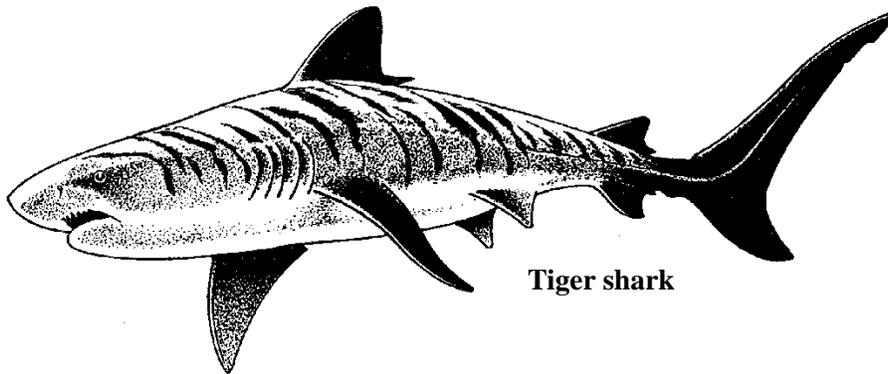


Dear Teacher:

During the **Shark Shenanigans** assembly program an Aquarium educator will introduce students to sharks and their adaptations using puppets, a PowerPoint presentation, song and dance, shark teeth and skin, egg cases, and a life-sized inflatable great white shark! After this program your students will understand the characteristics of sharks as cartilaginous fish.

Before your assembly program:

- Define adaptations for your students. Give examples of human adaptations.
- Ask your students to list the characteristics of fish. Give examples.
- Compare fish adaptations to human adaptations.
- Color the Leopard and Whale shark coloring sheets.
- Conduct the Measuring Sharks activity. Using a tape measure, have your students see how they measure up to some of the ocean's greatest predators.



Tiger shark

After your assembly program:

- Review shark adaptations and diversity using the Leopard and Whale Shark fact sheets.
- Make paper-mache sharks and hang them from your classroom ceiling.
- Match shark teeth with what they eat with the Wheel of Gorgin' craft.

Participating in this program and using the pre and post curriculum will help your students meet Oregon science standards and Ocean Literacy Principles.

Shark Shenanigans assembly program: Grades K-2

Goal: To understand that sharks are important animals that have special adaptations for survival in the ocean.

Cognitive Objectives:

1. Explain that sharks have adaptations that help them survive in the ocean environment.
2. Name 3 shark body parts and describe how they are helpful to their survival.
3. Understand that most species of sharks are not dangerous to humans.

Affective Objectives:

1. Students will value sharks as worthy of protection and conservation.
2. Students will be inspired to learn more about sharks.

Oregon Science Standards:

K.2P.1 Examine the different ways things move.

1.1L.1 Compare and contrast characteristics among individuals within one plant or animal group.

1.2L.1 Describe the basic needs of living things.

2.1L.1 Compare and contrast characteristics and behaviors of plants and animals and the environments where they live.

Ocean Literacy: Essential Principles and Fundamental Concepts

5. THE OCEAN SUPPORTS A GREAT DIVERSITY OF LIFE AND ECOSYSTEMS.

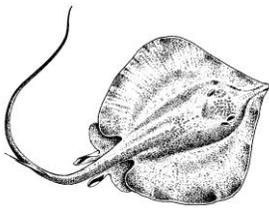
Sharks and Their Relatives

Background Information

Cartilaginous vs. bony fishes

Fishes can be divided into two major groups; bony fishes and cartilaginous fishes. Sharks, rays, skates, and ratfish are all cartilaginous fishes. Examples of bony fishes include: salmon, flounder, tuna, catfish, eels and goldfish.

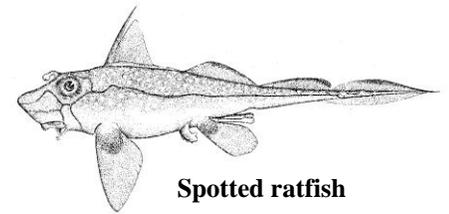
| Bony fishes | Cartilaginous fishes |
|---|--|
| Skeleton made of bone | Skeleton made of cartilage |
| Non-replaceable teeth if teeth are present | Several rows of replaceable teeth |
| Fins are usually flexible | Fins are usually stiff |
| Gills are covered by bony plate | Five to seven gill slits (except ratfish) |
| Scales are usually smooth and grow as the fish grows. | Scales are called dermal denticles, which means "skin teeth." New scales grow as the fish grows. |



Kinds of cartilaginous fishes

Two important groups within the cartilaginous fishes are the sharks and the **batoids** (skates, rays and sawfishes). Sharks are typically torpedo-shaped and have their gill slits on the sides of their bodies, while batoids have a flattened body shape with their gill slits on the underside of their bodies.

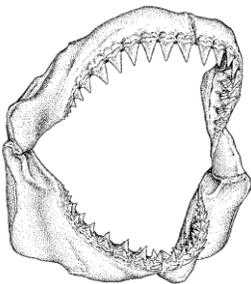
The third group of cartilaginous fishes are the **chimaeras**. This group includes all of the ratfishes. Ratfish are easily recognized by their short, rounded snouts and long, pointed tail fins. Unlike sharks, ratfish have one pair of external gill openings and no scales on their bodies. Spotted ratfish are found off of the Oregon coast.



Spotted ratfish

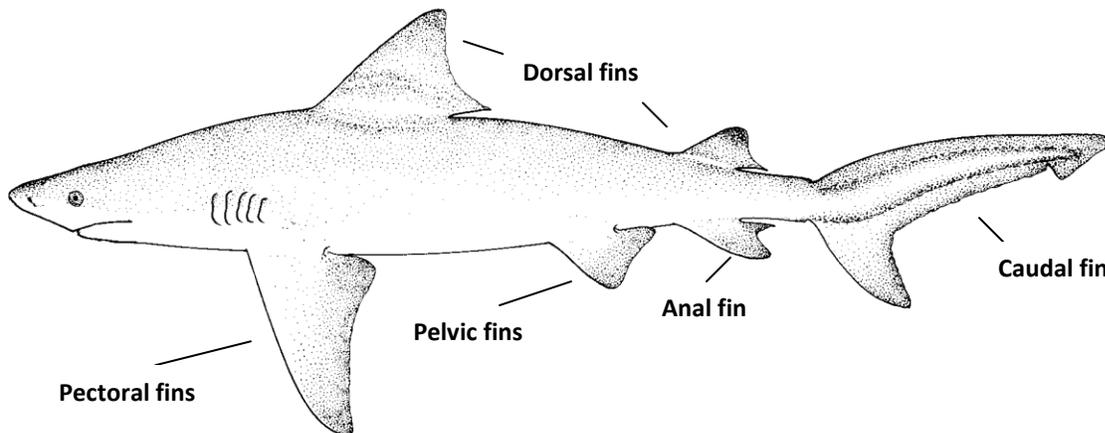
Shark anatomy

Mouth: The mouth of both sharks and batoids is usually on the underside.



