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Anadromous Ears: Fish Ears?

It's true! Fish have three ears and they know how to use them to avoid predation and to find food sources without the need of "sight"

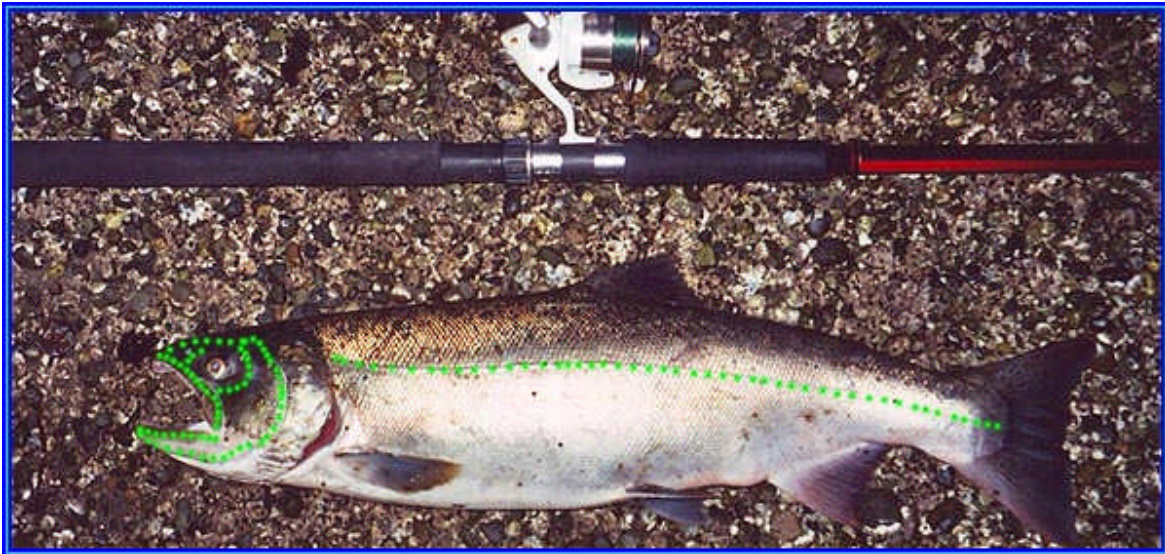
Timothy Kuserets



There are Salmon holding up near some structure on the opposite shore, right bank. The wake my legs are creating has alerted them, but because I've used unique wading practices, these fish are still on the bite. The Lamiglas noodle rod is a ten-and-a-half footer; long enough to get across the river and keep most of the line above the surface keeping it tight and sensitive to even the most subtle strike.

If how humans and animals hear sound makes up that part of the body we call ears then anadromous species of fish have three ears and they know how to use them. I've never been convinced that the recreational fishing world and the scientific community have ever given the credence to sound that all inland migrating fish experience. Sound travels many times faster and farther in water than it does in air; effectively giving all fish a distinct advantage of being able to hear things even when rivers, lakes, streams, and estuaries have zero visibility. Knowing how they hear is the right step in the right direction into hooking into fish; moreover, if anglers know how they hear then they will be able to avoid spooking fish. Fish, in general, have three physical ways for hearing sound: the Lateral Line; the Otolith; and facial pores called Forward Lateral Pores, together they are the Lateral Line System, but for the purpose of this article we're going to break them down into three fundamental groups. All three of these "organs" (the Otolith is actually a bone surrounded by tissue, but for ease I'll refer to it as an organ) are used by fish to perceive water displacement, which involves current speed, boating, and wading; ironically, these are very important things to fishermen as well for very different reasons. The first step in understanding how fish hear is to briefly explore the Lateral Line.

