

# HISTORICAL REVIEW OF AMERICAN CROCODILES (*CROCODYLUS ACUTUS*) ALONG THE FLORIDA GULF COAST

Charles LeBuff<sup>1</sup>

## ABSTRACT

In this paper, I review historic and recent geographic distribution patterns of *Crocodylus acutus* in Florida, USA. I summarize reasons for the historical decline of its population in North America between 1930 and 1970. Major causes include hunting for the hide industry, pet trade, wildlife exhibitions, habitat loss, and road kills after 1938 when voluminous motor vehicle traffic was first introduced into their habitat. Individuals and groups of *C. acutus* became established along the coast of Southwest Florida over more than an 80-year period, but not to the habitat's potential carrying capacity because of human interference. Recent changes in its distribution pattern suggest continual dispersal into Southwest Florida and the Florida Keys because of climate change and alteration of the population's primary sites in South and Southeast Florida. Habitat destruction, because of dredge and fill development in the region's coastal zone followed by an increasing human population, has limited successful dispersal and growth of the *C. acutus* population along the Gulf of Mexico in Southwest Florida. Recent occurrences of *C. acutus* in the region (excluding questionable inland sightings) extend its northernmost range to the northern end of Lake Tarpon in Pinellas County. Climate change may provide temperatures that allow *C. acutus* extension of its range northward along Florida's southwest coast.

**Key words:** American Crocodile, *Crocodylus acutus*, dispersal, Florida, nesting success, range expansion.

Published On-line: December 7, 2016

Open Access Download at <https://www.flmnh.ufl.edu/bulletin/publications/>

ISSN 2373-9991

Copyright © 2016 by the Florida Museum of Natural History, University of Florida. All rights reserved. Text, images and other media are for nonprofit, educational, or personal use of students, scholars, and the public. Any commercial use or republication by printed or electronic media is strictly prohibited without written permission of the museum.

<sup>1</sup>14040 Eagle Ridge Lakes Drive, Apartment 101, Fort Myers, Florida 33912, USA <charles.lebuff@comcast.net>

## INTRODUCTION

The note I published nearly 60 years ago discussed the geographic range of *Crocodylus acutus* (Cuvier 1807) in Southwest Florida USA (LeBuff, 1957). Today, this threatened crocodylian's distribution is more extensive, individuals are more numerous, and the population is much better documented than it was then, although its dynamics remain poorly understood. In this paper, I briefly review the historical changes in *C. acutus* populations in Florida, and note the most recent northernmost occurrence in Southwest Florida.

### HISTORY OF *CROCODYLUS ACUTUS* POPULATIONS IN FLORIDA

The occurrence of *C. acutus* in North America, specifically Florida, was first suggested by Rafinesque (1822). Confirmation was based on cranial dimensions of a *C. acutus* that was killed in 1869 at the mouth of the Miami River in Biscayne Bay, Dade County (Wyman, 1870). Six years later, Hornaday (1875) killed a pair of large *C. acutus* in Arch Creek where it entered Biscayne Bay. The first of Hornaday's specimens was a 4.27 m total length (TL) male with approximately 12.7 cm of its tail missing. The next day he shot a 3.25 m TL female *C. acutus* at the same location. Author A. W. Dimock claimed to be responsible for the first photographic documentation of *C. acutus* in Florida in 1889 (Milanich and Root, 2013).

The center of distribution of the Florida population is near North Key Largo, northeast Florida Bay, and southern Biscayne Bay at the Turkey Point Power Plant (TP) (Kushlan and Mazzotti, 1989a). The northernmost locality record for *C. acutus* on Florida's Atlantic Coast was established long before its historic range was delineated. In the winter of 1873–1874, a large *C. acutus* was killed in a remote waterway known as Cabbage Slough, in Volusia County (Barbour, 1923). The arrow in Figure 1 pinpoints this northern record near Indian River Lagoon.

