Video evidence: Japanese eels escape from their predator's stomach

September 9 2024

Odontobutis obscura. Credit: Wikimedia Commons Totti Creative Commons Attribution-Share Alike 4.0 International license.

Many prey species have defensive tactics to escape being eaten by their would-be predators. But a study published in *Current Biology* on September 9, 2024 has taken it to another level by offering the first video evidence of juvenile Japanese eels escaping after being swallowed into the stomachs of their fish predators.

With the aid of X-ray videography, they found that the eels back their way out, first inserting the tips of their tails through the esophagus and gills before pulling their heads free.

"We have discovered a unique defensive tactic of juvenile Japanese eels using an X-ray video system: they escape from the predator's stomach by moving back up the digestive tract towards the gills after being captured by the predatory fish," said Yuuki Kawabata of Nagasaki University in Japan. "This study is the first to observe the behavioral patterns and escape processes of prey within the digestive tract of predators."

In an earlier study, the researchers including Kawabata and Yuha Hasegawa had shown that Japanese eels can escape from the gill of their predator after capture. What they didn't know was how.

"We had no understanding of their escape routes and behavioral patterns during the escape because it occurred inside the predator's body," Hasegawa says.

In the new study, they found a way to see inside the predatory fish (Odontobutis obscura) using an X-ray videography device. To visualize the eel after it had been eaten, they had to first inject them with a contrast agent. It still took the team a year to capture convincing video evidence showing the escape process involved.

Their videos show that all 32 captured eels had at least part of their bodies swallowed into the stomach of their fish predators. After being

swallowed, all but four tried to escape by going back through the digestive tract toward the esophagus and gills, they report. Of those, 13 managed to get their tails out of the fish gill, and nine successfully escaped through the gills. On average, it took the escaping eels about 56 seconds to free themselves from the predator's gills.

"The most surprising moment in this study was when we observed the first footage of eels escaping by going back up the digestive tract toward the gill of the predatory fish," Kawabata says.

"At the beginning of the experiment, we speculated that eels would escape directly from the predator's mouth to the gill. However, contrary to our expectations, witnessing the eels' desperate escape from the predator's stomach to the gills was truly astonishing for us."

Further study found that, despite the similarities, the eels didn't always rely on the same escape route through the gill cleft. Some of them also circled along the stomach, seemingly in search of a way out.

The findings are the first to show that the eel Anguilla japonica can use a specific behavior to escape from the stomach and gill of its predator after being eaten. It's also the first time any study has captured the behaviors of any prey inside the digestive tract of its predator, according to the researchers.

The researchers say that the X-ray methods used in the study can now be applied to observations of other predator-prey behaviors. In future work, they hope to learn more about the characteristics that make for a successful escape by the eels.

More information: How Japanese eels escape from the stomach of a predatory fish, *Current Biology* (2024). DOI: 10.1016/j.cub.2024.07.023. www.cell.com/current-biology/f … 0960-9822(24)00926-6

Provided by Cell Press