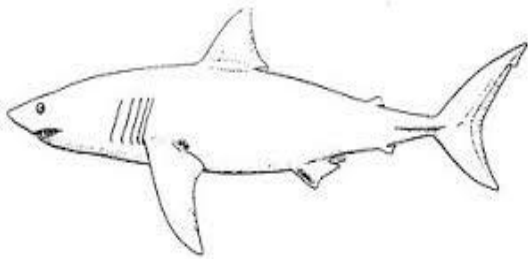
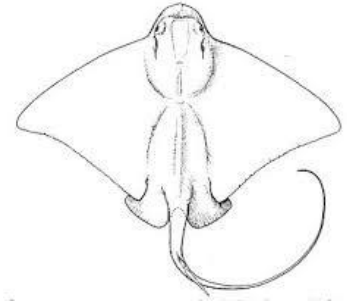


Lab: Shark and Ray Classification

(Modified from Monterey Bay Aquarium & Life on an Ocean Planet)

Background: All sharks belong to the class of fish called Chondrichthyes.

Like fish, sharks have gills and fins. These physical characteristics help sharks and other fish to breathe and move underwater. But sharks have some specialized characteristics, or adaptations, that other fish don't. Unlike bony fish, sharks lack true bones and have skeletons of cartilage, which consists of calcium phosphate and other minerals. The cartilage strengthens their body frames and makes them very flexible and lighter in weight than bony fish. Sharks' bodies also 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. All sharks have five to seven pairs of gill slits for breathing. Water flows through the shark's partially opened mouth and out through the gills, where oxygen is absorbed. Some sharks, especially those that rest on the ocean floor, may have holes behind their eyes called spiracles that also aid in the flow of water. 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 mollusks 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. Like in humans, these inner ear canals are very important for balance and orientation. Sharks also have a lateral line which runs from head to tail. It is made up of small hairs within pores and helps a shark detect movements and vibrations it may not be able to hear in the surrounding environment. 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, called a 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. They also have clusters of sensory pores, called Ampullae of Lorenzini, on their heads.

These jelly-filled pores can detect very weak electrical signals given off by an animal's muscle movements. The muscles and fins of a shark are what help it swim efficiently. The muscles are the shark's engine and helps it cruise for long distances. A shark's fins provide lift and enable it to effectively navigate. The stiff pectoral and pelvic fins help a shark move up and down and control the animal's movements. The caudal fin moves from side-to-side and propels the shark forward. Dorsal and anal fins prevent sharks from rolling from side to side when moving forward. Unlike bony fish with gas-filled swim bladders for buoyancy, a shark's liver is filled with fatty oil, called squalene. This helps it adjust its buoyancy in the water column. Shark populations around the world are declining primarily because of overfishing and habitat destruction. Of the approximately 350 species of sharks roughly one quarter are threatened, according to the International Union for the Conservation of Nature.

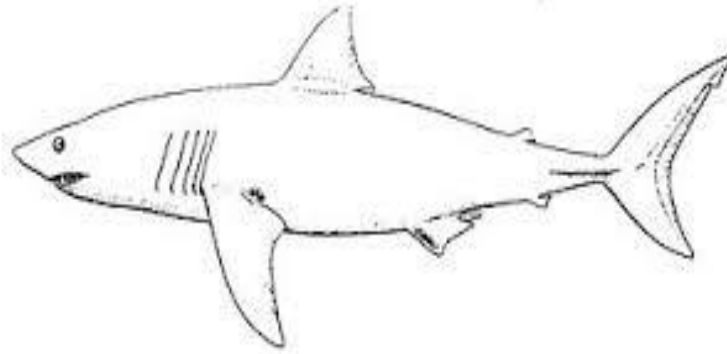
Prelab Questions:

1. What is the primary difference between sharks, rays & skates and most other fish?

2. How do dermal denticles differ from other scales?
3. What are otoliths and why are they important?
4. Describe the function of the Ampullae of Lorenzini.
5. Why are shark populations around the world declining?

Activity:

6. Sketch the basic shark body shape. Label the external features including: eye, gill slits, first dorsal fin, second dorsal fin, caudal fin, anal fin, pelvic fins, pectoral fin, and Ampullae of Lorenzini.



Shark Taxonomy - Phylum Chordata, Class Chondrichthyes, Subclass Elasmobranchii

Major Shark Orders

Heterodontiformes: Bullhead Sharks
 Carcharhiniformes: Ground Sharks
 Hexanchiformes: Sixgilled Sharks
 Squatiniformes: Angel Sharks
 Rajiformes: Skates & Rays

Orectolobiformes: Carpet Sharks
 Lamniformes: Mackerel Sharks
 Squaliformes: Dogfish Sharks
 Pristiophoriformes: Saw Sharks

- 7-15. Research one of the Orders listed above and record the information as seen below. Then share your information with each other group and record the information. A good place to start is www.eol.org (hint: using the scientific name when researching online usually yields better results)

Order:

Number of species included:

Three examples of species included:

Defining characteristics:

16. What characteristics define the entire group of Orders, collectively identified as the Subclass Elasmobranchii?
17. When did Elasmobranchs first evolve?
18. Identify two threats to Elasmobranch populations other than overfishing.
19. Name three Elasmobranchs that make an appearance in *Finding Nemo*.
20. What is your favorite Elasmobranch and why?