Teeth: Shark teeth are made of the same material as human's teeth. Rows of replacement teeth continually develop behind the outer rows of feeding teeth. Sharks frequently lose teeth while capturing their prey. As a tooth falls out, a replacement tooth takes its place. Some species of sharks lose as many as 30,000 teeth in a lifetime. The shape of a shark's teeth matches its diet. For example, sandtiger sharks have long pointed teeth like the prongs on a fork for grabbing smaller fishes. White shark's teeth are wide and serrated like a steak knife, allowing them to tear up larger prey such as seals, dolphins or other sharks.

Fins: Sharks have five different types of fins. Most shark fins are rigid and supported by cartilaginous rods. A shark may have one or two dorsal fins, located on the back, which stabilize the shark. Unlike most bony fishes, the upper lobe of the caudal, or tail, fin is larger than the lower lobe. As the shark moves the tail (caudal) fin from side to side, the tail fin rises, causing the head of the shark to sink. The paired pectoral fins compensate for this downward motion by providing lift at the shark's head end. Paired pelvic fins stabilize the shark, and on male sharks and rays the inner edges of the pelvic fins are modified into claspers, which aid in reproduction. Some shark species have a single anal fin, which provides further stability.



Gills: Sharks have five to seven pairs of **gill slits** on either side of their heads. Skates and rays have five pairs of gill slits on the underside of their body. Skates, rays and some shark species have small openings, called spiracles, behind the eyes on the top of the head. Fast-swimming sharks rely solely on water being pumped through the mouth and over the gills as they swim.

Scales: Sharks and batoids are covered with scales called **dermal denticles** which means “skin teeth.” They have the same structure as a human tooth, consisting of three layers: an outer layer of enamel, a layer of dentine and a pulp cavity. Unlike the scales of bony fishes, these dermal denticles do not get bigger as the fish grows. Instead, the shark grows more scales. Like the teeth of a shark, the shape of each scale is unique to a species and can be used in identification.

Shark Conservation

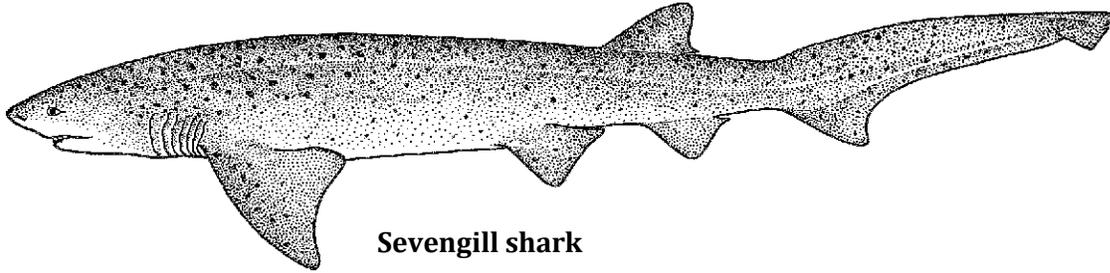
Sharks have always received much attention, usually negative. Shark attacks are rare. Statistics show that five to 10 people are killed worldwide each year by sharks. People are much more likely to be killed from drowning, bee stings, lightning strikes or traffic accidents.

Humans know little about the ecological role sharks play in the ocean. It is believed that as top predators, they are important in maintaining the balance of the marine ecosystem, preying on sick, weak and injured animals and keeping populations healthy.

We do know that sharks mature slowly, which makes them prone to rapid extinction by shark fisheries. Some shark species may have only a two percent replacement rate each year. Sharks, like marine mammals, often become fatally entangled in drift and gill nets. They are also hunted

for their meat, teeth , hide, cartilage, liver oil and fins. Shark fisheries were responsible for killing 100 million sharks in 1989 alone.

Sharks and batoids are increasingly vulnerable to human activities. As important indicators of the health of the oceans, they need our help if they are to survive.

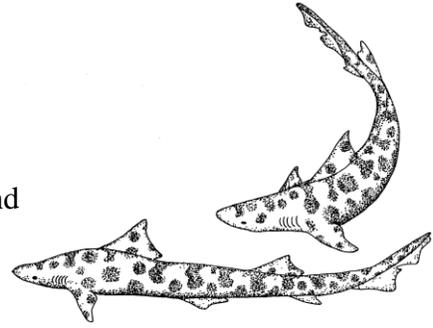


Sevengill shark

Leopard Shark

What does a leopard shark look like?

- A leopard shark has a long, torpedo-shaped body.
- They are gray or brown with black or dark gray spots and stripes.
- Like most sharks, leopard sharks have five gills slits on either side of their heads.



How big are they?

- Leopard sharks can grow to be five to seven feet long and weigh up to 70 pounds.
- When they are born, leopard shark pups are about eight to nine inches long.

Where do they live?

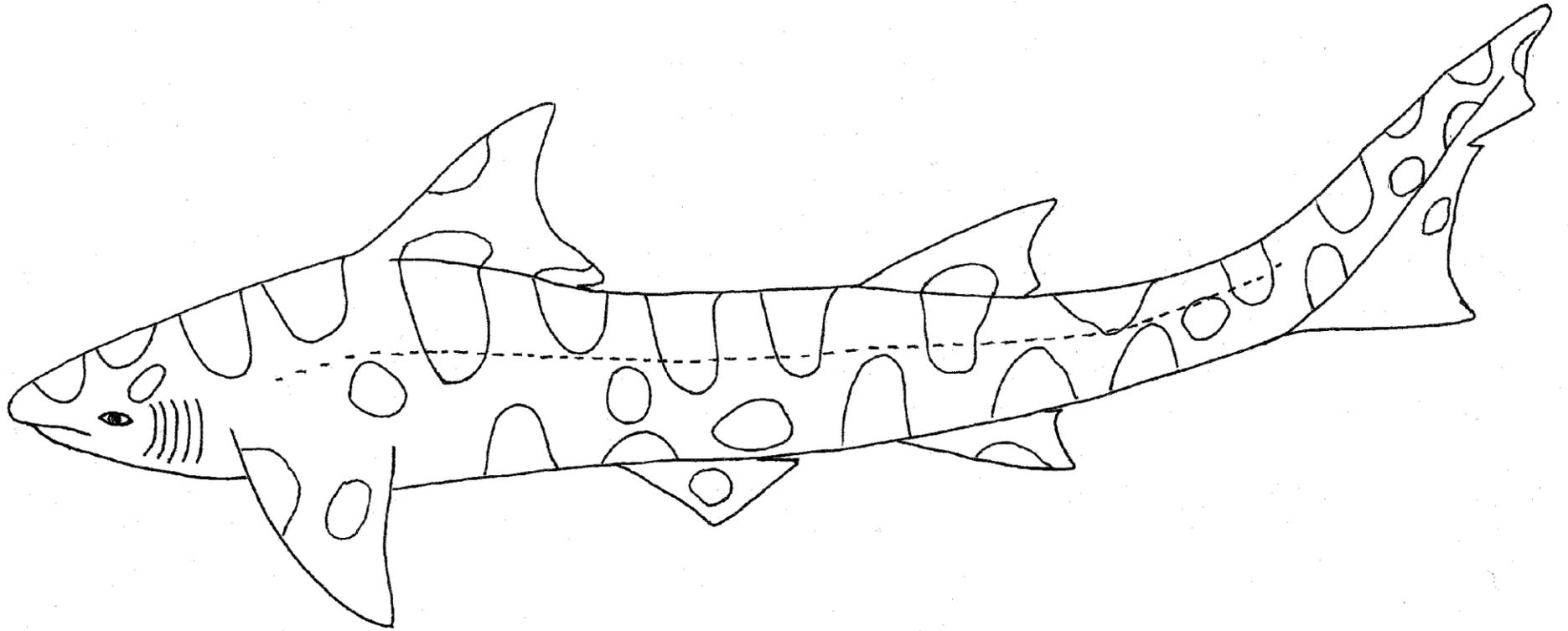
- Leopard sharks are found along the Pacific coast from Oregon to Baja California, Mexico.
- They are very common in northern California bays.
- They are found from the shallow waters of the rocky intertidal zone to depths of 300 feet. Most of the time they are found in 20 feet of water or less.

