



Cabrillo Marine Aquarium Lesson Plan

Grade Level: Kindergarten through Third Grades

Title: Shark Biology, Shark Bingo & other JAW-some Shark Activities!

Objective: This collection of classroom lessons, activities and games will introduce young students to the biology and behaviors of sharks, skates and rays. While also having FUN!

California Science Standards: K: 2a-c, 4a-e 1st: 2a-d 2nd: 2a-d, 4a-g 3rd: 3a-e, 5a-e

Time to Complete: approximately 30 minutes for each lesson

Materials provided by CMA: *Worksheet: Shark Coloring Sheet, Worksheet: Parts of a Shark, Graphic: Parts of a Shark Answer Key, Graphic: Cut and Paste Words for Parts of a Shark*

Materials provided by Teacher: Xerox copies of the Shark Bingo Card Print-outs, paper plates, Bingo game pieces (ex. bottle caps, dried pasta shells), classroom art supplies - markers, paper, scissors, glue, etc.

Vocabulary: Chondrichthyes, cartilage, dermal denticles, cold-blooded, camouflage, countershading, fusiform, caudal fin, pectoral fin, dorsal fin, pelvic fin, gills, lateral line, electro-receptors, ampullae of Lorenzini, gill rakers, carnivores, plankton, prey, ecosystem, conservation, apex, keystone species

Teacher Preparation: Go through the lessons that you plan to do for the week and prep any materials you may need to complete the project or activity.

Background Information: Sharks are mysterious and misunderstood creatures that have fascinated people for generations. There are over 400 species of sharks worldwide. Sharks belong to a large group of fishes known as **Chondrichthyes**, which in Greek means "cartilage fish." This group also includes skates and rays, all of which have skeletons made of cartilage, not bone.

Lesson Outline:

- #1 - Shark Anatomy
- #2 - Shark Senses
- #3 - Shark Feeding Behaviors
- #4 - Shark Bingo!
- #5 - JAW-some Shark Activities & Games

Lesson Procedures:

Lesson #1 Shark Anatomy: Show & Tell

- There are lots of misinformation and fallacies about sharks. Ask your students these questions. Give them the facts and try and dispel the myths.
- Do sharks have a skeleton? Yes, sharks have skeletons made of **cartilage**, the same material that our ears and noses are made of. **(have students investigate the shark vertebrae)**
- Do sharks have scales like most fish? Sharks are covered with tiny, tooth-like **scales**, called **dermal denticles**. These scales grow on the shark's skin usually point towards the tail. They make the shark's skin feel like sandpaper. **(have students touch the shark skin)**
- Are sharks warm-blooded like people? No, sharks are **cold-blooded**. This means that their blood changes temperature as the water temperature changes. (Quick Fact: Some sharks like the great white, threshers, and porbeagles have special heating systems that keep their blood slightly warmer than that of other sharks.)
- What color are sharks? Sharks are generally a light color underneath and darker above. This is a type of **camouflage** that helps them blend in with their surroundings. When viewed from above, sharks blend in with the dark ocean depths. When viewed from underneath, they blend in with the lighter sea surface. This is known as **countershading**. **(show the great white shark picture and counter shading)**
- How do sharks swim? Sharks' bodies are **fusiform** (streamlined and torpedo shaped). They have five different kinds of fins that they use to lift, stabilize, and propel themselves. The **caudal fin**, or tail fin, can be used for turning as well as for propulsion. Unlike most fish, the shark's backbone extends well into the tail, making it very powerful. The erect **dorsal fin** on a shark's back is used for balance. The second dorsal fin controls rolling. The front fins, or **pectoral fins**, are much stiffer than in other fish. The shark can change the angle of these fins to swim either up or down; they can not swim backwards. Stability is provided by the **pelvic fins**. (Quick Fact: Great White sharks can swim from 20 to 30 miles per hour and unlike most bony fish, sharks have no swim bladders to keep them afloat. They can use oil in their liver, which can be more than 15% of their total body weight, for buoyancy.) **(show the fins of sharks)**
- How do sharks breathe? Sharks breathe underwater the same way fish do, through **gills**. As the sharks take water into their mouths, their gills can absorb oxygen from the water, enabling them to breathe. Most sharks have five slits on each side, although some may have up to seven. **(show gill specimen)**
- How do sharks eat? The jaws of a shark are generally positioned on the underside of the snout. When biting, the snout protrudes upward as the jaws thrust forward. This gives the shark a rather fearsome appearance. The jaws of a shark are extremely powerful. Some sharks can bite hard enough to cut through a piece of steel.
- Do sharks lay eggs? Baby sharks or pups, are born in a couple of ways. Some shark species lay eggs. Laying them in underwater weeds and grasses. Some mothers carry their pups in a sac inside their body for about 10-12 months. Some are even carried

for two years. Female sharks can give birth to fully developed baby sharks, usually tail first. Shark pups are miniature versions of their parents. Once born they must fend for themselves. **(investigate shark egg specimens)**

