

Sharks

Pre- and Post- Visit Activities
Grades 1-3





This booklet was prepared by the Conservation Education Department at the National Aquarium in Baltimore.

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March, 2005

Sharks Auditorium Presentation

A 45-minute program for grades 1-3 at the National Aquarium in Baltimore

Program Description

For medieval Europeans, who were only just starting to explore the world, the oceans teemed with hostile monsters, one of which was the shark. Some scholars believe the word "shark" is derived from the German word *schurke*, meaning "villain." Even today, there are few, if any, animals on earth that people fear as much as they do sharks. Movies and books have made it seem that the world's oceans are full of hungry sharks waiting to attack every swimmer who enters the water.

Is the shark really the villain of the oceans, the ultimate eating machine? It is certainly a most efficient predator, but its success is due to more than just its toothy grin. In the 45-minute auditorium program at the Aquarium, you and your students will get a closer look at the animal that South Sea Islanders worshipped and today's beachgoers fear.

Such topics as shark characteristics, feeding habits, conservation, collection, and study will be discussed. Audience participation is encouraged.

Planning for the Program

Pre-visit preparation is strongly recommended. The Sharks Auditorium Program fits into a unit on animals, oceans, or marine life. Including your visit to the National Aquarium in Baltimore, this lesson should be covered in about three days.

Day 1

A day or two before your visit to the Aquarium, read the Teacher Background information and share this information with your students, as appropriate. Complete Activity 1 - Fish Comparison (page 5).

Day 2

At the Aquarium, attend the Sharks Auditorium Program. Then look for various sharks and their relatives throughout the Aquarium galleries, including the Wings in the Water and Open Ocean exhibits.

Day 3

The day after your Aquarium field trip, complete Activity 2 - The Name Game (page 8).

AAAS Benchmarks

5A-K-2#2

Plants and animals have features that help them live in different environments.

5A-K-2#3

Stories sometimes give plants and animals attributes they really do not have.

MD Voluntary Curriculum

SCIENCE

3.0 Life Science, Grade 1.

A.2. Recognize and explain how the function of various external structures enables plants and animals to survive.

6.0 Environmental Science, Grades 2-3.

D.1. Recognize and describe that the activities of individuals or groups of individuals can affect the environment.

Teacher Background

There is probably no other animal on earth that people fear as much as the shark. Movies and books have made it seem that the world's oceans are full of hungry sharks waiting to attack every swimmer who enters the water. Most people also think of a shark as a large gray, torpedo-shaped animal. Neither view is completely true. Sharks can be short, fat, skinny, flat, blue, brown, and even spotted, with strange heads and tails. About half of the roughly 400 different kinds are actually under 1 m (3 ft) in length, and range in size from the 15 cm (6 in) cigar shark up to the whale shark, which may be over 18 m (60 ft) long.

A Different Kind of Fish

All fish, including sharks, are vertebrate animals, meaning they have a backbone. Most fish have a skeleton made of bone. However, sharks and their relatives, the skates and rays, are very different from most fish because their skeletons are made of cartilage, a tough, flexible material that also forms people's ears and the tips of their noses. During the early stages of life, other vertebrates (including humans) have a temporary skeleton made of cartilage. But by the time they are born, their skeletons have been replaced with bone.

There are several other important differences between elasmobranchs, or cartilaginous fish, and bony fish. Sharks lack the gas-filled swim bladder found in most bony fish. A swim bladder holds gases and acts like a float inside the fish to counteract gravity and keep it from sinking. It allows a fish to remain just about neutrally buoyant - going neither up nor down in the water column - without putting extra energy into the effort of swimming. Still, sharks are able to remain somewhat buoyant without an air sac because of their enormous oily liver (oil is lighter than water), and some, like the sand tiger shark, can even swallow air.