What do they eat?

- Leopard sharks eat a wide variety of foods, including worms, shrimps, crabs, fishes, fish eggs and clams.

Did you know?

- Leopard sharks are often confused with tiger sharks since they are both named for big cats. However, leopard sharks are much smaller and less aggressive than tiger sharks.

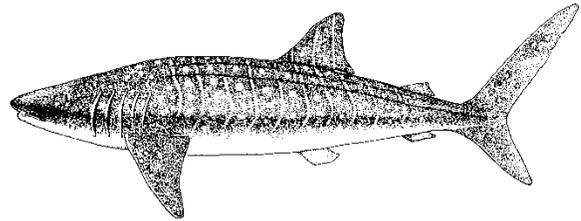


Leopard shark

Whale Shark

What does a whale shark look like?

- A whale shark is dark gray or brown with light colored spots and stripes on its back.
- Its huge mouth open up at the very front of its body and is full of very tiny teeth.



How big are they?

- Whale sharks are the biggest fish in the world.
- Some whale sharks may grow to be as big as 46 feet long and weigh as much as 20 tons!
- A baby whale shark is about 2 feet long.

Where do they live?

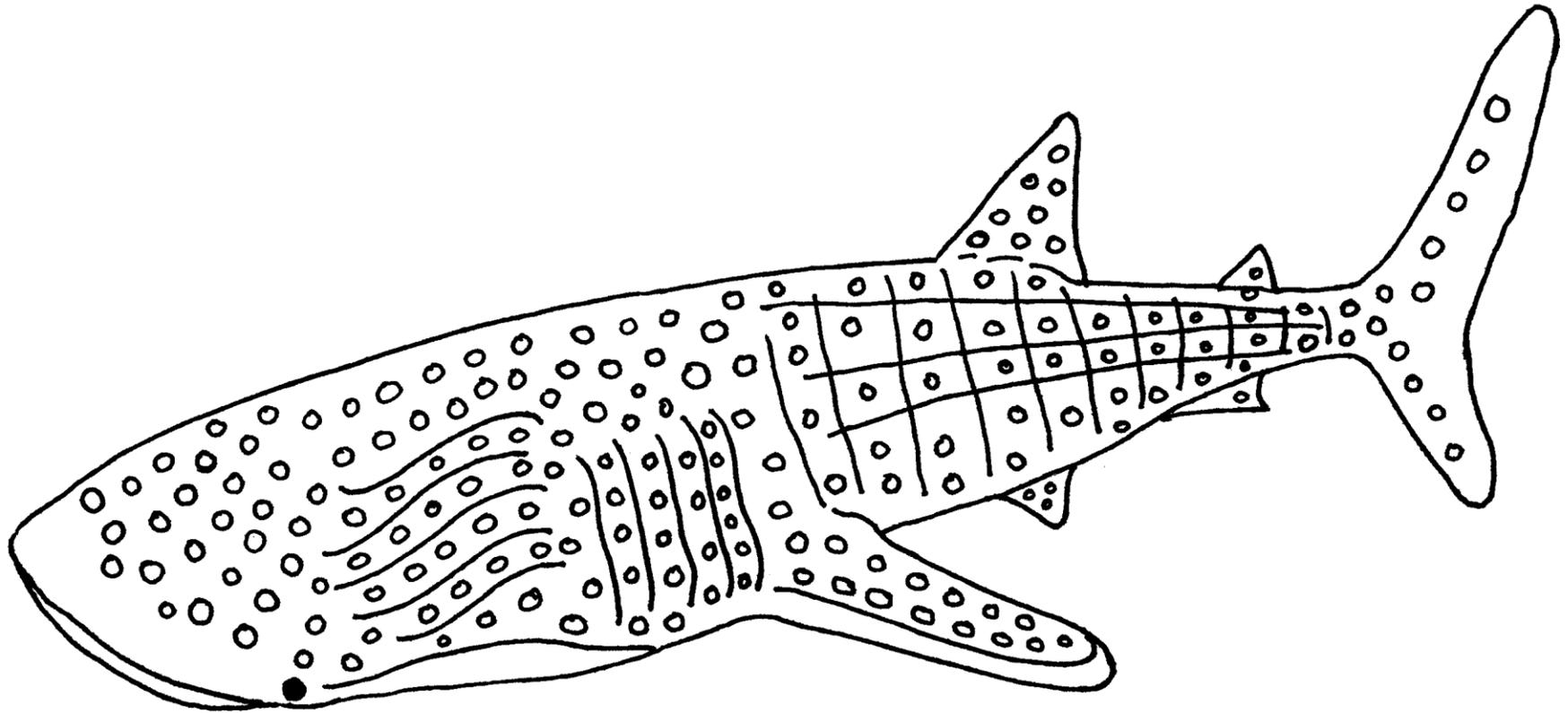
- Whale sharks are usually found in tropical oceans.
- Seeing a whale shark is very rare.

What do they eat?

- Whale sharks are filter feeders. This means that they swim with their mouths open to catch small schools of fish or squid and tiny plankton.
- Whale sharks don't chew their food, instead they strain or filter their food from the water. Once a whale shark's mouth is full of water and food it closes its mouth, pushes the water through its gills and gulps down its meal!

Did you know?

- A whale shark's skin is four inches thick.
- Scientists believe that whale sharks give birth to litters of up to 300 pups.



Whale Shark

Measuring Sharks

Lesson at a Glance:

Students will measure the lengths of several species of sharks and compare each animal's size.

Oregon Content Standards:

SCIENCE

- **Third Grade:** 3.1 Structure and Function: Living and non-living things vary in their characteristics and properties.

OTHER CONTENT AREAS

Mathematics: measurement

Ocean Literacy: Essential Principles and Fundamental Concepts

5. THE OCEAN SUPPORTS A GREAT DIVERSITY OF LIFE AND ECOSYSTEMS.

- 5.a. Ocean life ranges in size from the smallest virus to the largest animal that has lived on Earth, the blue whale.

Materials:

- Shark length cards (included with this kit)
- One 50-foot long clothesline
- Clothespins
- Measuring tape for each group

Background:

The class Chondrichthys (cartilaginous fishes) today includes 470 batoid (rays and skates) species and over 450 shark species. Off the coast of Oregon, there are at least 15 different shark species. These include the brown cat shark, the basking shark, the blue shark, the thresher shark, the leopard shark and the white shark. Over 80 percent of all sharks are less than six feet long, and 50 percent of all sharks are less than three feet long.

The lengths used for this activity come from the FAO (Food and Agriculture Organization) and are currently accepted record lengths for these sharks. If your students choose to pursue further research they may find resources with slightly different information.

