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A Safe Haven for Three Freshwater Invasive Alien Species in Tobago, Trinidad and Tobago

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A Safe Haven for Three Freshwater Invasive Alien Species in Tobago, Trinidad and Tobago

Invasive alien species are non-native species that have been introduced either through self-introduction or by man and which have subsequently become a threat to a country's economy (e.g., agriculture and trade, infrastructure [e.g., water supplies], human health, etc.). They may also impact biodiversity, habitat quality, and ecosystem functions. Aquatic invasive alien species (IAS) have been documented in both Trinidad and Tobago but generally are regarded as established or naturalised exotics, as their potential negative impacts are not appreciated fully. These exotics include a wide range of taxa such as the Malaysian prawn, *Macrobrachium rosenbergii,* in Trinidad (Rostant 2005; Mohammed *et al.* 2011); the red-rimmed melania (snail), *Melanoides tuberculata*, in Trinidad (Snider 2001) and in Tobago (Bass 2003); the quilted melania (snail), *Tarebia granifera*, in Trinidad (Snider 2001) and in Tobago (van Oosterhout *et al.* 2013); the apple snail, *Pomacea diffusa,* in Trinidad (Mohammed and Rutherford 2012) and in Tobago (Rutherford and Mohammed 2013); the red-eared pond slider (turtle), *Trachemys scripta elegans*, in Trinidad (Mohammed *et al.* 2010); and the three-spotted gourami, *Trichogaster trichopterus* (Mohammed *et al.* 2010), among others. The invasive snails arrived via the aquatic ornamental pet trade, presumably with aquatic plants and, as in the case of *Pomacea diffusa*, as intentional purchases as pets (pers. obs.).

Several monitoring events over the last five years throughout Tobago's drainages revealed three aquatic invasive species to be established at one site in southwestern Tobago: *Melanoides tuberculata, Pomacea diffusa*, and *Oreochromis mossambicus*. The site was visited three times in 2013 (March, June, and November). The main water source was found to be a limestone spring (GPS UTM 20P 737032, 1234456) just north of Milford Road, south of the Pigeon Point mangroves. The vegetation at the site includes a variety of swamp sedges: *Typha latifolia* (cattail), *Pistia stratiotes* (water lettuce), *Eichhornia crassipes* (water hyacinth), and *Salvinia* species (floating ferns); the latter are the predominant aquatic plants at the lower stream and lagoon area. Clear water flowed continuously (approximately 5m per min.) from the main limestone outcrop during all three visits and appeared to be independent of rainfall intensity. Coralline rocks and pebbles were visible within the thick detritus substrate. The riparian vegetation was comprised of an invasive terrestrial plant, the Noni fruit, *Morinda citrifolia*. The site seems to have had very little anthropogenic impacts except the exotic biota.

The Noni fruit is native to Southeast Asia and Australia. It has a wide habitat preference which includes shady forests, open rocky to sandy shores such as volcanic terrains, lava-strewn coasts, clearings or limestone outcrops, as well as in coralline atolls. It is tolerant of saline soils and drought conditions (Nelson 2003). Important amino acids such as aspartic acid and several minerals are found in the fruit (Chan *et al.* 2006). This plant was originally cultivated in Tobago as both an ornamental and oddity fruit; however, it is now widely distributed on the island.

Two of the three aquatic IAS at the spring are mentioned above: *M. tuberculata* and *P. diffusa.* The third IAS is a tilapine cichlid, *Oreochromis mossambicus.* Small depressions in the substrate characteristic of Tilapia were observed by G. White in the late 1980s at

Hillsborough Dam. The species was observed by the author in 2004 in shallow, brackish streams leading into the Bon Accord mangroves and also in small storm drains leading into Scarborough Bay. *Oreochromis mossambicus* was first documented in Scarborough (Phillip 1998). It was introduced to Tobago for aquaculture but was poorly managed with regards to housing and to distribution of fingerlings. Its impact can be rated as minimal overall because populations are restricted to southern Tobago. This species is herbivorous but will occasionally prey upon smaller fish. At the spring site, the population density of *O. mossambicus* ranged from 5 to 10 per m^2 during all three visits, whereas at the runoff drainage near Scarborough the density was greater, ranging from 10 to 20 per m^2. Some individuals were quite large (> 25.0cm in total length).

At the spring, the food web seemed to be fuelled by the dropped Noni fruits, as both *O. mossambicus* and the two species of snails mentioned above were observed feeding on Noni fruits. A native snail, *Marisa cornuarietis,* also was observed at the spring; individuals of all three species exhibited some degree of gigantism. Juveniles were observed, but the density of large individuals was high, with giants predominating the size classes for all three species. Density was highest (≈ 60 per m^2) in the native species, followed by that of *M. tuberculata* and *P. diffusa,* respectively (≈ 30 per m^2 and 5 per m^2). Our observations were consistent with those of Berry (1962) and McKillop and Harrison (1972), who documented increases in densities of terrestrial snails at the base of limestone hills; they attributed this increase to the snails' use of calcium and its availability in water flowing through limestone. The habitat at the spring was determined to be conducive for population expansion for all three species, as all snail and fish species have adequate food sources with reduced competition for food. The enemy release hypothesis (Blossey and Notzold 1995) indicates that when an exotic is introduced to a new range, population expansion can be rapid because of lack of predator or parasite pressure; in other words, a species is released from its natural enemies. At the spring, all species (the exotic fish, both species of exotic snails, and the single native snail species) have no predators, and they also have an unlimited food resource, conditions allowing for gigantism and also for increased fecundity.

This site, which provides a safe haven for aquatic IAS, should be monitored continuously as it could serve as a pool for proliferation of invasive species. In addition, introduction of other species, such as *Tarebia granifera*, could result in negative effects on the other species. Both *M. tuberculata* and *T. granifera* have been documented in high densities, outcompeting native gastropods, at other sites in both Trinidad and Tobago (van Oosterhout 2013). The dynamics of the Noni-powered food web, the occurrence of the giant snails, and the ecological impacts of these organisms on native wildlife need further investigation.

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