- Do sharks like to eat people? No, sharks do not normally eat humans, although there are some situations where people are mistaken for food and attacked. Less than about 25 people are killed by sharks each year worldwide. Many more people die from lightning or bee stings than shark attacks. **(show shark jaws and teeth specimens)**

Activity 1: Shark Color Pages & Parts of a Shark - see Worksheets

- Tell students that there are about 400 different types of sharks in the world or make this a guessing game and hint - if the number guess is higher or lower, until they guess 400.
- Show students pictures of the different types of sharks **(refer to photos section)**
- Talk about the physical differences between each shark/ray species (color, size, feeding behaviors, habitat, conservation issues; refer to background information)
- Pass out the *Worksheet: Shark Coloring Sheet* and *Worksheet: Parts of a Shark* - go over the answers using *Graphics: Parts of a Shark Answer Key*
- Use *Graphic: Cut and Paste Words for Parts of a Shark* if necessary
- For more shark color pages and printables go to:
<http://www.education.com/slideshow/shark-week1/hammerhead-shark-coloring/>

Lesson #2: Making Sense of Shark Senses!

- Sharks have larger brains than most **cold-blooded** animals. With this larger brain comes a vast amount of sensory information. In addition to the five senses used by humans, sharks possess a sixth, very unique sensory adaptation, **electro-reception**.
 - How do sharks see? Although sharks' eyes are small, they can see rather well, even in dim light. Color vision is believed to be somewhat limited. Sharks' eyes are very sensitive to light. They are designed for seeing in the dim light underwater. While most fish do not have eyelids, some sharks have 3 of them. Like humans, sharks have upper and lower eyelids. In addition, they also possess third eyelids that cover the entire eye. Deep water sharks generally have bigger eyes than shallow water sharks.
 - How well can sharks smell? Sharks have an extremely acute sense of smell. Nearly two thirds of a shark's brain is devoted to the sense of smell. They can detect minute quantities of certain substances, especially blood, in the water. Fish give off a certain odor when they are in distress, which is easily detected by sharks. They can detect odors up to one mile away.
 - How well can sharks hear/feel? Sound is often times the first sense a shark uses to locate food. They have excellent hearing. Some can hear prey in the water from 3,000 feet away. Their internal ear can detect sound as well as feel vibrations in the water, such as the thrashings of sick fish. The shark also uses its **lateral line system** to sense vibrations. The lateral line system is a series of

fluid-filled canals just below the head and along the sides of the shark. The canals are open to the surrounding water through tiny pores. Tiny hairs attached to sensory cells project into the canal. These hairs can detect turbulence or vibrations in the water. Sharks can locate injured or distressed fish by detecting their erratic movement.

- Can sharks detect electricity? Yes. They can detect electrical charges that are emitted by all living things. This is called **electroreception**. Some sharks can actually use electricity to locate prey. All living creatures emit small electrical impulses as they breathe or move. A shark uses a system of small holes and canals located in the snout and head called the **ampullae of Lorenzini** to detect these impulses. This works best at close range, and can be used to locate animals that the shark may not be able to see.
- Sharks rely on all of these senses to locate food and to make sharks extremely effective at hunting down prey.

Activity 2: Sniff-o-Rama

- Sharks have odor-detecting cells inside their nostrils. They can smell odors in very low concentrations - explain it this way: a great white shark can smell one drop of blood in 100 gallons of water.
- This activity will allow children to use their sense of smell just like a shark.
 - Gather several different opaque jars or vials & label them by number; you should not be able to see the contents through the jar.
 - Fill each one with different fragrant items. One jar could be filled with cinnamon, another one with rose petals, one with orange slices or vinegar.
 - Select familiar scents that the students will recognize.
 - One- at-a-time, have students take turns sniffing the jars.
 - Have students write down their answers.
 - After every student has had a turn sniffing all the jars, go over the contents.

