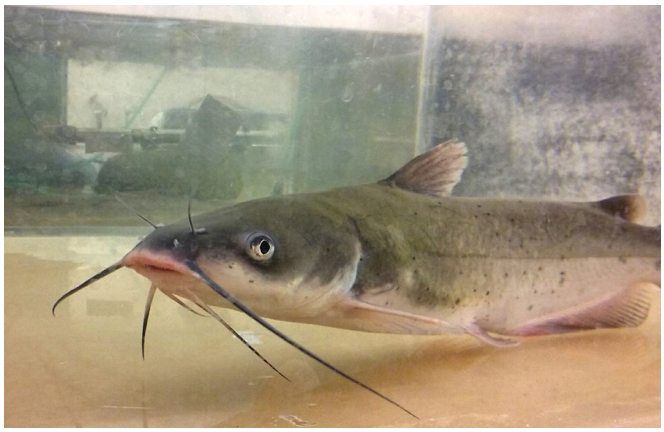
INSIDE JEB

Catfish keep head flat when gulping



Channel catfish. Photo credit: Aaron Olsen.

Compared with the monotonous chomping of mammal jaws, the expansive gape used by fish as they slurp in food is quite miraculous. ‘It’s a very cool and intricate behaviour’, says Ariel Camp from the University of Liverpool, UK, describing how the animals protrude their lips as they fling their jaws wide. Many fish use the forceful muscles packed along the trunk of their bodies to power the expansive mouth movement, pulling the top of the skull upward with the muscles along the back while rotating the lower jaw down with muscles on the belly side. However, catfish don’t seem to lift the top of their heads when gulping down lunch, which made Patricia Hernandez, at George Washington University, USA, Aaron Olsen and Elizabeth Brainerd, from Brown University, USA, and Camp wonder how much of a role the powerful trunk muscles might play in the process. ‘We wanted to know if catfish only use one of their two big body muscles to powerfully suck up food and if this meant they were limited to less powerful food sucking than other fish’, says Camp.

But getting to grips with the fine detail of how three channel catfish, *Ictalurus punctatus*, manoeuvre their jaws in front of an X-ray camera required enormous patience. ‘We tried to train the catfish by always feeding them in the part of the tank where they needed to be for filming’, recalls Camp, adding with a chuckle, ‘but the fish all had their own little personalities; we just had to wait until they were in the mood for food’. In addition, the team had to position minute metal markers on various jaw bones to track their movements, and within the upper and lower body muscles to monitor muscle shortening as they contracted. ‘We hadn’t done that on this species before, so it was tricky’, says Camp, who then filmed the fish dining, with the help of Hernandez.

However, when Olsen painstakingly tracked the movements of each jaw bone and Camp reassembled them in a 3D animation of the manoeuvre, the team was astonished to see that instead of moving upward, the fish’s head usually stayed in place and on one occasion it even moved down, ‘which is not how we normally expect fish to move their heads and backbones during feeding’, exclaims Camp. Most surprisingly, the fish’s back muscles did not shorten at all. However, the muscles along the belly side of the fish did shorten by up to 8%, rotating the fish’s shoulder bones to fling open the bottom jaw. And when the team compared the suction inside the catfish’s mouths as they threw their jaws wide, it was every bit as strong as the suction produced by similarly sized bass.

So what are the back muscles doing if they aren’t actively contracting to contribute to the catfish’s powerful slurp? Camp suspects that they hold the fish’s head in place while the lower body muscles yank the jaw open. ‘We think the epaxial [back] muscles may be generating force to prevent the head from moving relative to the body, the same way you’d use your arm muscles to hold a heavy bag of groceries. The muscles aren’t shortening, but they’re still exerting force’, says Camp. The team also suspects that holding the skull in place could help the bottom-feeding fish to position their mouths above a tasty morsel.

‘Fish have different ways of using their big body muscles to help them eat’, says Camp, and she and her colleagues are eager to find out whether other fish with similar body shapes use the catfish’s alternative guzzling strategy.

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