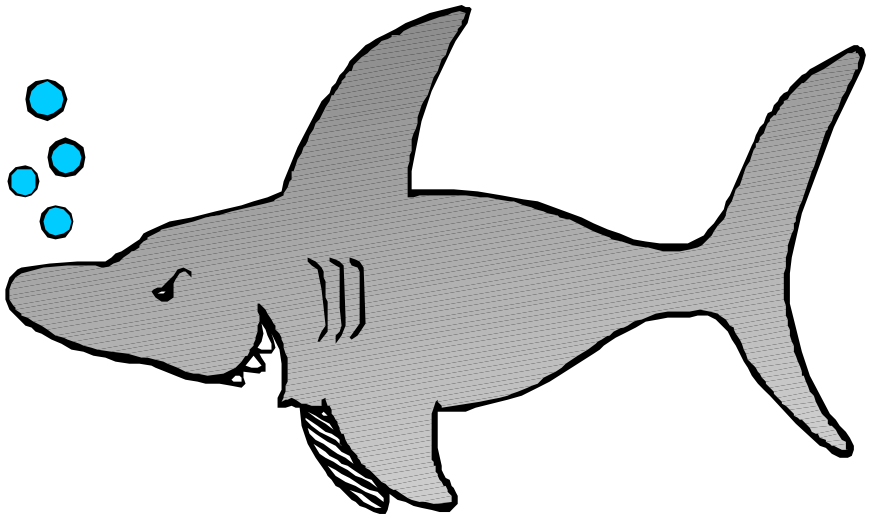

Shark Traveling Trunk

Cape Lookout National Seashore

NATIONAL PARK SERVICE
Department of the Interior

HOW TO USE THIS TRUNK:

This traveling trunk is designed to be used in the classroom to introduce students to sharks. It is intended to be used for grades 3 through 6. The activities in this book are designed to fulfill some of the goals of the North Carolina Standard Course of Study. In the back of this book is a curriculum index that shows which goals of the Standard Course of Study each activity will fulfill.

The first section in this book contains background information for teachers to use in order to introduce the subject to students. It is followed by activities that can be done with the students in class. The materials needed for these activities are located in the trunk. The final section of this book contains student activity pages. These can be photocopied and given to the students to work on in class or at home. Please keep all of the originals in the book.

You will find an inventory page inside the trunk. Please be sure that everything is back in the trunk before returning it to the National Park Service.

Please complete the evaluation form contained in this trunk if you have any comments or suggestions for the Cape Lookout National Seashore Traveling Trunk Program. You can also feel free to contact the park's interpretive division at:

Cape Lookout National Seashore
131 Charles Street
Harkers Island NC 28531
252-728-2250

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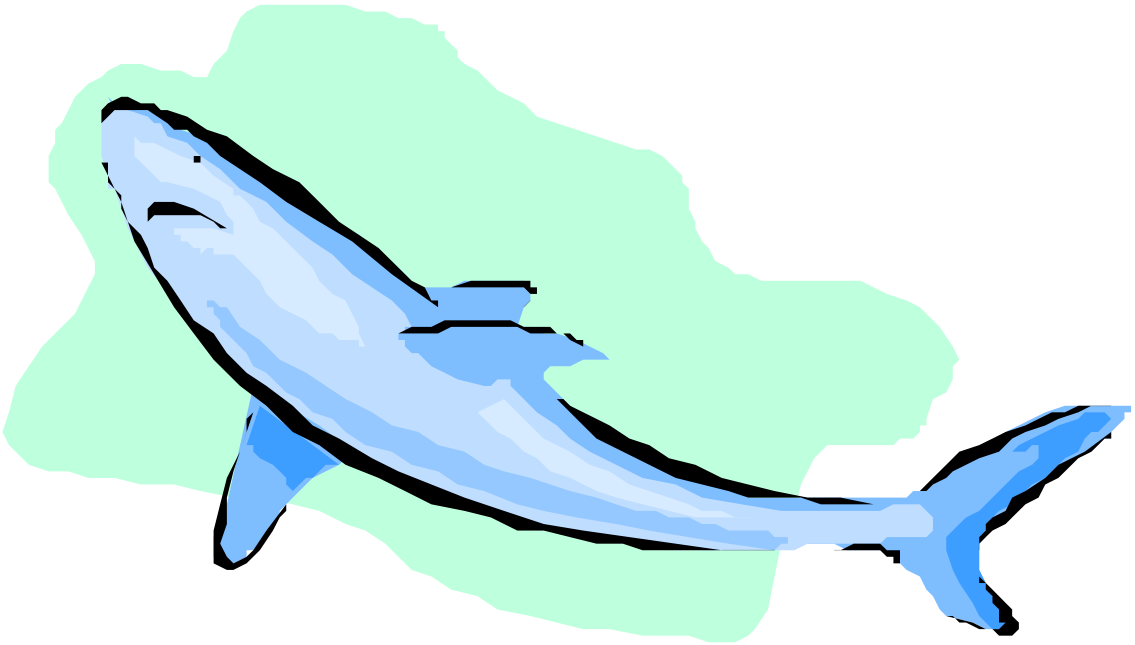


SHARKS

Sharks are mysterious and misunderstood creatures that have fascinated people for generations. This trunk will introduce students to the biology and behaviors of sharks.

There are over 350 species of sharks worldwide. Sharks belong to a large group of fishes known as **Chondrichthyes**, which in Greek means "cartilage fish." This group also includes skates and rays, all of which have skeletons made of cartilage, not bone. The word "shark" is probably derived from the German word "schurke," which can be translated as "villain" or "greedy parasite."

Sharks are believed to have evolved in the Devonian Period, over 400 million years ago. They swam the oceans 200 million years before the dinosaurs, and they have remained relatively unchanged for the last 65 million years.

Today, after 400 million years on earth, many sharks are facing the possibility of becoming threatened or endangered. This is due to years of over-fishing, habitat destruction, increased pollution levels, and a rather slow reproductive rate.

Shark Anatomy:

Sharks have skeletons made of **cartilage**, the same material that our ears and noses are made of. Cartilage is less dense than bone and helps the shark to be more buoyant and flexible. Sharks have no ribcage; they are held together by skin and muscle. This can cause the shark to be more susceptible to internal damage. Dolphins sometimes ram the shark's body wall, which often results in damage to internal organs.

The shark's tough skin serves almost as an exoskeleton, aiding in protection. Sharks are covered with tiny, tooth-like scales, often called **dermal denticles**. These scales grow out of the shark's skin, and usually point towards the tail. They cause the shark's skin to feel almost like sandpaper. These scales are often referred to as **placoid** scales. They have the same structure as a tooth: an enamel layer, a dentine layer, and a pulp cavity. The scales do not get larger as the shark grows. Instead, the shark just grows new scales.

Sharks are cold blooded. This means that their blood changes temperature as the water temperature changes. Some sharks like the great white, threshers, and porbeagles have special heating systems that keep their blood slightly warmer than that of other sharks. This is done through a modified circulatory system. As the red muscle functions, it generates heat that warms the blood traveling to the heart. This warmer blood is then pumped throughout the shark's body. Sharks have very low blood pressure. In order to circulate blood through their bodies, they must swim constantly.

Coloration: Sharks are generally a light color underneath and darker above. This is a type of camouflage that helps them blend in with their surroundings. When viewed from above, sharks blend in with the dark ocean depths. When viewed from underneath, they blend in with the lighter sea surface. This is known as **countershading**.

How do sharks swim? Sharks' bodies are **fusiform** (streamlined and torpedo shaped). They have five different kinds of fins that they use to lift, stabilize, and propel themselves. The **caudal fin**, or tail fin, can be used for turning as well as for propulsion. Unlike most fish, the shark's backbone extends well into the tail, making it very powerful. The erect **dorsal fin** on a shark's back is used for balance. The dorsal fin often is seen above the water surface when a shark is swimming. The second dorsal fin controls rolling. The front fins, or **pectoral fins**, are much stiffer than in other fish. The shark can change the angle of these fins to swim either up or down; they can not swim backwards. Stability is provided by the **pelvic fins**. Some sharks have an **anal fin** to provide extra stability.

Many sharks are rather sluggish swimmers, although some can swim very fast. Great white sharks can swim from 20 to 30 miles per hour.

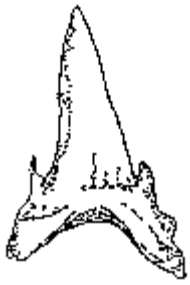
Unlike most bony fish, sharks have no swim bladders to keep them afloat. They can use oil in their liver, which can be more than 15% of their total body weight, for buoyancy. To keep from sinking, sharks must constantly swim in a slightly upward direction.

How do sharks eat? The jaws of a shark are generally positioned on the underside of the snout. When biting, the snout protrudes upward as the jaws thrust forward. This gives the shark a rather fearsome appearance. The jaws of a shark are extremely powerful. Some sharks can bite hard enough to bite through a piece of steel. Sharks do not chew their food. They swallow it whole or in big chunks and rely on enzymes and hydrochloric stomach acids to break the food down.

Different species of sharks have different shaped teeth. The shape of sharks' teeth depends on the type of food they eat. They can have anywhere from 20 to several hundred teeth. Some sharks have one type of teeth in the upper jaw and another type in the lower jaw.

There are three basic shapes for shark teeth:

Triangular, blade-like teeth; often serrated; used for cutting large hunks of meat out of their prey (great whites, tiger sharks)



Long, pointed, needle-like teeth; used for impaling, gripping, holding, and tearing (mako sharks, lemon sharks)

Flattened, blunt teeth, used for crushing (nurse sharks)

Sharks often loose their teeth. There are several rows of new teeth in a shark's jaw to replace lost teeth. A replacement tooth can move into place in only 24 hours. Some species of sharks may loose as many as 30,000 teeth in a lifetime.

A few species of shark, like basking sharks and whale sharks have small, non-functional teeth. These sharks filter plankton out of the water, much like whales. They filter water through their gills and catch plankton with tiny bristle-like projections called gill rakers on the inner margins of the gills.

Sharks normally do not kill for sport. They kill only when they are hungry. After a large meal, a shark may go for many days without eating at all. A shark will usually eat about 2% of its body weight per day.

Almost all sharks are carnivores, or meat eaters. They will eat almost anything, including **plankton**, fish, crustaceans, coral, sea urchins, horseshoe crabs, mollusks, sea turtles, sea birds, marine mammals, and other sharks. Most prey on weak, injured, or dying animals, since they are easier to catch. Some sharks have food preferences. Nurse sharks prefer crustaceans and mollusks; shortfin makos like bluefish; hammerheads prefer stingrays; bull sharks often eat other sharks; smooth dogfish eat crabs and lobsters; and tiger sharks like sea turtles.

Sharks do not normally eat humans, although there are some situations where people are mistaken for food and attacked. Only about 25 people are killed by sharks each year worldwide. Many more people die from lightning or bee stings.

How do sharks breathe? Sharks breathe underwater the same way fish do, through gills. As the sharks take water into their mouths, their gills can absorb oxygen from the water, enabling them to breathe. Unlike most fish, sharks do not have a bony covering over the gills. The sharks' gills open to the outside through slits. Most sharks have five slits on each side, although some may have up to seven.

Some sharks need to swim constantly in order to breathe, while others have muscles that can pump water over their gill slits. Lemon, nurse, tiger, and leopard sharks can rest at the bottom and pump water through their gill slits, while great white, basking, and mako sharks must swim constantly.

