

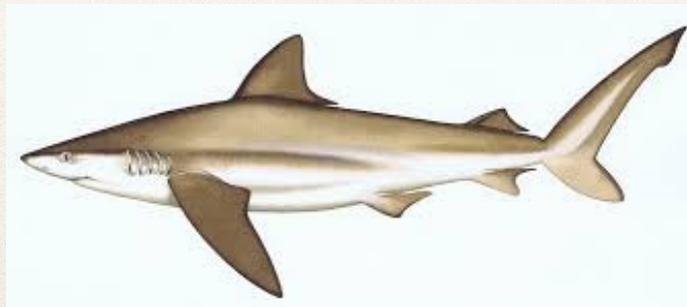


Chondrichthyes

Cartilaginous Fishes

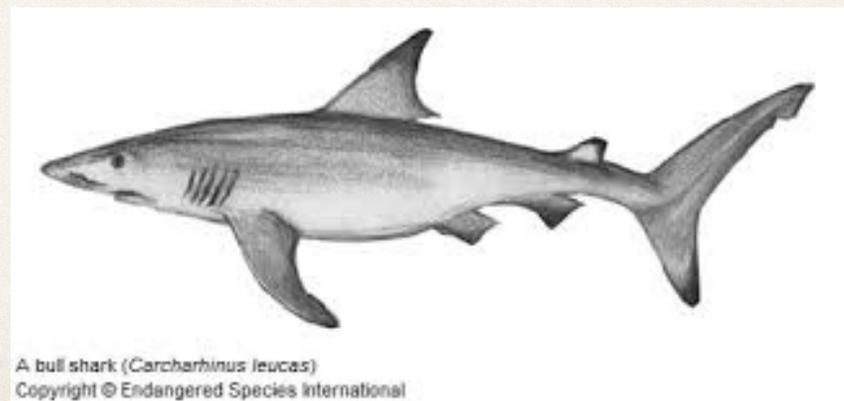
Chondrichthyes

- jawed cartilaginous fish composed of sharks, skates, and rays**
- They have a skeleton made up of cartilage and do not have any bones**
- They have existed on earth for over 400 million years**
- They are mostly ectothermic – have body temperatures similar to the temperature of the water around them**

