

Devils Hole pupfish found to be a lot younger than thought

January 27 2016, by Bob Yirka



Photo Credit: Olin Feuerbacher

Devils Hole pupfish (*Cyprinodon diabolis*). Credit: Olin Feuerbacher, USFWS / Wikipedia

(Phys.org)—A team of researchers from several institutions in the U.S. has found evidence that suggests that pupfish living in Devils Hole are not nearly as ancient as has been previously assumed. In their paper published in the journal *Proceedings of the Royal Society B*, the team describes a genetic study they conducted on the fish and others that are related to them, and what they found as a result.

The existence of small, goldfish sized, dark blue fish living in a water filled fissure in the Mojave Desert has led to many theories regarding how they got there and how they have survived. For many years, the consensus has been that they got there due to flooding during the Pleistocene epoch, approximately 10 to 20,000 years ago. How they managed to survive for so long in such a remote, small and hot environment has been a mystery. But now, new evidence suggests that the pupfish may not have been living in the Hole for nearly that long.

Prior research has shown that the pupfish are a unique species—with features that are unique to them alone among pupfish, such as the lack of a dorsal fin, bigger eyes and darker scales. To learn more about the origins of the species, which scientists have described as having the smallest range of any vertebrate on Earth, the group conducted a genetic analysis of 56 pupfish from around the Death Valley area (including one of the pupfish from Devils Hole which was found dead) and other parts of the world, sequencing over 13,000 different stretches of DNA—a process that allowed them to create a family tree. To gauge the historical age of the pupfish from Devils Hole, the team averaged the rate of gene mutations in its cousins. Doing so showed that the fish likely first inhabited their isolated environment approximately 105 to 830 years ago and then evolved very quickly to allow them to survive.

The researchers did not find any evidence that might explain how the fish got there during that time frame, but suggest it is possible that people living in the area put them there as a means of maintaining a food

source in the desert, or perhaps birds carried [fish](#) eggs from other, less remote water sources.

More information: Christopher H. Martin et al. Diabolical survival in Death Valley: recent pupfish colonization, gene flow and genetic assimilation in the smallest species range on earth, *Proceedings of the Royal Society B: Biological Sciences* (2016). [DOI: 10.1098/rspb.2015.2334](#)

Abstract

One of the most endangered vertebrates, the Devils Hole pupfish *Cyprinodon diabolis*, survives in a nearly impossible environment: a narrow subterranean fissure in the hottest desert on earth, Death Valley. This species became a conservation icon after a landmark 1976 US Supreme Court case affirming federal groundwater rights to its unique habitat. However, one outstanding question about this species remains unresolved: how long has *diabolis* persisted in this hellish environment? We used next-generation sequencing of over 13 000 loci to infer the demographic history of pupfishes in Death Valley. Instead of relicts isolated 2–3 Myr ago throughout repeated flooding of the entire region by inland seas as currently believed, we present evidence for frequent gene flow among Death Valley pupfish species and divergence after the most recent flooding 13 kyr ago. We estimate that Devils Hole was colonized by pupfish between 105 and 830 years ago, followed by genetic assimilation of pelvic fin loss and recent gene flow into neighbouring spring systems. Our results provide a new perspective on an iconic endangered species using the latest population genomic methods and support an emerging consensus that timescales for speciation are overestimated in many groups of rapidly evolving species.

Citation: Devils Hole pupfish found to be a lot younger than thought (2016, January 27) retrieved 9 April 2024 from <https://phys.org/news/2016-01-devils-hole-pupfish-lot-younger.html>

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