

# History, Status, Impacts, and Management of Invasive Black Spiny-tailed Iguanas (*Ctenosaura similis*) on Gasparilla Island, Florida<sup>1</sup>

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This publication summarizes the history, status, and management of invasive black spiny-tailed iguanas (*Ctenosaura similis*) on Gasparilla Island, in southwest Florida. Our target audiences are residents and visitors of Gasparilla Island as well as naturalists interested in Florida's diverse wildlife, especially introduced reptiles. Our specific goal is to increase knowledge and raise awareness about black spiny-tailed iguanas, their impacts, and the challenges of managing those impacts. More broadly, we aim to raise awareness about the many introduced and invasive reptiles in Florida and motivate people to take action to help prevent additional introductions of nonnative reptiles as well as support management efforts to curtail the spread of introduced reptiles in the Sunshine State. The information used to produce this publication was derived from published scientific articles, communications with colleagues, and our own research.

## Invasive Species

A species is considered invasive when it is introduced by humans to an area where it is not native, and it causes or could cause damage to the environment, economy, or human health and safety in that area (Iannone et al. 2021). Invasive species are a major threat to global biodiversity, causing the extinction of at least 34 species and

contributing to the extinction of at least 57 others (Clavero and García-Berthou 2005). Invasive species also cause about \$120 billion in damages and associated management costs per year in the United States alone (Pimental et al. 2005).

Florida has more established nonnative reptile and amphibian species than anywhere else in the world. Over 60 species of introduced reptiles and amphibians have established breeding populations within the state (Krysko et al. 2016). In fact, Florida has three times as many established species of introduced lizards as native lizards (Hardin 2007). Florida is a prime spot for invasion by nonnative reptiles due to several factors. Florida is a shipping hub with major ports of entry for arrival of wildlife species (both legal and illegal) (Lockwood et al. 2019). These species may be the commodity being shipped, as in the pet trade, or transported inadvertently as “stowaways” in cargo (King and Krakauer 1966). The state has a popular captive wildlife industry, and facilities housing nonnative species (e.g., breeders, retail vendors, individual pet owners) are susceptible to escapes and sometimes intentional releases of unwanted animals (Fujisaki et al. 2010) (Episcopio-Sturgeon and Pienaar 2019). Additionally, Florida's mild climate is suitable for many introduced amphibians and reptiles (Bomford et al. 2008) (Engeman et al. 2011). Much

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of Florida has a sub-tropical climate, and although the entire state lies north of the Tropic of Cancer, the very southern portion of the Peninsula is considered tropical. These conditions resemble the climate in the native ranges of many of the nonnative reptiles that are now established in Florida.

The Burmese python is probably the best known of Florida's invasive reptiles, frequently making headlines because of the snake's massive size and occasional interactions with alligators. Introduced through the pet trade, pythons were first recorded in the Everglades in 1979 and have been considered established there since 2000 (Guzy et al. 2023). Studies have shown that pythons have caused dramatic declines in mammal populations in the Everglades (Dorcas et al. 2012) (McCleery et al. 2015), and they have spread invasive parasites, which are affecting native snakes (Miller et al. 2018). They may also have a considerable impact on native bird populations (Dove et al. 2011). Government agencies have spent millions of dollars on research and management in an attempt to prevent further spread of this invasive snake in Florida (Guzy et al. 2023). While they are the most infamous, Burmese pythons are but one of many invasive reptiles harming Florida's economy, environment, and human quality of life.

## History of Black Spiny-tailed Iguanas on Gasparilla Island

Black spiny-tailed iguanas (*Ctenosaura similis*) occur naturally from Mexico to Panama (Fitch and Hackforth-Jones 1983). They were introduced to Gasparilla Island intentionally by a resident who apparently brought back three iguanas as pets from Mexico between the late 1970s and the early 1980s. He and his children raised the iguanas for several years and then released them near the Range (aka Gasparilla Island) Lighthouse on the southern end of the island (Krysko et al. 2003). The iguanas apparently were not hindered by inbreeding due to their small starting population size. They remained localized on the south side of the island for a while, but by 2003 they had spread across the entire island and onto the mainland (Krysko et al. 2003). Due to numerous reasons discussed below, black spiny-tailed iguanas are considered an invasive species in Florida.