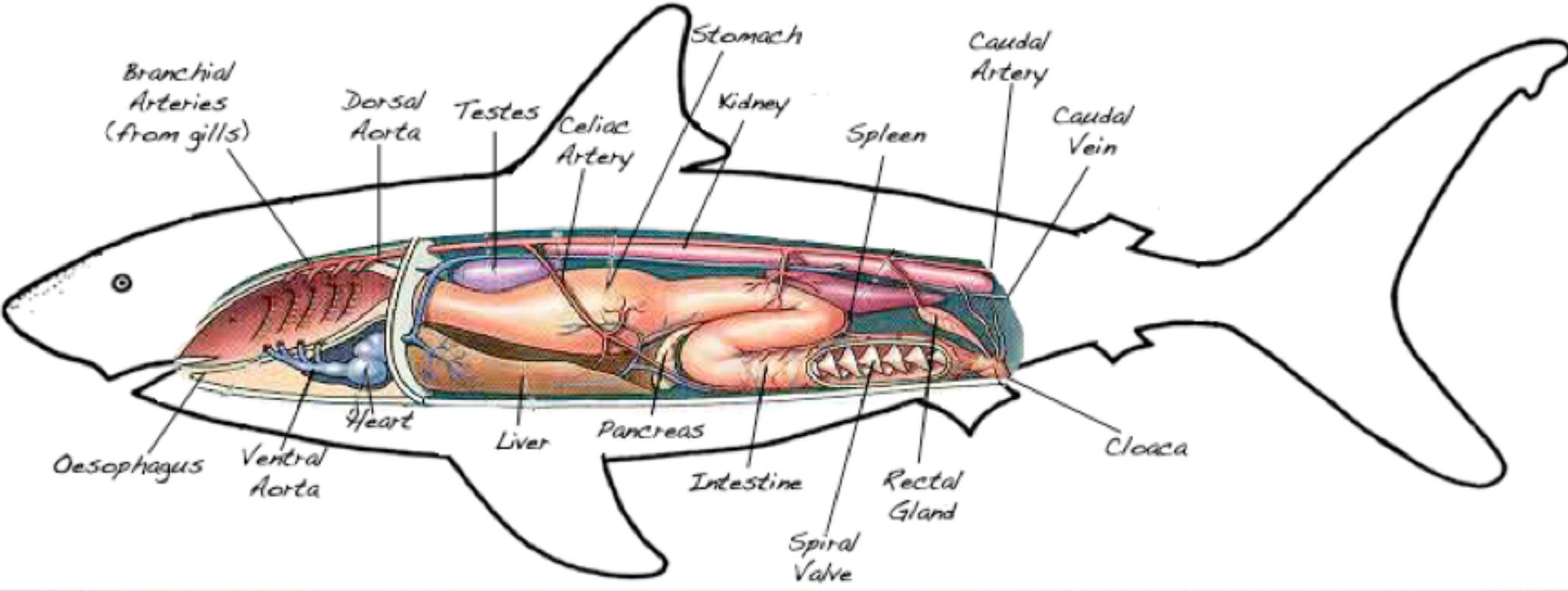


Chondrichthyes

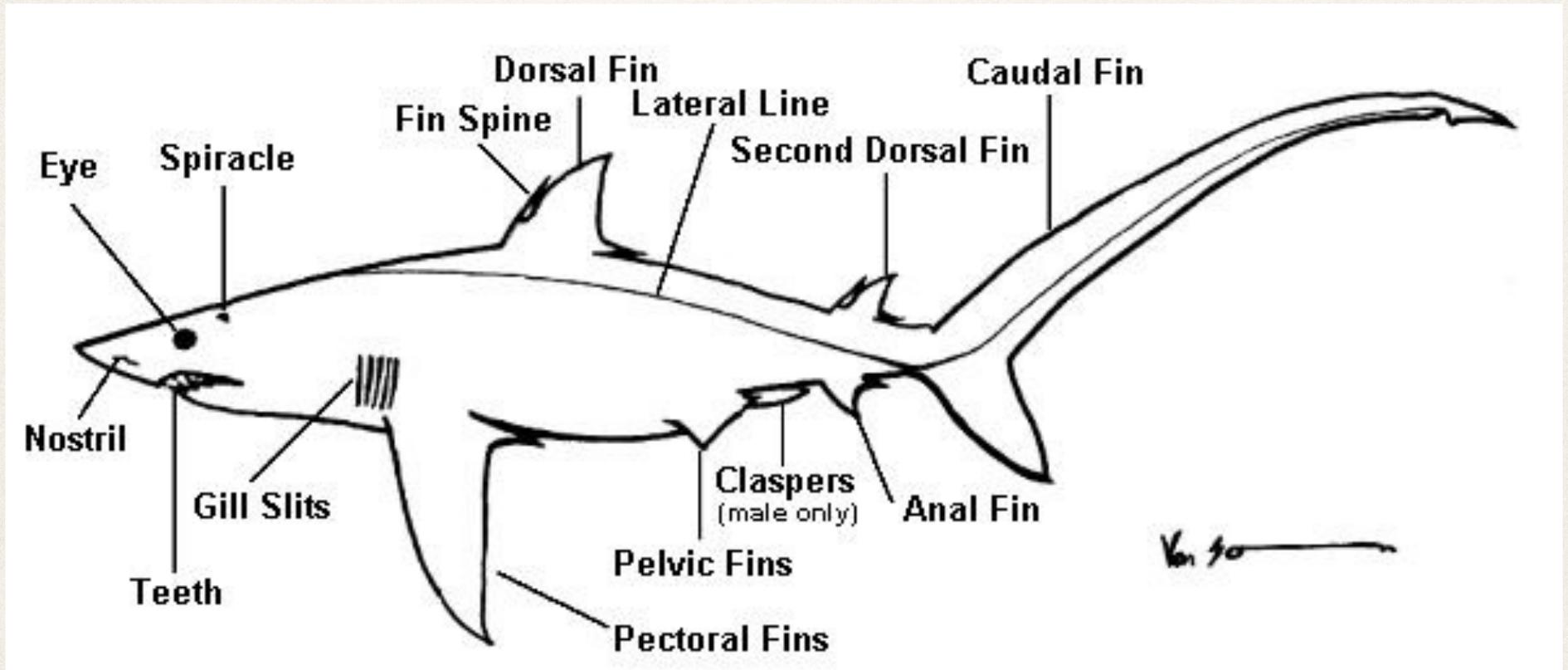
- These fishes have teeth-like scales called denticles.**
- Their mouth is usually located ventrally and they were the first fish to have paired fins (pectoral & pelvic fins) for more efficient swimming.**
- They have 5 to 7 gill slits per side and no swim bladder.**
- Internal fertilization**
- The largest shark, the whale shark is a plankton feeder.**



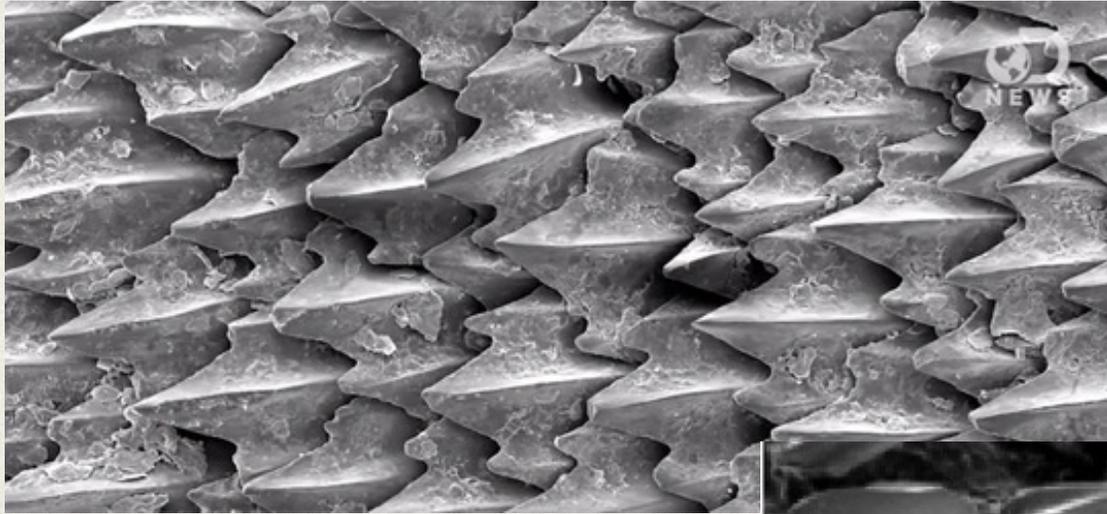
Internal Anatomy (remember NO Bones)



