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Status of the Nile Monitor (*Varanus niloticus*) in Southwestern Florida

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Abstract – The Nile Monitor (*Varanus niloticus*), the longest lizard in Africa, was first observed in southwestern peninsular Florida in the Cape Coral area of Lee County ca. 1990. From April 2001 through 7 July 2003, we compiled 146 sightings or captures of this species by local residents or ourselves. Numerous individuals of all size classes have been observed or collected, suggesting the occurrence of a reproducing population. Although our records are mostly confined to Cape Coral, our data indicate that *V. niloticus* has recently expanded its range northwards and to nearby islands. Because this large lizard has the potential to disperse into nearby ecologically sensitive areas and preserves where it could pose a serious threat to waterbirds, burrowing owls (*Athene cunicularia*), sea turtles, and other native wildlife, population monitoring and eradication are warranted.

Introduction

Introduced species are second only to anthropogenic habitat alteration in their negative effects on native species, habitats, and whole ecosystems (Parker et al. 1999, Wilcove et al. 1998). Certain introduced predators, including domestic cats (*Felis catus*), pigs (*Sus scrofa*), Norway rats (*Rattus norvegicus*), ship rats (*R. rattus*), Indian mongooses (*Herpestes javanicus*), and brown tree snakes (*Boiga irregularis*) have been known to decimate native fauna, especially when introduced onto islands (Loope et al. 2001, Mack et al. 2000, Rodda et al. 1999). Many non-native species have become established in Florida, often resulting in negative ecological impacts (Simberloff et al. 1997). Florida presently contains the largest number of established non-native amphibian and reptile species in the United States (Butterfield et al. 1997), partly due to the large volume of trade in exotic species, subtropical climate, and a native fauna that has become depauperate in human-altered habitats.

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Florida has a well-documented exotic herpetofauna (Butterfield et al. 1997, Dalrymple 1994, Duellman and Schwartz 1958, King and Krakauer 1966, Wilson and Porras 1983), but until recently, most exotic forms have been relatively small species that presumably compete with native species for resources. This situation has changed, however, with the introduction of a large, carnivorous lizard species, the Nile Monitor (*Varanus niloticus*), in the Cape Coral area of Lee County. *Varanus niloticus* was first observed ca. 1990 in the Four Mile Cove Ecological Park area, a 148-ha saltwater wetland preserve on the eastern side of Cape Coral, adjacent to the Caloosahatchee River. At around the same time, several sightings were reported from a residential area on the western side of Cape Coral, suggesting that several individuals were present. Both these areas are sparsely populated by humans and bordered by wildlife preserves.

Varanus niloticus is the longest lizard in Africa, attaining a maximum of 243 cm total length (TL) (Faust 2001). The two former subspecies, *V. n. niloticus* (Linnaeus 1758) and *V. n. ornatus* (Daudin 1803), are now considered distinct species based on morphology (Böhme and Ziegler 1997). The Nile Monitor is the second most commonly sold African monitor species in the United States; most individuals are imported from the wild (Bayless 1991, Faust 2001), and hatchlings retail for as little as \$10. Few lizard species are less suited to life in captivity than *V. niloticus* because of its large adult size and nervous disposition (Bennett 1995; Fig. 1).

Monitors (*Varanus* spp.) are frequently observed in Florida after they escape or are intentionally released by owners when the novelty of an exotic pet wanes, they outgrow their cages, become too expensive to feed, or their temperament and size make them difficult to handle (Fig. 2). Monitors may be illegally released by reptile dealers when they are too damaged or sick to sell, or to establish a local breeding population for later capture and resale.

Although *Varanus* spp. have been observed in Florida, particularly in Miami-Dade County, Dalrymple (1994) concluded that no evidence existed to suggest reproducing populations. Multiple sightings of *V. niloticus* have been reported from canals along Card Sound Road, Miami-Dade County, in the relatively unpopulated area between Florida City and Barnes Sound (pers. comm., P. Moler, Gainesville, FL; pers. comm., D. Roudebush, Marathon, FL; pers. comm., T. Crutchfield, Fort Myers, FL). Since 1994, a reptile dealer has seen *V. niloticus* approximately six times per year in the Coral Springs–Tamarac area of Broward County (pers. comm., M. Lucas, Coral Springs, FL). Several sightings have also occurred in Matheson Hammock County Park, Miami-Dade County (pers. observ., K. Krysko). A 2003 voucher photograph of an adult *V. niloticus* (UF 138065) exists for Lake Price, Orange County. In

this paper, we document the geographic distribution of *V. niloticus* in southwestern peninsular Florida, discuss possible ecological impacts in light of what is known about this species in Africa, and provide recommendations for immediate population control or eradication.

