



First record of native amphibian predation by the invasive alien African catfish *Clarias gariepinus* (Siluriformes, Clariidae) in Cuba

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Abstract: Herein we report the first evidence of predation by the invasive catfish *Clarias gariepinus* on the native Cuban Treefrog, *Osteopilus septentrionalis*, in central Cuba. This constitutes as well the first official record of one vertebrate as prey of this alien fish in Cuba.

Key words: Sharptooth catfish, threat, Cuban Treefrog

Resumen: Primer registro de depredación de un anfibio nativo por el pez gato africano invasor *Clarias gariepinus* (Siluriformes, Clariidae) en Cuba. Se reporta la primera evidencia de depredación de un anfibio autóctono, la Rana Platanera, *Osteopilus septentrionalis*, por el pez gato invasor *Clarias gariepinus*, en Cuba central. Éste constituye también el primer registro oficial de un vertebrado como presa de este pez en Cuba.

Palabras claves: Pez gato africano, amenaza, Rana Platanera

Biological invasions are considered the second most important cause of biodiversity loss, after habitat fragmentation (Vitousek *et al.* 1997, Clavero & García-Berthou 2005, but see Didham *et al.* 2005). These invasions are particularly harmful in island ecosystems, where many species have evolved under different pressures relative to continents (McArthur & Wilson 1967). Islands itself are centers of adaptive radiations and endemism (Myers *et al.* 2000), being more vulnerable to extinction by introduction of alien species (O'Dowd *et al.* 2003, Blackburn *et al.* 2004, Freed *et al.* 2008). Natural ecosystems of the Cuban Archipelago are subjected to the effects of 21 reported exotic freshwater fish species (Welcomme 1988). However, there are at least 14 more introduced species pending of formal publication (Álvarez 2013). One of the most recent introductions in Cuba corresponds to two catfish species genus *Clarias* in 1999-2000: *C. macrocephalus* Günther, 1864 and *C. gariepinus* (Burchell, 1822). These two predatory species were intentionally introduced for aquaculture purposes

from Malaysia and Thailand (unpublished official report provided by the *Centro Nacional de Seguridad Biológica*, Cuba, 2015, at the request of the authors).

The only published study mentioning the feeding habits of *C. gariepinus* in Cuba (Ponce de León *et al.* 2013) is limited to 37 small-sized (30-85 mm total length) juvenile individuals found in rice paddies. Thus, it does not reflect the whole picture about the diet of this predatory species in this archipelago. They found that such juveniles fed mostly on small benthonic invertebrates including insects (Coleoptera, Hemiptera, Diptera), crustaceans (Branchiopoda, Ostracoda) and mollusks (Gasteropoda). The other investigation discussing the feeding habits of this species in Cuba is a degree thesis (Pérez 2011) including individuals of higher sizes (310-1400 mm total length). This author also found detritus, vegetable matter, other mollusks (Bivalvia, Gasteropoda), other crustaceans (Malacostraca), introduced fishes (Cypriniformes, Perciformes,) and feathers as trophic resources of *C.*

gariepinus. However, other studies conducted in Africa and South America revealed that medium-sized to large individuals of *C. gariepinus* (240-1088 mm total length) are typical eurytrophic that also feed on plankton, fishes (including conspecifics), amphibians and reptiles (e.g., Munro 1967, Bruton 1979, Thorne & Hamman 1981, Kadye & Booth 2011, Dadebo *et al.* 2014, Rabelo & Soares 2014).

Evidences of the negative incidence of *C. gariepinus* on the New World native herpetofauna are very scarce (e.g., Vitule *et al.* 2008). Particularly, the possible impact of introduced invasive *Clarias* species on Cuban native amphibians has been repeatedly suggested (Díaz & Cádiz 2008, Hedges & Díaz 2011), but concrete evidences of predation are still missing. Herein we report the first record of predation on the Cuban Treefrog, *Osteopilus septentrionalis* (Duméril & Bibron, 1841) by *C. gariepinus*, which constitutes as well the first record of amphibians as prey of this alien fish in Cuba.

