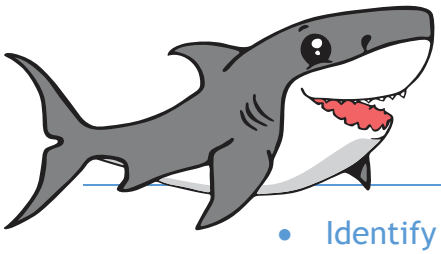
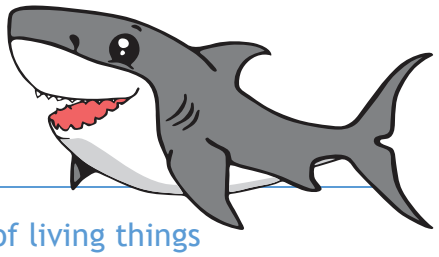
Living Systems

Why not get a hands on experience with your students at Irukandji Shark and Ray Encounters to learn about the oceans ecosystems from Apex Predators to Primary producers.

This Lesson plan is designed for students to observe and study the marine environment through interactive educational talks on Elasmobranches





Students will be able to

- Identify and describe the structure and function of living things
- Interact with the most misunderstood species in our marine systems Shark and Ray and their ecosystems.
- To observe marine animals and their reliance on all species
- . Students will look at the impacts on pollutants on marine plants by performing water test on controlled water source for a report.
- observe the food chain within a marine environment
- Observe various life cycles of Sharks and Rays.
- Identify, describe and evaluates the interactions between living things and their effects on the environment
- Look at Importance of Chondricthyan fishes (Sharks, Rays and Chimeras) to the marine environment and society, through an insightful look into 6 species life history strategies
- .to identify current conservation efforts of aquariums and marine parks throughout Australia.

Learning Environment

Core component is Group Work

- Ray Lagoon
- Tawny Terrian
- Fiddler Flats

Materials

- Pencil
- Activity sheet
- Ruler and clip board

Steps

Students should have some knowledge of what an Elasmobranches are, and what types of species can be found on our East Australian Coastline. Irukandji Shark & Ray Encounters has resources to help you pre-teach this information. Please see the section ,My shark and ray book ' below for details of pre-teaching material.

Step 1: Briefing approximately 10-15 minutes

Students will be lead to our briefing hut, were they will be taught and explained too about how to interact with Elasmobranches safely by a qualified aquarist.

Step 2: Getting Changed 20 minutes

Students will be given a chance to get changed and store all their valuables

Step 3: Before getting wet Tawny Terrain 10 minutes

This is where students will learn about tropical marine species in particular a 2.7 meter Tawny nurse shark and given a hands on demonstration on what do in the water in the main tanks.

Objectives

- *Observe different elasmobranches*
- *observe marine animals and relationships*
- *Food chain within a marine environment*
- *interactions between living things*
- *Identify current conservation efforts of aquariums and marine parks throughout Australia.*

Step 4: Getting wet Ray lagoon 25 minutes

This is where students will get a hands on experience feeding, touching and interacting with elasmobranches and teleost within their environment

Objectives

- *Observe the different forms of structure from plates to teeth.*
- *Effects of humans on rays*
- *Ocean acidification*

Step 5: Getting Change and heading over to Fiddler flats 20 minutes

This is where students will get a hands on experience feeding and observing ray species whilst an aquarist talks about the various types of life strategies employed by elasmobranchs

Objectives

- *Observe various life cycles of Sharks and Rays*
- *Identify, describe and evaluates the interactions between living things and their effects on the environment*
- *Look at Importance of Chondricthyan fishes (Sharks, Rays and Chimeras) to the marine environment and society, through an insightful look into 6 species life history strategies*

Step 6: Fill out the field work assessment 20 minutes.

Students will be given a chance to wonder the aquarium and obtain the relevant information for their reports

IRUKANDJI
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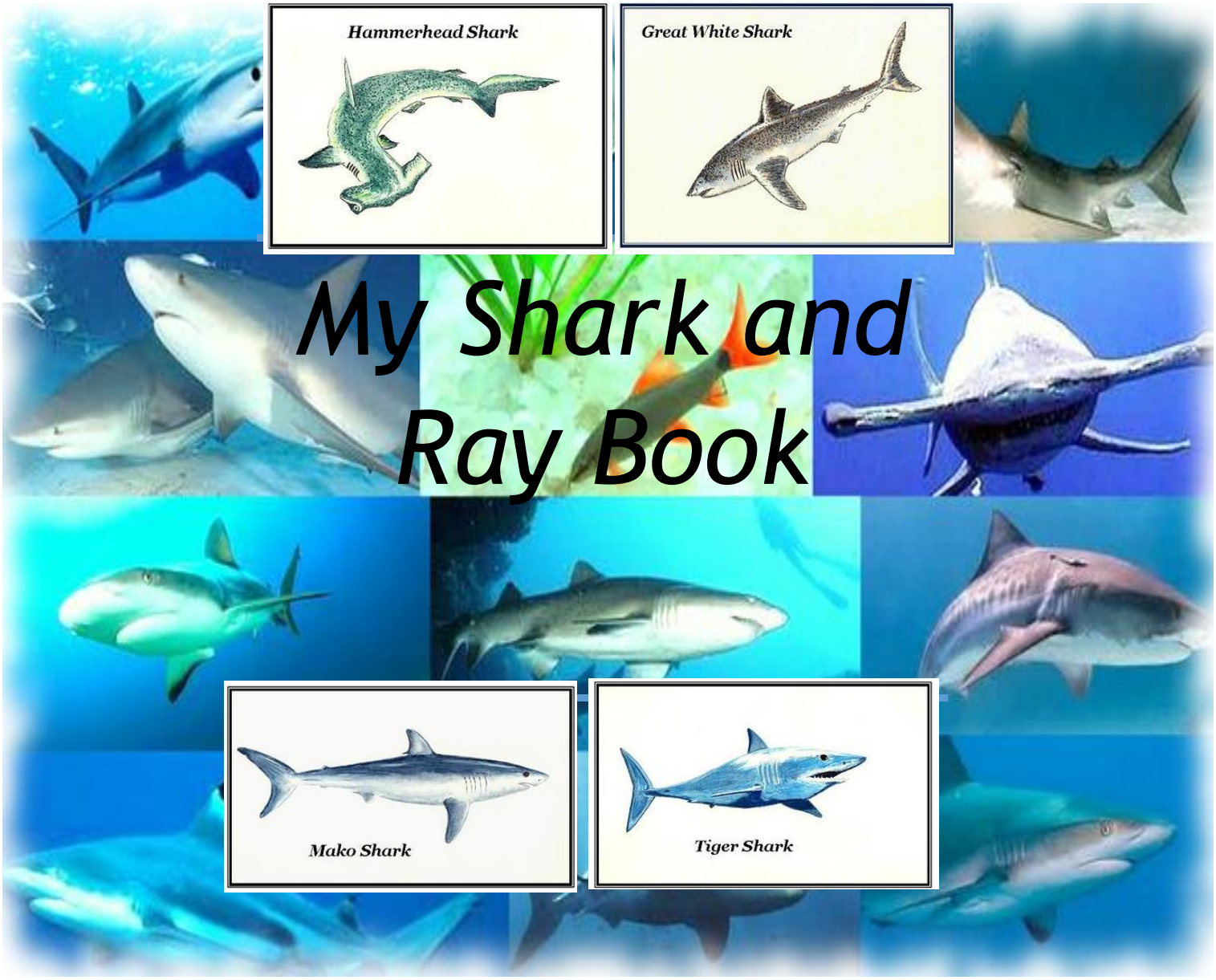


