



# Island Paradise or Island Trap: The Uncertain Future of Florida's Turtle Island

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Photographs by the author.

When most people think of Florida, they envision theme parks, hot sandy beaches, luxurious hotels and clubs, or perhaps Everglades National Park. Yet Florida is home to 25 species of turtles, making it one of the most species-rich US states in terms of chelonian diversity. Considering Florida's historical significance in turtle biology (home of Archie Carr, North America's most prominent turtle scientist, and Walter Auffenberg, as well as many of their students such as Peter Pritchard, John Iverson, and Peter Meylan), very little was known until recently about the life history of many of the state's species. For example, studies have been undertaken only in the past few years on Alligator Snapping Turtles (*Macrochelys suwanniensis*), Suwannee Cooters (*Pseudemys suwanniensis*), and Diamondback Terrapins (*Malaclemys terrapin*), even though these species are found close to Archie's former home in northern Florida. The same was true for Florida Box Turtles (*Terrapene bauri*).

The Florida Box Turtle occurs throughout the Florida Peninsula, from extreme southeastern Georgia through the Florida Keys. Its northern distribution parallels the Florida-Georgia state line westward to the Suwannee River, although genetic evidence indicates some influence of *T. bauri* genes



The brightly colored carapaces of two male Florida Box Turtles.

nearly to the Perdido River in extreme western Florida. The Florida species is boxy like the more familiar *T. carolina*, but it has radiating yellow stripes from the centrum of the scutes of the carapace. Plastrons may be uniformly yellow to completely dark, with many pattern combinations. Heads are dark, but with horizontal yellow stripes of varying widths and degrees of lateral coverage. The rear feet have three or four toes, and some turtles even have three on one foot and four on the other. Carapaces may or may not be flared. Males generally are larger than females (our largest female was 153 mm carapace length [CL]; males to 166 mm CL). The largest wild males and females occur on Sanibel Island (both >180 mm CL). Juveniles have a middorsal light yellow line on the carapace and are far more colorful than the juveniles of other box turtles.

In January 1991, I was invited by Dick Franz of the Florida Museum of Natural History to assist in a brief survey of Egmont Key, a <120-ha continental island located at the entrance to Tampa Bay Harbor on Florida's western coast (27°36'04"N, 82°45'40"W). The island's highest elevation is 3 m. Egmont Key had been a National Wildlife Refuge since 1974, but the state of Florida had recently entered into an



Florida Box Turtles (*Terrapene bauri*) are frequently encountered when they rest on the substrate near Cabbage Palms (*Sabal palmetto*).



The plastrons of Florida Box Turtles vary from uniformly yellow to dark, with all combinations in-between.



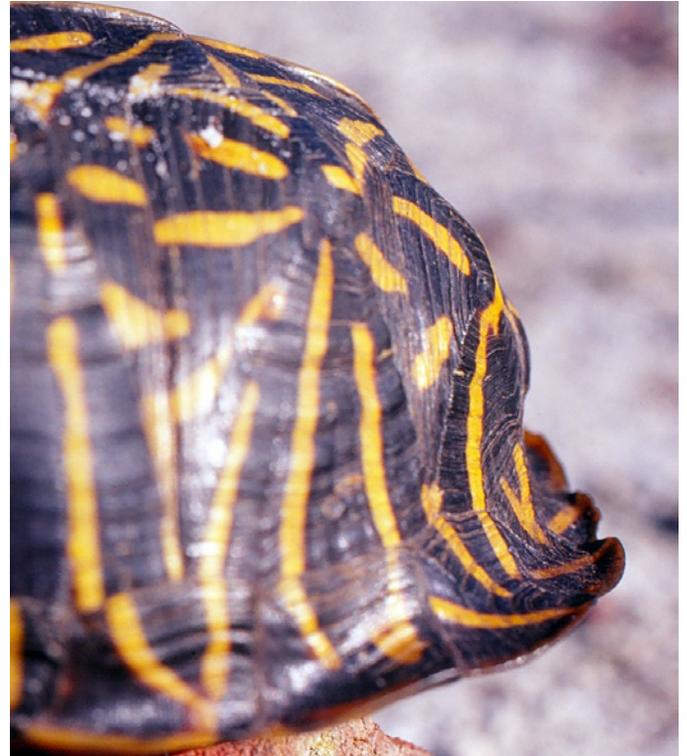
The heads of Florida Box Turtles are colorful, with bright yellow stripes of varying widths. However, the stripes may be white to cream-colored, or absent altogether.