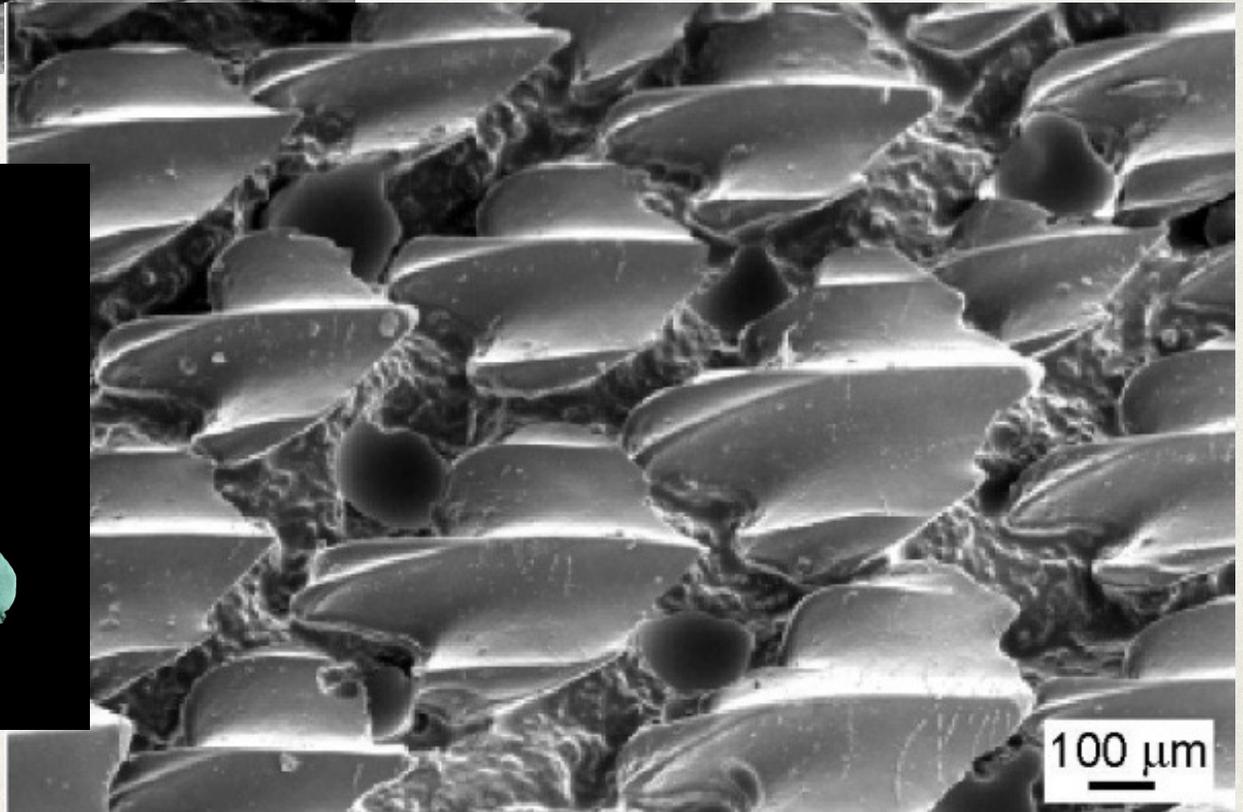
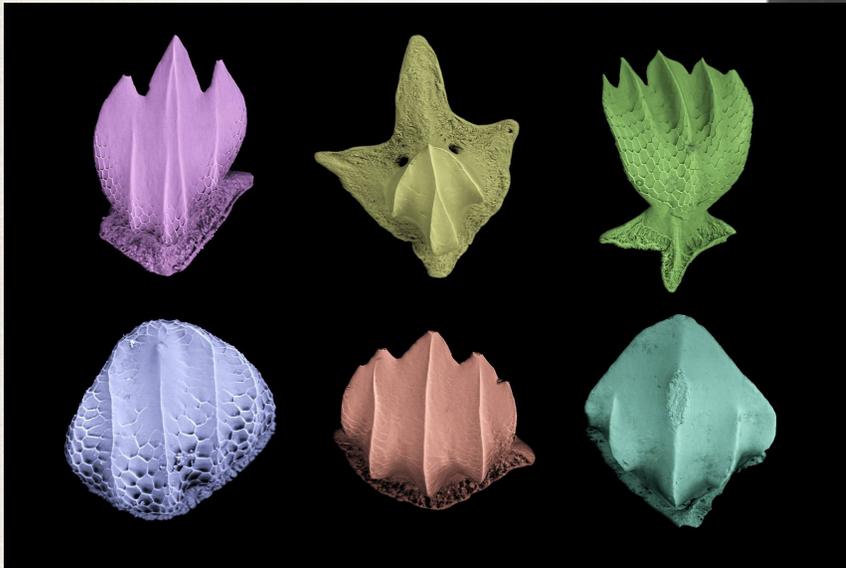
External Anatomy