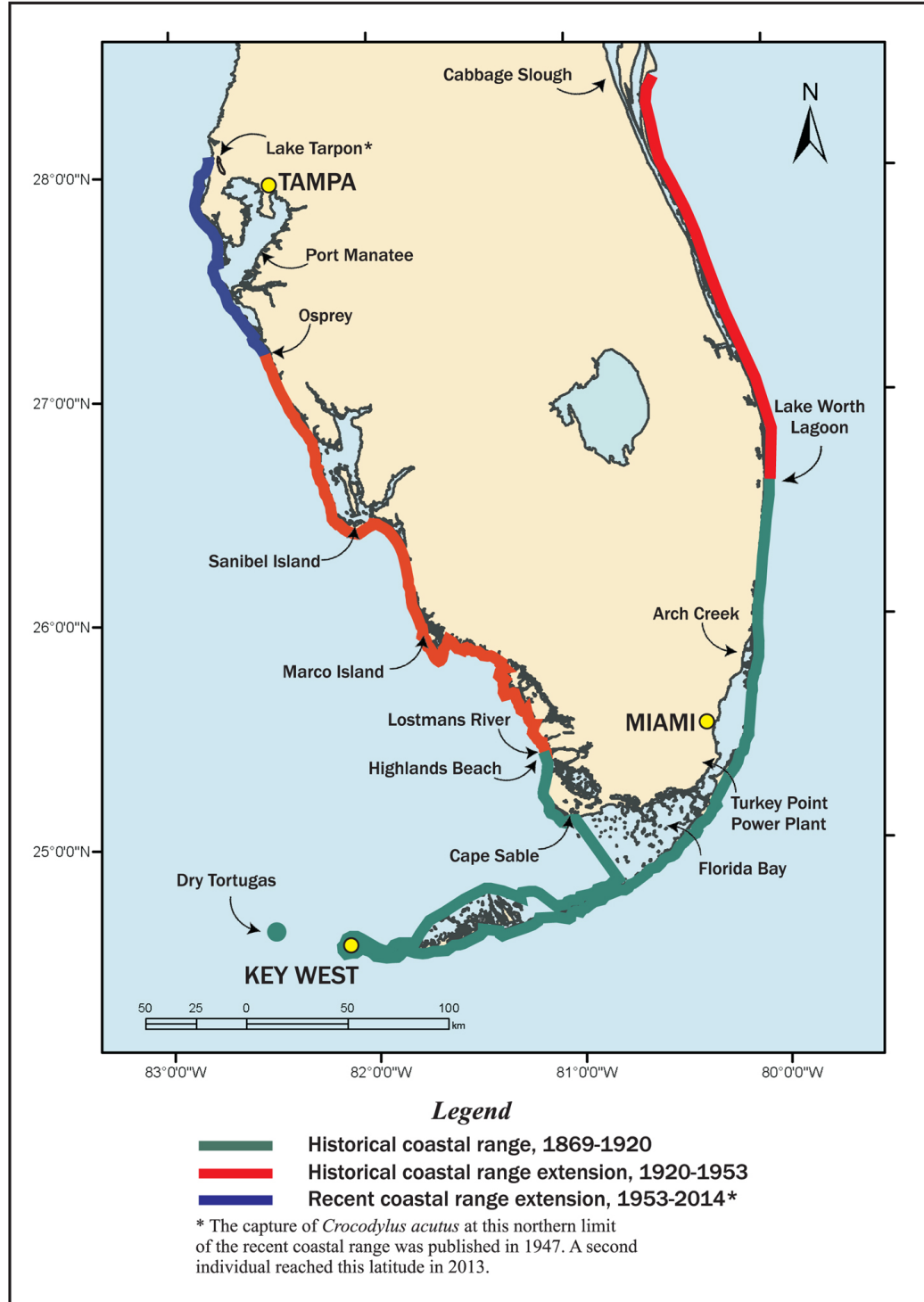
The historic range of *C. acutus* regularly included Key West (Neill, 1971). Today, an adult male *C. acutus* is known to live in Dry Tortugas National Park, 113 km west of Key West (Cherkiss

et al., 2006; Hedden, 2014). *Crocodylus acutus* are now moving south in Florida and are again occupying some of the Keys where they were absent for a half century (Cherkiss et al., 2006; Wadlow, 2014). Between 2005 and 2014, approximately 294 crocodile complaint reports (rpts) were received by the Florida Fish and Wildlife Conservation Commission (FWC) from Monroe County residents living between Key Largo (109 reports) and Key West (3 reports) (L. Hord, pers. comm.). The public complaints originated from 16 islands along the 180 km chain of keys.