Juvenile Florida Box Turtles are as brightly colored as the adults.

agreement with the U.S. Fish and Wildlife Service to jointly manage the island's wildlife and historical resources. The island has a long history of human occupation, from pre-European visitation by native peoples to its present use as a station for the

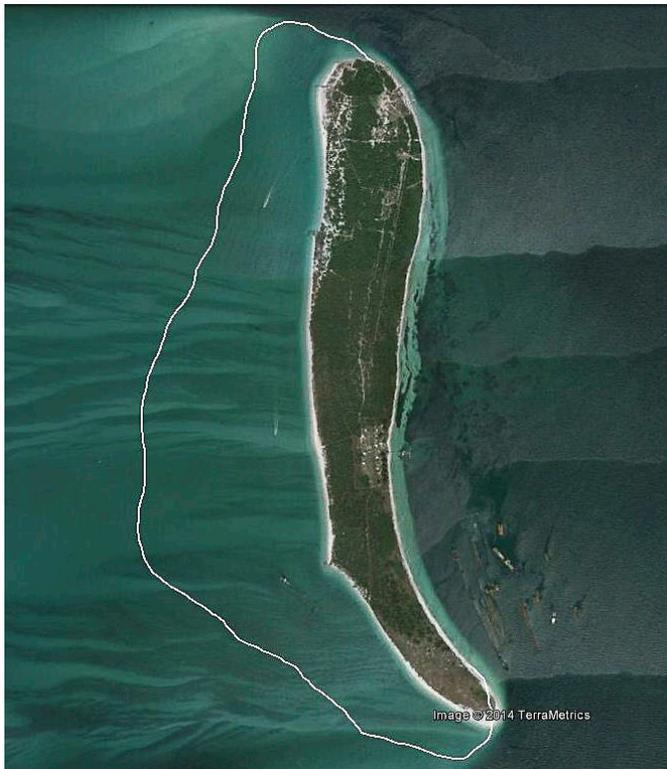
Tampa Bay Pilots who operate tugboats that guide large ocean-going vessels in and out of Tampa Bay, a Coast Guard lighthouse (built in the 1850s), and as a destination for day tourists to enjoy its unspoiled beaches. Surprisingly, no survey of the island's herpetofauna had ever been conducted, although a few collections had been made in 1869–1870 and 1904 (no box turtles were recorded). On that cool rainy January day, Florida Box Turtles seemed to be everywhere we went. This surprise discovery led to a 16-year study of the species' life history and



Some very large male Florida Box Turtles on Egmont Key have flared rear marginals, a characteristic usually associated with Eastern Box Turtles (*Terrapene carolina*) from the Florida Panhandle. Those turtles until recently were assigned to a distinct subspecies called the Gulf Coast Box Turtle (*T. c. major*).



Box Turtle hatchlings are rarely found in the wild, but my wife Marian became quite adept at finding them.



Aerial view of Egmont Key. The white line shows the historical maximum extent of the island. This photograph was taken on 4 February 2016. Image © Google Earth.

how it copes with the natural and man-made disturbances that accompany island life.

### Initial Studies

After my first visit, I decided that Egmont Key would make an excellent location to begin a study of the life history of this species. I assembled a team of volunteers, graduate students, and, later and most importantly, my wife Marian to gather basic information on the island's box turtles. We focused on activity patterns, habitat use, size-class and population struc-



Two Florida Box Turtles meet on Egmont Key. High population densities result in frequent intraspecific encounters.



Two Florida Box Turtles resting in close proximity.