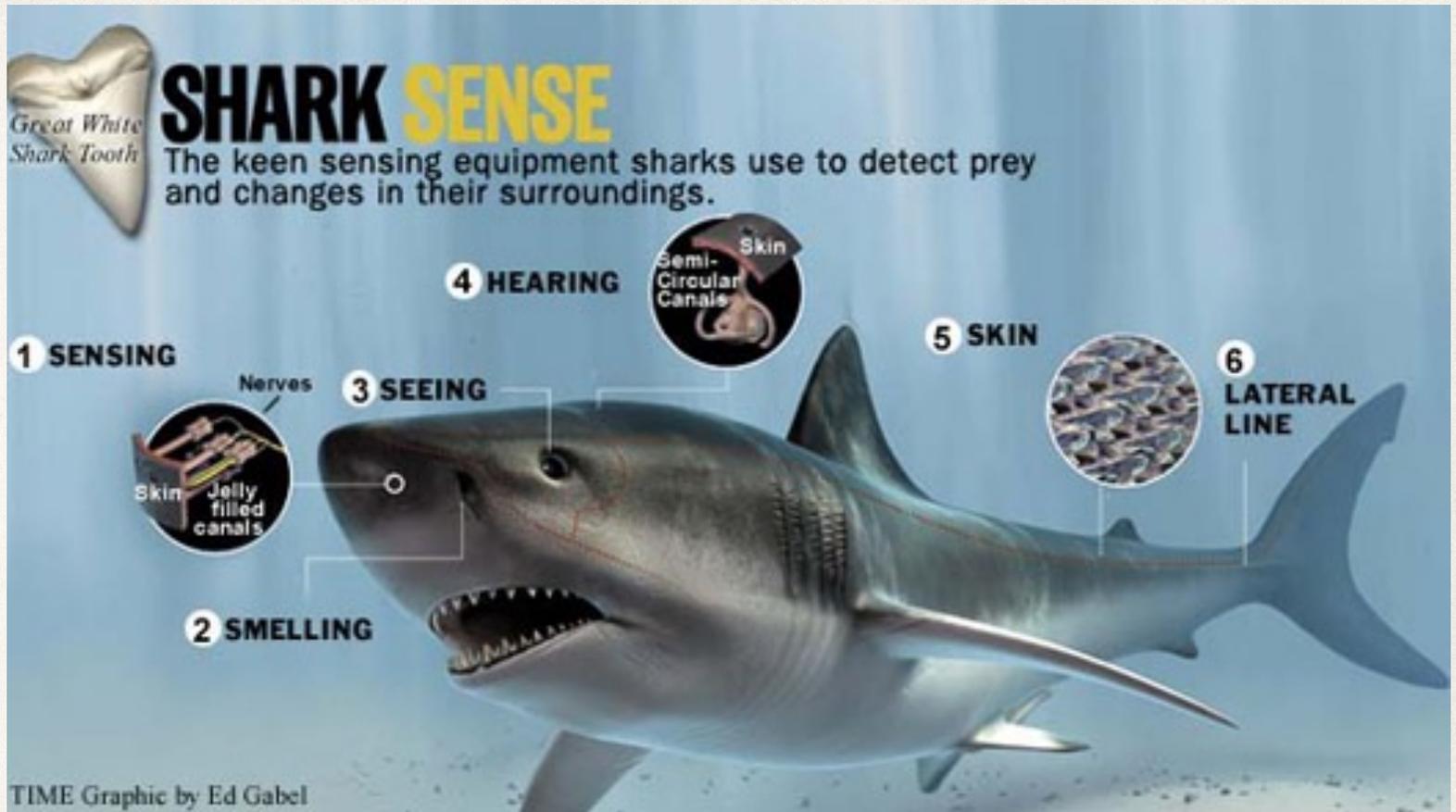
Denticles



Dermal Denticles= Skin Teeth



Shark Senses



- Sound
- Smell
- Sight
- Electromagnetic Fields
- Touch

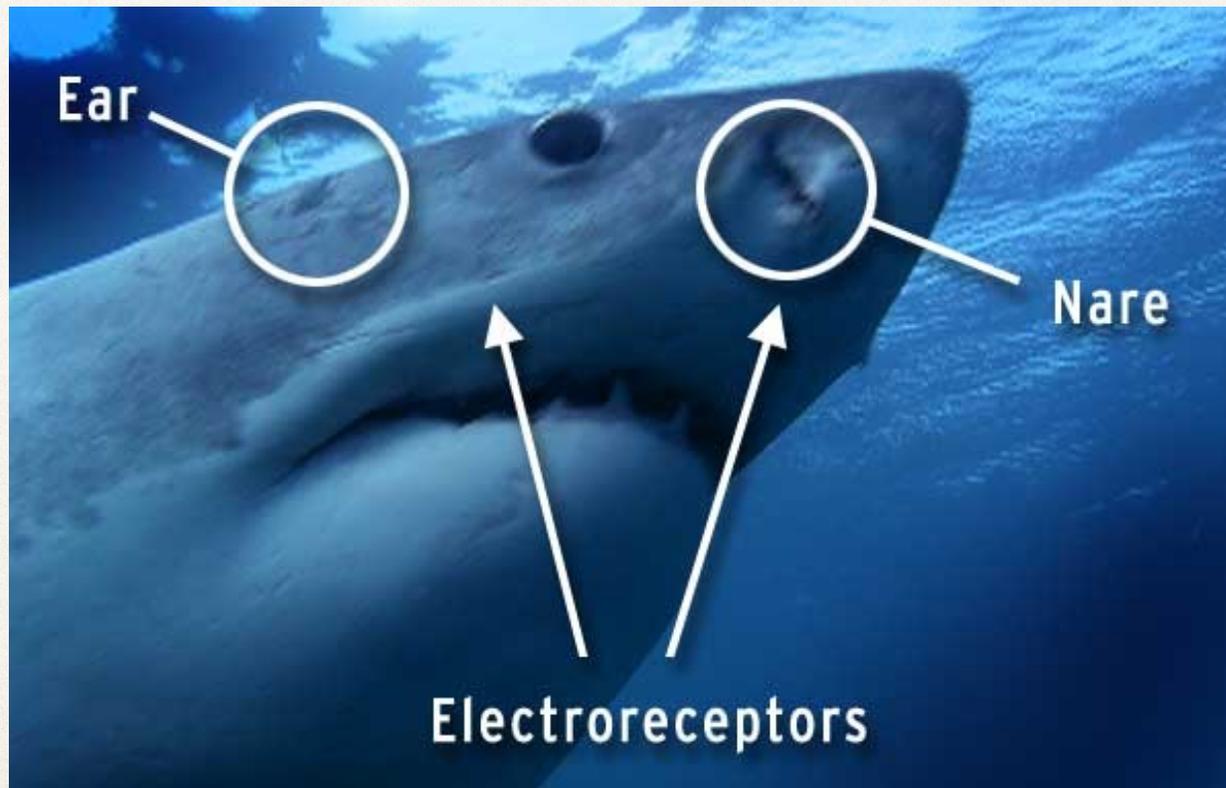
Sound



- **Sound Travels 5X faster in water than air and quite far. Sharks have inner ears but no outer ears.**
- **They are attracted most by low-pitched sounds. Sharks cannot make any noises, they have no vocal cords.**
- **Bursts of sound, like that made by injured fish are particularly attractive. This is also the sound made by humans splashing in the water.**

Smell

- Will then help the shark to move closer to the prey.
- Through its nares (nostrils), sharks can detect one part of blood in many millions of parts of water. (One part per million is equivalent to you taking one large mouthful of food compared to all the large mouthfuls you will take in a lifetime).



Sight

- They can see extremely well in dim light. While bony fishes cannot dilate their irises, sharks can to allow more or less light to reach their retinas.
- Some sharks have a third eyelid called the “nictitating membrane” that can move to cover the eye completely to protect it during feeding.



Electromagnetic Fields

- **Produced by the prey can be detected by sharks.**