Despite their oily liver, most sharks must swim constantly to prevent sinking. This movement is also necessary for many to maintain a flow of water over the gills in order to provide oxygen. Bottom dwellers like the nurse shark are able to rest on the bottom because muscles in their mouths pump water across the gills. Though they appear to be swallowing the water, it actually passes out of the gill slits after the dissolved oxygen diffuses into the gills. Another difference is that bony fish have a hard covering over their gills, with one opening to the outside. Sharks lack the hard coverings, and have 5 to 7 gill slits.

Most bony fish are covered with smooth scales. Instead of scales, sharks have rough skin with tiny toothlike structures called dermal denticles, or "skin teeth." Like teeth, the denticles have a pulp cavity and are composed of dentine and enamel. They make the skin feel like sandpaper.

"Sense-ational" Sharks!

It is believed that the first sharks appeared about 400 million years ago - before the first dinosaurs - and were as well adapted to their environment as they are today.

Although they've changed very little in that time, they are not inferior to modern bony fish, and a number of specialized senses make them some of the most efficient predators on earth. In fact, with so many sophisticated sensory systems, the shark has a proportionately heavier brain than that of other fishes.

Sharks are carnivores and actively hunt down their prey. As a shark swims, the lateral line - a complex of superficial canals, pores, and sensitive cells distributed over the head and sides - responds to vibrations transmitted through water. The vibrations may be caused by a swimming fish, and the shark can swim toward it. From a few hundred meters, smell becomes useful as scents fill a sac-like nostril on either side of its snout. Sharks have been called "swimming noses" and can detect substances like blood that are diluted to as little as one part per million in sea water. By moving its head from side to side and sensing the direction of the water current, the shark can follow the strongest concentration of scent toward its target.

Mucus-filled tubes in the head area, called the ampullae of Lorenzini, are sensitive to electrical potentials and detect the weak electrical fields given off by live animals. This works best at close range and can help to pinpoint an animal that the shark may not even see in dark water. In addition, the shark's eyes are specialized for seeing in dim light and work with the other senses to help guide the animal to its prey. In a shark's eyes, plate-like crystals of the tapetum lucidum function like microscopic mirrors, reflecting light back through the retina and increasing the chance that light rays will be absorbed. In bright light, dark pigments cover the reflective surface.

The Tooth About Sharks

Of course, the business end of a shark's hunt is its teeth. Different types of sharks have different shapes of teeth adapted to the kinds of food they eat, ranging from marine mammals and fish to crustaceans and mollusks. Experts can tell what kind of shark a tooth came from by its shape. For example, Great white sharks have narrow teeth in their bottom jaws used for holding and sharp triangular teeth in the top jaws for cutting. But not all sharks have sharp teeth for tearing. Some, such as nurse sharks, have a flat "plate" for crushing shells of crabs and lobsters. Other do not even use their teeth. Whale sharks are filter-feeders, using the rake-like inner edge of the gills to strain food from the great quantities of water that they take in.

Because a shark's mouth, in most cases, is on the underside of its head, it must change the shape of its face to feed. As it starts to bite, the shark's snout bends up out of the way and the jaws move forward. The jaws are only loosely connected to the skull and are very mobile. When the shark bites its prey, the mouth moves back under. After getting a good hold, the shark may also shake its head from side to side to help tear out a chunk of meat. The shark then swallows its food whole, relying on enzymes and hydrochloric acid in its stomach to break down the food into basic nutrients. Because a shark is ectothermic (cold-blooded), it does not need to eat the same amounts of food as a warm-blooded mammal the same size. A good meal will provide enough energy to last days or even weeks. This is why the nickname "eating machine" is a misnomer. Actually, a dolphin eats much more than the average shark!

Sometimes when a shark tears out a chunk of meat, some of its teeth fall out. This is because the teeth are not held in place by roots and are only loosely connected to the jaws. When a tooth is lost, another one moves up in the jaw, like stairs on an escalator. It takes about 24 hours to replace a missing tooth. Sharks have 5-15 rows of teeth ready for use. Some sharks will replace up to 30,000 teeth in their lifetime.