Lesson #3 Shark Feeding Behaviors: A Feeding Frenzy

- Sharks do not chew their food. They swallow food whole or in big chunks and rely on enzymes and hydrochloric stomach acids to break the food down.
- Different species of sharks have different shaped teeth. The shape of sharks' teeth depends on the type of food they eat.
- They can have anywhere from 20 to several hundred teeth. Some sharks have one type of teeth in the upper jaw and another type in the lower jaw.
- There are three basic shapes for shark teeth:
 - **Triangular, blade-like teeth; often serrated; used for cutting large hunks of meat out of their prey (great whites, tiger sharks)**
 - **Long, pointed, needle-like teeth; used for impaling, gripping, holding, and tearing (mako sharks, lemon sharks)**
 - **Flattened, blunt teeth, used for crushing (nurse sharks, rays)**

- Sharks often lose their teeth. There are several rows of new teeth in a shark's jaw to replace lost teeth. A replacement tooth can move into place in less than 24 hours. Some species of sharks may lose as many as 30,000 teeth in a lifetime.
- A few species of shark, like basking sharks and whale sharks have small, nonfunctional teeth. These sharks filter plankton out of the water, much like whales. They filter water through their gills and catch plankton with tiny, bristle-like projections called **gill rakers** which are located on the inner margins of the gills.
- Sharks normally do not kill for sport. They kill only when they are hungry. After a large meal, a shark may go for many days without eating at all. A shark will usually eat about 2% of its body weight per day.
- Almost all sharks are **carnivores**, or meat eaters.
- Sharks have a varied diet, including **plankton**, fish, crustaceans, coral, sea urchins, horseshoe crabs, mollusks, sea turtles, sea birds, marine mammals, and other sharks. Most **prey** on weak, injured, or dying animals, since they are easier to catch. Some sharks have food preferences. Nurse sharks prefer crustaceans and mollusks; shortfin makos like bluefish; hammerheads prefer stingrays; bull sharks often eat other sharks; smooth dogfish eat crabs and lobsters; and tiger sharks prefer sea turtles. Sharks do not normally eat humans, although there are some situations where people are mistaken for food and attacked. Only about 25 people are killed by sharks each year worldwide. Fatal shark attacks are extremely rare, that is why it usually makes headline news. People are not a shark's prey of choice.

Activity 3: Chomp!

Project Materials:

- Paper plates
- Scissors
- Pencils & Markers

To Make:

1. Fold your paper plate in half "backwards" (with the bottom of the plate facing you, and the folded edges coming toward you).
2. Using small scissors trim away the outer edges of the plate in a sweeping arched "M" design on the top half and bottom half, which should leave it looking like the hinges on the jaw, and the "m" shaped bottom & top of the mouth.
3. Cut out a large oval from the middle, and then work from that center to cut out free-form teeth that follow the inside arc of the paper plate on the top and bottom. Shark teeth are often quite irregular and jagged and not always parallel. Be creative!

Lesson #4 Shark Bingo!

Game Materials:

- Shark Bingo Cards & Print-outs (make 3-5 copies of each)

- For Shark Bingo Printables - Go to:
<http://deceptivelyeducational.blogspot.com/2013/01/shark-bingo-game-free-printable.html>
- Set of 25 game pieces for each student (ex. dried pasta shells or beans, gummy bears or fish crackers)

How to Play:

- Five squares covered - across, up, down or diagonal - wins!
- Alternatively, play Shark Bingo Blackout.
- In a game of blackout, all of the squares on the bingo card must be marked with a game piece to win.
- Teacher or a designated student can pick and call out the colored game cards.
ex. Letter S, Bull Shark, color Green or Letter H, Nurse Shark, color Blue
- You can also give facts about each shark as you call the cards

SHARK FACTS:

- **Thresher Shark:**
 - Known for their 10 foot tails; which can be half the size of their body
 - Feed primarily on squid & schooling fish
 - Often get caught in tuna fishery longlines
 - Scientists think they use their long tails to herd or even stun fish
- **Six-gilled Shark:**
 - Also known as a cow shark or mud shark
 - Have 6 gill slits unlike the more common 5 gill slits of most sharks
 - A deep water shark
 - Only has one dorsal fin at the back of its body, near the tail
 - Can grow to lengths of 18 feet
- **Shortfin Mako Shark:**
 - Fastest of all the sharks; can swim at speeds of over 30 mph
 - Prey on sharks, swordfish and tuna
 - Can leap high in the air to try and shake out a hook if caught on a fishing line
 - Have knife-long, serrated teeth
 - Are bluish gray on top and white underneath
- **Hammerhead Shark:**
 - Their eyes are at either end of their rectangular-shaped head
 - Have a heightened sense of electro-reception
 - Make meals out of crustaceans, octopus, rays and small sharks
 - Common around tropical reefs
 - Can give birth to over 40 pups in one litter