Today, black spiny-tailed iguanas occur along much of the southern half of Florida's Gulf Coast (including Gasparilla Island) as well as the south Atlantic Coast (Figure 1). Analysis of DNA suggests the majority, if not all, of the black spiny-tailed iguanas on the west coast are derived

from the initial introduction and subsequent spread of the species from the three pet iguanas on Gasparilla Island (Nunez 2016). The black spiny-tailed iguanas on the east coast appear to be from several additional and independent introductions of iguanas associated with the pet trade (Nunez 2016). There is also an isolated population of Mexican spiny-tailed iguanas in a small area near the Charles Deering Estate in Miami.

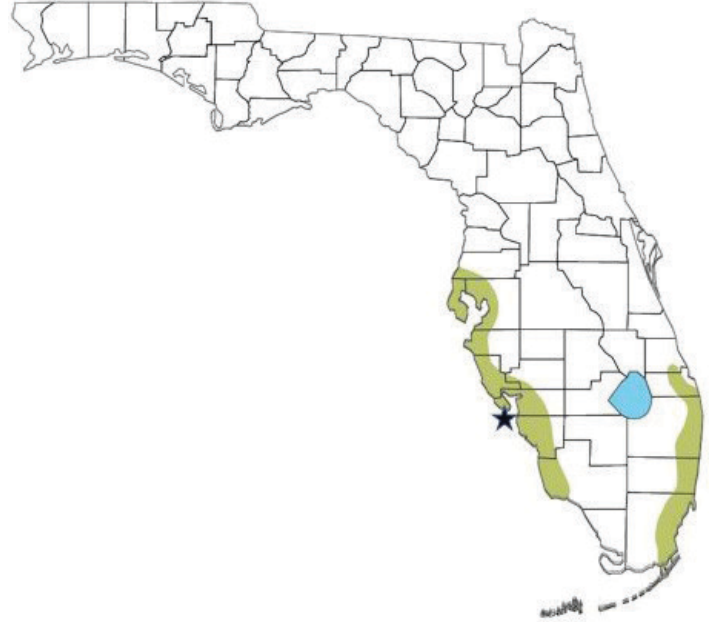


Figure 1. Approximate range of black spiny-tailed iguanas (*Ctenosaura similis*) in Florida. This map is based on personal communications with colleagues and on records in EDDMapS, the Florida Museum of Natural History herpetology database, and iNaturalist. Note that they occur throughout the Florida Keys, and there are numerous additional records of single individuals from the mainland that are not included here. Thus, this map approximates the minimum extent of where the species is likely established in Florida in 2022. The location of Gasparilla Island on Florida's southwest coast is indicated by the star. Credits: Tracy Bryant, UF/IFAS

## Identification and Ecology of Black Spiny-tailed Iguanas

Black spiny-tailed iguanas are the only large nonnative lizard on Gasparilla Island, making identification there straightforward. Hatchlings are around six inches long, including their tail, when they emerge from the egg. Sometimes they may be light green, but more typically they are pale tan to gray with dark brown netlike markings called "reticulations" (Figure 2) (Fitch and Hackforth-Jones 1983). Tan/gray hatchlings become bright green with brown, black, and gold markings within a few months of hatching (Lee 2000). Juveniles may or may not have dark crossbands on their back (Figure 3). Juveniles move quickly and may be seen running along the ground or climbing low trees or shrubs. After about six months, they attain their