Hatchling Florida Box Turtles are occasionally found on the island, where they are very difficult to see on the forest floor. Marian found several within close proximity to one another on several occasions.

ture, environmental variables (temperature, relative humidity, weather conditions) associated with detection, and reproduction. We confirmed that box turtles were extremely abundant throughout the island, eventually capturing and marking 2,477 turtles, with >5,300 total captures; about 30 % of the population consisted of juveniles and subadults. The sex ratio was male-skewed, with more than two males per female. As time went on, this sex ratio was as great as three males per female, but toward the end of the study it decreased again to about 2:1. We think the skewed sex ratio resulted partly from differential placement of nests, with cooler nests in the island's shaded interior producing males. Nests deposited in the much less hospitable open and hot compacted sands would likely produce females. In the summer, surface temperatures in these locations easily topped 50 °C.

Not unexpectedly, most turtles preferred the shaded interior of the island, which was characterized by having leaf litter and pockets of deep organic soil. These areas had a closed canopy forest of Cabbage Palms (*Sabal palmetto*), Brazilian Pepper (*Schinus terebinthifolius*), and Australian Pine (*Casuarina equisetifolia*), while leaving the understory open and easy to traverse. Temperatures were moderate (a



Florida Box Turtles forage at dawn and dusk on the beach on Egmont Key where they search debris for food.



Sea Grapes (*Coccoloba uvifera*) are a favorite seasonal food for Florida Box Turtles on Egmont Key. They eat a variety of other fruits, including those of Prickly Pear cacti.



Box Turtles on Egmont Key share the island with more and 1,000 Gopher Tortoises (*Gopherus polyphemus*). Interactions are rare, but usually occur when turtles and tortoises are foraging under fruiting plants.



Sea Grapes (*Coccoloba uvifera*) are a favorite seasonal food source.

relative term in summer!) inside the canopy forest with high humidity, especially when compared to the open areas of the island. The leaf litter harbored abundant cockroaches and other invertebrates that serve as the main food source for the box turtles. This diet is supplemented by seasonal fruits, particularly those of Sea Grapes (*Coccoloba uvifera*) and cactus



During the autumn when sea grapes ripen, Florida Box Turtles congregate in large numbers to eat the sweet fruits. This is the morning's catch under a single tree.



Florida Box Turtles frequently burrow into or under fallen palm logs, or take refuge in the hollow interior.



During Florida's hot summers, most Florida Box Turtle activity occurs in the early morning or late afternoon. Box turtles may burrow into the substrate or leaf litter at other times, but they often are encountered sitting on the substrate.



Florida Box Turtles hide under many objects in the leaf litter, but on Egmont Key they frequent the cool regions under palmetto fronds where their pattern of radiating yellow stripes helps conceal them.



When Cabbage Palms fall, they often leave a natural cavity that acts as a pitfall for Florida Box Turtles. Box turtles are sometimes trapped and die in these cavities.

(*Opuntia* sp.). When these plants are fruiting, box turtles may aggregate in the dozens feasting on fallen fruit. Here, they compete with the island's Gopher Tortoise (*Gopherus polyphemus*) population, which itself numbers about 1,500 individuals. As elsewhere, Egmont Key's box turtles are omnivorous, and even have been observed scavenging dead fish in the rip-rap along the shoreline.

Box turtles on Egmont Key are active year-round, but the activity pattern changes with the season. During the cooler months (October–April), turtles are most active during the middle of the day. With increasing summer temperatures, however, the turtles switch to a bi-modal pattern with a peak of morning activity and a lesser peak late in the afternoon and evening. In summer, activity extends from sunrise (0600 h) until nearly dark (2100 h); we encountered nocturnal activity only three times. During the heat of the day, the turtles dig in to moist organic soil or hide in palm logs or cavities left by fallen Cabbage Palms. Rainfall can bring them out



Egmont Key has no standing fresh water. Florida Box Turtles obtain water from their food and by drinking water from palm frond axils and puddles that collect rain after storms.



During cold, heat, and drought, Florida Box Turtles take refuge under leaf and pine needle litter, or burrow into organic soils.



