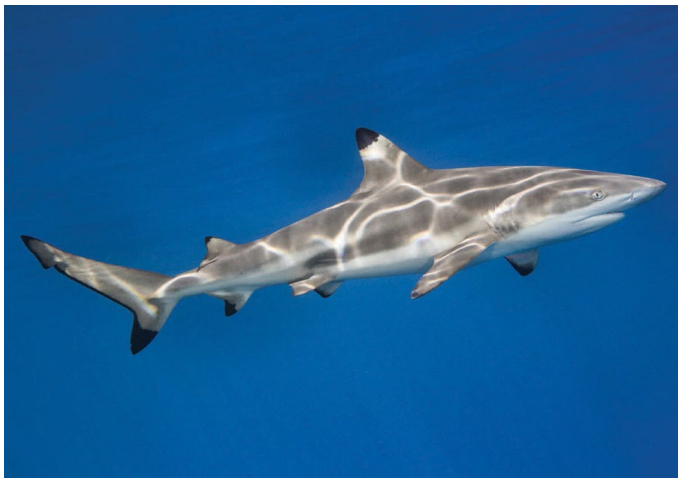
Commonly known as Great white sharks, these fish play a special role in keeping prey populations in balance, especially elephant seals and sea lions.



**Great Hammerhead shark**

Average length: 12 feet

By locating prey with Ampullae of Lorenzini, these sharks use their "hammer" head to pin stingrays and other prey to the ocean floor.



**Blacktip reef shark**

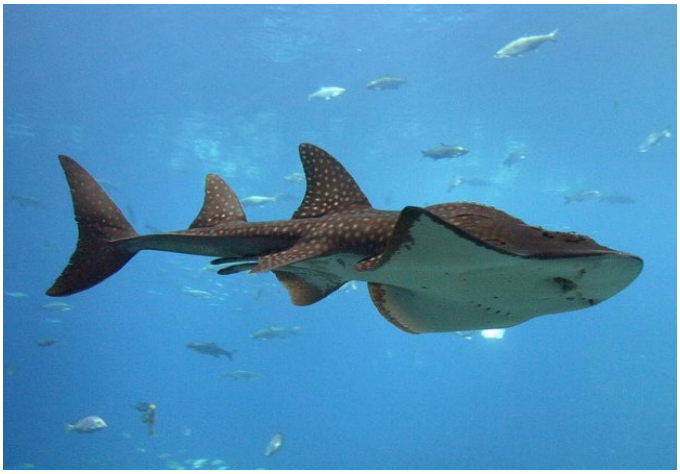
Average length: 5 feet

Because Blacktip reef sharks spend most of their time near the coast, they commonly encounter humans in the water. While they are not aggressive sharks, they are protective of their food and their young.

**Epaulette shark**

Average length: 3 feet

Epaulette sharks are the only shark species that can be found in tide pools; they can survive without oxygen for an hour in low-tide conditions.



**Shark ray**

Average length: 8 feet

Shark rays are critically endangered in the wild, and are part of a Species Survival Plan here at Newport Aquarium. They are more closely related to stingrays than sharks.

**Bull shark**

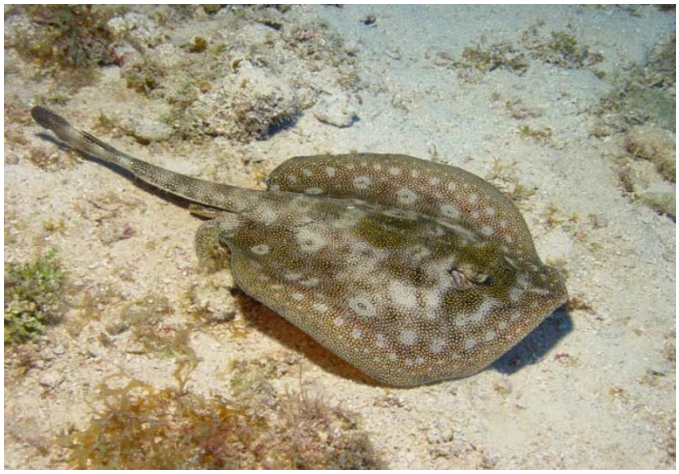
Average length: 11 feet

Bull sharks are one of the only shark species that can survive in freshwater for long periods of time. These sharks have a special gland that filters excess salt from their blood and releases it through their urine.

