Sharks

Objective:

1. Students will be able to describe key components of the shark's habitat.

2. Students will demonstrate an understanding of the basic body structure and parts of a shark.

3. Students will describe the general behaviors of hammerhead sharks.

Grade 3-5

Key Vocabulary:

- **Carnivorous**
- **Cartilage**
- **Buoyant**
- **Dermal denticles**
- **Ampullae of Lorenzini**

Related Literature:
Sharks
Miranda Smith

Hammerhead Sharks
Heidi Mathea

Hammerhead Sharks
Anne Welsbacher

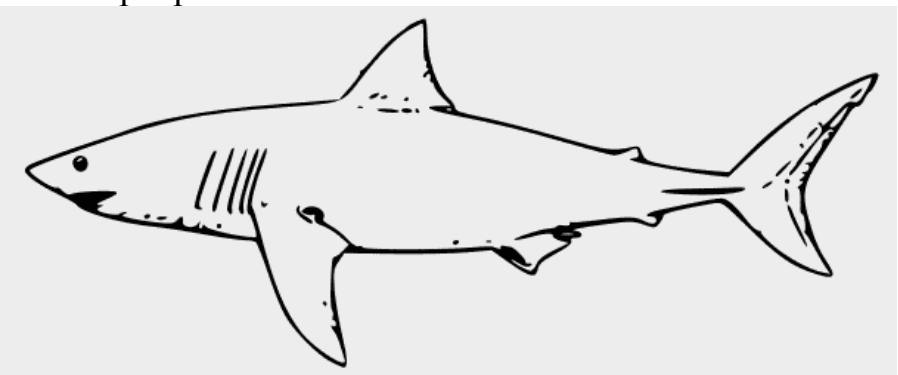
Performance Objectives:

Grade 3: Strand 4: Concept 3 – PO 1, 4
NGSS: 3-LS2-1
Grade 4: Strand 4: Concept 1 – PO 2; Concept 4 – PO 1
NGSS: 4-LS1-1
Grade 5: Strand 4: Concept 1 – PO 1-3
NGSS: 5-LS2-1

Background Information:

The oceans are filled with marine life, big and small, fierce and docile, fast swimmers and slow swimmers, and yet the most recognizable creature of the deep is the SHARK! When you hear the word "shark" what comes into your mind? That is right, huge teeth, a fierce hunter, with a telltale fin. Sharks have been swimming in oceans since prehistoric times and are thought of as rulers of the sea. But are all sharks the same? There are more than 400 different species of sharks swimming in waters around the globe. However, if you're at the beach, the chances of seeing one are rather remote.

Most species of sharks prefer the deeper waters of the oceans, staying well offshore cruising along hunting for food. Almost all sharks are **carnivorous**, eating almost 10 percent of their body weight every week. Their streamlined yet powerful bodies are designed to be strong predators, which places them at the top of the ocean food chain. The favored food among sharks includes squid, fish, sea lions, lobsters, and stingrays. Humans really are not on the menu for sharks, and they do not like the taste of people.



Sharks are classified as Chondrichthyes, which translates to 'cartilage fish' and describes the shark very well. Sharks are not boney fish at all. The shark body is made of **cartilage**, a thick material much like a human's ear. The cartilage allows the shark to be more **buoyant** (floating easily) and flexible, which is important to the shark's ability to swim at great speeds and bend or turn with enormous power. The shark's powerful body is covered with a thick skin that provides protection. The rough texture of the shark's skin is due to the scales, called **dermal denticles**. These scales are tougher than the scales on a boney fish and feel like sandpaper. These cold blooded creatures have evolved and adapted to changes on Earth over millions of years. Their body temperature changes as the water around them becomes warmer or colder. Most sharks must swim all the time to keep their blood circulating throughout the body. The fins on a shark play a vital role in the shark's movement. There are five different fins that are designed to help propel, balance, and stabilize the shark as its buoyant body reaches great speeds or as it floats along gracefully in the currents.

Unique to sharks are their rows of teeth that often loosen or fall out. Sharks have teeth that are designed to tear away parts of food so they can swallow it down fast. Sharks do not chew their food like people do, and their sharp teeth look very different.

This is a shark's jaw with many rows of teeth. A shark can have around 3,000 teeth at one time. Each type of shark has slightly different shaped teeth, and as one tooth falls out, another tooth moves into place.