- **The “Ampullae of Lorenzini”, electro-receptors, located on the snout of the shark, allows them to detect weak electrical currents produced by a prey's gill movement.**



[2 min video electroreceptors](#)

Touch and Taste

- Sharks can feel touch with their skin
- Sharks can taste their prey with their tongue



Shark predators

- a. The natural enemies of sharks include other sharks, killer whales and the most dangerous to sharks, by far, are humans
- b. Gill nets kill sharks and mammals when the intended catch is actually fish. Sharks can drown if they do not have water running over their gills.
- c. Sharks have a protective coloration to hide them on the bottom or in reefs and exhibit counter-shading to hid them while free swimming in the open ocean.
- d. The bamboo shark can come out of the water for hours to follow prey or avoid predators.



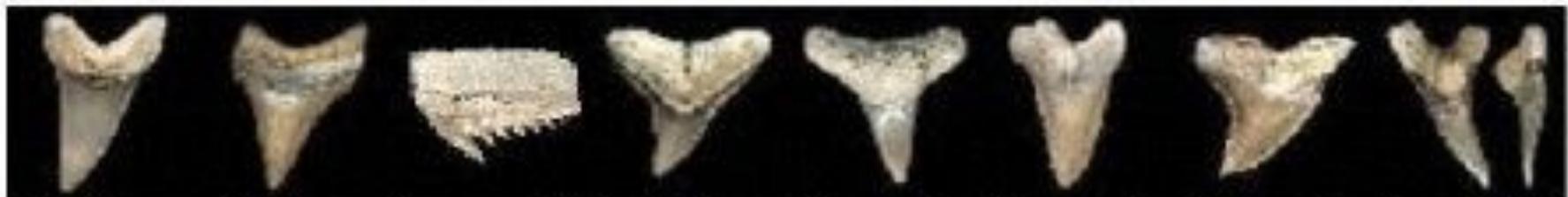
Fossil Shark Tooth Identification Guide



Bull Bull Copper Copper Dusky Dusky Great White



Great White Lemon Shark Mako Mako Mako Mako



Mako Meg Seven Gill Silky Snaggle Snaggle Snaggle Sand Tiger



Sand Tiger Sand Tiger Thresher Tiger Tiger Tiger

Shark teeth today

www.elasmo-research.org/education/evolution/guide_r.htm

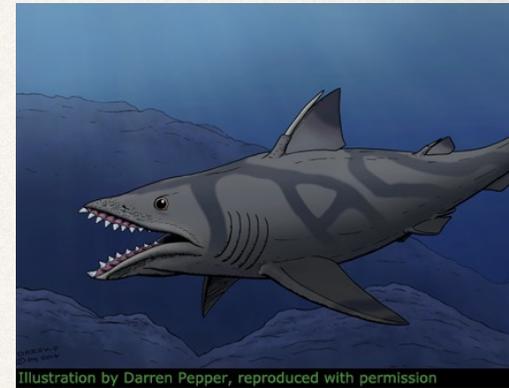
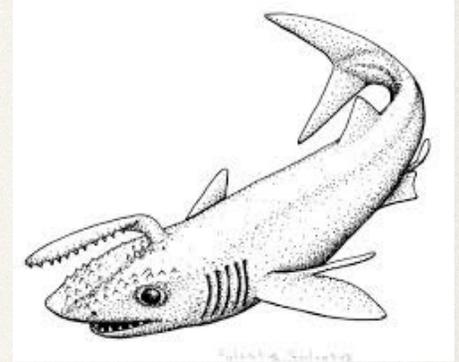