**Manta ray**

Average wingspan: 22 feet

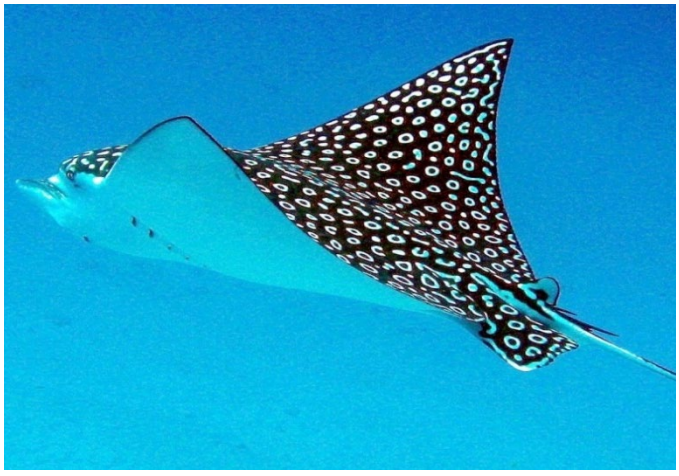
The largest recorded manta ray was 30 feet long! They are the largest species of ray and despite their size, they are completely harmless to humans.



**Yellow stingray**

Average wingspan: 2 feet

Yellow stingrays have a 360-degree vision thanks to their periscopic eyes. This comes in handy when they are looking out for predators!



**Eagle ray**

Average wingspan: 10 feet

They have a unique pattern on their back, which is why they are often called spotted eagle rays. No two eagle rays have the same pattern, it's like a fingerprint!

**Giant Devilray**

Average wingspan: 8 feet

Similar to whales, giant devilrays will jump (breach) out of the water, several feet above the surface. The reason for why they do this is unknown.

**Cownose ray**

Average wingspan: 4 feet

Cownose rays are almost always swimming, as they are very active. When threatened, they can sting with their barbed tail, which is mildly venomous.

**Teacup stingray**

Average wingspan: 8 inches

Also known as the reticulated stingray, this group of freshwater stingrays are one of the smallest recorded species. They are found in the Amazon River, and other tropical rivers of South America.

# REPTILE ROUNDUP

Goal: Explore the characteristics that set apart reptiles from other animals.

**Useful vocabulary terms:**

Camouflage: also known as cryptic coloration, a defense mechanism that animals use to disguise their appearance.

Carnivore: an animal that feeds on flesh.

Countershading: a form of camouflage; the animal's dorsal side is dark and its underside is light. Countershading is found in many reptiles, as well as sharks, penguins, and other aquatic animals. The colors are meant to counter the shade of the water.

Ectothermic: also known as cold-blooded, an animal that relies on its external environment for body heat.

Endothermic: also known as warm-blooded, an animal that is dependent on the internal generation of heat.

Herbivore: an animal that feeds on plants.

Omnivore: a person or animal that eats both plants and meat.

Plastron: the bottom of a turtle's shell structure.

Predator: an organism that obtains food by the capture and killing of other organisms.

Prey: an animal that is hunted and killed by another for food.

Reptile: air-breathing vertebrates covered in special skin made up of scales, bony plates, or a combination of both. Reptiles include turtles, snakes, crocodilians, and lizards. They are cold-blooded and lay eggs.

Semiaquatic: an animal living partly on land and partly in water.

Terrestrial: of or relating to the earth and its inhabitants.

Tortoises: a type of turtle, typically an herbivore that is found on land.