Most sharks have teeth that are razor sharp, pointed, and with serrated edges. The teeth were designed for catching large and small prey, and tearing it apart. Different species of shark can have teeth of varied shapes and sizes. Notice the differences in the white shark and the hammerhead shark teeth. Different, yes, but they all do the same efficient job.

Great White Shark

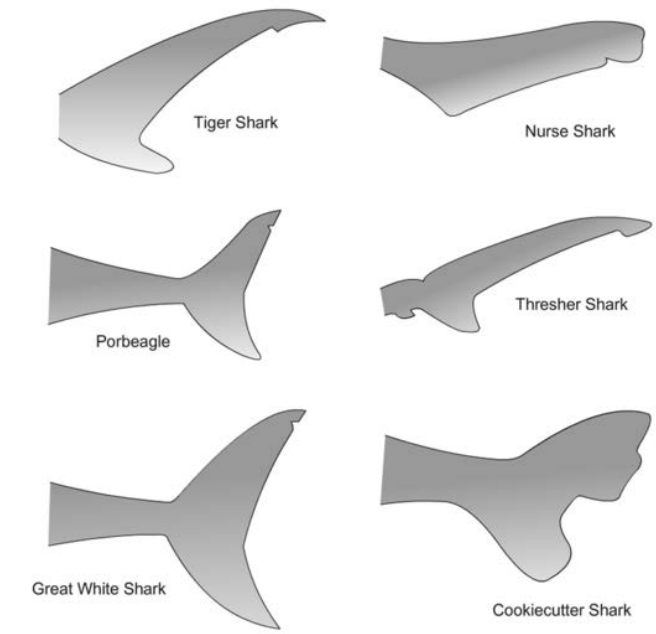
Smooth Hammerhead Shark

(Shark Teeth Photos: Apex Predator Program, NEFSC/NOAA)

Scientists have identified shark teeth that date back to prehistoric times. The great megalodon had teeth that were as big as 7 inches long and weighing almost a pound. Shark teeth, both very old and new, have been found on beaches all around the world. The ocean floor is certainly a wealth of shark teeth and various other interesting specimens.

Fossil shark jaws are an amazing attraction to visitors at museums and aquariums. This specimen demonstrates the enormous size of a shark's mouth and the biting power of the rows of teeth. There is no mystery as to why sharks are at the top of the ocean food chain.

Every part of the shark's body has a purpose, even the tail. Sharks can move quickly in the water by using their entire body to propel themselves forward. Sharks have been known to leap out of the water to catch their food, but most sharks find food by swimming quietly and sensing their prey.

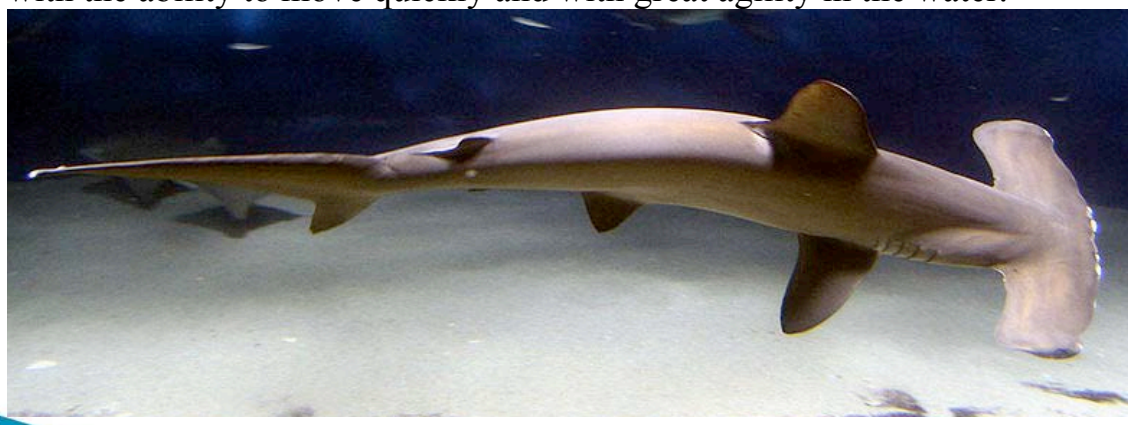


Shark Tails

The tail of a shark can assist in identification. Notice the variation in the shape and size of each tail. The tail of a shark is similar to a rudder on a boat. It helps the shark move rapidly through the water and navigates turns in different directions. Along with the fins, the tail is a perfect mechanism to 'steer' the shark on its journey through the ocean.