Florida Box Turtles frequently use abandoned Gopher Tortoise burrows when temperatures and humidity decrease.

at any time, and they will often sit in temporary pools that form infrequently on the otherwise waterless island. Most of their water is presumably obtained from their food, but three turtles we found drank between 14 and 21% of their initial



These adults were observed as the male attempted (unsuccessfully) to mount a female. Courting attempts may occur throughout the year, but most mating likely occurs in autumn.

body mass after a prolonged period of dehydration. Box turtles even drink from the axils of fallen palms.

Reproductive traits varied considerably among the island's females. Our smallest female with eggs was 124 mm CL. On Egmont Key, box turtles deposit 1–5 eggs, with a modal clutch size of 2. Unlike northern populations, Florida Box Turtles can produce 2–3 clutches in a year, although some individuals apparently skip breeding seasons. Eggs are present in females from late March to early August, with most nesting occurring from late April to June. We only found 54% of our females gravid in our best month, again unlike the annual reproduction assumed for many box turtle populations. We hypothesize that reproductive variation results from the variability of food resources available to females for oogenesis, but this question deserves much more research.

In addition to these basic questions, we catalogued shell injuries (resulting from deliberate vandalism or park vehicles) and recorded observations on health and mortality. After a warm and unusually wet winter, many of our turtles developed aural abscesses. These were treated by incision and removal, followed by an application of antibiotic cream. Treating the abscesses was highly successful, and we recaptured many of these turtles in subsequent years with no evidence of further health problems. In other studies, my graduate student Ali Hamilton studied juvenile behavior and habitat use using a thread-trailing device. She ascertained that juveniles were found only in the Cabbage Palm-Brazilian Pepper forest in leaf litter with moist organic soils. Juveniles were most active in the early morning. Over a 24-hr period, juveniles moved from 0–200 m, with movements >100 m common; movements decreased significantly in October–November. Rainfall did not influence movements. Another colleague, Susan Hagood, determined that the level of genetic heterozygosity (0.641) in Egmont Key's box turtle population was similar to that of Galapagos Tortoises! This suggests a long period of isolation despite the island's proximity (ca. 2 km) from the mainland.



Florida Box Turtles frequently develop aural cysts during warm wet winters on Egmont Key. These cysts are excised, the material removed, and the cavity treated with antibiotics. Recovery usually is very rapid.

### Response to Disturbances

Beginning in the latter half of 1995, two types of habitat disturbances, hurricanes and extensive exotic vegetation cutting, affected the island. Four tropical storms passed either directly to the north or west of Egmont Key in the Gulf of Mexico during 1995–1996. In 2004, four additional hurricanes passed over or near the island, and overwash extended across the entire southern and central portions of the island. Beginning in 1996 and with increasing intensity through the mid-2000s, additional habitat disruption involved attempts to kill large stands of Australian Pine and Brazilian Pepper. Chemical application of herbicide killed large stands of these trees that were later cut down but not mulched or removed. These efforts resulted in substantial loss of canopy cover and subsequent exposure of leaf litter to intense sunshine, thus elevating temperatures and increasing desiccation.

Much of Egmont Key was flooded by salt water during the tropical storms, especially in the southern and central



No mammals live on Egmont Key and the dense canopy cover limits avian scavenging; consequently, dead turtles are not uncommonly found intact. We deposited more than 100 shells and skeletons in the U.S. National Museum over the course of our study.



Many parts of Egmont Key were covered with introduced Australian Pine (*Casuarina equisetifolia*). Needles formed a dense carpet in which box turtles sheltered. Since the pine has been removed, the substrate has become warmer and drier.



Introduced Brazilian Pepper (*Schinus terebinthifolius*) occurs throughout much of the interior of Egmont Key, a habitat favored by Florida Box Turtles because of the deep organic soil formed from decaying leaves.

portions of the island. Likewise, removal of the tree canopy, especially in the south and at the northern tip of the island, disrupted turtles by exposing them to much higher temperatures and dryer conditions. In response, box turtles moved to sections of the island that were unaffected by storm surge and canopy removal. We were unable to document specific mortality to the population, although some turtles exhibited a peeling and erosion of shell scutes, likely the result of prolonged contact with salt water or salt-saturated soils. At least through 2006, turtles remained in unaffected areas rather than moving back to habitats where they were formerly abundant.