On 21 March 2015, we collected six males *C. gariepinus* (355-525 mm total length) in a stream locally named “Cañada de Cabrales” (22°10'36"N, -79°40'58"W; datum WGS 84; 140 m a.s.l.), Nazareno town, Placetas municipality, Villa Clara province, Cuba. This stream is tributary of the “Guaracabuya” river and then of the “Agabama” river. During the dry season it fragments into several

pools rarely exceeding 30 m long, 6 m width and 1 m depth (Fig. 1). This stream passes through an anthropogenic area set aside for agriculture and stockbreeding. The native fish fauna inhabiting this stream is composed by the “Biajaca” *Nandopsis tetracanthus* (Cichlidae), the Mosquitofishes, *Gambusia punctata* and *G. puncticulata* (Poeciliidae) and the Obscure swamp Eel, *Ophisternon aenigmaticum* (Synbranchidae). But there are other introduced species occurring in the stream like the Common Carp, *Cyprinus carpio* (Cyprinidae), the Black Carp, *Mylopharyngodon piceus* (Cyprinidae), the Bluegill, *Lepomis macrochirus* (Centrarchidae), the Largemouth Bass, *Micropterus salmoides* (Centrarchidae) and the Blue Tilapia, *Oreochromis aureus* (Cichlidae). Other water-associated vertebrates occurring in the stream are the native Cuban Treefrog (Hylidae), the endemic Eastern Giant Toad, *Peltophryne peltocephala* (Bufonidae), the introduced Bullfrog, *Lithobates catesbeianus* (Ranidae) and the native Cuban Slider Turtle, *Trachemys decussata* (Emydidae). We collected the catfishes using a gillnet (8 m x 1.5 m) of 45 mm mesh size. To open the abdominal cavity and remove the gastrointestinal tract we made a ventral cut from the anterior insertion of pectoral fins to the anterior insertion of anal fin.

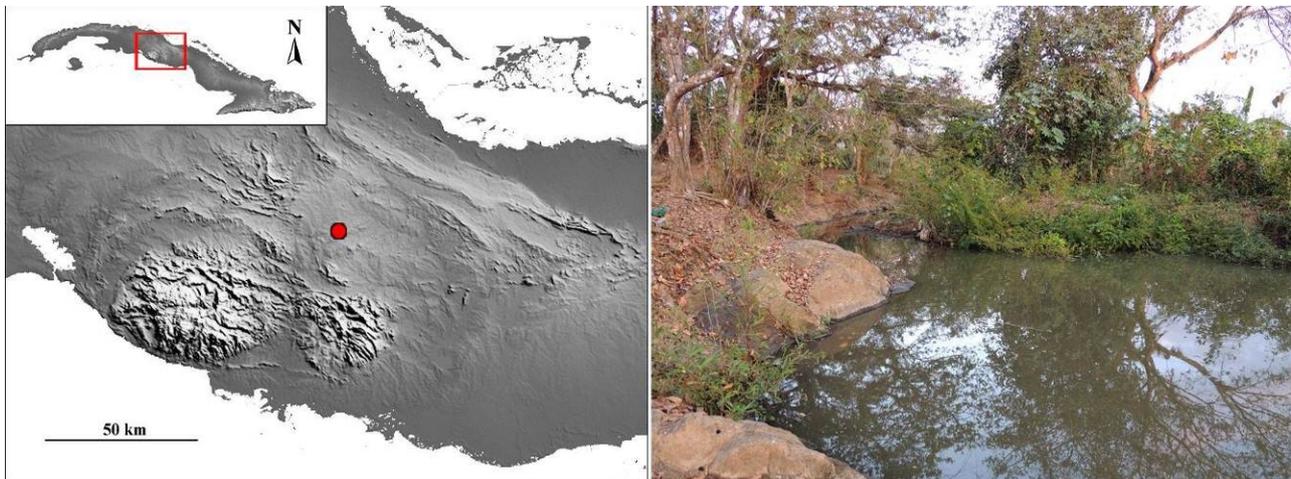


Figure 1. Collecting site at the stream “Cañada de Cabrales”, Placetas, Villa Clara province: red dot indicates location (left), and pool where specimens of *Clarias gariepinus* were collected (right).

