Sharks

Objective:

1. Students will demonstrate an understanding of the structure and function of sharks.

2. Students will understand and compare the food chains of dominant marine species and the relevance to the environment.

3. Students will be able to discuss the survival and adaptations of hammerhead sharks.

4. Students will demonstrate an understanding of the ocean environment and the impact of pollution.

Grade 6 – 8

Key Vocabulary:

- **Chondrichthyes**
- **Dermal Denticles**
- **Nictitating Membrane**
- **Ampullae of Lorenzini**

Related Literature:

Sharks
Seymour Simon

Swimming with Hammerhead Sharks
Kenneth Mallory

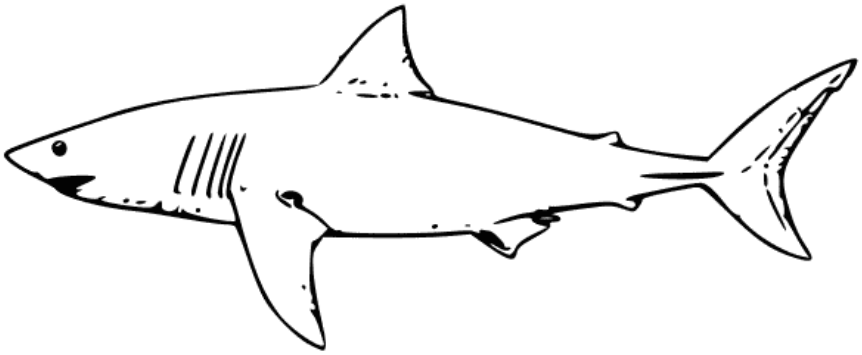
Performance Objectives:

Grade 6: Strand 4: Concept 1 – PO 6; Concept 3 – PO 2
Grade 7: Strand 4: Concept 3 – PO 1-5
Grade 8: Strand 4: Concept 4 – PO 1-6
NGSS: MS-LS2-1-5

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 are related to skates, rays and chimeras. 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 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. The rough texture of the shark's skin is due to the scales, called **dermal denticles** which translates to skin (dermal) teeth (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 that of the water they're currently swimming in. 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 sharks 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.

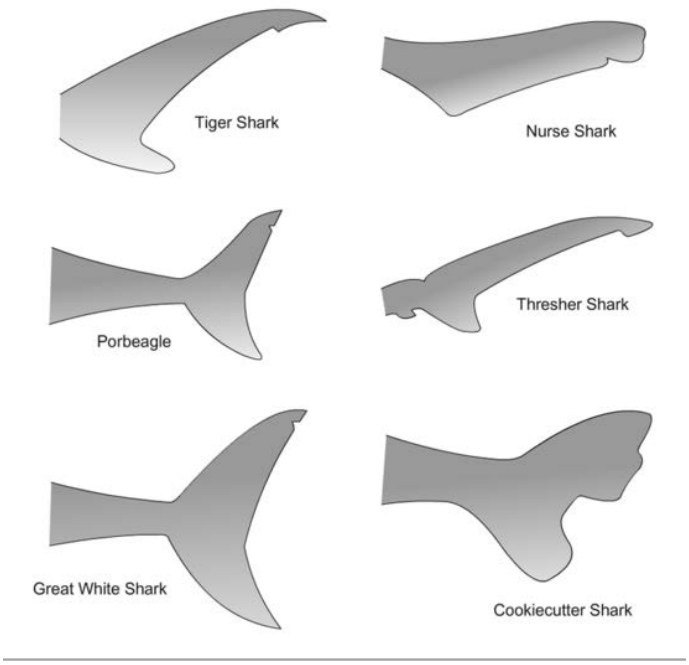
Great White Shark Smooth Hammerhead Shark

(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.

