

Largest Breeding Aggregation of Burmese Pythons (*Python bivittatus*) Kuhl 1820 (Squamata: Pythonidae) and Implications for Potential Development of a Control Tool

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Burmese Pythons (*Python bivittatus*; Fig. 1), native to southeastern Asia, are an established invasive species in southern Florida, USA, where they negatively impact native wildlife through predation and competition for resources (Dorcas et al. 2012; Dove et al. 2011; Snow et al. 2007a, 2007b). Efforts, such as trapping, to remove them from introduced areas have been largely unsuccessful (Reed et al. 2011). Understanding the ecology of Burmese Pythons in Florida could help efforts to control these invasive populations.

Several species of constricting snakes are known to be social breeders. Green Anacondas (*Eunectes murinus*) form breeding aggregations of as many as 13 males coiled around

a single female (Rivas et al. 2007). Breeding aggregations also have been observed in Diamond Pythons (*Morelia spilota*), with as many as six males associating with a single female (Slip and Shine 1988). Wall (1912) provided an account of six Indian Pythons (*P. molurus*) discovered in a stream bank cavity in Mysore, India, but did not specifically mention aggregations as a possible reproductive behavior. Although many researchers working with these pythons are aware of breeding aggregations in invasive Burmese Pythons, they have not previously been documented. However, if this behavior is reliably present in Burmese Pythons in Florida, it could be exploited as a method to detect and remove additional snakes. We conducted a pilot radio-telemetry project in 2005 in Everglades National Park (ENP) to explore the ecology of Burmese Pythons and to determine if this social breeding behavior exists in Florida.

ENP is a 0.9-million hectare U.S. National Park located on the southern tip of Florida. Habitats vary, but the park is predominantly wetlands, including freshwater and saline glades, and one of the largest mangrove ecosystems on Earth (e.g., Meshaka et al. 2000). We began our pilot radio-tracking study in the Pa-Hay-Okee region, which is dominated by freshwater glades and a large hardwood hammock. Between 6 and 8 December 2005, we captured four Burmese Pythons (3 M, 1 F), and on 9 December 2005, we surgically implanted each python with two VHF radio-transmitters (Holohil Systems, Ltd., Ontario, Canada). We used two models, SI-2 (11 g, nine-month battery life) and the AI-2 (25 g, 12-month battery life). They did not exceed 0.1% of any python's body mass. The transmitters were implanted intraperitoneally following standard methods (Hardy and Greene 1999, 2000; Reinert and Cundall 1982; Weatherhead and Anderka 1984).



Fig. 1. Burmese Pythons (*Python bivittatus*) are an established invasive species in southern Florida, where they negatively impact native wildlife through predation and competition for resources. Photograph by Brian J. Smith, University of Florida.