Study Area

The City of Cape Coral, Lee County, Florida (26°35'N, 82°00'W), is a 295-km² subdivided community west of Fort Myers that contains ca. 645 km of freshwater and saltwater canals and >2,200 km of roads (Cape Coral 2003a). The city is situated on a peninsula bordered on the south and east by the Caloosahatchee River and on the west by Matlacha Pass (Fig. 3). Pine Island and Little Pine Island are located on the west side of Matlacha Pass and are accessed via Pine Island Road (State Road 78).

The Cape Coral peninsula was historically mesic slash pine (*Pinus elliotii*) flatwoods and tidal swamp (Wesemann 1986). Canal construction and development of Cape Coral began in the late 1950s (Bernard 1983, Dodrill 1993), and by 2000, this fast-growing community had a population of 102,286 residents, which represented a 36.3% increase since 1990 (Cape Coral 2003b). The west side of the peninsula still contains an extensive tidal swamp of mangroves (*Avicennia germinans*, *Laguncularia racemosa*, and *Rhizophora mangle*) in the Charlotte Har-



Figure 1 (above). Hatchling Nile Monitors retail for as little as \$10 at pet stores, though their nervous disposition and large adult size make them unsuited for life in captivity. Photo by Todd Campbell

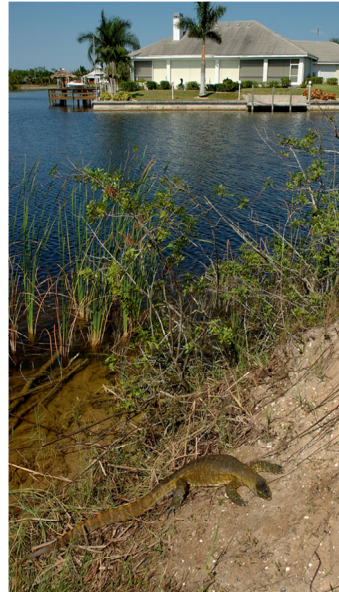


Figure 2 (right). Large (approximately 6 foot long) Nile Monitor basking on the edge of a canal near a residence in Cape Coral, FL. Photo by Todd Campbell.

bor State Buffer Preserve and Matlacha Pass State Aquatic Preserve. A spreader canal on the western side of Cape Coral separates it from the tidal marsh/swamp zone.

Methods

To document the current distribution of *V. niloticus* in the Cape Coral area, we capitalized on frequent unsolicited calls from residents to Lee County Animal Control, police, pet stores, and City of Cape Coral offices. We also solicited sightings via an e-mail message to all city employees and a press release that appeared in the local newspaper, The News-Press, on 14 July 2002, and on local television and radio. The distinctiveness of this species makes it unlikely to be mistaken for any other species in the area, except for possibly young American alligators (*Alligator mississippiensis*) when in the water. The only other large lizard species present in Cape Coral is the Green Iguana (*Iguana iguana*), and *V. niloticus* is easily distinguished from iguanas by its elongated head and neck, absence of a vertebral crest, and by its habit of repeatedly flicking its bluish black, forked tongue.

We compiled records of *V. niloticus* in Cape Coral from April 2001 through 7 July 2003, when a funded study and trapping program began. We also interviewed residents, golf course managers, realtors, and pet store owners. Some records are personal observations by K.R. Hankins during this period or by T.S. Campbell during field visits in August and December 2002, but most records represent reports containing accurate descriptions that were submitted by residents to the City of Cape Coral. Other records consist of captures of live specimens, dead-on-road (DOR) specimens, photographs, or videotapes. Voucher specimens and photographs were deposited in the Florida Museum of Natural History (FLMNH), University of Florida (UF collection).

