

American Alligator (*Alligator mississippians*) Behavioral Ecology on the FGCU Campus

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Abstract

Wild animals often travel deeper into urban areas than they realize and find themselves confronted with an environment they do not understand. They may wander into heavily trafficked areas, get hit by cars, get frightened by people, or, if it happens to be a bird, fly into glass (Threats to wildlife 2018). The top predator, the American Alligator (*Alligator mississippians*) is one of the native animals that still call Florida Gulf Coast University its home. The purpose of this research is to better understand how human activity and development affect the behaviors of the American Alligators (*Alligator mississippians*) at Florida Gulf Coast University. Interactions between humans and alligators have become more frequent, so understanding how human presence and activity changes the detectability of these alligators is important to their long-term management on a human dominated landscape (Kidd-Weaver et al., 2022). This study focused on the ability to track radio-tagged alligators toward a visual sighting and whether this changes with time of day or location on campus. This project built on a previous study where alligators on the FGCU campus were captured, measured, gender-identified, radio-tagged, and released. This part of the study focused on the spatial ecology of movements of the American Alligators based on gender. This phase of the study focused on the time of day they can be found and how this varies between more, to less-developed parts of the campus. Counts of visual locations versus non-visual locations were compared by time of day, campus location, and gender and tested for significant differences using Fisher's Exact Test. Alligators were visible 53% of the time when tracked. This did not vary significantly by gender or area of campus, though males showed some tendency to be more visible where there were less people ($p=0.173$). Understanding the behavior of American Alligators in a developing landscape is critical to the sustainable management of this species.

Background

Habitat loss and degradation are the primary drivers of the decline and extinction of wildlife populations in terrestrial ecosystems, with the main precursors of these impacts being roads and human settlements. If current trends continue, by 2030, urban areas will increase by 1.2 million km² globally and, by 2050, our planet will accommodate more paved-lane kilometers than required to reach Mars (Torres et al. 2016).

American Alligators inhabit wetland ecosystems throughout the southeastern USA. Their western range extends into the Gulf coast, southern, and central portions of Texas (Ross & Ernst 1994; Conant & Collins 1998). Across this range, the American Alligator population is reported to be increasing (Elsey & Woodward 2010). In Florida,

they reported an increase in alligator population due to hunting protection. However, Fujisaki et al. (2011) express concerns about negative alligator population impacts resulting from changing hydrology from human activity.

American Alligators are territorial and are known as a top predator. In many cases of alligator attacks, humans are not the primary target. Instead, the alligator first goes after a nearby pet, which may manage to escape. Unfortunately, less agile humans can unintentionally become victims of such attacks (Langley 2010). However, when human activity is involved, these alligators become more curious and more active due to being food driven (Bradley 2022). One key to minimizing alligator acts is the ability to detect their presence. Although American Alligator behavior has been extensively studied (e.g. Dietz &

Hines 1980; Vliet 1989; Nifong et al 2014; Joanen & Merchant 2018); these studies have focused on captive populations or those in protected areas. Only Kidd-Weaver's (2022) research focused on American Alligators in a human-dominated landscape. She found that "alligator abundance was greater in areas with more freshwater alligator habitat... humans' ability to detect alligators was related to the configuration of alligator habitat in the landscape and physiological and behavioral limits of an alligators' risk-taking behaviors"; and "chronic exposure to humans can alter alligator space use behaviors." Given our campus' efforts to maximize wildlife habitat in our created wetlands, this project examines similar questions on a university campus.

The objective of this study is to gain a better understanding on how American Alligator behavior differs between areas of high density of human traffic versus areas of low density of human traffic. We hypothesized in this research that we will see a difference between the behaviors of the American Alligators that are around more humans than the ones that are not.

Methods and Material

Location site background

Around 70% of Estero Florida is currently developed or becoming developed since the early 2000 (Estero, Florida population history 2015–2021). This is leaving the open space that the animals once called home overpopulated with human foot traffic and development. One place that we can see is on a college campus like Florida Gulf Coast University (FGCU).

FGCU was founded during a time when major changes were happening in higher education, land use planning, and environmental protection. The baby boomers' children were entering college, but the population decrease nationally between generations was never an issue in Florida where there was a net annual increase of 260,000–280,000 residents in the 1970s, 80s, and 90s (Smith 2005). In the 1980s, Southwest Florida underwent significant growth. This growth led to the construction of notable development projects to accommodate the expanding population.

Key developments included the completion of I-75 in 1984, the commencement of construction

for the Southwest Florida Regional Airport (RSW) in 1980, and its subsequent opening in 1983. Additionally, the Lee County Solid Waste Resource Recovery Facility started commercial operations in December 1994. However, these rapid changes in the region's landscape sparked economic and cultural shifts that faced opposition from long-term residents who wished to preserve Florida as it had been in the past (Erwin & McTarnaghan 2021). At the same time, a deeper understanding of the downstream impacts of altered hydrology associated with traditional development drove new guidelines for retaining and treating stormwater (Burr 2008).