As the study progressed, we began to assemble a truly long-term history of the population. This allowed us to examine both individual and population growth rates, capture probabilities, survivorship, and recruitment into the adult population. Male Florida Box Turtles on Egmont Key initially matured at 10.8 years of age, but this decreased to 9.5 years following the disturbances (a 19% increase in growth rate). Females, however, showed a 19% decrease in growth rate, maturing at 8.5 years prior to disturbances and 11 years post-disturbances. With resources equally available to adults, we hypothesized that females diverted resources from growth to reproduction; not surprisingly, we observed a surge in juveniles after the disturbances. Another interesting observation was that the subadult life stage actually increased from 2 to 3.5 years; this likely contributed to the post-disturbance unbalanced sex ratio as males entered the adult population faster than females.

In terms of demography, however, the disturbances had little overall effect on the population over the 16-year period. Short-term effects affected perceptions of abundance (roughly 800–1,200 males; 400–500 females; as many as 200 juveniles), but through time the population still appeared to increase. Pre- and post-disturbance analyses of survivorship showed that adult males and females had similar annual survi-

vorship rates (about 92%) both before and after disturbances, as did juveniles and adults among years. The basic differences were in individual growth rates and dispersal. As long as the box turtles could disperse to unaffected areas and escape catastrophic mortality, even extensive temporary habitat changes had little effect on the species' demography through time. Longevity (30, 40, or 50 or more years?) allows them to “wait out” significant disturbance events.

### Response to “Take”

As noted, box turtles are long-lived, and individuals and populations likely face periodic catastrophic effects from habitat alteration, such as hurricanes and other violent storms, flooding, and climatic perturbations such as cold or drought — but can populations tolerate prolonged individual loss? We were able to use our dataset to model the effects of rare and chronic removal of individuals from the population. “Removing” individuals based on actual sampling records allowed us to compare the resulting effects on population structure and persistence with the known demographic characteristics of the population. For our increasing population, removal of 3.8% of the population annually was estimated to have no effect on population size over a projected 50-year time span assuming the population growth rate continued at 5% and that the demographic parameters we observed remained constant. However, only an increasing population can sustain an annual loss of even 3.8% of our initial model population per year. Beyond this level of annual removal, even our seemingly large population eventually would go extinct. We projected that both stable and declining populations would become extinct by year 50, regardless of removal intensity. Irrespective of frequency, a pre-reproductive season loss would lead to a smaller population than a post-reproductive season loss. Also, not surprisingly, chronic removal of individuals had more severe effects than rare episodic events.

Our simulations suggest that declines will occur in box turtle populations even when favorable demographic parameters prevail unless populations are initially quite large and exhibit steady or increasing growth rates. In small populations, any periodic removal of individuals would result in a decreased probability of population persistence. When managing box turtle populations, therefore, factors that result in stress must be minimized, particularly those acting recurrently, in multiples, or when populations are small and fragmented. Box turtle populations are extremely sensitive to chronic individual removal from whatever source, a situation that argues against “sustained” harvest and supports continued statutory prohibitions against commercial take.

### Future Prospects

Researchers would like to think that when they study a population in a “protected” area, such as a National Wildlife Refuge, that their animals will be secure in perpetuity.



Egmont Key's greatest threat is the continual erosion of its western shore during hurricanes and winter storms. The island already has lost more than half its area since it was first observed by Europeans.



A view from the dunes on the northern portion of the island looking toward the southwest. The beach to the right has been partially restored. The piles of palm logs and debris at the center right of the photograph are remnants of previous storms.

Concerns about emerging infectious diseases, climate change, exotic species, and the spread of toxic chemicals in air and water shatter such ideas. Such is the case with Egmont Key. The island is threatened by extensive erosion as a result of human activities that have altered sand deposition on the northern and western sides of the island; the island is now half the size it was in the 1800s, and is very vulnerable to tropical storms. If sea levels rise as much as projected because of climate change, Egmont Key likely will be inundated completely and washed into the sea. Since our study was completed in 2006, the island has been invaded by rats (*Rattus* sp.); no resident non-flying mammals occurred on the island during our study. Rats will likely have a serious impact on the juvenile and subadult Florida Box Turtles, Gopher Tortoises, other herpetofauna, and nesting birds.

