Fish researcher demonstrates first 'non-visual feeding' by African cichlids

April 13 2009

Most fish rely primarily on their vision to find prey to feed upon, but a University of Rhode Island biologist and her colleagues have demonstrated that a group of African cichlids feeds by using its lateral line sensory system to detect minute vibrations made by prey hidden in the sediments.

The lateral line system is composed of a canal embedded in the scales along the side of the body of a fish, around its eyes and on its lower jaw, which contain small groups of sensory hair cells that respond to water flow. The lateral line system aids some fish in swimming upstream, navigation around obstacles, and the detection of predators and prey.

According to Jacqueline Webb, a URI professor of biology, cichlids in the genus Aulonocara, which only live in Lake Malawi, have widened lateral line canals that are highly sensitive to vibrations and water flows. They feed by gliding through the water with their chin close to the sand like a metal detector, seeking out twitching arthropods and other unseen prey items.

There are about 16 species of Aulonocara cichlids in Lake Malawi, all of which feed in the sand.

"These cichlids join a short list of fish that have been demonstrated to use their lateral line system to feed," said Webb. "Since most of the fish with widened lateral line canals are found in the deep sea, it's difficult to study them. These cichlids can now be used as a model system for

studying widened canals, and we can apply what we learn from them to the fish in the deep sea."

Webb analyzed video of the swimming behavior of the fish in response to live and dead brine shrimp located on the surface of the sandy substrate in a tank. She compared the fishes' ability to detect prey under light and dark conditions, and looked at their ability to detect prey when the lateral line system was chemically "deactivated."

She found that the fish were able to find live prey easily, even in darkness, but not without a healthy lateral line system.

Her discovery opens the door to the study of the convergent evolution of wide canals and raises the question of whether fish that feed non-visually have an ecological advantage over visual-only feeders. Webb was recently awarded a $334,000 grant from the National Science Foundation to study the development and behavioral role of wide lateral lines.

"We also hope that this work will allow us to determine whether the sensory biology of a species can be used to predict its ecological success," she said, "especially in environments where the water quality is poor or where there is increased turbidity. Do these fish have an advantage in water where it is difficult to see well?"

To examine these questions, Webb will use microCT imaging to create a three-dimensional reconstruction of the skulls of cichlids, while also developing what she calls a "chin tickler" - an artificial stimulation delivery system - to standardize the stimulation provided from beneath the sand to the cichlid test subjects.

Source: University of Rhode Island (news : web)