The design of the FGCU campus, however, was "not because of a regulatory driving force, but because of a commitment to preserve open space for habitat and environmental value" (Duke et al. 2022). At Florida Gulf Coast University, there are 15,892 students that are currently attending the college. Approximately 4,754 of those students live in campus housing (2022 data). The campus has 807 acres and approximately half of those acres are designated Conservation Areas that provide habitat for native wildlife such as the American Alligator. Alligators can be found in almost all bodies of water on campus (Florida Gulf Coast University, 2022).

Field methods

On Florida Gulf Coast University's campus, we surveyed for American Alligators at the stormwater retention ponds, native and created wetlands, and North Lake (a rock mine barrow-pit) (Figure 3). We conducted visual surveys during the day, spotlight surveys at night, and utilized social media for alligator sightings. We used snatch hooks, and/or snare poles to capture each individual alligator, following Florida Fish and Wildlife Game Commission (FWC) protocols. Each individual larger than 60 cm (from recommendation from FWC staff) was tagged with an SI-2 radio tag and web tag provided by FWC for more permanent identification. The sex of each captured American Alligator was identified by inserting a gloved finger into the cloaca (Ziegler & Olbort, nd). We also determined their total length and categorized them as: juvenile (60.0–121cm), subadult (121.1–182.9 cm), or adult (183.0+ cm); individuals were then tracked one to three times per week. When a tracked animal was located by its radio

signal, it might be sighted visually or it might not be sighted—the latter could indicate avoidance. We categorized gators as normally in high density human areas on campus versus the low density of human areas on campus (Persson et al. 2020). We tested for significant differences in sightings between these more and less developed areas for all animals, and by gender (Fisher's Exact Test, Sokal & Rohlf 1995). This research is approved by FGCU's Institutional Animal Care and Use Committee (IACUC), Protocol 2122-06 and the FWC Permit SPGS-22-13R.

Results

Although the entire study started in the Spring of 2022, this phase, focused on the alligator behavior was initiated at the end of 2022. From December 4th, 2022 through June 12th, 2023, we caught a total of eight alligators at Florida Gulf Coast University and collected data on six of these (2 females and 4 males). These alligators were tracked once to three times a week for a total of 115 times over the seven-month period. Overall, American Alligators were visual 53% of the time when being tracked to their location. Sighting of all alligators was not significantly different between areas we categorized as high density of human foot traffic versus low density of human foot traffic ($p=0.46$). Females were also not significantly different between these two areas ($p=0.796$). Males showed some tendency to be more visual in less dense areas, although this was not a significant pattern ($p=0.173$). Out of the two female alligators in this study, one of them spent more time in a higher traffic area probably due to availability of food. Our sample had a higher number of male alligators compared to female alligators, and we saw more damage on the males (injuries, missing limbs - Figure 4) that we assumed to be intraspecies aggression. These results should be considered in light of the relatively small sample sizes, though studies of large and protected species often have smaller study populations (Metcalf 2017).

Discussion and Conclusions

Although we did not find a specific difference in visually locating the Alligators from categories of high to low human use, we did not quantify the degree of human use. It is possible that all of the alligators

on our campus are subjected to relatively high human presence. In the future, researchers can conduct another similar study on high foot traffic area and low foot traffic area to see if results are similar; and if possible, increase the sample size. Kidd-Weaver et al. (2022) found the capture and tagging process “increased the probability of flight” from subsequent interactions. In our study, all alligators had been captured and tagged. A future study that differentiated captured animals from naive animals might provide further insights, and Kidd-Weaver et al. emphasized the need to do this work in developed landscapes. Adverse conditioning may be particularly important in more developed landscapes with increased human and alligator interactions. However, 47% of our locations did not include a visual sighting. This could be interpreted as our campus alligator populations having an appropriate desire to avoid human interaction.

Our data indicated a non-significant trend in increased visibility for male alligators in areas with less human use. Our field observations lead us to a non-quantified generalization that young male alligators were more ‘curious’ and were more likely to approach the capture team. Vliet (1989) did report gender differences in breeding and territorial displays, but no generalizations about gender behavior beyond courtship. Younger, more subordinate animals were reported as exhibiting these behaviors less commonly. We also detected avoidant behavior following the initial capture, supporting the finding of Kidd-Weaver et al. (2022) that the capture could serve as adverse conditioning to human presence. Overall, we felt that alligator behavior was often individually distinct, leading to the ability to identify individuals by how they responded to our presence. These unique behavioral patterns would require much larger sample sizes before any robust generalizations between genders could be made.