The stomach content analysis of the catfishes revealed that one of them (424 mm total length, 377 mm standard length, 66 mm head width, 570 g) (Fig. 2A- 2B) contained a partially digested adult female Cuban Treefrog (ca. 80 mm SVL, 30 mm head

width), one fruit of “Guásima” tree (*Guazuma ulmifolia*; Malvaceae) and two fruits of the Royal Palm Tree (*Roystonea regia*; Arecaceae) (Fig. 2C- 2D); we found four more *Roystonea* fruits in the pharynx and five in the gut. The fish stomach with

all content weighed 63 g, which represent 11% of the total fish mass. We found only *Guazuma* and *Roystonea* fruits in the pharynx, the stomach and the gut of two more catfish specimens; the remaining three specimens had their digestive tracts empty. We additionally carried out some interviews (N=10) to

local trustworthy expertise fishermen and they confirmed our findings of the Cuban Treefrog and the *Guazuma* and *Roystonea* fruits as items repeatedly found in the stomachs of catfishes caught by them in the area.

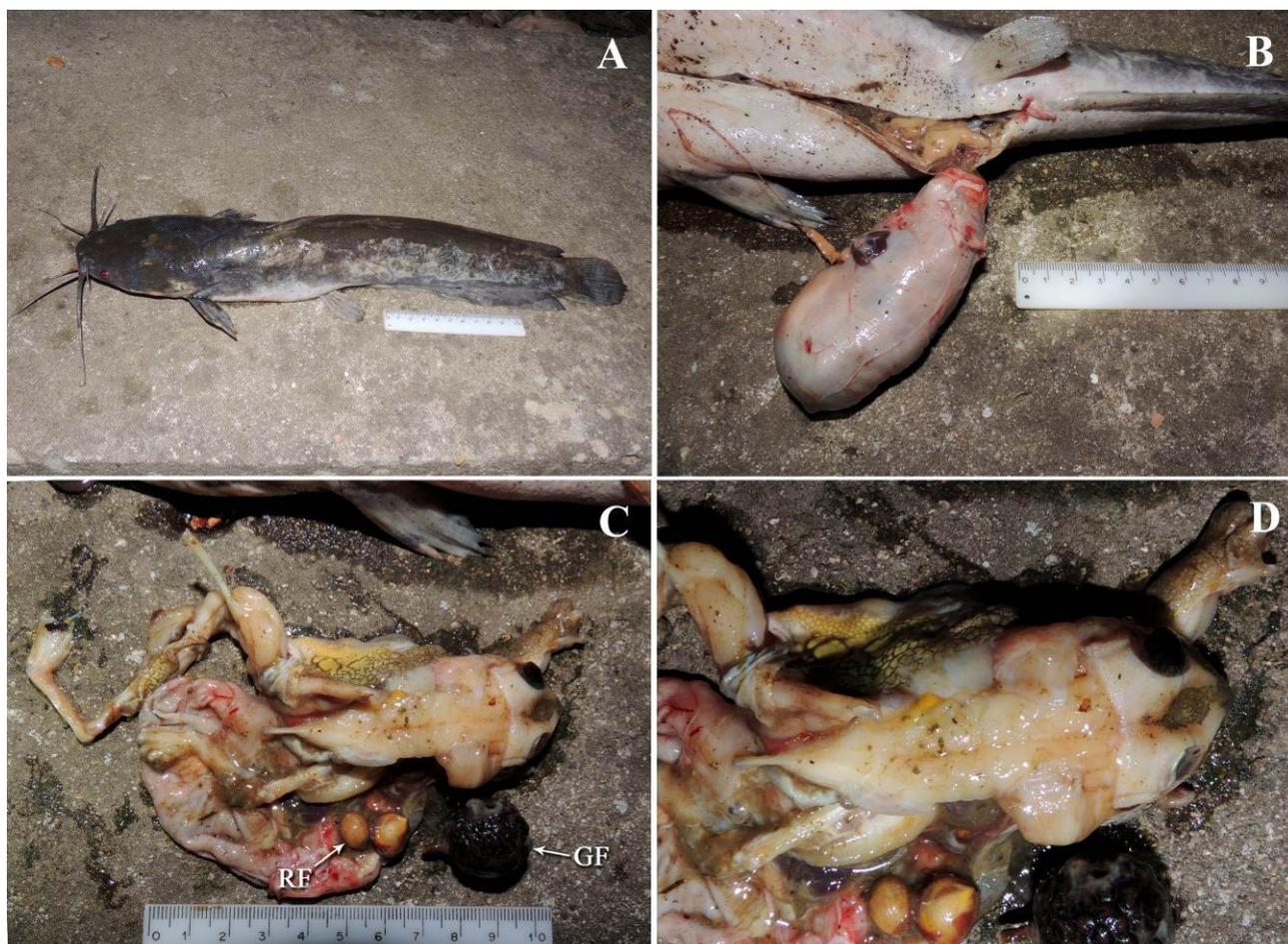


Figure 2. Specimen of the Catfish (*Clarias gariepinus*) found with an adult female Cuban Treefrog (*Osteopilus septentrionalis*) in its stomach at “Cañada de Cabrales”, Placetas, Villa Clara province: **A**, freshly captured; **B**, with stomach removed; **C**, opened stomach showing an adult female Cuban Treefrog (*Osteopilus septentrionalis*), two *Roystonea* fruits (RF) and one *Guazuma* fruit (GF); **D**, close up of the frog.

The Cuban Treefrog is widespread in Cuba, the Bahamas and the Cayman Islands; although it has been introduced to Puerto Rico, northern Lesser Antilles, Florida, Costa Rica and the O'ahu Island in Hawaii (e.g., Díaz & Cádiz 2008, Henderson & Powell 2009). It inhabits a great variety of environments, from sea level to 1,974 m, but depends on the water to reproduce (Díaz & Cádiz 2008). Several predators have been reported for both adults and larvae of this frog, including conspecifics, insects (*Lethocerus*), lizards (*Anolis*), snakes (*Caraiba*, *Cubophis*, *Tropidophis*, *Chilabothrus*) and

birds (*Bubulcus*, *Melanerpes*, *Quiscalus*, *Tyrannus*, *Tyto*) (for a review see Henderson & Powell 2009, Alfonso *et al.* 2013).

