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Rapid Communication

Croaking gourami, *Trichopsis vittata* (Cuvier, 1831), in Florida, USA

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Abstract

The croaking gourami, *Trichopsis vittata*, is documented from wetland habitats in southern Florida. This species was previously recorded from the same area over 15 years ago, but was considered extirpated. The rediscovery of a reproducing population of this species highlights the dearth of information available regarding the dozens of non-native fishes in Florida, as well as the need for additional research and monitoring.

Key words: canal; croaking gourami; cypress swamp; Florida; Loxahatchee; Osphronemidae; *Trichopsis vittata*

Introduction

Dozens of non-native fishes have been introduced into Florida's inland waterways, via accidental escape, pet releases, or intentional introduction (Fuller et al. 1999; Shafland et al. 2008a). Many of these species have flourished (especially in south Florida's subtropical environment), established self-sustaining populations that span large geographic ranges, and persisted over several decades Alternately, some species have either remained locally established (e.g., *Metynnis* sp.; Shafland 1996; Shafland et al. 2008a) or died out over time [e.g., climbing perch *Anabas testudineus* (Bloch, 1792)], twospot ctenopoma *Ctenopoma nigropannosum* Reichenow, 1875 and others, Shafland et al. 2008a). Distribution of non-native fishes is tracked by the Florida Fish and Wildlife Conservation Commission; however, it is not possible to sample all habitats in all locations. Thus, non-native fishes may go undetected.

Herein we relay information on a fortuitous collection and subsequent follow-up documentation of a population of the croaking gourami [*Trichopsis vittata* (Cuvier, 1831)]. This species was previously considered extirpated (Shafland et al. 2008a, b), but is now known to be reproducing in a localised area.

Trichopsis vittata – *Croaking gourami*

Native Distribution

Trichopsis vittata (Fam: Osphronemidae) is wide-ranging throughout tropical Asia, from Thailand to Indonesia, including Java, Borneo, and Sumatra (Kottelat 1985; Rainboth 1996). Information in the native range on its biology and ecology have been published in: Malaysia (Beamish et al. 2003), Vietnam (Freyhof et al. 2000; Herder and Freyhof 2006), Thailand (Liengpornpan et al. 2007; Beamish et al. 2010), Cambodia (Rainboth 1996), Lao People's Democratic Republic (Martin et al. 2011), and Singapore (Alfred 1966; Low and Lim 2012). There is substantial literature on the species' ability to make noise ("croak"), which is accomplished by snapping enlarged pectoral fin tendons over basal elevations of fin rays, especially in relation to agonistic behaviour (see Henglmüller and Ladich 1999 and citations therein).

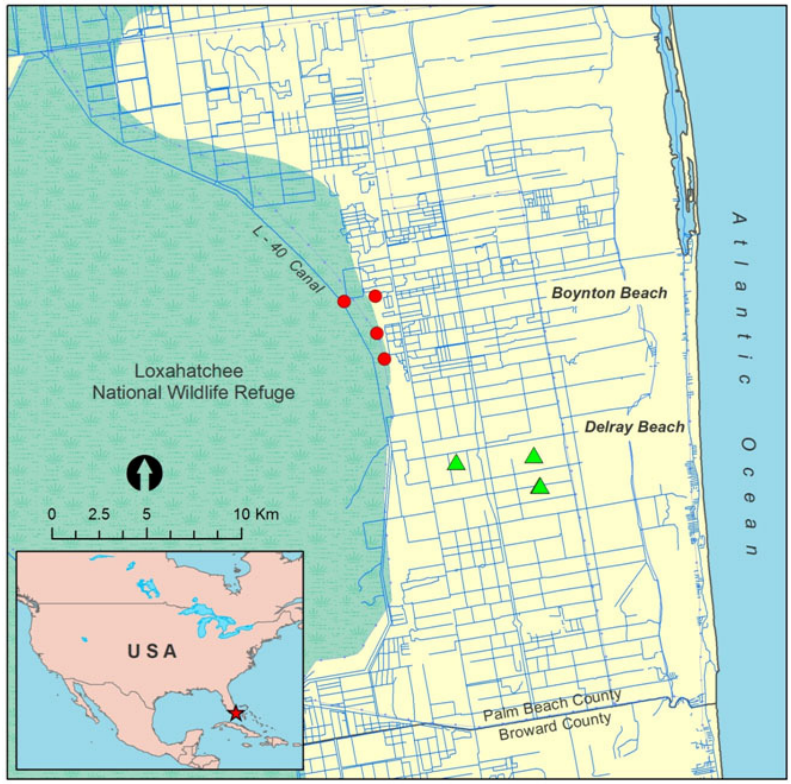

Figure 1. Map of occurrences of *Trichopsis vittata* in Florida, USA. Blue lines indicate canals. Green triangles represent pre-2000 collections; red dots represent collections made in 2012. All data are available online (USGS-NAS 2013).

History of Trichopsis collection in Florida

Trichopsis vittata was first collected in Florida in 1978 from a canal near Delray Beach (Lee et al. 1980; Figure 1). The source of the introduction was thought to be a nearby aquarium fish farm (Courtenay et al. 1984, 1986). Through the 1980s, the population was considered relatively localised (Courtenay et al. 1984, 1986; Courtenay and Stauffer 1990). Shafland (1996) reported that the species had never been abundant, was found in only one small canal and questioned the persistence of the population. US Geological Survey personnel made two collections of the species in 1992 (FLMNH 2013). In their comprehensive review of foreign non-native freshwater fishes in Florida, Shafland et al. (2008a) reported the species had not been collected or observed in more than 15 years. Moreover, the only canal thought to harbour the species had been dewatered and paved over. Therefore, Shafland et al. (2008a,b) designated the species as extirpated in Florida. There are no other known collections of the species in the United States (Fuller et al. 1999; USGS-NAS 2013) or elsewhere in North America.

