Robotic fish aids understanding of how animals move

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The weakly electric black ghost knifefish of the Amazon basin has inspired Northwestern University's Malcolm MacIver and an interdisciplinary team of researchers to develop agile fish robots that could lead to a vast improvement in underwater vehicles used to study fragile coral reefs, repair damaged deep-sea oil rigs or investigate sunken ships.

MacIver will discuss the research at a press briefing, "Robots from Nature: Making Mechanical Animals," to be held on Saturday, Feb. 15, in Vevey Room 3 of the Swissôtel Chicago. The briefing is part of the American Association for the Advancement of Science (AAAS) annual meeting in Chicago. He also will speak about "Electric Fish Robotics" as part of the symposium "Intelligent Autonomous Robots: Biologically Inspired Engineering" to be held on Sunday, Feb. 16, in Columbus KL of the Hyatt Regency Chicago.

"Our technology for working in water is not very advanced," said MacIver, a robotics expert who has studied the black ghost knifefish for two decades. "Current underwater vehicles are large and lack agility, which means that working close to living or manmade structures is nearly impossible. We've taken lessons learned from the knifefish about movement and non-visual sensing and developed new technologies that should improve underwater vehicles."

MacIver is an associate professor of mechanical and of biomedical engineering at Northwestern's McCormick School of Engineering and

Applied Science. His work at the intersection of robotics and biology has led to consulting for science fiction movies and TV series, including "Tron: Legacy" (2010), "Terminator: Genesis" (2015) and "Caprica."

The black ghost knifefish hunts at night in the murky rivers of the Amazon basin using closely integrated sensing and movement systems. It has the unique ability to sense with a self-generated weak electric field around its entire body (electrosense) and to swim in multiple directions. The fish moves both horizontally (forward and backward) as well as vertically using a ribbon-like fin on the underside of its body.

MacIver and colleagues in Northwestern's Neuroscience and Robotics Lab have developed more than half a dozen robots based on the weakly electric knifefish. A major motivation for creating the robotic models of the knifefish is to generate a better understanding of how the nervous system combines the acquisition of information with movement.

Future integration of electrosense and ribbon fin technology into a knifefish robot should result in a vehicle capable of navigating complex 3-D geometries in murky waters, tasks that are impossible with current underwater vehicles.

Provided by Northwestern University