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Fast-fire moths are better jammers, but bats can outsmart them

It might seem that the odds are stacked against moth targets as a bat attacker swoops in. But on some occasions, the bat appears to lose focus at the final instant, 'narrowly missing its dinner', says Yohami Fernández from Wake Forest University, USA. Far from being defenceless bystanders, some tiger moths are able to produce many loud clicks at fast rates that are capable of jamming the echolocation signals of approaching bats to throw them off course. And in an alternative survival strategy, other species of tiger moths produce a smaller number of intermittent clicks to warn incoming bats that they might be in for a nasty-tasting surprise. Yet, no one knew whether there was a recognisable transition point from intermittent warning signals to fast-fire jamming clicks that could differentiate between moths that warn bats off and jammers. So, Fernández, Nicolas Dowdy and William Conner, also from Wake Forest University, simulated a range of moth clicks – from intermittent warnings to rapid-fire jamming signals – to find out whether there is a natural point in the moth clicking realm when warning clicks transition to jamming for better protection.

Fernández tempted three adult big brown bats (*Eptesicus fuscus*) with tethered greater wax moths (*Galleria mellonella*) that couldn't hear – so couldn't attempt evasive action – while playing simulated moth clicks, based on *Bertholdia trigona* sounds, ranging from slow intermittent warnings to machinegun-like jamming clicks. But, even when the simulated moth clicks were relatively intermittent, the bats were still unable to intercept some of the moths. There was no point at which the moth clicks transitioned from being exclusive warnings to disruptively jamming the bat's approach. 'Species cannot be unambiguously classified as moths that warn bats off or sonar jammers based solely on the amount of sound they produce', says Fernández, although the bats' success rates declined as the trains of moth clicks became more rapid. And when she recorded the bats' incoming calls, to find out whether the mammals modified their echolocation strategy in an effort to outwit the evasive jamming moths, she discovered that the bats lengthened the final trill as they closed in for the kill – known as the terminal buzz – in an attempt to outmanoeuvre the insects' jamming strategy.

However, when Fernández checked whether the bats increased the number of specialised echolocation calls – known as sonar sound groups, which they use when hunting in cluttered environments – to overcome the effects of jamming – she found they did not; they decreased. 'Perhaps reducing the number of sonar sound groups could be a strategy to decrease the amount of sound perceived by the jammed bat', she suggests.

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