

## RESEARCH

Dismissed by many as mere “drainfish”, guppies have long been held in high esteem by the global scientific community for their ability to reveal insights into many aspects of biology – from medicine and genetics to evolution and ecology.

A new study in the prestigious journal, *Ecology*, represents yet another example of how research on Trinidad’s humble guppy can provide valuable insights towards answering important questions. In this case: Why do some introduced species succeed where most fail? How can a species successfully invade in one location yet fail in another?

These questions are pressing ones as invasive species are one of the greatest threats to biodiversity, causing devastating economic as well as ecological damage across the globe.

The guppy (*Poecilia reticulata*) is native here in Trinidad and Tobago, but is a notorious invasive species outside of its natural habitat. Once established, guppies can cause damage to ecosystems by outcompeting native species for food and space and, in some cases, eating their eggs and young. Thanks to its popularity as a pet and as a mosquito control agent, it enjoys an introduced range that spans six continents and more than 70 countries.

Despite this remarkable success, there are notable places where guppies seem unable to establish despite ample opportunity. One such anomaly is Florida.

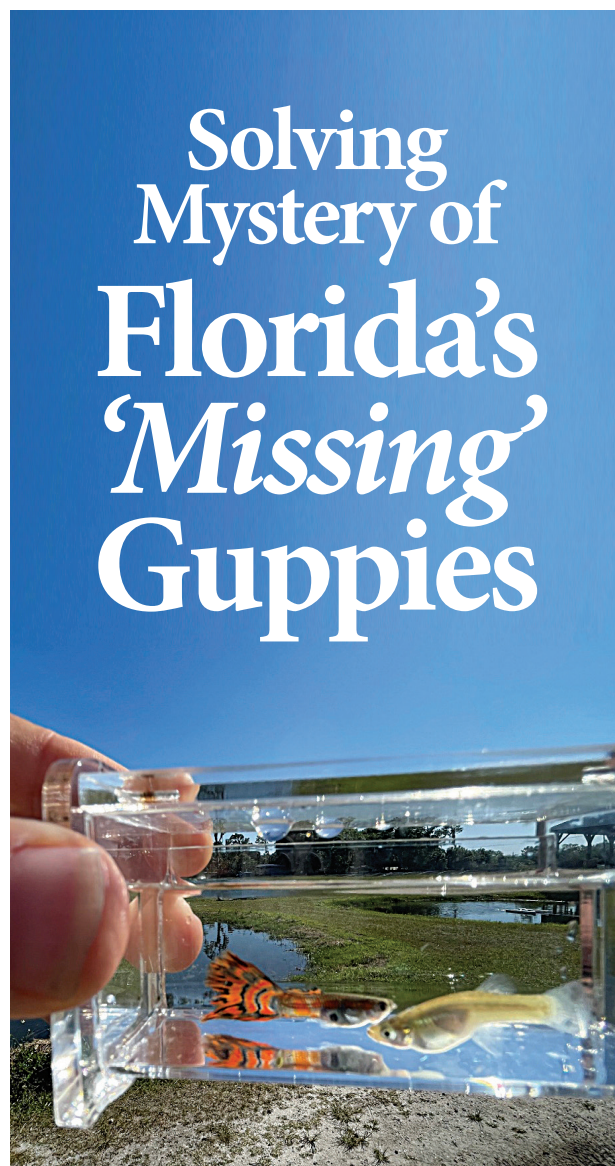
Guppies have been bred commercially in outdoor ponds in Southern Florida for decades, with frequent escape opportunities, and they should be well-suited to the climate. What’s more, Florida is famously susceptible to invasion by tropical invasive freshwater fish. Thus, the persistent absence of guppies from Florida’s waterways has long represented a puzzle to fish experts.

A team, led by Dr Quenton Tuckett from the University of Florida’s Tropical Aquaculture Laboratory (an expert on non-native fish) and Dr Amy Deacon of The UWI’s Department of Life Sciences (an expert on guppies), set out to solve this mystery.

Dr Deacon explained: “We recreated typical ditch habitats in artificial containers, and followed the fate of introduced guppies under various conditions.”

The results confirmed the suspicions of many – that one of Florida’s native fish species, the mosquitofish (*Gambusia holbrooki*) provides “biotic resistance” – in other words, the presence of mosquitofish prevented guppy establishment. “Guppies thrived in the containers when on their own, but always failed in the presence of even low densities of mosquitofish,” reported Dr Deacon.

The team then tried to get to the bottom of precisely *how* the mosquitofish were impacting the guppies so dramatically by observing the behaviour



The battle of the drainfishes: although exceptionally good at establishing in places outside of Trinidad, our guppies (above) have failed to colonise Florida thanks to small but aggressive native mosquitofish (below). PHOTO: QUENTON TUCKETT

## Solving Mystery of Florida’s ‘Missing’ Guppies

of the two species in aquarium tanks in the laboratory.

These trials revealed that mosquitofish were extremely aggressive towards adult guppies, causing serious fin damage.

Further experiments demonstrated that mosquitofish readily consumed young guppies, preventing population growth. Interestingly, guppies also fed on mosquitofish fry, but their smaller mouths meant that young mosquitofish quickly grew too large to be eaten.

These findings are consistent with predictions based on this ecological theory: two species that prey upon each other are unlikely to be able to coexist for very long as one will always have the edge and eventually force the other out. However, this is the first time that biotic resistance between two strongly-interacting species has actually been demonstrated to be the cause of a failed invasion.

A huge amount of effort goes into studying successful invaders, what allows them to succeed and how we can minimise the damage they cause. In contrast, failed introductions, despite being much more common, are rarely studied or even documented. “These failed introductions often go unnoticed, yet they offer valuable insights into what determines the success of an introduction,” explains lead author Dr Tuckett.

In this case, the guppy’s failed attempt to put down roots in Florida shows us that species’ interactions can sometimes be more critical to invasion success than more commonly considered factors, such as a suitable climate or the number of fish released. And, rather than being unique, the guppy-mosquitofish system may be just one of many where this is the case.

In Florida, where invasive species cost the state US\$45 million per year, this work has immediate implications for invasive species management. Dr Tuckett says, “[A]lthough highly invasive on paper, the reality seems to be that guppies pose very little threat to places like Florida where another species consistently prevents their establishment.”

Dr Deacon adds, “It is exciting to discover yet another way in which Trinidad’s guppies can offer vital insights into real world problems.” She expects that this work will encourage invasion biologists and policy makers to consider how a potential invader might interact with the native fish community and how this impacts the level of risk posed.

“In some instances, it might give us cause for concern – for example, if there is no species capable of ‘pushing-back’ – while, in others, it may provide reassurance that however hard it tries, a particular exotic species is unlikely to spread and cause a problem.” Thankfully, this seems to be the case for Florida’s “missing” guppies.