Today, the range of *C. acutus* in Florida extends south from Lake Worth Lagoon, Palm Beach County, on the state's east coast. From that northern position, it follows the southern coast of the peninsula and includes the Florida Keys. The range extends west across the southern Everglades and Florida Bay. Above Cape Sable, the crocodile's historic range reached Osprey, Sarasota County, on the Gulf Coast (LeBuff, 1957) (Fig. 1).

Incidental captures of *C. acutus* have occurred on the U.S. east coast north of Palm Beach County. Two of these were considerable distances north of the published limit of their historic range. An emaciated, semi-comatose individual reported to be 0.91 m TL was captured in the Great Dismal Swamp, Virginia, near the North Carolina border in December 1976 (Bonavita, 1979). It was turned over to the US Fish and Wildlife Service (FWS) for relocation. Another *C. acutus* measuring about 1.89 m TL was captured in the Atlantic Ocean at Isle of Palms, South Carolina, in 2008 (Petersen, 2008). This individual had been marked earlier in South Florida, and although it is well outside the normal range, its capture point is the northernmost known locality record in North America although it was likely captured and released there by humans.

Many *C. acutus* that reached Southwest Florida were killed or removed because humans considered them dangerous or designated them as nuisance crocodiles. The latter are currently captured by state-authorized trappers under the supervision of FWC. Trappers remove and usually relocate them to locations within other *C. acutus* populations. Until the third quarter of the last



**Figure 1.** Map of the southern Florida peninsula showing the historic (green) and recent (red) geographic range of *Crocodylus acutus*. Only coastal populations are included. Base map courtesy of Carla Garrison.

century, *C. acutus* in Southwest Florida were either killed or committed to a life in captivity until it was listed under the U.S. Endangered Species Act (ESA) in 1975.

Range expansion of *C. acutus* has continued despite diminishing available habitat, dislike of crocodylians by the people who now crowd Florida's coasts and fear the animals, and harsh winter cold-weather events. As juvenile *C. acutus* disperse from the three core nesting populations near the upper reaches of Florida Bay, an increase in the number of complaints and conflicts is expected. The majority of these recruits entering remaining habitat in Southwest Florida will continue to be removed by FWC. The current practice of relocation could be minimized if FWC and FWS partnered and launched an education program directed toward altering the public's opinion of the *C. acutus* in Florida. This approach has worked well in some Florida communities with American alligators (*Alligator mississippiensis*) and humans (LeBuff, 2015). Relocating *C. acutus* to remote wild populations or captivity has thwarted efforts to establish long-term populations along the Gulf Coast. This policy inhibits colonization of *C. acutus* in suitable estuarine areas. The IUCN-SSC Crocodile Specialist Group website defines *C. acutus* that leave the periphery of their northern historic range in Florida as itinerants.

Numbers of *C. acutus* declined in the 20<sup>th</sup> century because of hunting pressures and habitat destruction after 1910 during construction of the railroad line to Key West that year. Crocodile hunters, who migrated to the upper Florida Keys during and after the railroad's construction, nearly depleted the *C. acutus* in northeast Florida Bay for the commercial market. Between 1936 and 1945, the number of *C. acutus* collected alive in upper Florida Bay may have exceeded those harvested for the leather trade during the same decade. W.A. Hendry, a well-known professional crocodile hunter in Monroe County, supplied live *C. acutus* to zoological parks, museums, and private collectors. He shipped many of them to northern destinations via the Florida East Coast Railway. As many as 300 *C. acutus* were sold to the Southwest

Florida reptile exhibitors Wilford and Lester Piper (Allen and Neill, 1949). By the mid-1970s, only 20 breeding females remained in the wild in Florida (Ogden, 1978).

U.S. Route 1 (the Overseas Highway) replaced the railroad after it was destroyed by the 1935 Labor Day Hurricane (2 September 1935). It opened in 1938. *Crocodylus acutus* road-related mortalities were, and continue to be, a serious detriment to population growth. Brien et al. (2008) recorded 143 *C. acutus* mortalities from all causes in southern Florida between 1967 and 2007. Most of these (67.8%) were on or close to a road, suggesting most deaths were caused by motor vehicle impact. Traffic on three roads (U.S. Route 1, Card Sound Rd., and County Rd. 905) was responsible for 84.4% of the mortalities that occurred between Florida City (mainland) and northern Key Largo (Brien et al., 2008).