My Shark and Ray Book

This book belongs to: _____.

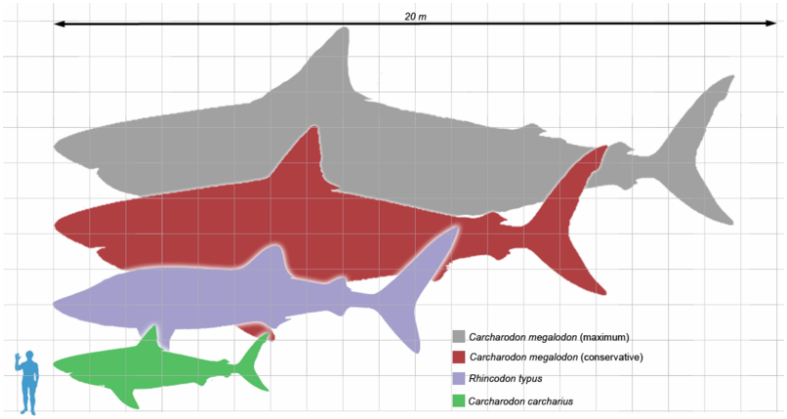
I am _____ years old. Today's date is _____.

Sharks

Topic1: Evolution

Sharks and rays are amazing fish that have been around about 170 million years long before the dinosaurs existed.

They live in waters all over the world, in every ocean, and even in some rivers and lakes. One of the largest sharks was the Megalodon shark. Megalodon Sharks, which were three times larger than our largest recorded great white WOW!



Of the shark families alive today, the cow sharks (six and seven gilled sharks) are believed to be the oldest and the youngest family are the strange looking hammerhead sharks.
Sharks developed their streamlined shape and powerful muscles made them so successful as predator.

In fact, it is believed that they have evolved very little over the past 150 million years!

QUICK QUIZ

Multiple Choice

1) What is the youngest family of sharks in the terms of evolution?
   (A) Six gilled Shark
   (B) Great White Shark
   (C) Megalodon Shark
   (D) Hammer Head Shark

2) How long have sharks been around for?
   (A) 150 millions years
   (B) Before Dinosaurs
   (C) 400 million years
   (D) 170 million years

3) How much larger was the Megalodon Shark compared to the Great White?
   (A) 5 times
   (B) 2 times
   (C) 1 Times
   (D) 3 Times

4) Write a story about sharks and were they live.