Shark Senses:

Sharks have larger brains than most cold-blooded animals. With this larger brain comes a vast amount of sensory information. In addition to the five senses used by humans, sharks possess a very unique sensory adaptation. They can detect electrical charges that are emitted by all living things. This is called electro-reception. Sharks rely on all of these senses to locate food.

How do sharks see? Although sharks' eyes are small, they can see rather well, even in dim light. Color vision is believed to be somewhat limited. Sharks' eyes are very sensitive to light. They are designed for seeing in the dim light underwater. While most fish don't have eyelids, some sharks have 3 of them. Like humans, sharks have upper and lower eyelids. In addition, they also possess third eyelids that cover the entire eye. Deep water sharks generally have bigger eyes than shallow water sharks.

How well can sharks smell? Sharks have an extremely acute sense of smell. Nearly two thirds of a shark's brain is devoted to the sense of smell. They can detect minute quantities of certain substances, especially blood, in the

water. Fish give off a certain odor when they are in distress, which is easily detected by sharks. They can detect odors up to one mile away.

How well can sharks hear? Sound is often times the first sense a shark uses to locate food. They have excellent hearing. Some can hear prey in the water from 3,000 feet away. Their internal ear can detect sound as well as vibrations in the water, such as the thrashings of sick fish.

The shark also uses its **lateral line system** to sense vibrations. The lateral line system is a series of fluid-filled canals just below the head and along the sides of the shark. The canals are open to the surrounding water through tiny pores. Tiny hairs attached to sensory cells project into the canal. These hairs can detect turbulance or vibrations in the water. Sharks can locate injured or distressed fish by detecting their erratic movement.

Electro-reception: Some sharks can actually use electricity to locate prey. All living creatures emit small electrical impulses as they breathe or move. A shark uses a system of small holes and canals located in the snout and head called the **Ampullae of Lorenzini** to detect these impulses. This works best at close range, and can be used to locate animals that the shark may not be able to see.

All of these senses working together make sharks extremely effective at hunting down prey.

Life Cycle:

How do sharks reproduce? Unlike most fish, sharks reproduce through internal fertilization. Males have modified pelvic fins called **claspers** that are used in sperm transferal. Most sharks breed between the ages of 10 and 12. The courtship behaviors of sharks can be rather violent. Males bite, nip, and harass females during mating. Many females bear scars as a result of this mating courtship. Female sharks have adapted to this by developing skin that is almost twice as thick as a male's and heals rather quickly.

There are 3 different means of reproduction used by sharks. Some sharks develop inside the mother and are born live. This is known as **viviparity**. Lemon, bull, blue, and hammerhead sharks reproduce in this way.

Other sharks carry eggs that develop and hatch within the mother's body. The first baby to hatch will eat the undeveloped young not yet hatched. The mother may even produce unfertilized eggs for the pups to eat. This method of reproduction, known as **ovoviviparity**, is used by whale, tiger, sand tiger, spiny dogfish, thresher, nurse, and mako sharks.

A third method of reproduction, known as **oviparity**, is used by hornsharks and skates. These sharks develop in egg cases outside the mother's body.

Some sharks have only a few offspring, while others can have many. Nurse sharks can have 20 to 30 pups, and tiger sharks can have as many as 80 pups. The more offspring a shark has, the better the chances are that a few will survive. Sharks that have only a few offspring, like the great white, generally give birth to pups that are large enough to defend themselves. Nurse shark pups are about a foot long, while newborn great white sharks can be 4 1/2 feet long.

Sharks do not care for their young. Many adults will even kill and eat shark pups. Mothers often lose their appetites just after giving birth. This prevents the young from being eaten.

Most sharks live for 20 to 30 years. However, tiger sharks can live for 40 to 50 years; whale sharks can live for 70 years; and spiny dogfish can live to be 100 years old. Sharks range in size from the 8 inch long dwarf shark to the 60 foot long whale shark. Scientists have found evidence of a prehistoric shark (Carcharodon megalodon) that was 50 feet long and had teeth 5 to 6 inches long.

There are several species of fish that depend on sharks for food. Remoras are small fish that attach themselves to sharks with suction-like devices on their heads. They feed on tiny parasites that live on the shark's skin. This is known as a **symbiotic** relationship; it benefits both the shark and the remora. Pilot fish also benefit from sharks. They follow the sharks around and feed on the scraps left over when a shark catches its prey.

There are several animals that have mechanisms that help them to defend themselves against sharks. Dolphins defend themselves by ramming sharks in the sides. Since the shark has no ribcage, this can do some serious internal damage. When a shark tries to eat a porcupine fish, the porcupine fish will inflate itself, causing its spines to stick out. This can block the shark's throat, causing it to suffocate. If the porcupine fish is lucky, it can then escape from the dead shark's jaws. The Moses sole has a rather unique defense mechanism. When a shark bites the sole, it releases a chemical into the shark's mouth. The shark finds this extremely repulsive and will immediately release the sole. Scientists are trying to duplicate this chemical so that it could be used as a shark repellant.

The shark's biggest enemy is man. Commercial fishermen catch about 1.2 billion pounds of shark each year. Many sharks are caught accidentally by fishermen that are fishing for tuna, swordfish, and salmon. Some are killed just for their fins, which people like to eat in soup. Sometimes they are thrown back into the ocean after their fins have been cut off. These sharks will either bleed to death or die of starvation, since without a dorsal fin, the shark can not stay upright in the water.

Shark Products:

Humans tend to fear sharks, even though only a few are dangerous or aggressive. Sharks actually have a lot more to fear from humans. They have been hunted, sometimes to the point of population depletion, and used by man in many different ways.

Shark meat has an excellent flavor and is high in protein and low in fat. In many countries shark meat is very popular. Shark fins are often used to make shark fin soup, an Oriental delicacy.

In the past, shark skin has been used for sandpaper and in leather goods. Shark liver oil has been used as a source of Vitamin A. It also is used in medicines, soap, burn ointments, and cosmetics. Liver oil from deep sea sharks was used by the Japanese during World War II as a lubricant.

Shark teeth have been used for jewelry, knives, razors, and arrow tips.

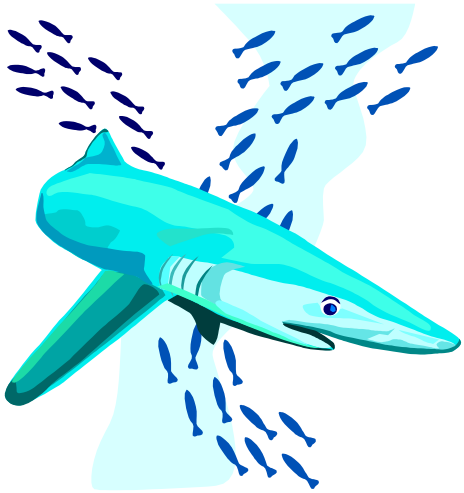
Sharks are rarely found with diseases or tumors. Their immune systems are believed to contain anticancer agents. Scientists are studying sharks to find a cure for cancer. A protein extracted from shark cartilage is effective in controlling blood clotting and flow. An extract from the cartilage of sharks has been used as a temporary skin for burn victims, and shark corneas have been used for human corneal transplants.

Conservation:

Due to over-fishing, pollution, and people's misunderstandings, many sharks are in danger of becoming extinct. Recreational and commercial shark fishing has increased over the last few years due to an increased demand for sharks and shark products. Many are taken unintentionally in nets set out to catch other fish. Others are intentionally killed only for their fins.

Sharks are slow growing and females produce relatively few pups over their lifetimes. This means that depleted populations will take a long time to recover. The reduction of shark populations will have dramatic effects worldwide. Sharks are important members of the food chain and essential in maintaining aquatic animal populations. They play a very important role in maintaining the health of the oceans by removing the weak and sick members of populations so that the fittest can survive.

What can we do? Although many of the threats facing sharks may seem beyond our range of control, there are many things that we can do to insure a healthier environment for sharks. We can keep our oceans clean by reducing the amounts of fertilizers and pesticides we use, and by reducing the amount of trash we throw away. This means recycling, reusing things instead of throwing them away, and reducing the amount of trash that we generate. We can fish responsibly and keep trash out of our oceans.

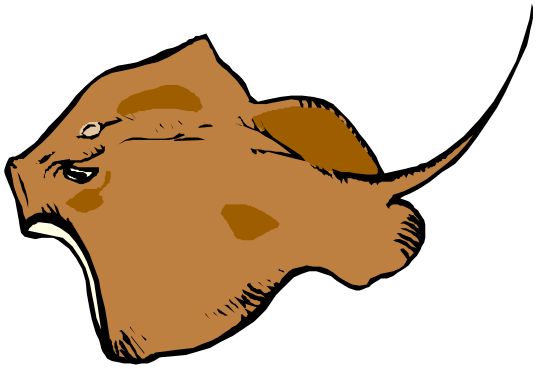


There is much more to learn about sharks. The

question facing us is “Will sharks be around long enough for us to learn all that we can from them?”

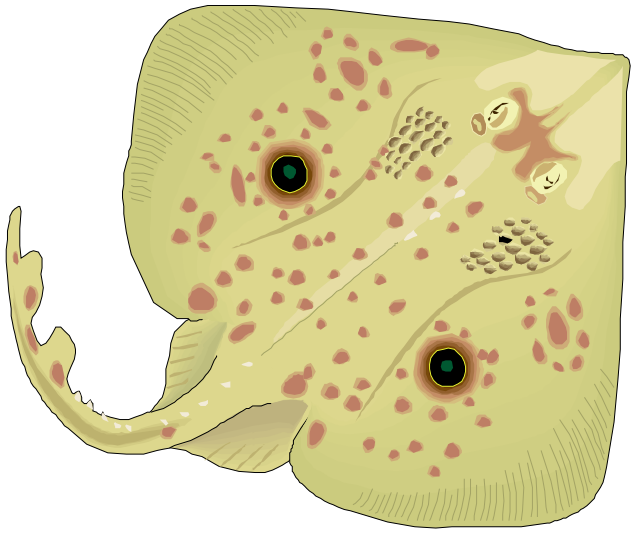
SKATES AND RAYS

Skates and rays belong to the same class as sharks. Some scientists believe that they descended from sharks about 200 million years ago. Like sharks, skates and rays have a skeleton made of cartilage. They have flattened bodies that are adapted for survival in ocean bottom habitats. They can swim by flapping their large, wing-like pectoral fins. A shark’s pectoral fins are used for lift and steering.



Skates and rays breathe through gills, although the gills are located on the underside. A shark’s gills are located on the sides, just in front of the pectoral fins. Like sharks, skates and rays have 5 to 7 gill openings.

Skates and rays have long, narrow tails that may be used for balance or steering. Sharks use their tail fins for propulsion. A ray’s tail is slender and whip-like. Many rays have a sharp barb on their tails, which is used for protection. Electric rays have powerful electric organs in their tails that can stun prey with severe shocks.



Like sharks, skates and rays reproduce through internal fertilization. Skate egg cases, sometimes called mermaid’s purses, are commonly found on the beach. The egg cases have strings on them that get tangled in sea weed or coral to keep the eggs from floating away.

