The Safe Hatch Initiative Phase 1

Prepared for: MORAES OF SOUTH FLORIDA

Prepared by: FLORIDA ENVIROMENTAL AND WILDLIFE MANAGEMENT SERVICES

Author: Nicholas Gonzalez

Date: 08/16/2025

FEWMS
—EST. 2024—

Contents

1. Introduction

The North American raccoon (*Procyon lotor*) and the loggerhead sea turtle (*Caretta caretta*) currently coexist within the coastal ecosystem of Historic Virginia Key. While this association is ecologically natural, anthropogenic influences—including increased food availability and the reduction of natural predators—have likely elevated raccoon densities, with negative implications for loggerhead nesting success. Studies have found that mesopredators such as raccoons have devastating direct effects on the marine community on islands in the absence of top-down pressure from apex predators (Suraci et al., 2014).

Loggerhead sea turtles, designated as endangered under the U.S. Endangered Species Act, have experienced severe nest predation in recent years. During the 2024 nesting season, MORAES of South Florida documented the loss of approximately 2,000 eggs and 43 hatchlings across the Virginia Key shoreline. The predation rate reached 60%, with 42 discrete predation events recorded (MORAES, 2025).

Research in urban environments has shown that raccoons inhabiting anthropogenically influenced areas tend to establish significantly smaller home ranges than those in rural habitats—often due to the abundance and concentration of human-derived food sources. Raccoons in urban settings preferentially select human-use areas (such as dumpsters or structures) as habitat, whereas woodland habitats remain important across all landscapes (Bozek, Prange, & Ghert, 2007). Studies in the Atlantic barrier islands of North Carolina indicate that raccoon populations may live near or at carrying capacity with high site fidelity, while seasonal resources (sea turtle nests) support high-density populations with few sources of mortality (Parsons et al., 2013). These studies

suggest that similar dynamics may occur on Historic Virginia Key, thus causing unnaturally elevated raccoon carrying capacity.

Studies on Florida beaches found that removal of raccoons, particularly during nesting season, has the potential to reduce predation pressure by disrupting this seasonal shift toward sea turtle nest foraging. However, the removal of these raccoons will provide an opportunity for recolonization from neighboring areas. (*Barton & Roth, 2007*). A site-specific study is required to assess the impacts of predator-prey dynamics and the effects of removal.

In response, Florida Environmental and Wildlife Management Services (FEWMS) devised a structured management program to evaluate predator–prey dynamics and develop appropriate mitigation strategies. The program is structured into three sequential phases:

1. Baseline assessment and trail camera monitoring
2. Humane capture and relocation of raccoons
3. Post-relocation monitoring using trail cameras

The objectives of Phase I were to quantify raccoon activity through trail camera monitoring, estimate Relative Abundance Indices (RAI), and establish a baseline for evaluating management interventions. This report presents the findings from that first phase.

2. Study Area

Historic Virginia Key Beach Park is situated on the southeastern part of Virginia Key, a barrier island in Biscayne Bay. The park spans 82.5 acres and features habitats such as mangrove wetlands, coastal hammocks, seagrass beds, sand dunes, and natural beaches. This diverse array of habitats supports a wide range of wildlife, including loggerhead sea turtles and raccoons (Virginiakeybeachpark.net, 2025). Often described as an oasis just outside Miami's urban sprawl, it holds significant ecological value for both people and animals. The shoreline habitat, which includes beaches and sand dunes, is a particular focus of this study. Using GPS coordinates of historic sea turtle nests, especially the hotspots of nests that have been predated, sites were selected along the shoreline at roughly equal distances, as shown in Figure 1.

