

"Sharks: The Real Story"**Ocean Explorers Program**

Program Overview and Shark Background Information

(Grades 3-5, Age 8-10)

Program Description

This standards-based Ocean Explorers shark program for grades 3-5 emphasizes misconceptions about sharks. The program can be used in conjunction with an aquarium school field trip or using the contents of our web site.

The program includes pre-visit and post-visit classroom activities plus observation sheets to be used during your visit to the aquarium. The entire set of activities, California Science Standards and background information about sharks can be found on the aquarium's web site at

http://www.montereybayaquarium.org/lc/teachers_place/activity_sharks_realstory.asp

When your class arrives at the aquarium for their reserved Ocean Explorer shark program, they will receive a short introduction by an aquarium educator that will help students and chaperones begin a focused, on-their-own data gathering investigation of sharks in the aquarium exhibits. While observing live sharks, students note their physical adaptations and the habitats where sharks live.

When they return to school, students share the information they gathered at the aquarium through a variety of post-visit activities, such as graphs, cartoons, myths, interviews or surveys.

Designed for school groups, these sets of activities may also be done by families.

Activity Descriptions

- Sharks: The Real Story Group Exploration Guide: Chaperones use this guide to record student observations during an aquarium visit. It suggests exhibits where students can investigate shark species, sizes, structures and behaviors.
- Shark Surveys: Students create a survey to find out what people think about sharks, their sizes and reputations. After research and their visit to the aquarium, they sort facts from opinions and may discover their opinions about sharks have changed.
- Shark Research: Students make observations or use nonfiction resources to obtain information about shark behaviors and habitats. When they become shark "experts," they conduct interviews with their classmates.
- Sidewalk Sharks: Try this activity to learn about the length of many different sharks. Students can research, measure, compare and graph.
- Shark Cartoons: Using information they have compiled about sharks, students draw cartoons that contain a conservation message.
- Myth-try Cards: After making shark observations, students select sharks and write myths about their physical structures or behaviors. They provide a scientific explanation for these adaptations or the animal's role in a diverse habitat.

California State Content Standards

<http://www.cde.ca.gov/be/st/ss/>

Find standards for grades 3-5 in specific content areas on this web site.

Science

English Language Arts

Mathematics

History - Social Science

Visual and Performing Arts

Suggested Uses of Activities

Activity	Pre-visit	At the Aquarium	Post-visit
“Sharks: The Real Story” Exploration Guide		X	
Shark Surveys	X		X
Shark Research	X	X	X
Sidewalk Sharks	X		
Shark Cartoons		X	X
Myth-try Cards	X	X	X

Activity ResourcesMonterey Bay Aquarium Web Site

Live Web Cams

Students can observe sharks in Kelp Forest and Outer Bay exhibits

http://www.mbayaq.org/efc/cam_menu.asp

“Meet the Sharks”

Information about the sharks in “Sharks: Myth & Mystery” exhibit

http://www.mbayaq.org/efc/efc_smm/smm_meet.asp

Shark Stories and Myths

Stories and myths (audio and video included) from seven cultures

http://www.montereybayaquarium.org/efc/efc_smm/smm_gallery_pi.asp

Shark Cartooning Tips

Tips for creating shark cartoons and comics

http://www.montereybayaquarium.org/lc/activities/sharks_cartooning.asp

Shark Conservation Issues

Why sharks are endangered in the wild

http://www.montereybayaquarium.org/efc/efc_smm/smm_conservation.asp

Shark Animal Fact Cards

http://www.montereybayaquarium.org/lc/activities/critter_cards.asp

Online Field Guide (Search for Sharks)

http://www.montereybayaquarium.org/efc/living_species/default.asp

Shark Videos (short clips to watch online from our Video Library)

http://www.montereybayaquarium.org/efc/video_library/video_library.aspx

Sea Searcher's Handbook

The “Sharks, Skates and Rays” chapter includes more shark information and activities, including a sample survey.

http://www.mbayaq.org/lc/teachers_place/resources_seasearchers.asp

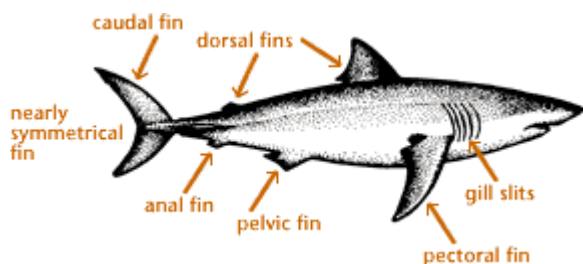
External Links

Clip-art and more shark information. <http://www.oceanstar.com/shark/>

Shark Background Information Sheet

Sharks belong to the class of fish called Chondrichthyes. They lack true bones and have cartilaginous skeletons made of calcium phosphate and other minerals. The cartilage strengthens their body frames and makes them very flexible, agile and lighter in weight than bony fish.

Sharks have adaptations, physical structures (body parts), camouflage and behaviors, that improve their chance for survival in specific habitats.

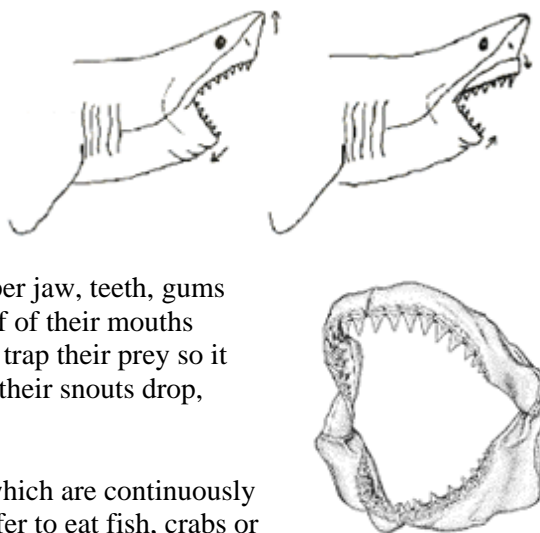


<-- White shark body parts

While there is great diversity among sharks, most sharks have streamlined, torpedo-shaped bodies. Their bodies have rough skin, which is covered with *dermal denticles*, known as placoid scales or "skin teeth." These scales are similar to human teeth, are covered with enamel and contain dentine. The scales continue to grow as the shark grows.

