Volume 14, Number 3 September 2007

IGUANA

Conservation, Natural History, and Husbandry of Reptiles

International Reptile Conservation Foundation
www.IRCF.org

MICHAEL D. KERN

This Panther Chameleon (*Furcifer pardalis*) in Ankify was a highlight of a trip to Madagascar.
See article on p. 184.

MICHAEL D. KERN

This beautiful Gold Dust Day Gecko (*Phelsuma laticauda laticauda*) was one of many encountered during an expedition to Madagascar (see travelogue on p. 184).

DANIEL ARIANO

The Guatemalan Beaded Lizard (*Heloderma horridum charlesbogerti*) recently was elevated from CITES Appendix II to I, affording it a higher level of legal protection (see related article on p. 152).

KEVIN M. ENGE

An adult male Green Iguana (*Iguana iguana*) on the edge of a pond in Hollywood, Broward County, Florida (see article on p. 142).

JAMES R. MCCRANIE

This spectacular *Polychrus gutturosus* from the rainforests of Honduras was bright green when found, but changed to brown in the collecting bag (see article on p. 172).

JAMES R. MCCRANIE

The Splendid Treefrog (*Cruziohyla calcarifer*) is a seldom-seen, highly arboreal canopy frog found in the rainforests of Honduras (see article on p. 172).

ALEXANDRE SOULLIER

Yellow Anacondas (*Eunectes notaeus*) show high levels of sexual size dimorphism. Here an approximately 2-m-long male courts an approximately 3-m-long female (see article on p. 160).

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ROBERT POWELL

Lesser Antillean Iguanas (*Iguana delicatissima*) are critically endangered or have been extirpated on many of the islands where they occurred historically. Principal threats are habitat destruction, exploitation of adults and eggs for food, contamination of the gene pool by hybridization with introduced Green Iguanas (*Iguana iguana*), and invasive predators like cats, dogs, and mongooses. Only on Dominica do these lizards remain abundant. This young individual was feasting on leaves in a Noni Tree (*Morinda citrifolia*) overlooking Champagne Beach, a favorite diving site.

ANTHONY FLANAGAN

An adult male Green Iguana (*Iguana iguana*) basking on a dock in Hollywood, Broward County, Florida.

Distribution, Natural History, and Impacts of the Introduced Green Iguana (*Iguana iguana*) in Florida

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Abstract.—In this article, we document the geographic distribution, reproduction, potential ecological impacts, and nuisance value of the non-native Green Iguana (*Iguana iguana*) in Florida. We further provide management recommendations for control of this species in Florida. Locality records of *I. iguana* were obtained via the literature and both photographic and specimen vouchers, and also from the field, where specimens were collected and observations made from May 1992 through December 2006. We compiled 3,169 records of *I. iguana* in Florida. *Iguana iguana* was first reported (but not breeding) in Florida in 1966 from Miami-Dade County; however, it is now reproducing and established in much of southern Florida, including many Florida Keys. We observed *I. iguana* mating as early as December and as late as April. Ovipositioning usually takes place in sandy areas. Females were found to have vitellogenic follicles in November, December, and February; carried oviducal eggs between February and April; and we found a single clutch of 41 eggs that was oviposited in April. Neonates were observed from May through August. *Iguana iguana* feeds on a variety of vegetation, as well as insects, tree snails, and possibly small mammals. This species causes considerable damage to landscape vegetation and often is considered a nuisance by land managers and property owners. Burrowing by Green Iguanas causes erosion and undermines sidewalks, foundations, seawalls, berms, and canal banks. They also force vehicular traffic to brake; deposit unsightly and unhygienic defecations on moored boats, seawalls, docks, porches, decks, pool platforms, and inside swimming pools; potentially act as seed dispersers for invasive plant species; and may transmit *Salmonella* to humans. A number of steps can be taken by Florida landowners to help control *I. iguana* in the state: First, vegetation selected for landscaping should lack the showy flowers and colorful fruits that are eaten preferentially by iguanas. Second, trapping and removing live lizards can be undertaken using live traps (e.g., Havahart, Tomahawk), snare traps, and nooses. Third, artificial nesting sites can be easily constructed and monitored during the reproductive season so that iguana eggs can be removed and destroyed. Finally, before purchasing pet iguanas, prospective owners should be educated on the life history details (e.g., large adult size, potential to inflict painful wounds, etc.) and complex husbandry requirements of this lizard, and be made aware that releasing this or any other non-native animal into the wild is illegal in Florida.

Introduction

The Green Iguana, *Iguana iguana* (Linnaeus 1758), was first reported in the 1960s in Florida as occurring, but not breeding, on the southeastern coast from Hialeah, Coral Gables, and Key Biscayne in Miami-Dade County. Over the next few decades, many residents enjoyed watching these large exotic lizards, allowing them to roam unmolested on their properties, and at times even feeding them. By the mid-1990s, however, many residents' attitudes changed as iguana populations exploded, often becoming a nuisance to humans and having a negative impact on the environment. Although many authors have documented the occurrence of *I. iguana* populations in Florida, none fully illustrate this species' expansive geographic distribution or remark on its potential effects. Herein, we document the current geographic distribution using voucher specimens and field observations, potential ecological impacts, and nuisance value of this non-native species in Florida.

Materials and Methods

Locality records of *Iguana iguana* were obtained from the literature and from systematic collections throughout the United States. Fieldwork was conducted from May 1992 through December 2006; *I. iguana* were collected by hand, noosing, and shooting small tapered corks from a blowgun (for neonates only). In addition, photographs were taken and used as vouchers. Specimens were deposited in East Tennessee State University (ETMNH), Indiana State University Vertebrate Collection (ISUVC), Florida Museum of Natural History, University of Florida (UF), United States National Museum (USNM), and Yale Peabody Museum (YPM). All records with locality data were plotted using ArcView v. 3.2 (ESRI).

Distribution and History of Introductions

The native range of *Iguana iguana* extends from southern Mexico to central Brazil and Bolivia (Lazell 1973, Savage 2002),

including the Caribbean islands of Cozumel (J.C. Seitz, pers. obs.), San Andrés and Providencia, Roatán, Utila, Swan Island, Cayo Icacos, Curaçao, St. Vincent and the Grenadines, Grenada, Îles des Saintes, Montserrat, Saba, St. Lucia, and Trinidad and Tobago (Bakhuis 1982, Murphy 1997, Schwartz and Henderson 1991). Green Iguanas have been introduced in Grand Cayman (Seidel and Franz 1994), Guadeloupe (Lever 2003), St. Martin/St. Maarten (Powell et al. 2005), Puerto Rico (Thomas 1999), Hawaii (McKeown 1996), the southern Rio Grande Valley in Texas (Meshaka et al. 2004a, Bartlett and Bartlett 2006), and Florida (Wilson and Porras 1983). The origin of the U.S. Virgin Islands population has been disputed for some time (Lazell 1973), with some authors contending that iguanas were introduced by man (see Thomas 1999).

We compiled 3,169 records of *I. iguana* from southern Florida; 1,088 of these represent preserved specimens and photographic vouchers collected between 1965 and 2006 (Appendix) and 2,081 represent field observations. The species is widely established along the Atlantic Coast in Broward, Martin, Miami-Dade, Monroe, and Palm Beach counties, and along the Gulf Coast in Collier and Lee counties. Although *I. iguana* has been found farther north in Alachua, Highlands, Hillsborough, Indian River, and St. Lucie counties, no voucher specimens exist for these scattered localities (except Alachua, UF 122514) and these individuals are unlikely to represent established populations due to low winter temperatures.

King and Krakauer (1966) recorded the first Florida voucher specimen (UF 22910, Table 1) collected in 1965 from Coral Gables, and subsequently reported *I. iguana* as an established, but non-breeding species from four separate areas in Miami-Dade County: East 7th Avenue and West 27th Street in Hialeah, Caballero Boulevard and Hardee Road in Coral Gables, southwest corner of Miami International Airport, and Key Biscayne. More than 300 individuals were released between May and September 1964 at the Hialeah site (King and Krakauer 1966). Wilson and Porras (1983) reported *I. iguana* from the Miami Seaquarium on Virginia Key, and Butterfield et al. (1997) speculated that this species had probably been breeding in Miami since around 1980. Although *I. iguana* is occasionally observed in Everglades National Park (e.g., nine sightings in 1995–2004), a population has apparently not become established, possibly because of the presence of potential predators and competitors, and the lack of suitable nesting sites (Meshaka et al. 2000, 2004a, 2004b). *Iguana iguana* was first documented from Broward County in Davie (Townsend et al. 2002), and Palm Beach County in Loxahatchee National Wildlife Refuge and Palm Beach Gardens (Krysko et al. 2005). We photographed this species in 2006 in Port Mayaca, Martin County.

Records (N = 3,169) of Green Iguanas (*Iguana iguana*) in southern Florida. Open circles indicate preserved specimens and photographic vouchers (N = 1,088) collected between 1965 and 2006, circles with central dots indicate observations (N = 2,081). A circle may represent more than one record.

Bartlett (1980) first observed *I. iguana* in southwestern Florida in Collier County, but did not identify a specific locality. Krysko et al. (2005) documented the first voucher specimens from Collier County (collected as early as 1998) in Golden Gate. *Iguana iguana* has been established for at least a decade on Marco Island (N. Richie, pers. comm.), and in 2005 this species was observed along the mangrove fringe between Goodland and Goodland Bay (K. Laakkonen, pers. comm.), the Florida Panther National Wildlife Refuge (D. Giardina, pers. comm.), Copeland (within Fakahatchee Strand Preserve State Park), and in Naples. In Lee County, *I. iguana* has been reported from Cape Coral (Bartlett and Bartlett 1999, Krysko et al. 2005), and Bonita Springs between Williams Road and the Imperial River since about 2000 (Spinner 2005).

Duquesnel (1998) first observed *I. iguana* in the upper Florida Keys at John Pennekamp Coral Reef State Park, Key Largo. Krysko et al. (2005) documented this species in the lower Florida Keys from (east to west) Little Torch and Sugarloaf keys, and Stock Island. More recently, these findings have been augmented with voucher specimens from Key Largo, Windley Key, Big Pine Key, Vaca Key, and Key West; and with observations only from Plantation, Duck, Little Crawl, Bahia Honda, Middle Torch, Summerland, Cudjoe, Lower Sugarloaf, Big Coppitt, and Boca Chica keys.

Food Habits and Predators

Neonate and juvenile *Iguana iguana* feed on vegetation (i.e., new shoots, leaves, blossoms, and fruits) and insects such as grasshoppers (Hirth 1963). In addition to these items, adults have been reported to feed on bird eggs (Lazell 1973) and carrion (Loftin and Tyson 1965). In Florida, neonates and juveniles feed on vegetation, insects, and tree snails (Townsend et al. 2005), whereas adults are primarily herbivorous, but may take additional items as well. A juvenile *I. iguana* appeared to be feeding on Firebush (*Hamelia patens*) fruits in a Naples garden (J. Schmid, pers. comm.). Fecal contents of a Homestead, Florida individual included flowers, leaves, and fruits from non-native Jasmine (*Jasminum* sp.) and Washington Fan Palms (*Washingtonia robusta*; Meshaka et al. 2004b). At Bill Baggs Cape Florida State Park (BBCF) on the southern tip of Key Biscayne, we have observed *I. iguana* feeding on Nicker Bean (*Caesalpinia bonduc*),

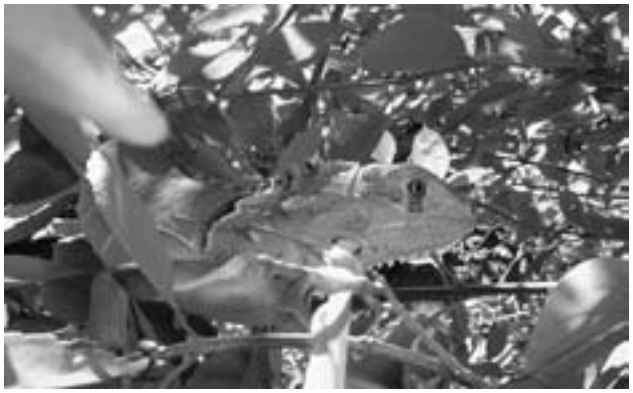
and we have collected specimens that had eaten tree snails (*Drymaeus multilineatus*; see Townsend et al. 2005) and an adult (UF 137405) found dead-on-road (DOR) with mammal hair in its mouth. At Crandon Park on Key Biscayne, *I. iguana* eats cracked corn supplied to captive waterfowl, and adults removed from an overbrowsed area defecated rat (*Rattus* sp.) hair (G. Ward, pers. comm.). Two Green Iguanas were observed feeding on a Spanish Stopper (*Eugenia foetida*) just before basking on a Strangler Fig (*Ficus aurea*; J.G. Duquesnel, pers. comm.).

In its native range, *I. iguana* is preyed upon by a variety of reptilian, avian, and mammalian species. In Venezuela, juveniles that had emerged by the thousands over a 14-day period were preyed upon by three crocodilian, two snake, three teiid lizard, nine accipiter, four falcon, one owl, three heron, three cuckoo, two passerine, and six mammalian species, including domestic dog (*Canis familiaris*) and cat (*Felis domesticus*; Antonio Rivas et al. 1998). Some of the predators identified in its native range also occur in southern Florida: Boa Constrictor (*Boa constrictor*), Spectacled Caiman (*Caiman crocodilus*), American Crocodile (*Crocodylus acutus*), Giant Ameiva (*Ameiva ameiva*), Barn Owl (*Tyto alba*), Broad-winged Hawk (*Buteo platypterus*), Swallow-tailed Kite (*Elanoides forficatus*), White-tailed Kite (*Elanus leucurus*), Osprey (*Pandion haliaetus*), American Kestrel (*Falco sparverius*), Crested Caracara (*Caracara cheriway*), Great Egret (*Ardea alba*), and Smooth-billed Ani (*Crotophaga ani*; Antonio Rivas et al. 1998, Greene et al. 1978, Swanson 1950, Wunderle 1981). Cats, Caracaras, and Kestrels are among the most common predators in Venezuela (Antonio Rivas et al. 1998). Juvenile Green Iguanas in Florida are eaten by the Florida Burrowing Owl (*Athene cunicularia floridana*), Yellow-crowned Night-heron (*Nyctanassa violacea*), Yellow Rat Snake (*Elaphe obsoleta*), and domestic dog (Engeman et al. 2005b, McKie et al. 2005, Meshaka et al. 2004b). Potential predators of iguana eggs are the Raccoon (*Procyon lotor*), Spotted Skunk (*Spilogale putorius*), Fish Crow (*Corvus ossifragus*), Black (*Coragyps atratus*) and Turkey (*Cathartes aura*) Vultures, feral pig (*Sus scrofa*), and domestic dog (Hirth 1963, Sexton 1975).