Turtles: a slow-moving reptile, enclosed in a scaly shell into which it can partially or fully retract its head and legs.

Activity #1

# Cold-Blooded Critters

- Evaluate ectothermic vs. endothermic.

Adapted from: Tulsa Zoo Education Department

The goal of this experiment is it help young learners understand what ectothermic means – how reptiles raise or lower their internal body temperature based on need.

Teacher Background

The terms “ectothermic” and “cold-blooded” are often interchanged. Reptiles cannot produce their own body heat and rely on their external environment to heat themselves up or cool themselves down. Because reptiles are cold-blooded, you will often find them basking out on rocks under the sun. The internal body temperature of a reptile affects their metabolism, and most reptiles do not eat everyday if their body temperature is cooler. Because they use their external environment to provide heat for their body, it is not necessary for reptiles to burn food energy to produce body heat.

Background

Ask the students if they have ever worn a dark colored shirt on a hot day? Did the shirt make it feel hotter outside than it actually was? What about wearing a white shirt? Do lighter shirts make it feel cooler outside? Darker colors allow for more heat to be absorbed. Have them think about American alligators. Their scales are a dark green/brown, which allows them to warm up quicker when basking in the sun.

Materials

- Two pieces of paper, one black and one white
- Lamp(s) with incandescent light bulb
- Ice cubes (same size)
- Timer
- Optional: thermometer(s)

Activity Outline

1. Set up the lamp(s) and place the pieces of paper underneath, both the white and black piece. If thermometers are being used, place one on each piece of paper.

2. Have the students guess what they think will happen to an ice cube if placed on each piece of paper. The white paper? The black paper? Explain that they are making a hypothesis.
3. Next, place an ice cube on each piece of paper and turn on the lamp(s). Start the timer.
4. For 10 minutes, have the students make observations. These observations can be written down on the board. What happens at 3 minutes? What happens at 5 minutes?
5. After 10 minutes, have the students remember their guesses/hypotheses. Were they correct?

<u>After-Activity Discussion</u>

Recall with students what the definition of cold-blooded, or ectothermic, is. Which piece of paper absorbed the heat faster? The ice on the black sheet of paper should have melted quicker than the ice on the white sheet of paper. The black sheet of paper represents reptiles, or cold-blooded animals. They can absorb heat quicker because they rely on it for energy. Humans and other mammals are warm-blooded, and are more like the white sheet of paper. It is not necessary for warm-blooded organisms to rely on their external environment, as endotherms regulate body temperature on their own.

Activity #2

# Paper Snakes

- Snake locomotion
- Skills: crafting, compare and contrast

Adapted from: Reptile and Amphibians Activities & Fun Ideas for Kids - ChildFun

Snakes are one of the five types of animals that belong to the reptile family. One of the characteristics that all reptiles have are scales. Scales will vary amongst groups in size shape and color. This activity is going to focus on snake scales! A snake's scales have many functions such as protection, preventing water loss through their skin, aid in locomotion, and camouflage. The scales on their back will look different than the scales on their stomach because their stomach scales are more adapted to help them move. Their back scales will be more round and pointed while their belly has elongated scales.

Ventral (belly) scales

Back scales

<u>Materials</u>

- Paper plates
- Scissors
- Crayons
- String

<u>Activity Outline</u>

1. Draw an oval shape in the center of the plate. This will be the snakes head. Draw a line in a spiral circling five times to the edge of the plate.
2. Starting at the edge of the plate where the spiral line ended, begin cutting along that line and ending with an oval shape for the snake's head.

3. Now the students have a blank snake! The students can draw and color the long scales on the underside of the snake and the camouflage on top. This is where students can take inspiration from different species, or they can create their own.
4. Once they are finished coloring, poke a hole in the snake's head and pull the string through. Create a knot underneath the head to hold it in place. Hang the snakes around the room and watch as the snake twirls and swirls.

Extension

Remind the students that different snakes have camouflage to help them blend in to their specific environment. Does their snake camouflage into anything in the room? Students can camouflage their snakes into the room and see if their peers can find it.

