

# Fish choose their leaders by consensus

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A stream-resident male threespine stickleback from Alaska

Just after Americans have headed to the polls to elect their next president, a new report in the November 13th issue of *Current Biology*, a Cell Press publication, reveals how one species of fish picks its leaders: Most of the time they reach a consensus to go for the more attractive of two candidates.

"It turned out that stickleback fish preferred to follow larger over smaller leaders," said Ashley Ward of Sydney University. "Not only that, but they also preferred fat over thin, healthy over ill, and so on. The part that really caught our eye was that these preferences grew as the group size increased, through some kind of positive social feedback mechanism."

"Their consensus arises through a simple rule," said David Sumpter of Uppsala University. "Some fish spot the best choice early on, although

others may make a mistake and go the wrong way. The remaining fish assess how many have gone in particular directions. If the number going in one direction outweighs those going the other way, then the undecided fish follow in the direction of the majority."

Sumpter defines consensus as a decision in which all the information possessed by the individuals making the decision is used as effectively as possible. "Usually when talking about our own decision making, we say a consensus is reached if everyone is allowed to present their evidence for a course of action and the decision made reflects the general opinion of the decision makers." That's in contrast to decisions made by one or a very small number of group members, which are likely to reflect only their opinions.

The test for whether a group is reaching its decisions on the basis of consensus originated with the French philosopher Condorcet in the 18th century, Sumpter said. Condorcet justified the jury system by showing that the probability that a majority of independent-minded individuals is correct in a decision between "guilty" and "not guilty" increases with group size.

Now, the researchers find, the same is true in schools of stickleback fish making the decision about which leader to follow. Ward presented groups of three-spined sticklebacks with two fish replicas differing in characteristics, including size, fatness, shade, and spottiness, that reflect something about the health or fitness of the individual. For instance, a plump belly can indicate success in food gathering, while spots may indicate a parasitic infection.

He then ran trials in which one, two, four, or eight sticklebacks had to choose between two replica fish, one of which had been shown to be more attractive on the basis of the team's earlier studies. As group size increased, the fish made more accurate decisions, the researchers report,

better discriminating subtle differences in the replicas' appearances.

In the majority of trials, either all or all but one of the fish followed the more attractive leader, they found. But the consensus method sometimes led the fish astray. In a substantial minority of trials, all or all but one of the fish followed the less attractive leader—not quite reaching Condorcet's philosophical ideal.

A simple quorum rule, in which an animal's probability of committing to a particular option increases sharply when a threshold number of other individuals have committed to it, proved sufficient to explain the observations, suggesting that animals can make accurate decisions without the need for complicated comparisons of the information they possess.

"Our results show rather that submission to peers and occasional cascades of incorrect decisions can be explained as a by-product of what is usually accurate consensus decision-making," the researchers wrote. Indeed, Sumpter said, humans make the same types of errors.

"A good example here is the stock exchange," he said. "Just now there is a lot of discussion about traders unable to make their own assessment and panic selling because others are selling. In these instances, this behavior seems somewhat irrational. But in lots of other scenarios, such behavior is perfectly rational. Watching others and copying them if enough individuals seem to be doing the same thing is generally a good behavioral strategy."

Source: Cell Press

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