_____
_____
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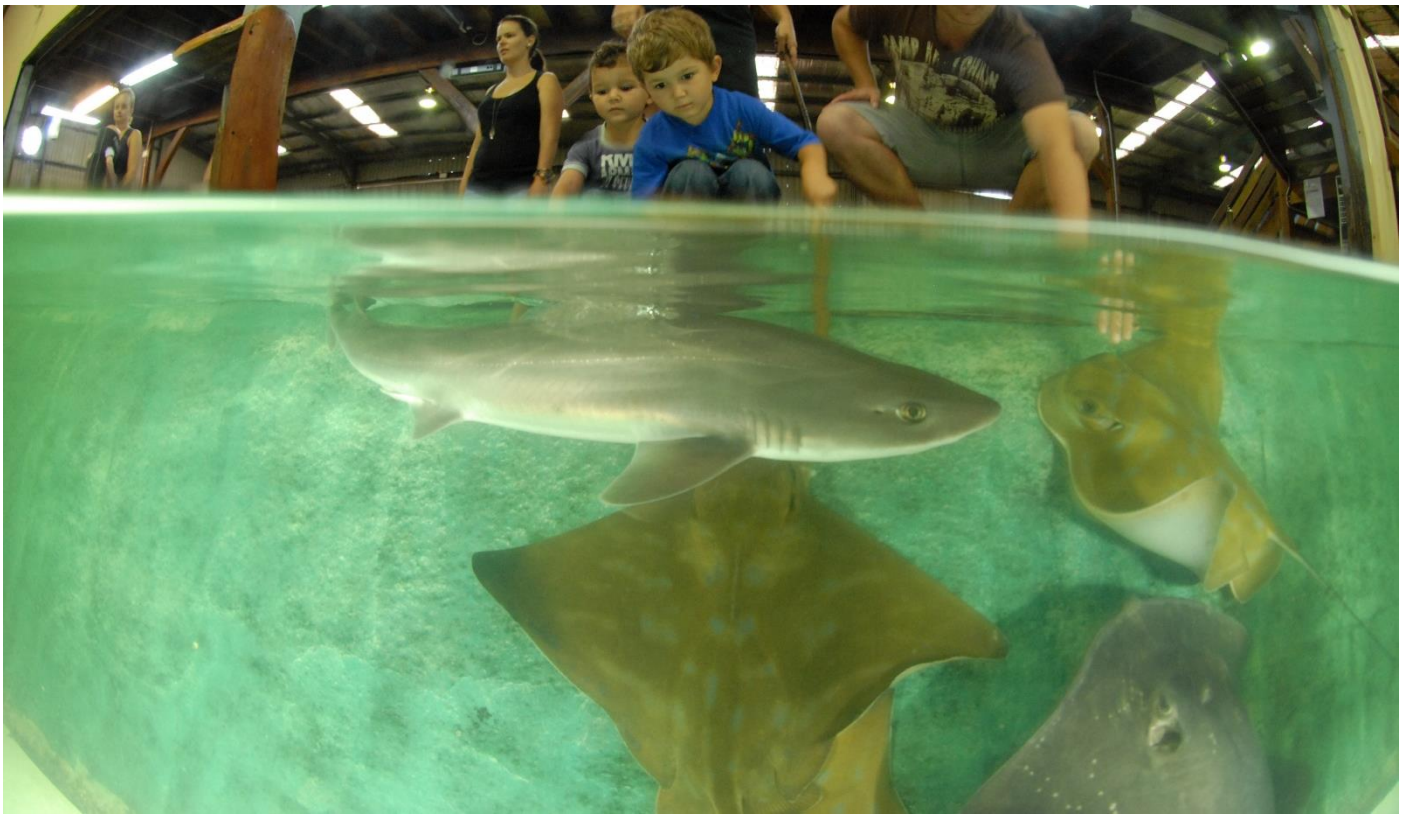
SHAPES

Sharks and rays have a variety of body shapes. Most sharks have streamlined, torpedo-shaped bodies that glide easily through the water.

Some bottom-dwelling sharks and rays (e.g. the angelshark and eastern fiddler ray) have flattened bodies that allow them to hide in the sand of the ocean bed. Some sharks have an tear drop body shapes (e.g., cookiecutter sharks and wobbegongs).

Sawsharks have long snouts, thresher sharks have a very long tail fins, which they use to stun prey, and hammerheads have very wide heads. The goblin shark has a large, very pointed noise on its head; its purpose is unknown.

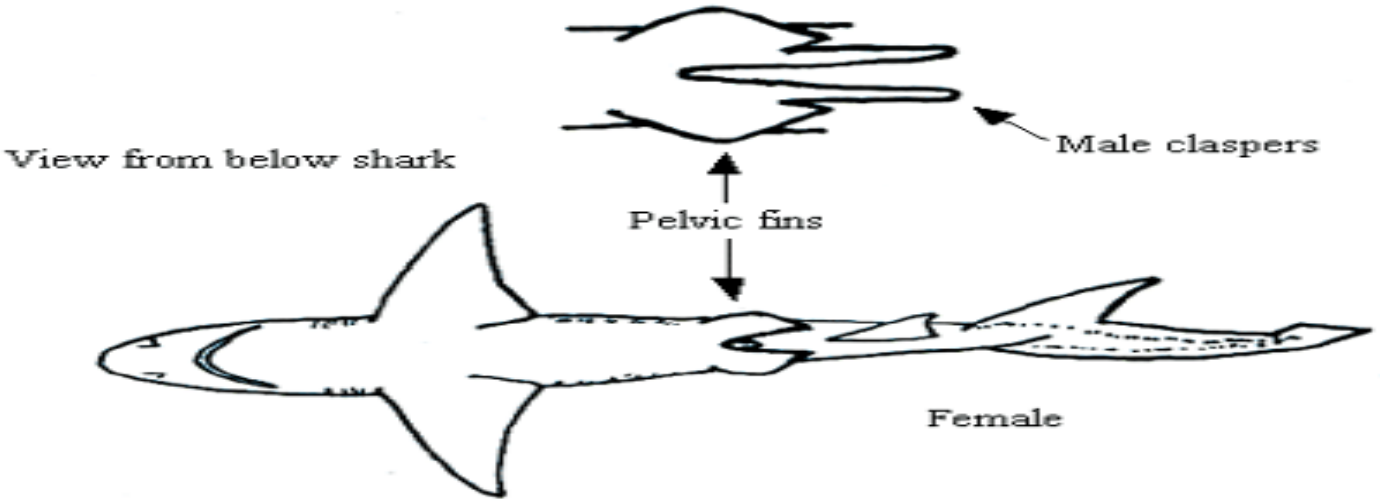
Can you spot all the different shapes of All the Species At Irukandji?



Life History and Reproduction

How do sharks and rays have babies?

Unlike most bony fish, shark's and rays eggs are fertilized inside the female's body. As you can see on the diagram below male sharks have claspers, which are extensions of the pelvic fins.



Most sharks give birth to live young, but some release eggs that hatch later. Baby sharks and rays are called pups are born with a full set of teeth and are fully ready to take care of themselves. They quickly swim away, even from their mothers who might eat them. Some sharks have one or two pups and some have over 100.