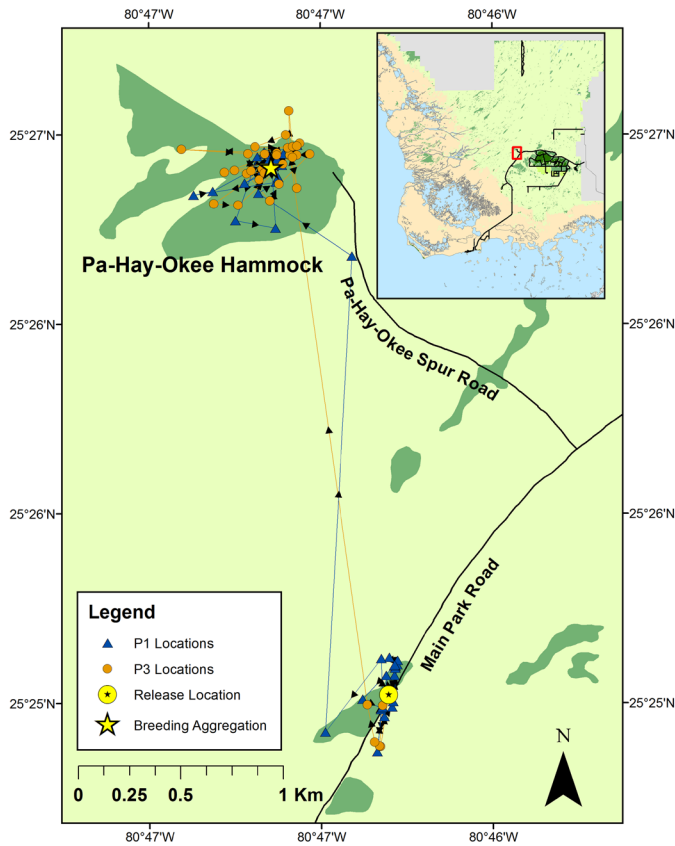


Fig. 2. Release location, subsequent tracks, and the final location of the breeding aggregation for the two male Burmese Pythons (*Python bivittatus*; P1 & P3) radio-tracked in the Pa-Hay-Okee region of Everglades National Park (ENP). The inset shows the extent of the map within ENP.

We took standard measurements (snout-to-vent length [SVL] total length [TL] in cm, mass in kg) of each snake while anesthetized to increase precision of measurements (Blouin-Demers 2003). We allowed all snakes to recover after surgery for 24 h, and released each one along the Main Park Road in ENP on 10 December 2005. We determined the daily location of each python through triangulation, and we confirmed the actual location of each python occasionally through direct observation. We directly observed the pythons daily for the first week post-surgery, and then typically once every 2–3 weeks while they remained in the field. Two of the male pythons (P1 & P3) were released at the same location along the Main Park Road, 1.5 km south of Pa-Hay-Okee spur road (25.41703°N, 80.78007°W; Fig. 1). P1 and P3 separately made their way into Pa-Hay-Okee hammock, with P3 arriving on 22 December 2005, and P1 arriving on 23 January 2006. They both stayed in that area until being recaptured 97 days after their release. We obtained 21 visuals on P1 and 11 visuals on P3 during this time.

On 17 March 2006, we radio-tracked these male pythons in Pa-Hay-Okee hammock to obtain a visual. When we located the snakes (25.44024°N, 80.78573°W; Fig. 2), we discovered them together in an aggregation with six other

Burmese Pythons. We captured and removed all eight pythons. The aggregation contained a total of seven males ranging from 168–368 cm (\bar{x} = 256.3 cm) SVL, 192.5–419.5 cm (\bar{x} = 295.8 cm) TL, and 3.5–30.2 kg (\bar{x} = 12.3 kg) in mass. The eighth snake was a female measuring 295 cm SVL, 332 cm TL, and with a mass of 20.5 kg. Three snakes were above ground and five were underground in a raised, hollow mound (Fig. 3).

The discovery of these eight pythons represents the largest documented breeding aggregation in wild Burmese Pythons and the first ever documented in invasive pythons. Researchers in Hawaii have used radio-telemetry to track feral goats (*Capra hircus*), allowing them to detect and remove additional goats, and researchers term this the “Judas” technique (Taylor and Katahira 1988). Our data suggest that this method can also be used to help detect and remove Burmese Pythons in southern



Fig. 3. (A) Photograph of the Burmese Python (*Python bivittatus*) breeding aggregation discovered in Everglades National Park on 17 March 2006. The three above-ground pythons are visible. Photograph by Chris Bugbee, University of Florida. (B) Black and white outline showing the location of the three above-ground pythons in the photograph.



Fig. 4. Photograph of an *in situ* breeding aggregation of Burmese Pythons (*Python bivittatus*) discovered in March 2010. The aggregation of five pythons (4 M, 1 F) serves as an example of a large aggregation of invasive Burmese Pythons. Photograph by Trey Kieckhefer, University of Florida.

Florida during the breeding season. A single female Burmese Python from Florida may have as many as 87 eggs (Krysko et al. 2012), so using males to locate and remove reproductive females could be highly beneficial to control populations of this invasive species. In subsequent years, more breeding aggregations of Burmese Pythons in Florida have been discovered (e.g., Fig. 4). Efforts are underway to develop this tool, and future research will reveal more about the potential utility of exploiting breeding aggregations of Burmese Pythons via radio-telemetry and the Judas technique.

Acknowledgements

All python radio-tracking was permitted under University of Florida animal care protocols E285 and National Park Service (Everglades) permit EVER-2005-SCI-0102. We thank M. Dorcas for providing his expertise with implanting radio transmitters. L. Brandt, J. Brien, C. Bugbee, V. Chartier, J. Davis, E. Gilbert, W. Guzman, V. Johnson, J.

Kern, K. Chartier, and L. Slavick provided assistance in the field. Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

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