Sharks have 5-7 pairs of gill slits (usually five) for breathing. Water flows through the shark's partially opened mouth and out through the gills, where oxygen is absorbed. Some sharks have holes (*spiracles*) behind their eyes that also aid in the flow of water.

Sharks have true, movable upper and lower jaws located below the skull. Predatory sharks like white sharks use their lower jaw first to strike their prey and then use the top one to bite down. First, they lift their snouts as much as 40 degrees and drop their lower jaws, opening their mouths to a suitable size for the food (left image). Then their upper jaws protrude, producing the startling image of the upper jaw, teeth, gums and connective tissue thrust forward from the roof of their mouths (right image). Next, they lift their lower jaws and trap their prey so it can't escape. Finally, their upper jaws retract and their snouts drop, applying the force necessary to take a single bite.



Sharks have rows of teeth or fused tooth plates, which are continuously replaced from inside the mouth. Many sharks prefer to eat fish, crabs or molluscs rather than mammals and have specialized teeth for surviving and eating in their habitats. None includes humans in their diet, unless it's a case of mistaken identity or opportunistic feeding.

The senses of sharks are very acute. Sharks have no external ear flaps but have two small pores on the top of their heads that connect to inner ear ducts. The inner ears of sharks consist of three fluid-filled semicircular canals and three *otolith* ("ear bone") organs. These organs have tiny hairs that bend when an animal moves near the shark. The hairs trigger the ear canal organs, and nerve cells send a message to the animal's brain about the prey's position and direction of movement.

Many sharks' eyes are on the side of their heads, allowing them to see forward, backward, up and down. Sharks have two eyelids that do not meet to cover the eye. Some sharks have a third eyelid (nictitating membrane) that covers the eyes for protection. The pupils appear as oval black patches and have the appearance of a cat's eye.

Sharks' nostrils or nares are located under their snout. The nostrils contain a pair of olfactory sacs that detect odors. Water flows in and through the sacs and carries smells to these organs.

Sharks also have clusters of sensory pores, *ampullae of Lorenzini*, on their heads. These jelly-filled pores can detect very weak electrical signals given off by an animal's muscle movements.

Sharks have fins, which allow them to cruise for long distances. The stiff pectoral (on the sides) and pelvic (underside of body) fins help sharks move up and down (lift) and control the animal's movements. The caudal (tail) fin moves from side-to-side and propels the sharks forward. Dorsal (on the back) and anal (underside) fins prevent sharks from rolling from side to side when moving forward.

Unlike bony fish with gas-filled swim bladders for buoyancy, sharks have a very large liver filled with fatty oil (*squalene*) that helps keep them from sinking.

Humans have an impact on healthy shark populations. Pollution, coastal development, over-fishing and bycatch are major threats.

The issue of bycatch, when fishermen unintentionally catch sharks while fishing for other species, is a concern of both fisheries and ocean conservationists. Most of the pelagic (open ocean) sharks need to swim continually to breathe and will die if they are caught in a net. Long line methods are more likely to result in bycatch than pole-and-line methods.

The Monterey Bay Aquarium's Seafood Watch researches fishing methods when collecting data about the health of certain fish populations. Nets and trawling are methods that often result in a lot of bycatch. In addition, trawling destroys benthic (ocean floor) habitats.

More information about fishing methods is available on the Monterey Bay Aquarium's web site in the Seafood Watch section (<http://www.montereybayaquarium.org/cr/seafoodwatch.asp>).



Broadnose Sevengill Shark



Leopard Shark



A detailed illustration of a Great White Shark (Carcharodon carcharias) swimming. The shark is shown from a side profile, facing right. It has a large, greyish-brown body with a lighter, white underbelly. The dorsal fin is prominent on its back, and the pectoral fins are extended forward. The mouth is slightly open, revealing sharp, white teeth. The illustration is set against a plain white background.

OCEAN'S EDGE

SECOND FLOOR

SKYWALK

STORE

DISCOVERY LAB CLASSROOMS

OB

OUTER BAY

DRIFTERS GALLERY

OCEAN'S EDGE

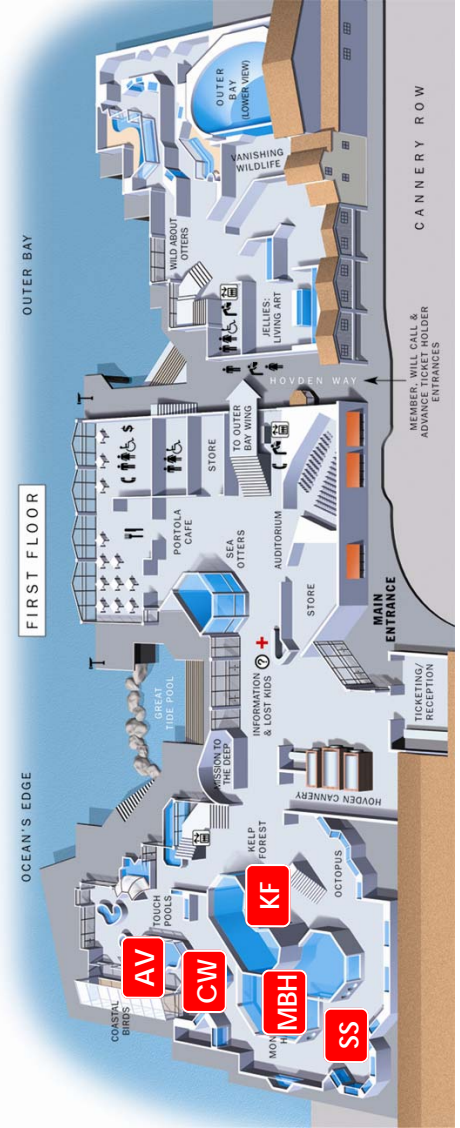
Opening March 2008

We're expanding our Splash Zone galleries, with new exhibits and new animals like cuttlefish, seahorses, sea dragons - and our popular penguins. Plus larger touch pools and new ways to explore kelp forest habitats. Come back and visit!