Results

We compiled 146 reports (Fig. 3) of 159 *V. niloticus* (some reports contained sightings of more than one individual) ranging from hatchlings to adults ca. 183 cm total length (TL). Of six DOR *V. niloticus*, three were collected (UF 133933, 137056–7) and one was photographed (UF 135179). Three DOR individuals were found on bridges over saltwater canals. One hatchling (UF 137058) measuring 13.1 cm snout-vent length (SVL) and 35.4 cm TL was collected alive in a swimming pool on 29 October 2002. On 6 June 2003, animal control officers noosed from a tree an adult male (UF 137128) measuring ca. 150 cm TL. From local residents and city workers, we received two photographs (UF 135176, 135178) and a videotape showing two different individuals. All specimens and photographs

examined were identified as *V. niloticus*, not *V. ornatus*. In addition to our records, a reptile dealer claims to have collected for resale approximately 40 *V. niloticus* 60–122 cm TL and 10 specimens >122 cm TL since the early 1990s, but mostly within the past three years (pers. comm., C. Clark, Punta Gorda, FL). Lee County Animal Control annually catches approximately six *V. niloticus* and buries a few DOR individuals, nearly all of which come from Cape Coral (pers. comm., S. Trebatowski, Cape Coral, FL).

Most monitor observations have been in residential areas in southwestern Cape Coral, but 16 sightings occurred along the spreader canal, including the Chiquita Lock at the south end of the canal. In 1999, a large *V. niloticus* was photographed among mangroves from a helicopter, and in August 2002, Campbell photographed one basking on sand bags along a canal in the buffer preserve and was told of numerous sightings by fishing guides in tidal creeks there. Monitors have been observed swimming to shore from mangrove islands (pers. comm., C. Clark, Punta Gorda, FL). For the 144 monitor sightings with habitat data, 31.9% were along or in canals (sometimes on seawalls or docks), 27.1% were along or on roads, 20.8% were in yards, 11.1% were in vacant lots, 5.6% were near ponds or lakes, and 3.5% were going into

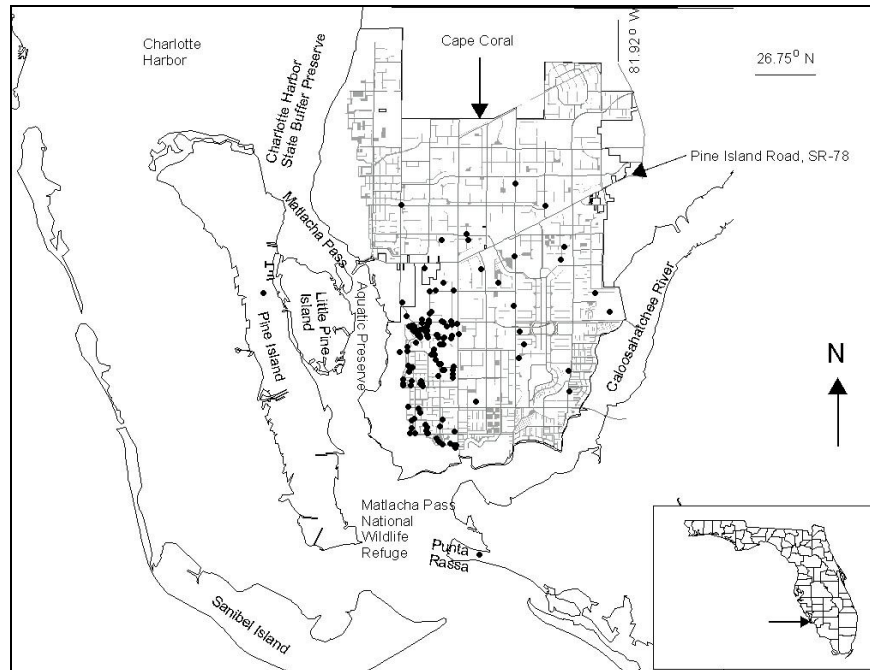


Figure 3. Distribution of the Nile Monitor (*Varanus niloticus*) in the Cape Coral area, Lee County, FL. Black dots represent 146 reports (sometimes multiple sightings) or captures from April 2001 through 7 July 2003.

woods. We found eight well-developed eggs inside a partially decomposed female (52 cm SVL) collected on 15 August.

