



LET'S INVESTIGATE SHARKS
HOW DO SHARKS LIVE IN FRESHWATER?

Created by Josh Moyer for Sharks4Kids

Disciplinary Core Ideas:

MS-LS1:From Molecules to Organisms: Structures and Processes

Osmoregulation

How Do Sharks Live in Saltwater?

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How is Ocean Water Special?

Have you ever gone swimming in the ocean and tasted the water? It probably tasted very different from the water you get out of your kitchen sink. Why is that? It's because ocean water has salt dissolved in it. Over millions and millions of years, chemicals and minerals that make salts get carried into ocean by rivers or streams. Other chemicals and minerals come from deep within the Earth. When these chemicals meet in the ocean, they make salt. That's why we say the ocean is a body of **saltwater**. Bodies of water like rivers or lakes usually don't have much salt in them, so we call them bodies of **freshwater**.

A Problem Living in Salt Water

The ocean is full of salt water. It is also home to thousands of species of fish and sharks. When all those fish and sharks are swimming through ocean water, they are surrounded by salt. That can be a problem!

When you're surrounded by salt, it can dry you out because of a funny process with a very weird name. The process is called **osmosis**, and is pronounced like this: oz-moe-sis. During osmosis, water will go from where there is more fresh water to where there is less fresh water. Osmosis is happening in your body right now. When you drink a glass of water, the water gets out of your digestive tract and into your blood by osmosis.

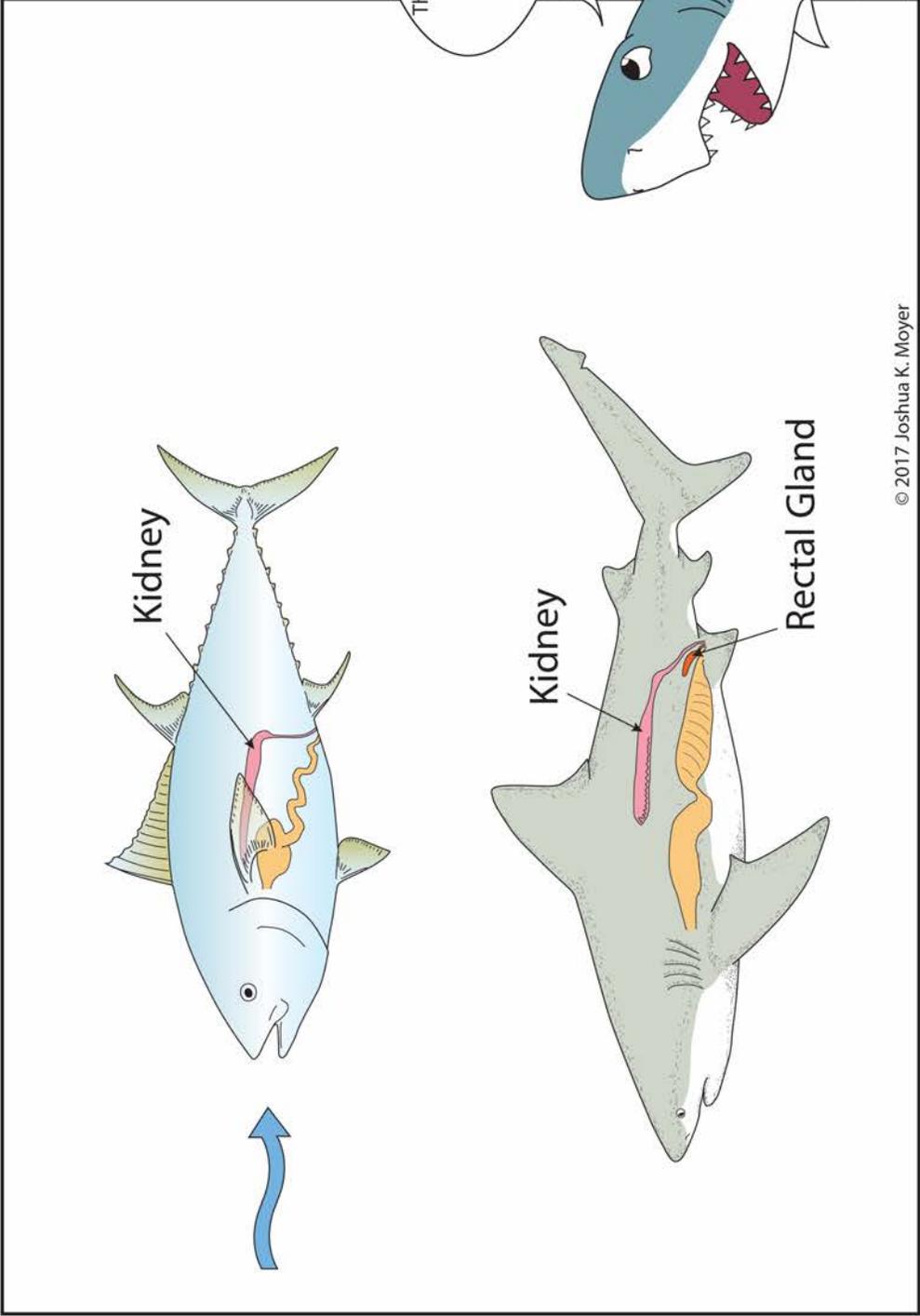
So if you have fresh water in your body that isn't very salty, and you're swimming through the ocean then there is more fresh water in your body than in the ocean water around you. Thanks to osmosis, that fresh water will leave your body through your skin as it travels from where there is more of it to where there is less of it. So if you're a fish or a shark in the salty ocean, how do you solve that problem and keep from shriveling up like a raisin because you've lost all your water?