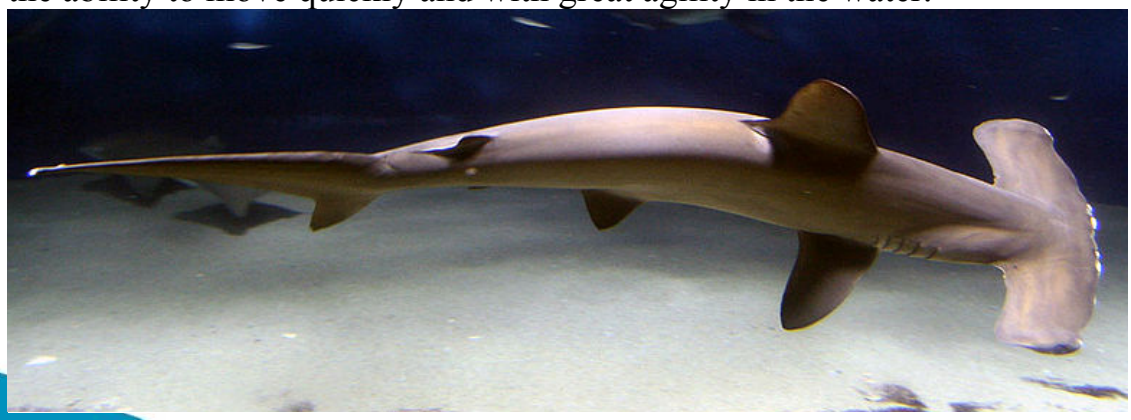


Shark Tails

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 navigate turns in different directions. Along with the fins, the tail is a perfect mechanism to 'steer' the shark on its journey through the ocean.

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 called a **Nictitating Membrane** 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 nine species of hammerheads that range in size and differ slightly in head shape. The largest species, the great hammerhead, can reach over 11 feet and 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.

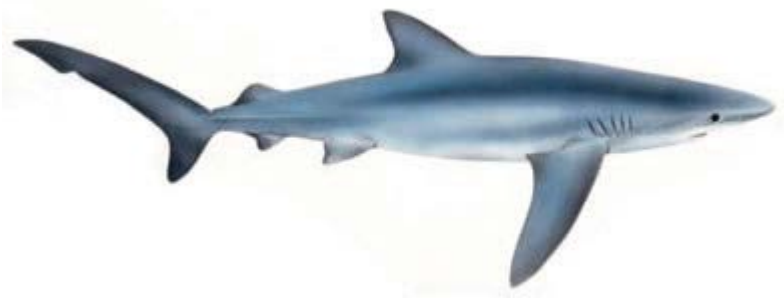


Hammerhead sharks prefer warm, temperate water and can be found in most tropical waters around the world. These sharks migrate along the coastal areas as water temperatures change and food sources fluctuate. Hammerhead sharks are considered powerful predators found in deep water near the coast. Preferring 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 the shark's rostrum (nose) that can 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 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. These 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 and 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; 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 various areas of oceans and seas where various species of sharks are found and why.
5. Discuss populations of sharks, hereditary traits, adaptations, existence on earth, migration patterns, and threats.
6. Ask students to look up the IUCN Red List and identify what sharks are on the list and how they are rated.
7. Discuss the ocean ecosystem and the importance of sharks.

Activity: 'Label the Shark' checks for understanding of the external anatomy of sharks and focuses on dermal denticles, ampullae of lorenzini and nictitating membrane.

Activity: 'Shark Investigation' gives students an opportunity to use technology to locate and identify two species of sharks in that region of the ocean. Species may vary and can be a sharing activity.

Activity: As a follow-up to the fieldtrip and discussion of conservation, students make a large poster with a conservation message about sharks, or hammerheads, 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: 'Speaking of Sharks' is an activity that involves the student being a reporter for the news. Students are asked to write a news report about a shark sighting off the coast of California.