A characteristic of sharks is their keen sense of hearing, and it is believed they can hear low **frequencies** over enormous distances. A shark's eyes are light sensitive and designed to see in the low light of deep water. Their third eyelid can cover the eye completely to protect it. In addition, sharks have a very strong and unique sense of smell. Sharks can smell the scent of a fish or blood in the water as far as a mile away. All of the characteristics of a shark make it a formidable predator in the world's oceans.

One of the most interesting and unique types of shark is the hammerhead shark. Likely named for its oddly shaped head, hammerhead sharks are easy to identify. There are ten species of hammerheads that range in size and differ slightly in head shape. The largest species, the great hammerhead, can reach 11 feet or more and reach over 500 pounds. Similar to other sharks, the hammerhead has a sleek body with the ability to move quickly and with great agility in the water.



Hammerhead sharks prefer warm, temperate water and can be found in most tropical waters around the world. These sharks migrate along the coastal areas as water temperatures change and food sources fluctuate. Preferring to dine on stingrays, fish, crabs, lobster, and squid, hammerheads hunt alone.
The hammerhead is distinctively adapted to precision hunting in the ocean. The head shape and placement of the eyes allow this shark to see at 360 degrees at all times. That means this shark can see very well above, below and to the sides as it moves swiftly in the water. The shark's ability to sense electrical fields enhances the hammerhead's hunt for stingrays, even if they are below the sand. This "sixth sense" is called Ampullae of Lorenzini and are pores on its rostrum (nose) to help detect electromagnetic fields and pulses. These adaptations contribute to the efficiency of hunting at night and the survival of the species.

Another unique feature about hammerhead sharks is their frequent 'suntan.' Hammerhead sharks produce more melanin (colored pigment) in their skin than other sharks. As the hammerheads swim close to the surface of the water, the sun rays cause the melanin to change, giving the shark's skin the appearance of suntan. This often occurs when hammerheads congregate by sea-mount cleaning stations. Sea-mount cleaning stations are underwater mountains where cleaner fish live, and sharks come to allow these fish to eat dirt and particles off their skin. The sharks can float or swim slowly while cleaner fish do their job cleaning the shark's skin.

At the top of the ocean food chain, hammerhead sharks are the perfect predator. These sharks can find food quickly, swim with rapid speed, for continued survival in the ocean. These formidable ocean creatures have rarely been a danger to humans and are considered harmless by most scientists. Sharks in general

contribute to maintaining balance in the ocean ecosystem and yet they remain vulnerable to overfishing, pollutants in the ocean, and illegal 'fin' hunting (in order to make shark-fin soup) by humans. Several species of sharks remain on the IUCN Red List, and conservation efforts have been established around the globe to ensure survival of sharks, including the hammerhead shark.

Additional Resources:
Sharks Breaching: https://www.youtube.com/watch?v=4EojXTOtNTA
Shark Bites Explained: https://www.youtube.com/watch?v=jZuUGJRtreI
Shark Egg Birth: https://www.youtube.com/watch?v=CP_xkNYq49M
Shark Live Birth: https://www.youtube.com/watch?v=LfQgRCg1bNA

Sources: National Oceanic and Atmospheric Administration (NOAA); National Geographic; Shark World; IUCN Red List; Our Endangered World (OEW). Photos: OdySea Aquarium; Apex Predator Program, NEFSC/NOAA; Public Domain.

Procedures and Activities:

1. State the learning objectives. Review previous instruction as it relates to the topic and objectives.
2. Review vocabulary.
3. Read related literature, and follow-up with discussion and open-ended questioning. Use technology to project pictures of shark species to compare characteristics of types.
4. Ask students to use technology to locate areas of oceans and seas where various species of sharks are found and why. Discuss water temperatures, ocean depth, and food sources.
5. Discuss populations of sharks, hereditary traits, adaptations, existence on earth, migration patterns, and threats.
6. Discuss the ocean ecosystem and the importance of sharks in the balance of life in the ocean. Sharks play a vital role in the ocean's food chain.

 **Indicates 'take along' activity**.

Activity: Students research a species of shark and write an essay including the details listed on the handout. Students may select a species and add a picture to the paper.