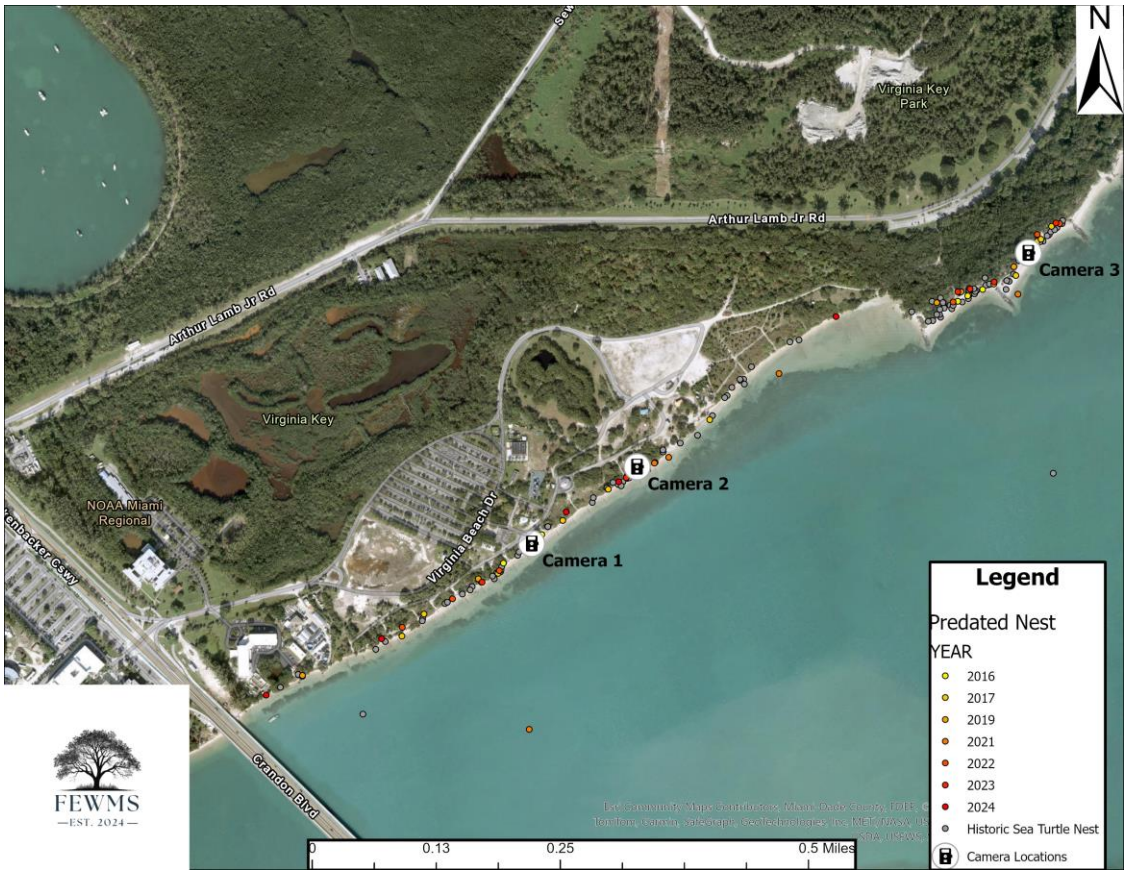

Figure 1: Map of Historic Virginia Key Beach Park showing historic loggerhead sea turtle (*Caretta caretta*) nests, documented predation events by year, and locations of deployed trail cameras.

3. Methods

3.1 Trail Camera Deployment & Collection

Preliminary site visits were conducted to better understand the environment of Historic Virginia Key Beach Park and to determine suitable camera trap locations. During these visits, I met with collaborators including TJ Morrell (MORAES), Sarah Beggerly (Turtl Project), Luiz Galvao Serra Arenas (Historic Virginia Key), and Maya Forbes (Historic Virginia Key). On July 11, 2025, we surveyed beach sites with a history of sea turtle nest predation. Areas with the highest concentration of nests and predation events were prioritized for camera placement.

Three locations along the shoreline were selected and designated as Camera 1 (Figure 2), Camera 2 (Figure 3), and Camera 3 (Figure 4), arranged from south to north, respectively. Each camera was a Bushnell Core-S4K model, deployed for a three-week sampling period to monitor raccoon activity near loggerhead sea turtle nests. Cameras were secured to trees using chains and padlocks to prevent theft, and a warning sign was posted above each camera to inform visitors of ongoing wildlife research and discourage tampering.