There are different types of shark and rays reproduction:

•**Live Birth** (Viviparity)- The eggs hatch inside the female's body and the babies are fed by a placenta which transfers nourishment from the mother to the babies via an umbilical cord which is connected to the baby shark behind the between the pectoral fins.

•**Laying Eggs** (Oviparity)- These sharks deposit eggs in the ocean which will hatch later if they are not eaten by predators. The eggs are not guarded by either parent. Shark eggs (sometimes called "mermaid's purses") are covered by a tough, leathery membrane.

•**Laying Eggs inside of the female** Aplacental Viviparity (Ovoviviparous)- In these animals, the eggs hatch and the babies develop inside the female's body but there is no placenta to nourish the pups. The pups eat any unfertilized eggs and each other.

Habitat

Sharks and Rays live in oceans and seas all over the world, and even in some rivers and lakes, especially in warmer waters. Some sharks live near the surface, some live deep in the water, and others live on or near the ocean floor. Pelagic sharks and rays (living in the open ocean) include the great white shark, the basking shark, etc. Benthic sharks and rays (living at the ocean floor) include the zebra horn shark, the wobbegongs, and the angelshark, which usually have flattened, camouflaged bodies that let them hide in the sea bed. Some sharks even venture many miles up into the fresh water of rivers like the bull Sharks in Queensland Australia.

Some sharks and rays live in relatively warm waters (hammerheads, bull sharks, manta Ray and tiger sharks). Other sharks, such as the thresher, mako, basking and blue shark, live in temperate water (which is neither hot nor cold). Others, including the dogfish, Greenland, and goblin, live in cool waters. Some sharks stay in the same region their entire lives while others travel across oceans.

QUICK QUIZ

Multiple Choice

5) What is a baby Shark and Raya called ?

_____

6) What are the types of Shark and Ray reproduction?
   (E) Eggs
   (F) Live birth
   (G) Eggs inside the females body
   (H) All of the above

7) Circle Yes or No can Sharks live in fresh water?

   YES
   NO

8) What interest you most about Sharks and Rays ?

_____
_____
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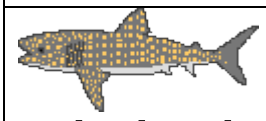
What Do Sharks Eat?

Sharks and Ray are carnivores that eat almost anything! Most sharks commonly eat bony fish, crustaceans (crabs, lobsters, etc), molluscs (snails, sea slugs, octopus and squid), and different types of worms. Many species also add larger sea animals to Great White hunting their diet (seals and sea turtles).

A shark's and Rays diet is often determined by its habitat. Sharks and Rays that live out at sea (pelagic sharks) are more likely to eat fish and squid because that is all that is available. Most sharks are predators, there are a few sharks that live by filtering plankton from the water. These filter feeding sharks may consume microscopic plants and algae while hunting for more nourishing zooplankton (tiny animals and larvae that drift around on the currents). The Whale Shark which is the largest shark (and fish) in the sea, lives on plankton which is one of the smallest animals! Although this shark has a huge mouth, its throat is tiny making it unable to eat anything larger than a grapefruit.

