Fish fertilize eggs in their male relatives' nests

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Male cichlid fish sometimes fertilize eggs in nests belonging to one of their male relatives, a behaviour that is counter-intuitive yet ultimately beneficial, according to a study published in *BMC Biology*.

Researchers at Karl-Franzens-Universität Graz, Austria, investigated the behaviour known as cuckoldry in cichlid fish, whereby 'cuckolder' males mate with females that are already socially partnered to other males. The result is that males are not always the genetic fathers of their female partners' offspring. This is often thought to be an issue for the social partner of the mother, especially when he must subsequently care for offspring that are not all his own. The researchers found that 'cuckolder males' and the mother's social partner were, on average, more related than expected by chance.

Dr. Kristina Sefc, corresponding author of the study, said: "We found that the partnered male fish were often related to some 'cuckolder' males, who swoop in to fertilize some of the eggs. At first glance, this is evolutionarily puzzling because when males are related, we typically expect them to compete less with one another, not more. This 'banding together' of related males makes sense, however, when spawning events involve many males, including lots of unrelated males. Then, the male relatives essentially work together to compete against the host of unrelated males."

The researchers concluded that tolerating cuckoldry by a relative can sometimes make sense because when males are related they share a portion of their genes, and these genes have a chance to get passed on to

offspring regardless of which male does the fertilizing. Importantly, this extra cuckoldry by relatives can also reduce the number of offspring fathered by the rest of the unrelated males involved in the spawning event. Ultimately, both the original male and his related cuckolder can benefit.

Dr. Aneesh Bose, co-author of the study, said: "This study has the potential to change our contemporary view of cuckoldry and paternity loss. Paternity loss is widespread across the animal kingdom, but outside of animals that live in close-knit family groups, relatedness between males and their cuckolders is often assumed to be zero. Here, we show that males can be related to their cuckolders and it will be exciting to see how widespread this phenomenon is in other species."

The researchers combined theoretical modelling with a detailed genetic study on a socially monogamous cichlid fish, *Variabilichromis moorii*, a species in which both males and females perform parental care. They tested how closely related the male fish were to their cuckolders, in addition to other pairings, including females to cuckolders, and male-female social partners. The authors sampled offspring from 70 broods and were able to reconstruct 74 cuckolder genotypes.

The authors caution that the empirical portion of this study was conducted with one species of fish; therefore, further research is needed to establish whether the conclusions can be applied more broadly.

More information: Aneesh P. H. Bose et al, Inclusive fitness benefits mitigate costs of cuckoldry to socially paired males, *BMC Biology* (2019). DOI: 10.1186/s12915-018-0620-6

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