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INSIDE JEB

Cuttlefish hear looming danger

Cuttlefish trying to catch live prawns enclosed between two Petri dishes. Photo credit: Jens Haga.

Imagine trying to get close to your dinner only for it to be swept aside by your approach; this is the scenario faced by aquatic creatures every day as they try to snap up a tasty morsel. 'It is impossible to eat something underwater without creating a hydrodynamic disturbance', says Maria Wilson from the University of Southern Denmark, describing how a predator's approach is heralded by a bow wave that arrives before the final slurp. Explaining that the surge of water produces low-pitched (low-frequency) vibrations, Wilson and her colleagues, Jens Haga and Hans Erik Karlsen from the University of Oslo, Norway, wondered whether cuttlefish – the preferred delicacy of many large aquatic predators – might keep an ear out for the approaching attack, and, if so, in which direction they would swim to evade the predator.

Wilson explains that cuttlefish ears – statocysts – which are buried in their heads, are fine tuned to low-pitched sounds and could allow the animals to sense the vibrations that herald an attack in dim and cloudy conditions. So, she and Karlsen decided to test the cuttlefish's reactions to low-frequency vibrations in a tank. However, with their sensitive vision and sensors that detect water flow over the skin, cuttlefish are easily startled, so the team used a specialised tank designed by Karlsen to make sure that the animals were not side-tracked by other distractions. In addition, Wilson made sure that the environment remained calm, in case the animals released ink into the water. 'When that happened, we had to remove the cuttlefish and clean everything', says Wilson, who even took a shot of ink in the face on one occasion: 'Almost as if it did it on purpose', she laughs.

Having settled individual cuttlefish in the tank, Wilson, Karlsen and Haga simulated a predator's approach and the sucking attack with vibrations generated by shakers on the side of the tank in light and dark conditions. Filming the cuttlefish's responses as the vibrations washed over the animals, the team could see that the cuttlefish were aware of the disturbance as they changed the patterns on their skin. And when the cuttlefish encountered the vibrations simulating a predator's approach, they turned to flee in the same direction that the bow wave was travelling, regardless of whether the lights were on or off.

However, when the cuttlefish were startled by a pressure wave simulating the final suck as the predator struck, the cuttlefish again moved in the same direction as the flowing water, '[which] would move the cuttlefish directly into the mouth of the predator!' says Wilson. Although she was initially surprised by the counterintuitive behaviour, Wilson suspects that in real life the animals may have already taken evasive action before they sensed the impending slurp.

The team also tried to distract the hungry cuttlefish with a movie of tasty shrimp. 'They only had to see the video once and when the screen went black, they would … just wait for the show to start again', recalls Wilson. In fact, the cuttlefish were so engaged by the prospect of food that the team had to turn up the shakers, producing the simulated attack to get the animal's attention.

So, cuttlefish depend on their ears to evade an approaching attack and Wilson is concerned that the fog of low-pitched noise produced by shipping may mask bow wave warning signals, leaving cuttlefish vulnerable to predators that they currently outwit.

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