How fish punish 'queue jumpers'

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Fish use the threat of punishment to keep would-be jumpers in the mating queue firmly in line and the social order stable, a new study led by Australian marine scientists has found.

Their discovery, which has implications for the whole animal kingdom including humans, has been hailed by some of the world's leading biologists as a "must read" scientific paper and published in the *Proceedings of the Royal Society of London Series B*.

Studying small goby fish at Lizard Island on Australia's Great Barrier Reef, Dr Marian Wong and colleagues from the ARC Centre of Excellence for Coral Reef Studies at James Cook University and, the Biological Station of Donana, Spain, have shown the threat of expulsion from the group acts as a powerful deterrent to keep subordinate fish from challenging those more dominant than themselves.

In fact the subordinate fish deliberately diet - or starve themselves - in order to remain smaller than their superiors and so present no threat that might lead to their being cast out, and perishing as a result.

"Many animals have social queues in which the smaller members wait their turn before they can mate. We wanted to find out how they maintain stability in a situation where you'd expect there would be a lot of competition," says Dr Wong.

In the case of the gobies, only the top male and top female mate, and all the other females have to wait their turn in a queue based on their size –

the fishy equivalent of the barnyard pecking order.

Dr Wong found that each fish has a size difference of about 5 per cent from the one above and the one below it in the queue. If the difference in size decreases below this threshold, a challenge is on as the junior fish tries to jump the mating queue – and the superior one responds by trying to drive it out of the group.

Her fascinating discovery is that, in order to avoid constant fights and keep the social order stable, the fish seem to accept the threat of punishment – and adjust their own size in order to avoid presenting a challenge to the one above them, she says.

“Social hierarchies are very stable in these fish and in practice challenges and expulsions are extremely rare – probably because expulsion from the group and the coral reef it occupies means almost certain death to the loser.

“It is clear the fish accept the threat of punishment and co-operate as a way of maintaining their social order – and that’s not so very different to how humans and other animals behave.”

Dr Wong said that experimentally it has always proved extremely difficult to demonstrate how higher animals, such as apes, use punishment to control subordinates and discourage anti-social activity because of the difficulty in observing and interpreting their behaviour.

In the case of the gobies the effect is much more apparent because they seek to maintain a particular size ratio relative to the fish above them in the queue, in order not to provoke a conflict.

“The gobies have shed new light on our understanding of how social stability is maintained in animals,” she says.

“While it not be accurate to draw a direct link between fish behaviour and specific human behaviour, it is clear there are general patterns of behaviour which apply to many higher life forms, ourselves included. These help us to understand why we do the things we do.”

Source: James Cook University