Prior to August 2002, only one *V. niloticus* had been observed north of Pine Island Road in Cape Coral, but since then, five sightings and one capture have occurred north of this road (Fig. 3). A confirmed sighting has recently occurred west of Matlacha Pass on Pine Island (Fig. 3). In 2001, a monitor was sighted at Punta Rassa, south of the Caloosahatchee River (Fig. 3). Two observations in 2003 from the north and south ends of Cayo Costa (pers. comm., A. Nielsen, Port Charlotte, FL), an island west of Pine Island, suggest that the population may have expanded even farther, and a monitor was reportedly sighted farther south on Sanibel Island ca. 1996 (pers. comm., L. Hamilton, Naples, FL).

There have been other observations of *V. niloticus* in southwestern Florida. At least five years ago, the manager of the Charlotte Harbor State Buffer Preserve observed a monitor among black spiny-tailed iguanas (*Ctenosaura similis*) farther north on Gasparilla Island, Lee County (pers. comm., R. Repenning, Punta Gorda, FL). Monitors are occasionally sighted or captured in Fort Myers, Lee County, and along the Peace River near Fort Ogden, Arcadia, and Brownville in De Soto County (pers. comm., C. Clark, Punta Gorda, FL). Several monitors were sighted up until four years ago along a canal emptying into tidally influenced Haldeman Creek, west of Bayshore Drive in Naples, Collier County (pers. comm., J. Seitz, Naples, FL).

The only predation events or attempts reported by Cape Coral residents have been of monitors chasing ducklings, eating an unidentified snake and frog, climbing a screen to eat a brown anole (*Anolis sagrei*), feeding on goldfish (*Carassius auratus*) in a pond, eating a rabbit (*Sylvilagus* sp.) in a yard, and digging up grubs in a yard. We found five Brown Anole eggs inside a partially decomposed adult female.

Discussion

Presently, the natural history of *V. niloticus* in Florida has not been documented, but information gathered from studies in Africa indicates that this exotic species may pose a serious threat to native wildlife, particularly if it expands its range. This species is found throughout sub-Saharan Africa except for desert regions; it occurs along desert fringes and from grasslands to rainforests in the vicinity of rivers, swamps, ponds, lakes, and seashores (Luxmoore et al. 1988, Faust 2001). Monitors readily inhabit human settlements and cultivations, often foraging around rubbish dumps (Bennett 1995, Faust 2001) and sheltering in crevices or burrows, including those of other animals (Edroma and Ssali 1983). They are mainly aquatic during activity periods, often hiding in

dense vegetation in shallow water (de Buffrénil and Hémery 2002). Monitors often use bare tree trunks, logs, rocks, or overhanging branches as basking sites (Edroma and Ssali 1983, Lenz 1995, Muhigwa 1998), and when alarmed, often dive into the water and swim strongly away on the surface or remain submerged (Bennett 1995, Branch 1998, Cowles 1930). Activity is reduced or suspended during the dry season in tropical Africa and in the cooler months in temperate regions (Cowles 1930, Faust 2001).

The most suitable habitats in Florida for *V. niloticus* are probably mangrove swamps, edges of freshwater and saltwater marshes, and banks of rivers, canals, and lakes. The tidal creeks, marshes, and swamps of Charlotte Harbor State Buffer Preserve and Matlacha Pass State Aquatic Preserve on the west side of Cape Coral probably represent core activity and feeding areas. Monitors are often observed along the spreader canal separating the preserves from the residential areas to the east. However, most observations have occurred in residential areas, probably because more observers are present and dense, obstructing vegetation is lacking. Sightings have decreased in some areas as vacant lots have been developed and seawalls have been constructed along canals.