Illustration by Darren Pepper, reproduced with permission

Shark Attack

- a. A shark may attack a rogue shark, or people swimming who sound like an injured fish and may be mistaken for natural prey.
- b. Many attacks involve spear fishers: sharks are attracted to fluttering movements of an injured fish
- c. A shark bothered by a swimmer or diver may attack.
- d. 99% of the cases in which a rescuer goes to the aid of a victim they are not attacked.



Shark Attacks

e. There is a statistical preference of sharks for males over females among swimmers; 1 female is attacked for every 9 males. Less than 1/2% of attacks on scuba divers were on women (1 out of 244) and she was spear fishing. This may be a reaction to a territorial intruder with movement of men more threatening than women.

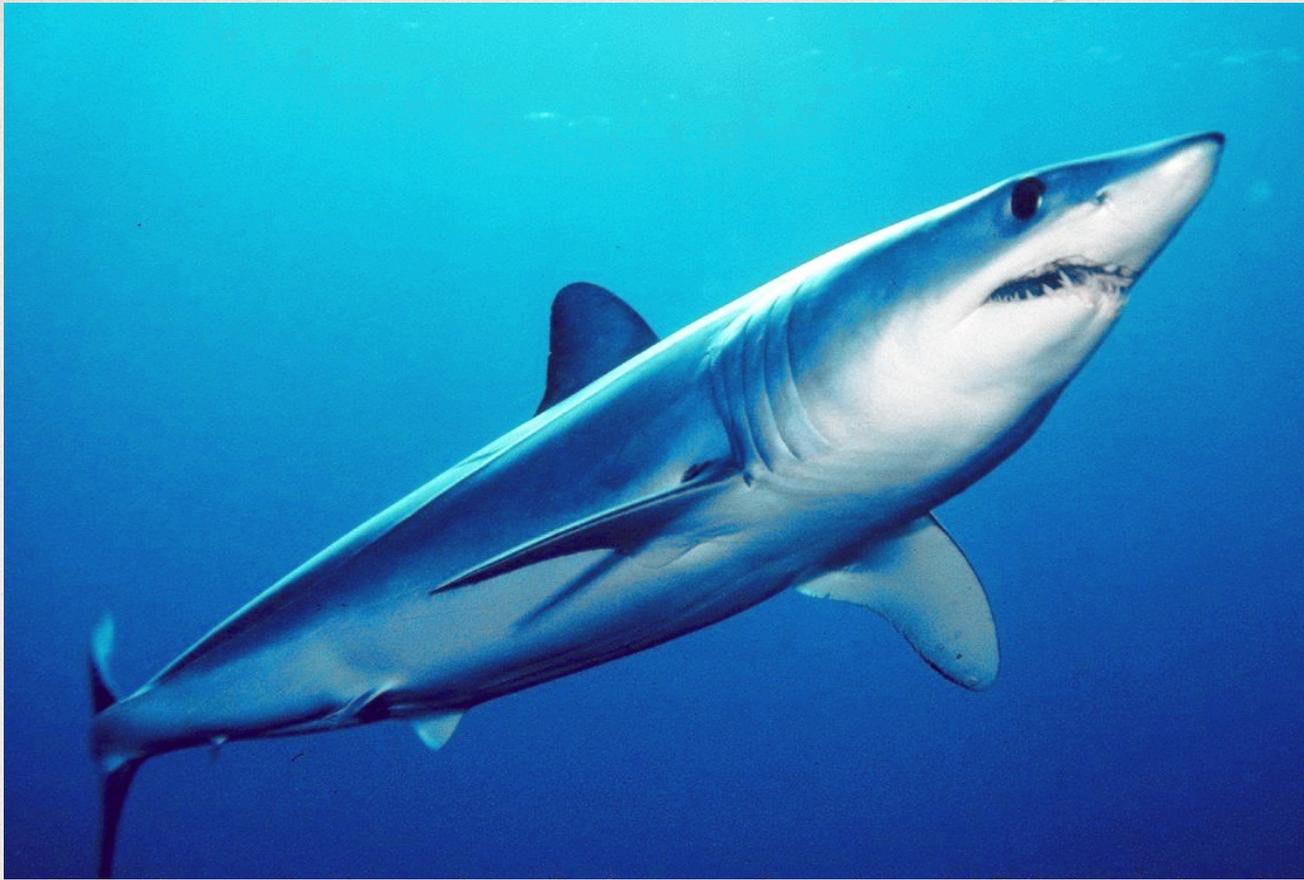


f. 80% of attacks involve 1 or 2 bites; no intent to kill?

Maybe a human doesn't react like other prey when bitten and it loses interest. We certainly do not taste like other prey.

g. When an attack does occur it is likely to be a single bite and not an attempt to consume the human. Death may occur due to blood loss. Humans do not taste like other natural shark food and are not desirable to a healthy shark.





h. Of the approximately 360 plus known species of shark, of which about 250 species are now alive, only about 25 have ever been identified in a human attack for one reason or another. The most dangerous are the white, mako, tiger and bull sharks.