Activity: 'Label the Shark' checks for understanding of external anatomy of sharks and highlights the purposes of dermal denticles and Ampullae of Lorenzini.

 **Activity:** 'Find the Sharks' is a scavenger hunt activity to do at the aquarium.

Activity: As a follow-up to the fieldtrip and discussion of sharks, students make a large poster about their favorite shark, or a hammerhead, and a few facts. Students share their posters with the class. Materials: poster board, markers, cutouts of sharks, and glue.

Activity: Using technology, students investigate the ocean food chain with sharks at the top. Students then illustrate their findings. Materials: construction or drawing paper, colored pencils, and computers.

Activity: "Shark Infested Water" is an activity and a snack. (See sheet for materials.)

Activity: 'Hammerhead Shark Species' discusses the different species of hammerheads. Through research, students chose a species of hammerhead and create a Hammerhead Shark Species Profile.

Reflections and Assessments: Students are assessed on various levels depending on the activity. Participation, grade standards, and percentages may be applied to each activity. Activities are designed for flexibility and use pre or post fieldtrips.

Most activities meet the STEM education guidelines.

Shark Research

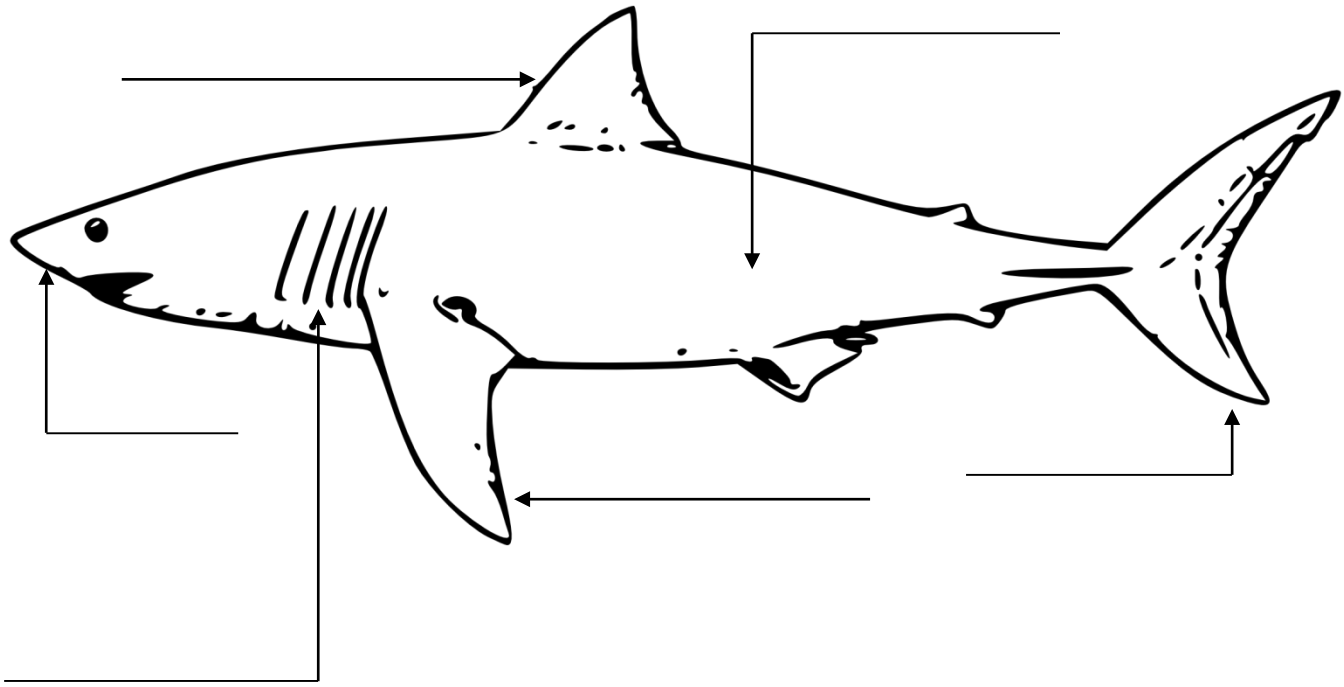
Select a species of shark. Using technology, do your research on the shark and write down all of your sources. Cut out or draw a picture of your shark to attach to the essay paper. Write your essay including the following:

- Species of shark
- Body Shape
- Coloration
- Fins
- Head
- Scales
- Special characteristics
- Habitat

Use an essay format for your paper. Write a rough draft, edit the draft, and write the final paper. Add your shark picture with your final paper.