All wetland habitats and adjacent terrestrial habitats in peninsular Florida could potentially be colonized by *V. niloticus*, including residential and agricultural areas containing water. This species could survive cold weather in northern Florida by using underground refugia, as it does in temperate regions of Africa (Cowles 1930). Its fecundity, eclectic diet, and ability to travel over land and across water would allow the species to disperse widely in Florida. Extensive canals in southern Florida would provide ideal dispersal corridors. The population in the Cape Coral area appears to have recently expanded to Pine Island and probably will reach Sanibel Island (one observation ca. 1996) if not controlled. The Ten Thousand Islands, Big Cypress National Preserve, Everglades National Park, Lake Okeechobee area, and parts of the Florida Keys would provide particularly suitable habitats for colonization.

Many monitor observations in Cape Coral probably represent sightings of the same individuals, especially considering the longevity and vagility of this species. However, numerous observations since 1990 consisting of all size classes suggest the presence of an established breeding population, particularly considering the number that have been killed on roads or removed from the wild by collectors, animal control officers, and researchers. It is highly unlikely that all these animals were released or escaped from captivity, and we are unaware of any person or business that possessed large numbers of Nile Monitors in Cape Coral in the past. From July 2003 (the end of our data collection period) through

22 April 2004, 50 *V. niloticus* ranging in size from 13 to >100 cm SVL have been trapped, including gravid females and 10 hatchlings between 13 and 17 cm SVL (TSC, pers. obs.).

The Nile Monitor is a prolific species that potentially can attain high population densities (Western 1974). In Africa, females oviposit in burrows or active termite mounds from August to early January (Bennett 1995, Branch and Erasmus 1982, de Buffr enil and Rimblot-Baly 1999). We found a gravid female in August, and small specimens have been captured or observed primarily in winter and early spring. In Mali and Chad, females reach sexual maturity at ca. 36 cm SVL or 24 months of age, and ca. 50% of mature females reproduce each year (de Buffr enil and Rimblot-Baly 1999). Small females typically oviposit 12–13 eggs, whereas large females (>71.5 cm SVL) oviposit 53–60 eggs (de Buffr enil and Rimblot-Baly 1999). Eggs apparently take 6–10 months to hatch in the wild (Cowles 1930, Faust 2001).

Nile Monitors have the potential to significantly reduce native wild-life species by preying upon them or competing for habitat or food. They are opportunistic and generalist predators in Africa that hunt or scavenge for arthropods, crabs, crayfishes, mussels, gastropods, fishes, anurans, lizards, turtles, snakes, young crocodiles, eggs, birds, small mammals, carrion, and human food scraps (Bennett 2002, Branch 1998, Ciss e 1972, Cott 1960, Cowles 1930, Edroma and Ssali 1983, Lenz 1995, Losos and Greene 1988). Juveniles prey primarily upon invertebrates (Bennett 1995, 2002; Lenz 1995). Skull and tooth morphology changes with age (Rieppel and Labhardt 1979), allowing older monitors to crush molluscs and crustaceans, which are heavily preyed upon where available (Bennett 1995, Branch 1998).

Some protected wildlife species would be particularly vulnerable to predation by monitors. In 1999, at least three mangrove islands just west or south of Cape Coral were used for nesting by colonial waterbirds, including the brown pelican (*Pelecanus occidentalis*), a species of special concern (Rodgers et al. 1999). Monitors are adept at finding and opening nests of sea turtles and other turtle species (Spawls et al. 2001), and in coastal areas, could impact nesting sea turtles and diamondback terrapins (*Malaclemys terrapin*). If a Nile Monitor population already exists along Card Sound Road, it could severely reduce reproductive recruitment from the 6–8 nests of the endangered American crocodile (*Crocodylus acutus*) that are produced annually on Key Largo, Monroe County (pers. comm., P. Moler, Gainesville, FL). *Varanus niloticus* is one of the most important predators of Nile crocodile (*C. niloticus*) eggs and young (Cott 1960, Mohda 1965). Alligators would be less impacted because of their large population size and tolerance for removal of up to 50% of their annual production (Rice et al. 1999).

Because *V. niloticus* occupies and modifies burrows of other species (Edroma and Ssali 1983), two species of special concern, the Burrowing Owl (*Athene cunicularia*) and Gopher Tortoise (*Gopherus polyphemus*), could be particularly impacted. Lee County contains Florida's highest density of Burrowing Owls (Bowen 2001); the Cape Coral owl population is estimated at more than 1,000 pairs living primarily in vacant residential lots (Millsap and Bear 2000). Monitors could usurp owl and tortoise burrows and prey upon eggs and young (also adult owls).

