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## Raccoon Predation as a Potential Limiting Factor in the Success of the Green Iguana in Southern Florida

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Henry T. Smith, Walter E. Meshaka Jr., Richard M. Engeman, Steven M. Crossett, Mark E. Foley, and Gary Bush

## Raccoon Predation as a Potential Limiting Factor in the Success of the Green Iguana in Southern Florida

The Green Iguana, *Iguana iguana*, is a well established, large-bodied, exotic species in Florida (Meshaka et al. 2004a. The Exotic Amphibians and Reptiles of Florida, Krieger Publishing Company, Malabar, Florida. 155 pp.; Meshaka et al. 2004b. *Iguana* 11:154-161). Limiting factors of populations and causes of Green Iguana mortality in Florida are poorly understood and the only documented predators are the domestic dog (*Canus familiaris*) (Meshaka et al. 2004a), Yellowcrowned Night-heron (*Nyctanassa violacea*) (Engeman et al. 2005. *Herpetol. Rev.* 36:320), Florida Burrowing Owl (*Athene cunicularia floridana*) (McKie et al. 2005. *Florida Field Nat.* 33:125-127), and an unidentified species of hawk (HTS pers. obs.). Here, we report the first documented predation of a juvenile Green Iguana by a Raccoon (*Procyon lotor*) in a southern Florida state park. Additionally, we provide strong evidence of Green Iguana population density and recruitment suppression by Raccoons.

Hugh Taylor Birch State Park (HTBSP) is a small, urban park located in Broward County, Florida, USA, within the City of Ft. Lauderdale. It consists of 56.7 ha of uplands and 14.2 ha of freshwater and tidal wetlands for a combined total of 70.9 ha. HTBSP is completely encapsulated by urban infrastructure, and the Intracoastal Waterway (a large bulkheaded canal) truncates the entire western boundary.

At ca. 1130 h on 16 October 2006, a sunny day, temperature ca. 85°F, HTBSP Park Rangers SMC and MEF observed a Raccoon chase a ca. 20 cm SVL Green Iguana out of maritime hammock on to one of the park roads. The iguana cut back across the road surface apparently trying to reach the safety of trees/ woodland cover, and the Raccoon then caught it in its jaws and carried it back into the hammock. SMC estimated the entire sequence of events to cover less than 15 seconds. This observation brings the list of known predators of invasive Green Iguana in Florida to five. Likewise, this predation observation provides additional support for our hypothesis that an inverted trophic pyramid dominated by artificially high midlevel predator biomass of the Raccoon exerted almost complete population suppression on an invasive, large-bodied, lower trophic level reptile for at least six years. In subsequent observation, nearly one month later, a large male Green Iguana basking at 1535 h on 9 November 2006 at HTBSP was first circled by a young Raccoon and then attacked. Its response (Figure 1) and follow-up behavior suggest that even large adults are susceptible to attack by Raccoons, and at least during the day, can be successfully fended off (Figure 1).

Raccoon population densities in the park have always been artificially high as a direct result of un-

lawful feeding by humans. Estimates of Raccoons in HTBSP during the 1990s ranged from ca. 75 to 125 animals (Smith and Engeman 2002. *Canadian Field-Nat.* 116:636-639). The threats of epizootic disease transmission (particularly rabies) to other wildlife, bites to humans, and vehicular traffic hazards, resulted in a control program in November 2000 to reduce these threats. The HTBSP trap and removal program documented an absolute minimum density of 238 raccoons/ km<sup>2</sup> [= 169 raccoons/175 acres] (Smith and Engeman 2002. *Canadian Field-Nat.* 116:636-639), which is the third highest Raccoon density ever reported in North America, 4-200 times greater than the other reported rural densities of 0.9-55.6 Raccoons/ km<sup>2</sup> (Smith and Engeman 2002. *op cit.*).

During the years of this extraordinary mid-level predator density, few ground-dwelling reptiles were observed in the park and virtually all mast was stripped from trees annually (HTS pers. obs.). The Green Iguana was first opportunistically observed by HTS in the park maritime hammock in 1994 and the date of their initial introduction is unknown; however, the very rare individuals encountered in subsequent years were always large adults and in arboreal situations. During frequent visits from 1994 to 2000 for various projects, no evidence of Green Iguana recruitment was found in HTBSP. Since 2001, and after Raccoon removal, new hatchlings have been observed annually and as of 2006, the Green Iguana has saturated the park in mixed size-classes in all ground, arboreal, and ruderal habitats (HTS and WEM pers. obs.).

The post-Raccoon removal spike in Green Iguana presence at HTBSP and the depredation of a ca. 60 cm TL Green Iguana suggest to us the effectiveness of the Raccoon as a potentially severely limiting factor of Green Iguana abundance in southern Florida. In this connection, we propose that predation of the nest, as well, is a mechanism for suppression of the Green Iguana by the Raccoon. The case for nest predation and its effects on the



Figure 1. A male Green Iguana (*Iguana iguana*) fends off a Raccoon (*Procyon lotor*) at Hugh Taylor Birch State Park in Broward County, Florida on 9 November 2006.

Green Iguana remain to be tested but seem logical in light of the Raccoon's keen ability to find and destroy nests, up to 95% of Sea Turtle nests in Florida and down to 9.4% after Raccoon removal (Stanczyk 1982. In Bjorndal, K.A. [ed.], *Biology and Conservation of Sea Turtles*, pp. 139-152, Smithsonian Institution Press, Washington, DC; Engeman et al. 2002. *Ecological Economics* 42:469-478; Engeman et al. 2005. *Oryx* 39:318-326).

Ironically, even as the targeted management benefits of removal of Raccoons were completely achieved at HTBSP beyond expectations, the release from predation pressure of the Green Iguana may well have resulted in the unexpected ecological consequence of a biotic burst of an exotic species in this urban park.

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