10:30 a.m.
1:30 p.m.
3:30 p.m.

11:00 a.m.

Tuesday,
Thursday



11:30 a.m.
4:00 p.m.

Science to Share

- Leopard sharks, like white sharks and most other sharks, have five gill slits on each side of their body.
- A leopard shark's tail is longer on top and shorter on the bottom. This tail shape provides "lift" to the shark as it swims. If a leopard shark stops swimming, it will sink to the bottom!
- A white shark's tail is forked and is about the same length on the top and bottom; this tail shape is found in fishes that swim constantly or with speed.
- The coloration and patterning of a leopard shark help it to blend in with its surroundings (camouflage).
- Like white sharks, leopard sharks are countershaded – meaning they are darker on top and lighter on the bottom. When viewed from below, the lighter belly of the shark blends in with the lighter waters above. When viewed from above the darker top of the shark blends in with the darker water below.

Like white sharks, leopard sharks are ocean predators.

Observe a leopard shark closely.

Try to attend a Kelp Forest Feeding at 11:30 a.m. or 4:00 p.m.



white shark



How are white sharks and leopard sharks similar?

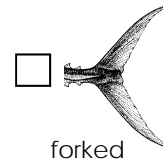
How are they different?

Here are some things to look for.

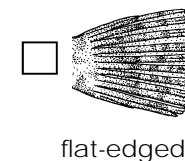
How many gill slits does a leopard shark have?

☐ 4☐ 5☐ 6☐ 7

How is a leopard shark's tail shaped? (Images not to scale.)



forked



flat-edged



longer on top
shorter on bottom

How would you describe a leopard shark?

☐ silver☐ brown☐ striped☐ spotted☐ dark on top and light on bottom☐ light on top and dark on the bottom

Science to Share

- Sevengill sharks have seven gills on each side of their body, unlike most sharks, which have five.
- A spiny dogfish has one poisonous spine in front of each dorsal fin. These spines provide protection from predators.
- Rays and skates are like flattened sharks. They have gill slits and a backbone made of cartilage.
- In rays and skates, the pectoral fins are used for swimming and are fused to the head.

White sharks are related to other sharks, rays and skates.

Can you find these sharks?

(Images not to scale.)

☒ = we found it!

Sevengill

How many gill slits does this shark have?

☐ 5

☐ 6

☐ 7

☐ 382



Spiny dogfish

What two "special weapons" do you see on this shark?

☐ two huge teeth

☐ two spines

☐ two water guns



Rays and skates, unlike white sharks, have flattened bodies.

Can you find these animals?

☐ Bat ray

How does this shark relative move its wing-like fins?

☐ like a butterfly

☐ like a mermaid



☐ Skate

Can you find any resting on the bottom?

☐ Yes

☐ No



Science to Share

- All male sharks, skates and rays have claspers.
- Male sharks use claspers to make new baby sharks.
- Look for two pencil-shaped organs on the bottom of the shark. If a shark has claspers, it is a male!
- Claspers are attached to the pelvic fins of male sharks.

Male white sharks have claspers

Find male sharks, skates and rays. (Images not to scale.)



Do you think there are more male or female sharks in this exhibit?

☐

More males

☐

More females

Science to Share

- All skates lay a tough egg case containing one to seven skate embryos.
- The young skates grow and develop for many months inside the egg case.
- Each embryo is attached to an egg yolk. The egg yolk provides food for the developing skate while it is inside the egg case.
- All rays give birth to live young.
- Sharks may lay an egg case or give birth to live young, depending on the species of shark.
- Leopard sharks and white sharks are examples of sharks that give birth to live young.
- Horn sharks, swell sharks and cat sharks are examples of sharks that produce egg cases.

White shark babies are born alive.
Skates hatch from egg cases.

Observe the skate egg case in the exhibit closely.



Images not to scale —
egg case enlarged
to show detail.

How many baby skates can you see inside the egg case in the exhibit?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Is each baby skate connected to its own egg sac or do they all share the same one?

☐ each has its own ☐ they all share the same one

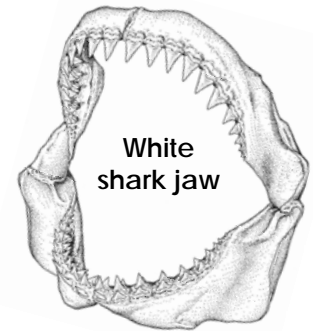
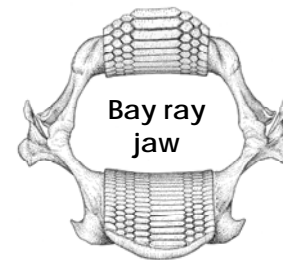
Science to Share

- Rays are like flattened sharks. They have gill slits and a backbone made of cartilage.
- All sharks, skates and rays are carnivores (meat eaters).
- Sharks, skates and rays are consumers in ocean food chains. Consumers eat other animals to obtain energy.
- Sharks, skates and rays can replace worn and missing teeth. Numerous rows of new, growing teeth line up behind the front teeth; as a tooth is worn out or lost, the one behind it moves forward to take its place.
- Bat rays are carnivores that consume (eat) clams, shrimp and worms. Bat rays do not eat plants.

White sharks and bat rays are carnivores (meat eaters).

Explore the "Nature Center."

Bat rays are carnivores with flat, grinding teeth. They use their fins to uncover animals living in the sand or mud.



Images not to scale.

In areas with muddy bottoms, which organisms would a bat ray be good at consuming (eating)? Look around the Nature Center for clues!