- **Bull Shark:**
 - Can grow to a length of 11 feet
 - Can weigh over 200 pounds
 - Have been known to attack swimmers in rivers, estuaries & saltwater creeks that flow directly to the ocean
 - Gray to brown in color
- **Nurse Shark:**
 - Sluggish and generally docile sharks that usually lie on the ocean floor
 - Nocturnal animals, resting in large groups during the day
 - Have long, fleshy appendages, called barbells that hang below their snouts
 - Usually found near rocky reefs, mudflats & sandbars
 - Feed on crab, lobster, urchins & fish
- **Great White Shark:**
 - Strong & powerful swimmers
 - Prey on seals, sea lions, sea turtles and other sharks
 - Are known to attack humans, in a case of mistaken identity
 - Found in all the oceans
 - Can reach lengths of over 20 feet and weigh over 2,000 pounds

Lesson #5 Jaws-some Shark Activities & Games!

➤ Who Am I?

1. Play a fun game of charades with your students
2. Have students take turns picking an animal from the sea, then act out how it eats.
3. Have the others try to guess what ocean animal they are.
4. Some leading descriptive statements that you can HINT to your students:
 - Can you think of an animal that chases its food? (crab, seabird)
 - What is an animal that waits for its meal to come close? (a ray)
 - What animals strain tiny plants and animals from the sea? (whale shark)
 - An ambush predator? (a great white)

➤ Science Songs

- Kids love learning science songs to help them remember science lessons and science vocabulary in a fun & educational setting. Just remembering a simple rhyme can help students recall simple facts about even the most complicated subjects. Elementary schools and middle schools are incorporating fun online games, songs and videos into their regular curricula and best of all, kids have fun while learning!
- Check out these catchy tunes from the band - **They Might be Giants**
 - **I am a Paleontologist**
http://www.learninggamesforkids.com/science-games/science-songs/paleontologist_song.html

- **Science is Real**
http://www.learninggamesforkids.com/science-games/science-songs/science_is_real_song.html
- **The Sun Song**
http://www.learninggamesforkids.com/science-games/science-songs/sun_song2.html
- **Meet the Elements**
http://www.learninggamesforkids.com/science-games/science-songs/elements_song.html
- Check out these cool **VIDEO** links on Sharks and Rays:
 - Great White Shark : National Geographic Video
http://www.learninggamesforkids.com/animal_and_nature_games/ocean-animal-games/shark-games/video-great-white-shark.html
 - Whale Shark : National Geographic Video
http://www.learninggamesforkids.com/animal_and_nature_games/ocean-animal-games/shark-games/video-whale-sharks.html
 - Sting Ray City: National Geographic Video
<http://video.nationalgeographic.com/video/animals/fish-animals/sharks-and-rays/stingray/>
- **Do-it, Do-it!**
 - Why should WE care about sharks? And what can YOU do to protect sharks?
 - **Fact: Sharks keep our oceans healthy and productive. Share with your students:**
 - Sharks have evolved in a tight inter-dependency with their **ecosystem**. They tend to eat very efficiently going after the old, sick, or slower fish in a population, keeping that population healthy. Sharks groom many populations of marine life to the right size so that those prey species do not cause harm to the ecosystem by becoming too populous. The ocean ecosystem is made up of very intricate food webs. For the most part, sharks are at the top of these webs and are considered **keystone species**, meaning that removing them may cause the whole structure to collapse. For this reason, the prospect of a food chain minus its **apex** predators may mean the end of the line for many more species.
- **Weave a Food Web**
 - Students will discover the food/energy relationships within a food web.
 - Materials: animal index cards (so that you have one organism/ animal for each student), yarn or string, large playing area
 - Game Procedures:
 - Draw or write the names of organisms/ members of the reef ecosystem and use yarn to create signs students can wear around their necks with yarn. (ex.

sea turtle, phytoplankton, zooplankton, fish, sea anemone, octopus, jellyfish, coral, crab, lobster, sea star, sea bird, shark, etc.)