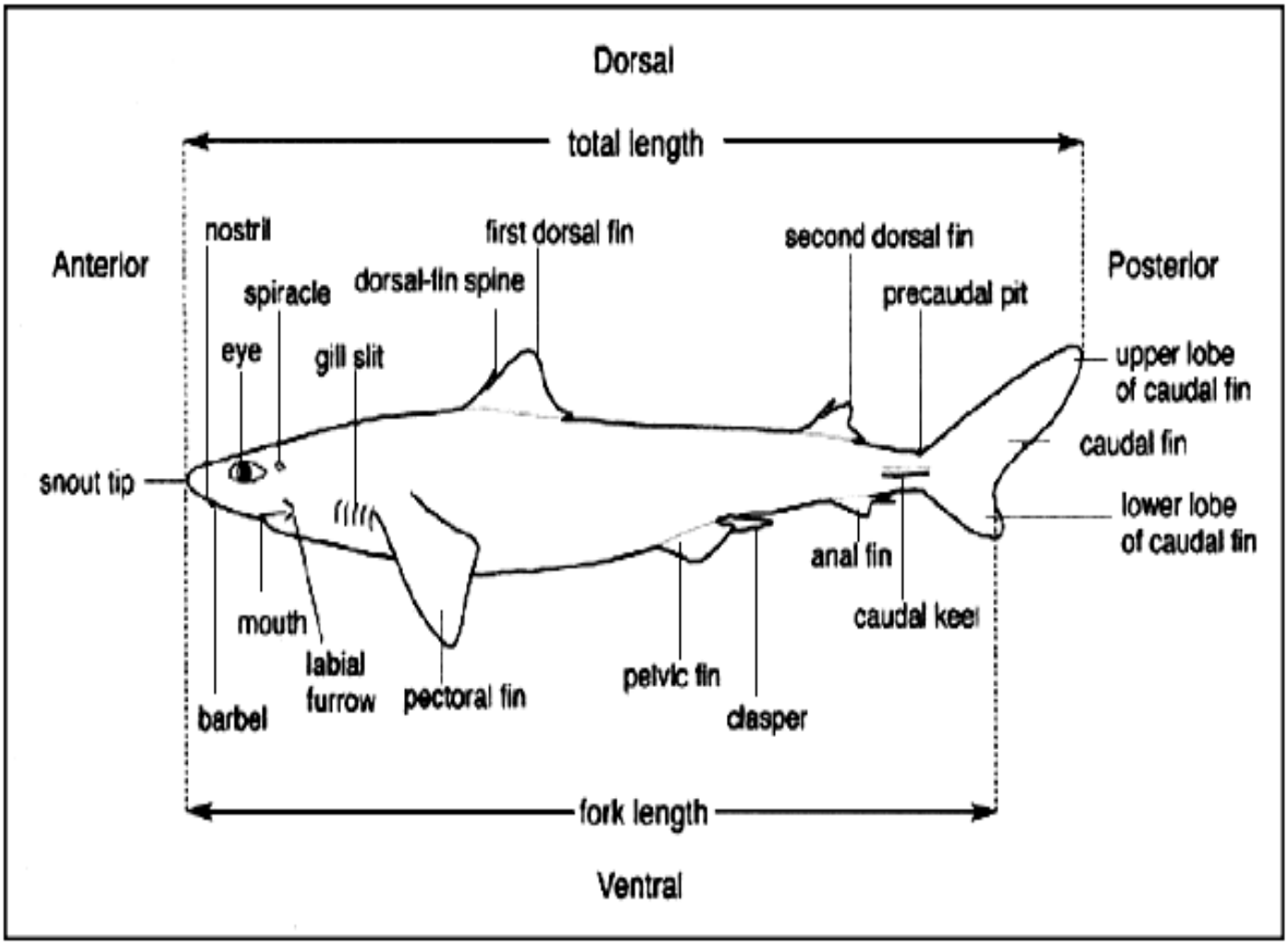
Shark activity

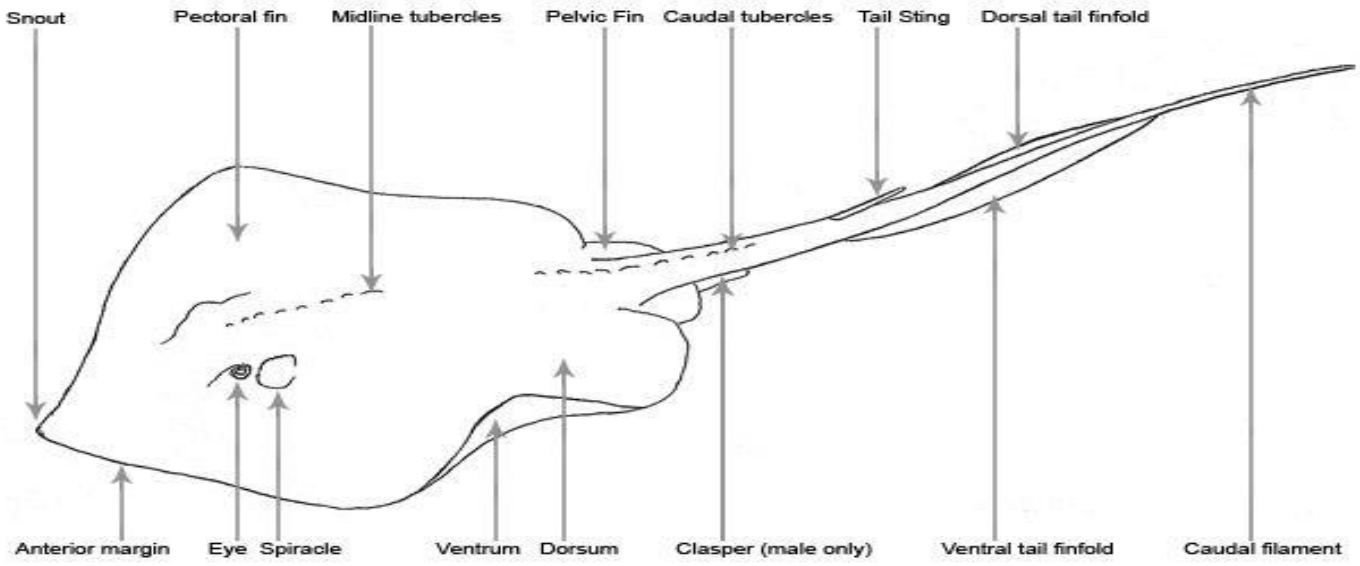
Draw links between the shark species and the food they eat. Remember some like more than one

Shark		***Type of Food***
 ***Whale shark***		 ***Seal***
 *NURSE SHARK*		 ***fish***
 *GREAT WHITE SHARK*		 ***Krill***
 *MANTA RAY*		 ***Squid***

Anatomy

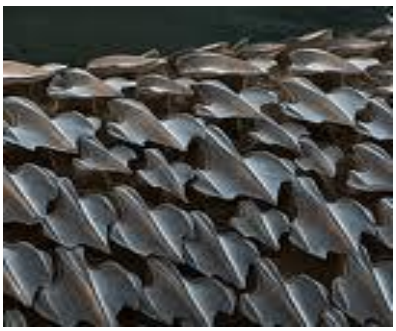
Although sharks and rays are part of the fish family they are very different, sharks have no bones because their skeleton is made of cartilage, like your ears and your nose. Sharks also have no swim which means they cannot float in the water like bony fish they sink as soon as they stop moving.





Skin

Sharks skin consists of very small scales known as Dermal Denticles (skin teeth). Like their teeth, if damaged dermal denticles soon grow back. Dermal denticles help sharks swim by making the water flow better over the body without creating turbulence. The skin feels very rough one way and when stroked the other is very smooth. Human swimmers can be badly cut by the skin of a shark! Below are images of Mangnified dermal denticles

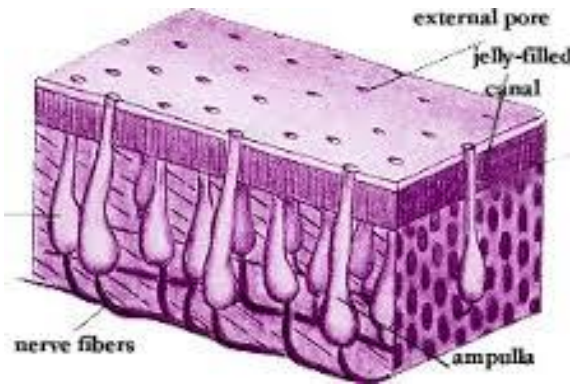


Super Senses

Sharks have been evolving 100 times longer than humans, which is why they have such highly developed senses. They have an incredible 7 senses compared to our 5 (sight, touch, smell, taste and hearing).