The lengths of the sharks included in this activity are listed on the table below. These lengths are maximum recorded lengths and most sharks will probably never reach these lengths during their lifetime, just as most humans will never reach the record height set for our species. The tallest man ever recorded was 8 feet, 11 inches. Also, some basketball players are over 7 feet tall, but most people never grow even close to that height. Keep in mind however that we have not seen, let alone measured, all the sharks in the world, so there may be some record breakers out there.

| Sharks | Currently accepted maximum lengths |
|------------------------------|---|
| Cookie-cutter shark | 1.5 feet |
| Swell shark | 3 feet |
| Horn shark | 4 feet |
| *Spiny dogfish | 5 feet |
| *Soupfin shark | 6 feet |
| *Leopard shark | 6.5 feet |
| *Salmon shark | 10 feet |
| *Sevengill shark | 10 feet |
| *Blue shark | 13 feet |
| *Mako shark | 13 feet |
| Nurse shark | 14 feet |
| Megamouth shark | 17 feet |
| Tiger shark | 18 feet |
| *Common thresher | 19 feet |
| Great hammerhead | 20 feet |
| *White shark (“great white”) | 21 feet |
| *Basking shark | 40 feet |
| Whale shark | 46 feet |

* Species found off the Oregon coast.

Activity:

Preparation:

1. Introduce your students to sharks using the Shark Background Information sheet.
2. Discuss where sharks live and their diversity. There are about 15 species of sharks found off the Oregon coast, ten of which are included in this activity.
3. Reserve a hallway, gym or outdoor area where you will have room to fully extend a 50-foot long clothesline.
4. Affix the clothesline to the ground or floor.

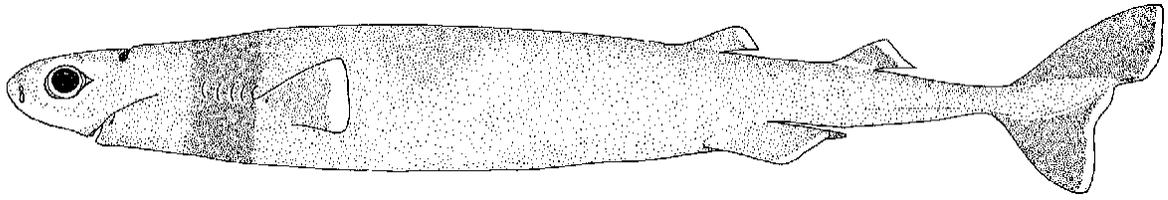
Activity:

1. Divide your students into groups of four.
2. In each group:
 - Two students will be using the measuring tape.
 - One student will be responsible for holding the clothespins.
 - One student will be responsible for holding their assigned shark cards.
3. Give each group two or three shark length cards (at least one smaller and one larger shark).
4. Explain that the end of the rope, where they will begin each measurement, is the tip of the tail of every shark to be measured.
5. Have the group with the cookie-cutter shark go first.
6. Once they have measured 1.5 feet on the rope, have them clothespin their shark card onto the rope so that it lays down on the ground with the picture side up.
7. Continue having the groups measure their sharks onto the rope until all 18 shark cards have been pinned to the clothesline.
8. Once all the sharks have been measured have two or more students hold up the entire rope for everyone to see. Compare the sizes of the different sharks.

9. After the rope has been disassembled and everyone has returned to class, have students research information about the sharks that their group measured, (ie. where their shark species can be found [their range] and what they eat [their diet]).
10. Have students present the information about their sharks to the rest of the class.

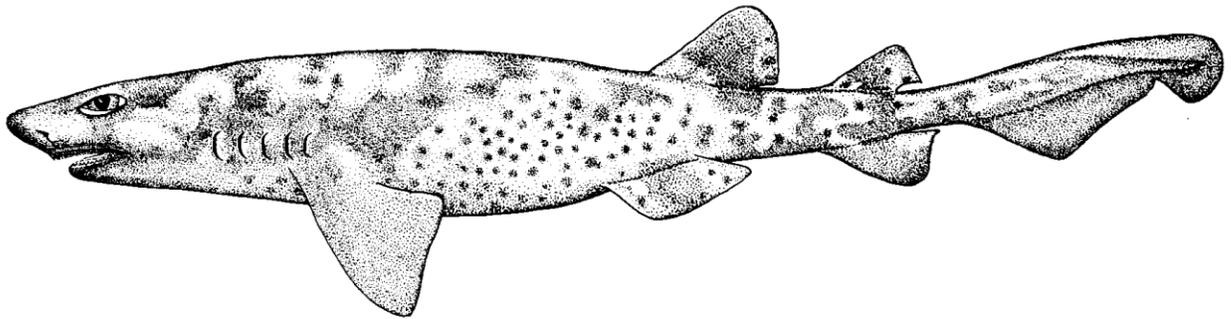
Extensions:

1. Have your students look up the lengths of other sharks or things they are familiar with and add them to the rope. For example, find the length of a school bus or the average fourth grader.
2. Have your students calculate how many of each shark (nose to tail) it would take to reach one end of the hallway or gymnasium to the other.
3. Have your students convert each shark length in feet into inches, yards, meters or centimeters.



