

# Your Pond or Mine?

Confusion reigns when froggy goes a-courtin'

By CAROL EZZELL

It's a warm Saturday night in July, and things are literally hopping down at the pond. Hordes of male gray tree frogs have gathered at the water's edge, belting out guttural trills that fill the air with songs of frog love.

Seduced by the dulcet tones, female frogs — their eggs ripe for fertilization — descend from the trees around midnight for their once-yearly night of romance. Each selects a male and pulls him onto her back in a mating clasp called amplexus. But instead of lingering to luxuriate in the embrace and release her eggs, she immediately hops away — with her lover still clinging — in search of a more perfect pond for pairing.

Why, after being dragged around season after season for millennia, haven't the species' males evolved to call from sites that better suit the females?

Ecologists who study the gray tree frog, *Hyla chrysoscelis*, have long been stumped by this odd gender gap. Although the phenomenon remains unresolved, new research shows that males and females of this nonterritorial species have somewhat different criteria for what constitutes the ultimate love puddle.

William J. Resetarits Jr. and Henry M. Wilbur of Duke University in Durham, N.C., began studying the species' disjointed breeding behavior in 1985. As population ecologists, they sought to discover whether opposing natural forces kept the males and females out of sync.

"We want to understand how ecology affects the behavior of organisms," says Resetarits, now at the University of Missouri-St. Louis. "We're really interested not only in the behavior of individual species, but what effect their behavior may have on the community."

In the June *ECOLOGY*, Wilbur, now at the University of Virginia in Charlottesville, and Resetarits report the results of 52 long, sweaty summer nights spent in the woods of North Carolina, monitoring the frogs' mating quirks at 45 pseudo-ponds.

The study's design garnered praise from their colleagues but raised some eyebrows at the local toy store. To make the test ponds, Resetarits

and Wilbur bought 45 blue plastic wading pools, complete with green printed turtles. They arranged the kiddie pools in five circles of nine, scattering them at least 65 feet apart throughout the forest of the Duke Zoology Field Station. (Wilbur had devised the pattern to allow a rigorous statistical analysis.) They filled the pools with tap water, left them in the sun for a day to allow the chlorine to evaporate, and then dumped in several shovelfuls of dried leaf litter collected from a nearby natural pond. The researchers wanted their pools to mimic the conditions of small, rain-filled temporary ponds — such as truck-tire tracks and animal burrows — already known as popular pickup spots for gray tree frogs.

They also gathered members of six animal species known to prey on or compete with *H. chrysoscelis* eggs or young frogs: adult newts, adult black-banded sunfish, larval spotted salamanders, larval dragonflies, bullfrog tadpoles and *H. chrysoscelis* tadpoles. In every circle, the researchers added a different species to each of six pools and left three pools empty as controls. Then, they observed a season's love-play.

Resetarits and Wilbur discovered that, for unknown reasons, male gray tree frogs avoided calling from pools containing either sunfish or *H. chrysoscelis* tadpoles. Females avoided mating and releasing eggs in those pools, but they also stayed away from pools containing larval salamanders. In addition, the researchers noted that males began calling shortly after dusk, whereas females seldom came down to mate before midnight.

Although males called 409 times during the study and females released eggs 109 times, the two events occurred at the same pool only 50 times — much less often than Resetarits and Wilbur had predicted. They attribute this to differences in male and female preferences regarding the best time and place to mate.



Eggs of the gray tree frog. During amplexus, the male deposits sperm on the eggs as the female lays them. Hours later, the protective jelly firms, shielding the developing embryos until they hatch as tadpoles.

John E. Faugh/Denison Univ.

Sizing up a mating site seems as important to these frogs as sizing up a mate. "If only breeding factors had a selective force, you would expect the male and female behaviors to be very tightly coupled to avoid waste in time, energy and exposure to predation," says Resetarits. Instead, "there are many more factors that are influencing selection [of a breeding site] than those that are directly related to reproduction. . . . The reproductive choice is a compromise between all of these competing forces."

In most animal species, males try to mate with as many females as possible, which increases their chances of passing on their genes to subsequent generations. Females, limited in the number of offspring they can produce, usually try to mate with the healthiest or largest male, giving their relatively few descendants the best possible chance of inheriting survival advantages.