AMAZING SHARK FACTS

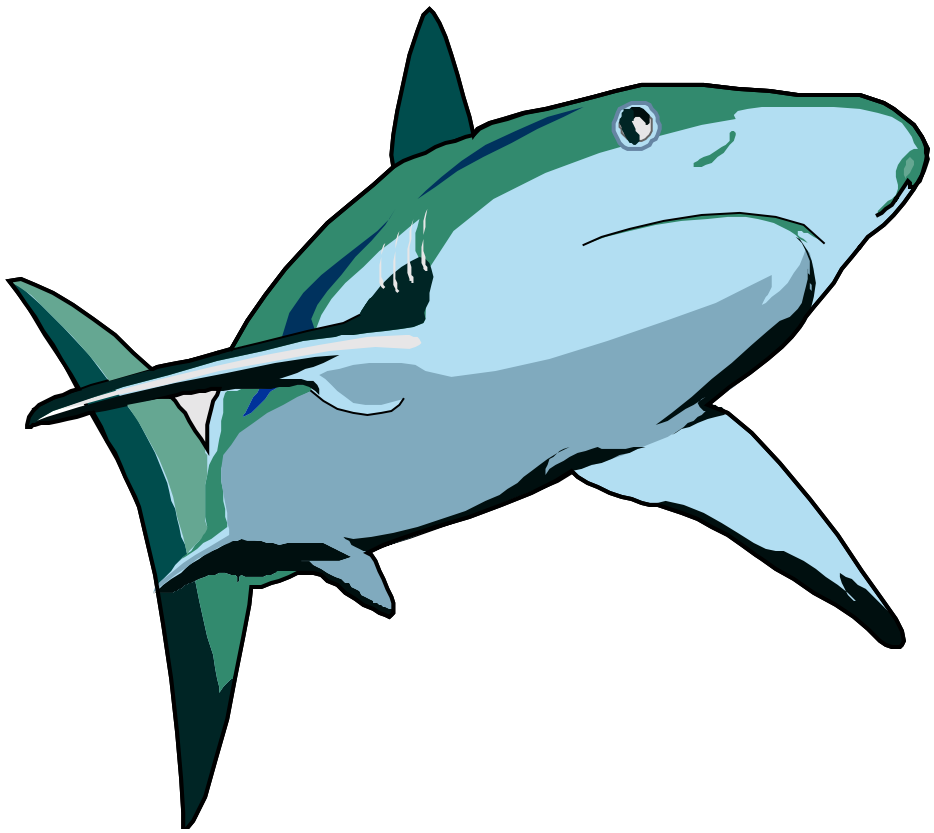
- There are over 350 different species of sharks worldwide.
- Sharks have been around for over 400 million years (200 million years before the first dinosaurs).
- Some sharks are hatched out of eggs, although most are born alive. Tiger Sharks may have up to 80 pups at one time.
- The liver of a basking shark can weigh over 1,800 pounds and contain 600 gallons of oil.
- The largest fish ever caught with a rod and reel was a great white shark that weighed 2,664 pounds and was almost 17 feet long.
- The smallest shark known is the dwarf shark, less than 8 inches long.
- Before the invention of sandpaper, some people used the rough skin of sharks to smooth and polish wood.
- Unlike most fish, sharks do not have swim bladders to help them stay afloat. They must constantly swim in a slightly upward direction to keep from sinking.
- Sharks have excellent hearing. Some sharks can hear prey in the water from 3,000 feet away.
- Almost two-thirds of a shark's brain is devoted to the sense of smell.
- If a shark looses a tooth, there are many new teeth in the jaw to take the place of the one lost. Sometimes it may take as few as 24 hours for a lost tooth to be replaced.

- Scientists believe that there were once sharks that were three times bigger than the great white sharks are today. The giant *Carcharodon megalodon* had jaws large enough to swallow a small car.

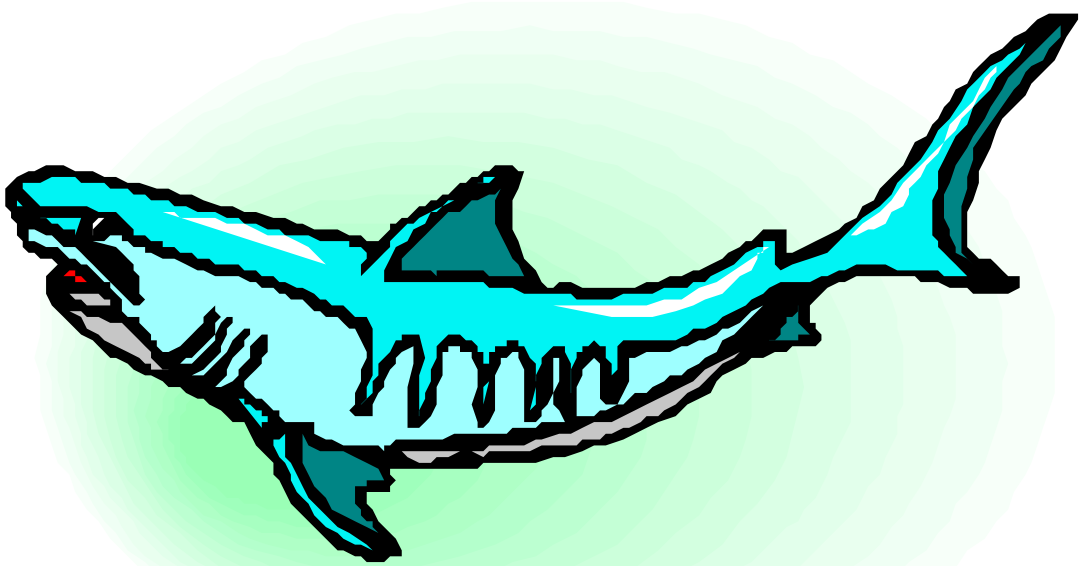
- Mako sharks are the fastest of all sharks. They can swim at speeds of over 30 miles per hour.

- There are about 20 species of sharks that actually glow in the dark. This may be to locate each other or to make themselves less visible to predators beneath them.

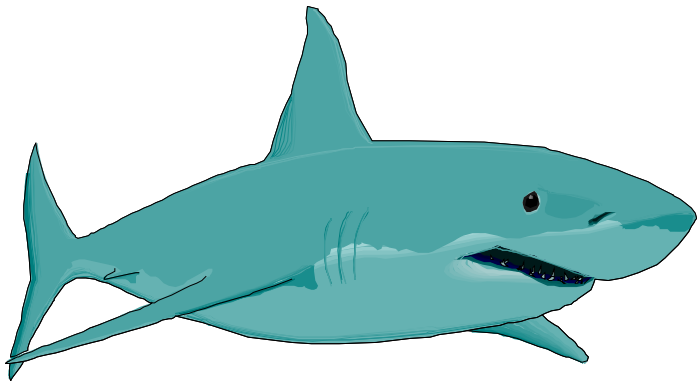
- A basking shark's stomach can contain up to 1,000 pounds of plankton at one time.



SHARK GALLERY



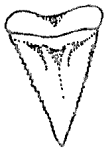
GREAT WHITE SHARK



Size: 14 to 21 feet long
2,000 to 7,300 pounds

Color: slate blue to gray, white underneath

Teeth: triangular and serrated; upper teeth are broader than lower; 24 to 26 rows of teeth in each jaw



Distribution: worldwide; frequents inshore waters in spring; rare south of Cape Lookout

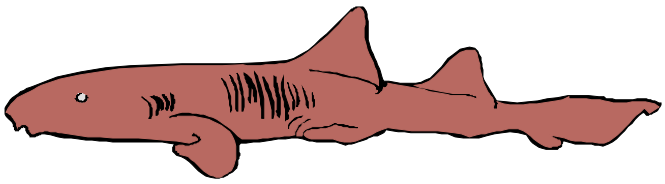
Conservation Status: Populations are decreasing due to years of being hunted by man. Protected in some areas

Great white sharks are aggressive and strong swimmers that normally travel alone or in pairs. Young sharks will eat fish like tuna, menhaden, and other sharks. Older great whites will eat dolphins, seals, sea lions, sea birds, and carrion (dead animals).

The great white shark is the only type of shark known to go to the surface and poke its head out of the water. This may be to see potential prey.

Great white sharks are **ovoviviparous**. In the fall, females migrate to warmer waters to give birth. They will give birth to 2 to 4 fully formed pups that are up to five feet long when they are born. The pups will swim away from their mothers as soon as they are born. The mother does not care for the young.

NURSE SHARK



Size: 7 to 14 feet, 330 to 370 pounds

Color: brown to yellow

Teeth: flattened shape for crushing; 30 to 36 in upper jaw; 28 to 31 in lower

Distribution: tropical Atlantic and East Pacific waters; shallow, inshore waters from Cape Cod to Florida

Conservation Status: None

Nurse sharks are nocturnal, resting during the day in groups of up to 36 individuals. Although they not normally aggressive, they can easily be provoked to bite. Nurse sharks eat primarily squid, shrimp, lobsters, crabs, sea urchins, and small fish. They use their thick lips to create suction that is used to pull their prey out of holes and crevices.

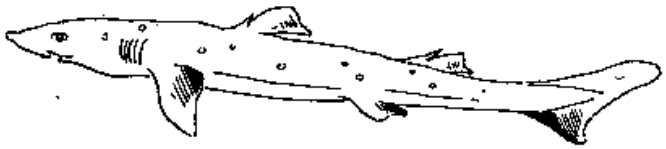
Characteristic features of nurse sharks are the barbels that hang below the mouth. These are whisker-like organs on the lower jaw that sense touch and taste. They are used to help the shark locate potential food.

Nurse sharks live in warm, shallow waters. They are bottom dwellers that live near sandy beaches, mudflats, and sandbars.

Nurse sharks reach maturity at 15 to 20 years old. Females will have from 20 to 30 pups in a litter. They are **ovoviviparous**; the eggs develop and hatch inside the mother's body.

SPINY DOGFISH

Size: 2 to 4 feet
up to 20 pounds



Color: slate or brown above,
gray or white beneath;
white dots on the sides

Teeth: Low, flat, grinding teeth, also
an extra set of small, sharp teeth

Distribution: Labrador to Florida;
occurs in North Carolina year round;
coastal and deep water

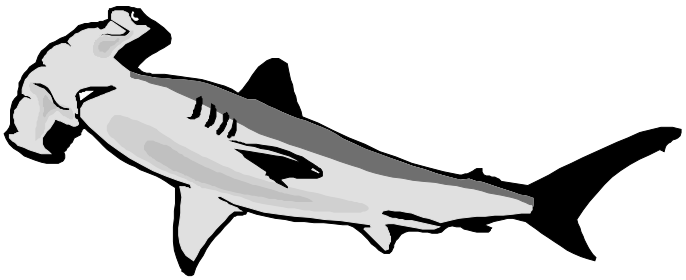
Conservation Status: Very abundant; They are one of the most abundant sharks in the world.

The spiny dogfish is characterized by a sharp spine that sticks out in front of each dorsal fin. The shark may use these spines for defending itself. Scientists can use the growth zones on the spines to help determine the age of the shark.

Spiny dogfish are mostly bottom dwellers that swim in schools of hundreds to thousands. They prey on mackerel, herring, cod, and haddock, as well as octopus, crabs, and squid.

Mating takes place in the winter. Males reach maturity at about 11 years old; females at 18 to 21 years. They are **ovoviviparous**. Females give birth to 2 to 11 pups in a litter, after an 18 to 24 month pregnancy. Their life span is estimated to be from 25 to 100 years.

HAMMERHEAD SHARK



Size: 13 to 14 feet

Color: brownish-gray to olive above; paler beneath

Teeth: triangular with extremely serrated edges

Distribution: North Carolina to Brazil; Carolina waters June to August

Conservation Status: No special status

There are 9 different species of hammerhead sharks, ranging from 3 to 20 feet in length. The largest ever reported was 20 feet long. They are found in tropical and sub-tropical waters worldwide.

Hammerhead sharks prey on fish, stingrays, other sharks, squid, octopuses, and crustaceans; although stingrays seem to be the food of preference.

Hammerheads are **viviparous**, giving birth to 20 to 40 pups in a litter. Newborns are about 27 inches long and born live.

