

Fish follow the rules to school

November 7 2011

The rules of school are simple: it is all about watching the kid nearest to you and making sure you do what they do. Researchers at the mathematics department at Uppsala University, together with biologists at Sydney University have shown that fish apply similar rules when traveling in small shoals.

Some of the most mesmerizing sights in the natural world are seen in the [collective motion](#) of [fish](#) schools and shoals. In the ocean, vast schools of hundreds of thousands of fish can form which then move together in unison. The shoals we see in our local aquariums may be smaller but they are nonetheless impressive examples of how a group can move together without a leader. Researchers have been studying the shape and structure of fish shoals for some time. They have used [computer simulations](#) to hypothesise about how this co-ordination works. However, until now we have not been able to determine the rules by which individual fish interact with each other.

In a study published this week in the [Proceedings of the National Academy of Sciences](#), researchers at the mathematics institute in Uppsala, working together with biologists in Sydney, have studied groups of a small lake-dwelling fish, known as the mosquito fish. By tracking the fish using computer imaging and fitting mathematical models to how the fish interact with each other, the researchers were able to decode the rules by which these fish interact with each other. The rules turned out to be strikingly simple but effective. Fish try to catch up with other fish in front of them, but they slow down when they get too close. Much in the same way as [car drivers](#) on an open highway try to

keep a fixed distance from each other. Fish also turn their bodies to move towards their neighbours and appear to react primarily to only their nearest neighbour. Through these simple rules, shoals of mosquito fish move in a co-ordinated fashion.

These studies of small groups of fish now set the scene for understanding larger schools form and move. Researchers in the collective animal behaviour group in Uppsala use a combination of data analysis and mathematical modelling to understand how, not only fish, but animals as diverse as ants, birds and humans behave together in groups.

Two videos feature shoals of four mosquito fish swimming in a rectangular tank. The first shows how fish are tracked individually to follow their position and direction of movement. In the second video, all the frames are transformed to follow the movement of one of the fish (in red). The colour of the other fish reflects their distance from the focal fish: the fish marked in green is the nearest neighbour etc. By looking at where the other fish of the shoal are when the fish in red speeds up, slows down, or turns to a particular direction the researchers can learn what "rules of motion" fish follow when schooling together.

Provided by Uppsala University

Citation: Fish follow the rules to school (2011, November 7) retrieved 28 April 2024 from <https://phys.org/news/2011-11-fish-school.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.