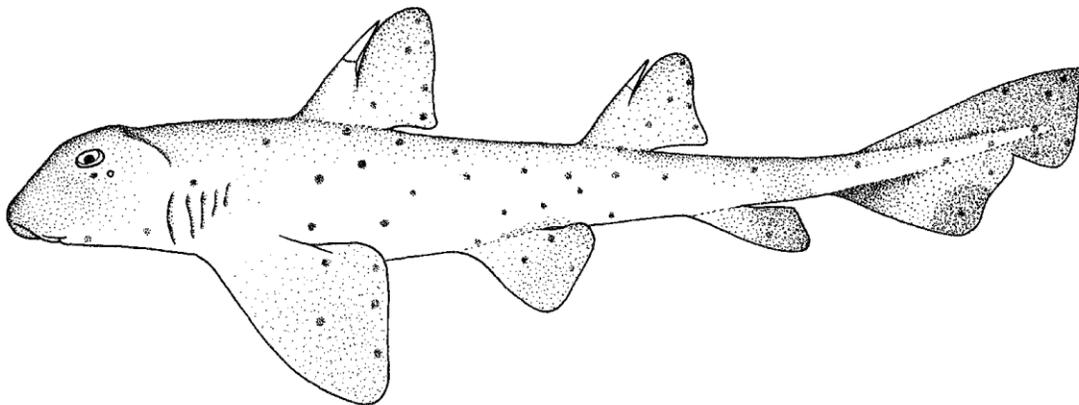
Cookie Cutter Shark

Up to 1.5 feet



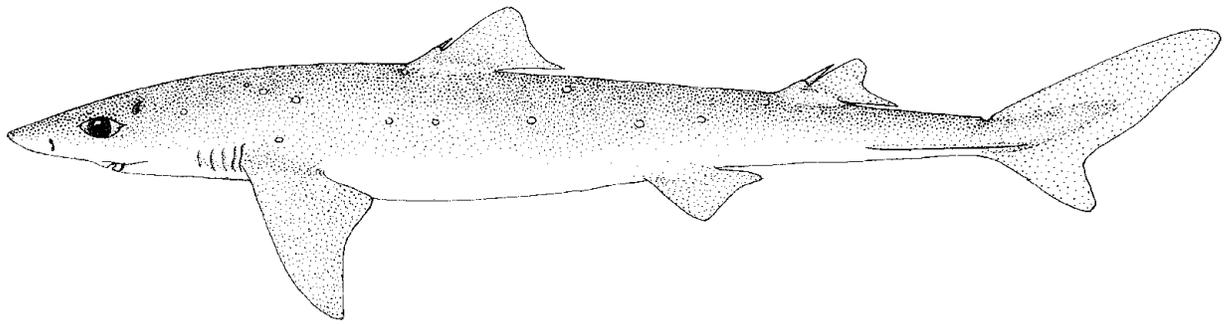
Swell Shark

Up to 3 feet



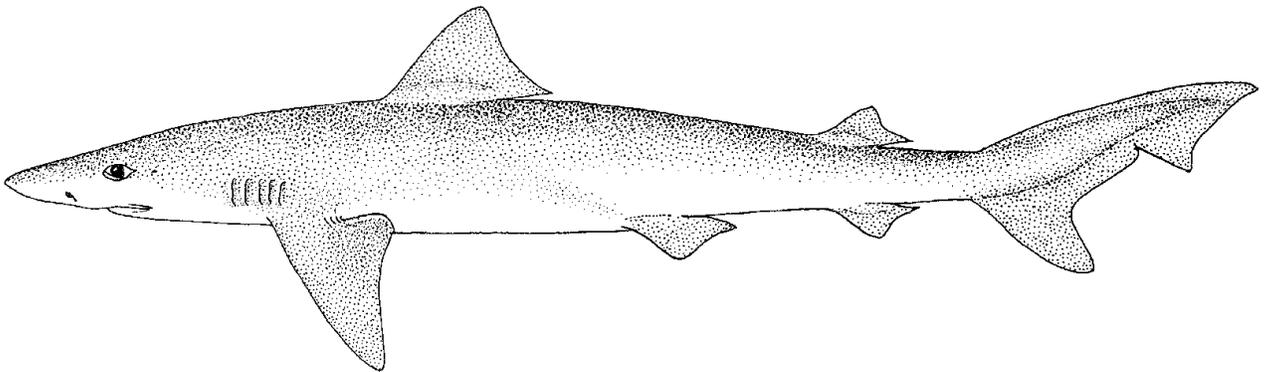
Horn Shark

Up to 4 feet



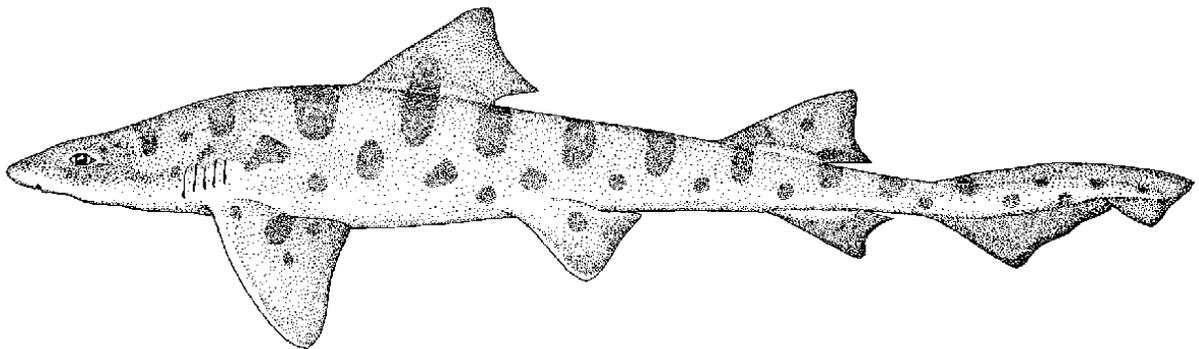
Spiny Dogfish Shark

Up to 5 feet



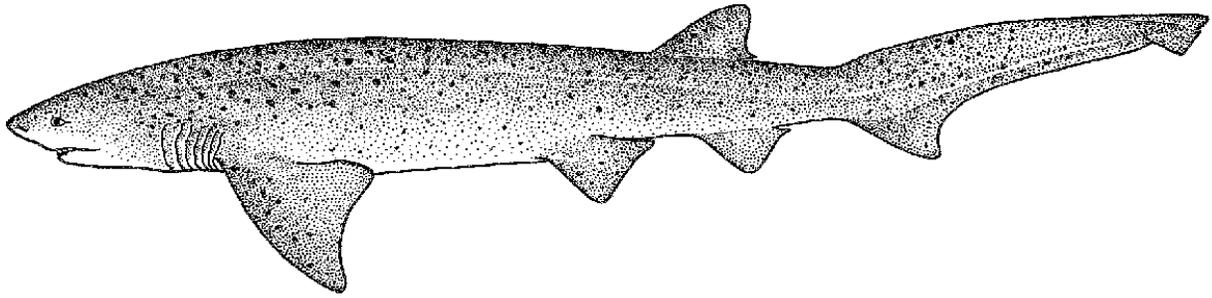
Soupfin Shark

Up to 6 feet



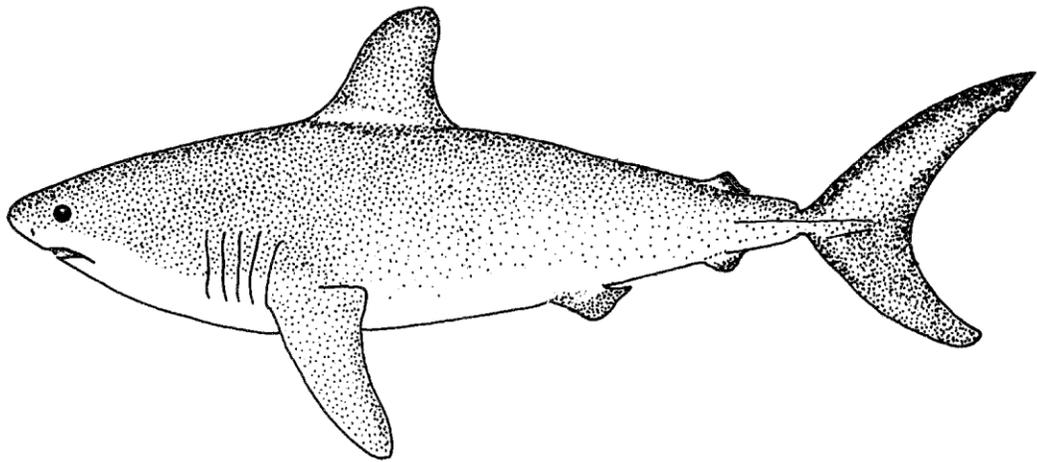
Leopard Shark

Up to 6.5 feet