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

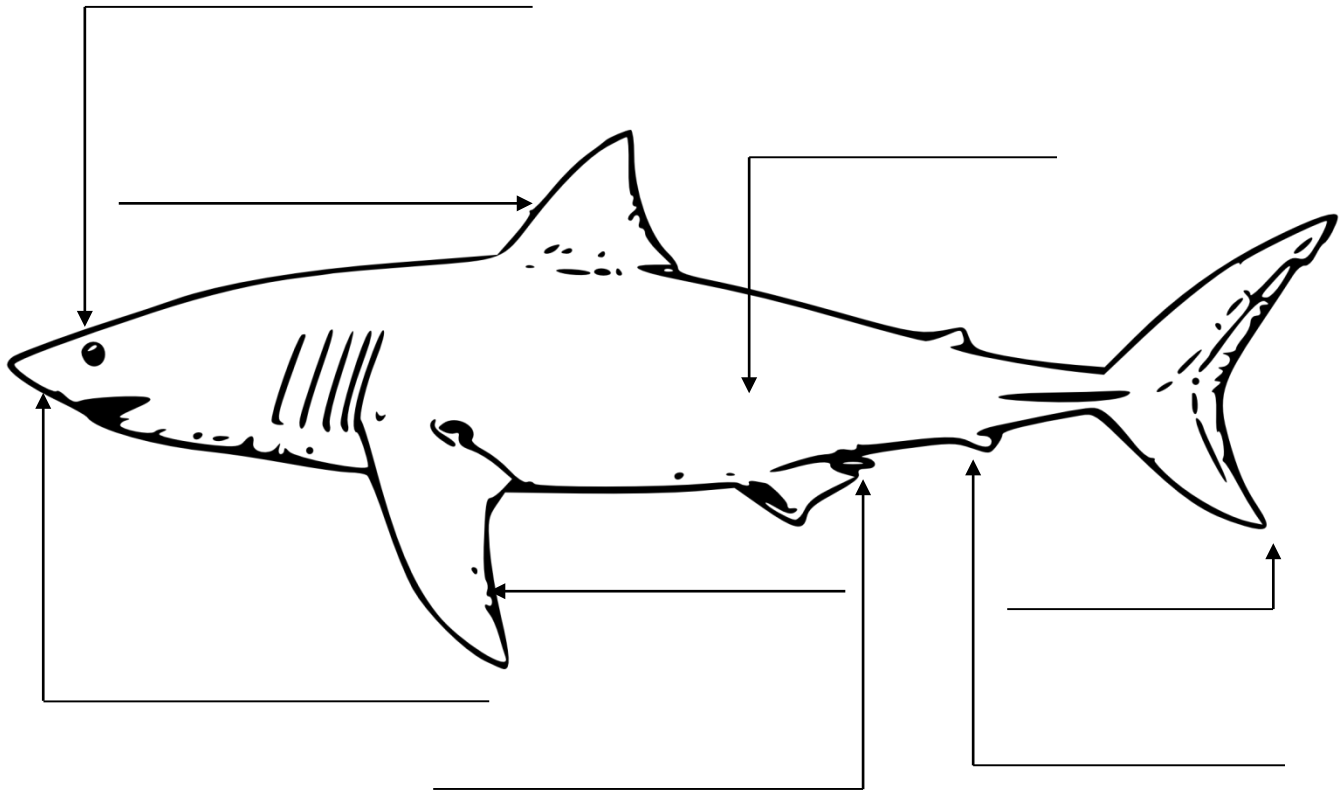
Activity: Students research a species of shark and write an essay including the details listed on the handout. Students may select a species and add a picture to the paper.

Activity: Shark tracking is an activity that students will use technology to complete. Students select a shark to track on the web site. They track the shark over a period of time (1 week or more) and document the migration and hunting pattern.

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.

Label the Shark



Word Bank:

Caudal Fin	Ampullae of Lorenzini	Anal Fin
Dorsal Fin	Dermal Denticles	Pectoral Fin
Pelvic Fin	Nictitating Membrane	

What are dermal denticles?