- Be sure you only have one sun, roll the rest of the yarn into a ball.
 - Define a food web for your students: write the words sun, phytoplankton, jellyfish, and sea turtle on the board and draw pictures to symbolize each one. Share with students the idea that phytoplankton gets its energy from the sun, the jellyfish gets energy by eating the phytoplankton, and then the sea turtle gets its energy by eating the jellyfish. Explain that most animals eat more than one thing. Tell them that the transfer of energy through food between life-forms in an ecosystem is called a **food web**.
 - Take students out to a safe playing area, and have them form a large circle. Give everyone an animal index card to wear.
 - Have the person who is wearing the sun card hold one end of the string. Ask students which member of the food web gets its energy from the sun (phytoplankton). As they volunteer answers, unroll the yarn and have students wearing those signs hold onto the yarn. Next, ask students which members of the food web get their energy directly from phytoplankton (coral polyps and zooplankton). Have those students hold onto the yarn, too.
 - Continue until the food web is complete.
 - Carefully lay the yarn on the ground so that the web stays intact. Step back and notice the pattern created by the interaction of organisms.
 - Explain that many factors can disrupt a food web: pollution, overfishing, and habitat destruction. As you name each factor, use your foot to discreetly disturb part of the yarn web.
 - Have the students pick up the yarn again and ask them if the web looks the same. Explain that many factors including pollution, habitat destruction, and overharvesting resources destroy ecosystems.
 - Instruct students to set the web down again. Ask all corals to take a step back. Have students pick up the web again. Ask students what happens to the food web when an animal becomes extinct.
 - Play the game a few times; describing natural & man-made disasters that might disturb the food web.
- **Making Waves** - This activity is to encourage students to be more creative in their writing assignments. Have students write descriptive sentences about the ocean in up and down patterns, depicting the waves of the sea. Then students can add color and ocean animals creating a colorful, language-arts experience!
- **Saltwater Paintings** – Have students paint ocean pictures with a saltwater mixture on white construction paper. In a small container, mix 1/4 cup of warm water with 6 teaspoons of salt and 3 drops of food coloring. Mix well. Have students brush on a beach or ocean scene. Let pictures dry. When the water evaporates the colored salt will remain, creating a colorful & textured ocean scene.

- **Guess Who?** - On index cards write the names of different ocean animals. Have students pick a card and research the animal on it. On the back of the card they can write unique facts about their animals: where it lives, what it eats, color, size, shape, how it behaves and protects itself. When they are finished, your students can swap with multiple partners to guess what ocean animal the description matches.
- **Aqua Animal Acrostics** – This is a great way for students to recall facts about sea animals. Write an ocean word down on the board. Brainstorm related words that begin with each letter and list them on the board. As a class, use the words to create an acrostic about the animal. In no time at all, students will be creating their own!
- **Creature Discovery** - Pretend you have just discovered a new animal in the ocean. Name your animal; tell where you found it, what it looks like, size and color, what it eats, and how it behaves. Make an illustration of your ocean animal in its habitat and share your discovery with the class. The stories and illustrations can be separated and your students can guess which creature illustration matches its description.
- **Sand Art** – Give each student a sandwich-sized plastic baggie filled with sand, add a few drops of desired food coloring, seal bags and shake for about 1 minute. Have students design a beach scene on white construction paper using white Elmer's glue. Then pour the colored sand over the entire picture and after about 10 minutes have students shake off the excess sand into a container. Students can also share their colored sand with classmates to make a colorful beach scene.

References:

- Shark Traveling Trunk Curriculum: Cape Lookout National Seashore
www.nps.gov/california/forteachers/classrooms/travelingtrunks.htm
- The-Shark-Side-Of-Life
<http://www.the-shark-side-of-life.com/>
- Learning Games for Kids
<http://www.learninggamesforkids.com/>
- The Great White Shark: Dare to Explore
<http://library.thinkquest.org/>
- How to Smile.org/ All the Best Science & Math Activities: Sharks Sense of Smell
<http://howtosmile.org/>
- The Original Paper Plate Shark Jaws
<http://paperplatesharkjaws.com/>
- Shark Bingo
<http://deceptivelyeducational.blogspot.com/>
- Sea World: Corals and Coral Reefs: 4 - 8 Teacher's Guide
www.usm.edu/marineeducation/old/coralreef/13.pdf