☐ clam



☐ eelgrass

☐ fat innkeeper worm



☐ perch



(Images not to scale.)

Coastal Wetland to
Sandy Shore Nature Center

CW

Science to Share

- Some shark, skates, and rays live along the seafloor. These sharks, skates and rays can pump water through an opening (the spiracle) on top of their bodies and across their gills. This allows these animals to breathe while resting on the bottom or hiding in the sand.
- Spiny dogfish, shovelnose guitarfish, round rays and bat rays all have spiracles.
- As a white shark swims, water enters the mouth and flows across the gills. White sharks do not have spiracles. If a white shark stops swimming, it will drown!

As a white shark swims, water enters the mouth and flows across the gills.

White sharks do not have spiracles.

Closely observe the animals shown below.

Which of these animals has **spiracles** (openings to the gills located behind the eyes)?



Spiracle **No Spiracle**

☐
☐


Spiny dogfish

☐
☐


Shovelnose guitarfish

☐
☐


Round ray

☐
☐


Images not to scale.

Why might spiracles be helpful to sharks, skates and rays living along the seafloor?

Science to Share

- Galapagos and hammerhead sharks are countershaded (darker on the top and lighter on the bottom). When viewed from below, the lighter belly of the shark blends in with the lighter waters above. When viewed from above the darker top of the shark blends in with the darker water below.
- If threatened by a predator or competitor, a Galapagos shark will arch its back, lower its pectoral fins and swim with a distinct posture.
- A hammerhead's eyes and nostrils are located at the extreme ends of its head.
- Why do you think hammerhead sharks have a head shaped like a hammer? Perhaps this unusual shape gives the sharks added lift, lets them make sharper turns or helps them to have a wider field of vision. Scientists aren't really sure!

Adult white sharks roam the open ocean.

Look for these sharks.

☒ = found it!



Galapagos
shark

Images not
to scale.



Scalloped
hammerhead
shark



How would you describe these sharks?

- ☐ silver ☐ brown ☐ striped ☐ spotted
- ☐ dark on top and light on bottom
- ☐ light on top and dark on the bottom

Myth-try Cards Activity

(Grade 3-6, Age 8-11)

Activity Description

How did the leopard shark get its spots? Why is a thresher shark's tail so long? Students read creation myths to learn various cultural explanations for natural phenomena. They select sharks and write myths to explain physical structures, behaviors or roles in ecosystems. They research the animals to provide scientific explanations.

Key Concepts

- As part of oral tradition, world cultures tell stories to explain natural phenomena, such as the origin of the ocean and sea animals (*creation myths*).
- Animals have physical structures and behaviors that help them survive in specific ecosystems.
- Scientists observe carefully, conduct research, record their observations and write about what they observe.

California Science Standards

Grade 3: 3a, 3b, 3c, 3d, 5b, 5e

Grade 4: 2a, 2b, 2c, 3a, 3b, 3c, 6a

Grade 5: 2b, 2c, 6a, 6g, 6i

Grade 6: 5a, 5b, 5c, 5d, 5e, 7a, 7d, 7e

(<http://www.cde.ca.gov/re/pn/fd/documents/sci-stnd.pdf>)

California Language Arts Standards

Grade 3 Grade 4

Grade 5 Grade 6

Reading, Writing, English Language Conventions, Listening and Speaking

(<http://www.cde.ca.gov/re/pn/fd/documents/ela-contentstnds.pdf>)

Materials

- Myth-try and Science Card sets
- Loose-leaf rings
- Creation myth books
- Nonfiction shark resources (books, magazines, photographs)
- Writing supplies

Activity Link

This activity is used in the Teaching Units "Sharks: The Real Story"

http://www.mbayaq.org/lc/teachers_place/activity_sharks_realstory.asp and

"The World of Sharks"

http://www.mbayaq.org/lc/teachers_place/activity_worldofsharks.asp

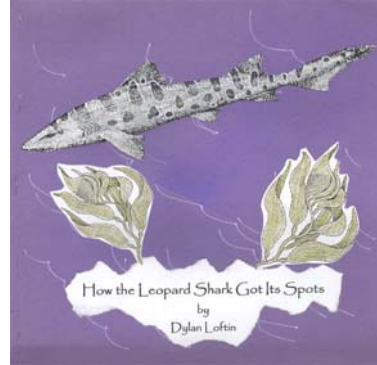
You'll find other related activities, background information about sharks and their physical characteristics and more online resources students can use to research sharks.

Teacher Directions


1. Before the activity, make Myth-try and Science Card sets for each student. Punch a hole in one corner of each card. Place a loose-leaf ring through the holes to create a card set.
2. Read examples of creation myths from different cultures, focusing on animal stories. Discuss how these stories are part of a culture's oral tradition.
3. Discuss the settings, characters and plots. Ask students to explain what was created in the myth, how and why it was created and by whom.

<input type="radio"/>	Physical Features:
<input type="radio"/>	Behaviors:
Fast: <input checked="" type="checkbox"/>	Hiding: <input checked="" type="checkbox"/>
Slow: <input type="checkbox"/>	Eating: <input checked="" type="checkbox"/>
Crawling: <input type="checkbox"/>	Holding on: <input type="checkbox"/>

4. Provide nonfiction resources for students to make shark observations. What physical features (body parts, camouflage) or behaviors do they notice? Use the Monterey Bay Aquarium web site to look for clues about the sharks' ecosystems, such as their roles in food webs.
5. Each student selects one shark for which he/she will write a myth. The myth may explain a physical feature, behavior or the shark's role in an ecosystem. If you plan to visit an aquarium, have students select sharks that can be observed there. Give each student a set of Myth-try Cards to record data.
6. Have students write and illustrate their myths. Ask students to share their stories with the class.
7. Discuss possible scientific explanations for sharks' physical features, behaviors or their place in the ecosystem.
8. Students then gather and record scientific information about their sharks, using nonfiction resources. Have them look for data about physical structures, behaviors, diet and habitat. Give students Science Card sets to record data.
9. If your class visits the aquarium, have students observe their sharks and habitats and record additional findings on their Science Cards. Have chaperones collect the cards.
10. In class, review the cards. Students now write a scientific explanation for the item explained in their myths, using their notes and resource materials.