_____

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

_____

_____

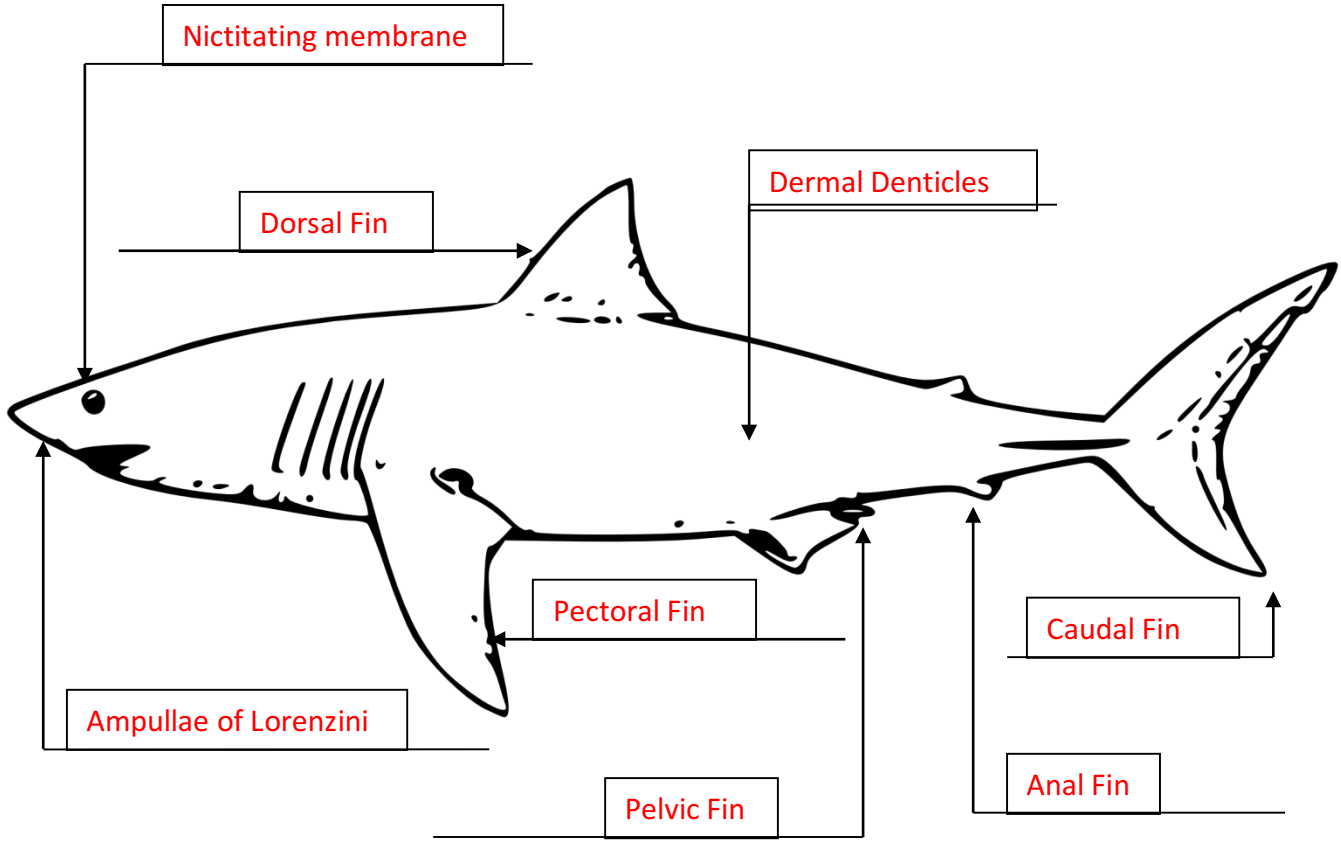
_____

What is a nictitating membrane and why do animals have them?

_____

_____

Label the Shark KEY



Word Bank:

Caudal Fin	Ampullae of Lorenzini	Anal Fin
Dorsal Fin	Dermal Denticles	Pectoral Fin
Pelvic Fin	Nictitating Membrane	

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.

What is a nictitating membrane and why do animals have them? Protective layer/film that covers sharks eyes similar to that of a cat or alligator/crocodile.

Shark Investigation

You are an oceanographer sent by the university to investigate marine life off the coast of Baja Mexico and the island called Isla Guadalupe. You are asked to locate 2 species of sharks that frequent the waters of Isla Guadalupe and record the following data:

First Species:

1. Species of shark: _____
2. Physical characteristics
   - Head-
   - Tail-
   - Weight-
   - Length-
3. Diet: _____

Second Species:

1. Species of shark: _____
2. Physical characteristics
   - Head-
   - Tail-
   - Weight-
   - Length-
3. Diet: _____

Draw an identification picture of each species on the following page.