Nile Monitors usually pose no threat to humans unless cornered or captured, when they vigorously defend themselves by biting, clawing, or tail whipping (Cowles 1930, Branch 1998, Faust 2001). However, monitors that have become acclimated to humans sometimes do not flee and may act aggressively (Edroma and Ssali 1983). They could also pose a threat to domestic animals, such as poultry (Bennett 1995, Cowles 1930), cats (McGraw 1992, Bennett 1995), and small dogs.

We recognize the novelty of having an established population of a large, predatory, exotic lizard species in Florida. The presence of *V. niloticus* in Cape Coral has already received national media coverage. The only other place where monitors have been introduced and become established are on a few South Pacific islands, where the Mangrove Monitor (*V. indicus*), which is native to nearby areas, was intentionally released to control rat (*Rattus* spp.) populations on military bases (Luxmoore et al. 1988, Spennemann 1997).

Florida already contains at least 28 established non-native lizard species (Butterfield et al. 1997), but *V. niloticus* may prove to be the most detrimental to local wildlife populations. No adverse impacts on native species have been documented yet, but we feel that eradication of this large, exotic species is warranted because of its potential danger to native wildlife, potential nuisance value to humans and domesticated animals, high fecundity, dispersal abilities, and adaptability to diverse habitats.

The Charlotte Harbor National Estuary Program and the National Fish and Wildlife Foundation have funded TSC to study and attempt to eradicate the Cape Coral population of *V. niloticus* by trapping. Eradication will be difficult, particularly in mangrove areas, and possibly all we can hope for is population control and prevention of expansion into other areas containing rare and vulnerable wildlife species. Until recently, the monitor population in Cape Coral apparently has been in the lag phase of invasion, the period of time between the first introduction of a species and its rapid population increase and subsequent range expansion (Crooks and Soulé 1999). The best and most cost-efficient opportunity to control or reduce the impact of a non-indigenous species is during the lag or early spread phase (Byers et al.

2002), but observations of monitors from outlying areas indicate possible population expansion, the fourth of six stages of the invasion process (With 2002). The monitor population will need to be assessed periodically, and any individuals that appear elsewhere will need to be immediately eliminated.

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Literature Cited

- Bayless, M.K. 1991. A trip from Africa. *VaraNews* 1(5):5–8.
- Bennett, D. 1995. *A Little Book of Monitor Lizards*. Viper Press, Glossop, U.K. 207 pp.
- Bennett, D. 2002. Diet of juvenile *Varanus niloticus* (Sauria: Varanidae) on the Black Volta River in Ghana. *Journal of Herpetology* 36:116–117.
- Bernard, E. 1983. *Lies That Came True: Tall Tales and Hard Sales in Cape Coral, Fla.* Anna Publishing, Ocoee, FL. 241 pp.
- Böhme, W., and T. Ziegler. 1997. A taxonomic review of the *Varanus (Polydaedalus) niloticus* (Linnaeus, 1766) species complex. *Herpetological Journal* 7:155–162.
- Bowen, P.J. 2001. Demography and distribution of the Burrowing Owl in Florida. *Florida Field Naturalist* 9:113–126.
- Branch, B. 1998. *Field Guide to Snakes and Other Reptiles of Southern Africa*. Ralph Curtis Books, Sanibel Island, FL. 399 pp.
- Branch, W.R., and H. Erasmus. 1982. Notes on reproduction in the South African Water Monitor *Varanus niloticus niloticus*. *Journal of the Herpetological Society of Africa* 28:4–9.
- Butterfield, B.P., W.E. Meshaka, Jr., and C. Guyer. 1997. Nonindigenous amphibians and reptiles. Pp. 123–138, *In* D. Simberloff, D.C. Schmitz, and T.C. Brown (Eds.). *Strangers in Paradise: Impact and Management of Nonindigenous Species in Florida*. Island Press, Washington, D.C.
- Byers, J.E., S. Reichard, J.M. Randall, I.M. Parker, C.S. Smith, W.M. Lonsdale, I.A.E. Atkinson, T.R. Seastedt, M. Williamson, E. Chornesky, and D. Hayes. 2002. Directing research to reduce the impacts of nonindigenous species. *Conservation Biology* 16:630–640.
- Cape Coral. 2003a. Planning Division: Block Grant. Plan of Action for CDGB Fiscal Year 2002–2003. 4 pp. Available online at: http://www.capecoral.net/citydept/comdev/glm/glm_blockgrant.cfm.
- Cape Coral. 2003b. Planning Division: City Demographics. City Demographics. 2 pp. Available online at: http://www.capecoral.net/citydept/comdev/glm/glm_citydemogs.cfm.
- Cissé, M. 1972. L'alimentation des Varanidés au Sénégal. *Bulletin de l'Institut Fondamental d'Afrique Noire Série A2, Sciences Naturelles* 34:503–515.

