

## Male fish dig pits and build sand castles at the bottom of Lake Malawi to attract females

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New research shows that courtship rituals evolve very fast in cichlid fish in Lake Malawi. Whenever species evolve to feed at different depths, their courtship evolves as well. In the shallows where the light is good, males build sand castles to attract females. Males of deep-dwelling species dig less elaborate pits and compensate with longer swimming displays. The results are published in the open-access journal *Frontiers in Ecology and Evolution*.

"Lake Malawi cichlids are famous for the diversity and fast evolution of their feeding habits, body form, and sex determination system," says Ryan York, a graduate student at Stanford University and lead author of the study. "Here we show for the first time that their <u>courtship rituals</u> also evolve exceptionally fast."

The researchers made a DNA-based "family tree" for 75 <u>species</u> (out of over 500) of Lake Malawi cichlids, noting for each whether males build castles or dig pits. The tree looks like a messy patchwork: the closest relatives of species with castle-building males often have pit-digging males, and vice versa. York and colleagues conclude that individual species have repeatedly moved back and forth between castle building and pit digging during cichlid evolution.

Lake Malawi is approximately 5 million years old, which means that all evolutionary changes in the cichlids' ecology—including courtship behavior—have happened within this extremely short period.



The evolution of cichlid courtship seems to be driven by shifts in the average depth at which each species feeds. Castles require more effort to build but are more striking to females in clear, shallow waters. In species that live at greater depth where light is scarce, castle building does not pay off.

In support of their theory, the researchers show that castle-building species live at an average depth of 15 meters in Lake Malawi, compared to 30 meters for pit-digging species.

The body of pit-diggers is likewise better suited for living at greater depths. For example, females and males of pit-digging species can extend their upper jaw further towards prey, allowing them to catch fast-moving animal plankton on the murky lake bottom. Their retina is less able to detect UV light—a wavelength that is too short to reach the depths.

Digging pits takes less effort than building castles, and pit-digging males seem to use the time and energy saved to good effect. Studying courtship in one castle-building and one pit-digging species in detail inside aquaria, the researchers found that males of the latter invest twice as much time in display behavior, for example swimming towards females or extending their fins and gill cover to look larger.

Pits and castles are only used during <u>courtship</u> and mating, and have no other function. If a female likes what she sees, she lays her eggs inside the pit or castle, to be fertilized by the male. She then keeps them in her mouth for several weeks, never eating until they hatch.

**More information:** Evolution of bower building in Lake Malawi cichlid fish: Phylogeny, morphology, and behavior, *Frontiers in Ecology and Evolution*, journal.frontiersin.org/articl ... fevo.2015.00018/full



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