The hammer-shaped head may serve as a bow rudder to increase maneuverability or compensate for the poor lift provided by its small pectoral fins. The shark's eyes are located at the ends of the hammer. Perhaps this gives a better view of prey.

LEMON SHARK

Size: 8 to 11 feet

Color: yellowish-brown

Teeth: triangular, slightly curved

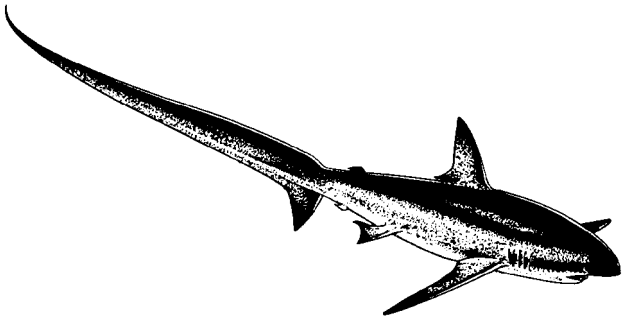
Distribution: inshore waters from New Jersey to Florida

Lemon sharks are often seen near the surface, where they frequent docks, bays, and river mouths. They do not have to swim to breathe and will often lie on the ocean bottom during the day. Although lemon sharks are not very aggressive, they have been known to attack humans.

Young lemon sharks feed primarily on crustaceans, while the adults feed on crustaceans, fish, stingrays, and even turtle grass.

Lemon sharks are **viviparous**. Pups are born live, and are about 18 inches at birth. Females give birth to about 36 pups in a litter.

THRESHER SHARK



Size: 16 to 20 feet
up to 1,000 pounds

Color: brown to blue-gray with metallic hues

Teeth: small; very sharp

Distribution: tropical and temperate waters; year round in Carolinas

Conservation Status: No special status; very common

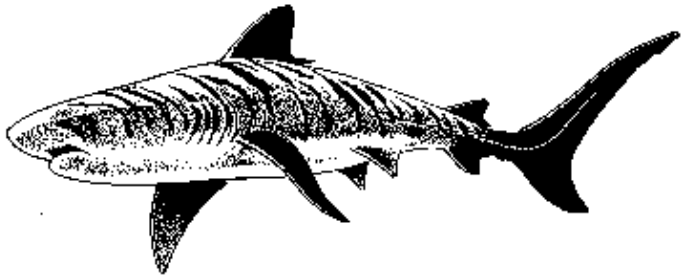
Thresher sharks are very strong swimmers, capable of even jumping out of the water. They are usually found from the surface to 1,100 feet deep.

A thresher shark's tail can be up to 10 feet long; half the length of the shark. They use their tails to herd fish together, and sometimes even swing their tails like a bat to stun prey. They eat mainly small, schooling fish such as bluefish, menhaden, shad, and mackerel.

Female thresher sharks reach sexual maturity when they are about 10 feet long. They are **ovoviviparous**. There will normally be 4 to 6 pups in a litter.

TIGER SHARK

Size: 11 to 14 feet, up to 20 feet; 850 to 1,400 pounds



Color: brownish-gray, with tiger-like markings

Teeth: triangular, serrated teeth; 18 to 20 rows in each jaw

Distribution: worldwide in tropical, warm seas; frequents shallow waters; inshore in the Carolinas April to December

Conservation Status: Not endangered

Tiger sharks are fierce predators that can swim at speeds of over 20 miles per hour. They are sometimes called “garbage cans of the sea” because they will eat almost anything in the water, including carrion. They primarily feed on bony fishes, other sharks, sea turtles, dolphins, seals, lobsters, crabs, conchs, and whelks. Tiger sharks have been known to attack humans.

Tiger sharks are nocturnal. They move into shallow, inshore areas at night and retreat to deeper water during the day. They are mainly solitary.

Tiger sharks are **ovoviviparous.** Females give birth to 10 to 82 pups per litter, after a gestation period of about 9 months. Newborns are 20 to 30 inches long.

WHALE SHARK

Size: up to 50 feet; 20,000 to 40,000 pounds

Color: gray to brownish with white or yellow spots

Teeth: 300 rows of non-functional teeth

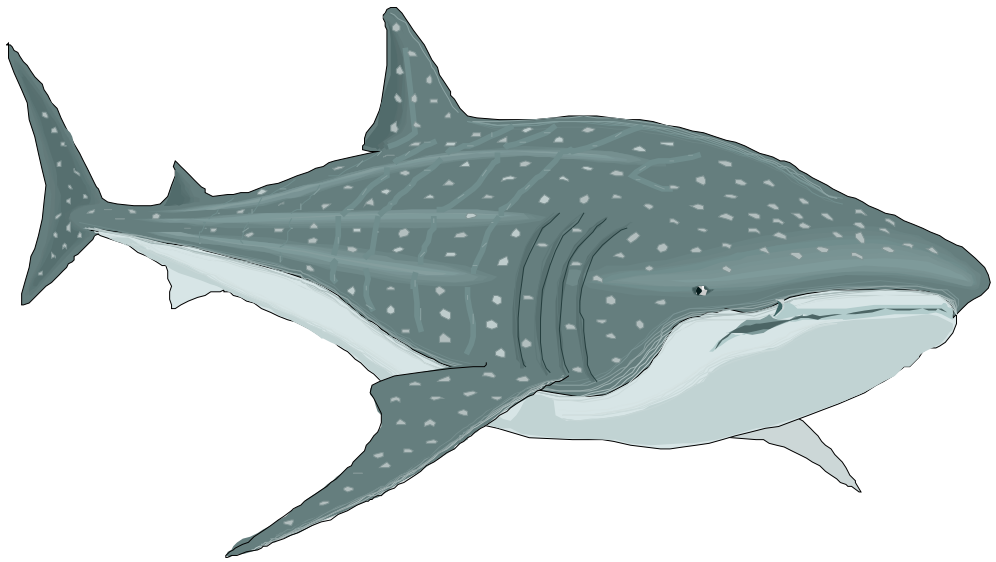
Distribution: worldwide

Conservation Status: Endangered

Whale sharks are the largest sharks, as well as the largest fish in the ocean. They eat tiny plankton much like whales. Whale sharks inhale water and strain it through their gills as they swim to remove the food. They will also eat squid and small schooling fish.

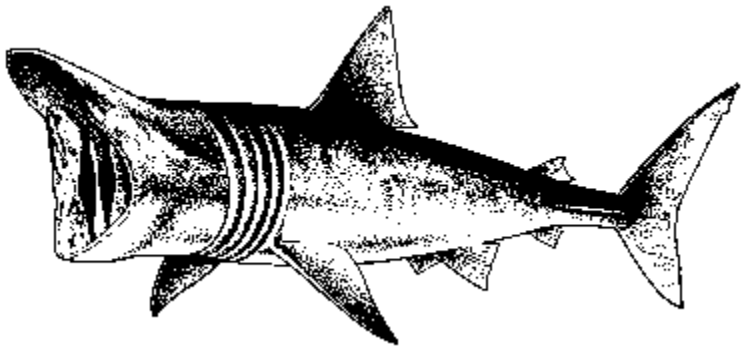
Whale sharks reach sexual maturity at about 30 years old. They are **viviparous**, giving birth to live young. Newborn whale sharks are 1 ½ feet long.

Whale sharks live in warm water along the coast and in the open ocean. They are often seen near the surface.



BASKING SHARK

Size: up to 50 feet, normally under 30 feet; 8,000 lbs.



Color: gray-brown to nearly black

Teeth: tiny, non-functional

Distribution: worldwide in temperate coastal waters, Maine to North Carolina

Conservation Status: Threatened

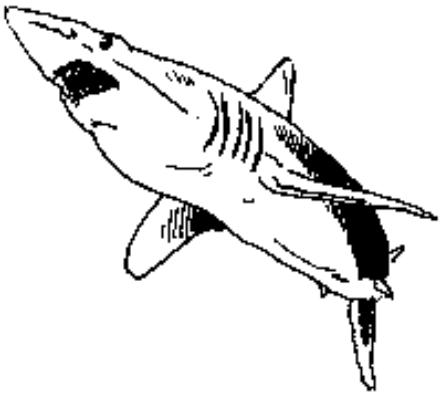
The basking shark is the second largest fish in the world, second only to the whale shark. They are slow swimmers (no more than 3 mph) that travel alone, in pairs, or in groups of up to 100 members.

Like whale sharks, basking sharks are filter feeders. They use gill rakers to filter plankton from the water. They filter water through their gills and catch tiny plankton with bristle-like projections on the inner margins of the gills. A basking shark can process 1,500 to 2,000 gallons of water in just one hour.

Basking sharks reach maturity at about 2 to 4 years old. Mating takes place in the summer. The female will give birth to 1 or 2 live young after a gestation period of 1 to 3 ½ years. They are **ovoviviparous**. The newborn pups are about 5 ½ feet long, the largest of any shark pups. Like other sharks, the mother does nothing to care for the young.

Basking sharks get their name from their habit of “basking” in the sun. They are often seen lying motionless with their backs above the water.

SHORTFIN MAKO



Size: 10 to 13 feet

Color: bluish gray, white underneath

Teeth: long, knife-like; not serrated

Distribution: Tropical and temperate seas; Carolina waters in summer

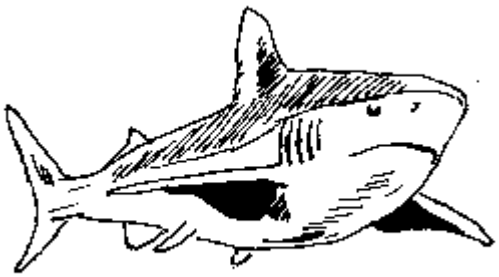
Conservation Status: Endangered

Mako sharks are among the fastest sharks, capable of reaching speeds up to 30 miles per hour. They often can be seen leaping out of the water when hooked or in pursuit of prey.

Makos feed mostly on small schooling fish such as mackerel and herring. Larger makos may eat swordfish.

Makos are **ovoviviparous**. Females will give birth to 4 to 16 pups in a litter. Newborn pups are about 2 feet long.

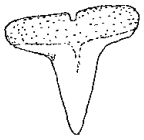
BULL SHARK



Size: up to 8 feet, 200 pounds and up

Color: gray to gray brown above; white below

Teeth: triangular, serrated



Distribution: worldwide in tropical, subtropical, and temperate seas; frequents shallow inland waters; also in some freshwater rivers and lakes

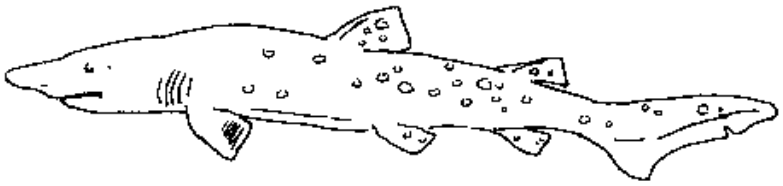
Conservation Status: Not endangered; a very common shark

Bull sharks can survive in both salt and fresh water. They often venture up rivers, and have even been found 1,750 miles inland up the Mississippi River.

Bull sharks eat almost anything, including fish, other sharks, stingrays, turtles, birds, and mollusks. They are the most frequent attacker of humans since they often are found in very shallow water where people swim.

Female bull sharks give birth to 1 to 13 pups in a litter, after a one year pregnancy. They are **viviparous**, giving birth to live young. A newborn pup is about 28 inches long.