Extensions

-  Read a myth from a culture featured in the *Sharks: Myth and Mystery* exhibit, such as the Pacific Northwest Indians. Draw a map of the region. Discover and share some of the culture's traditional customs.
- Choose a shark from another habitat to write a myth explaining a different physical feature or behavior. Then research the scientific explanation(s). Compare your two sharks using a Venn diagram.
- Create an Australian "bark" painting or Central American *mola* using paper to tell the story of your shark.
- Compare human and shark internal systems, such as respiratory, digestive and reproductive.

Background

World cultures tell stories to explain natural phenomena, pass on cultural values and share ancestral history. These stories became part of a culture's oral tradition, as many did not have a written system of communication.

In creation myths or legends, people related narrative stories thought to be historical. The stories often showed the relationship between people and their environment and usually contained a moral lesson.

Recommended Books

Caduto, Michael J. and Joseph Bruchac. *Keepers of the Animals*.

MacQuitty, Miranda. *Shark*.

Martin, Rafe. *The Shark God*.

Nordenstrom, Michael. *Pele and the Rivers of Fire*.

Wardlaw, Lee. *Punia and the King of Sharks: A Hawaiian Folktale*.

Activity Resources

Monterey Bay Aquarium Web Site

Live Web Cams

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Sea Searcher's Handbook

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http://www.mbayaq.org/lc/teachers_place/resources_seasearchers.asp

External Links

Clip-art and more shark information. <http://www.oceanstar.com/shark/>

Myth-try Cards

Your Name: _____

Date: _____

Animal: _____

Habitat: _____

Animal's Physical Features:

Body shape: _____

Size: _____

Body parts: _____

Color/Camouflage: _____

Behaviors:

Swimming fast: _____ **Hiding:** _____

Swimming slow: _____ **Moving fins:** _____

Crawling: _____ **Eating:** _____

Staying still: _____ **Holding on:** _____

Other behaviors:

Habitat:

Saltwater: _____ **Freshwater:** _____

Coral: _____ **Sand:** _____

Plants/algae: _____ **Other:** _____

Role of animal in habitat: _____

Draw a picture of your animal in its habitat. Use the back of the card if you need more space.

Science Cards

Your Name: _____

Date: _____

Animal: _____

Habitat: _____

Animal's Physical Features:

Body shape: _____

Size: _____

Body parts: _____

Color/Camouflage: _____

Behaviors:

Swimming fast: _____

Hiding: _____

Swimming slow: _____

Moving fins: _____

Crawling: _____

Eating: _____

Staying still: _____

Holding on: _____

Other behaviors:

Habitat:

Saltwater: _____

Freshwater: _____

Coral: _____

Sand: _____

Plants/algae: _____

Other: _____

Role of animal in habitat: _____

Draw a picture of your animal in its habitat. Use the back of the card if you need more space.

Shark Cartoons Activity

(Grades 3-6, Age 8-11)

Activity Description

How can humans have a positive impact on people's perceptions of sharks? Students will create shark cartoons to share content and conservation information they have learned about sharks.



Key Concepts

- Many people have the misconception that all sharks are a danger to humans.
- As top ocean predators, sharks serve an important role in ecosystem food webs.
- Some species of sharks are threatened as a result of human actions, such as over-fishing, ocean pollution and fishing methods.
- Cartoons are pictures that tell a story, focus on specific issues and provide an insight to current attitudes.

California Science Standards

Grade 3: 3a, 3c, 3d, 5b

Grade 4: 2b, 3a, 3b, 6a

Grade 5: 2c, 6h

Grade 6: 5a, 5b, 5c, 5d, 5e

(<http://www.cde.ca.gov/re/pn/fd/documents/sci-stnd.pdf>)

California English Arts Standards

Reading

Writing

Written and Oral English Language

Conventions

Visual Arts

Creative Expression Activity

(<http://www.cde.ca.gov/re/pn/fd/documents/elacontentstnds.pdf>)

Materials

- Nonfiction shark resources (books, magazines and web sites)
- Cartoon examples
- Drawing paper
- Pencils, crayons, markers or other art supplies

Activity Link

This activity is used in the Teaching Units “Sharks: The Real Story”

http://www.mbayaq.org/lc/teachers_place/activity_sharks_realstory.asp and

“The World of Sharks”

http://www.mbayaq.org/lc/teachers_place/activity_worldofsharks.asp

You'll find other related activities, background information about sharks and their physical characteristics and more online resources students can use to research sharks.

Teacher Directions

1. Have students use nonfiction resources to collect information about sharks, such as physical structures, behaviors, diet, habitat and interesting facts. If possible, visit a local aquarium to observe sharks and record findings.
2. Review the information students have gathered about sharks. For example, what attributes help them survive (a keen sense of smell for locating their prey, a special eye membrane that closes when attacking prey)?

3. Discuss some of the threats to sharks, such as habitat pollution, decreased food sources, long reproductive cycles and fishing methods.
4. Ask the students to think of conservation messages that might increase people's awareness of factors which impact sharks' lives or improve the image of sharks.
5. Visit the Monterey Bay Aquarium web site for suggestions on making a shark cartoon using the "Shark School of Art" activity sheet. Look at cartoons in newspapers and magazines. Discuss the use of words or thoughts, caricature and satire to convey a message.
(http://www.mbayaq.org/lc/activities/sharks_cartooning.asp)
6. Have the students make shark cartoons individually or in small groups.
7. Share the cartoons and discuss the messages. What can people do to positively impact sharks?

Background

Sharks play an important role as top ocean predators, helping to maintain biodiversity in ecosystems. However, it is estimated that every year humans kill approximately 100 million sharks. In contrast, less than 10 humans per year die as a result of shark attacks.