Sharks in Danger

Much attention has been focused upon the interactions between sharks and humans in the past several years. According to the International Shark Attack File (ISAF), there are an average of 50-75 each year worldwide, but only about 8-12 fatalities. And, of the approximately 400 species of sharks, only 32 have been documented in attacks on humans. Scientists theorize that human attacks occur for several reasons. Attacks may occur as a result of territorial responses, inquisitive testing, accidental interference with mating activities, or, as in most cases, mistaken identity.

Despite their bad reputation, most sharks are shy and harmless, avoiding people and other large animals whenever possible. Only a dozen kinds of sharks are considered very dangerous to humans. On the other hand, people kill over a million sharks per year. Their rough skin and sharp teeth have been used historically for sandpaper and spears. Nowadays, the skin is used to make strong leather. Many sharks are hunted for their meat and cartilage or for their fins, to make shark fin soup. Some sharks are also killed to make fertilizer or for research. Many sharks die as accidental bycatch, caught by fishermen who intended to catch another species. Shark populations are declining and, without protection, may not be able to sustain the pressures put on them by humans. Scientists who study sharks are working to find out more about these amazing animals and how to better protect them.

Resources

National Aquarium in Baltimore

Learn about the sharks at the National Aquarium in Baltimore's Web site and take the Shark Personality Quiz. Find out which kind of shark you are!

National Aquarium in Baltimore
www.aqua.org/animals.html

Animal Planet

Contains a great list of weblinks to information on sharks facts and conservation.

Animal Planet
www.animalplanet.com

The Secret World of Sharks and Rays

An overview of the world of sharks and the roles they play in nature. Worldwide, there are more than 370 species of sharks, which vary greatly in terms of size, shape, preferred habitat, and prey. This film explores their world and that of their close cousins, the rays.

WNET Video Distribution
Write to:
P.O. Box 2284
South Burlington, VT 05407
Call: 1-800-336-1917

Activity 1- Fish Comparison

Description

Cartilaginous fish (sharks, skates, and rays) differ in various ways from bony fish. To help your students begin to understand the differences between cartilaginous fish and bony fish, we have prepared a Fish Comparison activity.

Procedure

1. Make copies of the Fish Comparison Student Page (page 7). Distribute to your students. Or, put the information on an overhead or on the blackboard. Go over the characteristics of bony fish and sharks. Ask the students to notice differences in:

Skin
Fins
Skeleton
Mouth
Gills
Eyes

Use the teacher background material for more information.

2. Make copies of the What's Wrong? Student Page (page 8). Distribute to your students.

3. Ask your students to find and circle the features on the bony fish and the shark that don't belong or are missing. On each fish some parts are missing and some are incorrect. The Teacher Page with the answers is on page 9.

Activity 1 - Fish Comparison

Bony Fish

Skin

Bony fish are covered with scales. Their skin feels smooth and slimy.

Fins

Bony fish have flexible fins. Some fins have sharp rays or spines.

Skeleton

Bony fish have a skeleton made of bones.

Mouth

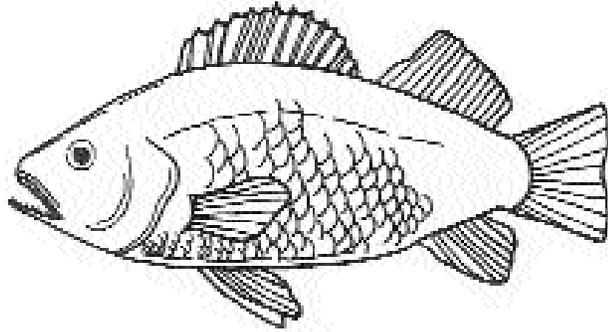
The mouth is located at the front of the head. Usually the lower jaw juts forward. Most bony fish have teeth.

Gills

Bony fish have feather-like gills. A bony flap, called a gill cover, protects the gills.

Eye

Bony fish do not have eyelids.