SAND TIGER SHARK



Size: 6 to 10 feet

Color: pale gray-brown; gray to white below

Teeth: sharp, pointy teeth

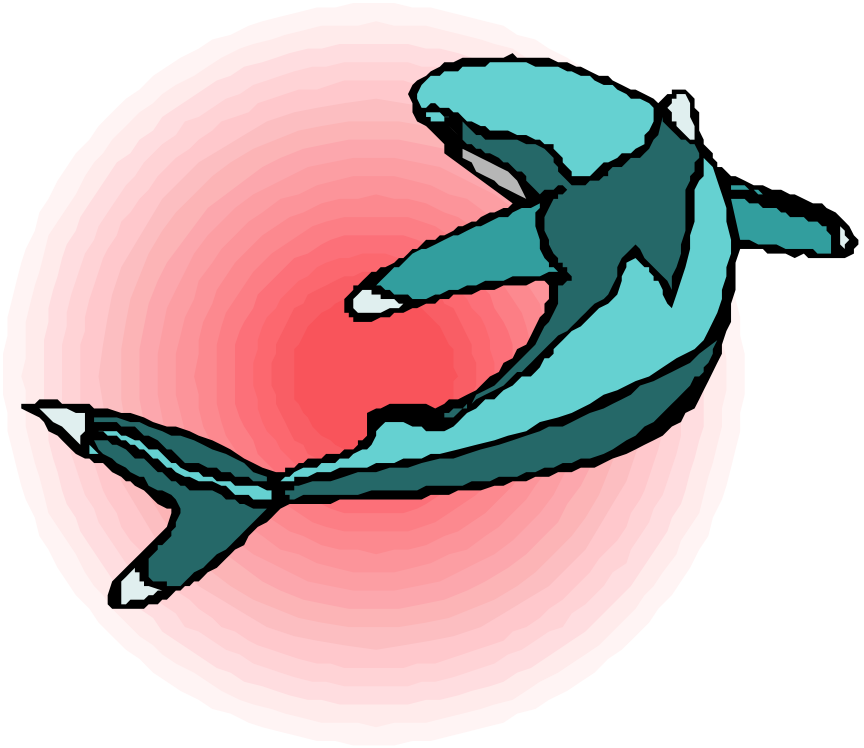
Distribution: Atlantic Ocean from Maine to Brazil

The crooked grin of the sand tiger shark has earned it the nickname "ragged tooth shark."

Sand tiger sharks are rather sluggish bottom dwellers usually seen in shallow water. They feed on small fish such as mackerel, menhaden, flounder, skates, and sea trout, as well as squid and crab.

Sand tiger sharks are **ovoviviparous**. Two embryos develop in the uterus, and then consume eggs as they come down the oviduct.

SHARK ACTIVITIES



Here are some activities that can be done in the classroom. Some of the activities will use the materials in the trunk, while some can be done without.

ACTIVITY 1: ALL SHARKS ARE FISH, BUT NOT ALL FISH ARE SHARKS

OBJECTIVE: Students will be able to tell the similarities and differences between sharks and bony fish.

BACKGROUND: There are over 20,000 species of fish found in the world's oceans, rivers, and lakes. Over 350 of these are sharks. What are the similarities and differences between sharks and bony fish?

SKELETON:

Bony fish: calcium impregnated (true bones); backbone extends into caudal (tail) fin

Shark: no true bones; skeleton made of cartilage; backbone extends into caudal fin

FINS:

Bony fish: paired; flexible; some with individual rays

Shark: paired; inflexible; function like flippers in whales

GILLS:

Bony fish: gills protected by gill cover; no **spiracles** (remnant gill slit used to bring water into the gill chamber)

Shark: 5 to 7 gill slits located on the side of the head; some sharks have spiracles

SKIN and SCALES:

Bony fish: thin skin; scales grow with the fish; thin and overlap in rows

Shark: tough hide; dermal denticles that do not grow with the shark; new scales are added as the shark grows; skin feels like sandpaper

REPRODUCTION:

Bony fish: external fertilization; numerous offspring; no parental care

Shark: internal fertilization; 2 to 80 pups; no parental care

SWIMMING

Bony fish: swims using swim bladder

Shark: must swim to stay afloat; uses strong tail fin for propulsion

MATERIALS:

Paper and pencils

PROCEDURE:

1. Discuss with the students the differences between sharks and bony fish.

2. Have the students figure out whether the statements on the following page are true of sharks, bony fish, or both. You can make copies of that page and hand them out to each student. They can work as a group or individually.

3. Discuss the results with the class

STUDENT PAGE

	shark	bony fish	both
1. has calcium impregnated bones			
2. has a skeleton made of cartilage			
3. has smooth scales			
4. covered with tooth-like scales			
5. has no swim bladder			
6. gills covered with gill cover			
7. has 5 to 7 gill slits on each side			
8. uses strong tail fin to move through the water			
9. has scales that grow with fish			
10. have several pairs of fins			
11. do not care for offspring			
12. can replace teeth when some break off			
13. backbone extends into tail fin			
14. use gills to extract oxygen from water			

ANSWER PAGE

	shark	bony fish	both
1. has calcium impregnated bones		X	
2. has a skeleton made of cartilage	X		
3. has smooth scales		X	
4. covered with tooth-like scales	X		
5. has no swim bladder	X		
6. gills covered with gill cover		X	
7. has 5 to 7 gill slits on each side	X		
8. uses strong tail fin to move through the water	X		
9. has scales that grow with fish		X	
10. have several pairs of fins		X	
11. do not care for offspring			X
12. can replace teeth when some break off	X		
13. backbone extends into tail fin	X		
14. use gills to extract oxygen from water			X

ACTIVITY 2: SHARK TEETH

OBJECTIVE: Students will learn how sharks use specialized teeth to eat different types of food.

BACKGROUND: Different species of sharks have different shaped teeth. The shape of a shark's teeth depends on the type of food the shark eats.

Triangular, blade-like teeth are often serrated and used for cutting large chunks of meat out of prey.

Long, pointed, needle-like teeth are used for impaling, gripping, holding, and tearing.

Flattened, blunt teeth are used for crushing.

Below is a list of what different sharks eat:

Great White Shark: Eats dead animals, large fish, dolphins, seals, sea lions, sea birds.

Bull Shark: Eats other sharks, stingrays, and bony fishes.

Thresher Shark: Feeds on schooling fish (bluefishes, mackerels, and menhaden).

Tiger Shark: Primarily feed on bony fishes, other sharks, sea turtles, dolphins, seals, lobsters, crabs.

Nurse Shark: Primarily eats squid, shrimp, lobsters, crabs, sea urchins. Note that many of these animals have shells that need to be crushed in order to be eaten.

MATERIALS:

Activity sheets (copy sheet enclosed in this book)
Pencils

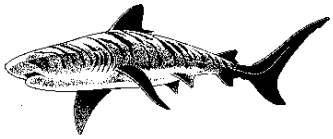
PROCEDURE:

1. Discuss with the students how sharks eat their prey and the different types of teeth that sharks have. Refer to the text in front of this book.

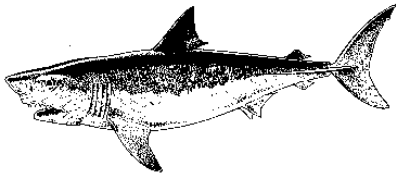
2. Make copies of the activity page for each student. Pass out the copies of the activity page and see if the students can match the shark to its teeth. To do this they will need to think about what each shark eats, and what type of teeth would be needed to eat this type of food.

STUDENT PAGE

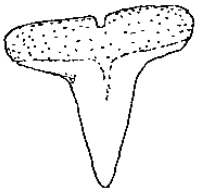
See if you can match the shark to its tooth. Think about what types of food these sharks eat, and what type of teeth might be needed for this type of diet.

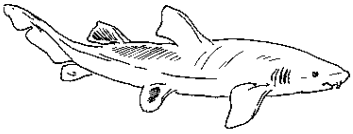


Tiger Shark

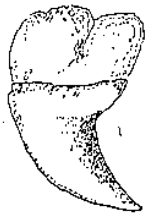


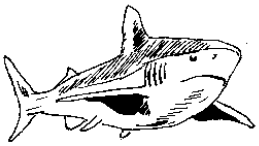
Great White



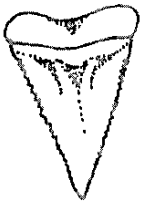


Nurse Shark

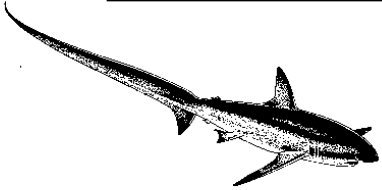




Bull Shark



Thresher Shark



ACTIVITY 3: INTERVIEW WITH A SHARK

OBJECTIVE: To introduce students to the different types of sharks, and orient them to research procedures.

BACKGROUND: There are many different species of sharks, each having different characteristics.

MATERIALS:

Notebook
Pen or pencil

PROCEDURE:

1. Divide the students into pairs and a) assign them a shark, b) let them select a shark, or c) let them draw a shark out of a hat.

2. Have the students conduct research about the shark they selected. Also, have the students draw up a list of questions they would like to know about the shark. They can use the information provided in this book, books contained in this trunk, or the school library.

3. When the research is completed, each pair of students can role-play a reporter and a shark being interviewed. The reporter will then ask the shark questions. This can be done in small groups or in front of the class.

ACTIVITY 4: HOW BIG ARE SHARKS?

OBJECTIVE: Students will learn the sizes of different species of sharks.

BACKGROUND: Sharks come in all sizes. The smallest shark known is less than 8 inches long. The largest, the whale shark, can be 50 feet long. Listed below are typical lengths for several species of sharks:

SHARK	LENGTH
Great White Shark	23 feet
Tiger Shark	20 feet
Basking Shark	33 feet
Short-finned Mako Shark	12 feet
Hammerhead Shark	20 feet
Lemon Shark	10 feet
Nurse Shark	13 feet
Whale Shark	46 feet
Bull Shark	11 feet
Spiny Dogfish Shark	4 feet

MATERIALS:

Laminated sheet of graph paper (in trunk – to be used to make copies)
Tape measure (in trunk)
Strings on green winders
Chalk
Pencils

PROCEDURE:

1. The teacher can write the shark lengths listed above on the blackboard.

2. Give each student a copy of the sheet of graph paper found in this trunk. They can work individually or in pairs.

3. Have the students graph the length of each shark. Tell them that each square on their graph paper represents 5 feet. They should write the name of each shark on the graph paper, then draw a line through the right number of boxes to show how long each shark is.

4. Have the students go outside with their graphs. Tell them to use the tape measure to measure out the length of each shark. They can mark the lengths with chalk. Have the class stand shoulder to shoulder along each length. If you are indoors, the students can use the green winders to see the lengths of several different species of sharks.

ACTIVITY 5: SHARK ANATOMY

OBJECTIVE: Students will become familiar with the different parts of a shark's anatomy. They will better understand how sharks move.

BACKGROUND:

Sharks have 5 different types of fins that they use to lift, stabilize, and propel themselves. The **caudal fin**, or tail fin, can be used for turning as well as for propulsion. Unlike most fish, the shark's backbone extends well into the tail, making it very powerful. The erect **dorsal fin** on a shark's back is used for balance. The dorsal fin often is seen above the water surface when a shark is swimming. The second dorsal fin controls rolling. The front fins, or **pectoral fins**, are much stiffer than in other fish. The shark can change the angle of these fins to swim either up or down; they can not swim backwards. Stability is provided by the **pelvic fins**. Some sharks have an **anal fin** to provide extra stability.