It is important to be able to understand how development is changing the behavior of not just the American alligators, but of all animals living in these habits. Rosenwieg's (2003) concept of “reconciliation ecology”, an effort to guide human development toward the goal of “sharing our habitats deliberately with other species,” is likely to increase human and wildlife interactions both positively and

negatively. On the FGCU campus, we have attempted to maximize conservation area and wildlife habitat within the human footprint. This inevitably increases human and wildlife interaction. On our campus human wildlife interactions have included: wild hogs, raccoons, bobcats, Florida panthers, black bears, and venomous snakes. All of those listed have been perceived by some as negative. It is common during our fieldwork to interact with humans who would ask if we are moving the alligators off campus or away from high human-use areas. The assumption seems to be that if they are potentially dangerous the research or management effort should be to remove them, rather than to learn to live with them safely.

Our data did indicate behaviors can be influenced by feeding. It is well recognized that feeding alligators not only makes them bolder, but can make it seem aggressive because it loses its natural fear of humans (Dean 2016). Our campus has installed interpretive signs in an effort to educate new students on the danger, and illegality, of feeding. Each new crop of freshmen seem to need reminders, and a more focused education program on campus wildlife for students and staff, seems warranted (Eversole et al. 2018).

Our study will hopefully lead to three insights. First, more natural landscape design that is intended to maximize green space for humans and habitat for other species will lead to more human/wildlife interactions. Second, these interactions, positive and negative, will likely change wildlife behaviors. Third, a need arises to more carefully study wildlife in urbanizing landscapes, and the human behaviors that can lead to, or mitigate, negative interactions. As we strive to “surround ourselves with our cousins from other species” (Rosenweig (2023) we must focus some attention and research on how we change them, and how they change us and how we all may live together.

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Figure 1: Map with the location of Florida Gulf Coast University

