

Robofish accepted by wild fish shoal

By Jody Bourton

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'Robofish' leads the way for sticklebacks

Scientists have created a remote controlled "robofish" that sticklebacks accept as one of their own.

By controlling the robot, scientists can influence fish behaviour and get wild fish to follow it. The robot is a computer controlled replica model of a three-spined stickleback. This is an important advance in studying group behaviour and may also be used to understand and predict fish migrations, the scientists say. The researchers reveal their findings in the journal *Behavioral Ecology and Sociobiology*.

Crowd control

Similar devices have previously been developed for a number of uses such as detecting pollution. However, this is the first robotic fish used in studying animal behaviour that interacts with other fish, say the researchers.



Three-spined stickleback

Robofish is a model fish made from a plastercast of a three-spined stickleback (*Gasterosteus aculeatus*) controlled via electromagnets beneath a fish tank. The electromagnets are moved by a computer program which the scientists control. By placing the robofish in a fish tank with 10 three-spined stickleback fish, the team discovered that the model was realistic enough to tempt a fish shoal to follow it. Video footage shows the robot fish moving in a straight line along a set route and the shoal of sticklebacks leaving a refuge to follow. The robofish then turns 90 degrees and the sticklebacks, follow, also changing direction.

"We were surprised the fish followed even our first prototype of the robotic fish. We thought it would take many different prototypes before we could convince the fish that the robotic fish was one of them," says PhD student Jolyon Faria from the University of Leeds.

Follow the leader

Mr Faria undertook the study along with colleagues from the University of Leeds, UK, the Leibniz-Institute of Freshwater Ecology & Inland Fisheries in Berlin, Germany, Princeton University, New Jersey, US and the University of Sydney in Australia. The team examined the ability of the robofish to recruit followers. The researchers measured the time between the

activation of robofish and real fish leaving their refuge.

They also tested whether robofish could initiate the real fish to turn, studying how the shoal changed direction in its wake. The sticklebacks responded to robofish to a greater degree than other fish in the group, and the researchers suggest a number of reasons why. Robofish moved faster than the real fish, which may indicate to them that it knows something useful they do not. Another reason is that robofish was at the front of the group and studies have shown that bold leading individuals have a greater influence.

"Because robofish moved faster, without stopping and tended to be at the front or edge of the shoal, the other fish saw it as bold and definite in its actions, which encouraged them to follow," says Mr Faria. "One of our key goals in our research is to understand how fish behave in groups, and how this behaviour evolved. Using a robotic fish is a step towards these goals," says Mr Faria. Computer simulations have led to important advances in our understanding of collective fish behaviour, he explains. "But we don't yet know if fish actually use the behaviours that we used to program our simulations. This is where research with the robotic fish comes in."

Knowing how fish behave and influence a group could advance our knowledge of how fish swim in highly synchronous patterns, such as those demonstrated by sardine bait balls off the coast of South Africa. A deeper understanding of fish behaviour may also yield unexpected benefits.

"Simulations of fish schools and flocking birds have been used to simulate animal groups in films, and ant behaviour has inspired solutions for logistic problems in companies." Being able to predict fish behaviour may also inform management strategies for economically important species, Mr Faria suggests. "For instance, an understanding of fish behaviour may be used to predict the timing and direction of fish migrations."

Source: [BBC News](#) .