

Vocabulary

- **Anal Fin** - fin located near the anal opening; used for balance and steering.
- **Caudal or Tail Fin** - fin at the tail of a fish; used for propulsion.
- **Circulatory System** - delivers blood and oxygen throughout the body via the heart.
- **Digestive System** – breaks down and processes proteins, carbohydrates and fats.
- **Dorsal Fin** – backside (top) fin on a fish; used for balance and protection.
- **External Anatomy** - the outside body parts, such as, fins, scales, mouth.
- **Gills** – organ used to obtain oxygen from the water and rid carbon dioxide.
- **Gill Rakers** – filter feed tiny prey; appendages along the front edge of the gill arch.
- **Gonads** – the sex organs; males have testes, females have ovaries. Some fish are hermaphroditic, meaning having both sets of gonads (male & female) in one fish.
- **Lateral Line** – organ of microscopic pores that sense low vibrations and water pressure.
- **Nares** - organ to smell; similar to nostrils.
- **Nervous System** - organs receiving and interpreting stimuli for nares, eyes, lateral line, muscles, and other tissues.
- **Pectoral Fin** - fins on the sides; used for balance and assist turning.
- **Pelvic Fin** - belly fins on a fish; used for balance and steering.
- **Pyloric Caeca** – “finger-like” organ that aids in digestion, using bile from the liver.
- **Reproductive System** – the organs and tissues involved in reproduction, including gonads, eggs, sperm.
- **Respiratory System** – organs and tissues involved in the oxygen & carbon dioxide gas exchange, including gills, gill rakers, and gill filaments.
- **Scales** - protective cover on a fish; similar to skin.
- **Slime** – slippery covering on scales, protecting fish from bacteria, parasites, etc.
- **Swim bladder** – found only in “ray-finned” fish; a double sac used to assist in buoyancy.
- **Urinary System** – the kidneys remove nitrogen (ammonia) from the blood and regulate water balance in the blood and tissues.
- **Vertebrate** – an organism with a backbone or spine.

Vocabulary words will show up once in **bold**

Background

Fish and other vertebrates have much in common with humans. Many of the systems and organs are the same. Yet there are many unique differences in the organs and their functions in fish, and even between fish species. This lesson will be one for inquisitive exploration, and hands-on learning.

Internal Anatomy

Heart

This organ pumps blood throughout the body delivering oxygen and digested nutrients to the cells of various organs. It transports waste products from the cells to the kidneys and liver for elimination. In fish, the circulatory system is a single circuit, with a 2-chambered heart, unlike the typical 4-chambered heart found in land animals like mammals and birds. From the fish's atrium blood is pumped into the ventricle of the heart. From the ventricle, blood is pumped to the gills where gas exchange takes place in the gill filaments. Carbon dioxide (CO₂) is expelled and oxygen (O₂) is taken in. This re-oxygenated blood then flows on to the rest of the body's tissues and organs removing carbon dioxide and replacing it with life-giving oxygen. Blood is finally pumped back to the heart's atrium chamber where the process begins again.

Liver

The liver has many digestive and storage functions. One is the production of bile, a solution which emulsifies or breaks down fats in the intestine. The liver also stores fats and carbohydrates, destroys old blood cells, maintains proper blood chemistry, and plays a role in nitrogen waste removal.

Pyloric Caeca

This organ with finger-like projections is located near the junction of the stomach and the intestines. It is thought that through the secretion of enzymes it assists in breaking down the food further and absorbs needed nutrients, yet the function of this organ is still not well understood.

Gonads

Gonads are the sex organs. Males have paired testes that produce sperm, and females have paired ovaries that produce eggs. In most cases, fertilization of the eggs is performed externally, called spawning.

Swim Bladder

Most fish have an organ called the swim bladder. It is a flexible, gas-filled sac located in the dorsal or top portion of the body cavity and helps to control the fish's buoyancy. Since fish have a density that is heavier than water, they need this swim bladder to not sink when they stop swimming. There are two types of swim bladders, the physostomous and physoclistous.

Fish with a physostomous swim bladder are usually found in shallow water, though some are in deeper water. They will expel bubbles as they swim closer to the surface of the water and then they will swallow air at the surface before diving back down into the water. This air is passed into the guts and then they will force it into the swim bladder.

On the other hand, the physoclistous swim bladder is completely closed off from the swim bladder. These fish are able to control gas exchange or the amount of gas in their swim bladder through the capillaries that are found where the membrane of the swim bladder is very thin. When a fish is too buoyant, and starts to float upward, gas diffuses out of the swim bladder into the blood. The gas in the blood is removed at the gill filaments and expelled. Conversely, if a fish starts to sink, air enters the swim bladder via a gas gland. . Sometimes if a fish is caught and quickly brought to the surface from deep water, their swim bladder may expand so fast that it inflates into their mouth or even burst which usually will kill the fish, unfortunately

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Swim bladders are only found in ray-finned fish. In carp and catfish, the swim bladder is located close to their inner ear and thus giving better auditory ability. Fish with small or no swim bladders, such as darters and flat fish like flounder, sink to the bottom if they stop swimming and have a lowered hearing ability.