Shark deaths occur for many reasons. Many sharks die as bycatch when commercial fishermen catch them accidentally in their fishing lines or nets while trying to catch other fish. Some fishermen are only interested in the shark's fins for shark fin soup, which is considered a delicacy in some cultures. They cut the fins from sharks and toss the sharks back into the water where they are no longer able to swim and consequently die.

Humans negatively impact shark habitats by depositing pollutants into the ocean, i.e., oil, plastics and other debris.

Human impacts are intensified by the fact that sharks have a very slow rate of reproduction. Many sharks do not reach sexual maturity until late in life. And once they do reach that age, they only give birth to a small number of pups at a time. These conditions make it difficult for species to recover if the population number is low.

Cartoons and illustrations have been used throughout history to record events and express views with others. In colonial America, cartoons focused on political issues. Ben Franklin is considered the first U.S. political cartoonist. In satirical editorial or political cartoons, cartoonists use caricature (deliberate exaggeration of physical features or mannerisms), allusion (an indirect reference to something) or metaphors (a figure of speech in which one thing is spoken of as if it were another) to help readers understand their cartoons' messages.

Extensions

- Create posters with shark cartoons and conservation messages to display at school.
- Design a comic strip that illustrates the need for shark conservation, some of the misconceptions people have about sharks or what they can do to positively impact sharks.

Recommended Books

Cook, Lisa, and Joel Simonetti. *Why I Care about Sharks*. (Some information may be more appropriate for older students.)

Clarke, Penny, and Mark Bergin. *Scary Creatures: Sharks*.

James, Sylvia M. *Sharks*.

Activity Resources

Monterey Bay Aquarium Web Site

Live Web Cams

Students can observe sharks in Kelp Forest and Outer Bay exhibits

http://www.mbayaq.org/efc/cam_menu.asp

“Meet the Sharks”

Information about the sharks in “Sharks: Myth & Mystery” exhibit

http://www.mbayaq.org/efc/efc_smm/smm_meet.asp

Shark Stories and Myths

Stories and myths (audio and video included) from seven cultures

http://www.montereybayaquarium.org/efc/efc_smm/smm_gallery_pi.asp

Shark Cartooning Tips

Tips for creating shark cartoons and comics

http://www.montereybayaquarium.org/lc/activities/sharks_cartooning.asp

Shark Conservation Issues

Why sharks are endangered in the wild

http://www.montereybayaquarium.org/efc/efc_smm/smm_conservation.asp

Shark Animal Fact Cards

http://www.montereybayaquarium.org/lc/activities/critter_cards.asp

Online Field Guide (Search for Sharks)

http://www.montereybayaquarium.org/efc/living_species/default.asp

Shark Videos (short clips to watch online)

http://www.montereybayaquarium.org/efc/video_library/video_library.aspx

Sea Searcher's Handbook

The “Sharks, Skates and Rays” chapter includes more shark information and activities, including a sample survey. http://www.mbayaq.org/lc/teachers_place/resources_seasearchers.asp

Seafood Watch Sustainable Seafood Program

Information about fishing methods, the health of particular fish species, threats to ocean animals and healthy seafood choices. <http://www.montereybayaquarium.org/cr/seafoodwatch.asp>

External Links

Visit the U.S. News web page “Political Cartoons: Do You ‘Get It’?” and find background information about cartoons and student activities.

<http://www.usnewsclassroom.com/resources/activities/cartoons>

Visit the web site for the Cartoon Factory TV show and learn how to create cartoons from numbers, letters and common everyday shapes.

http://cartoonfactory.net/you_can_do_it.htm

Shark Research Activity

Grades 3-5, Age 8-10

Activity Description

What do you know about sharks and what do you wonder about these fish? Working in groups, students make observations or use nonfiction resources to become “experts” about different sharks, shark behaviors and shark habitats. The class generates a set of interview questions, and then students take turns interviewing one another.

Key Concepts

- Sharks are cartilaginous fish.
- There is great variety among shark appearances and behaviors.
- Sharks live in different habitats throughout the world.
- All living things have basic survival needs.

California Science Standards

Grade 3: 3a, 3b, 3c, 3d, 5b, 5e

Grade 4: 2b, 3a, 3b, 6a, 6c

Grade 5: 2b, 2c, 2d, 6a, 6h, 6i

(<http://www.cde.ca.gov/re/pn/fd/documents/sci-stnd.pdf>)

English Language Arts Standards

Reading

Writing

Written and Oral English Language

Conventions

Listening and Speaking

(<http://www.cde.ca.gov/re/pn/fd/documents/el-contentstnds.pdf>)

History-Social Science Standards

Continuity and Change 3.1

California: A Changing State 4.1

(<http://www.cde.ca.gov/re/pn/fd/documents/histsoosci-stnd.pdf>)

Materials

- Nonfiction shark resources (books, magazines and web sites)
- Paper or science notebooks for recording shark facts

Activity Link

This activity is part of an Ocean Explorers Teaching Unit “Sharks: The Real Story” available at:

http://www.montereybayaquarium.org/lc/teachers_place/activity_sharks_realstory.asp

You’ll find other related activities and a background information sheet about sharks and their physical characteristics.

Teacher Directions

1. Have students use nonfiction resources to collect information about sharks, such as physical structures, behaviors, diet, habitat and interesting facts. If possible, visit a local aquarium to observe sharks and record findings.
2. Review the information students have gathered about sharks. Discuss some of the attributes that help sharks survive, i.e., a keen sense of smell for locating their prey and a special eye membrane that closes when attacking prey.

