**PAESTA Podcast Series – You Asked, We Answered!**

**Episode 45 -- How do salmon know where to return to spawn?**

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Good morning listeners! This is Matthew Merrone, an undergraduate student at Penn State Brandywine, and I am here today to introduce this new episode of the PAESTA Podcast Series – How do salmon know where to return to spawn?

A growing mystery for scientists revolves around the idea of salmon being able to know exactly how to return to their home stream to spawn. Salmon are a very unique type of fish that are born in a stream and eventually venture off into the vast oceans before coming home to give birth. For something that seems so far-fetched, salmon are somehow able to migrate thousands of miles into the open ocean for years at a time, and then they miraculously swim all the way home to the stream they were hatched in. For years, scientists have speculated many different possible explanations for this odd phenomenon. Now, they may have finally broken the code to understanding how the salmon manage to do such a difficult task.

One of the tools that salmon use to migrate back to their home stream is their brains. [1] Experiments and research taken through the Institute of Creation Research state that salmon remember the water and its components while traveling downstream into the ocean. They claim that the fish have a flexible system for learning olfactory waypoints at appropriate time and places. [2] With the use of their brains, salmon are able to comprehend important oceanic factors including the ocean currents, length of the days, amount of sun exposure, water salinity, and the temperatures of the waters. These unique abilities allow the salmon to be able to recognize the water in which they are swimming in and navigate with the conditions of the ocean on their journey making it easier to migrate home.

Beyond their excessive use of their brains, scientists knew that salmon had a keen sense of smell that aided them in finding their way to their original stream. [2] It was observed that salmon use their sense of smell to imprint on their hatching stream for future reference. These fish imprint on the odor of the stream that they are hatched in and can remember that odor for the duration of their life. In an experiment, several salmon were moved from their home streams during their hatching periods. The scientists observed as the salmon migrated back into their home streams, concluding the importance of the fish’s ability to imprint early on in its life. This experiment later led to the discovery that salmon imprint at other important time periods of their lives like when the emerge from their gravel nets. [3] A hatchery research center for salmon in Oregon spent time digging their own fake streams for research. What they did was they took water from the salmon’s home stream and put it upstream while using regular water for the downstream. What they observed was that the salmon were using pheromones to sense their water. Almost all of the salmon were found migrating upstream to the water at which they were born into. The Oregon hatchery then confirmed that salmon’s sense plays a big role in the migrating process, and they wanted to repeat the experiment several more times with stronger sensing water.

The newest discovery that scientists have made referring to the ability for salmon to migrate to their home stream correlates to the Earth’s magnetic fields. [4] A team of researchers from the National Science Foundation put together data from patterns in salmon migration out of the Fraser River in British Columbia, Canada for the last 56 years. Coming into the experiment, the scientists knew that Earth’s magnetic field changes each year and it is weakened with proximity to the equator and the Earth’s poles. Vancouver Island sits at the mouth of the Fraser River, and blocks the salmon from entering their home stream. The scientists were able to predict the salmon’s route by observing the strength of the magnetic fields around the island. They determined that the salmon would take the route that most likely matched the magnetic fields of the Fraser River in the years that those fish were hatched there. The salmon did indeed take the route that the scientists predicted they would, confirming that they use the magnetic fields of the Earth to help navigate back into their home streams. Furthermore, these researchers were also able to identify that the salmon are not only imprinting on the odor and chemical properties of the water they were born into, but these fish are also imprinting of the earth’s magnetic field and later using it to sense which direction home is.

So, to focus on the underlying question of how salmon know where to migrate, we can confirm that it is a combination of three important aspects of their life. The use of their complex brain allows the salmon to understand complex waypoints through their journey while examining the conditions of the ocean and the sun. Their keen sense of smell allows them to imprint on the odor of the home stream and navigate through the ocean with that unique smell lingering in their mind to know where to go home. And finally, the use of the fish’s ability to map their way home after imprinting on the Earth’ magnetic field also helps them to make it home after a very long trip. The salmon is a magnificent fish, and it is very unique how they use different abilities to make their way back home again.

(*This audio file was recorded by Matthew Merrone on November 9, 2016)*

**Works Cited**

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