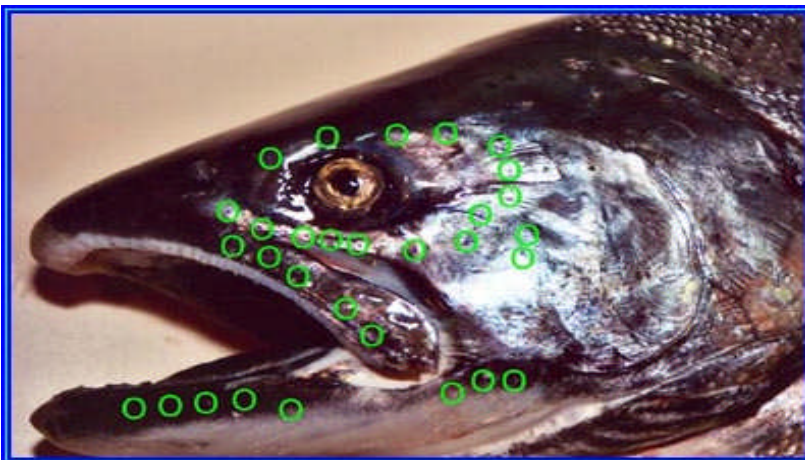
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With the animation of the green dots you can see just how long the Lateral Line on this fish is. The slightest movement in the water can be detected though subsonic vibrations. Fish can actually differentiate wave current motion from that of a fisherman's foot steps, from a boat, from a pier, from a predator, and that of prey and they don't need to "see" any of them. Moving a rock or trodding through the river is a sure way to put fish off the bite regardless of the clarity of the river, lake, tributary, estuary, cove, bay, or lake.

Note: In some species of fish the lateral line passes over the Peduncle and to the end of the tail.

The Lateral Line is a porous organ that is found on both sides of any fish's body that form a canal beneath the skin and scales which send information, via vibrating hairs at varying depths of the canal, to the brain and "Otolith. The Lateral Line is a sensory organ that allows fish to feel vibrations and to sense barometric pressure changes through vibrations. The ability to sense vibrations works in conjunction with another organ at the head of fish called the Otolith (located in a cross sectional above both eye orbits) found deep in the skull near the brain. The Otolith will actually vibrate much the same way our ears do when vibrations are sensed; both of these organs work together to give fish the ability to not only sense vibrations from predatory fish, but also from prey (an essential tool for those who want to use live bait). Both organs receive subsonic wave vibrations that trigger a response of flight or feed. How sound travels and the anatomical makeup of fish make it vital that fishermen learn how to wade upstream if they want to keep fish on the bite.



The facial pores of this fish aid it in detecting movement and sound; after a fashion. Even if fish cannot see you because of turbid conditions they'll still be able to hear you and sense vibrations. Currents that flow over logs and against banks alert fish into avoiding the structure, if they can do that then avoiding boats and fishermen is that much easier. Depending on the species of fish will dictate

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the size and specific locations of the Forward Lateral System referred to as facial pores.

Wading upstream from any fish is an advantage as opposed to wading downstream. From downstream, heading upstream, anglers can actually transmit sound with little effect on fish because of the diminished surface for receiving sound. Most fish don't have any form of sound receptors in the tail; and experienced anglers will tell you that it's also their blind side. If they cannot hear or see you then you can actually sneak up on them and being able to do that means more fish on the hook. Before you can sneak up on them we must first discuss the Facial Pores and then why wading downstream is a no-no. Sheryl Coombs and Christopher B. Braun have written about these premises in the book *Sensory Processing in Aquatic Environments* but have never taken the time to translate the data into what it could mean for fishermen either commercial or recreational but the information is vital to understanding the physiology of fish and what it means for downstream wading anglers. There are canal lines and pits within the face of each fish a.k.a. Facial Pores. The pits are extremely sensitive to movement as well as stationary objects; translation, they can sense the difference between a boat that drifts, pier that is stationary, and a fisherman wading. Throughout the head is a map of pores that follow the orbits of the eyes down towards the maxillary (upper jaw) and the mandible (lower jaw). Generally speaking, each species of fish will vary slightly, but only slightly so it's important to know that if it's a fish then it has these pores. There are more pores in the head and the face of fish than throughout the entire lateral portion of the head, with few exceptions; has an armada of pores pointed at an angler upstream means fish will be aware of you long before you're aware of it. Fishermen have literally no chance of heading fish off at the pass from a head-on-approach "I'm not talking about fishing from your position to downstream, which is done relatively slow, I'm talking about wading downstream to get to your favorite fishing hole; they're not the same thing". There is a way to circumvent those pores however. When fishing upstream take the time to actually wade back from your location and head away from the river, stream, or lake before heading downstream. As you make your way back to the water be aware that moving upstream will give you a decided advantage of staying hidden, and with the right offering ensure that you'll keep fish on the bite regardless of the species you're fishing for; with all of this in mind it's time to consider how boats interact with the lateral pores of fish.