Camera placements were as follows:

Camera 1: (25.734975, -80.156000), facing nest VKH045

Camera 2: (25.736099, -80.154273), facing nest VKH041

Camera 3: (25.739194, -80.147927), facing nest VK028

Cameras remained in place until August 2, 2025, at which time the SD cards were collected and the images uploaded for analysis..

Figure 2 : Camera 1 Location Historic Virginia Key Beach Park

Figure 3 : Camera 2 Location Historic Virginia Key Beach Park

Figure 4 : Camera 3 Location Historic Virginia Key Beach Park

3.2 Data Analyses

Photo processing began by confirming that all cameras were active throughout the sampling period. Deployment and collection photos were reviewed and labeled to verify start and end times for each camera. Wildlife detections were recorded using a standardized metric referred to as an occurrence. An occurrence was defined as the first appearance of an individual raccoon in a photo, with a duration of 30 minutes before a new occurrence could be counted for that same individual. If additional raccoons entered the frame, each was counted as a separate occurrence, with its own 30-minute interval applied. For every raccoon occurrence, individuals were classified as adult or juvenile. Other wildlife species detected were also identified by species name, and occurrences were counted using the same 30-minute interval rule. All occurrence data were compiled

into a spreadsheet for analysis. Relative Abundance Indices (RAI) were calculated for each species using the following formula: $RAI = \frac{Occurrences}{Total\ Trap\ Nights}\ x\ 100$ Multiplication by 100 scales the index to represent the expected number of occurrences per 100 trap nights. RAI values were calculated separately for adult raccoons, juvenile raccoons, feral cats, and black spiny-tailed iguanas. In addition, the ratio of adult to juvenile raccoons was calculated to provide demographic context.

4. Results

4.1 Raccoon Relative Abundance Indices

The occurrence of raccoons near the marked sea turtle nest in Historic Virginia Key was impressively high in the photo data analyses. The total raccoon occurrences were (n = 317), which computed to a relative abundance indices of (RAI = 609.62). Camera location played a key factor in occurrence data, as camera 3 had substantially higher occurrences (Figure 5), which in turn caused the relative abundance indices of camera 3 (Figure 6) to be comparatively higher. The proximity to other sea turtle nests and the remote location of camera 3 may have contributed to the high values. It's important to note that RAI calculations were scaled to represent the expected occurrences in 100 days, while this study was over 21 days. Age group occurrences for adults and juveniles were (n=287) & (n=30), respectively. The population was adult-biased with a ratio of (>9:1), which can also be interpreted as 91% adult to 9% juvenile (Figure 7). While a few individuals were identifiable, the majority of photos were taken at night, making specific phenotypic markings and the health of individuals too difficult to identify.