How Bony Ocean Fish Solve the Problem

When a fish, or a shark, or any other organism has to control, or **regulate**, the amount of osmosis going on in its body, it is called **osmoregulation**. That word is a combination of *osmosis* and *regulate*.

Bony fish that live in saltwater don't want to shrivel up in all that salt water so they are always drinking the water around them to replace the water they're losing. An example of a fish that does this is a Bluefin Tuna. But what happens to all the salt in the water the fish is drinking?

Thankfully, fish like the tuna have very active kidneys. You have kidneys too! Kidneys are two organs inside the body that help by filtering all the blood in the body. When the blood passes through a kidney, the kidney filters out extra salt. Then the fish gets rid of the salt in its **urine**. Urine is a fancy word for pee.



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Why are sharks special?

Sharks are special when it comes to osmoregulation. Most sharks live in the ocean, although some sharks, like the Bull Shark, can swim back and forth between salt and freshwater! When sharks are in the ocean, they have to deal with all that salt and find a way to keep the water they need inside their bodies. The bony fish do this by replacing all the water they lose, but sharks have **evolved** a trick that helps them avoid losing the water in the first place! Sharks make the water in their bodies just as salty as the ocean water around them. How do they do this?

Sharks keep special chemicals in their bodies. One of those chemicals is called **urea**. Another chemical has a long name, but most people abbreviate it as **TMAO**. These chemicals help by making the inside of the shark's body saltier. If the inside of the body is just as salty as the water around it, osmosis won't take place, and the shark won't lose too much water and **dehydrate**.

Another thing that makes sharks good at osmoregulation is a special organ called the **rectal gland**. Rectal glands are only found in **cartilaginous** fish like sharks, skates, or stingrays. It is on the inside of the body just at the end of the intestine, and it is shaped like your finger. Why is it so important for osmoregulation in sharks? The rectal gland gathers even more salt from the blood than the kidneys and allows sharks to get rid of extra salt that their kidney didn't get. This makes sharks well suited for life in salt water.

Sharks in Freshwater?

