

Fishes that hold their breath?

Among humans, underwater breath-holding is a subject of widespread fascination from an early age. Children, including myself and my friends in primary school, frequently challenge each other to see who can hold their breath the longest. Among adults, breath-holding is central to the sport of free-diving, with competitions regularly held around the world and winners recognized in the Guinness World Records book. The current men's and women's record holders, Tom Sietas and Karoline Meyer, can respectively hold their breath for an astonishing 22 min, 22 s and 18 min, 33 s! These breath-holding competitions are mostly held underwater, in part because of the mammalian dive reflex, a taxonomically widespread physiological response in which a mammal's capacity for breath-holding is increased via heart rate reduction and redirected blood flow.

Among mammals, the reason for a specialized ability to hold one's breath in water is obvious – we lack the ability to breath underwater – but why would a fish need to hold its breath underwater? In this issue of JFB, coauthors Nicholas Philip Long and Stacey C. Farina (2019) describe a remarkable behavior in which members of the deep-sea coffinfish family Chaunacidae hold their breath for as long as 245 s, during which their buccal and gill cavities are greatly expanded, dramatically altering their appearance. Long and Farina use 10 in situ, publicly available videos of chaunacids recorded by ROVs, and delve into the morphological underpinnings of this behavior via x-ray CT scans.

In answer to the question of why chaunacids hold their breath, Long and Farina see no shortage of potential reasons. As ambush predators, chaunacids might reduce their chances of detection by prey or other predators by minimizing respiratory movement. Moreover, breath-holding may increase chaunacids' own ability to detect prey and predators by minimizing respiratory interference with their lateral line canal, which in chaunacids features an enlarged branch that runs along the surface of their gill chambers. Breath-holding is also

consistent with a more widespread pattern among deep-sea organisms of minimizing metabolic demand and thereby increasing survival in a cold, dark and vast habitat where food is scarce and hard to find. Finally, Long and Farina suggest that the body enlargement accomplished by chaunacids via breath-holding may function to intimidate predators or otherwise inhibit predation in a manner similar to that of pufferfishes (Tetraodontidae) and swellsharks (Scyliorhinidae), despite the mechanisms of inflation being different in each of these groups.

So, as summer begins to take-hold throughout the northern hemisphere and many of you seek out the the nearest pool or beach, tell your friends and family about the coffinfishes that hold their breath. Check out too the excellent videos that Long and Farina include as supplements to their article. Breath-holding is just one of many bizarre characteristics of chaunacids, and these videos provide a rare opportunity to see these fascinating fishes alive in their natural habitat.

Nathan K. Lujan
(Associate Editor)

REFERENCE

Long, N. P., & Farina, S. C. (2019). Enormous gill chambers of deep-sea coffinfishes (Lophiiformes: Chaunacidae) support unique ventilatory specialisations such as breath holding and extreme inflation. *Journal of Fish Biology*. <https://doi.org/10.1111/jfb.14003>

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