Nesting success of *C. acutus* improved a decade after establishment of Everglades National Park (ENP) on 20 June 1947. Subsequently, individual crocodiles slowly dispersed into formerly occupied habitat in Florida Bay. A few crocodiles moved west through red mangrove (*Rhizophora mangle*) forests and small keys in upper Florida Bay to reoccupy the Cape Sable area in Everglades National Park (ENP) by 1985 (Mazzotti, 1999). Some continued north to Marco Island and Sanibel Island and established permanent territories.

Southwest Florida includes the coastal counties of Manatee, Sarasota, Charlotte, Lee, Collier, and the western mainland section of Monroe County. Reports of *C. acutus* from major freshwater lakes, rivers, and canal systems in peninsular Florida's interior appear occasionally (Kushlan and Mazzotti, 1989a). Identifications of many of them have been questioned and some recent reports have been attributed to released animals or escapees. Therefore, for purposes of this discussion, records or reports of *C. acutus* occurrences, either historically or recently, in inland sections of Southwest Florida outside of their estuarine habitat or other tidal waters are excluded. Figure 1 illustrates only the *C. acutus* coastal range in Florida.

*Crocodylus acutus* may have naturally inhabited Southwest Florida as early as 1920, as far north as Sarasota County, and in Lee County in 1936 (LeBuff, 1957; 2014; LeBuff and Lechowicz, 2013). Carr (1940) included Collier County in the range of *C. acutus*, but Duellman and Schwartz (1958) did not document the species anywhere in Southwest Florida. Behler (1978) published a report of an adult male *C. acutus* in Lake Tarpon, Pinellas County, in 1947. Krysko et al. (2011) listed all the Southwest Florida counties, with the exception of Manatee County, in the Florida range of *C. acutus*.

Locality data for a few verified crocodiles along the lower Florida Gulf Coast are in LeBuff (1957); the northernmost individual at that time was a 2.48 m TL female captured alive in Sarasota County in 1953 and placed in captivity. Reports of crocodiles occurring in “brackish waters adjacent to Marco Island” were also mentioned in my 1957 note. There is now a known well-established population of about seven *C. acutus* approximately 7.0 km northeast of Marco Island, in the Collier County mangroves. They were reported during independent interviews with regional commercial mullet (*Mugil cephalus*) fishers in 1956. Biologists had known of this localized population since the 1960s (J. Vanas, pers. comm.). A lone, huge, and apparently sterile male dominates the current group of females. The staff of Rookery Bay National Estuarine Research Reserve (RB) has monitored this colony since 1997. This group of *C. acutus* is not isolated. An observation of one substantially smaller female suggested recruitment occurs in this population (S. Bertone, pers. obs.). Only lone individuals occur on the Gulf Coast north of Marco Island.

By 1953, individual *C. acutus* were known as far north as Sarasota County (LeBuff, 1957). Since then, their range had progressively moved north, and by the 1970s, crocodiles were reported on the southern shore of Tampa Bay, near Port Manatee, in Manatee County. Today, individual crocodiles occur north of Tampa Bay in Lake Tarpon in Pinellas County (LeBuff and Lechowicz, 2013; Cherkiss et al., 2014). The northern boundary for *C. acutus* on

the Florida Gulf Coast is currently located in this lake, positioned at about 28.0829°N latitude. This animal, an adult male, had apparently attempted to establish a permanent territory, as it had remained in Lake Tarpon for nearly a year. It displayed no attempt to move farther north (or south), although there were water routes available for it to do so.

*Crocodylus acutus* moving north out of ENP would transit the mangrove waterways and estuaries. Crocodiles prefer waters that are placid and protected from wind and wave action (Kushlan and Mazzotti, 1989b). There is evidence, however, that some individuals choose to navigate the Gulf of Mexico. On 7 March 1953, a 2.9 m TL *C. acutus* was captured in the Gulf at Point of Rocks, Sarasota County, Florida. This animal was placed in captivity (Anonymous, 1953). In the early 1980s, a boater followed an estimated 8-foot (2.4 m) TL *C. acutus* as it moved north along the Gulf beach at Bonita Beach, Lee County, Florida (J. Vanas, pers. obs.).