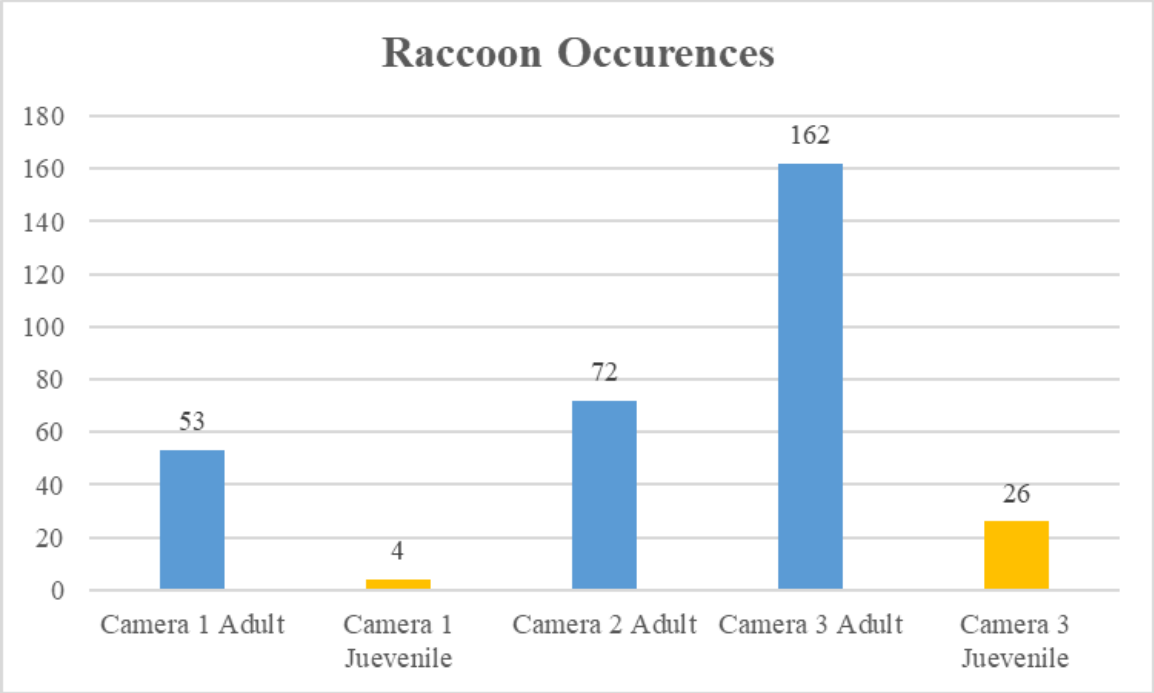

Figure 5: Raccoon occurrences per camera and subdivided into adult and juvenile.

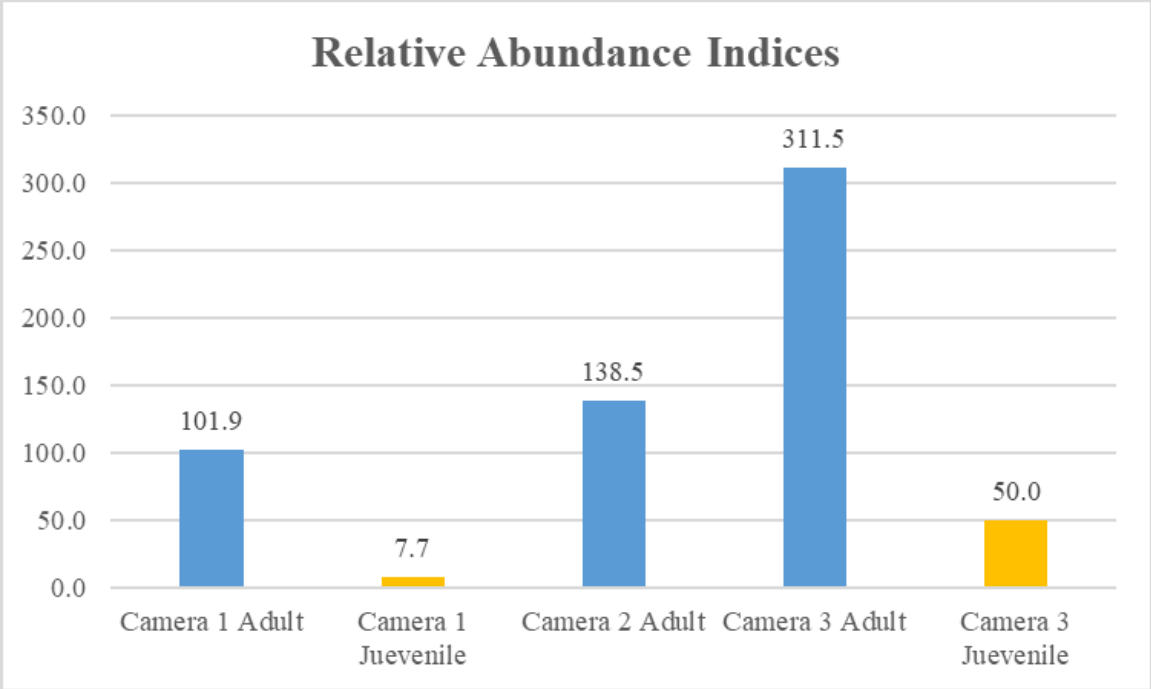

Figure 6: Raccoon relative abundance indices per camera location and subdivided into adult and juvenile.