Eggs and young Green Iguanas possibly are eaten by a variety of native wildlife species in Florida, and they might provide an important source of food, particularly in areas with dense iguana populations and few remaining native prey species. Neonate *I. iguana* are frequently found on the ground, in shrubs, or low in trees (Henderson 1974, Hirth 1963, Swanson 1950), exposing them to different predators than adults, which are usually high in trees. In Florida, once *I. iguana* reaches about 60 cm TL, it has few adversaries except humans, possibly domestic dogs, American Alligators (*Alligator mississippiensis*; see Kern 2004), and American Crocodiles, and is frequently found in open areas. Green Iguanas of all sizes are collected by humans for the pet trade, nuisance control, and human consumption.

Reproduction

In its native range, adult male Green Iguanas have larger home ranges (up to 9,000 m^2) than females and juveniles (Rand et al. 1989). In Costa Rica, mating occurs in October–November (possibly December in Tortuguero) during the dry season (Hirth 1963). Females are known to travel up to several kilometers to reach suitable nesting sites, where they nest either alone or communally (Alvarez del Toro 1960, Rand 1968, Rand and Dugan 1983). Nesting sites are usually in sandy open areas, such as riverbanks, islands, or beaches (Burghardt et al. 1977, Campos 2004, Haller and Rodrigues 2005, Hirth 1963), and females exhibit nesting site fidelity (Bock et al. 1985). In Panama, *I. iguana* sometimes shares nesting sites with American Crocodiles, whose nest defense behavior may disrupt iguana nesting activities (Bock and Rand 1989); similarly in Honduras, iguana eggs have been uncovered in a Spectacled Caiman nest (Carr 1953). Female *I. iguana* typically dig an egg chamber 10–120 cm deep and 100–463 cm long (Haller and Rodrigues 2005, Rand 1968, Rand and Dugan 1980), but complex nests shared by multiple females may have a system of interconnecting tunnels up to 24 m long (Rand and Dugan 1983). Female *I. iguana* plug the nest tunnel, which is 10–15 cm wide and 7–10 cm high, with substrate using the snout (Rand 1968). Ovipositioning of 10–71 eggs (Campos 2004, Fitch 1985, Haller and Rodrigues 2005, Hirth 1963, Rand 1968, Swanson 1950) occurs in late afternoon (rarely in the morning) between early February and April in Mexico and Central America (Alvarado et al. 1995, Alvarez del Toro 1960, Bock and Rand 1989, Hirth 1963, Swanson 1950). Nesting


JEFFREY R. SCHMID

A juvenile Green Iguana (*Iguana iguana*) on a non-native Golden Dewdrop (*Duranta erecta*) in Naples, Collier County, Florida (photographic voucher UF 146274). This iguana appeared to be foraging on fruit from an adjacent Firebush (*Hamelia patens*).


JAMES G. DUQUESNEL

Two Green Iguanas (*Iguana iguana*) on a Strangler Fig (*Ficus aurea*) on Key Largo, Monroe County, Florida (photographic voucher UF 149986). These iguanas were observed feeding on adjacent Spanish Stopper (*Eugenia foetida*).


ANTHONY FLANAGAN

Two adult male Green Iguanas (*Iguana iguana*) fighting on 24 February 2004 on a dock in Hollywood, Broward County, Florida.


KENNETH L. KRYSKO

Two Green Iguanas (*Iguana iguana*) being fed by humans on a dock on Sugarloaf Key, Monroe County, Florida (photographic voucher UF 131549).

may take place from December to February in the Lesser Antilles (Lazell 1973), from late January to March in Colombia (Muñoz et al. 2003), and September to December in Brazil (Campos 2004, Haller and Rodrigues 2005). Incubation of eggs takes approximately three months (Alvarez del Toro 1960; Swanson 1950). In southern Florida, we observed Green Iguana mating behavior, including male combat, as early as December and lasting through April. Ovipositioning usually takes place in sandy areas, but one known female nested in a mulch pile on Key Largo (J. Duquesnel, pers. comm.). We collected: (1) Four females with vitellogenic follicles (mean = 30.2 ± 4.5 mm, 20–42 mm) from November, December, and February; (2) 22 females with oviducal eggs (mean = 35.5 ± 2.9 mm, 12–62 mm) between February and April; and (3) A single clutch of 41 eggs oviposited in April. Neonates are observed from May to August in both the southern peninsula and Florida Keys.

Nuisance Problems in Florida

From the 1960s through the 1980s, many residents in Miami enjoyed watching the large exotic *Iguana iguana*, allowing them to roam unmolested on their properties and at times even feeding them. Prior to Hurricane Andrew in 1992, *I. iguana* was not generally considered a nuisance species, but populations exploded in the 1990s in many areas of southeastern Florida. In 1992, a large reptile dealer in Hollywood, Broward County, purchased few *I. iguana* that were captured locally (R. Van Nostrand, pers. comm.); now this species can be captured by the hundreds in this county and in adjacent Palm Beach County to the north. According to newspaper articles since 2003, *I. iguana* populations have increased markedly to nuisance levels in Pompano Beach, Pembroke Pines, Dania Beach, Plantation, Davie, Delray Beach, and Boca Raton. In the past few years, *I. iguana* began appearing in large numbers in the Keys, sometimes crossing roads and forcing traffic to brake along U.S. 1, which prompted the Florida Keys Invasive Species Task Force to solicit advice from the Florida Fish and Wildlife Conservation Commission and Florida Museum of Natural History on how to control or eradicate these populations.


ANTHONY FLANAGAN

Green Iguanas (*Iguana iguana*) basking on a dock in Hollywood, Broward County, Florida. Note iguana feces covering the deck.

On Key Biscayne, the post-Hurricane Andrew *I. iguana* population explosion was possibly due to opening up of the canopy, subsequent replanting of non-native landscape vegetation favored as food by iguanas (see Meshaka et al. 2004a), and creation of suitable nesting areas. This aggressive replanting of ornamental vegetation occurred throughout southeastern Florida after the widespread destruction caused by the hurricane. Before the hurricane, Bill Baggs Cape Florida State Park (BBCF) was extensively vegetated by non-native Australian Pines (*Casuarina equisetifolia*), thus iguana food and iguanas were scarce. After most of the Australian Pines were destroyed by the hurricane, BBCF park staff eventually began efforts to restore natural habitats and native vegetation. Fallen trees and other hurricane debris at BBCF and the county-owned Crandon Park to the north on Key Biscayne were mulched and bulldozed into piles, creating exposed, well-drained mounds that served as ideal sites for *I. iguana* to dig nesting burrows. *Iguana iguana* became so common at BBCF that, in 2003 alone, 824 iguanas were removed, mostly by one of us (EMD; see also Townsend et al. 2003), who also compiled these records into the park database. Meshaka et al. (2004a) attempted to illustrate increasing and high population densities of *I. iguana* at BBCF based solely on records maintained in the park database from 1 July 1998 through 30 June 2003 (reported therein as 0, 0, 1, 12, 384, respectively); however, the park database records are incomplete. Although we also believe that *I. iguana* has increased there (and other areas) since the late 1990s, the values reported for 2003 are elevated solely because of the collecting effort by EMD, who focused on removing non-native wildlife beginning in 2003 and ending upon leav-

ing BBCF in March 2004. If one were to calculate and expand on the actual numbers of *I. iguana* removed from BBCF from 1998 through 2006 (0, 0, 0, 9, 57, 824, 265, 189, and 89, respectively), after the point in which EMD left BBCF, this would erroneously illustrate a severe population crash.

Iguana iguana can cause considerable damage to residential and commercial landscape vegetation and is now often considered a nuisance by land managers and property owners, who sometimes have to install wire mesh or even electric fences around herbs, shrubs, and trees to protect them from these voracious lizards. Vulnerable young trees, and older trees with foliage or flowers particularly attractive to iguanas, can be protected from climbing lizards by encasing part of their trunks with sheet metal, as long as other trees are not within leaping distance. For many years, staff at Fairchild Tropical Botanic Garden in Miami tolerated *I. iguana* and prohibited their removal, until escalating populations started eating prized orchids (Orchidaceae) and the historic Hibiscus (*Hibiscus* spp.) garden was overgrazed to the ground and had to be relocated to a safer location. Other favored food plants include Impatiens (*Impatiens* spp.), Rose (*Rosa* spp.), Nasturtium (*Tropaeolum majus*), Caladium (*Caladium* spp.), Purple Heart (*Tradescantia* [*Setcreasea*] *pallida*), Bougainvillea (*Bougainvillea* spp.), and Hong Kong Orchid Tree (*Bauhinia blakeana*; see Kern 2004, Johnson 2006). *Iguana iguana* will eat most fruits (except citrus) and flowers, tender new growth, and almost anything planted in a vegetable garden (Kern 2004). In the 2000s, *I. iguana* ate most of the recently planted butterfly garden at the Key Deer National Wildlife Refuge on Big Pine Key (C. Bergh, pers. comm.).

Iguana iguana also is considered a nuisance by homeowners in part due to unsightly and unhygienic defecations on docks, moored boats, seawalls, porches, decks, pool platforms and inside swimming pools. *Iguana iguana* can transmit the infectious bacterium *Salmonella* to humans through their feces, which conceivably could occur if iguanas defecate in swimming pools or on food while people are eating outside. Some *I. iguana* dig burrows that are used as refugia, which can be accompanied by erosion that undermines sidewalks, foundations, seawalls, berms, and canal banks (Kern 2004, Johnson 2006). Although *I. iguana* usually uses burrows only as temporary refugia when away from water, over 100 iguana burrows (up to 4.5 m long) were observed in a seasonally flooded borrow pit in Venezuela; these were used as nocturnal refugia despite the presence of numerous trees (Rodda and Burghardt 1985). In treeless habitats in Florida, such as cleared canal banks and vacant lots, normally arboreal lizards seek shelter in burrows, culverts, drainage pipes, and rock or debris piles.

Large *I. iguana* basking on airport runways could pose a hazard to planes. At least five known records document airplanes colliding with iguanas at the international airport in San Juan, Puerto Rico, where this species was introduced, and large iguanas would have a relative hazard score equivalent to ducks and pelicans (Engeman et al. 2005a). *Iguana iguana* also can be observed basking and grazing on golf course fairways in Florida, but these lizards generally do not pose a hazard to golfers.

Iguana iguana is responsible for more complaints to the FWC than any other non-native reptilian species in Florida. Numbers of complaints continue to increase as iguanas expand their range into new areas, and additional homeowners experience the dubious thrill of having the reptilian version of a sheep devouring their landscape. Although many people enjoy watching *I. iguana* as long as they do not damage valued plants or property, many other people are afraid of these large lizards, especially visitors or new residents, who are not accustomed to such large prehistoric-looking animals living in their neighbor-

KEVIN M. ENGE

Adult male Green Iguana (*Iguana iguana*) above a culvert on a canal bank along U.S. 27 in Medley, Miami-Dade County, Florida (photographic voucher UF 150123).

KENNETH L. KRYSKO

Residence on Big Pine Key, Monroe County, Florida, with wire mesh installed around flowering plants to protect against Green Iguanas (*Iguana iguana*).

hood. Neighbors who were once friendly to each other have even become rivals and no longer speak, as some families decide to feed and protect iguanas while other families want to rid these lizards from their properties (C.D. May, pers. comm.). Nonetheless, *I. iguana* will continue to be a common sight in neighborhoods because of the tolerance of some residents who feed them, coupled with a scarcity of predators, abundance of palatable ornamental vegetation (some vegetation with thorns may ward off potential predators), sunny nesting sites, and the presence of canals, lakes, and swimming pools for drinking water and escape cover. Furthermore, the profusion of man-made canals serve as dispersal corridors that allow iguanas to colonize new areas.


CARL MAY

Adult male Green Iguana (*Iguana iguana*) at the front door of a residence in Fort Worth, Palm Beach County, Florida.

Potential Impacts on Other Species

On Marco Island, *Iguana iguana* occasionally uses burrows of the Florida Burrowing Owl (N. Richie, pers. comm.), a "Species of Special Concern" in Florida. At Crandon Park, *I. iguana* sometimes shares the same burrow as another non-native species, the Black Spiny-tailed Iguana (*Ctenosaura similis*), but most Green Iguanas utilize trees, particularly those in and around ponds and canals. The stomach of a juvenile *I. iguana* from Key Biscayne contained 12 tree snails (*Drymaeus multilineatus*), suggesting that it had selectively eaten them (Townsend et al. 2005). This snail species is common; however, iguanas could potentially impact other more rare tree snails (Townsend et al. 2005).

The species composition of the plant community might eventually be altered in areas with dense populations of *I. iguana* due to excessive grazing and defoliation of vegetation, resulting in death or lack of reproduction. In Mexico, *I. iguana* helps maintain forest diversity by consuming and dispersing seeds of many tree species (Morales-Mávil 1997). *Iguana iguana* is selective in its diet, and ingested seeds typically have higher germination rates than uneaten seeds (Benítez-Malvido et al. 2003). In Florida, *I. iguana* may be an important seed disperser of non-native invasive plant species, carrying seeds from people's yards into adjacent natural areas and hindering invasive vegetation control efforts. *Iguana iguana* at BBCF feed on Nicker Bean, an important food plant for larvae of the Endangered Miami Blue Butterfly (*Hemiargus thomasi bethunebakeri*).


CARL MAY

Juvenile Green Iguana (*Iguana iguana*) on a non-native Silk Floss (*Chorisia speciosa*) tree in Lake Worth, Palm Beach County, Florida (photographic voucher UF 149868).