MATERIALS:

Student worksheets (in this book)
Pens or pencils
Shark model (in trunk)

PROCEDURE:

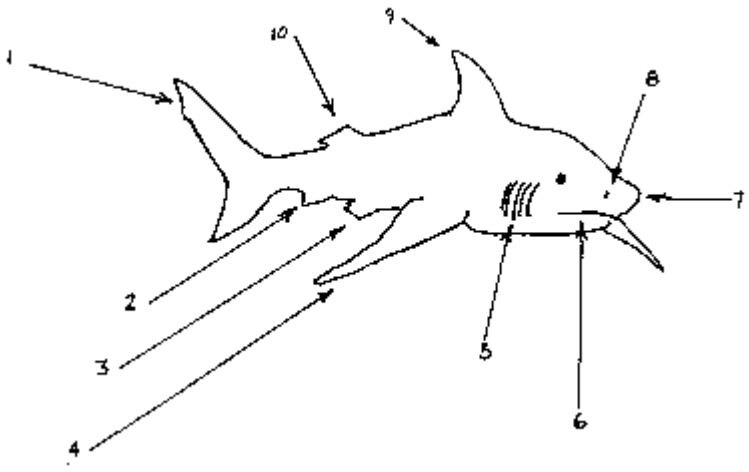
1. Make copies of the worksheet on the following page. Give a copy of this worksheet to each student.

2. Discuss with the students the different parts of a shark's anatomy, how sharks use their different fins to move through the water, how sharks breathe, and how sharks smell, and how sharks eat. This information can be found in the first section of this guide under shark anatomy. You can use the shark model to show the shark's gills.

3. Have the students complete the worksheets.

4. Review the answers with the students.

SHARK ANATOMY WORKSHEET



1. Try to match the numbers on the picture above with the body parts listed below.

Mouth ____
Nostril ____
Snout ___
Caudal fin ____
1st dorsal fin ____
2nd dorsal fin ____
Pectoral fin ____
Pelvic fin ____
Anal fin ____
Gill slits ___

2. Fill in the blanks on the sentences below using the words listed above.

a. The _____ and the _____ are used for stability.

b. The _____ and the _____ are used for balance and to prevent rolling.

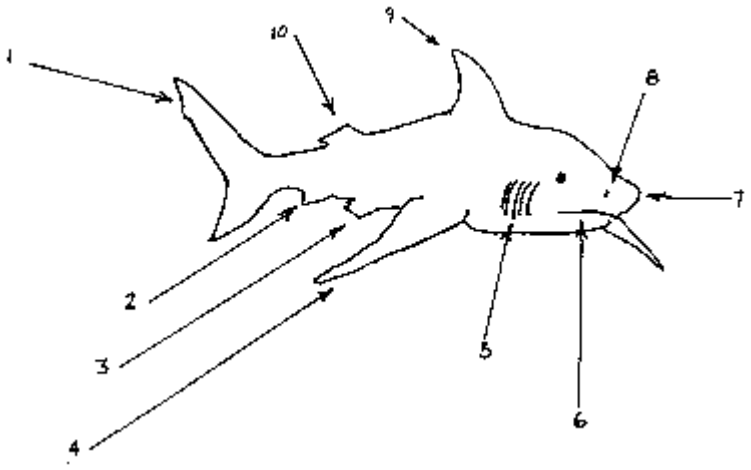
c. Sharks change the angle of their _____ to swim either up or down.

d. The _____ is used for propulsion and turning.

e. Sharks use their _____ to breathe.

f. The shark's _____ contains many rows of teeth.

SHARK ANATOMY ANSWER SHEET



1. Try to match the numbers on the picture above with the body parts listed below.

Mouth **6**
Nostril **8**
Snout **7**
Caudal fin **1**
1st dorsal fin **9**
2nd dorsal fin **10**
Pectoral fin **4**
Pelvic fin **3**
Anal fin **2**
Gill slits **5**

2. Fill in the blanks on the sentences below using the words listed above.

    a. The **pelvic fin** and the **anal fin** are used for stability.

    b. The **1st dorsal fin** and the **2nd dorsal fin** are used for balance and to prevent rolling.

    c. Sharks change the angle of their **pectoral fins** to swim either up or down.

    d. The **caudal fin** is used for propulsion and turning.

    e. Sharks use their **gill slits** to breathe.

    f. The shark's **mouth** contains many rows of teeth.

ACTIVITY 6: PLASTER CASTING

OBJECTIVE: Students will learn about the different types of shark teeth, and how these teeth are preserved as fossils.

BACKGROUND: Sharks' teeth are made out of the same material as ours. They have dentine with a pulp cavity and an enamel coating. Fossilized teeth are preserved over time because they are hard and durable.

Shark teeth are fairly plentiful because sharks are constantly replacing them, and will go through thousands of teeth in a lifetime. Scientists can identify the specie of shark just by the tooth, since each specie has a distinctive tooth design.

MATERIALS:

Modeling clay
Plaster of paris
Container and stirrer for mixing plaster
Paper cups or small, clean milk cartons (one for each student)
Shark teeth (in trunk)

PROCEDURE:

1. Cut the sides of the milk cartons or plastic cups so that they are about 3 inches high. Press softened clay into the carton until the bottom is covered to a depth of one inch.

2. Press a shark tooth into the clay, then carefully lift and remove it. An impression of the tooth should be left behind in the clay. This is how many fossils are preserved.

3. In a clean container, mix the plaster of paris according to the directions. Pour an inch of plaster over the clay impression and let the plaster set. This will take about an hour.

4. Peel away the cup or milk carton and carefully separate the plaster from the clay. Your plaster impression is similar to molds found by fossil hunters.

OPTIONAL EXTENSIONS:

- Use the shark casting kit in this trunk to make casts of different species of sharks. Have the students paint their sharks.

- Use the shark teeth casting kit in this trunk to have the students make plaster casts of fossil shark teeth.

ACTIVITY 7: SHARK ADAPTATIONS

OBJECTIVE: Students will use observation and creative thinking skills to explore the concepts of adaptation and diversity.

BACKGROUND: Adaptations are advantageous characteristics that help animals to survive. Through the process of natural selection, these characteristics become inherited genetic characteristics that are passed down through many generations. As animals move into many different environments evolutionary adaptations in tooth structures have developed in order to deal with varied diets.

MATERIALS: (in trunk)

Shark jaw
Human jaw
Turtle jaw

PROCEDURE:

Show the students the 3 different jaws. Have them compare the two and then answer the following questions.

1. Describe the teeth in terms of size, shape, and number of incisors (biters), canines (flesh tearers), and molars (grinders).

2. What are the similarities and differences between the different teeth.

3. Can you tell by looking at the teeth what the animal eats? Is the animal an herbivore, carnivore, or omnivore?

4. How can the teeth improve an animal's chances for survival in its environment?

ACTIVITY 8: SHARK THREATS

OBJECTIVES: Students will learn about threats to the survival of sharks, and what possible solutions may exist.

BACKGROUND: Many people fear sharks, although sharks actually have a lot more to fear from us. Sharks have been killed and over-fished to the point that many shark populations have already been severely depleted. There are many other factors that threaten the survival of sharks today.

MATERIALS:

Copies of the shark threats worksheet (following this page)
Pens or pencils

PROCEDURE:

1. Divide the class up into groups of 4 or 5 students. Give each group a copy of the shark threats worksheet.

2. Have the students read each of the threats listed on the worksheet. They should first decide if these are natural or human-caused threats. They can then brainstorm to see if they can come up with some possible solutions to these threats.

3. There are three empty rows at the bottom of the worksheet. See if the students can come up with any other threats to the survival of sharks.

4. Have each group report to the rest of the class on what they came up with. Have the class comment on the solutions presented by each group:
   - Are the solutions realistic? Why or why not?
   - Will they affect other species of animals?

SHARK THREATS WORKSHEET

Threats	**Natural threats**	**Human-caused threats**	**Possible solutions**
Over-fishing			
Pollution			
Loss of prey species			
Habitat degradation			
Entanglement in fishing gear			

ACTIVITY 9: SHARKS, SKATES, AND RAYS

OBJECTIVE: Students will learn the differences and similarities between sharks, skates, and rays.

BACKGROUND: Sharks, skates, and rays all belong to a group of fish known as Chondrichthyes. Some scientists believe that skates and rays descended from sharks about 200 million years ago. Sharks, skates, and rays have many traits in common, but they also have several important differences. Listed below are some of the similarities and differences between sharks, skates, and rays.

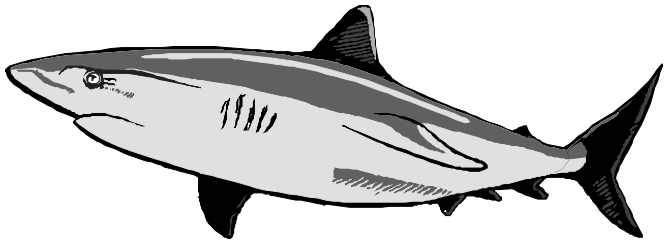
SIMILARITIES:

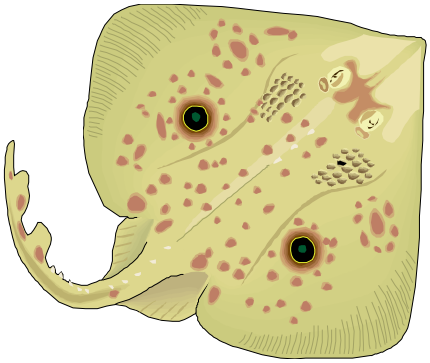
- Skeleton made of cartilage
- Dermal denticles: small tooth-like structures covering the skin
- 5 to 7 gill openings
- reproduce by internal fertilization

DIFFERENCES:

- Sharks have long, slender bodies; skates and rays have more flattened bodies.
- A shark's pectoral fins are used for lift and steering; skates and rays use their pectoral fins to swim. They do this by flapping them like wings.
- Sharks have powerful tail fins that are used for propulsion; skates and rays have narrow tails that may be used for steering or balance.
- A shark's gill openings are on the side in front of the pectoral fins; skates and rays have gill openings on the underside of the head.

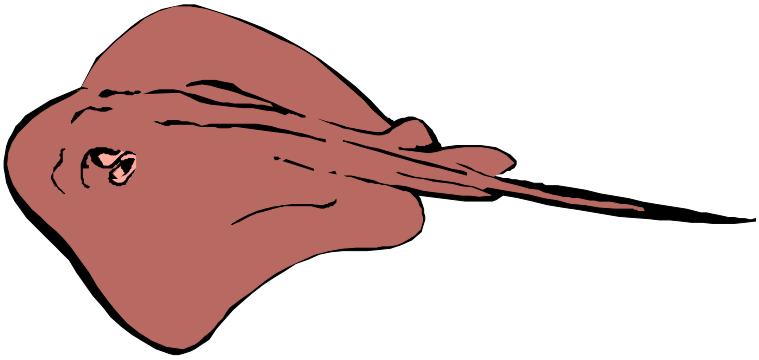
Shark





Skate

Ray



MATERIALS:

Skate (in trunk)
Shark poster (in trunk)
Copies of worksheet (following this page)
Pencils

PROCEDURE:

1. Make copies of the worksheet on the following page. Distribute these to the students.

2. Show the students the skate and the shark poster found in the trunk. Discuss the physical characteristics of sharks, skates, and rays.

3. Have the students read over the worksheet and decide if each of the characteristics listed on the sheet apply to sharks, skates, rays, or all three.