Sharks 6th sense is the detection of electricity, which is emitted in small amounts by every living animal. They have a special network of jelly-filled canals in their head called the ampullae of Lorenzini that detect electric fields (rays also have this).

The 7th sense sharks have allows them to detect vibrations in the water (the lateral line).
These extra senses can lead sharks to injured fish (easy prey) that are thrashing around in the water and have helped them to become one of the best hunters in the wild!



Label the Shark: Anatomy

Read the definitions, then label the shark diagram below. (Note: not all sharks have all of the fins and spines defined below.)

anal fin - the fin on the lower side of the body near the tail (not on all sharks)

caudal fin - the tail fin

eye - sight organs located on the head

fin spine - a protective spine located at the base of the first dorsal fin (not all sharks have fin spines)

first dorsal fin - the fin on the upper side of the body nearest the head

gills - fleshy organs that are used for breathing - they are located on the side of the head

mouth - the part of the body which the fish uses to catch food - it is located at the front of the body

nostril - paired slits on the underside of the snout. Water continually flows through the nostrils, giving the shark olfactory (sense of smell) information. Unlike humans, shark nostrils have nothing to do with breathing - they are not even connected to the mouth.

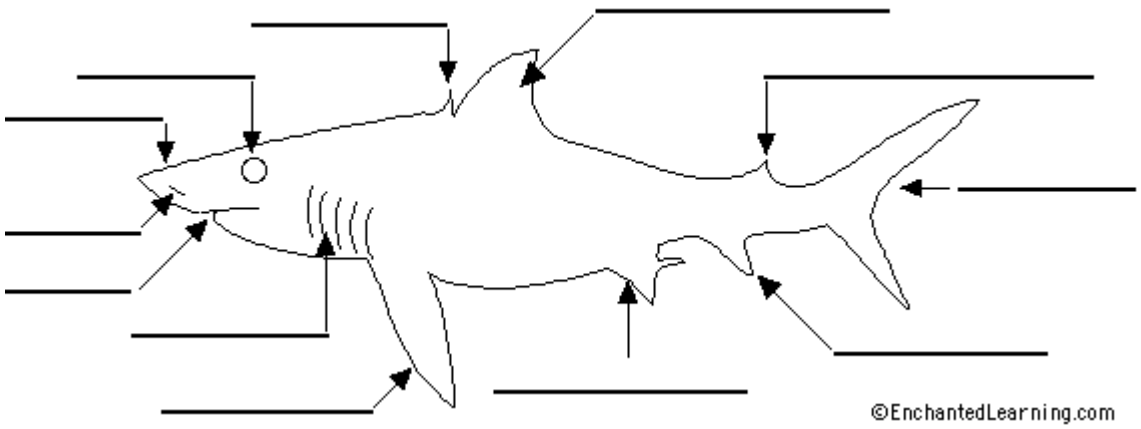
pectoral fin - each of the paired fins on either side of the body, near the head

pelvic fin - each of the small, paired fins on the lower rear side of the body

second dorsal fin - the fin on the upper side of the body nearest the tail

snout - the front part of the shark's head

ventral fin - each of the paired fins on the lower side of the body, near the head



Why is our Ocean *Important*

The Ocean is important because

- The Earth has one big connected ocean, yet there are many ocean basins, such as the Atlantic, Pacific, Indian, Arctic and Southern.
- The ocean covers about 70% of the planet's surface making ours a water world.
- Most of the Earth's water (97%) is in the ocean.
- All water on Earth is connected! Water evaporates from the earth's surface, falls as precipitation (rain, snow, sleet, etc.) onto the land and ocean, and returns to the ocean as river runoff and groundwater (underground) flow.