adult coloration of light gray or tan with dark bands across the back. Adults may reach lengths of greater than four feet, including their long, spiny tail. Males are larger than females and have stockier heads and a more pronounced crest of scales along their back (Figure 4). Their heads are usually light gray or tan, but during the breeding season, males will often develop orange coloring on the head with reddish-orange spots on the body. They have long tails with rings of prominent, spiny scales as their name suggests. The spines may be used for defense if the animals are picked up or attacked by a predator (Figure 5) (Fitch and Hackforth-Jones 1983) (Lee 2000). Other lizard species found on Gasparilla Island include the nonnative brown anole (*Anolis sagrei*) ([more about brown anoles in Florida here](#)) and tropical house gecko (*Hemidactylus mabouia*); as well as the native green anole (*Anolis carolinensis*) and six-lined racerunner (*Aspidoscelis sexlineata*). However, none of these grows longer than about 12 inches, including the tail, so they are not likely to be confused with black spiny-tailed iguanas. Several other large invasive lizards also occur in Florida, including the Nile monitor (*Varanus niloticus*), green iguana (*Iguana iguana*) ([more about green iguanas in Florida here](#)); and Argentine black and white tegu (*Salvator marinae*) ([more about tegu lizards in Florida here](#)); but none presently occur on Gasparilla Island.



Figure 3. Juvenile black spiny-tailed iguana with tan to gray coloration, a hint of green on the neck and legs, dark brown reticulations, and dark crossbands across the back.  
Credits: Steve A. Johnson, UF/IFAS



Figure 2. Juvenile black spiny-tailed iguana that still has green coloration.  
Credits: Kevin Enge, FWC, used with permission

Juvenile black spiny-tailed iguanas feed almost exclusively on insects and other small invertebrates. They begin to consume more plant material as they get older but will still prey on animals when given the chance, including small mammals, birds and bird eggs, hatchling sea turtles, young gopher tortoises, and other lizards, including their own species (Avery et al. 2009) (Krysko et al. 2009) (Garcia Rosales et al. 2020).

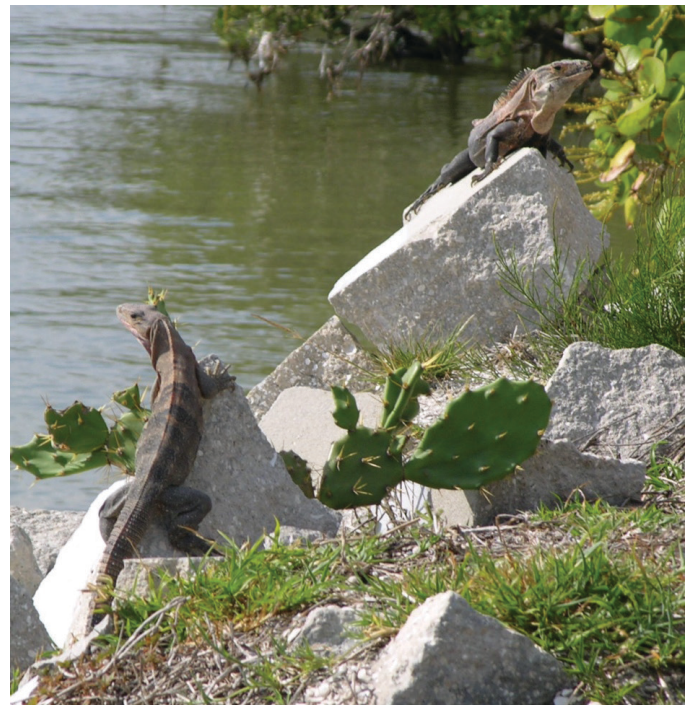


Figure 4. Adult black spiny-tailed iguanas. Female (left) and male (right).  
Credits: Steve A. Johnson, UF/IFAS

Female black spiny-tailed iguanas become reproductive at two years of age. On Gasparilla Island, females lay a single group of eggs (called a clutch) each year in early summer, and hatchlings emerge in late summer. The number of eggs per clutch increases with the body size of the female and averages about 30 on the island, though up to 82 eggs have been found within a female in Florida (Krysko et al. 2003) (Avery et al. 2014). In their native range, females are known to lay their eggs in burrows in sunny, sandy areas. These nest burrows can be extensive, with numerous side

tunnels, and up to five females may lay eggs in separate chambers within the burrow (Fitch and Hackforth-Jones 1983). However, their nesting behavior on Gasparilla Island is poorly documented.