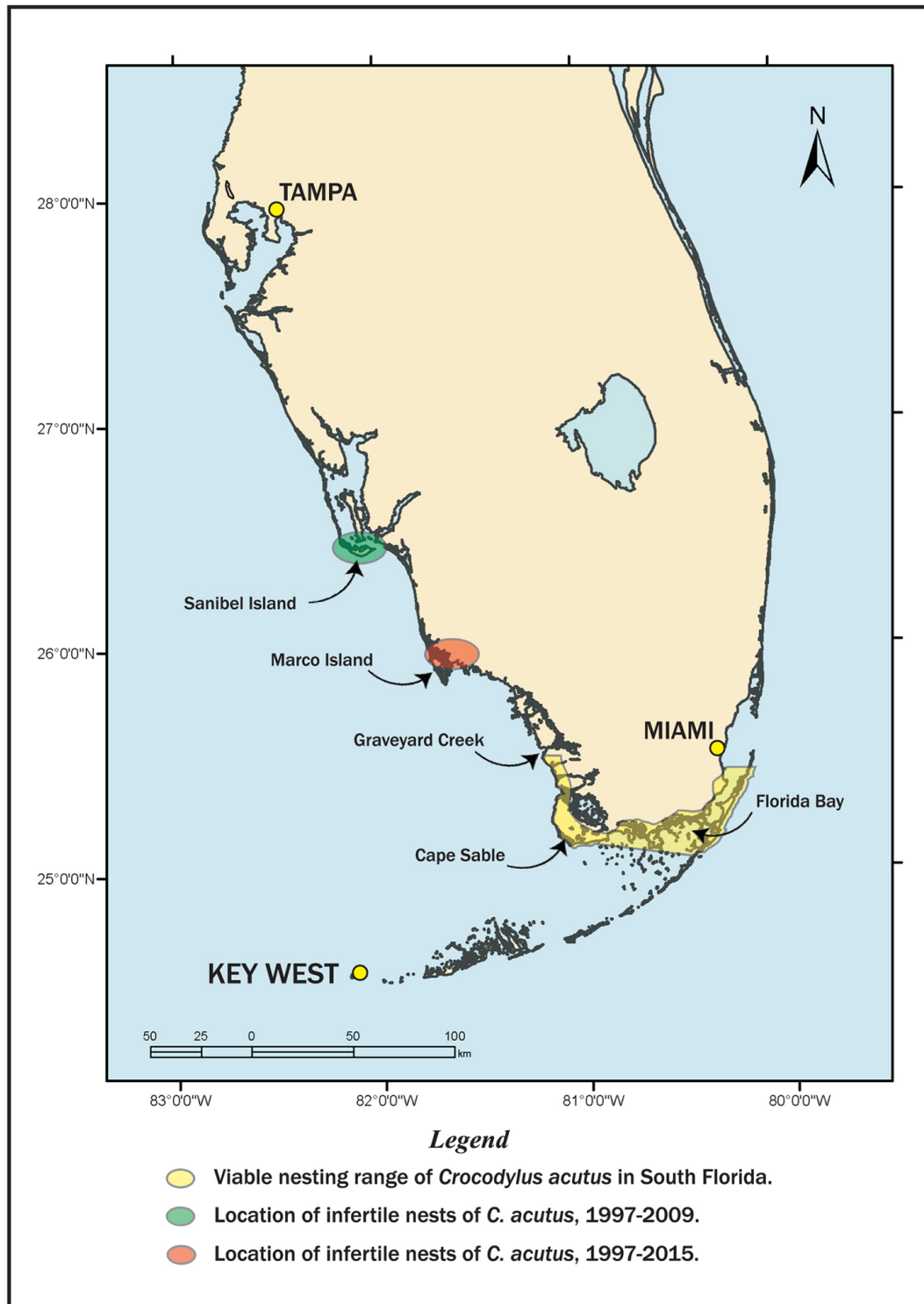
According to Mazzotti and Cherkiss (2003), hatchling and juvenile crocodiles have not dispersed from ENP since 1986. Despite coded marking of hatchling *C. acutus* at ENP, Turkey Point Power Plant (TP), and Crocodile Lake National Wildlife Refuge, there has been no evidence of dispersal.