- Cott, H.B. 1960. Scientific results of an enquiry into the ecology and economic status of the Nile crocodile in Uganda and northern Rhodesia. *Transactions of the Zoological Society of London* 29:212–356.
- Cowles, R.B. 1930. The life history of *Varanus niloticus* (Linnaeus) as observed in Natal South Africa. *Journal of Entomology and Zoology* 22:1–31.
- Crooks, J.A., and M.E. Soulé. 1999. Lag times in population explosions of invasive species: Causes and implications. Pp. 193–125, *In* O.T. Sandlund, P.J. Schei, and A. Viken (Eds.). *Invasive Species and Biodiversity Management*. Chapman and Hall, Dordrecht, The Netherlands.
- Dalrymple, G.H. 1994. Non-indigenous amphibians and reptiles. Pp. 67–78, *In* D.C. Schmitz and T.C. Brown (Project Directors). *An Assessment of Invasive Non-indigenous Species in Florida's Public Lands*. Florida Department of Environmental Protection Technical Report No. TSS-94-100, Tallahassee, FL.
- de Buffrénil, V., and G. Hémery. 2002. Variation in longevity, growth, and morphology in exploited Nile Monitors (*Varanus niloticus*) from Sahelian Africa. *Journal of Herpetology* 36:419–426.
- de Buffrénil, V., and F. Rimblot-Baly. 1999. Female reproductive output in exploited Nile Monitor Lizard (*Varanus niloticus* L.) populations in Sahelian Africa. *Canadian Journal of Zoology* 77:1530–1539.
- Dodrill, D.E. 1993. *Selling the Dream: The Gulf American Corporation and the Building of Cape Coral, Florida*. University of Alabama Press, Tuscaloosa, AL. 311 pp.
- Duellman, W.E., and A. Schwartz. 1958. Amphibians and reptiles of southern Florida. *Bulletin of the Florida State Museum, Biological Sciences* 3:181–324.
- Edroma, E.L., and W. Ssali. 1983. Observations on the Nile Monitor Lizard (*Varanus niloticus*, L.) in Queen Elizabeth National Park, Uganda. *African Journal of Ecology* 21:197–201.
- Faust, R. J. 2001. Nile Monitors: Everything about History, Care, Nutrition, Handling, and Behavior. Barron's Educational Series, Hauppauge, NY. 95 pp.
- King, F.W., and T. Krakauer. 1966. The exotic herpetofauna of southeast Florida. *Quarterly Journal of the Florida Academy of Science* 29:144–154.
- Lenz, S. 1995. Zur biologie und ökologie des Nilwarans, *Varanus niloticus* (Linnaeus 1766) in Gambia, Westafrika. *Mertensiella* 5:1–256.
- Loope, L.L., F.G. Howarth, F. Kraus, and T.K. Pratt. 2001. Newly emergent and future threats of alien species to Pacific birds and ecosystems. Pp. 291–304, *In* J.M. Scott, S. Conant, and C. van Riper III (Eds.). *Evolution, Ecology, Conservation, and Management of Hawaiian birds: A Vanishing Avifauna*. *Studies in Avian Biology* No. 22, A Publication of the Cooper Ornithological Society, Allen Press, Lawrence, KS.
- Losos, J.B., and H.W. Greene. 1988. Ecological and evolutionary implications of diet in monitor lizards. *Biological Journal of the Linnean Society* 35:379–407.
- Luxmoore, R., B. Groombridge, and S. Broads (Eds.). 1988. *Significant Trade in Wildlife: A Review of Selected Species in CITES Appendix II. Volume 2: Reptiles and Invertebrates*. IUCN Conservation Monitoring Centre, Cambridge, U.K. 306 pp.
- Mack, R.N., D. Simberloff, W.M. Lonsdale, H. Evans, M. Clout, and F.A. Bazzaz. 2000. Biotic invasions: Causes, epidemiology, global consequences, and control. *Ecological Applications* 10:689–710.