Population Control in Florida

Iguana iguana is now common in many urban areas of the southern peninsula and Florida Keys, and may be flourishing in larger natural areas of coastal Florida. Green Iguanas are extremely popular in the pet trade and sometimes escape or are intentionally (and illegally) released by owners when they grow too large. Many pet enthusiasts are unaware (or unwilling to accept) that releasing non-native animals, including *I. iguana*, in Florida is illegal and potentially detrimental to the environment. Future illegal introductions of non-native animals can be ameliorated by incorporating pet owner education into the invasive species management process. Prospective iguana owners should be educated on the life history details (e.g., large size of adults, potential for inflicting painful wounds) and the complex husbandry requirements of this species before a purchase. In an attempt to facilitate disposal of unwanted exotic pets, the FWC now allows people to return animals (as long as they do not


KEVIN M. ENGE

Two non-native Green Iguanas (*Iguana iguana*) and a non-native Red-eared Slider (*Trachemys scripta elegans*) on non-native Melaleuca (*Melaleuca quinquenervia*) along a canal in Opa-Locka, Miami-Dade County, Florida (photographic voucher UF 150122). Two discarded automobile tires and other debris litter the man-made canal bank.

profit from the transaction by receiving more money than what was originally paid) to the pet store where purchased without requiring a costly license to sell wildlife.

Iguana iguana populations at the northern extent of their introduced range in Florida, as well as individual escapees farther north, are controlled by cold winter temperatures, except when thermal refugia or urban heat islands are available. When temperatures drop below 10 °C (50 °F), sluggish iguanas can be easily plucked from trees or collected after falling from trees, especially at night or on overcast days when basking does not increase body temperature quickly. Well-established populations in southern Florida appear to have exceeded the point of human control, and many animal control officers and nuisance trappers no longer respond to iguana complaints. Even if removal of *I. iguana* is successful, more lizards will repopulate the site from adjacent areas or when eggs hatch. Some private trappers charge upwards of $100 to visit an iguana-infested site, and they usually will not guarantee success in catching and removing lizards. However, David Johnson, "The Iguana Trapper," claims to specialize in removing *I. iguana* from overpopulated residences and subdivisions (Johnson 2006). During the past four years in his Pelican Harbor neighborhood along the C-15 Canal in southern Palm Beach County, Johnson (2006) has removed 406 iguanas, and during one week in April 2006, he caught 54 iguanas at one residence in Pompano Beach. Some residents have taken matters into their own hands; because *I. iguana* is a non-native species, it is not afforded protection in Florida, and it is legal to catch, trap, and humanely kill these lizards. However, permits or permission must be obtained before collecting wildlife, including non-native species, from a county, state, or national park and other public land. Once a Green Iguana is captured, it cannot legally be released again in Florida, limiting the captor to choose between killing the iguana humanely, keeping it in captivity, or selling it. Selling iguanas is no longer lucrative due to the availability of inexpensive farm-raised iguanas from Latin America; some pet stores sell imported neonate iguanas for less than $10 each. Wild-caught adult Green Iguanas seldom become tame, but zoos and other exhibits are sometimes interested in acquiring large individuals (especially orange-colored males) for display purposes, and foreign buyers may pay up to $300 for exceptional specimens (G. Ward, pers. comm.).

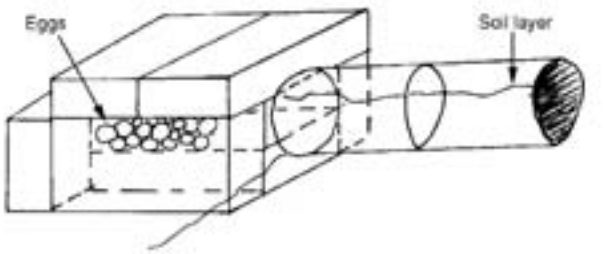
KEVIN M. ENGE

Adult male Green Iguana (*Iguana iguana*) basking on a fallen tree during a cool day at Crandon Park on Key Biscayne, Miami-Dade County, Florida (photographic voucher UF 150121). Non-native Senegal Date Palms (*Phoenix reclinata*) can be seen in the background.

Trapping methods for *I. iguana* include the use of live traps (e.g., Havahart, Tomahawk) baited with fruit, such as bananas or mangoes, or locking snares that can be set during the daytime at burrow entrances, at holes under fences, or along seawalls (Kern 2004), canals, and ponds. Johnson (2006) used a semicircular mesh trap with a snare at each end (D-I-Y trap) and bait in the center. However, the most common capture method is by noosing with a long pole, especially while lizards are sleeping at night or torpid during cold weather. Some commercial *I. iguana* catchers use boats to noose lizards from trees at night, sometimes stretching out nets to catch iguanas jumping from trees to the water below (G. Ward, pers. comm.). Persistent harassment may encourage *I. iguana* to move to the next-door neighbor's yard; this can be accomplished by launching pebbles or palm fruits at them using a slingshot (Kern 2004), spraying them with a hose, or through the use of loud vocalizations on the part of a person or a dog combined with quickly approaching the lizard. Shooting firearms is outlawed in residential areas.

Over the past few years, we have established a cooperative effort with personnel at Crandon Park on Key Biscayne to reduce their abundant *I. iguana* population. Despite our efforts and those of commercial collectors, who have additionally removed hundreds of iguanas annually, this species is still a common sight. People have been caught illegally releasing their pet iguanas at Crandon Park because they thought it was an "iguana nursery." "Iguana crossing" signs were once posted on Key Biscayne to advise motorists of a potential driving hazard. Over time, heavily harvested *I. iguana* populations can be expected to have lower densities, smaller individuals, and smaller clutch sizes than unharvested populations (Muñoz et al. 2003).

Female Green Iguanas are known to travel up to several kilometers to nest (see Alvarez del Toro 1960; Rand 1968; Rand and Dugan 1983), suggesting that females return to the same suitable nesting sites year after year. Desirable nesting sites can be heavily used by females. A clearing about 6 x 7 m in size on a 0.3-ha islet (not normally inhabited by *I. iguana*) in a Panamanian lake attracted as many as 150–200 females annually (Burghardt et al. 1977). In the Florida Keys, where *I. iguana* is expanding its range and is a nuisance, limestone is often near the surface, and nesting sites are usually limited to sandy microhabitats along beaches or soil and mulch piles brought in from the mainland for landscaping. Besides removing *I. iguana* from the wild whenever possible, in areas where suitable nesting areas are limited, we recommend establishing artificial nesting sites and removing the eggs. Suitable nesting mounds using sand, soil, or mulch can be placed in key problem areas for the express purpose of luring female iguanas. Monitoring these sites during the nesting season might help control the population, but care must be taken to locate and remove all iguana eggs. An easier solution than laboriously searching a mound of dirt for eggs would be to construct a small artificial nest box that would concentrate iguana eggs. Werner and Miller (1984) designed a simple but successful nest box using six concrete blocks 40 x 20 x 10 cm (15 x 8 x 4 in) and two clay tubes 30 cm long x 20 cm outside diameter (12 x 8 in). The interior of the nest chamber is 40 cm long, 20 cm wide, and 10 cm high (15 x 8 x 4 in) and filled with loose soil. The 60-cm (24 in) long entrance tube, which has a 15-cm (6 in) interior diameter, is one-third to half



An artificial nest box constructed using concrete blocks and clay tubes (illustrated after Werner and Miller 1984). Note that the tubes are originally half filled with a layer of dirt; the layer of dirt (observable by looking into the tube from the outside) will exceed the half-full mark when female iguanas excavate a nest chamber inside the box. Illustration by Audrey K. Owens.

filled with a 7-cm (2.75 in) layer of dirt; iguanas will fill this tube while excavating the nest chamber, indicating that nesting females or eggs are present and can be removed. This nest box is set on the surface of the ground and covered with 3 cm (1 in) of dirt; and the nest chamber is checked for eggs by removing one or both of the concrete blocks that form the roof. In an artificial nesting chamber, Werner and Miller (1984) believed that substrate composition is relatively unimportant (iguanas have been observed nesting in different mixtures of soil and sand, and even in ashes and refuse in garbage dumps), but solid walls and a roof are essential. These artificial nest sites should be monitored during the nesting season and all eggs or iguanas removed before refilling the nest chambers with displaced dirt from the entrance tubes. We recognize that this type of artificial nest box cannot be moved easily once constructed. Thus, we suggest using lighter-weight materials such as a similarly sized plastic, rubber, or fiberglass shell (for the chamber) and PVC tube (for the entrance), which will allow the nest box to be moved easily to different sites. Furthermore, these artificial boxes can be used to remove adult Green Iguanas as well as Spiny-tailed Iguanas (*Ctenosaura* spp.), as both species utilize burrows throughout the year.

Acknowledgements

We thank A. Nichole Hooper, Anthony T. Reppas, Todd S. Campbell, Julian C. Lee, Andy P. Borgia, Rick Rego, Steve A. Johnson, Kurt W. Larson, Esther M. Langan, Larry D. Wilson, Sean B. Thompson, Debbie T. Townsend, Steve H. Townsend, Bill Love, F. Wayne King, Chris S. Samuelson, Brooke L. Talley, Kristen L. Bell, Brian J. Camposano, Lorraine P. Ketzler, David G. Cook, Thomas M. Cravens, Ronald St. Pierre, George J. Ward, and Mark A. Flowers for assistance in the field; Stan Chrzanowski, Jim Duquesnel, Keith Laakkonen, Mike Owen, Thomas Owen, Carl May, Jeffrey R. Schmid, and Anthony Flanagan for providing photographs and information; Jim and Janice Duquesnel, Bill Love, Chris Bergh, Dennis Giardina, Nancy Richie, Raymond Goushaw, Ray Van Nostrand, Carl May, Kenyatta K. Nichols, and J.H. Altman for information of iguana populations in Florida; and Audrey K. Owens for illustrating the artificial iguana nest box.

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Appendix. Voucher specimens of *Iguana iguana* examined from Florida counties.

Alachua: UF 122514; *Broward*: UF 123126–27, 134066, 146556, 149568–69, 149979–81, 150124; *Collier*: UF 141486, 146036, 146067, 146273–74, 149612; *Lee*: UF 133209–10; *Miami-Dade*: ETMNH-CC 418–32; ISUVC 3846–47, 3849–53, 3855–92; UF 22910, 131544–47, 131556–60, 131764–66, 132864–83, 133838–41, 134203–10, 134231, 134910, 135083–91, 135093–94, 135294, 135470–71, 135485–89, 135494–500, 135538–63, 135616–22, 135624, 135896, 135907–23, 135925–46, 137405, 140562–65, 140579–82, 140740, 141040–41, 141098, 141101–03, 141109–19, 141220–23, 141225–27, 141230–31, 141233–34, 141236–39, 141248–49, 141487–96, 141498, 141609–17, 141766–68, 141897–99, 141902–03, 141953, 142317, 142333–42, 142344–54, 142551–74, 142591–95, 142625–80, 142722–24, 142731, 142812, 142817–19, 142897–904, 143602, 143605, 143607–08, 143946–48, 144060, 144239–41, 144261–65, 144268–97, 144310, 144312–23, 144343–471, 144575, 145202–14, 145218–333, 145335–57, 149715–32, 149734–810, 149873, 149892–978, 149982, 150002–13, 150121–23; USNM 245339; YPM 13950–52; *Monroe*: UF 131549, 133862, 134836, 137214, 141212, 145524, 149864, 149985–86, 150065, 150093; *Palm Beach*: UF 137086, 137183, 146557–72, 149863, 149868–70, 150079.

MICHAEL KERN

With powerful limbs and claws, the Guatemalan Beaded Lizard (*Heloderma horridum charlesbogerti*) is well equipped to climb trees in search of nestling prey.

Notes on the Distribution of the Endangered Lizard, *Heloderma horridum charlesbogerti*, in the Dry Forests of Eastern Guatemala: An Application of Multi-criteria Evaluation to Conservation

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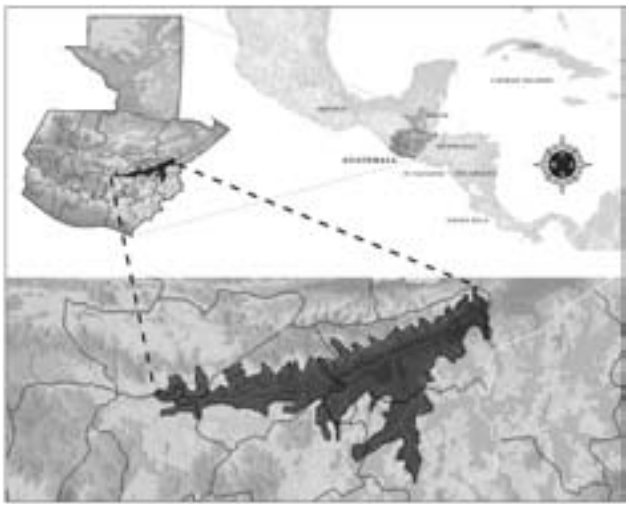
The Helodermatidae belong to the reptile clade possessing toxin-secreting oral glands (Fry et al. 2006). Lizards of this family are specialized vertebrate nest predators (Pianka 1966). The two species of *Heloderma* that comprise the Helodermatidae are *Heloderma suspectum* and *H. horridum* (Campbell and Lamar 2004). The former is commonly known as the "Gila Monster," whereas the latter is known as the "Beaded Lizard," "scorpion," or "sleeping baby" (Ariano 2003, Beck 2005). The coloration of *H. horridum* is both cryptic and aposematic (Beck 2005). This species reaches an average total length of about 650 mm (Beck and Lowe 1991), and the tail is short in relation to the size of the rest of the body (Álvarez del Toro 1982). The average weight of an adult is around 800 g (Beck and Lowe 1991).

Four subspecies of *H. horridum* have been described: *H. h. horridum, H. h. exasperatum, H. h. alvarezi* (Bogert and Martín del Campo 1956), and *H. h. charlesbogerti* (Campbell and Vannini 1988). *Heloderma h. charlesbogerti*, the Guatemalan Beaded Lizard, represents an isolated and distinctive population at the southern limit of the species' distribution (Beck 2005). *Heloderma h. charlesbogerti* differs from the other subspecies in body proportions and color patterns (Campbell and Vannini 1988). Recent molecular studies suggest that this taxon (in conjunction with *H. h. alvarezi*) may actually represent a distinct species (Douglas et al. 2003).