4. Discuss the results with the class.

SHARKS, SKATES, AND RAYS WORKSHEET

	SHARK	SKATE	RAY
Long, slender bodies			
Flattened bodies			
Use gills to breathe			
Gill openings are on the underside of the head			
Gill openings are on the side in front of the pectoral fins			
Have a skeleton made of cartilage			
Have dermal denticals (small tooth-like structures covering the skin)			

SHARKS, SKATES, AND RAYS ANSWER SHEET

	SHARK	SKATE	RAY
Long, slender bodies	**X**		
Flattened bodies		**X**	**X**
Use gills to breathe	**X**	**X**	**X**
Gill openings are on the underside of the head		**X**	**X**
Gill openings are on the side in front of the pectoral fins	**X**		
Have a skeleton made of cartilage	**X**	**X**	**X**
Have dermal denticals (small tooth-like structures covering the skin)	**X**	**X**	**X**

ACTIVITY 10: PREDATOR AND PREY

OBJECTIVE: Students will be able to define predator and prey; they will learn about how a shark's senses are essential for their survival.

BACKGROUND: Sharks are predators that depend on other animals (prey) for food. Predators help prey species by controlling their population size.

MATERIALS:

6 Bandanas

PROCEDURE:

1. Have the students define **predator** and **prey**. Discuss why predators are important in maintaining a natural balance in an ocean ecosystem. Ask the students what they think would happen if there were no predators.

2. Select six students to stand in the middle of a circle formed by the rest of the class. Three of the students will be fish, the other three will be sharks. The six students are blindfolded. By listening to each other the sharks should try to tag the fish. When they are tagged they have been eaten. The fish should try to avoid the shark.

3. Try the game again, only this time have four students be sharks, and only one two be fish. Play the game for several more rounds trying different variations (change the number of sharks and fish).

4. Ask the students the following questions:
   - Why would using their senses help the sharks? What senses can a shark use to locate prey?
   - What can the prey use to help them survive?
   - What would happen to the predators if there were not enough prey species? What factors could cause there to be too few prey species?
   - What would happen to the prey species if there were not as many predators? What factors could cause there to be too few predators?

ACTIVITY 11: ENDANGERED SPECIES

OBJECTIVE: Students will understand the meanings of the terms: threatened, endangered, and extinct. They will be able to list factors involved with extinction. They will be able to determine solutions for the recovery of endangered species.

BACKGROUND: Species of plants and animals are disappearing all over the world. Some may become extinct before we have a chance to know them.

MATERIALS:

Paper and pencils

PROCEDURE:

1. Discuss with the students the meaning of the terms: threatened, endangered, and extinct:

    - **Threatened:** a species whose numbers are low or declining. Although they are not in immediate danger of extinction, they are likely to become endangered if not protected. (basking sharks are threatened)

    - **Endangered:** a species in danger of becoming extinct because there are so few of them left. (whale sharks and shortfin makos are endangered)

    - **Extinct:** when there are no individuals of a plant or animal species left on earth.

2. Read the following statistics to the class:
    - Most extinctions are caused by humans.
    - Since Columbus, over 500 species of plants and animals have become extinct in the U.S.
    - Over 4,000 species are listed as candidates for the Endangered Species list.
    - Listing a species as endangered takes about 1 year from start to finish.

3. Have the students get into groups of three or four. Let each group choose from the list of endangered species following this page an animal that they would like to support.

4. Each group will choose a spokesperson and a note taker. The spokesperson will give information to the rest of the class at the end of the activity; the note taker will write down the information for the group.

5. Each group will try to determine the following:
    - Three reasons for your specie becoming endangered
    - Three ways humans can help the specie regain a healthy population

Although the students probably will not know a lot of specific information about these species, they can theorize about the reasons for their becoming endangered.

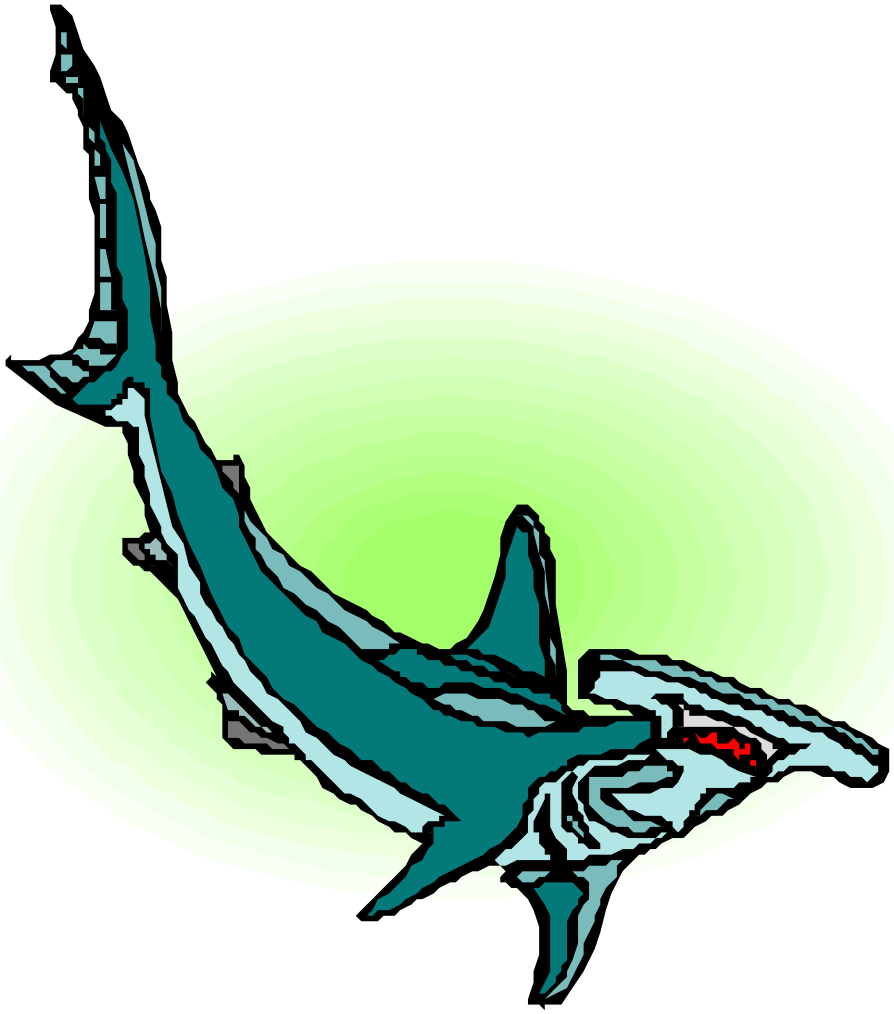
6. Have each group's spokesperson stand and tell the class what they determined.

LIST OF ENDANGERED SPECIES:

(T) = Threatened
(E) = Endangered

California Condor (E)
Whale Shark (E)
Basking Shark (T)
Green Sea Turtle (T)
Whooping Cranes (E)
Desert Tortoise (T)
Sperm Whale (E)
Black-footed ferret (E)
Kemp's Ridley Sea Turtle (E)
Humpback Whale (E)
Loggerhead Sea Turtle (T)
Hawksbill Sea Turtle (E)
Mountain Gorilla (E)

STUDENT ACTIVITY PAGES



These activity pages can be given to the students to work on in class or at home.

SHARK WORD SCRAMBLE

Unscramble the names of sharks.

1. _ _ _ _ _ _ _ _ _ _
   AHMEMRHDAE

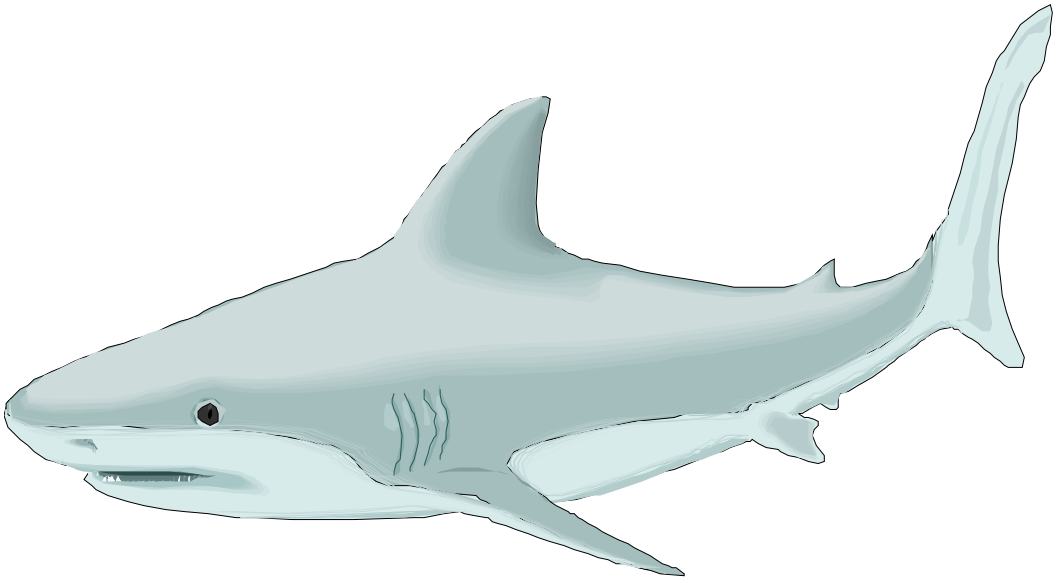
2. _ _ _ _ _
   EAWHL

3. _ _ _ _ _ _ _ _ _ _ _
   E GTAR E IWTH

4. _ _ _ _ _
   RNU ES

5. _ _ _ _ _
   EG T I R

6. _ _ _ _
   LB LU



Shark Word Scramble Answer Key:

1. hammerhead
2. whale
3. great white
4. nurse
5. tiger
6. bull

Shark Who's Who

Directions: Identify the shark described in each clue. Write the name of each shark in the space provided.

1. The largest shark as well as the largest fish in the ocean:

   _____

2. This shark is known as a "man-eater" and a "boat biter":

   _____

3. This shark prefers to dine on sea turtles:

   _____

4. This shark is the least intelligent of all shark species:

   _____

5. This shark is the most intelligent of all shark species:

   _____

6. This shark eats primarily crustaceans and mollusks:

   _____

7. These sharks have the keenest sense of smell due to the design of their heads:

   _____

8. This shark is the fastest swimmer:

   _____

9. These sharks prefer eating stingrays:

   _____

10. This is the smallest shark in the world:

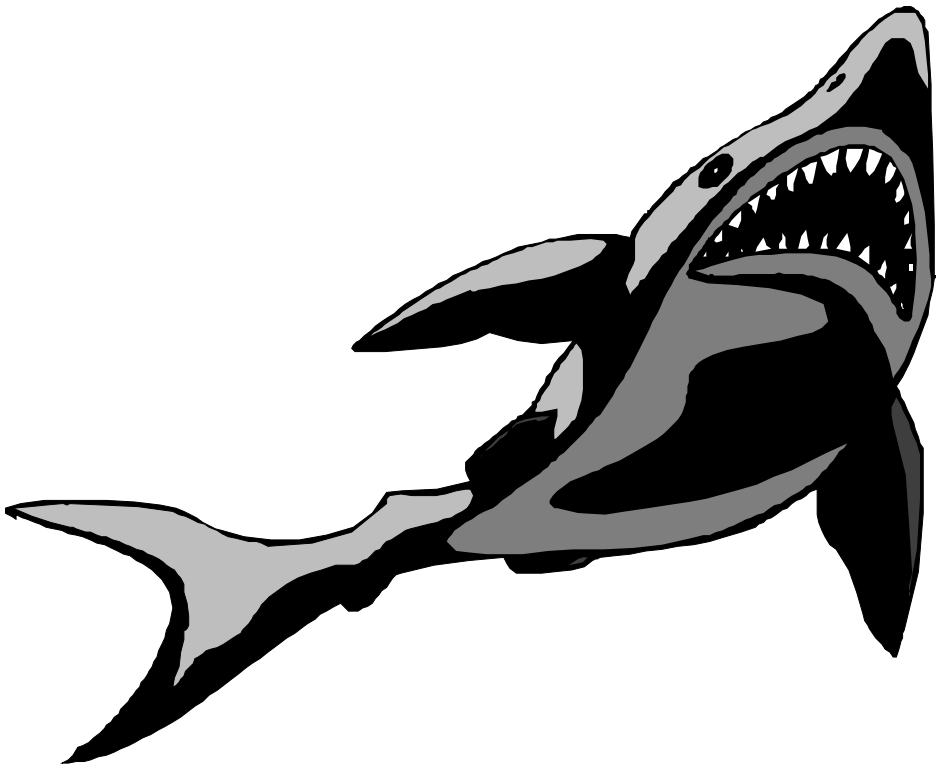
_____

11. This shark possesses 300 rows of non-functional teeth and eats zooplankton:

_____

12. The ancestor of the great white shark with teeth 5 to 6 inches long:

_____



Shark Who's Who Answer Key:

1. Whale shark
2. Great white shark
3. Tiger shark
4. Great white shark
5. Hammerhead shark
6. Nurse shark
7. Hammerhead shark
8. Shortfin mako shark
9. Hammerhead shark
10. Dwarf shark
11. Whale shark
12. *Carcharodon megalodon*

SHARK WORD SEARCH

See if you can find and circle all of sharks listed below. They can be found positioned forwards, backwards, up, down, or diagonally.