Another threat is tourism, as wildlife management agencies succumb to pressure to increase recreation. Egmont Key is now the subject of intense historical interest, and tourism is actively promoted, especially around the old 1898 Spanish



Fort Dade was built at the start of the Spanish-American War in 1898 to guard Tampa Bay harbor.

American War installation (Fort Dade) whose concrete buildings have been partially restored at the northern end of the island. Likewise, resource agencies do not view Egmont's box turtles as deserving of directed management. They are viewed as "common," rather than endangered, threatened, or the sub-



A portion of Fort Dade at the northern end of the island. Much of the tree cover has been removed; this allows sunlight and tourists to penetrate the walls of the fort. Box turtles used to be common in this area.

ject of specific legal protection, such as benefits migratory birds or raptors. Even though this may be the densest population of *T. bauri* in existence, no legal mandate guides or requires management, a decision left to the discretion of the local park and refuge officials. No peer review by scientists addresses actions that have the potential either to conserve or harm the population, and refuge personnel can even limit scientific research without explanation. Thus, the future of Egmont Key's turtle populations is far from secure.

Much information has been learned about the box turtles of Egmont Key, but we must realize that most of the information pertains to just one island population. Are populations elsewhere structured similarly? Probably not. Do box turtles on Florida's mainland respond to disturbances in similar fashion, with the same types of survivorship and reproductive characteristics? Probably not. Will Egmont Key's box turtle population respond to future management or disturbances in a similar fashion as they did from 1991–2006? Probably not. In fact, our studies are only snapshots during a particular time at one particular place, and may not be indicative of the species' life history elsewhere or in the future. Most urgently, researchers, whether amateur or professional, need to start long-term studies of turtle populations in many areas in order to understand and conserve these remarkable animals.

### Regrets and Rewards

One might think that resource agencies would welcome a long-term study of perhaps the densest "protected" population of box turtles in Florida. This was certainly the case with the Florida Park Service (FPS), who provided permits, transportation to and from the island in some incredibly rough weather (in 3–4' seas with strong currents, all the while dodging incoming and outgoing ocean freighters), housing, and even access to their refrigerator and microwave. Park personnel (especially Bob and Betsy Baker, Tom Watson) went out of their way to accommodate us, and we are deeply grateful to them for their encouragement and help. The "other" agency, the U.S. Fish and Wildlife Service (USFWS) operating out of Chassahowitzka National Wildlife Refuge, was rarely helpful, sometimes even hostile. Neither FPS nor the USFWS ever provided financial support for the 16-year project.

We initially (1991–1995) stayed at the USFWS house on Egmont. It was dilapidated, with a collapsed roof in the kitchen and rotten wood elsewhere. Without running water, all fresh water had to be brought to the island. However, an ancient air conditioner was a godsend in summer. I do remember the giant spiders, as I have a certain (ahem) arachnophobia. In the mid-1990s, the refuge manager decided to bring a huge hydroaxe to Egmont to cut down and level all the Brazilian Pepper throughout the island. No management plan guided this decision; it was based on availability and whim. Unfortunately, refuge personnel did not make any provision for protecting the large turtle populations (note that

*The Gainesville Sun, Monday, May 12, 1997*

# Methods clash in imported tree removal

*The Associated Press*

EGMONT KEY — Federal refuge manager Cameron Shaw just wanted to add a little industrial-strength firepower to the war on foreign plants invading this historic island at the mouth of Tampa Bay.

So he brought in Hydro-Ax — a giant lawn mower and weed-eater capable of shredding thickets of Brazilian pepper trees in the blink of an eye.

But the fact that a large and unique population of turtles also would be in the path of the 16-ton machine tended to complicate matters.

These are genuine state-listed gopher tortoises — a species of special concern, just two notches from endangered.

No one knows exactly how many inhabit the 300-acre island. But 675 have been weighed, measured, cataloged and marked with shell notches for future identification.

There easily could be twice that many, said Bob Baker, who manages the state park on Egmont.