Due date: _____

Label the Shark



Word Bank:

Caudal Fin	Dorsal Fin	Pectoral Fin
Gill Slits	Dermal Denticles	Ampullae of Lorenzini

What are dermal denticles?

_____

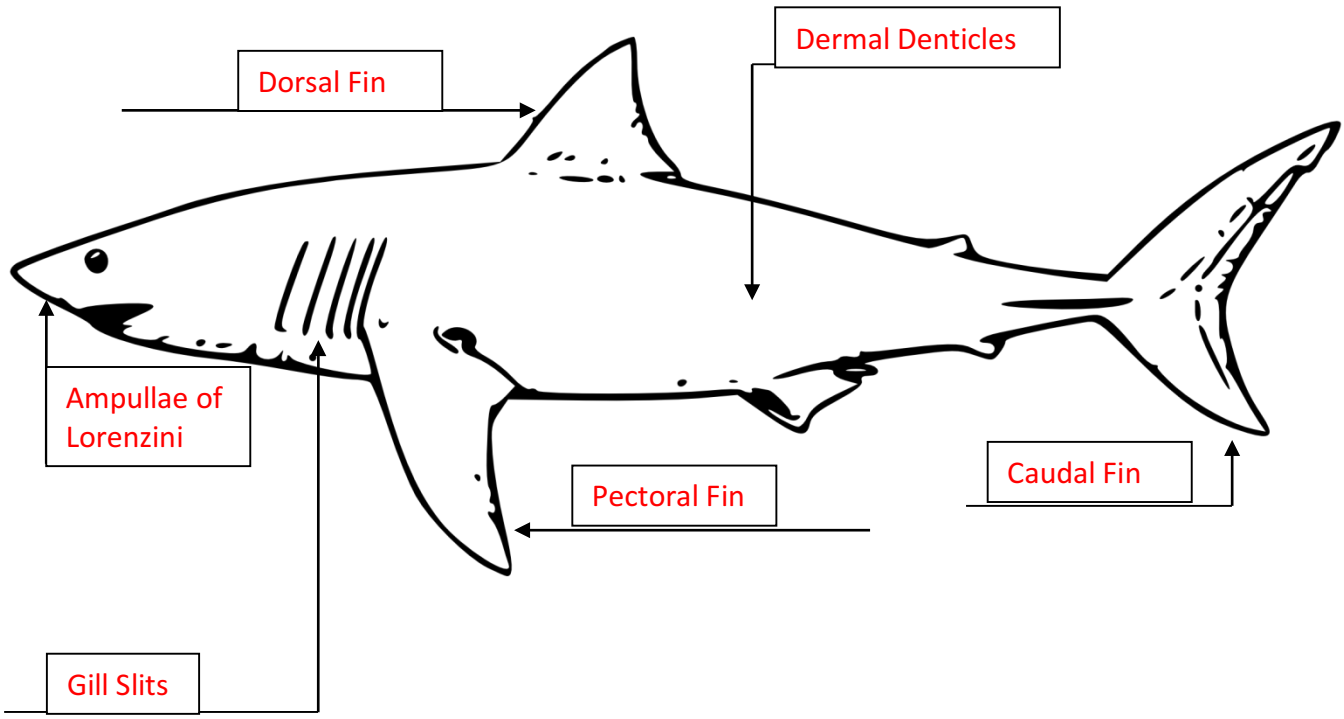
What are Ampullae of Lorenzini and how do they help sharks survive?

_____

_____

_____

Label the Shark KEY



Word Bank:

Caudal Fin	Dorsal Fin	Pectoral Fin
Gill Slits	Dermal Denticles	Ampullae of Lorenzini

What are dermal denticles? They mean 'skin teeth' and are what their scales are called. Under a microscope, they look like tiny shark teeth!

What are Ampullae of Lorenzini and how do they help sharks survive? Ampullae of Lorenzni are pores on the head of sharks that detect electromagnetic pulses. They help sharks navigate and can detect a heartbeat of animals in close ranges.