Sharks

Skin

Sharks have tough skin covered with small tooth-like denticles. Their skin feels like sandpaper.

Fins

Sharks' fins are not flexible.

They often stick out like an

airplane wing. The upper part of the tail fin is usually longer than the lower part.

Mouth

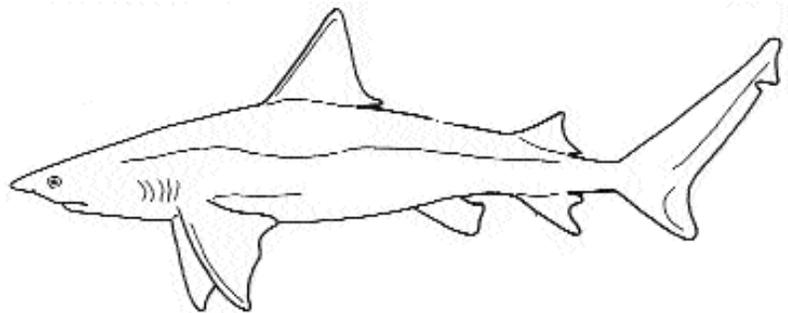
The shark's mouth is located on the underside of its head. Their powerful jaws have rows of teeth.

Gill

Sharks have 5-7 gill slits covering their feather-like gills.

Eye

Some sharks have eyelids. They close from the bottom to the top of the eye.



Activity 1- Fish Comparison

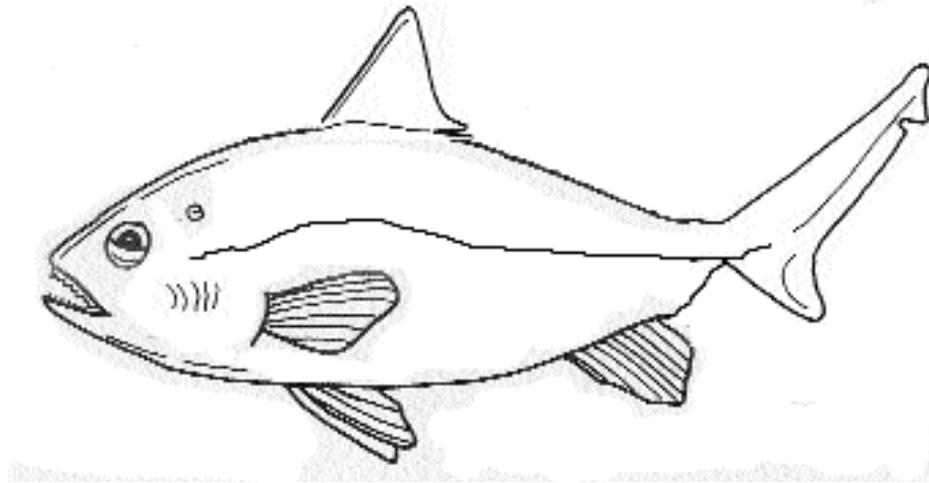
Directions to Students:

Step A. Look carefully at the pictures of a bony fish and shark below. Each picture has one or more things wrong with it.

