Across
5. The type of shark that will eat almost anything!
7. A fine sand paper made from the skin of sharks.
8. A class of fish that includes rays, skates, and sharks.
10. The absence of this organ makes it necessary for sharks to swim continuously to avoid sinking.
11. A slow, sluggish shark that can rest on the sea floor and eats benthic organisms.
12. A small shark that can be found traveling in large schools and is used in pet food.
13. The family of sharks most responsible for "shark attacks" named after a hymn or mass for the dead.

Down
1. A nonpredatory shark that feeds on plankton and small fish.
2. Shark skeletons are made of this material.
3. The practice of removing only a shark's fin to be used in shark fin soup, and throwing back the live shark to die.
4. The egg case of a skate.
6. A row of sensitive, fluid-filled sacks that extends from the head to the tail of fish, used to detect vibrations.
9. The type of shark with wide heads which serve as rudders for maneuvering.
Comparative Anatomies of a Shark and a Bony Fish
Label the different features of a shark and a bony fish.
FACT SHEET ON SHARKS

Kingdom: Animalia
Phylum: Chordata
Class: Chondrichthyes
Subclass: Elasmobranchii

- Sharks have been on the earth 400 million years—introduced during the Devonian Period—even before dinosaurs were on the earth!

- Sharks are expertly designed animals, and are considered "top line" predators of the oceans; they are not the vicious animals that they are perceived to be

- Many sharks have a nictitating membrane, which is a clear covering that protects their eyes during hunting and attacking prey

- Sharks have a powerful caudal (tail) fin for swimming with agility and speed

- Sharks have very efficient jaws and teeth, which vary from species to species

- Most open water sharks have "torpedo" shaped bodies which are streamlined in design and aid in swimming effectively

- Sharks' pectoral fins aid in balance and swimming

- Sharks do not have air bladders like other fish. Instead, they have an oil-filled liver, which is fatty and rich in Vitamin A

- Many sharks must swim to breathe, as they must move water over their gills.

- Sharks have an excellent sense of smell, and can smell blood 1/2 mile away
Sharks can pick up the vibrations of a struggling fish 3000 feet away with its sense of hearing.

The lateral line system along both sides of the shark is an important adaptation that enables the animal to detect vibrations in the water.

Shark skin is very rough, and was once used for sandpaper.

Ampullae of Lorenzini, tiny gel-filled pits on the snout, detect electrical impulses in the water, and can also aid in locating a struggling fish.

Did You Know?

Sharks are "scaleless fish;" that is, they have dermal dentides, which means skin teeth. This contributes to their very rough skin.

All sharks are carnivores: the whale shark eats plankton by filter feeding.

All sharks have several rows of teeth. When a tooth wears out or is lost, a new one moves forward to replace it.

Sharks are very beneficial to medical science for a variety of reasons:

Their fatty liver is very oily and rich in vitamin A.

Their retinas and corneas have been used in eye transplants.

Their immune systems are instrumental in cancer research (Sharks do not get cancer).

The largest shark is the Whale Shark. The smallest shark is the Dwarf Shark (Tsuranagakokitozame).

Sharks were the first animals on earth, evolutionarily, to give live birth to live young (Ziziparity).

Sharks have the most advanced process of reproduction among fish: internal fertilization.

Male sharks are easily identified; they have visible "claspers" on their undersides, which are used for internal fertilization of the female.

If a shark is on the hunt for a meal, it will opt for the "safest" meal (An injured, dying or sick animal).

Sharks can be attacked effectively by dolphins. Dolphins will slam into a shark beak first, in the most vulnerable areas of the shark (gills), and cause great damage.

In case of a shark attack, the best defense for a human is to hit the shark in the eye, snout, or gill area.

A Great White shark does not have a nictitating membrane: As it goes in for the kill, its eyes will-roll back into its head for protection.
SHARKS  By Jay R. Calkins

Sharks are a fascinating group of fishes that strike fear into the minds of humans. This fear is really a fear of the unknown, for little evidence exists that indicates sharks are really very dangerous. Sharks have much more to fear from humans than humans have to fear from sharks. Each year thousands of tons of sharks are killed by fishermen for food and other products while very few humans are ever bitten, and fewer still die from shark bites.

Sharks belong to the class Chondrichthyes, a group which also includes rays, skates and chimeras. Unlike other vertebrates, sharks have a skeleton made of cartilage rather than bone. Only about 800 species of cartilaginous fish are known to exist compared to over 20,000 known species of bony fishes.

Sharks differ from the more common bony fishes in several ways. Besides having no bones, sharks and their relatives do not have the overlapping scales that cover many bony fish. Nor do they have a swim bladder, the air-filled balloon-like organ that keeps most fish upright. Sharks have gill slits but no gill-cover, which is common to the bony fish.

Sharks vary greatly in size from the enormous 40-foot-long whale shark to tiny two-to three foot dogfish and angel sharks. Despite its huge size, the whale shark is not an active predator. It feeds rather passively by swimming with its mouth open to collect plankton and small fish.

Most sharks are active predators and eat primarily fish, although the great white shark will also prey upon seals, sea lions and other marine mammals. Some sharks eat bottom-dwelling animals such as crabs, and others scavenge for dead animals. Some sharks even eat trash as indicated by the tin cans and boots found in sharks' stomachs.

Because they have no swim bladder to keep them buoyant, sharks sink when not swimming. Sharks' bodies are heavier than water. The nurse shark, skates and rays have adapted to resting on the bottom, but most sharks are constantly on the move. Moving forward with their mouths open is how sharks move water across their gills for breathing. Most cannot stop for long or move backwards as can bony fishes.