3. Discuss shark behaviors, such as the ways they move and protect themselves. Many blend into their surroundings (camouflage), some can rapidly swim away from a predator, while others are bottom dwellers that lie immobile until prey appears.
4. In which habitats do sharks live? Students might compare the leopard shark that lives in a kelp forest with a zebra shark or a hammerhead shark in the coral reef. What is the same and different about the habitats and coloration or behaviors of these sharks?
5. After the class discussion about sharks in general, tell the students that they'll have a chance to ask shark experts more questions in the near future. Have them begin to generate a list of questions they'd want to ask. (They can add to the list throughout the activity.)
6. Working together in a group, ask the students to select a species of shark that interests them. Challenge them to find out as much information about their shark species as possible. Their task is to become "experts" on that one shark species.
7. Hold a "shark press conference." Identify one member from each group to serve as the representative expert (or perhaps the shark itself!). The rest of the class will serve as the "press corps" and will ask questions of the "experts."

Extensions

- Create a class Shark Field Guide. Include facts about each shark's size, habitat, prey and protective strategies. Add illustrations.
- Write shark riddles with clues about each shark.
- Use Venn diagrams to compare two sharks or two of their ocean habitats.
- Do an online investigation of more sharks or visit the aquarium to conduct a pattern search: http://www.montereybayaquarium.org/PDF_files/activities/aquarium_sharks_pattern.pdf

Activity ResourcesMonterey Bay Aquarium Web SiteLive Web Cams

Students can observe sharks in Kelp Forest and Outer Bay exhibits

http://www.mbayaq.org/efc/cam_menu.asp

"Meet the Sharks"

Information about the sharks in "Sharks: Myth & Mystery" exhibit

http://www.mbayaq.org/efc/efc_smm/smm_meet.asp

Shark Stories and Myths

Stories and myths (audio and video included) from seven cultures

http://www.montereybayaquarium.org/efc/efc_smm/smm_gallery_pi.asp

Shark Conservation Issues

Why sharks are endangered in the wild

http://www.montereybayaquarium.org/efc/efc_smm/smm_conservation.asp

Shark Animal Fact Cards

http://www.montereybayaquarium.org/lc/activities/critter_cards.asp

Online Field Guide (Search for Sharks)

http://www.montereybayaquarium.org/efc/living_species/default.asp

Shark Videos (short clips to watch online from our Video Library)

http://www.montereybayaquarium.org/efc/video_library/video_library.aspx

Sea Searcher's Handbook

The “Sharks, Skates and Rays” chapter includes more shark information and activities, including a sample survey.

http://www.mbayaq.org/lc/teachers_place/resources_seasearchers.asp

External Links

Clip-art and more shark information.

<http://www.oceanstar.com/shark/>

Recommended Books

Gordon, David George. *Uncover Sharks*.

MacQuitty, Miranda. *Eyewitness Books: Shark*.

Pope, Joyce. *1001 Facts about Sharks*.

Parker, Steve, and Jane Parker. *The Encyclopedia of Sharks*.

Tricas, Timothy C., et.al. *A Guide to Sharks and Rays*.

Shark Surveys Activity

(Grades 3-6, Age 8-11)

Activity Description

What is the real story about sharks? How big are they? How dangerous are they? Through surveys, students find out what people think about sharks, their sizes and reputations. After a trip to the aquarium or additional research, students conduct a follow-up survey to find out how their opinions have changed.

STATEMENT	Before	After	Change
Afraid	X		
I like them		X	
They're big	X		
They attack	X		
Important		X	

Key Concepts

- Many people have misconceptions about the perceived danger and the importance of sharks.
- Most sharks are harmless and play an important role as top ocean predators.
- As people learn more factual information about sharks, their opinions can change.

California Science Standards

Grade 3: 3a, 3b, 3c, 3d, 3e, 5a, 5b, 5d, 5e

Grade 4: 2b, 3a, 3b, 6a, 6d

Grade 5: 6b, 6c, 6g, 6h, 6i

Grade 6: 5c, 5d

(<http://www.cde.ca.gov/re/pn/fd/documents/sci-stnd.pdf>)

Mathematics

Statistics, Data Analysis, and Probability

(<http://www.cde.ca.gov/re/pn/fd/documents/math-stnd.pdf>)

Materials

- Paper
- Pencils
- Research materials about sharks
- Poster paper and markers

Activity Link

This activity is used in the Teaching Units

“Sharks: The Real Story”

http://www.mbayaq.org/lc/teachers_place/activity_sharks_realstory.asp and

“The World of Sharks”

http://www.mbayaq.org/lc/teachers_place/activity_worldofsharks.asp

You'll find other related activities, background information about sharks and their physical characteristics and more online resources students can use to research sharks.

Teacher Directions

Gather research materials about sharks, or plan a field trip to the aquarium where students can observe sharks.

Preparing the Surveys

1. With the students, discuss the differences between facts and opinions.
2. Explain that surveys are often used to ascertain people's opinions about a variety of items. Emphasize that even though surveys may indicate that a majority of people hold a specific opinion, that opinion is not always the “truth.”

3. With the class, brainstorm a list of questions that would help them find out how people in their class feel about sharks. What do they know? What do they think they know? What do they wonder about?
4. Discuss how to set up and conduct a survey. Which questions make good survey questions? Which questions will they include? Whom will they survey? How many people will they need to survey in order to get an accurate idea of people's feelings and understandings about sharks?
5. Identify which questions will lead to an "opinion response"? Which questions will lead to a "fact response"?

Conducting the Surveys

1. Working in pairs or small groups, have the students survey each other.
2. Compile, analyze and represent the results. Have students use a variety of ways to represent their findings, including circle charts, tables and graphs.
3. Did they collect any "facts" that were incorrect? How do they know?
4. Discuss the results in small groups. What did they find out about sharks? Was it truth or fiction? How do the people in their class feel about sharks?
5. Keep the results. You'll refer to them after your research or your visit to the aquarium.

After the Research or Field Trip

1. After their visit to the aquarium or research, have students take the same survey they created.
2. Have them compare their responses to the class responses before the research or field trip. What did they learn? How did their feelings and knowledge change from the first time they took the survey?
3. Which of their answers represent facts and which represent opinions? Emphasize the differences between facts and opinions.
4. Often people believe their opinions are facts and act in a way that may be harmful to animals, other people or even themselves. Share some examples. How can you help people understand that their opinions might not be facts?