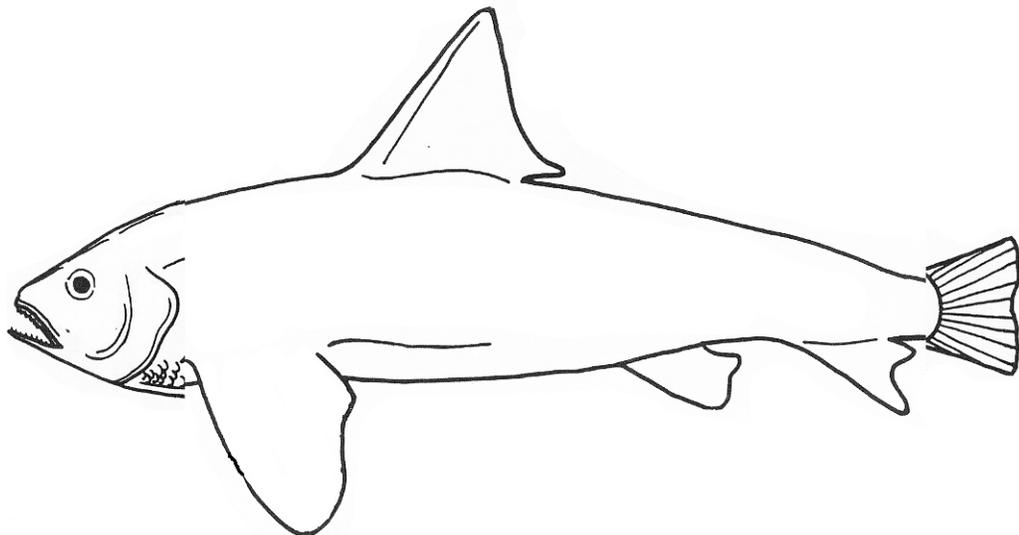
Step B. Find and circle the features on the bony fish and the shark that are incorrect.

Step C. (Optional). Write a sentence explaining why you circled each part.