Shark teeth come in a variety of sizes and shapes. Some are narrow and pointed and others are broad and sharp; still others are serrated and jagged depending on their food preference. Sharks can have several rows of teeth in their mouth. When one tooth breaks off another moves forward to replace it. Fossil teeth are often found in great numbers by beachcombers searching the southeast coast of the United States. Great collections of teeth are also found along Gulf of Mexico beaches.

**Examples of Shark Teeth**

![Image of shark teeth]

- **Tooth from Extinct Great White** (*Carcharodon megalodon*) (33 feet)
- **Tooth from Modern Great White Shark** (*Carcharodon carcharias*) (17 feet)
Sharks are well adapted to their watery environment. They have good eyesight and the ability to see colors. Their eyelid closes from the bottom of the eye. Even when the water is not clear, or when it is dark, sharks can easily locate their prey. They have an excellent sense of smell and can smell the odor of their prey from over one-quarter of a mile away.

Even better than its sense of smell is a shark's ability to detect the vibrations of other animals in the surrounding water. These vibrations are picked up by the lateral line, a row of sensitive fluid-filled sacks extending from the head to the tail of a fish. Even in the dark, a shark can sense the movement of prey or enemies through its lateral line.

Through pores in their skin, sharks also can detect the weak electrical charges produced by other animals. This sense allows them to find prey in the dark or buried in the sand.

Most sharks do not lay eggs for external fertilization as do most fish. Sharks practice internal fertilization more resembling the habits of mammals. Many sharks also bear their young alive, fully developed, and few in number. Because sharks produce so few young with each mating, fishermen and other predators can quickly reduce a population of sharks.

Some sharks do lay fertilized eggs, which are sometimes found on the beach. These eggs are commonly called 'mermaids' purses." In southern waters of the United States most "mermaids' purses" come from skates.

Most sharks are high on the ocean's food chain. They typically eat thousands of smaller fish during the course of their lives. As predators, they conserve energy by eating the slow, weak or sick fish in a school. They are, therefore, important to the ecological balance of the marine environment in that they eliminate the genetically weaker animals in a population.

The role of sharks in the marine environment is similar to the role of the great cats (lions, tigers and cougars) in terrestrial environments. Cats eliminate the weak or slow animals in a herd of wildebeests or deer in the same way as sharks eat the slower fish in a school of mackerel or herring.

Sharks provide many products that are utilized by humans. The flesh of sharks is excellent food, although Americans have not traditionally considered shark meat as a favorite food. An enormous shark fishery does exist in the United States for export to other countries. Sharks are often caught only for their fins which are used in shark-fin soup, an Asian delicacy. The livers of sharks are rich in oil, which is used for its vitamin A content and as a lubricant. The skin of sharks is used as leather and as fine sandpaper, called shagreen.

In general, sharks are much maligned. They are considered dangerous, wanton killers by many people. Their job is to live by eating, breathing and reproducing like other animals on this planet. Sharks evolved millions of years before humans. They eat fish and other marine animals, which exist in their environment. People are not part of a shark's normal diet. Most "shark attacks" are accidental, a case of mistaken identity. Perhaps a dozen of the 300+ species of sharks have been implicated in killing humans.

Twenty families of sharks have been described in the waters off North America. The following section briefly describes the five species found around Gray's Reef National Marine Sanctuary.
The Nurse Shark  The nurse shark is a relatively slow, sluggish shark often seen resting on the bottom. These sharks feed on benthic (bottom-dwelling) animals such as crabs and shrimp. They can be recognized by the barbels (fleshy appendages) that hang below their nose. Barbels are sensory organs, which help the nurse shark locate food on the bottom. Nurse sharks reach an average length of 6' to 10' and an average weight of 300 pounds. They are considered dangerous to humans only if aggravated.

The Spiny Dogfish  The spiny dogfish is the most abundant and best known of the sharks found on the east coast of the United States. This small shark is frequently found traveling in large schools. Recognized by its two dorsal fins, each with spines, the spiny dogfish is a favorite shark for laboratory dissections. Its flesh is eaten by people and often used for cat and dog food. These sharks eat many kinds of small fish and also invertebrates such as squid and octopus.

The spiny dogfish only grows to around 3’ to 4’ in length. The gestation period of the spiny dogfish is the longest of any vertebrate animal. It takes from 20 to 24 months from fertilization until young spiny dogfish are born.

The Lemon Shark  The Lemon shark belongs to one of the largest families of sharks, the requiem sharks. This family includes many of the better known sharks including the tiger shark, the blacktip shark, the bull shark, sandbar shark and blue shark. It is interesting that a requiem is a hymn or mass for the dead. Several of these sharks are reported to be responsible for "shark attacks."

The yellowish color on its sides gives the lemon shark its name. It is a common shark along the southeast coast of the United States. It eats mainly bony fish but will also eat shrimp, crabs and other small sharks. Lemon sharks grow 6’ to 8’ in length with a weight exceeding 200 pounds.

The Tiger Shark  The tiger shark is one of the largest sharks in the ocean. The tiger gets its name from the vertical black stripes that commonly appear on its sides. Tiger sharks will eat almost anything including conchs, skates, fish, sea turtles, birds, horseshoe crabs, and even human garbage. This shark also is a requiem shark and may be responsible for human casualties. Tiger sharks are caught as a gamefish and can weigh as much as 2,000 pounds.

The Great Hammerhead  Hammerheads are named for and easily recognized by the unusual shape of their heads. Their wide heads are thought to serve the same purpose as the bow rudders used in maneuvering undersea submersibles and submarines. Hammerheads are quite common in warm ocean waters. They are active predators that feed primarily on fish and squid.

The great hammerhead can reach a length of up to 18’, with a weight of 1500 pounds. They are considered to be one of the few sharks that can be dangerous to humans.