Due to all the pores of the Lateral System of fish movement of any kind can be detected by them no matter how turbid the water is. Boats that drift or are stationary will actually draw the attention of fish since they can actually sense the void of waves created by a boat. This void reveals, to fish, that it offers some kind of cover and fish will head for it; however, the second a sound comes from the void fish will know that a predator is waiting to ambush it and will avoid it. Boaters can counter any chance of making sounds by lining the boat with carpet and ensuring that when anchoring the rope or chain is off and away from the hull. The proof is in the pudding; any boater worth his salt has performed a figure-eight before taking his lure, or bait, out of the water because he knows that the chances of a fish being under his boat is real; if proper care is taken it will happen a lot and believe me you want it to. Not all sound has to be avoided; just the ones that can be transmitted into the water, talking, eating, drinking, and fishing are activities that will not put fish off the bite. The most destructive activity an angler can perform is to aggressively wade in any body of water; smooth motions with the current ensure that your motions will be disguised. I've seen it time and again; anglers anxious to wade out to their favorite fishing spot will move with gusto and in doing so draw the attention of fish; this is the same as any fisherman in a sled who roars upstream to until he or she gets to their favorite hidey-hole. When the fisherman finally gets to the water and casts out he almost always gets nothing, especially if the cast is short. Military men call this "hurry up and wait", and fishermen go through that enough without perpetrating this annoyance upon themselves by the way they move upstream. The single best way to wade is with rhythm. Rhythm wading can be done regardless of how intense the river is flowing or how low or high it is. It's all based on the direction of which you wade; ironically, the wakes waders leave are not necessarily important on how large the wake is.

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Wading upstream behind fish will create larger wakes but will actually disturb fish less than if anglers decide to aggressively wade downstream. So long as a fisherman wades upstream with methodical motions fish will not care; you could actually sneak up behind fish if enough care is taken; I've done it quite a few times. Rhythm wading is done by not trying to walk through the current above the surface, but rather, wade with your feet below the surface feeling for rocks and surface areas that offer stability. The stride of the wades is half that of what you might use downstream. If the wake in front of the wader becomes sporadic then the stride of the fisherman has become sporadic and will get the attention of fish. It all comes to bear on the way fish swim with the current and how it flows over fish and the direction the Lateral System is aimed at. All fish are aquatically dynamic in their anatomical makeup, which is partially the reason why they're able to differentiate various currents sounds. If you're scratching your head wondering why all of this means anything at all let's take one final abbreviated look.

All species of fish have the lateral system and can ascertain modulating amplitudes of sine waves and determine the direction, size, and speed of movements. The flatter the surface is the easier it is to detect prey and predator; conversely, spheres or sphere-like surfaces tend to be hard to detect suggesting a type of sonar but that sonar is done in the reverse. Sound waves are transmitted "to" fish not "from" fish and any movement in water is detected by fish no matter how fast, slow, high, or low the water is.

Remember, if a body part is capable of receiving sounds and that body part is recognized to be a functioning ear then fish have three of them and they are the Lateral Line, Otolith, and the Lateral System on the face and head called Facial Pores. These three things allow fish to sense you the second you step on the water or the second you make a sound that transmits from the bottom of the boat into the water. Understanding current speed, boating, and wading can help you to get fish. You'll actually be able to get up behind them undetected or draw them to you while out boating. What could be better than that?

Further Reading:

Collin, Shaun P., and Marshall, N. Justin. *Sensory Processing in an Aquatic Environment: Processing of Dipole and More Complex Hydrodynamic Stimuli Under Still-and running-Water Conditions*. Springer-Verlag, 2003

Levinton, Jeffery. S. *Marine Biology: Physiological and Behavioral Response*. New York: Oxford University Press, 2001.

Baker, Cindy., Carlton, Guy., Diebel, Carol., Montgomery, John., and Voigt, Rainer. *Sensory Processing of Water Currents by Fishes*. School of Biological Sciences, University of Auckland, Private Bag 92019, Auckland, New Zealand. 2000

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