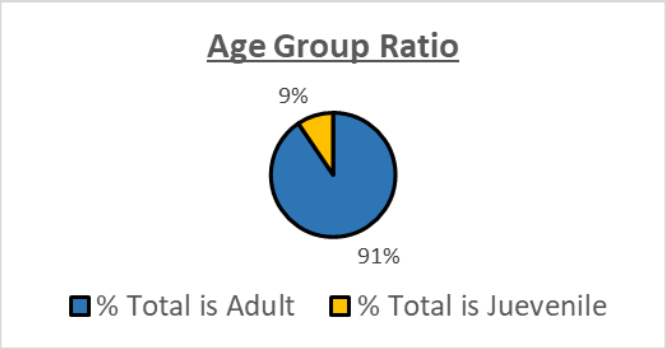

Figure 7: The ratio of adult to juvenile raccoons observed in the trail camera study conducted in Historic Virginia Key.

4.2 Additional Species Relative Abundance Indices

The focus of this study is the raccoon, but there were other wildlife species that appeared on camera and are worth mentioning. There were three additional species spotted on camera: Black Spiny-tailed iguana (*Ctenosaura similis*), Feral Cat (*Felis catus*), and Rabbit (species undetermined). The feral cat appeared the most of the three species, thus resulting in the highest relative abundance indices (Figure 8). The feral cat and the black spiney tail iguana are species of interest due to their diet, and being potential predators for sea turtle nests or hatchling sea turtles.

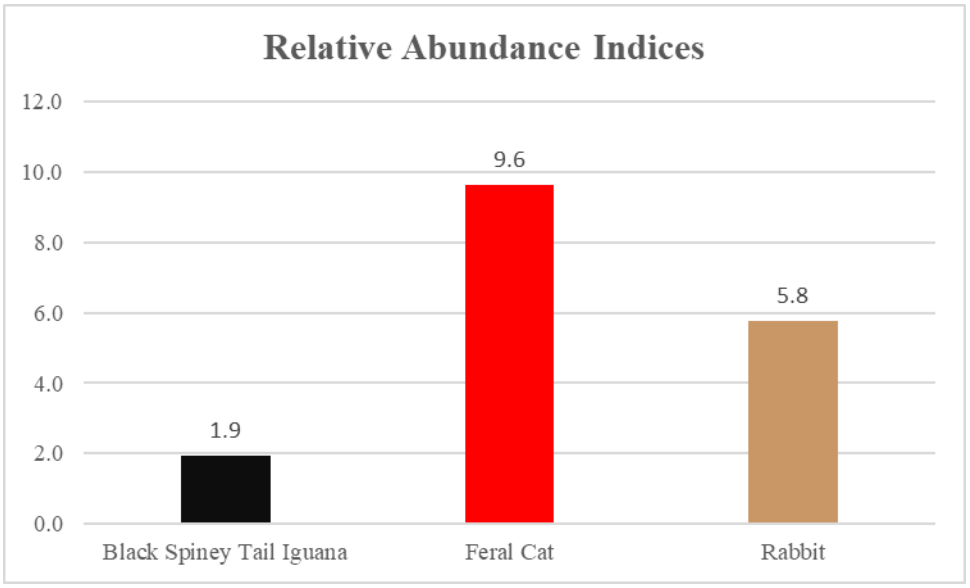

Figure 8: Relative abundance indices for other species caught on trail camera during study.

5. Discussion

5.1 Population Structure and Activity

Phase I of this study provided valuable insight into the ecological dynamics of Historic Virginia Key Beach Park and the interactions between terrestrial and marine fauna. Trail camera data revealed a high frequency of raccoon detections, reflected in elevated Relative Abundance Indices (RAI) values and an adult-biased population structure. These findings paralleled research from barrier islands in the Outer Banks of North Carolina, where raccoon populations at high densities exhibited delayed breeding (Parsons et al., 2013). Juveniles observed on camera were typically accompanied by an adult female, and in one instance (nest VK028), an adult female alongside her offspring was recorded digging into the nest following removal of the protective wire enclosure—illustrating the influence of learned behavior on nest predation. While such behavior is ecologically natural, it highlights the potential vulnerability of unprotected nests and the importance of effective management strategies.