The Guatemalan Beaded Lizard inhabits the dry forests of the semiarid region of the Motagua Valley in eastern Guatemala (Ariano 2003) at elevations of 300–900 m above sea level (Campbell and Vannini 1988, Ariano 2003). Studies have revealed that the species can be found along rocky hills with steep slopes associated with dry forest vegetation including *Bucida macrostachya*, *Pereskia autumnalis*, *Moringa oleifera*, *Licania hypoleuca*, *Cephalocereus maxonii*, *Bursera simarouba*, *Leucaena diversifolia*, and *Bursera bipinata* (Ariano 2003).

The holotype of *H. h. charlesbogerti* is in the vertebrate collection of the University of Texas, Arlington (UTA R-15000), and comes from the region of Espíritu Santo, El Jícaro, El Progreso. Most of the paratypes also are in the UTA collection, and others in the collection of vertebrates at the University of Costa Rica (UTA R-15001–3, UTA R-18693, UCR 9602–3). These were collected in 1984 and 1985 in the region of Gualán, Zacapa, and from the region of Espíritu Santo in the Motagua Valley (Campbell and Vannini 1988). The distribution of the Guatemalan Beaded Lizard in Zacapa has been reduced drastically in recent years as a result of extensive loss of forest cover, persecution by local people afraid of its venom, and extraction from the wild for illegal trade (Ariano 2006).

Guatemalan Beaded Lizards (*Heloderma horridum charlesbogerti*) in the wild.



JOHN BINNS

Semiarid region of the Motagua Valley in northeastern Guatemala (from Nájera 2006).

Geographic Information Systems (GIS) have been useful tools for identifying conservation priorities for species in changing landscapes (Bojorquez et al. 1995). Multiple criteria frequently need to be evaluated as part of this process. Such procedures are called "Multi-criteria Evaluation" (MCE; Carver 1991, Eastman et al. 1995). MCE is most commonly achieved by Boolean overlay. In this approach, all criteria are reduced to logical statements of suitability and then combined by means of one or more logical operators such as intersection (logical AND) or union (logical OR) (Gutierrez and Gould 2000). This study seeks to determine the potential distribution of *H. h. charlesbogerti* in the semiarid region of the Motagua Valley in order to prioritize conservation areas and develop better conservation strategies for this population.

Methods

Study Site.—The analysis was conducted in the semiarid region of the Motagua Valley (RSAVM) in northeastern Guatemala. Dry forests are among the most endangered ecosystems in the world (Janzen 1988). This region comprises about 200,000 ha in the departments of El Progreso and Zacapa; it has the lowest average annual rainfall in Central America (500 mm) and is characterized by many endemic species (Nájera 2006). Currently, the region is heterogeneous, characterized by agricultural lands, grass lands, thornscrub, and very dry deciduous forest remnants, and includes zones of tropical thorn scrub, very dry tropical forest, and dry tropical forest (Holdridge 1967). The meteorological records of this area indicate that average maximum and minimum temperatures are 34.1 ºC and 17.9 ºC, respectively, absolute maximum and minimum temperatures are 45.0 ºC and 4.4 ºC, average annual precipitation ranges from 400–1200 mm, and average relative humidity ranges from 60–80% (INSIVUMEH 2006). Elevations in the region range from 180–900 m, with some peaks reaching 1,200 m. The area is hot and is characterized by seasonal rains; but, in general, the evaporation-transpiration is greater than the total rainfall (Nájera 2006). The rare combination of conditions occurring in RSAVM has contributed to its designation as a "unique ecoregion of the world" in the classification developed by the WWF (Dinerstein et al. 1995).

Multi-criteria Evaluation.—Seven digital maps were used for the Multi-criteria Evaluation. These maps represented conditions of forest cover, actual land use, geology, average rainfall, human population centers, life zones, and slopes of the semiarid region of the Motagua Valley in northeastern Guatemala. The maps were in UTM coordinates with NAD 27 zone 16 datum in raster system (MAGA 2002).

The multi-criteria analysis used a Boolean approach of the type "AND," employing the macro-modeler interface of Idrisi 32 version I32.2. This means that only the pixels that have all of the specific characteristics defined in the analysis will be chosen as potential distribution pixels. The decision rules for this MCE were based on the 2004–2006 collecting sites of *H. h. charlesbogerti*. Categories chosen for each specific layer taking into account these collecting sites were: deciduous forest, shrubscrops, and shrubs for the forest-cover layer; forest-shrubs for the land-use layer; below 800 mm for the average rainfall layer; PZM, Pi, and I categories for the geology layer; thorn scrub and dry forest for the life-zone layer; and above15% for the slopes layer. A buffer zone of 500 m was defined around each human population center.

The final MCE (suitability map of potential distribution of *H. h. charlesbogerti*) was constructed by overlaying all the Boolean maps obtained for each layer, and then adding the constraint that the suitable areas not be within the human population centers and the 500-m buffer zone. The area of the resultant polygons was measured and classified as: < 100 ha; > 100 but < 500 ha; > 500 but < 1000, and > 1000 ha. The patches greater than 1000 ha were defined as the extant populations of the species in its natural habitat.

The characteristics of collecting sites were obtained from base maps (A, B), for which a Boolean transformation was made, assigning value 1 to pixels with the desired characteristics, and value 0 to pixels without those characteristics. Then, all the resultant Boolean maps (C, D) were overlaid to obtain a final potential distribution map (E). Map A represents forest cover and map B represents hill slopes.

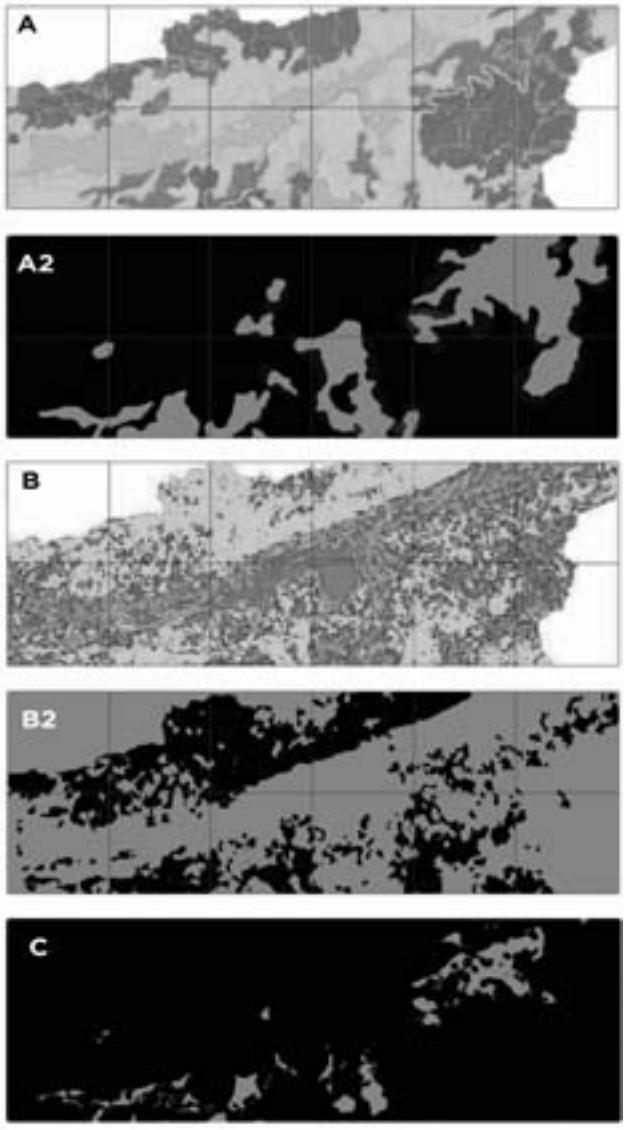
Finally, the suitability map was tested by overlaying the historical collecting sites of *H. h. charlesbogerti* from 1984–2001. These historical collecting sites were obtained by reviewing the literature (Campbell and Vannini 1988, Ariano 2003) and the data for specimens in local Guatemalan collections (both live and preserved animals), such as that of the Natural History Museum of the Universidad de San Carlos de Guatemala, National Natural History Museum "Jorge Ibarra," "La Aurora" National Zoo, Zootropic Collection, and the Collection of Universidad del Valle de Guatemala.

The accuracy of the suitability map was measured as the percentage of historical locations predicted correctly by the suitability map. Additionally, each area was visited and surveys were distributed to local inhabitants asking them about the presence of *H. h. charlesbogerti* in surrounding forests. As proposed by Ariano (2003), they also were asked to distinguish the species from a set of six photographs depicting the species *Ctenosaura similis, Coleonyx mitratus, Aspidoscelis managuae, Ctenosaura*

palearis, Hemidactylus tuberculosus, and *Heloderma horridum charlesbogerti*.

Results

The analysis generated a total of 60 polygons of potential distribution of *H. h. charlesbogerti*. Polygons were aggregated according to geographic proximity in seven areas of potential distribution of the species. These 60 polygons made up a total area of about 25,108 ha of suitable habitat. Of these 60 polygons, only 23 are in the > 100 but < 500 ha category, seven areas are in the > 500 but < 1000 category, and only three areas are > 1000 ha.



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Schematic representation of Boolean MCE for determining the potential distribution of *Heloderma horridum charlesbogerti* in the semiarid region of the Motagua Valley, Guatemala. **A:** Shades of gray represent the different types of vegetative cover found in the semiarid region of the Motagua Valley. **A2:** Gray areas represent portions of the same region that match the vegetative cover suitable for *Heloderma* (deciduous forest, shrub-crops, or shrubs) based on *Heloderma* collection sites from 2004–2006. **B:** Shades of gray indicate the degree of incline of slopes in the semiarid region of the Motagua Valley. **B2:** Gray areas represent slopes that correspond to 2004–2006 *Heloderma* collection sites (slopes > 15°). **C:** This map is the final product of the MCE showing the entire potential distribution area of *Heloderma horridum charlesbogerti*. Gray areas represent the cumulative overlay of all Boolean maps for each of the selection criteria (forest cover, actual land use, geology, average rainfall, human population centers, life zones, and slopes) appropriate for *Heloderma* according to actual collection sites from 2004–2006.

The resultant suitability map has an accuracy of 100% because all historical collecting points (1984–2001) were within the polygons predicted by the MCE analysis as potential habitat for *H. h. charlesbogerti*. Also, surveys confirmed the presence of the species in these seven major areas. For these reasons, we believe that the resultant suitability map is a good predictor of the actual distribution of the species according to actual land use, forest cover, rainfall, slopes, and distance to human population centers.

Area #3 contains the collecting sites of the holotype of the species (UTA R-15000) and one paratype (UCR 9602) (Campbell and Vannini 1988). Area #4 contains the more recent collecting sites (Ariano 2003) and is the study site in which six individuals of the species have been radio-tracked. Data from these localities were the basis for determining conditions and constraints established for the Boolean type MCE. This area also contains the collecting sites of the six individuals kept in captivity in the National Natural History Museum "Jorge Ibarra," the pair of individuals kept in the "La Aurora" National Zoo, and one of the two individuals kept in captivity in the Natural History Museum of Universidad de San Carlos de Guatemala. Area #7 contains the collecting sites of five paratypes (UTA-R-15001–3, UTA-R-18693, UCR 9603) and the collecting sites of the individual in the Zootropic collection and one of the individuals in the Natural History Museum of Universidad de San Carlos de Guatemala.

According to the definitions of this study, we identified only three extant populations of *H. h. charlesbogerti*. These populations were in areas #4 (Cabañas-El Jícaro), #5 (San Jorge-Zacapa), and #7 (Gualán-La Cartuchera-Los Jutes), all areas > 1000 ha of continuous potential habitat. The presence of *H. h. charlesbogerti* in these areas was confirmed by the surveys and by sightings in the wild by the authors.

Discussion

The three areas > 1000 ha are conservation priority areas for the species. According to Ariano (2003), the most relevant threats for the Guatemalan Beaded Lizard are loss of forest cover, illegal extraction for collectors, and persecution by local people, who consider it to be dangerous. As a means of mitigating these threats, we propose the development of strong environmental education programs for the human populations in the surrounding areas and promotion of the establishment of private natural reserves within these areas. These actions may help to eliminate the persecution of this species by local people and diminish the loss of forest cover in the area.

The present study will help to prioritize the human communities that need to be targeted by an educational program promoting the conservation of the species. This is a way to optimize the effectiveness of scarce resources (human and monetary) available for developing any educational program in the area. It also may be of great value in directing overall land conservation efforts to ensure that the protected areas proposed for the region

also preserve thorn scrub-very dry forest habitat and the extant populations of *H. h. charlesbogerti*.

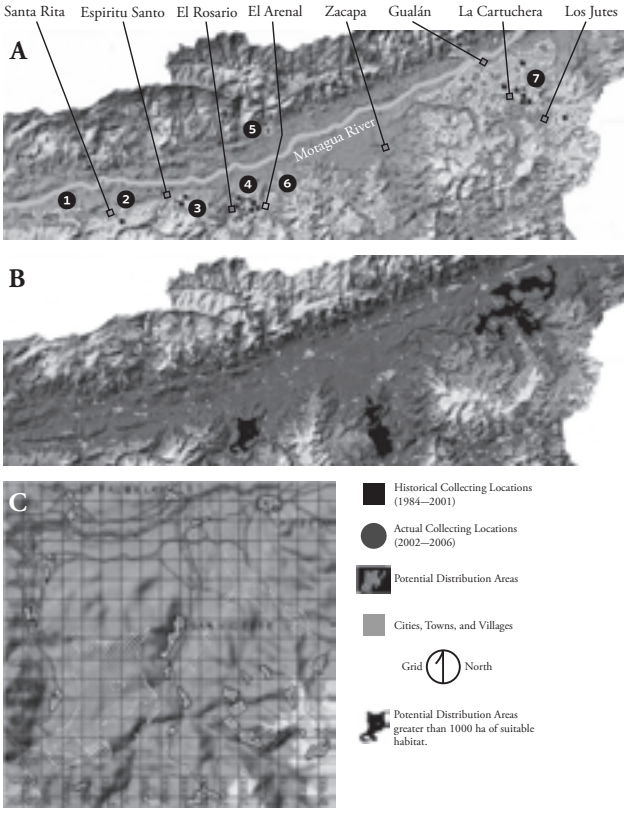
Excluding the areas < 100 ha from the analysis, the potential habitat for the species extends across only 17,534 ha. These data illustrate the critically endangered status of this taxon in its natural habitat, which is threatened by a considerable and ongoing loss of forest cover. For these reasons, the implementation of conservation policies and prompt short-term action are critical to ensure the conservation of the Guatemalan Beaded Lizard.