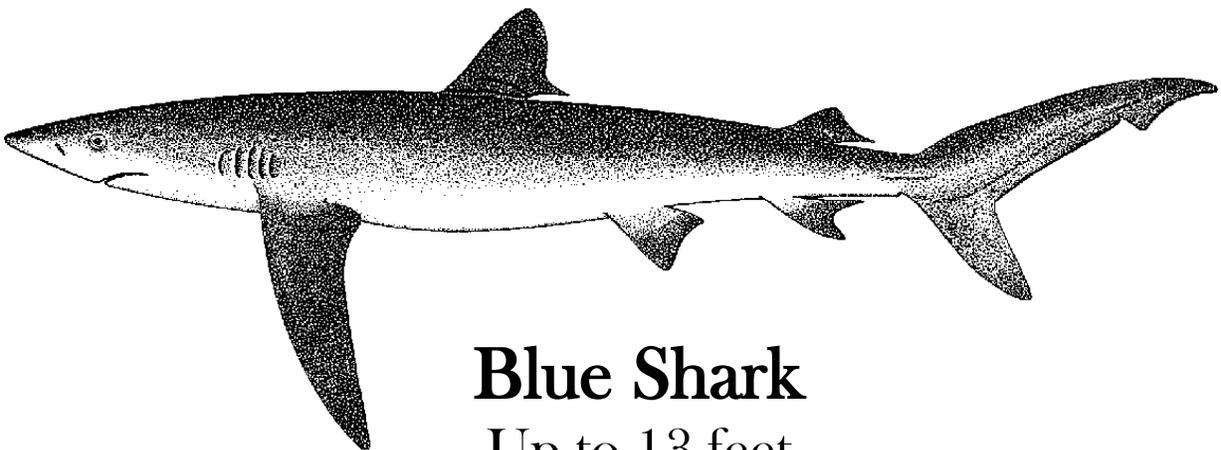
Sevengill Shark

Up to 10 feet



Salmon Shark

Up to 10 feet



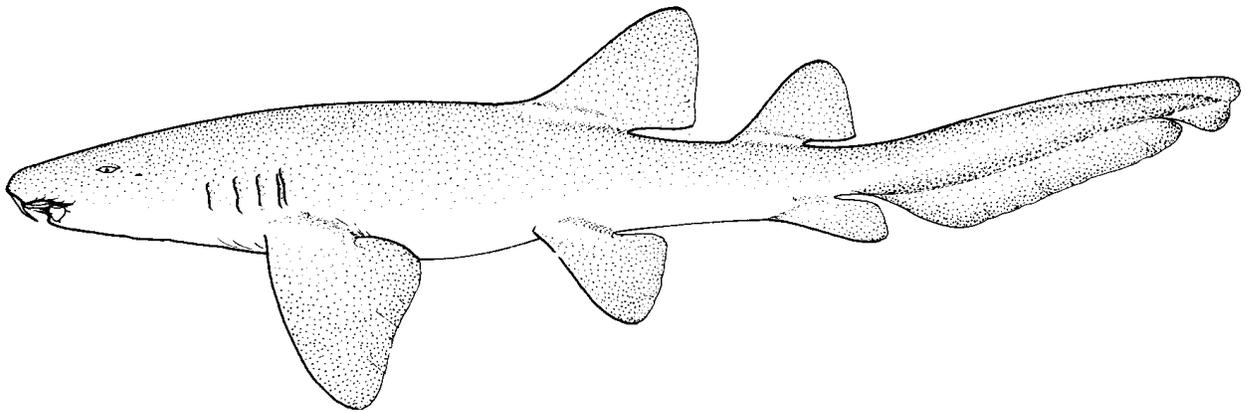
Blue Shark

Up to 13 feet



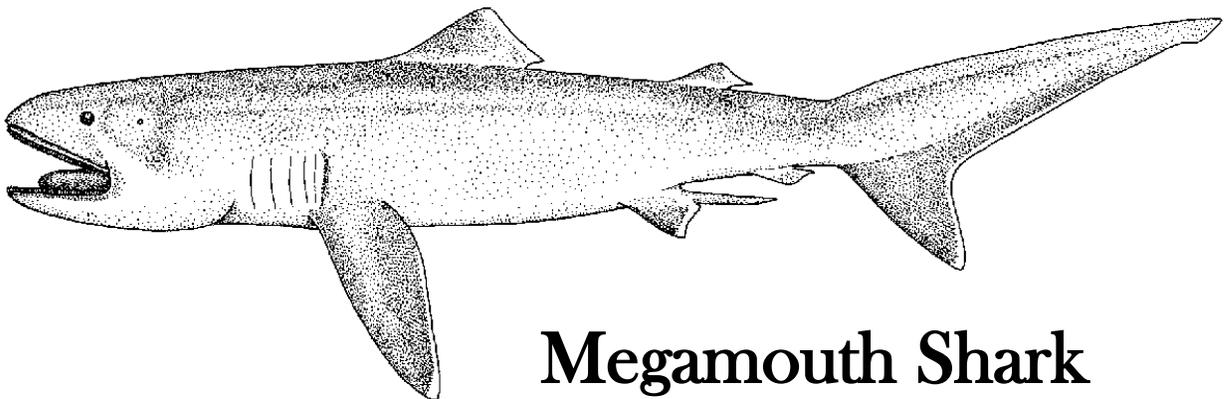
Mako Shark

Up to 13 feet



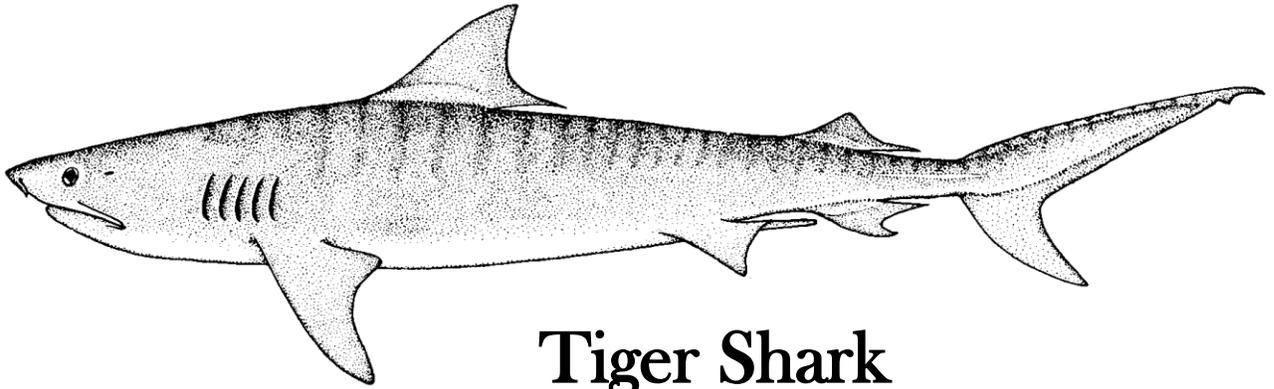
Nurse Shark

Up to 14 feet



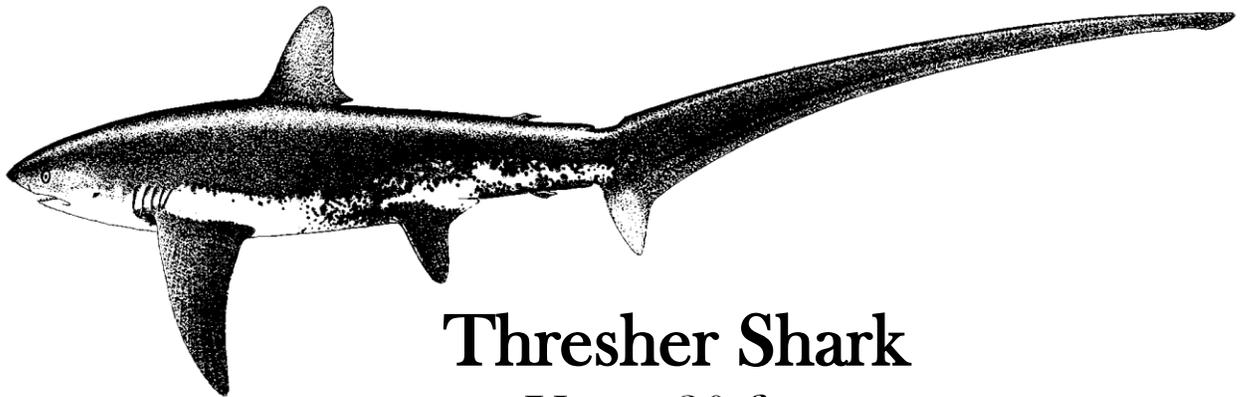
Megamouth Shark

Up to 17 feet



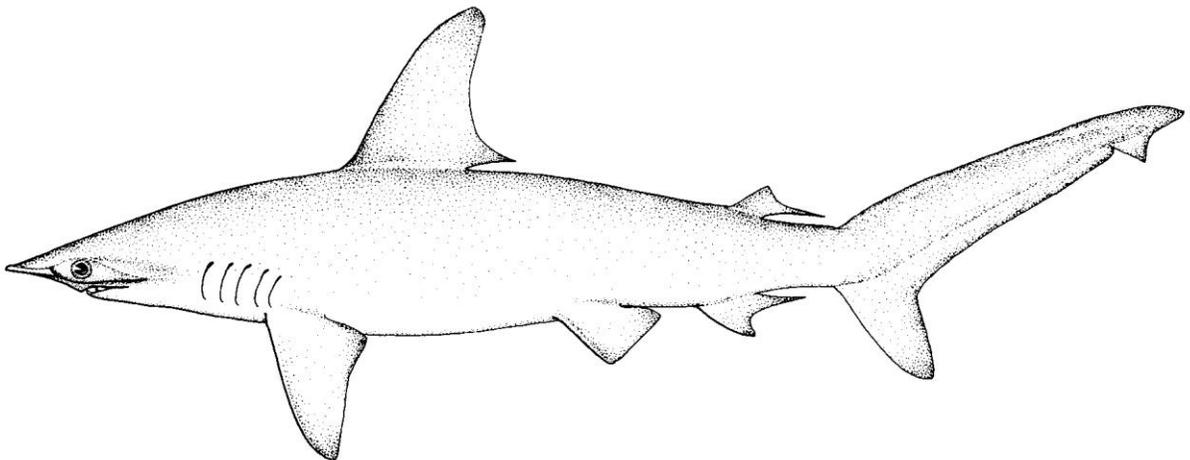
Tiger Shark