Post-Activity Discussion

After the craft, ask how they decided on their snakes camouflage. Was it inspired by another snake? If it was camouflaged around the room, how/what did they camouflage it in? Add a little bit of wind or hold a paper snake over a vent and observe how it swirls. Ask them how snakes move. Can snakes move in other ways? Snakes all "slither" but they can move in different ways! A video is available called *How Snakes Move! (They Don't Just Slither!)* that explains the different movements.

Activity #3

# Turtle Race

- How fast do turtles move?
- Skills: cooperation

Adapted from: Childfun Reptile Activities website

Materials

- Poster board
- Strong string
- Chairs
- Scissors
- Optional: colored pencils, crayons, and/or markers

Activity Outline

1. Cut out the different turtle pictures on pages 44-47. Glue each turtle to the poster board and cut out the poster board.
2. Punch a hole just above the center of the turtle and put a 6 foot long piece of string through the whole.
3. Get one chair for each turtle. Tie one end of the string to the leg of a chair.
4. Line up the chairs up along a finish line.
5. Have the students who are racing their turtles stand in a line at the starting line. Each student should hold the loose end of a string.
6. Begin the race with the turtles near the students' hands. When you say "Go!", the students should begin shaking or wiggling the string so that the turtles move towards the chair/finish line. For the students not racing this turn, encourage them cheer on their classmates!
7. Have the next round of students come up to the starting line and bring the turtle back towards their hands to begin.

Post-Activity Discussion

After all the students have had a turn and there is an official turtle winner, ask some follow up questions:

- Which turtle made it to the end first? Which one was last?
- Do you think this mimics real life? Would this turtle have been fast?

- Do you think turtles are just as fast in water?
- Who would win on land: humans or turtles? What about water?

Alternatives/Extensions

If there are a lot of students, place them into groups/teams and have two at a time race each turtle with two strings per turtle. Make sure they are taking turns and each student has a chance to race. Students can race several times in rounds, or make it a relay depending on the number of students.

Teacher Background

Turtles are known to be some of the slowest walking animals. This is generally true, but there are some factors to consider. The Galapagos tortoise is considered one of the slowest turtles relative to their size, walking at an average of 1 mph standing up to 5 feet tall and 500 pounds. These are also the longest living terrestrial reptiles reaching ages of over 150 years old! Now, if it were to race a much smaller turtle, like an Eastern box turtle, the Galapagos tortoise would likely win because of the significant size difference. Eastern box turtles may sprint in bursts around 0.25 mph which may seem slow, but is fast for a turtle at only a few inches tall and less than 3 pounds. If you were to put them in water, their speed declines. Neither a Galapagos tortoise nor an Eastern box turtle are aquatic turtles. A Galapagos tortoise cannot swim and a box turtle looks very clumsy but will swim if needed. However some turtle are MUCH faster in water than they are on land, such as common snapping turtles and sea turtles. The common snapping turtle is an aquatic turtle that can go about 2.5 mph on land but 8-10 mph in water! They are known for their amazingly strong bite force that is a cause for caution but are also very fast in water. A feature that helps them swim so well is their webbed feet that help them paddle through the water. Although these aquatic turtles are fast, they cannot compete with the speed of the fastest sea turtle, the leatherback sea turtle, coming in hot at speeds up to 22 mph! Instead of feet, they have flippers that act as massive paddles and are more aerodynamic to dart through the water. Sea turtles rarely come up on land if at all: females have to burrow their eggs on land, but otherwise they do not have a need to be on land. When they make this trip to lay their eggs, it is not a quick process and takes hours to do so. It takes about the same energy to run a marathon that it does to climb on land and lay eggs. So if there were a real race, a sea turtle would win in water but a terrestrial turtle would definitely win on land.

Eastern Box Turtle



Leatherback Sea Turtle

Common Snapping Turtle

Giant Galapagos Tortoise