Despite the frequent occurrence of *O. septentrionalis* in water bodies, particularly during the breeding season (Díaz & Cádiz 2008), no fish have been reported as predator of this frog in the West Indies. However, Díaz & Cádiz (2008) and Hedges & Díaz (2011) pointed out that introduced catfishes of the genus *Clarias* (mainly *C. gariepinus*) could be predators of eggs and tadpoles of water-breeding amphibians (*Osteopilus*,

Peltophryne) in Cuba. Our observations indicate that *C. gariepinus* can prey even on adults of one of the Cuba's largest amphibians. Also, we verified the presence of adults' Cuban Treefrog and toads along the stream sampled during nocturnal surveys. They were usually in shallow waters on the stream banks, at depths where we have also observed specimens of *C. gariepinus* (> 400 mm total length) foraging at night. Thus, it is expected that such co-occurrence increases the probabilities of amphibian predation by catfishes. Additionally, other Cuban endemic amphibians like riparian frogs of the genus *Eleutherodactylus* (Eleutherodactylidae) and other soil-dweller and generalist species that approach to the stream pools during the unfavorable conditions of the dry season (Rodríguez-Cabrera & Rodríguez 2015), could be as well highly vulnerable to predation by *C. gariepinus*. On the other hand, the presence of *Guazuma* and *Roystonea* fruits in the stomachs of *C. gariepinus* confirm once again that this species makes an opportunistic use of available food resources.

The real impact of introduced catfish genus *Clarias* on Cuban native fauna is by far underestimated. Most available information on catfishes in Cuba is limited to unpublished project reports and two degree theses (Pérez 2011, Álvarez 2013). Nevertheless, a complete investigation on its ecology, particularly on its feeding habits, is still pending and will be of major importance in Cuba. The high vulnerability of this group of amphibians to be predated by *Clarias* and the lack of information on this respect will only contribute to its faster diversity loss in Cuba and hence in the Caribbean.

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