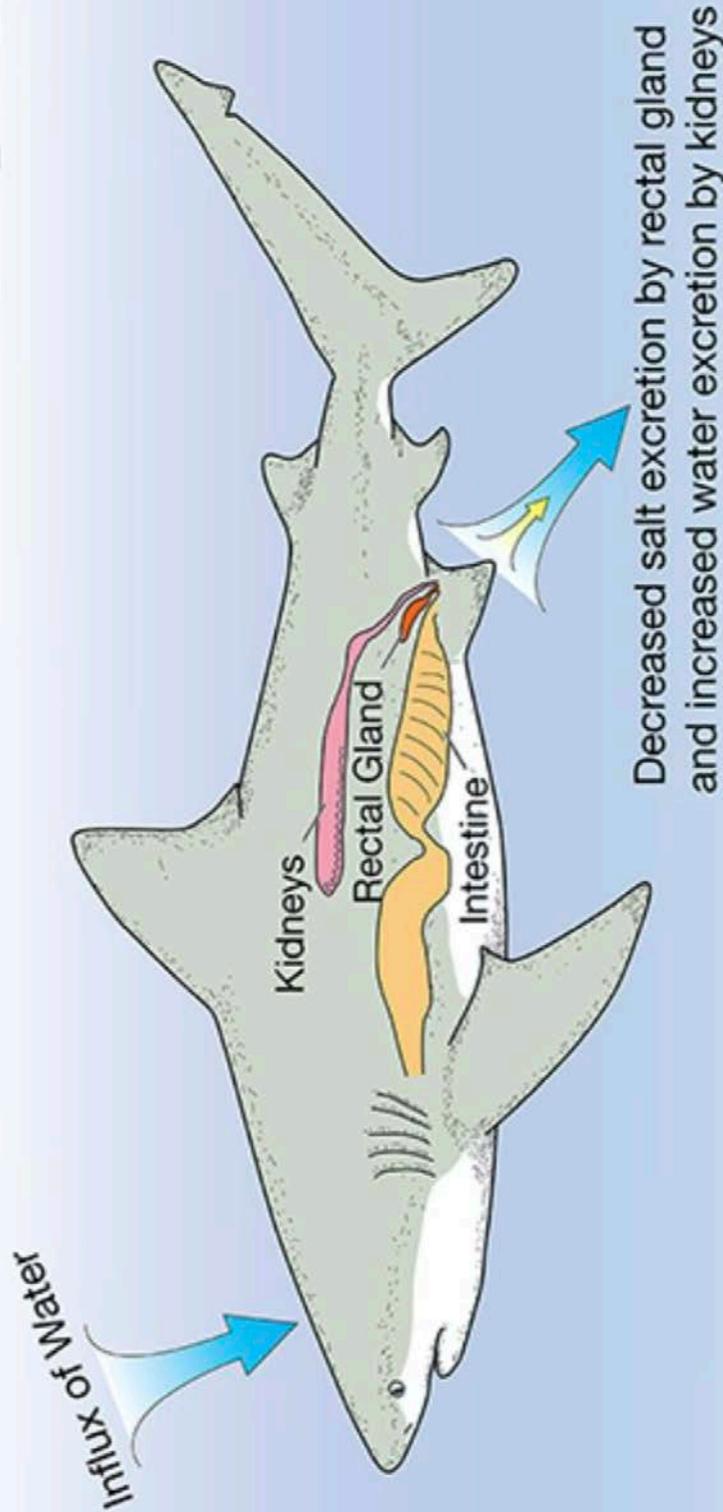
Most sharks live in the ocean, but some species of sharks and rays can live in fresh water too! You may have heard about the Bull shark. Bull sharks have been recorded over a thousand miles up the Mississippi River, over two thousand miles up the Amazon River, and even in Lake Nicaragua! In many parts of the world, the Bull Shark is not called the Bull Shark. Rather, it is named after the body of fresh water the shark lives in. For example, in parts of Africa the same species that Americans call the Bull shark is called the Zambezi shark because it swims up the Zambezi River.

The Bull Shark is the most popular example of a shark that can live in saltwater and in freshwater, but there are other examples too. Not many people know about the Ganges Shark or Northern River Shark. Scientists put these sharks in the same group called a **genus**. The genus of the Ganges Shark and Northern River Shark is called *Glyphis*. It is pronounced like this: g-lie-fis.

How do these sharks tolerate the fresh water? Sharks that travel between salt and freshwater release chemicals in one part of their body that tells another part of their body what to do. These chemicals are called **hormones**. We have hormones too! All animals do. In sharks like the Bull Shark, hormones are released that tell the body not to send so much blood to the rectal gland, and other hormones tell the sharks' kidneys to start making urine that has more water in it, to get rid of extra water that the sharks doesn't need.

That explains why you don't always have to be in salt water to see a shark.

Fresh Water



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