Lindsey Hord, former FWC crocodile response coordinator, reported multiple recaptures of a *C. acutus* marked after hatching at TP, Dade County, in 1999. The male was later encountered about 220 km (by water) away in 2008 in Naples, Collier County. It measured (2.55 m TL) and released by Hord in nearby RB. He observed this crocodile again in 2012 in Tampa Bay and in Lake Tarpon, Pinellas County, in 2013. Further details about this crocodile’s movements are in Cherkiss et al. (2014).

## CONCLUSIONS

*Crocodylus acutus* has been part of the Southwest Florida herpetofauna likely for decades. It has ranged through the mangrove-dominated coastal habitat for nearly 100 years (LeBuff, 1957). Large-scale commercial take, habitat destruction, road-crossing mortality, and major cold weather events contributed to the decline of *C. acutus* throughout





**Figure 2.** Current nesting range of *Crocodylus acutus* in Florida based on occurrence of viable or infertile eggs. Base map courtesy of Carla Garrison.

its range in Florida. Its population reached its modern low point in the 1970s (Ogden, 1978). It made a remarkable recovery after its listing as Endangered under the U.S. Endangered Species Act (1975). In 2007, FWS determined the Florida population of *C. acutus* had recovered sufficiently to reclassify it as Threatened. Adult *C. acutus*, some of them marked, continue to leave the South Florida population and move north along the Gulf Coast of Florida (Cherkiss et al., 2014) and south to repopulate the Florida Keys (L. Hord, pers. comm.) in increasing numbers.

A population of multiple *C. acutus* has occupied habitat in Southwest Florida near Marco Island for several decades, and although females construct nests, none has successfully produced viable eggs (Fig. 2; S. Bertone, pers. comm.). Lone crocodiles have frequently appeared at many locations along the Gulf Coast. Lemon Bay near Englewood in Charlotte and Sarasota counties is a historically important habitat for *C. acutus* (LeBuff, 1957). Several from that vicinity are part of the FWC nuisance crocodile database (L. Hord, pers. comm.). Individual *C. acutus* have again reached Lake Tarpon in Pinellas County that effectively establishes a new range extension for the species on the Gulf Coast.

The successful nesting range of *C. acutus* in South Florida has not changed in recent years, although the animal's overall distribution along the Florida Gulf Coast is more consolidated. According to Kushlan and Mazzotti (1989a), the animal's northward expansion in Southwest Florida is controlled by temperature. They suggest winter temperatures may restrict successful long-term recruitment of crocodiles into available northern habitats on both coasts of Florida. Ultimately, climate change may provide temperatures that allow *C. acutus* to expand its range northward along Florida's Southwest coast.

#### ACKNOWLEDGMENTS

For three years in the early 1950s, the late brothers Wilford (Bill) and Lester Piper gave me the responsibility for captive *C. acutus* propagation at their Everglades Wonder Gardens wildlife attraction in Bonita Springs, Florida. I worked

with *C. acutus* on a daily basis there for six years. Much later in my career, I had the opportunity to share part of my life with an interesting *C. acutus* at J. N. "Ding" Darling National Wildlife Refuge. I appreciate the help and input of those individuals I have mentioned in the text who have shared their personal observations and field experiences with *C. acutus*. Carla Garrison created the map used in the figures. Kent Vliet reviewed the earliest draft of the manuscript and made valuable suggestions. I acknowledge the editorial and proofreading assistance provided to this project by Betty Anholt and Susie Holly, both of Sanibel Island.