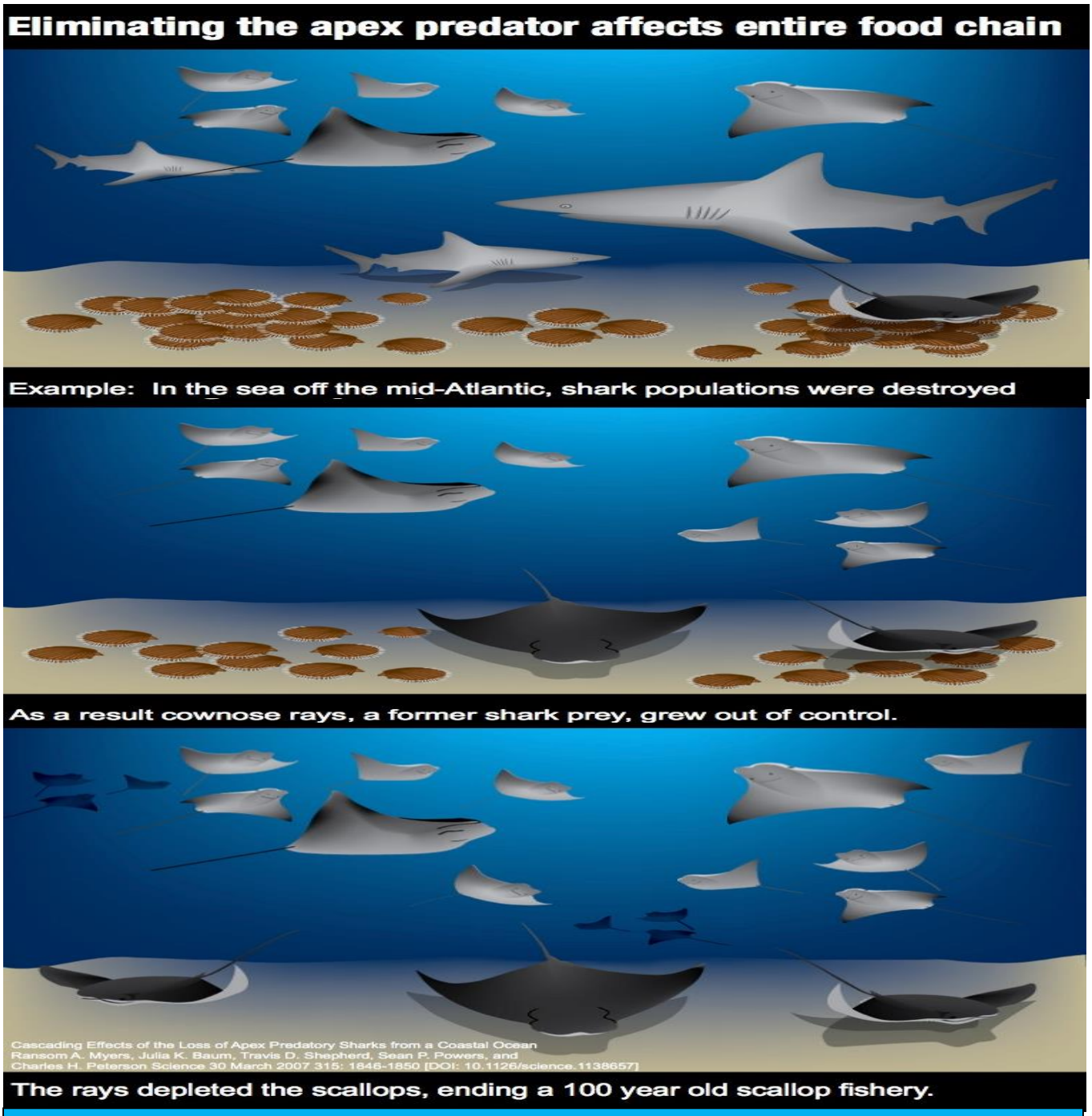
- This exchange of water is known as the hydrologic cycle.
- Although the ocean is large, it is finite and resources are limited.
- The ocean affects every human life! It supplies freshwater (most rain comes from the ocean) and nearly all Earth's oxygen.
- The ocean influences our planet's weather and climate and affects human health.

- The first life is thought to have started in the ocean. The earliest evidence of life is found in the ocean.
- Ocean life ranges in size from the smallest virus to the largest animal that has lived on Earth, the blue whale.
- Estuaries are coastal areas where freshwater and saltwater intermingle. Estuaries provide important and productive nursery areas for many marine and aquatic species.
- From the ocean we get foods, medicines, as well as mineral and energy resources. The ocean provides jobs, serves as a highway for transportation of goods and people, and plays an important role in national security.
- Much of the world's population lives in coastal areas. And, coastal regions are susceptible to natural hazards such as tsunamis, hurricanes, cyclones, sea level change, and storm surge.

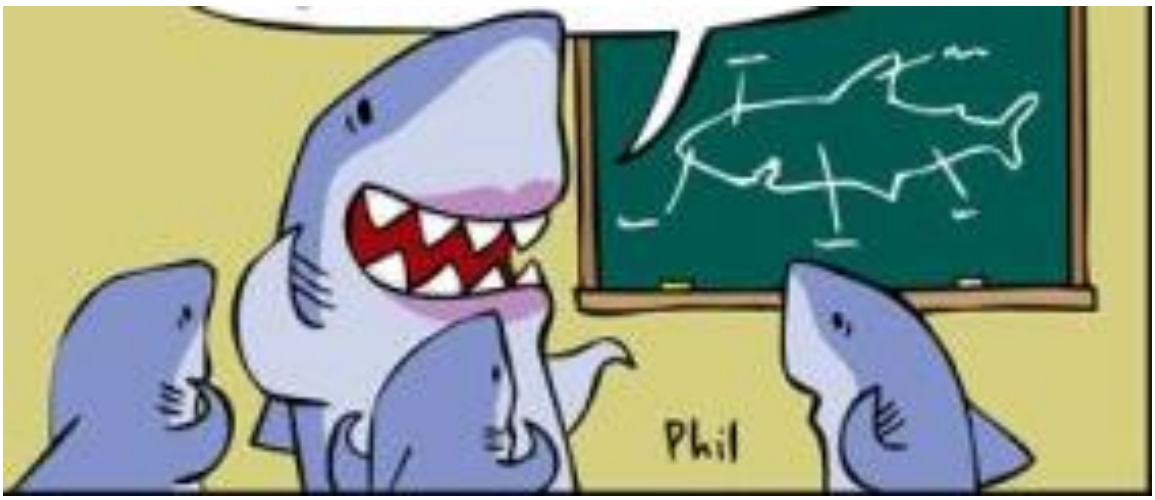
Let's learn about the sharks are so important

Sharks' Role in the Oceans

Sharks play a very important role in the oceans in a way that an average fish does not. Sharks are at the top of the food chain in virtually every part of every ocean. In that role, they keep populations of other fish healthy and in proper proportion for their ecosystem.



An important lesson: we need sharks!



In the parts of the ocean where sharks have been fished out of existence, we can see the dangerous result of removing the top predator from an ecosystem.

The lesson is important. Sharks are being killed for their fins for shark fin soup, a food that has assumed cultural value but is not important for human survival or health. However, removing the sharks can result in the loss of important foods that we do depend upon for survival.

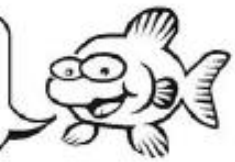
Sharks have survived for 450 million years, but may be gone within the next decades. Life within the oceans, covering 2/3rds of our planet, has enjoyed a relationship with sharks for about 450 million years. Our growing demand for shark fin soup has increased the slaughter of sharks to such a great extent that many shark species are already nearing extinction.