Up to 18 feet



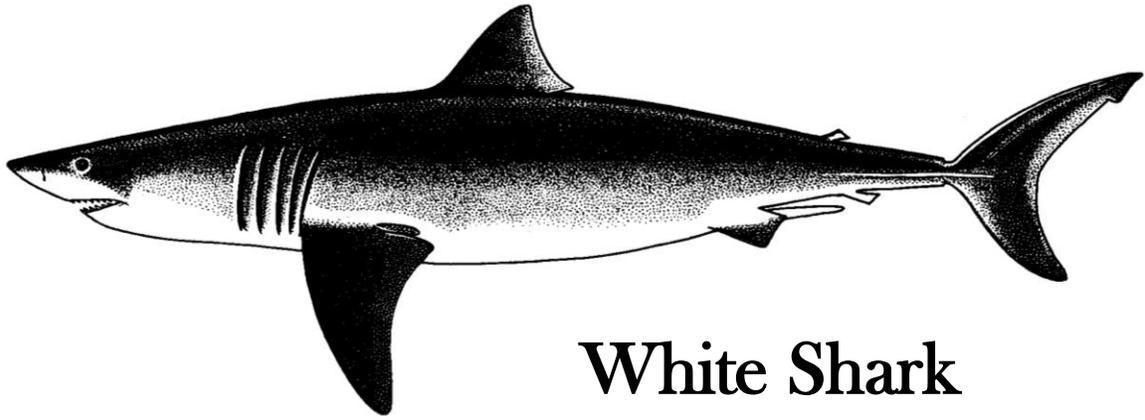
Thresher Shark

Up to 20 feet



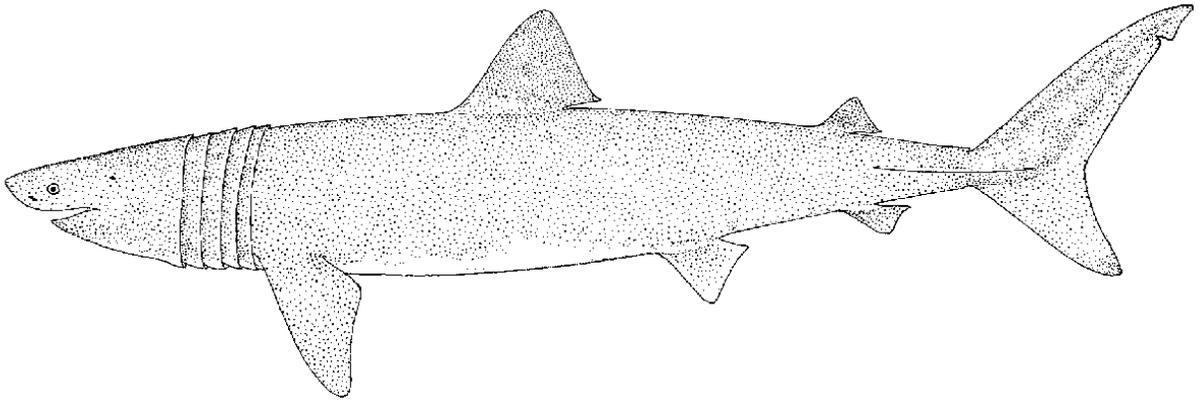
Great Hammerhead Shark

Up to 20 feet



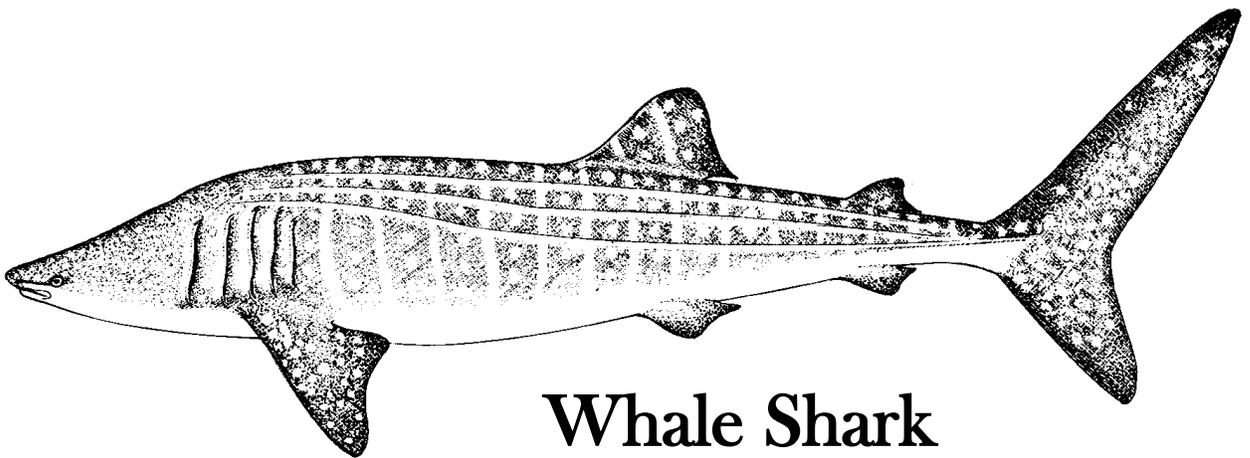
White Shark

Up to 21 feet



Basking Shark

Up to 33 feet



Whale Shark

Up to 50 feet

Wheel Of Gorgin' (AKA The Shark Wheel)

Lesson at a glance:

By making a shark wheel, students will learn how sharks' teeth vary with their diet.