"Here we have two or three sharing burrows. It's a much denser population than on the mainland," Baker said.

And that's not all. There's also a few thousand box turtles — not state-listed, but regulated nonetheless.

## The turtles would be in the path of the 16-ton machine trying to kill Brazilian pepper trees.

Unlike much of the island's wildlife, the box turtles have adapted to Brazilian pepper trees and burrow into the dense, humid vegetation for most of the day.

The difference between a tortoise and a turtle is their ability to swim, says Baker. Helpful boaters who frequent Egmont sometimes discover this when they attempt to "return" hapless gophers to the sea and watch them sink like rocks.

On Egmont, the turtles have few predators. Other than two-legged swimsuit-clad visitors, there are no mammals on the island.

Snakes pose a threat to the small turtles. Crows consider the babies' heads to be something of a delicacy.

With large black birds swooping down to pluck off their heads, the hatchlings have enough to worry about without giant weed-eaters on the loose, said Baker.

Ken Dodd was appalled at the plan to bring

Hydro-Ax to Egmont.

He has been studying the island's box turtles since 1991. He has tagged 1,200.

"It is the largest single contained population that has been studied this intensely in the Southeast," said Dodd, an associate professor at the University of Florida. "It kind of blows my mind that you can't export them or possess more than two, but a federal agency can destroy them."

Shaw says he wants to destroy exotic plants that are choking out natural habitat, not turtles.

"What we were intending to do would ultimately not only have benefited the turtles, but a lot of other species," said Shaw, who works for the U.S. Fish and Wildlife Service.

Park manager Baker has been battling Brazilian peppers, Australian pines and other exotics on Egmont since 1990.

He and other state workers and volunteers have waged a selective war using chain saws, axes and herbicides.

It has been a slow, tedious process — but the only one Baker believes will work on Egmont Key.

"It would be nice if we could be able to drive some equipment through and save some staff time and effort to control the exotics," he said. "But with the micro-community we have here, it needs a little more finesse."

An article in the *Gainesville Sun* (12 May 1997) addressed the potential effects of the hydroaxe on Egmont Key's turtle population. The USFWS Refuge Manager was not amused.

Gopher Tortoises are protected in Florida) from the onslaught of heavy equipment. Let's just say, the refuge manager was livid (the only time I was threatened physically in my career occurred in a meeting with refuge staff at Chassahowitzka) when the local press got wind of this decision and sent reporters and TV crews to the island to note the potential impact on the turtles. The hydroaxe was axed amid unflattering publicity. Not long afterward, we were told we could no longer use USFWS housing. The house was later renovated for USFWS personnel, but our tenure there was over.

In the late 1990s, a decision was made to eradicate the exotic Australian Pines from the island. Teams of hired contractors began to inject the herbicide Garlon™ into the trees. On a research visit to chase turtles, we were surprised to see even teenagers working in the hot weather without protective gear, cutting and spraying pines and other species (they apparently could not distinguish the exotic *Casuarina* from native Red Cedars), without any refuge supervision. Upon return, a call to the USFWS regional office indicated that they were unaware of the ongoing herbicide use, and that it had not been authorized through official channels. No one had conducted an environmental assessment to determine the

effects of the herbicide and its surfactant on the fauna and other vegetation on the island. Procedure had been violated, but naturally those who reported it (well, me) felt the anger of the local staff. Although the cutting of Australian Pines and Brazilian Pepper continued into the early 2000s, no true restoration plan was ever adopted. When cutting stopped, the Brazilian Pepper in particular quickly re-sprouted, and the new vegetation came up through a thick tangle of branches, since the deadwood had never been removed. Moving through the now hot and dry thickets was extremely difficult, and most box turtles vacated the most seriously affected areas.

Still, our volunteer crews continued to roam the island until 2004, when other activities (chasing amphibians) became paramount to my parent agency, the U.S. Geological Survey. My wife and I made one last trip in 2006 to see our hard-shelled friends, and publications resulting from the work have continued to 2016, with our latest paper modeling the effects of take. I had wanted to continue the study, and the FPS supported us, but USFWS communication came to a screeching halt. Despite numerous requests (letters, e-mails) for permits to continue the research, USFWS simply did not respond and would not issue permits. Letters to the head of



My wife, Marian Griffey, searching a Gopher Tortoise burrow for box turtles. Florida Box Turtles on Egmont Key use abandoned tortoise burrows as shelters. Marian found seven turtles in this single burrow.