I. The majority of attacks have occurred in temperate waters within 67m/200' of shore and in a depth of 1.5m/5' of water.



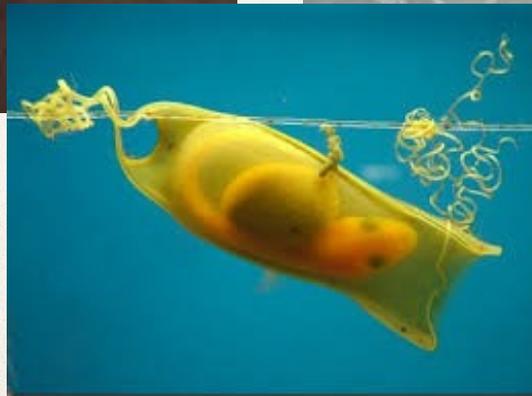
To avoid an attack by a shark there are a few things to know. **DO NOT**

1. Dive or swim alone.
2. Dive or swim at night
3. Keep captured fish near you in the water.
4. Spear fish over a prolonged time in one area.
5. Enter the water if you have a cut.
6. Panic and splash at the surface if you see a shark.
7. **DO** get out of the water as fast and quietly as possible.



Shark Reproduction

- Fertilization is internal. There is no parental care.
- Sharks have long life spans and low reproductive rates.
- The female produces scents to attract the male.



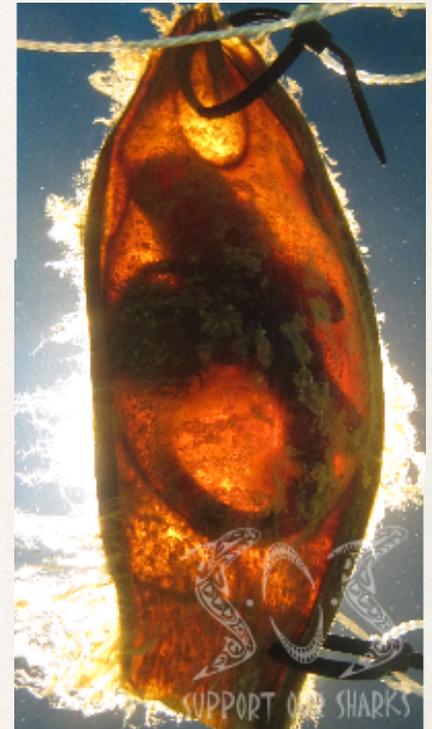
Shark Reproduction

The male sharks have claspers on each of their pelvic fins. These deliver sperm into the female's cloaca. Lemon sharks have been seen mating while swimming belly to belly.

Baby sharks are called "pups



Oviparous: The female lays a tough egg case and the shark develops in it for up to a year. It survives and grows from the nutrition provided by the yolk and hatches as a miniature version of the adult. Horn sharks and catsharks are egg case layers.



Viviparous: They are born live attached to an umbilical cord through which the mother has nourished it during development. Hammerhead, lemon and blue sharks are born in this way





Ovoviviparous: Born live without an umbilical cord is the way most sharks come into the world. The embryos feed off of yolk sacs inside the mother's body. If one of the embryos uses up its yolk supply before birth it may eat unfertilized eggs or other embryos.

<http://documentaryaddict.com/films/gordon-ramsey-shark-bait>

<https://www.youtube.com/watch?v=1pXN2F4EPb8>

Skates and Rays

They are characterized by having flattened bodies. The pectoral fins are flat and extend to appear as wing like structures.

Most are **demersal**; bottom dwelling organisms with 5 pairs of gill slits that are always located ventrally rather than on the sides of the body.

There is usually no distinction between the body head and pectoral fins.