The historical distribution of *H. h. charlesbogerti* extended across the dry forests of the semiarid region of the Motagua Valley in northeastern Guatemala (Campbell and Vannini 1988), an area of about 200,000 ha (Nájera 2006). Presently, only about 0.01% (25,108 ha) of the natural habitat remains. Our data suggest that *H. h. charlesbogerti* is one of the most endangered species in Guatemala.

All but one of the polygons of potential distribution were along the southern bank of the Motagua River. This lends support for the hypothesis proposed originally by Stuart (1954) that a Pacific subhumid corridor was the route by which *H. horridum* gained access into the middle Motagua Valley. This hypothesis has been considered the most plausible explanation for the present distribution of *H. horridum* and many other xeric-adapted species of reptiles in the Motagua Valley (Campbell and Vannini 1988). If true, we would expect that the major distribution of *H. h. charlesbogerti* in the Motagua Valley would be along the southern bank of the Motagua River, because the river has proven to be an effective biogeographic barrier for other taxa (Schuster et al. 2003).

The only way to ensure the conservation of this taxon in its natural habitat is by protecting the last forest remnants harboring populations, and by implementing an educational program for the human populations that inhabit the towns surrounding these areas. The conservation efforts made along the southern versant of the Motagua Valley have to be strengthened, because almost every conservation effort so far has been made along the northern versant of the Motagua Valley. Fortunately, these actions are now in progress, principally through the efforts of the Guatemalan NGO Zootropic and its partners, the International Reptile Conservation Foundation and Zoo Atlanta (Ariano 2006). The governmental authority for biodiversity conservation, the National Council of Protected Areas (CONAP) also has a strong interest in promoting the conservation of the last dry forest remnants in the Motagua Valley, and in developing national policies for the conservation of *H. h. charlesbogerti*. An educational program was initiated recently by Zootropic, with the financial support of the National Fund for Nature Conservation (FONACON). These actions provide reasonable hope for the conservation of the Guatemalan Beaded Lizard. Another positive is the first successful captive breeding of this species after years of failed attempts (Owens 2006).

Taking into account that most of the suitable habitat for the species is made up of patches of forest < 100 ha in a highly fragmented matrix of crops and cattle lands, the area should be managed at a landscape level to ensure the conservation of the species within its habitat (Bennet 2004, Ferrier et al. 2004). Only with a combination of education, land protection, and landscape management will the conservation of *H. h. charlesbogerti* be ensured for the long term.



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Historical and recent collecting localities and potential distribution of the Guatemalan Beaded Lizard (*Heloderma horridum charlesbogerti*) in the semiarid region of the Motagua Valley.

Acknowledgments

We thank the community in the Cabañas region, Zacapa, Guatemala for their willingness to preserve this species for future generations. Thanks to Luis Alvarado and Rodrigo Botrán of Zootropic for supporting this project since its inception in 2002. Thanks to Juan Aguilar, Priscilla Zamora (in memoriam), Alejandro Muñoz, Blanca Arauz, Sabrina Amador, Ana Guzmán, and Juan Palavicinni of the Universidad de Costa Rica for their help in the early attempts to digitize the base maps. CONAP provided permits to conduct this project. Thanks to Zootropic, IRCF, Zoo Atlanta, and Universidad de Costa Rica for support. Financial assistance for this part of the project was provided by the German Academic Exchange Service (DAAD), Zootropic, Idea Wild, and The Nature Conservancy. Special thanks to Brad Lock (Zoo Atlanta) and John Binns (IRCF) for their support of "Project Heloderma." The present paper is part of D. Ariano's Master of Science thesis in the Department of Biology of Universidad de Costa Rica.

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Guatemalan Beaded Lizard habitat in the Motagua River Valley during winter and spring (left) and during the summer (right).

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Guatemalan Beaded Lizard Elevated to CITES Appendix I

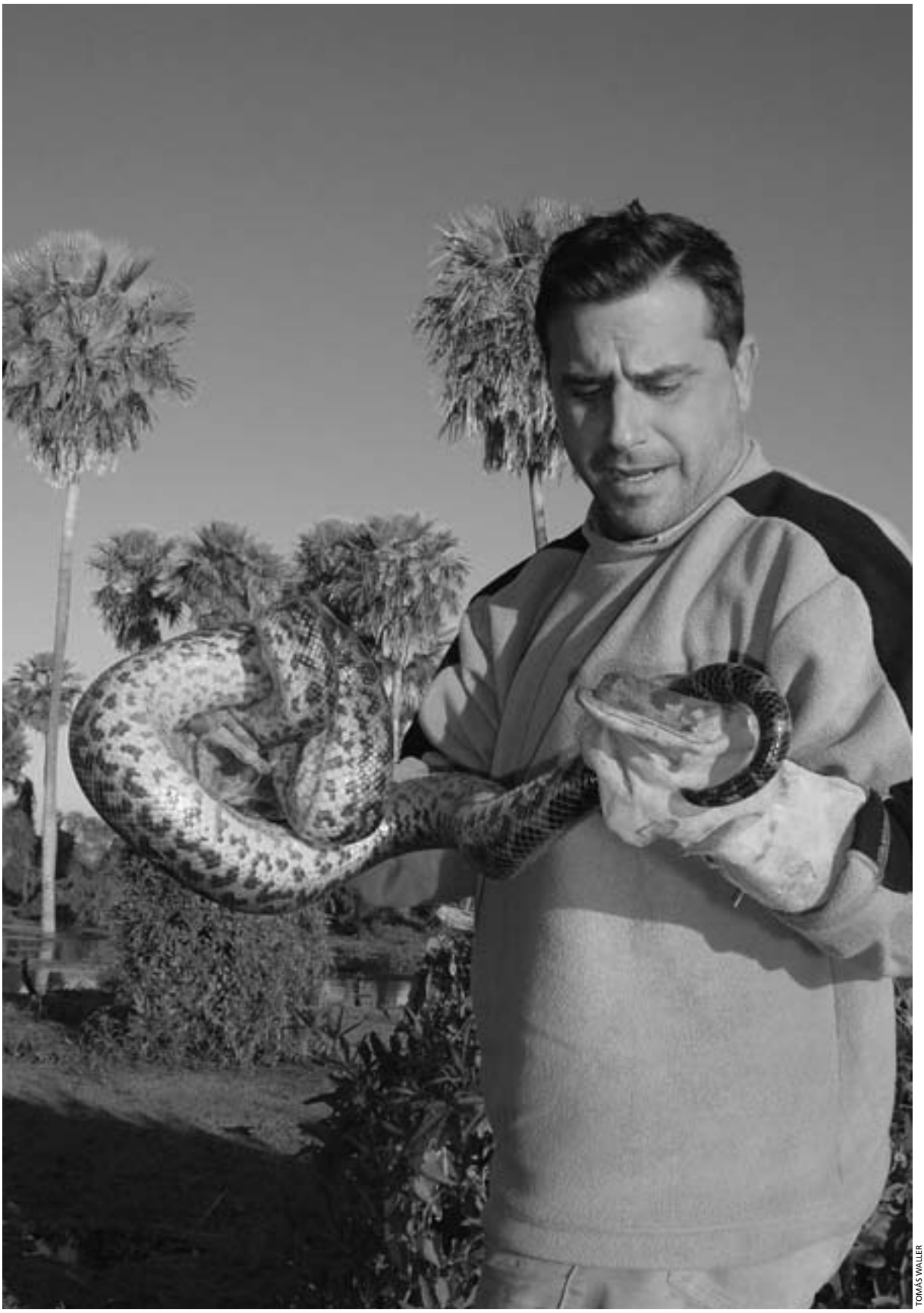
At the 12-day meeting of the 171 signatory nations of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in The Hague (The Netherlands), the Guatemalan Beaded Lizard (*Heloderma horridum charlesbogerti*) was elevated from Appendix II to I, affording it a higher level of legal protection. The committee considering species proposals requires a two-thirds vote of those present and voting to list a species initially, transfer, or delist a species.

Appendix I lists species that are the most endangered and threatened with extinction. CITES prohibits international trade in these species except when the purpose of the import is not commercial, for instance for scientific research. In these exceptional cases, trade may be permitted — provided that it is authorized by the granting of both an import permit and an export permit (or re-export certificate).

The Proposal Leading to the Change in Status

Summary: *Heloderma horridum charlesbogerti* is a subspecies of the Beaded Lizard, a large, venomous lizard that occurs in Mexico and Guatemala. This subspecies is endemic to the Motagua Valley in eastern Guatemala, where it is restricted to small, dispersed patches of forest in semi-arid areas. The species *H. horridum* was categorized as "Vulnerable" in the IUCN Red List in 1996. The range of the subspecies has been reduced to 24,000 ha, its wild population is currently estimated at 170–250 individuals, and it is regarded as threatened with extinction due to loss of its habitat, collection for local and foreign collectors, the effects of hurricanes, and persecution by local people, who fear it because of its poisonous nature. A National Conservation Strategy has been developed and will attempt to counteract the threats. The subspecies has apparently been traded, both nationally and internationally, and, although the numbers are small, they are significant in relation to the total population. Collection and trade in this subspecies is illegal in Guatemala. Four subspecies of *H. horridum* are recognized, and *H. h. charlesbogerti* differs from the others in various details of morphology and coloration, making it relatively easy to distinguish live animals when adult, although juveniles are said to be difficult to tell apart. *Heloderma suspectum*, the only other species in the genus, is very distinctive. Captive-breeding has so far been unsuccessful, despite many attempts. *Heloderma* species have been included in Appendix II since 1975. The proposal seeks to transfer the population of the subspecies of *Heloderma horridum charlesbogerti* from Appendix II to Appendix I.

Analysis: *Heloderma horridum charlesbogerti* appears to meet the biological criteria for listing in Appendix I. Its habitat has been severely reduced, it is restricted to dispersed patches of forest, the population is very small and localized, and a population decline can be inferred from the difficulty in finding the species currently, compared with the 1980s.



TOMÁS WALLER

The senior author with a Yellow Anaconda (*Eunectes notaeus*) just captured in La Estrella marshes.

The Management of Yellow Anacondas (*Eunectes notaeus*) in Argentina: From Historical Misuse to Resource Appreciation

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Abstract.—Herein we describe a program for the sustainable utilization of Yellow Anacondas (*Eunectes notaeus*) that was implemented in 2002 in the Province of Formosa, Argentina. The management plan was conceived to manage an activity that had been misusing a valuable wildlife resource with no regard for existing regulations. Delimited hunting areas were assigned to a restricted number of local skin buyers (LSB). A LSB is authorized to acquire hides from enrolled hunters living or working in his assigned territory; overlapping areas among buyers is discouraged and regulated. A minimum size limit of 230 cm was established for skins, while annual changes in skinning patterns ensure that hunters or LBs do not stockpile hides from one year to another. Sustainability is regulated by examining hunting effort in relation to catch-per-unit effort (CPUE) and monitoring traditional parameters like sex, origin, and size structure of the skins harvested. About 15% of the program's gross revenues return to cover program costs, whereas 13% goes to community members. Quantitative harvest data from the first five years are presented and discussed.

Introduction

Many developing nations are attempting to convert unmanaged and often illegal wildlife exploitation to sustainable utilization programs. Such projects seek to instill economic value in components of natural ecosystems threatened primarily by traditional land-use patterns. In many instance, a lack of scientific data has been used to defend the status quo and to boycott a sustainable use approach. However, recent history (Webb, 2002) suggests that management decisions rarely emerge from pure research; instead, long-term research can be a beneficiary of sustainable use plans.

Effective wildlife management results from a strong commitment by governmental agencies, users, pro-active NGOs, and other stakeholders. A well-planned management program should provide for an optimum allocation of resources, meaning that revenues have to be reasonably distributed among stakeholders, balancing the different economic levels, investments, risks taken, and responsibilities. Moreover, the main beneficiaries should return part of the income to the community. If funds are applied directly to the management plan, it will generate income and promote conservation.

Harvesting wildlife has received increasing attention and criticism in recent years. Biocentric views (Singer 1976, Callicot 1980) have been exacerbated in a media-dominated culture that promotes antipathy regarding the killing of charismatic animals. Although arguments against species exploitation are valid when based on solid scientific or even philosophical criteria, much of the criticism (e.g., Rivas, 2007) reflects emotional, political, or ideological perspectives.

The Yellow Anaconda (*Eunectes notaeus* Cope 1862) is the largest snake in Argentina. It is distributed in the River Paraguay drainage in Brazil, Bolivia, and Paraguay to northeastern Argentina, where its range covers 120,000 km^2 across six provinces (Henderson et al. 1995, Dirksen 2002, Micucci et al. 2006a). It is largely aquatic, a dietary generalist, and its range is restricted mainly to wetlands and floodplains.

TOMÁS WALLER

A Yellow Anaconda (*Eunectes notaeus*) from Formosa Province, Argentina.

TOMÁS WALLER

The dorsolateral position of nostrils and eyes reflects the aquatic habits of Yellow Anacondas (*Eunectes notaeus*).

Anaconda skins, like those of other boas and pythons, are considered a valuable resource and are highly prized for the manufacture of exotic leather goods (Jenkins and Broad 1994). In Argentina, trade in snake hides probably began earlier, but peaked during the 1940s. An estimated 60,000 Boa Constrictor (*Boa constrictor*) and Yellow Anaconda hides were exported from Argentina during each year of that decade (Gruss and Waller 1988, Micucci et al. 2006a). From 1980 through 1999, about 320,000 Yellow Anaconda skins were exported mainly from Argentina and Paraguay, primarily to the USA and Europe (Micucci et al. 2006a).