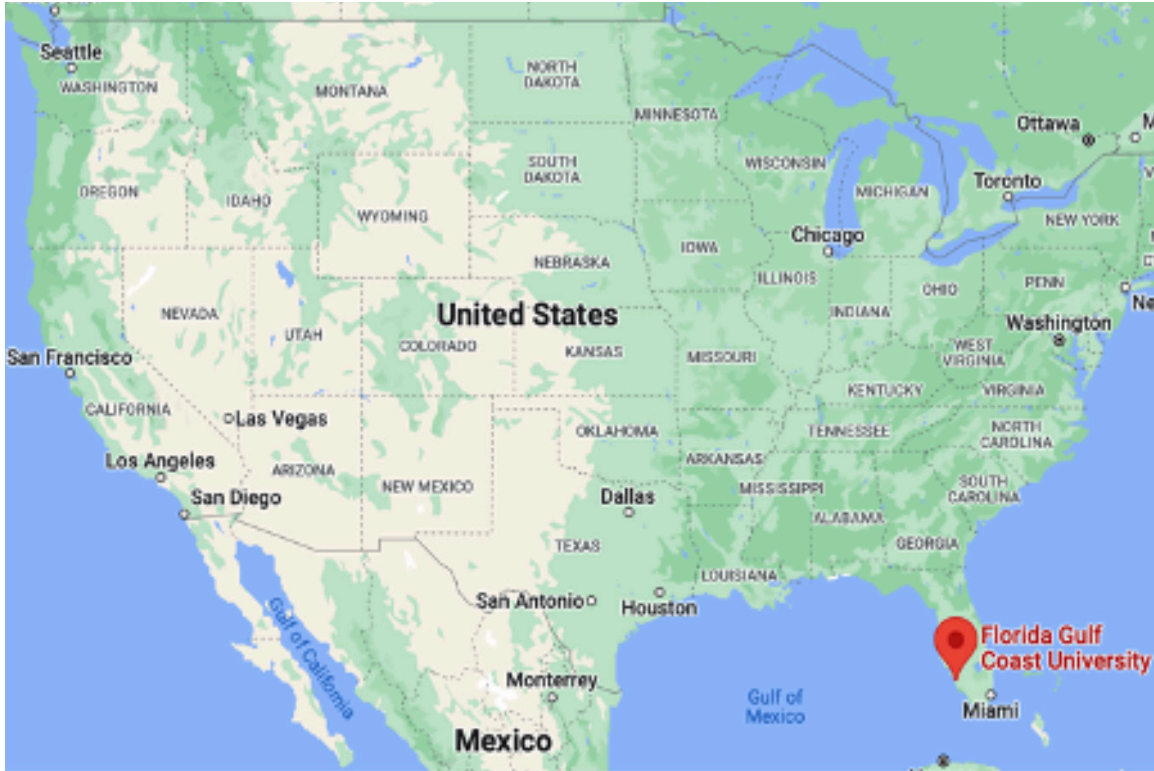


Figure 2: All alligator location from December 4th, 2022, to June 12th, 2023

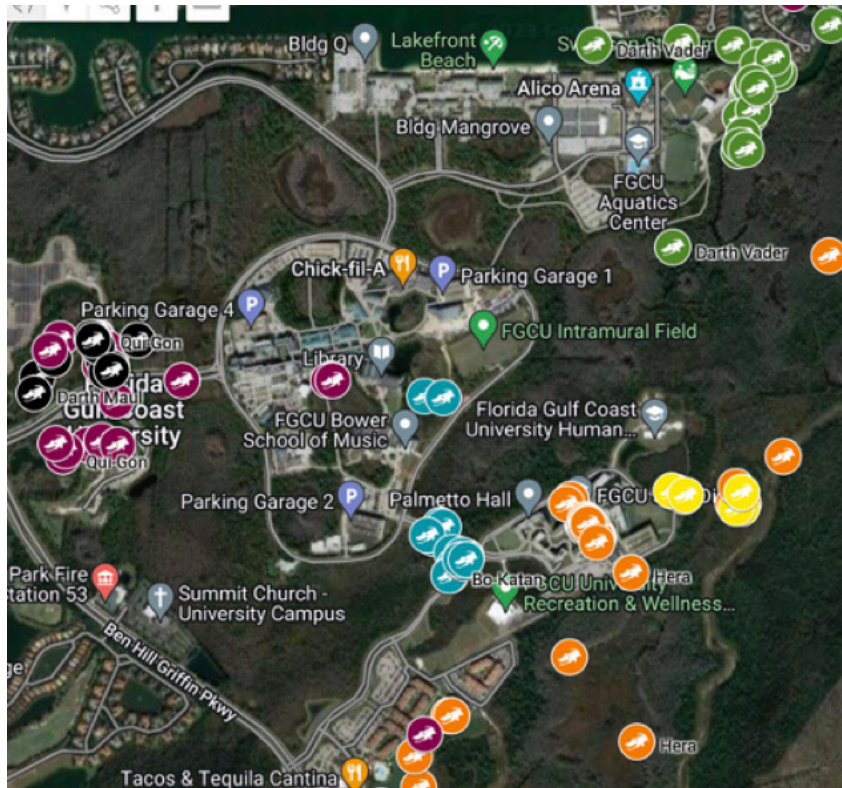


Figure 3: Individual tracking events, count of times signal was detected, and count of visual confirmation.

Alligators identified by volunteer observers' reports

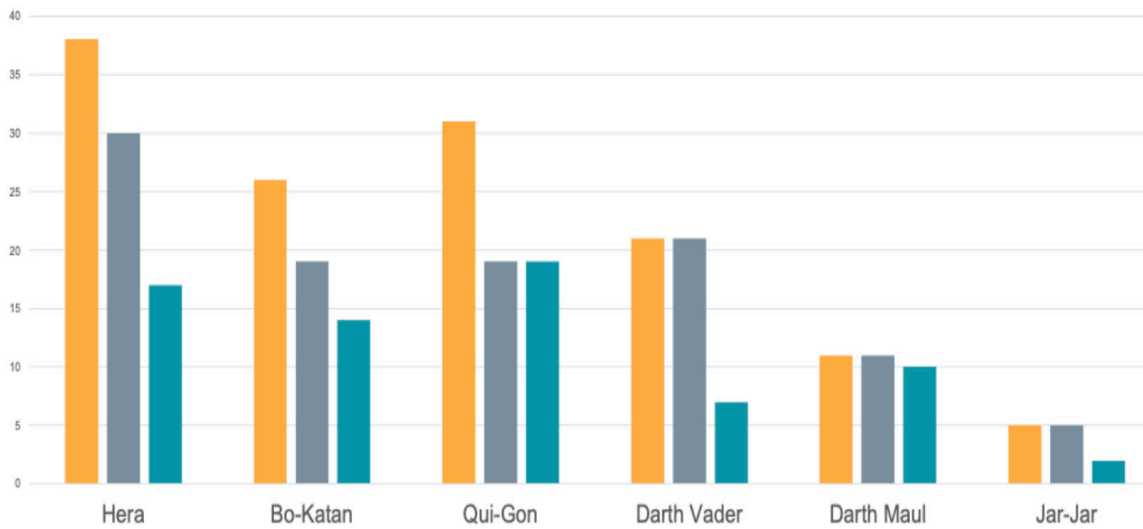


Figure 4: Male alligator injuries that we documented during the research. A. is our male alligator Darth Maul, B. is our other male alligator Jar-Jar. Both are missing legs and have an injury on their tails.

A.



B.