Figure 5. Tail of an adult black spiny-tailed iguana.  
Credits: Sean L. McKnight, UF/IFAS

## Black Spiny-tailed Iguanas as an Invasive Species on Gasparilla Island

Black spiny-tailed iguanas harm people on Gasparilla Island in several ways. The iguanas may compromise the integrity of manmade structures by burrowing beneath the foundations of buildings, into rock walls and sea walls, under sidewalks, etc. (Figure 6). They damage landscaping plants by eating the flowers and leaves of ornamental vegetation and stripping bushes of foliage, as seen in this video of one of them climbing a hibiscus bush to eat a flower: <https://original-ufdc.uflib.ufl.edu/IR00011963/00001/video>.

When black spiny-tailed iguanas occur at high densities, their feces can become smelly, unsightly, and unsanitary, particularly in or around swimming pools and docks (Figure 7). Although there is no evidence that wild iguanas in Florida transmit pathogens to humans, their feces may contain bacteria such as *E. coli* and *Salmonella* (Sylvester et al. 2014) (Charruau et al. 2020). They have been known to nest in attics and climb through vents, and sometimes end up in people's toilets (Skoloff 2006). Black spiny-tailed iguanas are not normally dangerous to people or pets. They are not aggressive and usually flee if approached.

However, they are defensive and may inflict a painful bite and scratches with their claws and spiny tail if grabbed or cornered by a person or dog.



Figure 6. Black spiny-tailed iguana burrow under the foundation of a home on Gasparilla Island.  
Credits: Sean L. McKnight, UF/IFAS

Black spiny-tailed iguanas could harm sensitive native wildlife species on the island such as the gopher tortoise (*Gopherus polyphemus*), loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), least tern (*Sterna antillarum*), a seabird, and snowy plover (*Chardrius nivosus*), a shorebird. Predation on juvenile tortoises has been documented on the island (Avery et al. 2009) (Figure 7). In Mexico, they are known to eat the eggs and hatchlings of least terns and prey on hatchling sea turtles (Garcia Rosales et al. 2020). The extent to which iguana predation affects the populations of any of these species in Florida is unknown.

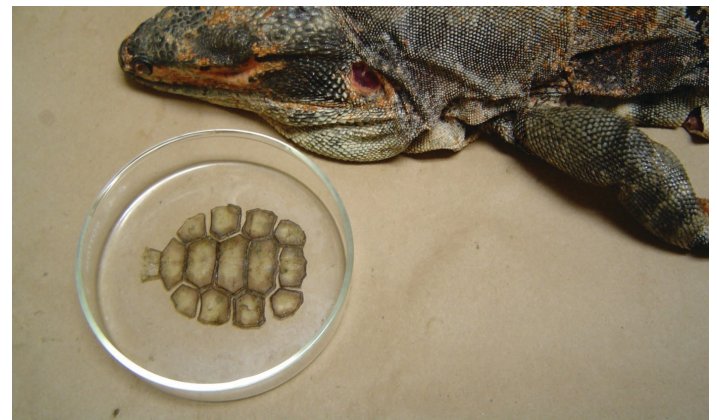


Figure 7. Stomach contents from a black spiny-tailed iguana captured on Gasparilla Island contained the undigested scutes (shell scales) of a juvenile gopher tortoise.  
Credits: Eric Tillman, U.S. Department of Agriculture and previously published in a scientific journal, used with permission



Figure 8. Black spiny-tailed iguana feces.  
Credits: Sean L. McKnight, UF/IFAS

## Ecology and Importance of Gopher Tortoises

Gopher tortoises are native to the Southeastern Coastal Plain of the United States from Louisiana east to South Carolina and south to Florida. They require well-drained, sandy soil for digging burrows and nests, a sparse overstory with sunny places for basking and nesting, and plenty of short, tender plants to eat (Hipes et al. 2000). This terrestrial turtle is common on Gasparilla Island, especially among the sand dunes. They are brown to gray land-dwelling turtles that average 8 to 10 inches long (shell length) as adults but can reach lengths of 12 inches (Ernst and Lovich 2009) (Figure 9). Hatchlings are about two inches long (Figure 10). Gopher tortoises are slow to reproduce and have low survival when they are small. Females take 9–21 years to reach sexual maturity (Landers et al. 1982) (Godley 1989) (Mushinsky and McCoy 1994). Predators destroy the eggs of many tortoise nests, and most young are consumed by predators or die from other causes before they reach adulthood. Studies have found that over 90 percent of eggs and hatchlings are eaten before reaching one year old (Alford 1980) (Witz et al. 1991).