As with practically all squamates (Dodd 1993, Scott and Seigel 1992), the exploitation of Yellow Anacondas was carried out informally, without management guidelines or any regard to the species' biology (Waller et al. 2007). Our recent study shows that Yellow Anaconda populations from Argentina exhibit favorable ecological attributes, with high scores in six broad scale categories that "enhance" (Shine et al. 1998) the species' ability to withstand decades of intense harvesting (Waller et al. 2007).

Hunting of Yellow Anacondas diminished abruptly when trade was effectively banned in 1999; however, in several locations in Formosa, anacondas were opportunistically captured and their hides smuggled to Paraguay for export. In 2001, we carried out a study in the Province of Formosa, Argentina, for the purpose of analyzing the feasibility of harvesting Yellow Anaconda skins in a sustainable manner (Micucci et al. 2002). Research focused on social and ecological aspects, and involved experimentation with innovative management policies. In 2002, as a direct result of that research, the CITES National Authority (National Coordination for Biodiversity, Environment, and Sustainable Development Secretariat) asked us to design a management program for the species.

The Yellow Anaconda Management Program

We conceived the Yellow Anaconda Management Program (YAMP), seeking to reconcile the traditional utilization of a resource with its long-term conservation, and with the additional goals of promoting biological research on anacondas, avoiding resource misuse and waste, and maximizing local income favoring resource and habitat appreciation (Micucci et al. 2006a).

From a conceptual perspective, we followed the Adaptive Management Approach (AMA; Holling 1978), which was adopted due to the fact that we faced a system with high levels of uncertainty, and because it provides the ideal conceptual framework for exploited species for which research and population monitoring by standard methods becomes unfeasible in practical terms. The AMA works on a step-by-step basis, monitoring the effects of actions taken through specific control variables and promoting changes, when appropriate, in a feedback fashion to progressively reduce uncertainty.

Anaconda populations are actually managed on the basis of "sustained yield" harvest theory (Caughley and Sinclair 1994, Webb 2002). Specifically, we tested surplus-yield production models (i.e., Schaefer 1954, Fox 1970), which have been used mainly in fisheries, but also for terrestrial fauna.

From a methodological perspective, a harvest can be controlled either by placing a quota or by controlling hunting effort (setting a hunting season or limiting the number of people or the amount of time they are harvesting a population; Caughley

and Sinclair 1994). The YAMP follows the latter approach, making no effort to control *directly* the number of animals harvested. Controlling effort usually is a safer mean of regulating a harvest than imposing a quota. Harvesting a constant number of animals each year is risky, particularly when the population is affected by environmentally induced swings in abundance (Caughley and Sinclair 1994) or when conducting a census of populations is a major constraint, both situations we knew or expected to occur in Yellow Anacondas inhabiting highly seasonal savannas.

Operative scheme of the Yellow Anaconda Management Program.

Fundación Biodiversidad (FB) was appointed by agreement with the federal government to lead and execute the program. Annual tasks and budgets are outlined in operative plans submitted annually for approval by the federal and provincial wildlife authorities. Seven major reptile skin exporters finance the program under a mechanism controlled by the central government. Federal regulations state that project benefactors will distribute benefits (i.e., snake hides) among themselves in proportion to the funds that each has contributed. Funds are received from donors by an administrative NGO (Fundación ArgenINTA), bonded by the federal authority, and then transferred to FB as needed. The Province of Formosa, in northeastern Argentina, was selected for implementing the experimental harvest program due to the abundance of anaconda habitat, a long-standing hunting tradition, and a favorable governmental predisposition. Formosa (Wildlife Agency, Ministry of Production) has the responsibility for establishing and controlling procedures and guidelines for executing the program at the local level.

TOMÁS WALLER

The floodplain of the Pilcomayo River in northeastern Argentina, locally known as "Bañado La Estrella," covers approximately 3,000 km^2 and harbors a large population of Yellow Anacondas (*Eunectes notaeus*). This savanna exhibits drastic seasonal changes, from complete flooding in autumn (shown) to almost complete drought in early summer. Yellow Anacondas take advantage of rodents and concentrations of birds during both periods.

Map of Formosa Province, Argentina, showing the areas with suitable Yellow Anaconda (*Eunectes notaeus*) habitat.

The Setting

The 72,066-km^2 Province of Formosa lies entirely within the Chaco region. For the purpose of our work, we divided the area into two regions: (a) Eastern Formosa, a 35,000-km^2 plain with meandering rivers and creeks, palm savannas, mesic forest patches, and swamps; and (b) La Estrella marsh, a 250-km long seasonal floodplain covering nearly 3,000 km^2 in the otherwise dry west of the province. This very unstable wetland originates from the Pilcomayo Riverbed; the original river inundated vast dry woodlands during its progressive regression to the west. Large grasslands, palm savannas, and standing dead Chaco forest patches, with tree stumps covered with climbing plants (locally called "champales") during the flood season, combine to form a singular landscape matrix.

Formosan anaconda populations are comprised mainly of adults. Females are larger than males, occasionally reaching a maximum size of 335 cm SVL, whereas males rarely exceed 250 cm. Average animals are about 180 cm, and very large specimens are uncommon (< 5%). Males exhibit larger cloacal spurs than females, allowing the determination of sex even on skins. Growth and maturity are quite rapid, with males capable of breeding at 128 cm SVL and females at 147 cm, during the third year of life, depending on food availability, genetics, and individual life history traits. Courtship lasts from the beginning of September to early November (local spring), and pregnant females are found during the summer months. Parturition in Formosa occurs from late March to the end of April (local autumn). Anacondas reproduce on average every two years, depending on the female's fat reserves. Fecundity is positively correlated with female size, with an overall mean value of 24 offspring per clutch. Newborns are large (49 cm SVL), very aggressive, and fast growers (Waller et al. 2007).

Anacondas are abundant everywhere in Formosa, with the eastern provincial plains providing the most extensive habitat (>6,000 km^2 of scattered tropical wetlands) and harboring potentially the largest populations. However, YAMP has received particularly strong support from the local communities

DANIEL GOMEZ

Yellow Anacondas (*Eunectes notaeus*) do not breed every year; however, clutch mass can equal half the weight of a female. Here, an individual from San Juan Poriahu Ranch, Loreto, Corrientes, Argentina, is giving birth.


TOMÁS WALLER

Burn scars on the head of a Yellow Anaconda from La Estrella marshes. The grasslands and dry wetlands are burned during the dry season to facilitate removal of domestic pigs. Snakes are sometimes injured or killed.

living around La Estrella marsh, where a subsistence economy of rural and indigenous people prevails. Eastern Formosa is more socially complex, with a different land tenure scheme, more jobs, and demanding a different approach. Because 90% of the harvest takes place at La Estrella marsh (Micucci et al. 2006a), most of the analysis and conclusions presented here pertain to that region unless indicated otherwise.

Harvest Control Procedures

The harvest of Yellow Anacondas is strictly confined to three elements: hunters, local skin buyers, and exporters. Middlemen (sub-local buyers and transporters) are not allowed. In the past, middlemen increased the value of the skins to the detriment of hunters. Anaconda collectors are rural and mostly indigenous (pilagá, toba). They rely on livestock breeding, hunting, and fishing. Some 250–450 families are involved in anaconda hunting, mostly (80%) from the area surrounding La Estrella marsh.

The local skin buyer (LSB) also serves as a food supplier or market-man, and can manage the logistics of transporting and stockpiling snake hides. Ten to 13 LSBs participate in a harvest, with a mean number of 35 hunters per buyer. According to YAMP guidelines, the exchange of goods for skins is forbidden, unless it is at the specific request of an indigenous community. To ensure compliance, at the end of each harvest season, we randomly survey hunters, collecting data on prices and payout modalities. Each LSB serves a designated area, defined in the local buyer's license. If the buyer reaches beyond his area, this could conflict with other LSBs, who will consequently report it to relevant authorities. The infringer could suffer confiscation of his goods, among other penalties. The rationale is to generate a local socio-economic impact, equitably including as many families as possible.

During April and May, a series of trips are organized to register and inform LSBs of any modifications to program guidelines. These activities are intended to regulate the hunting effort, although the program places no limit on the number of hunters (in practice they represent a finite number), actual numbers are closely tied to the number of skin buyers for economic and cultural reasons. During the last week of May, and immediately before the beginning of the harvest (June), we notify the LSBs of the skinning pattern to be used in the forthcoming season. In some cases, hides must bear both spurs on one side, in other cases, one on each side. This, in combination with leaving the entire head attached to the skin or not, for instance, allows us to select from a large array of different skinning specifications from one year to the next in order to minimize the incidence of illegal hunting and stockpiling.


EMILIO WHITE

Emergent logs and logs covered by climbing plants, locally known as "champas," are preferred basking sites of *Eunectes notaeus* in La Estrella marshes in northeastern Argentina. Snakes seek these microhabitats during the winter, when water temperatures drop to 15 °C or lower. Both males and females need warmer temperatures to complete gonadal cycles before the onset of the mating season in spring.


TOMÁS WALLER

Patricio Micucci (left) and collaborators from the Paraguayan CITES office measuring Yellow Anaconda skins seized in Asunción, Paraguay in 1996.


EMILIO WHITE

Yellow Anacondas (*Eunectes notaeus*) are most vulnerable to collection during the winter when they are cold and leave the water to bask.

The minimum size of hides is 230 cm from the neck to the anal scale, corresponding to a live specimen measuring approximately 200 cm SVL (live SVL = 11.71 + 0.66 × skin length + 1.59 × skin width, $r^2 = 0.93$, $P < 0.01$; Micucci et al. 2003). Because females mature at an average of 165 cm SVL (Waller et al. 2007), this precautionary provision is intended to allow anacondas a reproductive opportunity before hunted.

The harvest takes place from June to August (local winter), a period when Yellow Anacondas do not exhibit any reproductive behavior. The cool weather and the wide range of winter temperatures promote thermoregulatory behavior, allowing hunters to find and capture snakes by hand. Snakes, depending on program research requirements, are killed in place or transported live to the hunter's home for data collection.

Most of the conditions imposed on the hunters are enforced when they bring their skins to the LSBs for sale. Skins that do not comply with program standards are worthless. Furthermore, LSBs are visited periodically by a representative of the exporters (purchasing agent), a provincial wildlife officer, and a program team member for the purpose of buying skins. Anaconda hides are checked for compliance to the year-specific skinning pattern and minimum size guidelines. At this time, skins that conform to program standards are individually tagged for control and future tracking; non-compliant hides are seized and, according to program provisions, destroyed. These visits occur at intervals of about three weeks. These procedures and a gradual decrease in flexibility criteria have reduced the number of undersized skins from 1,109 hides in 2002 to 142 hides in 2006.

During the sale, the LSB fills out an "effort form," a legal document that records the number of skins, the name of the hunter, and the date and place of harvest. This document is needed for the hides to be legally transported within Formosa. The contents of the document are crosschecked against the results from periodic hunter surveys. In case of irregularities, a buyer could be penalized by the cancellation of his license.

Tagged hides obtained through the prescribed process are transported periodically to a warehouse in the city of Formosa. The representative of the exporters is the only person authorized to transport anaconda hides. Once they arrive, skins are inventoried. At the end of the season, but before leaving the province, hides are sexed (by spurs and bone remnants), measured, and field tags are replaced by export tags that comply with federal regulations. The export tag is required before a CITES export permit is issued and the skins can be transported out of the province. Wildlife inspectors from Formosa, and eventually from the central government, as well as a representative of YAMP supervise this procedure.

Once skins are tagged and all valuable data gathered, the skins are released for distribution among the seven exporters. In order to transport the hides to tanneries or export ports, Formosan authorities must issue a Transport Guide to each exporter. This document is enclosed with the shipment and is required by CITES Management Authorities in order to issue the pertinent CITES Export Permit.

Harvest Sustainability Monitoring

We monitor the impact of the harvest on anaconda populations through traditional indicators (i.e., capture per unit effort vs. effort, size and sex structure of the harvest). Hunting effort is closely checked by means of the aforementioned effort forms, on which basic data are recorded. The model assumes that each batch of skins sold by a hunter to his local buyer (LSB) represents a short and measurable hunting period or event. In case of suspicious data, we compare hunting effort information from hunters among different years to detect possible changes in pattern due to involuntary or intentional errors. For instance, since the LSBs are the only middlemen approved to stockpile skins, an excessive number of skins (above average values) sold by a hunter is considered suspect and is investigated.

TOMÁS WALLER

An excavation used by hunters in La Estrella marshes to keep the snakes alive for biological studies.

Most of our energy is invested in reducing data errors and uncertainty. For example, since the beginning of the Program in 2002, we have been able to reduce uncertainty progressively from about 15% to 5% with regard to the number of hunters that are effectively collecting snakes in a given year. Since current uncertainty values are stabilized and are acceptable, we can check and recalculate weak hunting effort estimates from the first year.

Hunting effort values depend not only on the number of hunters, but also on the time invested in that activity. Because we cannot closely monitor the time each of the 350 hunters invests in collecting snakes, we record the gross time (or total days) a LSB and its hunters are operative as a valid approximation of actual time invested. This is easily accomplished since each hunting season is precisely framed by start and end dates:

Table 1. Yellow Anaconda (*Eunectes notaeus*) harvest monitoring indices for La Estrella marsh, Formosa.

Year	Hunters	Effort (dH^{-1})	Capture (u.)[1]	CPUE[2]	Mean Autumn T
2002	305	24,779	3,973	0.14	18.0 °C
2003	303	37,000	3,327	0.08	20.7 °C
2004	313	22,407	4,275	0.15	16.6 °C
2005	301	22,187	3,834	0.12	20.0 °C
2006	213	16,051	2,346	0.11	18.7 °C

[1] Skins >230 cm
[2] See text for CPUE estimation

(1) The day the skinning pattern is distributed to hunters (harvest opening day), and (2) The day the last skins are retired from a local buyer's facility (harvest closing day).