5.2 Predation Dynamics

The absence of raccoon predators in both field surveys and trail camera data further supports the conclusion that this mesopredator population lacks natural top-down regulation (Suraci et al., 2014). Without predation pressure, raccoon populations are more likely to persist at high densities, increasing their ecological impacts on loggerhead sea turtle nests. The observations from this study highlight that nest enclosures are effective at delaying or preventing predation, and when combined with management practices such as raccoon removal, the potential for nest success increases.

5.3 Management Implications

Although the raccoon population may already be close to the local carrying capacity, phased trapping followed by ongoing post-relocation monitoring will be crucial to assess density changes and management results. Studies on raccoon removal along Florida beaches have shown that predator control can effectively reduce sea turtle nest predation (Barton & Roth, 2007). Concerns about over-removal are lessened by the presence of healthy raccoon populations on nearby mainland and island habitats, which are likely to allow natural immigration and recolonization. To sustainably decrease nest predation during the vital sea turtle nesting season, a long-term program of targeted trapping combined with systematic trail camera monitoring is recommended. Continued evaluation will not only measure the success of management efforts but also offer broader insights into predator–prey dynamics in this urbanized coastal ecosystem.

6. Recommendations

Based on the findings of Phase I, Florida Environmental and Wildlife Management Services (FEWMS) recommends removing **50 raccoons** from Historic Virginia Key Beach Park. This number is considered safe at this time and provides a cautious first step toward lowering predation pressure on loggerhead sea turtle nests. After removal, trail cameras will be redeployed at key nesting sites to monitor activity. Once collected, the data will be analyzed, and new Relative Abundance Indices (RAI) will be calculated. The percent change in RAI values will then indicate what proportion of the total raccoon population 50 raccoons represent in this specific area. This will then be used to extrapolate a more accurate estimate of the remaining raccoon population. This refined population estimate will serve as the baseline for sustainable management decisions, including possible future raccoon removals for the 2026 loggerhead sea turtle nesting season.

7. Conclusion

Phase I of the Historic Virginia Key Beach Park trail camera survey established a clear baseline for understanding raccoon activity and its effects on loggerhead sea turtle (Caretta caretta) nesting success. The high Relative Abundance Indices (RAI), along with an adult-biased population and lack of natural predators, highlight the increased predation risk to sea turtle nests in this urban coastal environment. These results confirm the need for targeted management actions, including phased raccoon removal and ongoing monitoring, to reduce predation pressure. By providing baseline data through RAI calculations, this study lays the groundwork for informed, science-based decisions in future phases of the program and supports the long-term conservation of loggerhead sea turtles at Virginia Key.

8. References

Barton, B. T., & Roth, J. D. (2007). Raccoon removal on sea turtle nesting beaches. *The Journal of Wildlife Management, 71*(4), 1234–1237.

Bozek, C. K., Prange, S., & Gehrt, S. D. (2007). The influence of anthropogenic resources on multi-scale habitat selection by raccoons. *Urban Ecosystems, 10*(4), 413–425.

Historic Virginia Key Beach Park. (2025, July 22). *Miami's cultural beach*. https://virginiakeybeachpark.net/

Parsons, A. W., Simons, T. R., O'Connell Jr., A. F., & Stoskopf, M. K. (2013). Demographics, diet, movements, and survival of an isolated, unmanaged raccoon (*Procyon lotor*) population on the Outer Banks of North Carolina. *Mammalia, 77*(1), 21–30.

MORAES. (2025). *The Safe Hatch Initiative: Virginia Key sea turtles*. Marine Operations Research and Environmental Assessment Services. https://www.soflomoraes.com/safehatch

Suraci, J. P., Clinchy, M., Zanette, L. Y., Currie, C. M., & Dill, L. M. (2014). Mammalian mesopredators on islands directly impact both terrestrial and marine communities. *Oecologia, 176*(4), 1087–1100.