But in the case of gray tree frogs, environmental factors appear tantamount to these basic drives, say Resetarits and Wilbur. Female tree frogs seem most concerned with releasing their eggs where the resulting tadpoles are least likely to be eaten or to face stiff competition for food. And male tree frogs end up reducing their breeding opportunities by stationing themselves away from such places.

The males' behavior could result from attempts to avoid contact with other, more dominant males, speculates David E. McCauley, an ecologist who studies insect mating behavior at Vanderbilt University in Nashville. "There's still a possibility that males are prevented from doing the most optimal behavior in terms of finding a mate because they are being excluded by other males," he says.

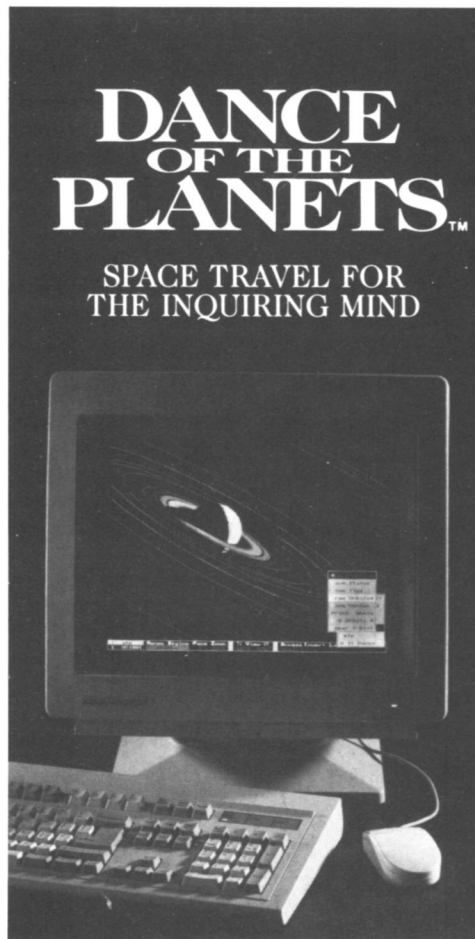
But Resetarits points out that in earlier studies involving a similar species of tree frog, males did not respond to the presence of other males by moving to less popular calling sites. In those studies, males called from their preferred sites no matter how many others were present.

**M**ost researchers investigating the motives behind mating habits have considered only the interaction between isolated males and females, McCauley says. "The ecology side of the equation has been downplayed," he contends. But the new work "puts some ecology into the study of mating systems. I think the observation that males and females are doing such different things is surprising enough that it should be of interest to people studying mating systems in general. I think it's a pretty important finding."

McCauley notes that, on average, male frogs called on 27 nights during the study period, even though they could have mated just as often if they had called on only four of those nights, according to the Duke team's statistical analysis. This means that on 23 nights, the males needlessly expended the energy to climb down from the trees to call — a risky move, since it made them more obvious and accessible to predators.

McCauley is particularly intrigued that on any given night, more than half the males serenaded from ponds where no females ever showed up. "I was quite surprised," he says. "The males were rarely at the right place at the right time, regardless of what was in the pond."

"The males just weren't very good at finding mates," he concludes.



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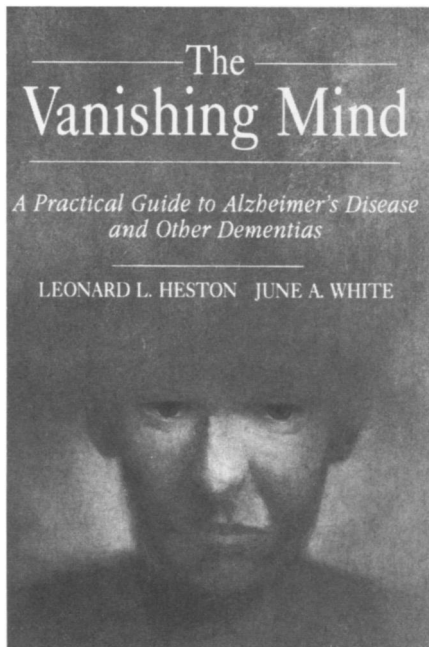
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