Capture per unit effort (CPUE = capture/hunters * total days), the first of our indicators, is calculated at the end of the harvest season. CPUE is an affordable and inexpensive estimator of population trends and can be assessed at different spatial scales from local to provincial. From a theoretical perspective, rather than presenting estimates for a specific location or for the entire province, calculating CPUE values for an ecologically uniform and delimited area is desirable. From a management perspective, our resolution level should be the management unit (Mendez et al. 2007). La Estrella marsh, aside from being our main management unit for anacondas in Formosa, has a clear landscape homogeneity delimited by definite natural boundaries and exhibits no particular internal barriers to the dispersal of the snakes.

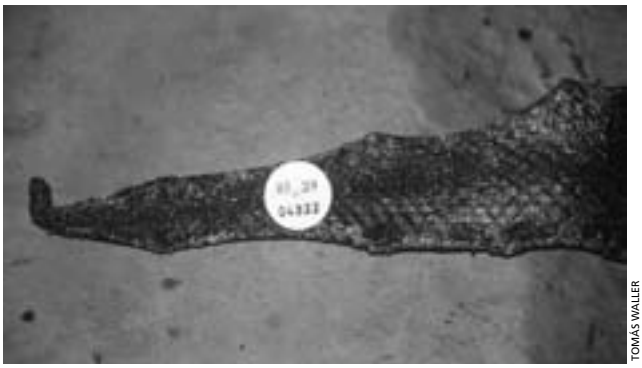
Annual CPUE values for La Estrella marsh were calculated from the slope of the "catch versus effort" regression line for each year, using the catch and effort data from the different buying centers (Micucci et al. 2007).

The effective hunting area (the cumulative territory of all the hunters) encompasses 20,000–30,000 ha of wetlands, depending on number of hunters. If we know the area for which the CPUE value has been calculated, we can estimate other demographic parameters, such as anaconda population density (Micucci et al. 2006b). To carry out this analysis, we made several assumptions that render the estimate very preliminary and without statistical significance, but nevertheless of great utility in providing an idea of abundance. For instance, we considered that a hunter always follows the same trail, which we know is not entirely true. However, we also assumed that collecting areas do not overlap among hunters, and again this is not realistic, although it compensates for errors caused by the previous assumption. We assumed that all anacondas are removed in a given year or season within a hunter's territory, which could not possibly be true, given the striking landscape complexity and current rudimentary methods of hunting. Consequently, density values are presumed to be greatly underestimated. A calculated density value for Yellow Anacondas of approximately 30–60/km^2 of wetland is consistent with our subjective perceptions of abundance based on years of field observations.

CPUE values for the first five years of harvest show an oscillating system tightly related to late autumn average temperatures


TOMÁS WALLER

A Yellow Anaconda skin nailed to the soil with Palm spines, which are used for this purpose in eastern Formosa. In La Estrella marshes, spines from a local bush (*Prosopis ruscifolia*) are used for the same purpose.


TOMÁS WALLER

The button marks used to identify skins prior to export (AR: Argentina, YA: Yellow Anaconda, and the number).


TOMÁS WALLER

A hunter extracting *Prosopis ruscifolia* spines for use as "nails" to stretch skins.

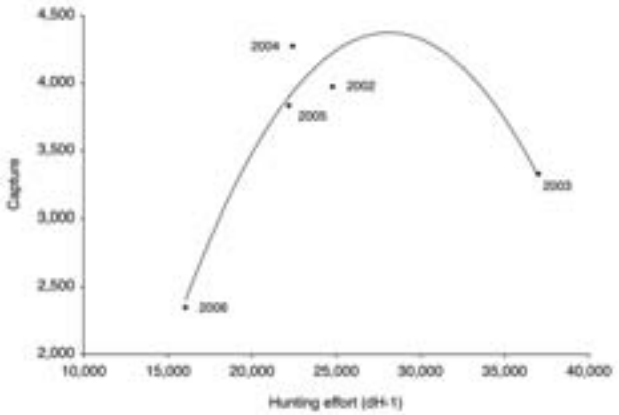
Table 2. Yellow Anaconda (*Eunectes notaeus*) density at La Estrella marsh compared to other large snakes for which data are available.

Snake Species	S/km^2	Locality and Source
Python regius	234	Southern Ghana, Africa (Gorzula et al. 1997)
Naja melanoleuca	212	Reserva Natural Abuko, Gambia, Africa (Starin and Burghardt 1992)
Dendroaspis viridis	120	Reserva Natural Abuko, Gambia, Africa (Starin and Burghardt 1992)
Python sebae	67	Reserva Natural Abuko, Gambia, Africa (Starin and Burghardt 1992)
Eunectes notaeus	30–60	This article
Bitis arietans	42	Reserva Natural Abuko, Gambia, Africa (Starin and Burghardt 1992)
Eunectes murinus	36	Hato El Catedral, Venezuela (Rivas 1999)

TOMÁS WALLER

TOMÁS WALLER

Drying Yellow Anaconda skins "nailed" to the dry Chaco soil using spines of a local bush (*Prosopis ruscifolia*).



The Yellow Anaconda Management Program observed yield curve.

(May–June). The harvest takes place mostly during the cool winter (June–August), when anacondas need to bask to raise their body temperatures. In this sense, the relationship between CPUE and temperature is an expression of vulnerability: When autumn temperatures are high, fewer anacondas will bask and CPUE values in the subsequent season are expected to diminish. A predictive model between CPUE and average autumn temperatures was inferred by calculating the following linear regression: CPUE = $-0.015 \times T\ ^{o}C_{meanM,J} + 0.40$ (R^2: 0.78; Micucci et al. 2007).

Appraisals of harvest intensity are derived from yield curves, analyzing capture volumes in relation to applied effort. These curves can be obtained from effort and CPUE data but, for this to be accurate and have some predictive value, large temporal series are needed in order to deduce the maximum sustainable yield. Our data do not represent a large temporal series (only five years); thus they do not yet exhibit the broad diversity of effort values needed to present conclusive results for a particular surplus-yield model.

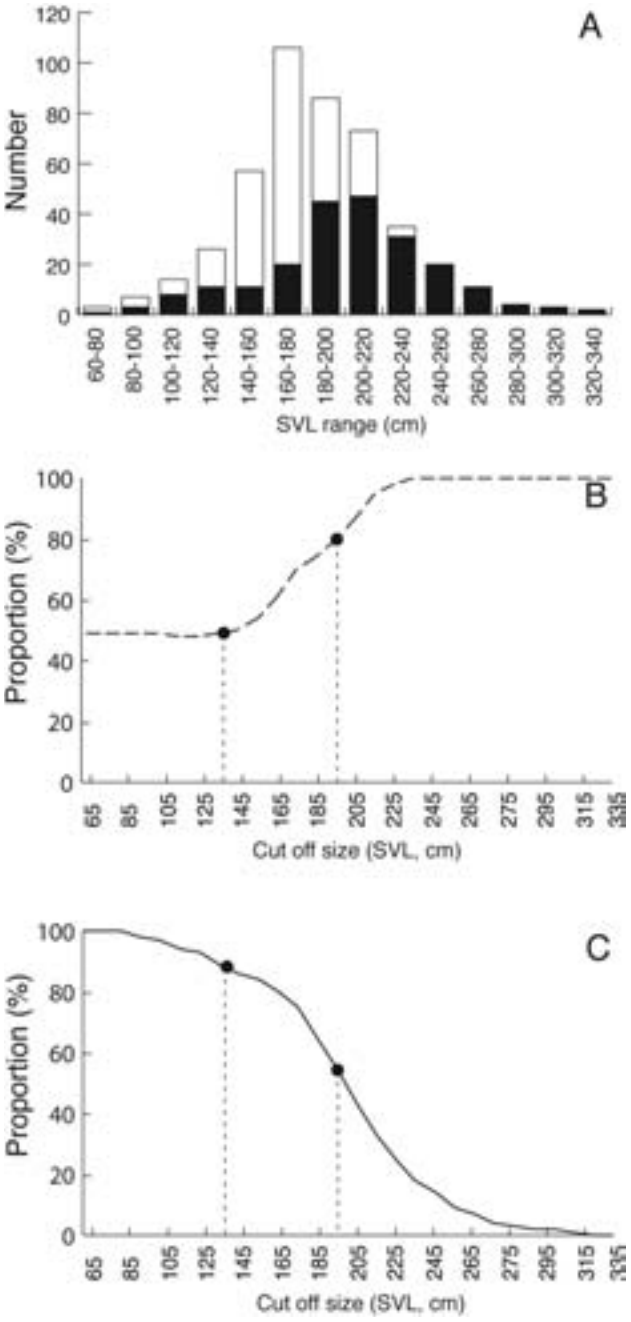
Total capture values are certainly useless to predict population trends if they are not considered in relation to hunting effort. While reductions in capture volumes should catch our attention, data misinterpretation could lead to incorrect conclusions. Because the rationale of sustained yield models implies that a harvest represents a specific proportion of the total population, a reduction of the crop would be expected, for instance, in the case of a population decline caused by natural conditions (i.e., drought, fires), but this does not mean over-harvesting in that year (Caughley and Sinclair 1994). As temperatures play a significant role in anaconda vulnerability, captures will vary from year to year.

Actual harvest monitoring also takes into consideration the significant correlation between number of hunters and gross capture. More hunters usually implies more effort, more capture, and vice versa: Gross capture = $17 \times$ hunters – 1.280 (R^2: 0.97) (Micucci et al. 2007). 2006, for example, was a "bad" year for captures because of the low number of hunters, which meant that the effort for that year diminished in relation to previous harvest seasons. In this sense, a gradual but permanent drop in the number of hunters has not influenced CPUE values in a significant manner (Table 1). This drop was in response to an increased demand for labor and an indiscriminate distribution of unemployment benefits to hunters and their families since 2003. In other words, if YAMP does not increase skin prices in order to compensate for currency depreciation (as we are constantly striving to do), the system tends to stabilize in such a way that exporters' actual profits are in consonance with actual structure. If exporters are reluctant to increase skin price as a means of avoiding hunter desertion, evidence strongly suggests that, in this effort-mediated system, a commercial collapse will precede the biological collapse of the resource.

Although a substantial reduction in active hunters inevitably leads to a drop in gross capture, the time variable is also a significant component for estimating hunting effort. The difference between hunters and effort is the sum of gross time invested by each local buyer. This is evident from the capture and CPUE values for 2003. The harvest season was extended for two weeks due to exceptionally warm conditions, and, with the same number of hunters compared to other seasons (2002 and 2005), both capture and CPUE diminished. In this way, we deduced a preliminary maximum sustained yield (MSY) value for La Estrella marsh of about 4,350 hides, with an ideal effort of approximately 28,000 dH^{-1}.

Monitoring sustainability must assess the evolution of the sex ratio of the harvested population. Both sexes, due to low temperatures, are equally vulnerable to capture (Waller et al. 2007). However, because females attain larger size than males, the established size limit (> 200 cm SVL) was expected to result in the harvest of more females than males, presumably in a fairly constant and predictable proportion. Consequently, the actual harvest sex ratio (ca. 75% females) reflects only the established minimum size limit. The harvest sex ratio was relatively

similar season after season, with only a small increase in females in later years. We consider this increase a mathematical artifact. Eight percent of the skins in the first two years were classed as "unknown" sex. Subsequently, sex determination became much more accurate by also examining the attached limb bone remnants rather than just the spurs, and the undetermined proportion of skins diminished to 1.3%, although the proportion of females increased, whereas the proportion of males remained constant.



Effects of skin minimum size limits on female anaconda harvest: (a) Natural size distribution of anaconda populations in Formosa, females in black (Waller et al. 2007); (b) Expected proportion of females in the harvest at different size cut-off limits; (c) Proportion of potentially harvestable females in a natural population at different size cut-off limits.

Table 3. Main parameters for Yellow Anaconda (*Eunectes notaeus*) skins harvested at La Estrella Marsh, Formosa.

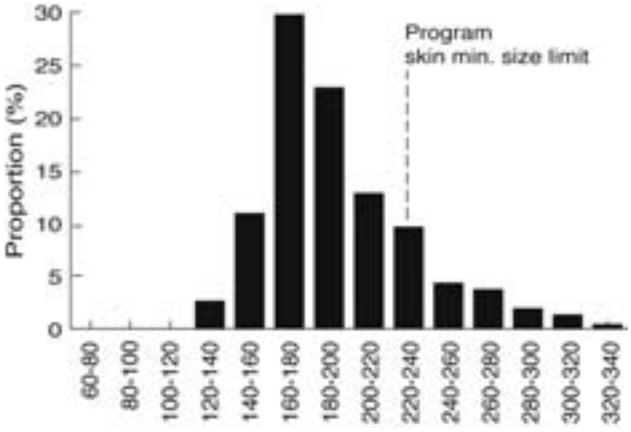
Year	2002	2003	2004	2005	2006
Average skin length (cm)[1]	271	268	264	263	263
Number of skins < 230 cm	1,109	1,075	420	343	142
ϵ coefficient[2]	-4.0%	-5.5%	-0.4%	+1.2%	+0.4%
Females (%)	70.5	69.9	75.8	75.4	76.3
Males (%)	21.3	22.1	20.7	23.1	22.4
Unknown sex (%)	8.2%	8 %	3.5%	1.5%	1.3%

[1] Average size of hides >230 cm after correcting for deformation (see text).
[2] Skin deformation coefficient (see text for explanation).