Figure 9. Adult gopher tortoise at the entrance of its burrow.  
Credits: Sean L. McKnight, UF/IFAS



Figure 10. Juvenile gopher tortoise.  
Credits: Steve A. Johnson, UF/IFAS

Gopher tortoises use their broad front feet and strong claws to dig long burrows for protection from predators, fire, dehydration, and extreme hot and cold temperatures (Hipes et al. 2000). Their burrows are usually easily recognizable (Figure 11). The opening is half-moon shaped and there is typically a mound of sand called an “apron” just outside the entrance, which is formed as the tortoise kicks out soil while digging the burrow. They spend most of their time in these burrows, leaving primarily to eat and bask in the sun (Douglass and Layne 1978). Gopher tortoises are considered ecosystem engineers because their burrows act as shelter, feeding, and reproduction sites for at least 360 other species, often referred to as “commensals,” some of which cannot exist without the tortoise (Jackson and Milstrey 1989). Gopher tortoises are also considered a keystone species because their presence promotes higher diversity of other species (Catano and Stout 2015). [Click here for more information on gopher tortoises.](#)



Figure 11. Gopher tortoise burrows.  
Credits: Sean L. McKnight, UF/IFAS

## Iguana Use of Gopher Tortoise Burrows

Gopher tortoises are common on Gasparilla Island and are found within beach dune and coastal strand habitats, as well as in grassy areas near buildings and roads. Although iguanas often dig their own burrows, particularly under objects such as rocks and logs, they will also occupy the burrows of gopher tortoises, as in Figure 12, below, and in this video showing a black spiny-tailed iguana (*Ctenosaura*

*similis*) entering a gopher tortoise burrow: <https://original-ufdc.uflib.ufl.edu/IR00011950/00004>.



Figure 12. Black spiny-tailed iguanas and juvenile gopher tortoise inside tortoise burrows on Gasparilla Island. Images are photos of the burrow-scope camera viewing screen. From top to bottom, Iguana face; iguana tail, body partially buried; rear of juvenile tortoise shell; and iguana gaping mouth after being nudged with camera scope on Gasparilla Island.

Credits: Sean L. McKnight, UF/IFAS

Research conducted by the lead author (S.L. McKnight) evaluated the interactions between black spiny-tailed iguanas and gopher tortoises on Gasparilla Island to see if iguanas moving into tortoise burrows changes tortoises' burrowing behavior, and, if so, whether the changes may eventually harm gopher tortoises. Specifically, it has been suspected that iguanas may exclude tortoises from existing burrows and cause them to dig additional burrows (Engeman et al. 2009). This work took place at two sites within the beach dune habitat along the west edge of the island (Figure 13) where tortoise burrows are easy to find. One site was within Gasparilla Island State Park, which has had minimal iguana removal effort, and the other was within private property where there has been ongoing iguana removal by the U.S. Department of Agriculture Wildlife Services since 2008. A camera scope was used to look inside tortoise burrows (Figure 14), as well as side tunnels dug by iguanas into the end, sides, and ceilings of the tortoise burrows (Figure 15). Scoping footage showing iguana side-tunnels in a gopher tortoise burrow is available here: <https://original-ufdc.uflib.ufl.edu/IR00011950/00003>. Note the nonnative greenhouse frog in the lower tunnel. Scoping frequently revealed these frogs in gopher tortoise burrows.