One of the benefits of studying Florida Box Turtles on Egmont Key is the many colorful sunsets. We have observed box turtles at the beach seemingly watching the sun go down after a hot summer day.

the Division of Refuges in Washington and the Director of the USFWS went unanswered, and a letter from the Regional Director in Atlanta simply stated that this was a “local issue.” To this day, and despite sending copies of all publications to Chassahowitzka, I have never received an official explanation for why they would not re-issue my permit.

But it was worth it! Egmont Key is a magical place that grows on you. It is sandy and incredibly hot in summer, but in the fall, winter, and spring, the place is a delight. The first time I went there with my bride, Marian, the mosquitos were horrendous, although on later trips they behaved much better. Still she came back. Marian quickly took over the project’s organization, data collection and cross-checking, and turtle health examinations, and she made pre-cooked meals for all the participants on a 3–5 day survey. The project could not have been successful, or perhaps even have continued beyond 1996, without her incredible voluntary efforts and dedication.

Hidden throughout the island are reminders of early inhabitants, from broken Quartermaster pottery to heavy iron window sashes, and of course the ruins of Fort Dade. We knew where the graveyard was located, and watched efforts to preserve one unmarked grave as it nearly washed into the sea. During our time there, we documented the collapse of batteries of the old fort and powerhouse, and in the evening, after the island was deserted and we were left alone, we could imagine the stories of the people — Native Americans, Civil War prisoners, patients from the yellow fever outbreak in Tampa, and the soldiers and families of Fort Dade. As a blistering sun settled into the Gulf, the temperature cooled, soft breezes would sway the sea oats, and the last turtles crawled across the sand to seek a leaf-litter retreat. On a perfectly calm night, we had solitude and soft quiet, gorgeous stars overhead, breezes through the palm fronds, cockroaches munching on palm flowers, and incredible lightning storms over the mainland to the east. And we remember the Gopher Tortoises, early encounters with rattlesnakes (now extirpated), the beautiful

kingsnakes (now also extirpated?), the Laughing Gulls, Boat-tailed Grackles, the nesting Ospreys, and the tiny seahorses floating by on the current.

However, the box turtles had drawn Marian and me back to the island, and they still occupy our thoughts. We are deeply concerned about their future and the apparent lack of recognition of their value by resource managers that can only see a species in terms of its legal obligations. While birds remain high priorities for nature appeal and resource agencies cover poor decisions by invoking “ecosystem management,” the Florida Box Turtle carries the essence and soul of Egmont Key.

#### Addenda

In late July 2016, a “hot” lightning-strike fire burned about 37 ha of Cabbage Palm habitat north of the Tampa Bay Pilot’s compound over a several day period. Fires have historically impacted the island, as burn scars on turtles and palm trees were common when we began our field studies in 1991.



Fires have occasionally burned through the island, and we found fire-scarred Florida Box Turtles (BT#600 is pictured), some with regenerating shells, during the early years of our studies. No fires occurred during our 16 years of observations, but a hot 37-ha fire occurred in July 2016.

The previous most recent fire occurred ca. 2010 on the south end of the island. In March 2017, Michael Jones (University of Massachusetts) and Lisabeth Willey (Antioch College) conducted a survey on Egmont Key, and recorded extensive box turtle mortality. Only 11 turtles were found alive, with more than 250 found dead. This is much higher mortality than reported by refuge personnel. In addition, evidence of raccoon predation was observed. The long-term effects of changes in vegetation structure and composition, the impacts from the invasion by mammals, which hitchhiked to the island on dredge barges, and the continued loss of habitat by erosion remain to be evaluated. Clearly, the Florida Box Turtle population, once large and robust, is now threatened with extirpation — with the threat emanating largely from poor management practices. The results of the Jones-Willey survey are being prepared for publication.

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