Extensions

- Design a cartoon or comic strip that illustrates some of the misconceptions that people have about sharks.
- Have the students create a performance or artwork that depicts their shark misconceptions. Share them with classmates and families.



Activity Resources

Monterey Bay Aquarium Web Site

Live Web Cams

Students can observe sharks in Kelp Forest and Outer Bay exhibits

http://www.mbayaq.org/efc/cam_menu.asp

"Meet the Sharks"

Information about the sharks in “Sharks: Myth & Mystery” exhibit

http://www.mbayaq.org/efc/efc_smm/smm_meet.asp

Shark Stories and Myths

Stories and myths (audio and video included) from seven cultures

http://www.montereybayaquarium.org/efc/efc_smm/smm_gallery_pi.asp

Shark Conservation Issues

Why sharks are endangered in the wild

http://www.montereybayaquarium.org/efc/efc_smm/smm_conservation.asp

Shark Animal Fact Cards

http://www.montereybayaquarium.org/lc/activities/critter_cards.asp

Online Field Guide (Search for Sharks)

http://www.montereybayaquarium.org/efc/living_species/default.asp

Shark Videos (short clips to watch online from our Video Library)

http://www.montereybayaquarium.org/efc/video_library/video_library.aspx

Sea Searcher's Handbook

The “Sharks, Skates and Rays” chapter includes more shark information and activities, including a sample survey.

http://www.mbayaq.org/lc/teachers_place/resources_seasearchers.asp

External Links

Clip-art and more shark information.

<http://www.oceanstar.com/shark/>

Recommended Books

Ferguson, Ava. *Sharks and Rays*.

MacQuitty, Miranda. *Eyewitness Book: Shark*.

Sowden, Craig. *Investigate Sharks*.

Taylor, Leighton. *Sharks and Rays*.

Sidewalk Sharks Activity

Grade 3-5, Age 8-10

Activity Description

How big are sharks, really? Students will measure themselves on the playground or sidewalk and use chalk to record how tall they are. Using books, web sites or observations of live animals, students investigate the length of different sharks and compare the sizes with their own heights.



Key Concepts

- There are 410 species of sharks in the world.
- Their sizes vary widely. The average length of sharks is four feet.
- Scientists observe carefully and record their observations.

California Science Standards

Grade 3: 3a, 3b, 3c, 3d, 5b, 5e

Grade 4: 2a, 2b, 3a, 3b, 6a

Grade 5: 2a, 6h, 6i

(<http://www.cde.ca.gov/re/pn/fd/documents/sci-stnd.pdf>)

Mathematics Standards

Measurement and Geometry

Statistics, Data Analysis, and Probability

Mathematical Reasoning

(<http://www.cde.ca.gov/re/pn/fd/documents/math-stnd.pdf>)

Materials

- Nonfiction shark resources (books and web sites)
- Tape measures
- Sidewalk chalk

Activity Link

This activity is part of an Ocean Explorers Teaching Unit “Sharks: The Real Story” available at:

http://www.montereybayaquarium.org/lc/teachers_place/activity_sharks_realstory.asp

You’ll find other related activities and a background information sheet about sharks and their physical characteristics.

Teacher Directions

1. Look at pictures of sharks. Have students guess the different lengths of sharks.
2. In pairs or small groups, students research different sharks. Use books or Monterey Bay Aquarium’s online Field Guide to find out information about the size of some species. Compile all the information in a chart.
(http://www.mbayaq.org/efc/living_species/default.asp)
3. How do sharks compare in size to humans? Have the students estimate and measure their own heights. What is the average height of the students in the class?
4. Compare their heights to the lengths of some sharks. Discuss the student findings.
5. On the playground blacktop or sidewalk, use chalk to draw a line equal to the average height of the students. Label the line “students.”
6. Have each pair or group draw and label a line equal to the length of the shark they studied. Label the line for each shark species.

7. Analyze the data to see how the lengths of sharks compare to the heights of students. What are your conclusions?

Background

Shark sizes vary from small to very large. The length of the smallest (cat shark) is only two feet while the largest (whale shark) is 60 feet. Most adult sharks range from about three to ten feet in length with an average of only four feet. Just four per cent of all shark species, approximately 17 kinds, grow larger than 13 feet.

The vast majority of sharks are not dangerous, and the few that attack do so mainly because they were provoked or disturbed. The size of a shark is not necessarily proportional to the degree of danger. Many of the biggest sharks live in the open ocean and do not harm humans. One example is the whale shark. It is the world's largest fish, but it is completely harmless. It eats tiny plankton, not people!

The average sizes of some of the sharks at the Monterey Bay Aquarium are listed in this table.

AVERAGE SHARK LENGTH
Blacktip reef shark – 5 feet
Epaullette shark – 3 feet
Horn shark – 3 feet
Swell shark – 3 feet
Galapagos shark – 11 feet
Scalloped hammerhead – 12 feet
Pajama catshark – 3 feet
Leopard shark – 6 feet
Zebra shark – 11 feet
Whitetip reef shark – 5 feet
Puffadder shyshark – 2 feet
Great white shark – 20 feet

Extensions

- Do an online investigation of more sharks or visit the aquarium to find out about sharks of all sizes.
- Create a class Shark Field Guide. Include facts about each shark's size, habitat, prey and protective strategies. Add illustrations.

Book Recommendations

Llewellyn, Claire. *The Best Book of Sharks*.

MacQuitty, Miranda. *Eyewitness Books: Shark*.

Taylor, Leighton. *Sharks and Rays*.

Activity Resources

Monterey Bay Aquarium Web Site

Live Web Cams

Students can observe sharks in Kelp Forest and Outer Bay exhibits

http://www.mbayaq.org/efc/cam_menu.asp

“Meet the Sharks”

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Shark Conservation Issues

Why sharks are endangered in the wild

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Shark Animal Fact Cards

http://www.montereybayaquarium.org/lc/activities/critter_cards.asp

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Sea Searcher's Handbook

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