Oregon Content Standards:

Science

- **First Grade:** 1.1L.1 Compare and contrast characteristics among individuals within one plant or animal group.
- **Second Grade:** 2.1L.1 Compare and contrast characteristics and behaviors of plants and animals and the environments where they live.
- **Third Grade:** 3.1 Structure and Function: Living and non-living things vary in their characteristics and properties.

Ocean Literacy: Essential Principles and Fundamental Concepts

5. THE OCEAN SUPPORTS A GREAT DIVERSITY OF LIFE AND ECOSYSTEMS.

- 5.d. Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.

Materials:

- Shark wheel pattern
- One brad (paper fastener) for each wheel
- Crayons or markers
- Scissors
- Scratch paper and pencils
- Shark jaws with various tooth styles (if available) or photos
- Shark Teeth overhead

Background:

Sharks have an unlimited, lifetime supply of teeth. Their teeth are arranged in rows, one behind the other. As one tooth in the front row falls out, a tooth from the next row moves forward to replace it. Some shark species can replace an entire row of teeth in a week. Others replace them a whole row at a time. An individual shark may go through more than 30,000 teeth in a lifetime. Each shark tooth has a pulp cavity surrounded by a hard core of dentine, and

| My teeth | What I eat |
|---|---|
|  | Fish- and squid-eating sharks, like lemon and salmon sharks, have long, narrow, prong-like teeth. |
|  | Mammal- and large-fish-eaters have triangular teeth with serrated cutting edges. |
|  | Those that eat clams or crabs may have flattened, crushing teeth. |
|  | Some dogfishes have teeth with the point laid over on its side to expose the cutting edge. |
|  | Plankton-eating sharks, like the basking shark (left), have small, essentially useless teeth. |

covered by an even harder layer of enamel. Shark teeth may be shaped differently, depending on the diet of the shark. Examine the chart on the right for just a few of these tooth shapes and their respective prey.

Activity:

Preparation:

1. Photocopy the wheel pattern onto card stock or another heavyweight paper. Tabloid (11" x 17") is a good size. Enlarge the pattern by 1.55 times for tabloid-size copies. Enlarge by 1.29 times for legal-size (8.5" x 14").
2. Make crayons/markers, scissors and brads available to students.
3. Prepare visual aids including Shark Teeth overhead with projector.

Activity:

1. Begin your lesson with a brainstorming session to find out what your students know about sharks. Alternatively, you could begin with a concept attainment exercise (see Extensions).
2. Ask your students to describe shark teeth. You might even like to have them draw a shark tooth. Explain to them that all shark teeth are not alike. Sharks have different shaped teeth depending on the kinds of food they eat.
3. Use your shark jaws or photographs to show your students the different shapes of shark teeth.
4. Put up your Shark Teeth overhead with the prey side covered. Ask your students to hypothesize about what each tooth type is best suited to catch and eat. Have them write their answers down on scratch paper then collect the most common responses on the board. See how their answers match up with the answers on the overhead.
5. Hand out shark wheel copies, one per student.
6. Have your students color, cut and assemble their shark wheels.
7. When cutting the tooth and text (bottom) half of the wheel, cut around the outer edge only. When cutting the shark heads (top) half of the wheel, cut all around the outer edge then cut out the shaded (mouth) areas.
8. Poke a hole in the blacked dots at the center of each disc. Place the shark heads disc over the tooth and text disc and affix them with a brad.

Summary:

1. Review each of the tooth types on the wheel.
2. See if your students can match the following sharks to the tooth type they inspired: white shark, mako, dogfish, horn shark and basking shark (clockwise from the most triangular teeth).

Extensions:

1. Begin your lesson with a concept attainment exercise. In this exercise, you'll make three columns on the board. One is labeled Examples; one is labeled Non-examples and one is labeled Hypotheses.

You have an idea in mind (in this case, “sharks”) and your students will offer hypotheses as to what it is based on the examples you give that are consistent with the idea and others that are not.

Start with your first positive example and collect student hypotheses. Next, give your first negative example. With each item you add to the list, evaluate the hypotheses already given and add new ones until you get to your idea (i.e., “sharks”). Even if your students come up with “sharks” very early, continue until you have eliminated all other reasonable hypotheses.

Here is a suggested list of examples and non-examples. Feel free to make your own. With this list you are giving the students characteristics that a shark has or does not have.

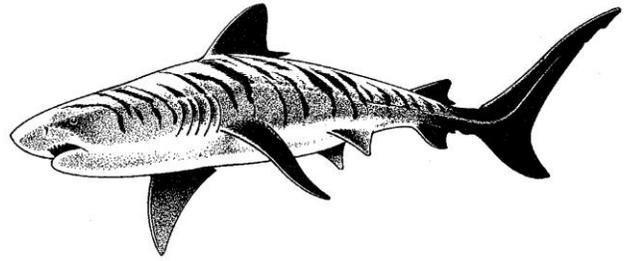
| My idea has... | My idea does not have... |
|----------------------------|---------------------------------|
| Backbone | Wings |
| Teeth | Claws |
| Fins | Whiskers |
| Torpedo-shaped body | Blowhole |
| Gills | Flat scales |
| Cartilage skeleton | Bony skeleton |

Once you’ve reached “sharks,” you can circle the word “teeth” and bring them into the activity.

- Some sharks have really strange teeth. Have your students do some research on the following sharks:
 - Cookie-cutter shark
 - Bowmouth guitarfish
 - Tiger shark
 - Sevengill shark
 - Saw shark

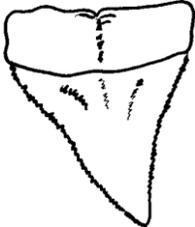
You can use www.elasmo.com as a resource to see photos of many different shark jaws. Click on “Extant dentition.”

Shark Teeth



My Teeth

What I eat

| | |
|---|--|
|  | <p>I eat slippery squid and fish. My long teeth are good for stabbing, not so good for chewing. I grab my food and swallow it whole.</p> |
|  | <p>My triangular teeth have rough edges like a knife or a saw. I use them to cut chunks out of marine mammals and large fish.</p> |
|  | <p>I use my flat teeth to grind up hard, crunchy prey like crabs and clams. My teeth are a little like your molars.</p> |
|  | <p>My teeth link together to form one long cutting surface. I use them to cut fish and squid into bite-sized pieces.</p> |
|  | <p>I don't even use my little teeth. I capture tiny plankton with gill rakers in my throat.</p> |