Question Time

What will the health of oceans be like when such an important group of animals have been destroyed?

How Long Will it Take?

It takes just a moment for an item to be carelessly discarded or blown by wind into the ocean, but it can take many, many years for that item to completely decompose. Test your knowledge about decomposition times. Draw a line between each item (left) to its corresponding decomposition time (right).



How Many Years Will it Take for These Items to Decompose in the Ocean?

Fishing Line

Cigarette Filter

Aluminum Can

Glass Bottle

Banana Peel

Milk Carton

Styrofoam Cup

Plastic Beverage Bottle

Undetermined
600 Years
450 Years
200 Years
50 Years
1-5 Years
3 Months
2-6 Weeks

The Answers are located at the end of this booklet

Field Trip Day Activity

Name:
Date:
School

List the species you find	Conservation status	Any adaptions they may have	Where are they found?

Name your favorite shark or ray?

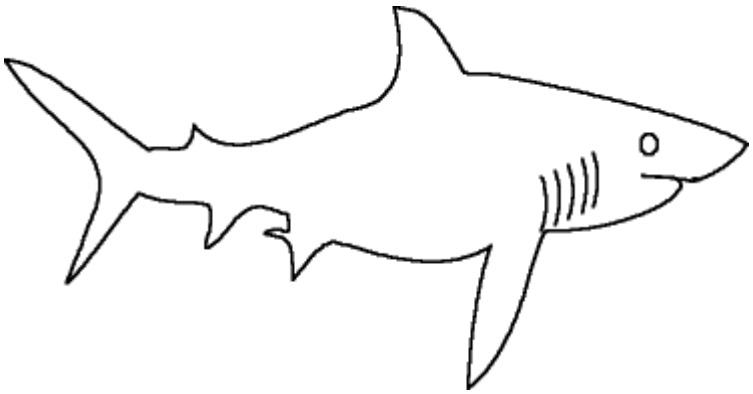
What adaptions make your favorite shark or ray the best for survival?

Why is your shark or ray important to the ocean?

Why are oceans changing today and our sharks disappearing?

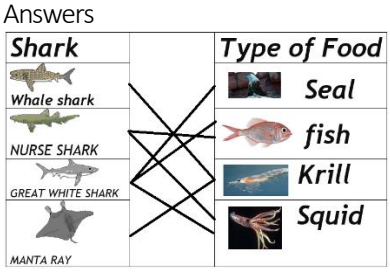
More Fun Activities

Colour the shark and write 5 facts and 5 opinions about sharks.
A fact is something that is true and is supported by evidence.
An opinion is something you believe or feel to be true and is open to debate.



Fact	Opinion

Answers



Marine Debris Match Up
Glass bottle = undetermined
Fishing line = 600 years
Plastic beverage bottle = 450 years
Aluminum can = 200 years
Styrofoam cup = 50 years
Cigarette filter = 1-5 years
Milk carton = 3 months
Banana peel = 2-6 weeks

Word Bank:

carnivores	rows	lakes	people
bones	water	flattened	tail
fish	teeth	shark	whale
white	heads	dinosaurs	filter

Sharks are a type of _____. They have been around since long before the _____ existed. They live in waters all over the world, in every ocean, and even in some rivers and _____. Sharks vary greatly in their diets, but they are all _____ (meat-eaters). Some are hunters (like the great _____ shark) and some (like the megamouth) are _____ feeders. Most sharks do not attack _____.

Unlike bony fish, sharks have no _____; their skeleton is made of cartilage, which is a tough, fibrous substance, not nearly as hard as bone. Sharks also have no swim bladder (unlike bony fish).

There are many different species of sharks that range in size from the size of a person's hand to bigger than a bus. Fully-grown sharks range in size from 7 inches (18 cm) long (the spined pygmy shark), up to 50 feet (15 m) long (the _____ shark, which is also the biggest fish).

There are about 368 different species of sharks, which are divided into 30 families. These different families of sharks are very different in the way they look, live, and eat. They have different shapes, sizes, color, fins, teeth, habitat, diet, personality, method of reproduction, and other attributes. The spiny dogfish shark is the most common _____.

Sharks have a variety of body shapes. Most sharks have streamlined, torpedo-shaped bodies that glide easily through the _____. Some bottom-dwelling sharks (like the angelshark) have _____ bodies that allow them to hide in the sand of the ocean bed. Some sharks have an elongated body shape (like cookiecutter sharks and wobbegongs). Sawsharks have elongated snouts, thresher sharks have a tremendously elongated upper _____ fin which they use to stun prey, and hammerheads have extraordinarily wide _____.

Sharks may have up to 3,000 _____ at one time. Most sharks do not chew their food, but gulp it down whole it in large pieces. The teeth are arranged in rows; when one tooth is damaged or lost, it is replaced by another. Most sharks have about 5 _____ of teeth at any time. The front set is the largest and does most of the work.

Irukandji
Shark & Ray Encounters

Sharkie Guardian Pledge:

Because I want to help the ocean and all the creatures that live in it and around its shores, I pledge today to do these things and accept membership into the Sharkies:

- Conserve water.
- Reduce waste and dispose of trash properly.
- Reuse or repurpose products to extend their usable life.
- Recycle disposable items and use products made of recycled materials.
- Be considerate of ocean wildlife and seabirds.
- Clean up the beach, park, or river and leave it better than I found it.
- Devote time every year to community service to benefit and beautify the environment.
- Increase my own awareness of the effects that I have on the ocean and our environment.
- Learn all I can about the environment, including special ocean areas like national marine sanctuaries.
- Promote ocean awareness and pass on my knowledge to friends and family.
- Encourage my family and friends to protect the ocean and our environment.

Signature

Print Your Name

Date