#### LITERATURE CITED

- Anonymous. 1953. Crocodile makes rare visit here. Sarasota Herald Tribune 12 December 2014. 1 p.
- Allen, E. R., and W. T. Neill. 1949. Increasing abundance of the alligator in the eastern portion of its range. *Herpetologica* 5:109–112.
- Barbour, T. 1923. The crocodile in Florida. Occasional Papers of the Museum of Zoology, University of Michigan 131:1–6.
- Behler, J. L. 1978. Feasibility of the establishment of a captive-breeding population of the American crocodile. South Florida Research Center, National Park Service Report T-509. 94 p.
- Bonavita, J. 1979. Virginia gators? *Virginia Wildlife* 40:11.
- Brien, M. L., M. S. Cherkiss, and F. J. Mazzotti. 2008. American crocodile, *Crocodylus acutus*, mortalities in southern Florida. *Florida Field Naturalist* 36:55–59.
- Carr, A. F., Jr. 1940. A contribution to the herpetology of Florida. University of Florida Publications, Biological Sciences 3:1–118.
- Cherkiss, M. S., O. S. Bass, and F. J. Mazzotti. 2006. *Crocodylus acutus* geographic distribution. *Herpetological Review* 37:491.
- Cherkiss, M. S., F. J. Mazzotti, L. Hord, and M. Aldecoa. 2014. Remarkable movements of an American crocodile (*Crocodylus acutus*) in Florida. *Southeastern Naturalist* 13:52–56.
- Duellman, W. E., and A. Schwartz. 1958. Amphibians and reptiles of southern Florida. *Bulletin of the Florida State Museum*,

- Biological Sciences 3:181–324.
- Hedden, M. 2014. Lonely crocodile Cleatus lives at Dry Tortugas National Park in Florida Keys. Miami Herald, 12 December 2014. 1 p.
- Hornaday, W. T. 1875. The crocodile in Florida. American Naturalist 9:498–504.
- Krysko, K. L., K. M. Enge, and P. E. Moler. 2011. Atlas of amphibians and reptiles in Florida. Final Report, Project Agreement 08013, Florida Fish and Wildlife Conservation Commission, Tallahassee. 524 p.
- Kushlan, J. A. and F. J. Mazzotti. 1989a. Historic and present distribution of the American crocodile in Florida. Journal of Herpetology 23:1–7.
- Kushlan, J. A., and F. J. Mazzotti. 1989b. Population biology of the American crocodile. Journal of Herpetology 23:7–21.
- LeBuff, C. 1957. The range of *Crocodylus acutus* along the Florida Gulf Coast. Herpetologica 13:188.
- LeBuff, C., and C. Lechowicz. 2013. Amphibians and Reptiles of Sanibel and Captiva Islands, Florida: A Natural History. Amber Publishing and Ralph Curtis Publishing, Fort Myers and Sanibel, FL. 304 p.
- LeBuff, C. 2014. America's crocodile kings with notes on the range, temperature tolerance, and nesting of *Crocodylus acutus* in Southwest Florida. Herpetological Review 45:643–649.
- LeBuff, C. 2015. How two Florida communities cope with crocodilians. Crocodile Specialist Group Newsletter 34:38–40.
- Mazzotti, F. J. 1999. The American crocodile in Florida Bay. Estuaries 22:552–561.
- Mazzotti, F. J., and M. S. Cherkiss, 2003. Status and conservation of the American crocodile in Florida: Recovering an endangered species while restoring an endangered ecosystem. University of Florida, Ft. Lauderdale Research and Education Center. Technical Report. 41 p.
- Milanich, J. T., and N. J. Root. 2013. Enchantments: Julian Dimock's Photographs of Southwest Florida. University Press of Florida. Gainesville. 168 p.
- Neill, W. T. 1971. The Last of the Ruling Reptiles: Alligators, Crocodiles and Their Kin. Columbia University Press, NY. 480 p.
- Ogden, J. C. 1978. Status and nesting biology of the American crocodile, *Crocodylus acutus* (Reptilia, Crocodylidae) in Florida. Journal of Herpetology 12:183–196.
- Petersen, B. 2008. Crocodile found on Isle of Palms headed to Florida. The Post and Courier 10 June 2008. Charleston, SC. 1 pp.
- Rafinesque, C. S. 1822. On the lizards of the United States. Kentucky Gazette N. S. 1:3.
- Wadlow, K. 2014. Crocs moving south. Florida Keys Keynoter 61:96.
- Wyman, J. 1870. On the existence of a crocodile in Florida. American Journal of Science and Arts 49:105.