

Female fish judge males on DIY skills, study shows

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Stickleback. Credit: University of Leicester

Female fish judge males based on their ability to design nests best suited for the conditions of their environment, according to a new study by University of Leicester researchers.

In the study, which is published today, biologists at the University of Leicester, the Australian National University (ANU) and the University of Technology Sydney (UTS) have shown that low oxygen can change the way in which fish build nests, and also change the nesting preferences of female fish.

Male three-spined stickleback fish are unusual in that they build nests and provide all the parental care for the eggs, which are spawned by females, and for the developing baby fish.

The research team found that males change the design of their nests depending on the [oxygen content](#) of the water – making looser nests under low-oxygen conditions and more compact nests when oxygen increases.

"This makes sense, because male sticklebacks have to work really hard as dads, using their fins to fan water through the nest to supply the eggs with the oxygen they need to develop," said lead researcher, University of Leicester biologist Dr Iain Barber. "If the water is low in oxygen, then having a looser, more open nest allows more oxygen to reach the eggs, but it probably comes at the expense of increasing the risk of them being discovered by predators."

Fish are under threat from a wide range of man-made environmental changes, including global warming and pollution, and together these can lead to reduced [oxygen levels](#) in aquatic habitats.

In the worst cases this can lead to large-scale fish kills, but low oxygen can also affect critically important reproductive behaviours, with associated effects on the viability of fish populations and even implications for natural selection and evolution.

The research has shown that it was not just male construction that was affected when water oxygen levels changed. The most interesting finding was that female fish also changed their preferences for the design of nest they went for.

Female choices flipped from preferring tighter nests under high oxygen condition, to preferring looser nests when conditions deteriorated.

Dr Megan Head, who carried out the experiments in Leicester and now works at ANU, explains why this is so interesting: "What is really cool about this result is that females seem to have flexible preferences for the type of nest they preferred – they did not always choose a particular nest design, but they chose the nest that was best designed for the particular conditions they were experiencing at the time. Interestingly, this flexibility was limited to their nest preferences: females always chose the biggest, most vigorously courting males irrespective of the [oxygen](#) level."

These flexible nest preferences might give sticklebacks a real advantage in rapidly changing environments. One problem animals in degraded habitats often face is that the decisions they make are shaped by their evolutionary history, with the result that they end up making choices that are no longer beneficial under changed conditions. The fact that sticklebacks appear to be able to moderate their behaviour and their decision-making dependent on local conditions might mean they might

be able to cope better in degraded environments.

Dr Rebecca Fox, a marine biologist at UTS and co-author of the study, explains why this might be: "One reason that sticklebacks might have this ability, and why they may be so good at adapting to new environments, is that they have evolved under really changeable conditions. Originally sticklebacks were found only in the sea, but they have successfully colonised freshwaters around the world. The sticklebacks that we see in our lakes and rivers now are the descendants of fish that successfully made the transition from marine to freshwater, which presumably required them to be good at adapting to new conditions. This inbuilt behavioural 'plasticity' might also explain why sticklebacks do relatively well in degraded conditions'."

Sticklebacks are increasingly important models for studying evolutionary and behavioural biology, and in the UK they are often the first 'tiddlers' caught by children using nets and jam jars.

More information: Megan L. Head et al. Environmental change mediates mate choice for an extended phenotype, but not for mate quality, *Evolution* (2016). [DOI: 10.1111/evo.13091](https://doi.org/10.1111/evo.13091)

Provided by University of Leicester

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