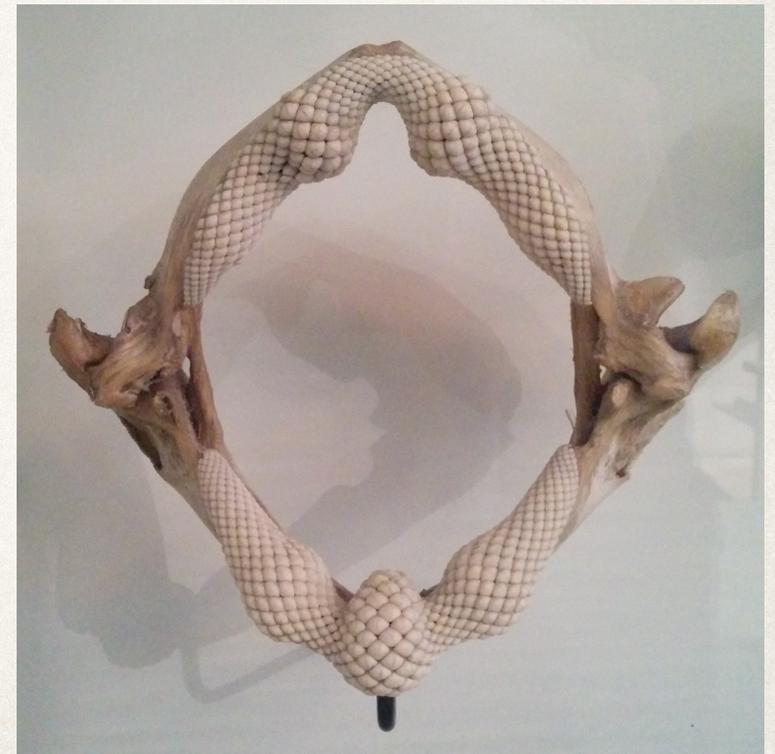
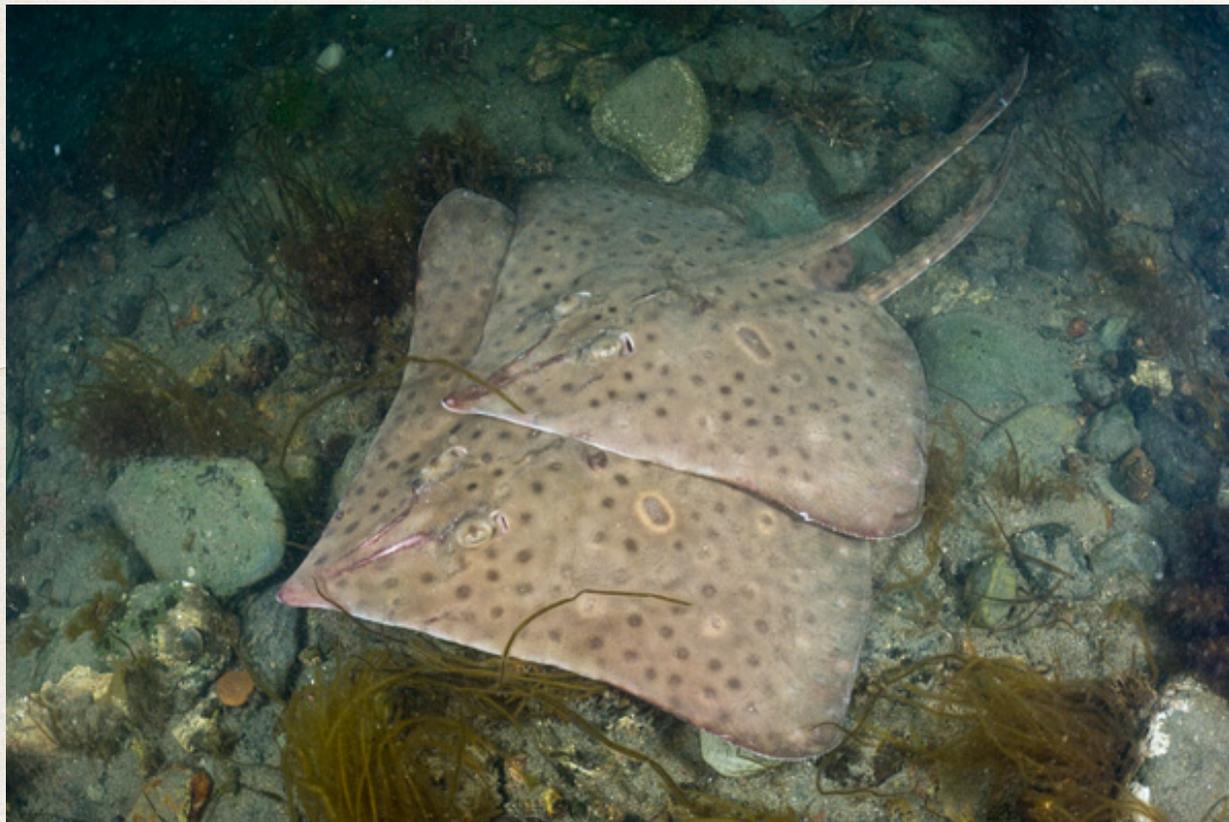
Their eyes are usually on the dorsal side.



Many skates and rays bury themselves under the sand becoming almost invisible except for their protruding watchful eyes looking for prey.

They typically feed on snails, clams, mussels, crabs, small fishes and other animals living in the sediment.

Instead of sharp teeth they have grinding plates to crush their prey.



Characteristics of skates include

1 to 6 1/2 feet long

Slender tail used as a rudder and some use electric organs to help locate prey.

Live on sandy and muddy bottoms along shores or in deep water.

They have a caudal fin on their tail.

There are spiracles on their dorsal side.



Characteristics of rays include:

Many have whip-like tails with a stinging spine for defense. There is a poison venom gland at the base of the spine. It may cause serious injury to the foot or hand but if stung in the abdomen or chest a person may die.

Internal fertilization with most young hatching within the female and some egg cases outside.



Rays

No caudal fin on the tail.

Generally larger than skates.

Some have electric organs to stun prey.

Some species of stingrays grow to 750 lbs.



The major difference between skates and rays is the way in which they reproduce.

Rays are viviparous (live bearing)

Skates are oviparous (egg laying), releasing their eggs in rectangular cases sometimes called "mermaid's purses".



Rays and Skates, unlike sharks, are not fusiform, but dorsoventrally flattened.

Gill slits open on the ventral surface of the head

Spiracles on the top of the head direct water over the gills, to prevent sludge from clogging these delicate structures

They feed primarily on mollusks and crustaceans, and so have teeth modified for crushing.

rays

night diving

whale shark

Human impacts on Sharks:

Jaws

Shark Finning

Habitat destruction

Overfishing/bycatch

Entanglement

Recreational fishing tournaments
as souvenirs



shark finning