Methods

In September 2012, one of us (DJP) collected several specimens of *Trichopsis vittata* when investigating a recently re-flooded 400 acre cypress swamp on the eastern edge of Arthur R. Marshall Loxahatchee National Wildlife Refuge (UF 184709). This swamp had previously been dry for at least one year. In days following that collection, several more specimens were collected in nearby areas (all part of the same swamp system), prompting us to conduct a more comprehensive survey of the area.

In November 2012, six teams of researchers converged in south Florida to conduct a one-day bioblitz of the areas adjacent to the recent

Figure 2. Photograph of *Trichopsis vittata* collected from the cypress swamp at Arthur R. Marshall Loxahatchee Wildlife Refuge, 3 March 2013. Photograph by Howard Jelks, USGS.

Table 1. Collection data for *Trichopsis vittata* taken in 2012 in Florida.

Collection date	Site name	GPS Coordinates	sampling gear	n	size range (mm TL)
26-Sep-12	Cypress Swamp	26°31'26.1"N, 80°13'04.8"W	minnow trap	17	33-56
2-Oct-12	Cypress Swamp	26°30'08.01"N, 80°12'59.03"W and 26°31'39.39"N, 80°13'10.57"W	minnow trap	25	33-60
3-Oct-12	Cypress Swamp	26°30'39.93"N, 80°12'58.39"W	minnow trap	16	38-60
4-Oct-12	Cypress Swamp	26°29'55.87"N 80°12'50.19"W	minnow trap	64	30-65
8-Nov-12	L-23W canal	26°32'30.0"N, 80°13'55.9"W	minnow trap, dip net	6	46-49
8-Nov-12	L-23W canal	26°32'29.9"N, 80°13'55.8"W	electroshock boat	4	48-57
				TOTAL: 132	

gourami collections. Sampling was conducting using a variety of gear types (minnow traps, electroshock boat, seines, dipnets) in canals, ditches and swamps. Native fishes were released alive; non-native fishes were quickly euthanized in an ice bath and retained as voucher specimens (Florida Museum of Natural History).

Results and discussion

A total of 132 specimens of *Trichopsis vittata* were collected from six localities in Florida in 2012 (Table 1; Figures 1 and 2). Four locations were in the cypress swamp and two locations in a canal. The collection localities are grouped in a relatively small area. Sampling in adjacent lands yielded no *T. vittata*. Thus, it appears that the species is relatively localised at this time. Other non-native fishes collected in the same localities included Mayan cichlid *Cichlasoma urophthalmus* (Günther, 1862), walking catfish *Clarias batrachus* (Linnaeus, 1758) (both dark and albino forms), African jewelfish *Hemichromis letourneuxi* Sauvage, 1880, brown hoplo *Hoplosternum littorale* (Hancock, 1828) and spotted tilapia *Tilapia mariae* Boulenger, 1899.

There are no plans to attempt eradication of *Trichopsis vittata* at this time. Currently, the only techniques available for eradication include dewatering and piscicides (e.g., rotenone), which are labour-intensive, expensive, and cause a great deal of collateral damage to native species. Additionally, those techniques tend to be more successful in ponds or other habitats without interconnected, flowing waters. Finally, it is unclear if or how the species will impact native species and habitats as so little is known about it.

In its native Asia, *T. vittata* inhabits shallow habitats with sluggish or still-water and abundant vegetation (Rainboth 1996; Liengpornpan et al. 2007). Similarly, the habitats from which we collected *T. vittata* in Florida include cypress swamps and man-made canals with abundant aquatic vegetation such as *Hydrilla verticillata* and *Pistia stratiotes*. The cypress swamp community is composed of 20 species of trees and shrubs, 20 herbs, nine vines, one sedge, 14 ferns, seven bromeliads and two lichens (USFWS 2000).

It is unclear whether the specimens of *T. vittata* found in 2012 are descendents of the population sampled in the 1970s and 1990s or whether they constitute a recent reintroduction. The first scenario (i.e., the same population has persisted for nearly 40 years) suggests this tropical species has been able to either acclimate or shelter during several cold winters (e.g., 1989, 2010), yet at the same time it appears it has not expanded greatly over the landscape. Previous research on non-native fishes in south Florida has shown that tropically-derived species can survive periods of cold if they can find suitable refugia (Adams and Wolfe 2007; Schofield et al. 2010; Schofield and Huge 2011). The second scenario (i.e., recent reintroduction) seems improbable. It is possible the species was released illegally, but it seems unlikely that a species that has not been introduced anywhere else in North America (USGS-NAS 2013) would be introduced on two separate occasions less than 10 km apart. In the end, we will likely never know if either of these (or some other) scenario is correct, as few sampling records and no detection estimates exist for this species.

Currently, we can only speculate on the potential pathways of introduction, mechanisms of persistence, and effects on the native community regarding this species. Our lack of understanding regarding these issues (highlighted by its rediscovery after it was considered extirpated) simply underlines the general lack of knowledge regarding non-native fishes in Florida. Dozens of non-native fishes have been established in Florida (Fuller et al. 1999; Shafland et al. 2008a; USGS-NAS 2013), yet we have minimal understanding of their geographic ranges, physiological tolerances, life-history characteristics, behavioural interactions and impacts. Indeed, in many cases even positive identification is unclear. The rediscovery of *T. vittata* demonstrates the potential value of expanded inventory and monitoring of waters by state and federal agencies.

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