Tadpoles create their own air bubbles to breathe

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A comparison of bubble-sucking and breach-breathing. (a) Hyla versicolor (Hylidae) showing attachment to the water's undersurface via the oral disc, which is formed into a circular cup. Although air is drawn into the mouth, the surface tension is not broken. (b) Rana clamitans (Ranidae). This large, 2nd year tadpole has no trouble breaking through the surface to draw gaseous air directly into the

buccal cavity. Not to scale. Credit: *Proceedings of the Royal Society B: Biological Sciences* (2020). DOI: 10.1098/rspb.2019.2704

A pair of researchers at the University of Connecticut, has found that hatchling tadpoles create their own air bubbles in order to breathe. In their paper published in *Proceedings of the Royal Society B*, Kurt Schwenk and Jackson Phillips describe their study of tadpoles in a tank of water and what they learned about them.

Tadpoles are, of course, frog larvae—they look similar to large-headed fish, and even have gills. But their gills are not developed enough to provide them with enough air to survive. Because of that, tadpoles must swim to the surface periodically and breathe in some air. In this new effort, Schwenk and Phillips discovered that during their first few days after hatching, tadpoles lack the strength to break the surface of the water, preventing them from getting enough air, and have developed a novel way to get the air they need.

After noticing the youngest tadpoles behaving differently than their older tank mates, the researchers set up high-speed cameras to find out what they were doing. Review of the action in slow motion showed that the youngest tadpoles were using a previously unknown technique to pull in air from the surface.

The technique involved swimming to the surface, opening the mouth wide, and sucking on the underside of the surface—similar to a person sucking on a window. The sucking action pulled the surface of the water lower and into the mouth of the tadpole, forming a partial bubble. The tadpole then snapped its mouth shut, trapping a full bubble of air in its mouth. It then used muscles in its mouth to push air in the bubble into its lungs.

The researchers also discovered that because the capacity of the mouth was bigger than the lungs, the tadpole would expel the remaining air as a small bubble, leaving it to float up and remain on the surface of the water for a period of time. Multiple tadpoles engaging in the same behavior led to the formation of a small island of bubbles of the type that can often be seen on frog ponds. The researchers found that the tadpoles refined their technique over time as they aged, eventually forming double bubbles in quick succession, making the process more efficient.

More information: Kurt Schwenk et al. Circumventing surface tension: tadpoles suck bubbles to breathe air, *Proceedings of the Royal Society B: Biological Sciences* (2020). DOI: 10.1098/rspb.2019.2704