Basking
Blacktip
Bull
Dogfish
Great white
Hammerhead
Lemon
Mako
Nurse
Porbeagle
Tiger
Thresher
Whale

N	D	O	G	F	S	H	N	O	M	E	L	L	P	Y
P	A	N	N	R	M	O	M	P	R	Y	Z	N	H	A
O	H	A	M	M	E	R	H	E	A	D	V	U	A	L
R	I	D	V	K	P	A	I	E	A	E	B	R	O	P
B	A	E	O	B	A	Q	T	O	U	G	G	S	K	M
E	H	J	O	G	R	R	R	W	D	N	A	E	F	G
A	T	A	K	L	F	N	E	N	H	I	S	A	N	N
G	M	I	W	T	R	I	Y	S	M	I	N	F	O	I
L	N	M	G	R	E	H	S	E	R	H	T	K	A	K
E	D	K	M	E	M	I	O	H	F	O	E	E	T	S
W	A	C	L	I	R	O	R	A	S	M	C	I	P	A
A	V	A	L	E	L	A	H	W	H	I	A	Y	O	B
Z	E	L	U	A	E	T	K	U	M	K	T	K	J	K
M	C	B	B	L	A	C	K	T	I	P	G	F	O	P
S	B	J	I	O	P	L	N	O	F	I	S	H	N	M

SHARK QUIZ

1. Sharks have skeletons made of _____.

2. Sharks use their powerful _____ fin for steering and propulsion.

3. A shark uses its _____ system to sense vibrations in the water.

4. A shark can detect electrical impulses in the water using a system of holes and canals in its snout called the _____.

5. A _____ shark is the largest fish in the world.

6. A thresher shark uses its _____ to herd and stun fish.

7. Basking sharks use _____ to filter plankton from the water.

8. Almost two thirds of a shark's brain is devoted to the sense of _____.

9. Sharks are covered with tiny, tooth-like scales called _____.

10. A shark uses its _____ to absorb oxygen from the water.

SHARK QUIZ: ANSWER PAGE

1. cartilage
2. caudal
3. lateral line
4. Ampullae of Lorenzini
5. whale
6. tail
7. gill rakers
8. smell
9. dermal denticles
10. gills

What am I?

See if you can identify the sharks in each of the following paragraphs:

1. I can be up to 14 feet long. I am a brownish-yellow color. I am active mostly at night. I have barbels below my mouth. I am a _____.

2. I am about 14 feet long. I am a brownish-gray color. I feed on fish, stingrays, and crustaceans. I have a hammer-shaped head. I am a _____.

3. I am not very intelligent. I can be aggressive. I like to eat large fish dolphins, seals, sea lions, and sea birds. I am sometimes considered to be a "man-eater." I am a _____.

4. I am about 20 feet long and weigh about 1,000 pounds. My tail is about 10 feet long, and I sometimes use it to stun prey or to herd fish together. I am a _____.

5. I am about 8 feet long. I can survive in both salt and fresh water. I have been known to venture up freshwater, inland rivers. I am a _____.

6. I use gill rakers to filter plankton from the water. I like to lie motionless with my back above the water enjoying the sun. I am a _____.

7. I can be up to 50 feet long and weigh 40,000 pounds. I am the largest fish in the ocean. I am a _____.

8. I am about 10 feet long. I like to eat crustaceans and turtle grass. I am a yellowish-brown color. I am a _____.

What Am I? Answer Key

1. nurse shark
2. hammerhead shark
3. great white shark
4. thresher shark
5. bull shark
6. basking shark
7. whale shark
8. lemon shark

GLOSSARY:

Ampullae of Lorenzini A system of holes and canals in a shark's head area that detect electrical impulses in the water

Anal fins A small fin on the shark's underside near the tail; used for stability; not present on all sharks

Cartilage Strong, flexible tissue that makes up a shark's skeleton

Caudal fin The tail fin

Chondrichthyes Cartilaginous fish including sharks, rays, and skates

Clasper Modified pelvic fins used by male sharks for mating

Countershading A form of camouflage in which the shark is a darker color above, and a lighter color below

Dermal denticles Tiny, tooth-like scales that grow out of a shark's skin

Dorsal fin The unpaired fin on the shark's back

Electro-reception A sense used by sharks to detect electrical charges emitted by all living things

Fusiform Streamlined; tapering towards each end

Gill rakers Horny, bristle-like projections that line the inner margins of the gills of whale and basking sharks; used to filter plankton

Lateral line system	Lines of small holes along the sides of a shark that are sensitive to small movements in the water around them
Oviparous	Laying eggs instead of giving birth to live young
Ovoviviparous	Giving birth to live young that developed from eggs that hatched inside the mother's body
Pectoral fins	The front fins
Pelvic fins	Fins on the shark's underside; used for stability
Plankton	Tiny organisms that live in the water
Placoid scales	The teeth-like scales of a shark
Pup	A young shark
Spiracles	Remnant gill slit used to bring water into the gill chamber
Symbiotic	A relationship where two dissimilar organisms live closely together
Viviparous	Giving birth to live young

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(Teacher)

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CURRICULUM INDEX

ACTIVITY 1: ALL SHARKS ARE FISH, BUT NOT ALL FISH ARE SHARKS

- Science Grade 4: #1: Understanding of Animal Growth and Adaptation
  - 1.1 Relate structural characteristics and behavior of a variety of animals to the environment in which they are typically found.
  - 1.2 Determine animal behaviors and body structures that have specific growth and survival functions in a particular habitat.

ACTIVITY 2: SHARK TEETH

- Science Grade 4: #1: Understanding of Animal Growth and Adaptation
  - 1.1 Relate structural characteristics and behavior of a variety of animals to the environment in which they are typically found.
  - 1.2 Determine animal behaviors and body structures that have specific growth and survival functions in a particular habitat.

ACTIVITY 3: INTERVIEW WITH A SHARK

- English Language Arts Grade 3: #3: Reading Comprehension
  - 3.1 Reads literary, informational, and practical text.
  - 3.10 Summarizes and records information. Notes and charts detail.
- English Language Arts Grade 4: #2: Reading Strategies
  - 2.4 Formulates questions and find relevant information from reading materials.
  - 2.8 Selects books and other materials that best suit purpose.
- English Language Arts Grade 3: #3: Reading Comprehension
  - 3.1 Reads literary, informational, and practical text.
  - 3.2 Reads materials on a variety of topics beyond personal experiences.

ACTIVITY 4: HOW BIG ARE SHARKS?

- Mathematics Grade 3: #2: Spatial Sense, Measurement, and Geometry
  - 2.6 Estimate and measure length, weight, and capacity using appropriate tools and units.
  - 2.7 Model and compare units within the same measurement system.
  - 2.13 Solve problems using measurement concepts and procedures. Explain the solutions.
- Mathematics Grade 4: #4: Data, Probability, and Statistics
  - 4.2 Display data on charts and graphs: picture, bar, and line plots.
  - 4.4 Read and interpret graphs and charts as sources of information; identify main idea; draw conclusions and make predictions.

ACTIVITY 5: SHARK ANATOMY

- Science Grade 4: #1: Understanding of Animal Growth and Adaptation
  - 1.1 Relate structural characteristics and behavior of a variety of animals to the environment in which they are typically found.
  - 1.2 Determine animal behaviors and body structures that have specific growth and survival functions in a particular habitat.

ACTIVITY 6: PLASTER CASTING

- Science Grade 4: #1: Understanding of Animal Growth and Adaptation
  1.1 Relate structural characteristics and behavior of a variety of animals to the environment in which they are typically found.
  1.2 Determine animal behaviors and body structures that have specific growth and survival functions in a particular habitat.

ACTIVITY 7: ADAPTATIONS

- Science Grade 4: #1: Understanding of Animal Growth and Adaptation
  1.1 Relate structural characteristics and behavior of a variety of animals to the environment in which they are typically found.
  1.2 Determine animal behaviors and body structures that have specific growth and survival functions in a particular habitat.

ACTIVITY 8: SHARK THREATS

- Science Grade 4: #1: Understanding of Animal Growth and Adaptation
  1.3 Evaluate living and non-living things that affect animal life (other animals, plants, climate, water, air, location).
- Science Grade 6: #2: Characteristics of matter and energy flow through an ecosystem
  2.3 Describe the ways in which organisms interact with each other and with non-living parts of the environment (limiting factors, coexistence, cooperation, competition, symbiosis).
- Social Studies Grade 4: #5: Geography
  5.3 Analyze causes and consequences of the misuse of the physical environment and propose alternatives.

ACTIVITY 9: SHARKS, SKATES, AND RAYS

- Science Grade 4: #1: Understanding of Animal Growth and Adaptation
  1.1 Relate structural characteristics and behavior of a variety of animals to the environment in which they are typically found.
  1.2 Determine animal behaviors and body structures that have specific growth and survival functions in a particular habitat.

ACTIVITY 10: PREDATOR AND PREY

- Science Grade 4: #1: Understanding of Animal Growth and Adaptation
  1.3 Evaluate living and non-living things that affect animal life (other animals, plants, climate, water, air, location).
- Science Grade 6: #2: Characteristics of matter and energy flow through an ecosystem
  2.2 Differentiate between the interconnected terrestrial and aquatic food webs.
  2.3 Describe the ways in which organisms interact with each other and with non-living parts of the environment (limiting factors, coexistence, cooperation, competition, symbiosis).
  2.4 Evaluate the consequences of disrupting food webs.

- Social Studies Grade 4: #5: Geography
  5.3 Analyze causes and consequences of the misuse of the physical environment and propose alternatives.

ACTIVITY 11: ENDANGERED SPECIES

- Science Grade 4: #1: Understanding of Animal Growth and Adaptation
  1.2 Evaluate living and non-living things that affect animal life (other animals, plants, climate, water, air, location).
- Social Studies Grade 4: #5: Geography
  5.3 Analyze causes and consequences of the misuse of the physical environment and propose alternatives.