Shark Investigation

Species # 1 Name_____

Species # 2 Name_____

Speaking of Sharks

A great hammerhead shark has been spotted off the coast of San Diego. People are frantic about going in the ocean. You are a reporter for the local news. You have been asked to do a news report about the hammerhead sharks and if it is safe to go swimming in San Diego. Write your speech for the news show. Be sure your facts are correct.

Title: Here are the facts you should know about hammerhead sharks.

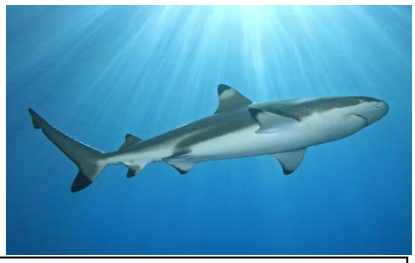
Find the Sharks!

While at OdySea Aquarium, look for the different species of sharks! When you find them, write their characteristics.

Scalloped Hammerhead Shark:
_____
_____
_____

Bonnethead Shark:
_____
_____
_____

Sand Tiger Shark:
_____
_____
_____



Blacktip reef Shark:
_____
_____
_____

Nurse Shark:
_____
_____
_____

Sand Bar Shark:
_____
_____
_____

Essay on Sharks

Select a species of shark and use technology to research the species. Write down your sources. Include the following information in your essay.

- Scientific classification
- Habitat and distribution
- Physical characteristics
- Anatomy
- Senses
- Adaptations
- Behaviors
- Diet
- Reproduction
- Life span
- Threats and conservation

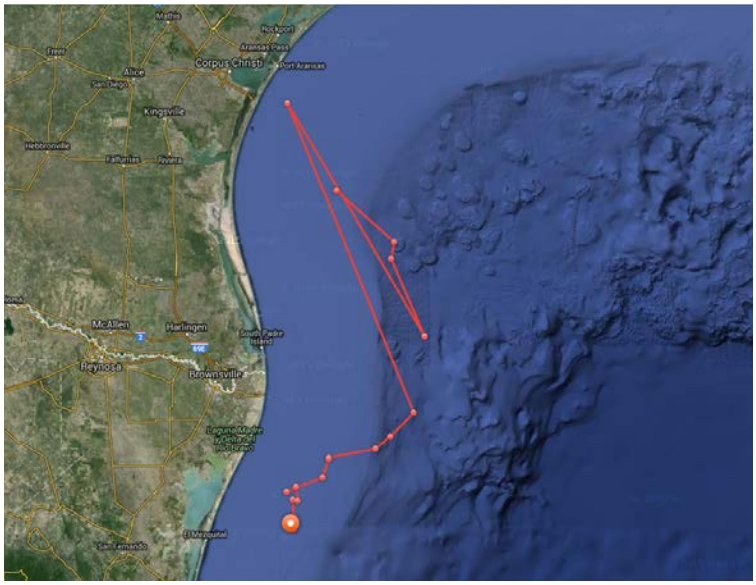
Your essay should be a minimum of five paragraphs. List your sources at the end of the essay.
Bonus: Add a picture of the shark you selected. (draw or printed picture)

Be prepared to share a few details about the shark you selected with the class.

Due date: _____

Shark Tracking

This diagram demonstrates the pattern of movement of a shark that was tagged on February 25, 2016 near Corpus Christi, Texas. The migration pattern shows this 120-pound shark traveled 290 miles in only 24 hours. The male Mako shark is one of the fastest swimming sharks in the Gulf of Mexico.



Using technology, go to the web address and find a shark to track. Compile the shark data on the shark tracking data sheet. Share the data with the class.

www.ocearch.org/

Shark Tracking Data Sheet

Name of shark _____

Weight _____ Length _____

Tag date _____ Time _____

Location of tagging _____

Type of shark _____

Distance covered so far _____

Date tracking begins _____

Approximate starting location _____

Tracking data:

Date	Location	Time	Distance