Bony Fish



Shark

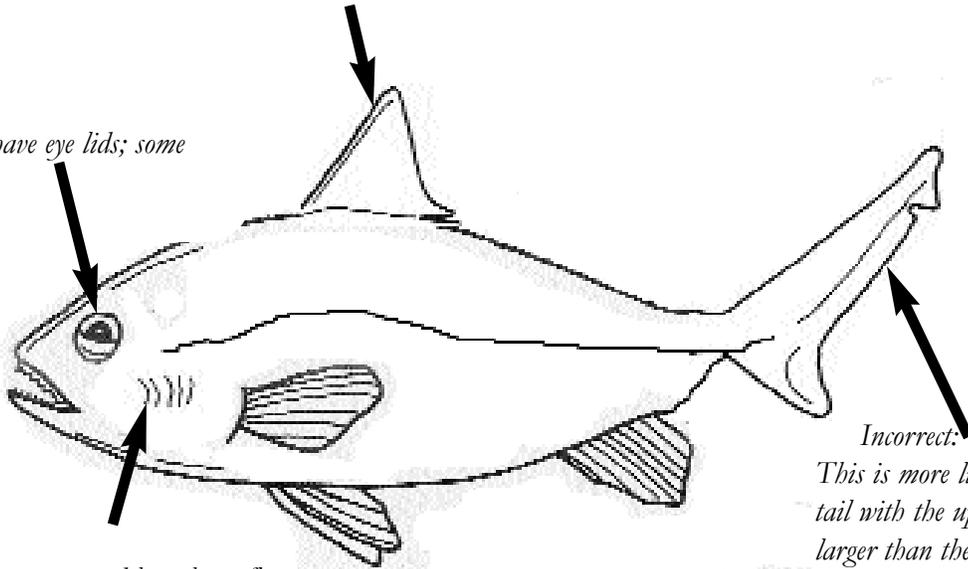


Activity 1- Fish Comparison Answer Page

Bony Fish

*Incorrect:
On a bony fish, the dorsal or top fin has spines.*

*Incorrect:
Bony fish do not have eye lids; some
sharks do.*

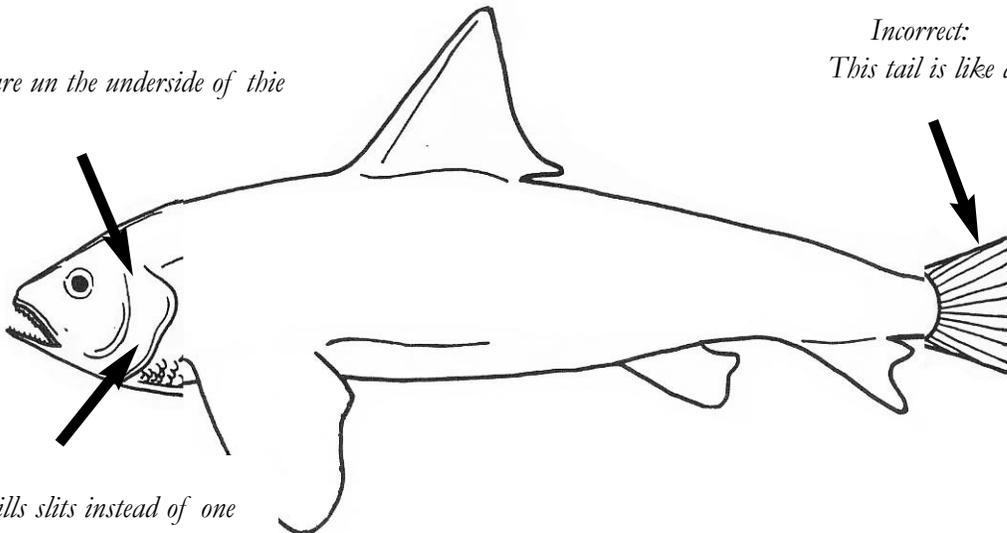


*Incorrect:
The gills of bony fish are protected by a bony flap*

*Incorrect:
This is more like a shark's
tail with the upper lobe
larger than the lower one.*

Shark

*Incorrect:
Sharks mouths are un the underside of thie
face.*



*Incorrect:
This tail is like a bony fish.*

*Incorrect:
Sharks have 5-7 gills slits instead of one
opening to their gills.*

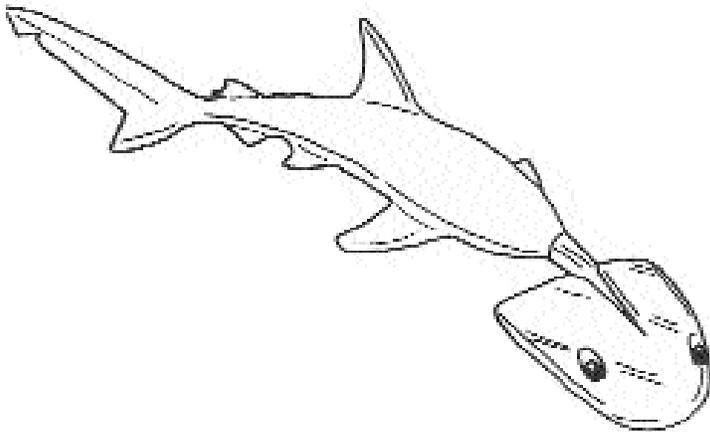
Activity 2 - The Name Game

Description

The Name Game provides your students with a creative way of learning some of the unusual common names given to sharks. Students could enhance this activity by researching a particular shark and explaining why it has the common name it does.

Procedure

1. Explain to your students that all plants and animals have scientific names. Because these names are not easy to remember (try tackling *Chlamydoselachus anguinus!*), we assign common names to help tell the difference between one living thing and another.
2. Tell them that common names are usually based on something specific or unusual about the plant or animal.
3. Ask each student to use his/her imagination to draw a cartoon shark from the list of nicknames in the side bar. By the way, *Chlamydoselachus anguinus* is the frilled shark.



Shark Nicknames

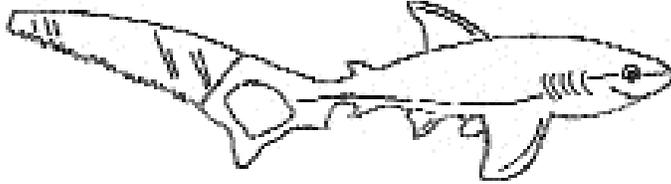
swell shark
zebra shark
blind shark
shovelhead shark
megamouth
angel shark
soupfin shark
slipper shark
mud shark
sharpnose shark
cookie-cutter shark
sawtail shark
pig shark
bull shark
ragged tooth shark
leopard shark
bramble shark
bonnethead shark
tiger shark
goblin shark
smalltail shark
nurse shark
bignose shark
Pacific sleeper shark
catshark
carpet shark