- McGraw, M. 1992. Monitor lizard eats cat. *Nyala* (Wildlife Society of Malawi) 16(1):30–31.
- Millsap, B.A., and C. Bear. 2000. Density and reproduction of Burrowing Owls along an urban development gradient. *Journal of Wildlife Management* 4:33–41.
- Mohda, M.L. 1965. The ecology of the Nile crocodile (*Crocodylus niloticus*) on Central Island, Lake Rudolf. *East African Wildlife Journal* 5:74–95.
- Muhigwa, J.B. 1998. Diel activity and biotope choices of the Nile Monitor Lizard in western Kenya. *African Journal of Ecology* 36:271–275.
- Parker, I.M., D. Simberloff, W.M. Lonsdale, K. Goodell, M. Wonham, P.M. Kareiva, M.H. Williamson, B.V. Holle, P.B. Moyle, J.E. Byers, and L. Goldwasser. 1999. Impact: Toward a framework for understanding the ecological effects of invaders. *Biological Invasions* 1:3–19.
- Rice, K. G., H. F. Percival, A. R. Woodward, and M. L. Jennings. 1999. Effects of egg and hatchling harvest on American Alligators in Florida. *Journal of Wildlife Management* 63:1193–1200.
- Rieppel, O., and L. Labhardt. 1979. Mandibular mechanics in *Varanus niloticus*. *Herpetologica* 35:158–163.
- Rodda, G.H., Y. Sawai, D. Chiszar, and H. Tanaka. 1999. Problem Snake Management: The Habu and the Brown Treesnake. Cornell University Press, Ithaca, NY. 534 pp.
- Rodgers, J.A., P.S. Kublis, S.A. Nesbitt, M.F. Delany, R.K. Felix, J. Swan, K.T. Bowman, and J.B. Dodge. 1999. Atlas of Breeding Sites for Colonial Waterbirds in Florida during 1999. Florida Fish and Wildlife Conservation Commission, Tallahassee, FL.
- Simberloff, D., D.C. Schmitz, and T.C. Brown (Eds.). 1997. Strangers in Paradise: Impact and Management of Nonindigenous Species in Florida. Island Press, Washington, D.C. 467 pp.
- Spawls, S., K.M. Howell, R.C. Drewes, and J. Ashe. 2001. A Field Guide to the Reptiles of East Africa. Academic Press, San Diego, CA. 543 pp.
- Spennemann, D.H.R. 1997. Distribution of rat species (*Rattus* spp.) on the atolls of the Marshall Islands: Past and present dispersal. *Atoll Research Bulletin* No. 446. 18 pp.
- Wesemann, T. 1986. Factors influencing the distribution and abundance of Burrowing Owls (*Athene cunicularia*) in Cape Coral, Florida. M.S. Thesis, Appalachian State University, Boone, NC. 86 pp.
- Western, D. 1974. The distribution, density and biomass density of lizards in a semi-arid environment of northern Kenya. *East African Wildlife Journal* 12:49–62.
- Wilcove, D.S., D. Rothstein, J. Dubow, A. Phillips, and E. Losos. 1998. Assessing the relative importance of habitat destruction, alien species, pollution, over-exploitation, and disease. *BioScience* 48:607–616.
- Wilson, L.D., and L. Porras. 1983. The ecological impact of man on the South Florida herpetofauna. University of Kansas Museum of Natural History Special Publication No. 9, Lawrence, KS. 89 pp.
- With, K.A. 2002. The landscape ecology of invasive spread. *Conservation Biology* 16:1192–1203.