Figure 13. Beach dune habitat on Gasparilla Island.  
Credits: Sean L. McKnight, UF/IFAS



Figure 14. Gopher tortoise burrow scope used for determining occupancy of burrows (iguana tail visible on monitor).  
Credits: Sean L. McKnight, UF/IFAS



Figure 15. Black spiny-tailed iguana side tunnel inside a gopher tortoise burrow. Note floor "tail-drag" and ceiling "crest-scrape" markings left by an iguana.  
Credits: Sean L. McKnight, UF/IFAS

Tortoise burrows were inspected in the morning during winter, while iguanas and tortoises would still be inside the burrows—both species are active during the day but seek shelter at night. Rarely (only 1.25% of burrows examined) were tortoises and iguanas observed in the same burrow at the same time, and tortoises were less likely to occupy burrows that contained side tunnels dug by iguanas. And on only a single occasion was more than one iguana observed in a burrow. However, at very high densities, the frequency of simultaneous use of burrows by multiple iguanas may increase. Tortoise occupancy was lower and iguana occupancy was higher in tortoise burrows at Gasparilla Island State Park, where there has been relatively little iguana removal compared to the private property site. Furthermore, tortoises were less likely to be seen in a burrow where iguanas were observed during previous surveys. Our research findings from Gasparilla Island suggest that tortoises are avoiding or being excluded from their burrows by the iguanas, causing tortoises to move and dig additional burrows. Although the precise mechanism is still unknown (e.g., tortoises leaving after a failed predation attempt or aggressive interaction, or avoiding iguana scent), Gasparilla Island State Park staff reported an observation of a brief “stand-off” between a very large iguana and a large tortoise at the park (Figure 16), where a tortoise blocked its burrow entrance and the iguana soon left. During the following days, both species were seen coming and going from the burrow, but eventually only the iguana was seen using the burrow.



Figure 16. Gopher tortoise blocking its burrow from a black spiny-tailed iguana at Gasparilla Island State Park.  
Credits: Gasparilla Island State Park staff, used with permission

Additionally, a higher proportion of smaller tortoise burrows (dug by juvenile tortoises) was found at the state park, although the tortoise occupancy rate was dramatically lower there. At first glance, an abundance of burrows, especially juvenile burrows, may seem like a good thing—a sign of a healthy breeding population. However, a low tortoise-to-burrow ratio (or more burrows per tortoise) is considered a sign of environmental stress, as each tortoise uses more burrows when food is scarcer or disturbances by potential predators are more common (Mushinsky et al. 1994) (Wilson et al. 1994). We suggest that the higher proportion of juvenile burrows at the state park is likely the result of juvenile tortoises being disproportionately affected because they are potential prey for iguanas. The concerns over tortoises having to dig additional burrows include the energetic cost of excavating the burrow as well as the lost opportunity to forage while they are digging. In addition, tortoises are more exposed to predators, extreme temperatures, and dehydration while they search for a new location to burrow and when digging the burrow.

Other species observed inside tortoise burrows on Gasparilla Island included the native eastern coachwhip snake (*Masticophis flagellum flagellum*), southern ringneck snake (*Diadophis punctatus punctatus*), and southern toad (*Anaxyrus terrestris*), as well as an invasive Burmese python (*Python bivittatus*) and nonnative greenhouse frogs (*Eleutherodactylus planirostris*) (see Figure 17 and [scoping footage](#)).

## Managing Iguanas on Gasparilla Island

The residents of Gasparilla Island found the iguanas such a nuisance that they self-imposed a tax to pay for iguana management. Gasparilla Island is part of two counties, with the northern portion in Charlotte County and the southern portion in Lee County. In 2007, Lee County hired a private iguana trapper, and, in 2008, Charlotte County contracted USDA Wildlife Services to remove iguanas (Avery et al. 2014). The trappers have access to county-owned property and arrange with private landowners and homeowner associations for permission to access private properties.

