New study shows mechanisms of hagfish burrowing into deep sea sediment

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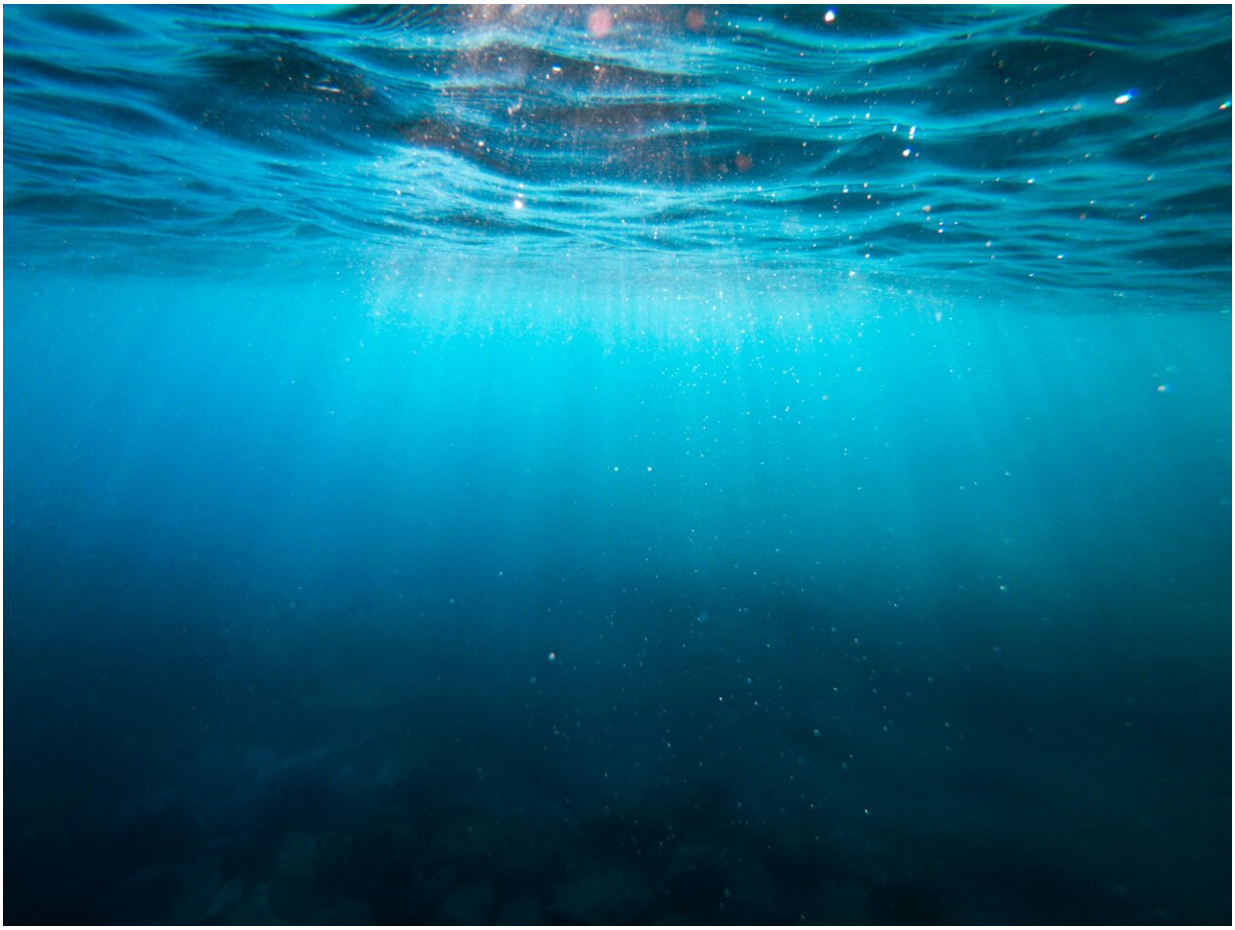

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Scientists at the Schmid College of Science and Technology at Chapman

University developed a novel way to observe the elusive burrowing behavior of hagfish. Dr. Douglas S Fudge and his team created a specialized tank of transparent gelatin in order to visualize how the hagfish behave and locomote within sediments.

Hagfish are bottom-dwelling marine animals that are capable of producing startling amounts of defensive slime when they are provoked. Understanding the burrowing activities of hagfish could lead to increased knowledge of sediment turnover in marine benthic habitats, new insights into the reproductive behavior of hagfish or even inspiration for the design of burrowing robots.

The new research, "Biphasic burrowing in Atlantic hagfish" published June 17 in *The Journal of Experimental Biology* builds upon Fudge's previous work with hagfish. Until now, how hagfish create burrows, how they move within them, and the final structure of the burrows have been enigmatic because the opacity of sediment obscures a clear view.

The scientists discovered that hagfish create a u-shaped burrow by utilizing a 'thrash' phase with vigorous swimming coupled with side- to-side head movements followed by a 'wriggle' phase that continues until the head of the hagfish pops up out of the substrate. They found that the wriggle phase seems to be powered by a burrowing strategy known as "internal concertina," which is also used by a specialized group of burrowing snakes and a group of burrowing amphibians known as caecilians.

"For a long time we've known that hagfishes can burrow into soft sediments, but we had no idea how they do it. By figuring out how to get hagfish to voluntarily burrow into transparent gelatin, we were able to get the first ever look at this process."

Fudge's research could have wide-ranging ecological implications.

Hagfish burrowing likely has important effects on sediment turnover, and, through ventilation of their burrows, on the redox chemistry of the sediment. Sediment near a hagfish burrow that might otherwise be anoxic might contain substantial amounts of oxygen, thus altering the kinds of organisms that can live there.

More information: Douglas S. Fudge et al, Biphasic burrowing in Atlantic hagfish (Myxine limosa), *Journal of Experimental Biology* (2024). DOI: 10.1242/jeb.247544

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