Shark Nicknames

Activity 2- The Name Game

Directions to Students:

1. Look at the cartoon drawing of a shark below.



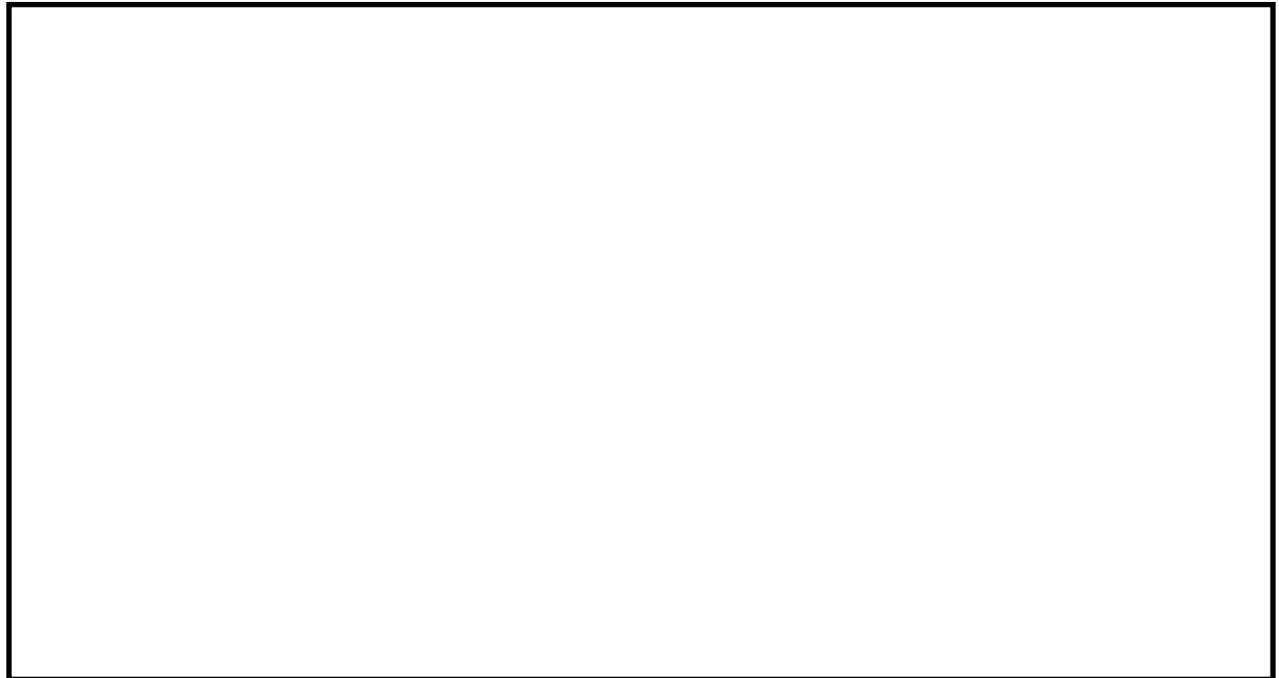
2. Find the name of the shark from the list to the right that matches the cartoon. Write the name here:

3. Choose the name of another shark from the list below.

4. Write down the name of your shark here:

5. What word in the shark's name describes the shark? Write down that word here:

6. Draw a picture of your shark in the box.



- swell shark
- zebra shark
- blind shark
- shovelhead shark
- megamouth
- angel shark
- soufina shark
- slipper shark
- mud shark
- sharpnose shark
- cookie-cutter shark
- sawtail shark
- pig shark
- bull shark
- ragged tooth shark
- leopard shark
- bramble shark
- bonnethead shark
- tiger shark
- goblin shark
- smalltail shark
- nurse shark
- bignose shark
- Pacific sleeper shark
- catshark