Trappers use a variety of methods to remove iguanas. When safe, they use .22 caliber rat shot or air rifles to shoot iguanas, and place baited live traps in areas frequented by iguanas. In addition, non-baited traps are often set in areas where iguanas have been recently sighted and/or tracked. These traps (referred to as colony traps) are placed in such a manner that iguanas must eventually enter them (Figure

18). Traps are typically located near tortoise burrows, under bushes, or in places where residents specifically report an iguana. The traps are placed in inconspicuous locations at the request of housing associations so they are not tampered with. Evidence of recent iguana activity is used to determine exactly where to set traps. Black spiny-tailed iguana tracks are easily identifiable in sandy areas throughout the island, including the beach dunes and on tortoise burrow aprons. They leave behind footprints on either side of a distinctive “tail drag,” often with visible ridges left behind from the tail’s spiny scales (Figure 19). They also leave distinct scratch marks on tree branches where they perch, especially those of seagrape (*Coccoloba uvifera*). Traps consist of a rectangular metal cage with a door connected to a flap on the floor that closes the door when stepped on by an iguana. Maraschino cherries make an ideal bait because their bright red color is attractive to iguanas, and they are durable due to added preservatives. Fruits such as watermelon and cantaloupe are also effective baits, but rot quickly and must be replaced frequently.

Gasparilla Island is unlikely, especially as there are areas with iguanas that trappers do not have access to, such as private properties without agreements with iguana trappers. Additionally, there has only been minimal iguana removal at Gasparilla Island State Park due to limited staffing and high visibility from park visitors, with only about 600 animals removed from the park since 2012 and no records of prior removals.



Figure 18. Black spiny-tailed iguanas (*Ctenosaura similis*) captured in box traps.

Credits: Sean L. McKnight, UF/IFAS



Figure 17. Other species found inside tortoise burrows during surveys conducted by the senior author on Gasparilla Island, FL. A) eastern coachwhip snake (native); B) southern ringneck snake (native); C) southern toad (native) and iguana tail; D) and E) Burmese python (invasive).

Credits: Sean L. McKnight, UF/IFAS

Since 2008, USDA has removed over 15,000 iguanas from the Charlotte County portion of the island, and private trappers have removed many thousands of iguanas from Lee County, as well. These efforts appear to be successful in suppressing numbers of iguanas, but management must be ongoing (Avery et al. 2014). Eradication of iguanas from



Figure 19. Black spiny-tailed iguana (*Ctenosaura similis*) tracks on a gopher tortoise burrow apron (left) and in sand dunes (right) on Gasparilla Island.

Credits: Sean L. McKnight, UF/IFAS

Even though it is highly unlikely that the iguanas can ever be eliminated from the island (remember that it only took three iguanas to populate it to begin with), ongoing removal can help manage the population to reduce the impacts to people and the environment. Iguanas are still a common sight on the island and still cause problems. However, many residents who lived there prior to iguana removals say the difference is obvious, and the iguanas were more numerous before their management than they are today.



## What You Can Do

Please support iguana trapping efforts. You can help by working with wildlife managers and allowing iguana trappers access to your property and by sharing this information with your neighbors and encouraging them to do the same. If you see an iguana trap, leave it alone. Managers are aware of the iguana situation on Gasparilla Island, so there is no need to report black spiny-tailed iguana sightings on or near the island. However, residents and visitors to Gasparilla Island State Park are encouraged to report iguana sightings to park staff and support increased iguana management in the park to protect the park's native plants and animals.

Do not feed iguanas. You can protect your valuable plants with cages or screen enclosures and install sheet metal guards around trees, palms, and dock pilings to prevent iguanas from climbing. Avoid planting species iguanas prefer to eat, such as hibiscus, orchids, bougainvillea, roses, garden vegetables, and some fruit trees. Instead, choose plants that are resistant to iguana damage like milkweeds, oleanders, pentas, crotons, and citrus (if not under quarantine), or other plants that are either too tough or too toxic for iguanas to eat (Kern 2004). [You can find more information on dealing with iguanas around your home here.](#)

Be a responsible pet owner. When purchasing a pet reptile, consider the cost of care, caging requirements, how long it will live, how large it will grow, and if it will be safe for your household (Johnson et al. 2011). [See a useful guide to buying pet reptiles here.](#) Never release a pet into the wild! It is illegal, and either your pet or native species—or very likely both—will end up suffering the consequences (Johnson et al. 2017). [You can find more advice and resources for dealing with unwanted exotic pets here.](#)

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