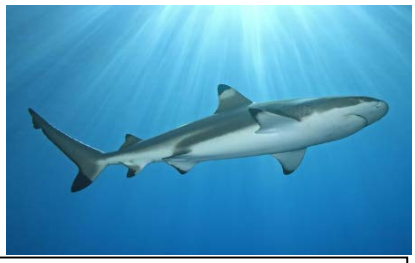
Find the Sharks!

While at OdySea Aquarium, look for the different species of sharks! When you find them, write down what you learned.

Scalloped Hammerhead Shark:
_____
_____
_____

Bonnethead Shark:
_____
_____
_____

Sand Tiger Shark:
_____
_____
_____



Blacktip reef Shark:
_____
_____
_____

Nurse Shark:
_____
_____
_____

Sand Bar Shark:
_____
_____
_____

Shark Infested Water!

Materials: Clear plastic cups, Blue boxed gelatin, Whipped cream, Gummy sharks.
Note: gummy sharks can be ordered online and come in one pound bags. The spray whipped cream works best.

Directions: Mix gelatin according to package. Fill cups slightly over half way with jell-o and refrigerate. Once gelatin is set, top it with whipped cream and gummy shark. Your shark infested water is complete!

Easy snack: Students receive two gummy sharks and a few goldfish crackers. They can demonstrate how sharks eat the goldfish. Yum!

Hammerhead Sharks

There are 8 species of hammerhead sharks in the world. Research your favorite hammerhead species, and write a profile for your hammerhead shark.

OdySea Aquarium has two species of hammerhead: Bonnetheads and Scalloped Hammerheads.

Bonnethead Shark:
Smooth rounded head

Scalloped Hammerhead:
Three evenly spaced indentations on their head making a bumpy appearance

These are descriptions of the other six species of hammerheads:

Great hammerhead:
Large straight head with slight bumps

Smooth Hammerhead:
notches by the eyes

Smalleye Hammerhead:
Indentation in the center of head

Scoophead:
Broad round head

Scalloped Bonnethead:
Round head with 2 indentations

Winghead Shark:
Long, skinny head

My Hammerhead Shark Species Profile

Species: _____

Distinguishing Feature: _____

Conservation Status: _____

Length: _____

Range: _____

Diet: _____

Hammerhead Sharks-KEY

Species: Smooth Hammerhead

Distinguishing Feature: Notches by the eyes

Conservation Status: Vulnerable

Length: 8-12 feet

Range: Worldwide in temperate waters

Diet: Fishes, cephalopods and crustaceans

Species: Smalleye Hammerhead

Distinguishing Feature: Indentation in the center of head

Conservation Status: Vulnerable

Length: 4-4.5 feet

Range: Eastern Atlantic

Diet: Small bony fish, swimming crabs and squid

Species: Bonnethead Shark

Distinguishing Feature: Smooth rounded head

Conservation Status: Not threatened

Length: 2.5-3.5 feet

Range: Tropical and Subtropical waters on both coasts of North America; the Caribbean and the Gulf of Mexico

Diet: Crustaceans, clams, octopuses and small fish

Species: Scalloped Hammerhead

Distinguishing Feature: Three indentations on head making a bumpy appearance.

Conservation Status: Endangered?

Length: 6 feet

Range: Warm temperate and tropical waters of the Atlantic, Indian and Pacific Oceans.

Diet: fish, cephalopods, lobsters, shrimp, crabs, and other sharks and rays.

Species: Great Hammerhead

Distinguishing Feature: Large straight head with slight bumps

Conservation Status: Endangered

Length: up to 20 feet

Range: Tropical waters of the world

Diet: Fish, other elasmobranchs, crustaceans and cephalopods.

Species: Winghead Shark

Distinguishing Feature: Long, narrow head

Conservation Status: Endangered

Length: 6 feet

Range: Coastal Indo-Pacific Oceans

Diet: fish, crustaceans and cephalopods

Species: Scoophead

Distinguishing Feature: Broad rounded head

Conservation Status: Data deficient

Length: Up to 5 feet

Range: Tropical western Atlantic and eastern Pacific Ocean

Diet: Small elasmobranchs, octopus, squid and flounders.

Species: Scalloped Bonnethead

Distinguishing Feature: Round head with 2 indentations

Conservation Status: Not Threatened

Length: 3 feet

Range: Tropical and subtropical waters of the eastern Pacific Ocean.

Diet: Crustaceans, mollusks, cephalopods, echinoderms and fish.