

When nature calls: Biologists unlock chemical clues to courtship in swordtail urine

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When you've got to go, you've got to go -- upstream, that is, if you are a male swordtail fish seeking a mate, according to research from Texas A&M University.

A recent study led by Texas A&M biologists Dr. Gil Rosenthal and Dr. Heidi Fisher in collaboration with scientists at Centro de Investigaciones Cientificas de las Huastecas in Hidalgo, Mexico, and Boston University has determined that the fish use chemical cues in their urine to elicit sexual responses from their downstream female counterparts.

In a study funded by the National Science Foundation and the American Livebearer Association, Rosenthal and his team found that male swordtail fish strategically release pheromone-packed urine in the presence of females as a display of courtship, indicating that they have evolved a temporal and spatial control of their pheromone release. The findings, which are featured in the current issue of the journal "*Public Library of Science (PLoS) ONE*," contradict previous assumptions that male pheromones in fish are passively released, given that most fish lack specialized scent glands or scent-marking behavior.

"We showed that male swordtail fish use chemicals in the urine as mating signals," Rosenthal says. "There's been relatively little work on how pheromones shape the lives of aquatic creatures."

The team studied wild-caught swordtail adults from the Rio Atempa in Huitznopala, Mexico, to determine whether females were attracted by

passively produced cues or to pheromones as a form of communication. Using fluorescein dye injections to visualize urine release inside an aquarium, the researchers were able to determine that male swordtails relieved themselves more frequently in the presence and proximity of females than when females were absent altogether. In the wild, males court females in much the same way, but by swimming further upstream to ensure their scent is detected in the current by the females downstream.

"Our findings show that aquatic species and vertebrates, in particular, can have fine control over their release of chemical cues in the same manner as mammals that mark their territories or advertise their reproductive state, for example," says Fisher, a former postdoctoral researcher in Rosenthal's laboratory who is now with the Department of Organismic and Evolutionary Biology at Harvard University.

Rosenthal notes that swordtail [fish](#) are considered an important model system in animal communication and are widely used in female mate-choice research. While numerous studies have addressed the role of cues in swordtails — from olfactory to visual — he says none previously have addressed exactly how and when chemical cues are released.

Rosenthal adds that studying the chemical signals of swordtails is vital not only to understanding how they and similar species communicate, but also because the information could be indicative of several environmental factors that could prove useful in the future. For example, he says, any amount of pollution might disrupt the communication within a species, thereby interfering with the courting and [mating](#) process and ultimately affecting the population.

To scientists like Rosenthal, these underwater [chemical cues](#) can serve as the proverbial "canary in the coal mine."

"Because these chemicals are rich in information and because they're transmitted through the water at very low concentrations, any change in the environment has the potential to shut down communication," he explains. "The silver lining is that we might be able to use communication behavior as a bioassay that local communities can use to detect pollutants in the water."

More information: To learn more about Rosenthal's lab and their work with swordtail fish, visit swordtail.tamu.edu/en/index.html

Provided by Texas A&M University

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