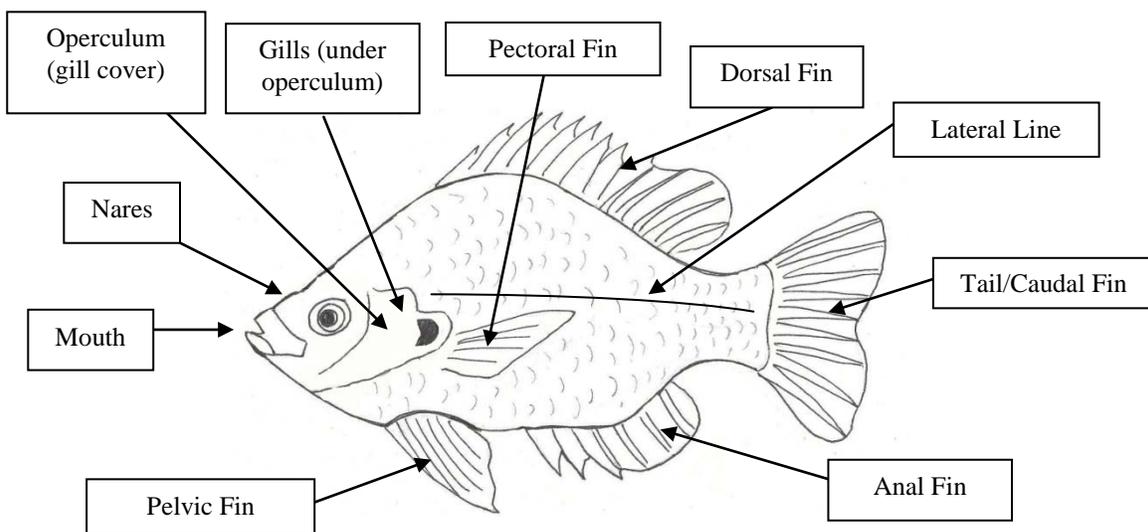
Stomach

The stomach is often referred to as the gut, and is where food is digested and nutrients absorbed. Fish such as bass are carnivores. Carnivores have fairly short intestines because such food is easy to chemically break down and digest. Fish such as tilapia that are herbivores (eat plants) and require longer intestines because plant matter is usually tough and fibrous and more difficult to break down into usable elements. By examining stomach contents, one can learn a great deal about fish feeding habits. Knowing what a specific fish species eats can also help with bait selection when fishing!

Kidneys

Kidneys are organs that filter liquid waste from the blood. The kidney is also extremely important in regulating water and salt concentrations within the fish's body. This allows certain fish species to exist in freshwater or saltwater, and in some cases both as in salmon.

External Anatomy



Fins

All fish have external appendages called fins. Fins allow fish to balance and steer while swimming. Fins are either single along the centerline of the fish like the dorsal fin, anal fin, and tail fin; or paired fins like the pectoral fins and pelvic fins.

The **dorsal fin** helps in steering but its main function is protection, with some species having a very sharp, spiny dorsal fin. **Pectoral fins** help fish balance and turn. The **pelvic fin** and **anal fin** are located on the belly and help with steering as well as balance. The **tail fin**, also called the caudal fin helps propel a fish forward.

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Gills

Located on either side of a fish's head, gills remove oxygen from the water and diffuse carbon dioxide from the body. The gills are covered by a flexible bony plate called the operculum. Some fish have spines located on the operculum as a defense mechanism to protect them from predators.

Lateral Line

Running down the length of a fish's body is the lateral line. It is made up of a series of microscopic holes located just under the scales of the fish. One of the fish's primary sense organs, the lateral line can sense low vibrations in the water, and is capable of determining the direction of their source.

Nares

All fish possess a sense of smell. Paired holes called nares, are used for detecting odors in the water, and are located on a fish's snout. Some fish, such as some shark varieties, catfish, and eels, have a very sharp sense of smell.

Scales and Slime

Most fish have scales covering the length of their body. Scales protect fish from injury, much like skin on the human body. On top of these scales is a mucous covering known as the slime layer. Slime protects fish from bacteria and parasites in the water. Anglers should be careful not to remove the slime layer when handling a fish.

Body Shape

A fish's body shape, as well as the shape and size of certain external features, can tell us a lot about that fish. For example, the body shape of a fish can indicate where that fish lives in the water and what type of swimmer it might be. In addition, tail fin shape also signifies a fish's swimming speed. A sharply forked tail, like that of a shark, implies a fast swimmer, where as a rounded tail means the fish is good at turning.

Mouth

The mouth parts of a fish will vary in size and may or may not contain teeth. The location of the mouth on a fish's body can also give us a clue as to what may be the fish's diet. A superior mouth, a mouth pointing upward, means the fish will eat food located above it; where as a fish with an inferior mouth, a mouth pointing downward, will eat food located below it.

Compare & Contrast

Even though humans and fish do not look the same, we share similar organs and body parts.

<u>Human</u>		<u>Fish</u>		<u>Human</u>		<u>Fish</u>
Lungs	=	Gills		Kidneys	=	Kidneys
Intestines	=	Pyloric Caeca		Ears	=	Lateral Line
Stomach	=	Stomach		Skin	=	Scales & Slime Layer
Liver	=	Liver		Nose	=	Nares
Ovaries/Testes	=	Ovaries/Testes		Arms	=	Pectoral Fins
				Legs	=	Pelvic Fins