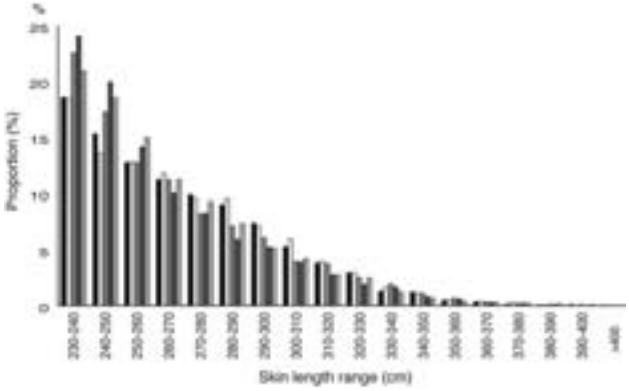
Prior to the introduction of the sustainable use program, anaconda exploitation was not permitted and illegal hunting took place with total disregard of size. According to traders and local dealers, Formosa's annual production was approximately 20,000 skins with widths > 15 cm (Micucci et al. 2002, 2006a). This hide width, according to our data, would correspond to a skin length of 150 cm and a live anaconda of about 135 cm SVL (Micucci et al. 2002). Many of the 500 or so seized Paraguayan skins that we measured confirmed that the minimum size of skins taken during illegal harvests were of that size. That translates to practically all (90%) anacondas of either sex older than 1.5 years of age (Waller et al. 2007) being vulnerable during that market-driven hunting period. That current harvest policy has been able to substantially reduce female hunting, both in terms of juveniles and adults, is indisputable. Current production, without mediation of quotas, represents a management-derived reduction of harvest to a quarter of Formosa's historical values (5,000 vs. 20,000 skins), and a 40% reduction of female vulnerability to hunting. So, the Program has been very conservative in establishing a minimum size limit despite the fact that, upon initial consideration, it appears to promote the hunting of females. What ultimately matters, however, is the overall number, not the proportion of females. If our harvest represents 5% of the total population, a crop that is 75% female equates to an overall female extraction of 3.75%, which is sustainable.

Hunters do not seek anacondas of specific sizes, but collect serendipitously the snakes available in a given area (Waller et al. 2007). During the first years of the Program (2002–2003), different prices were paid for skins of three different size classes (230–290 cm, 291–390 cm, > 391 cm), stemming from industry traditions aimed at promoting the harvest of larger snakes. We were aware that such guidelines were unlikely to produce the desired results for traders. In fact, in 2002 and 2003, instead of encouraging the harvest of large animals, this approach promoted the hunting of undersized snakes and severe skin deformation attributable to hunters stretching skins. Importers complained because stretched skins would inevitably shrink considerably when tanned.

In 2004, we established a single price and demanded that all anaconda hides conform to a standard represented by the



Size distribution of a shipment of Yellow Anaconda skins that were seized and measured in 1996 in Asunción, Paraguay (N = 539).



Size distributions of skins harvested from 2002–2006 (columns in order). Only skins above 230 cm are included. Hide sizes are corrected for intentional stretching (see text).

TOMÁS WALLER

The cloacal region of a Yellow Anaconda skin with spurs (insert) that allow sexing of the skin (in this case, a male).

equation: skin width at midbody = 0.10 × skin length. In order to correct hides for hunter-induced deformation and be able to perform demographically sound interpretations of population structure for any year, we developed the following formula to convert rough skin length values to corrected skin length values: Skin length$_c$ = (skin length + (skin width × 10))/2. This formula assumes (due to the cross pattern of skin fibers) that, for any increment in one dimension, a reduction in the other will compensate. To control for skin deformation, we also devised a stretching coefficient that permits us to determine the degree of bias (%) of a harvested skin (uncorrected length) from its "real" (corrected length) shape. When we compared sizes of harvested skins corrected for length, we found no significant difference in population size structures for prior years that may have been attributable to the stratified price scheme, confirming our views on the stochastic nature of hunting.

If a population is overexploited, we would expect to see a reduction in the average size of skins harvested. Instead, we see an oscillating pattern, partly attributable to changes in the skinning guidelines since 2004 and to a progressive reduction of small skins due to the imposition of intensive controls. Because no significant consistent reduction in the average size of snakes (i.e., skins) has been noted (Micucci et al. 2007), we suggest that current harvest guidelines are appropriate for continued sustainable management of the anaconda populations.

Harvest Economics

The economic structure of YAMP includes government (federal and provincial), exporters (7), hunters (about 350), local buyers (10–13), and the NGO in charge of the technical program. The government sector receives the smallest portion (4.2%) of partitioned benefits. In fact, the government delegates the administration of the program to an NGO in order to encourage prompt and direct allocation of funds for research and monitoring (14.8%). Hunters and local buyers collectively earn 13.3%, but three-fourths of this amount goes into hunters' pockets. Consequently, about one-third of the international value of a skin remains in the region. Although actual earnings at the local community level represent a three-fold increase over prices paid by illegal traders just a few years ago, we strongly encourage higher prices to enhance the local allocation of benefits.

Table 4. Yellow Anaconda Management Program benefit partitioning (based on a US $50 skin price).

Stakeholder	US $	%
Provincial and export taxes	2.1	4.2
Program running costs (NGO)	7.4	14.8
Hunters and local buyers	6.7	13.3
Stockpiling logistic expenses	3.1	6.2
Total expenses per skin	19.3	38.5
Exporters income	30.7	61.5

Conclusions

The Yellow Anaconda Management Program has been in operation for five years. Aside from the beneficial local economic impact, it has generated intense research on aspects of the species' biology (Waller et al. 2007) and population genetics (Mendez et al. 2007). The conservation biology of this species had been completely ignored until the establishment of YAMP, and ongoing results are being incorporated into the model to reduce uncertainty levels.

No discernible negative, harvest-related population trend has been detected. CPUE values, as well as the descriptive sta-

tistics for harvested skins, exhibit an oscillating but safe pattern of variation. CPUE values responded in direct relation to environmental factors that affect anaconda vulnerability (i.e., autumn temperatures). Observed differences in average skin size or sex ratio during this period relate to changes in the skinning guidelines and sexing procedures since 2004, and to an improvement in the control of undersized hides. Yield is determined by the number of active hunters, showing that controlling effort is a viable method of monitoring and limiting the harvest.

The program impacts about 20–30 thousand ha of wetlands, representing 2–3% of suitable habitat available in Formosa, which is relatively insignificant if we consider the species' total distribution. Assuming that current controls are maintained, the sustainable management of Formosa's anaconda populations is possible.

The tools applied to control and monitor for harvest sustainability have been effective, and could be replicated in other developing nations with marketable wildlife resources at a very low cost. Considering the economic constraints that developing countries face in implementing sound wildlife management practices, our experiences are encouraging.

Wildlife management must consider sociology, economics, and a generous dose of psychology in addition to biology (Webb 2002). In this broader context, whether the management procedures presented herein are optimal and the methods by which Yellow Anacondas can be successfully managed for the long-term benefit of local communities are appropriate questions that will require more than five seasons to be answered.

Acknowledgements

We express our deep thanks to Victoria Lichtschein (Biodiversity National Coordination Agency), Obdulio Menghi and Guillermo A. Puccio (Fundación Biodiversidad) for their constant support throughout the years; to Carlos A. Micucci for his help with data management; also to current and past Program team members: Ernesto Alvarenga, Emilio Buongermini, Emilio White, and Martín Mendez; and to Juan Carlos Orozco (Wildlife Agency Director) and Luis Basterra (Ministry of Production) in Formosa for trusting in us.

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The upper reaches of the Río Warunta during the dry season of 2006.

Herpetological Fieldwork in the Lowland Rainforests of Northeastern Honduras: Pleasure or How Quickly We Forget?

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Photographs by the author.

Lowland rainforests or "La Selva," have been an alluring mystery to me for many years. Although I had been collecting amphibians and reptiles in Honduras since 1976, not until 1992 did I actually enter pristine lowland rainforest. In September of that year, I spent three weeks working from a balsa raft along the Río Wampú in the southern portion of the Río Plátano Biosphere Reserve in the Mosquitia of northeastern Honduras. That trip still remains vividly in my mind as one of the most enjoyable trips I have ever made. However, that was only a small part of the pristine rainforests of the Honduran Mosquitia. In recent years, I have had further opportunities to explore these unique forests. This article details some of my experiences during a number of my more recent trips to La Selva.

The fieldwork done with Josiah H. Townsend and Larry David Wilson for our book on the herpetofauna of the Honduran Mosquitia was confined to areas with well-worn foot trails or along rivers that we traversed in "pipantes" (large canoe-like boats carved from large trees, usually a Mahogany or "Caoba" Tree, *Swietenia macrophylla*). Our fieldwork also had been concentrated in areas designated as protected by the Honduran government or areas that had been proposed for protection, but as yet had no official status.

Having recently retired from my real job and being single, I had plenty of time to do fieldwork. So, shortly after my last field trip into the Mosquitia with Joe and Larry in May–June 2003, I made up my mind to go to one particular area that the

The Montañas de Colón from the drop off point along the Rus Rus-Awasbila road. The Río Warunta lies at the base of the mountains.

three of us had not visited, the proposed Warunta National Park. In my home in Miami, I sat down with a set of topographical maps of the Honduran Mosquitia trying to figure out the easiest way into the "park." I soon realized that it would not be so easy. From those maps, I quickly determined that this proposed park lacked villages anywhere near its boundaries. Also, the only river that looked like it might be navigable by pipante, the Río Warunta, is some 75 airline km in length (probably at least three times that in actual length with all of its bends and turns) before it reaches the boundaries of the "park," and, as I later learned, the mouth of the Río Warunta is some three hours by motorized pipante from the nearest town, Puerto Lempira. So, river travel into the "park" was out of the question. However, the topographical maps showed one area where the headwaters of the Río Warunta were a mere 11 airline km from a point along the dirt road between the villages of Rus Rus and Awasbila. Surely, the Miskito guides with whom I had worked previously could easily cut a trail to the Río Warunta from the dirt road.

So, the night of 4 November 2003 found me in Rus Rus, where my main guide, Tomás Manzanares, lives. The following morning, armed with the topo maps, I sat down with Tomás and a couple of other Miskito men and showed them the route I wanted to take. After much pointing at the map, chattering by the Miskitos in their native language, and about 15 minutes, they seemed to reach a general consensus that they could cut the trail to the Río Warunta in two days. The maps showed several series of steep hills between the proposed starting point and the Río Warunta, but, according to my friends, those hills would not be a problem. Because of a prior commitment, Tomás could not start the trip until 15 November. So, we decided to depart for the Río Warunta on that date. In the meantime, I, along with two Miskito men, and Melissa, a Miskito woman who had previously worked with me as my cook, set out for a series of campsites in the rainforests north of Rus Rus.

I returned to Rus Rus on the evening of 13 November and began planning the Warunta trip in earnest. Because of the amount of work involved in cutting the trail, we decided that we should plan on a nine-day trip, which should allow ample time for me to collect and photograph voucher specimens. Also, we decided that we would need more men to help with the trail work than I was accustomed to taking. More men meant more food was needed, thus more men to carry the extra weight. We decided that, in addition to me, the group would consist of eight Miskito men (including Tomás) and Melissa to do our cooking. During the morning of the 14th, I bought the provisions we would need — but another problem arose. No vehicle was available in the village to take us to our drop-off point on the road about one and one-half hours from Rus Rus. Thus, we had no choice but to hang around the vicinity of Rus Rus until a vehicle arrived. I occupied my time by collecting in the nearby pine savanna and gallery forests. During that time, I kept thinking back to my first visit to Rus Rus in October 2001. Having spent four days around Rus Rus on that trip and not having seen a single vehicle in the village or even one pass by, I had the following conversation with Tomás (translated from Spanish): "Do cars pass by on this road?" Tomás: "Certainly!" Me: "Well, how frequently?" Tomás: "Oh, at least once a week." Time is not a problem in Rus Rus.

Finally, on the 17th, Herman, a half-brother of Tomás, showed up in his pickup truck. He agreed to drive us to the

An adult of the spectacular *Polychrus gutturosus*. The lizard was bright green when found, but the green changed to brown in the collecting bag.

drop-off spot the following morning, and all of the workers were instructed to arrive by 6 AM the following day.

Early on the 18th, the workers began arriving. By the time the stragglers arrived (some live in nearby villages), everyone had eaten breakfast and drank their coffee, the vehicle loaded, and last-minute searches for an extra .22 rifle were completed, it was 9 AM. We finally departed Rus Rus, and shortly before 11 AM, we reached a turnoff onto a seldom-used short "road" in the pine savanna that ended just before the transition zone into broadleaf rainforest. This was our drop-off spot. We made arrangements with Herman for him to return on the 26th to take us back to Rus Rus. Herman and his helper, Conce, started back to Rus Rus and my group began dividing the gear among themselves and loading it onto their backs. For about the first hour of the walk, we followed a seldom-used trail that required only a little opening. However, the old trail ended at a point where we needed to cross the upper Río Rus Rus. Because of recent heavy rains, the river was at least waist-deep, but a nearby tree had fallen across the river. After much talk and laughter about who would fall in the river, we began one-by-one crossing the "bridge," heavy backpacks and all. During this process I could not help but notice that the "bridge" was about two feet higher on this side of the river than it was on the other side. After everyone else has crossed the bridge (including Melissa with her back pack), my turn had arrived. After getting about one-third of the way across, the fact that I was going to hit the river any second became embarrassingly evident — so I dropped down and straddled the tree trunk and shimmied my way to the other side, much to the delight of the crew. I quickly named our bridge "El Puente del Mono" (The Monkey Bridge). Because we now had no trail to follow, the crew took turns opening a trail while one of them, armed with the topo map, a compass, and a GPS that usually did not work because of the closed canopy above, guided the cutters in the direction we wanted to go. When one set of workers tired from cutting and another set took over, the "tired" ones would walk back to the last place where we had piled some of our gear and brought it to our present position. By about an hour before dark, things started to look bleak. The nearby lightning and thunder and the quickly darkening skies indicated that a tropical downpour was imminent. To make matters worse, we had not seen a stream (from which Melissa needed water to do her cooking) for at least two hours. So, while part of the crew kept working on the trail, the others fanned out in search of a stream. Fortunately, one was found nearby and, in about 30 minutes, our trail led to that stream. After another 30 minutes, and just as dark was falling, the crew had cheerfully worked through the downpour to set up the camp and Melissa had a nice fire going under a tarp, using *ocote* shavings from a pine tree stump we had brought from the pine savanna and firewood from a small tree that burns green. Things were starting to look good again, especially after drinking a hot cup of Melissa's coffee. Shortly thereafter, Herman and Conce surprised us by walking into our camp. The truck had become stuck on the "road" back to the Awasbila-Rus Rus road, and they needed some of the workers to go back with them the following morning to help with the truck. So, while the rain continued, we all huddled under the two tarps that had been set up and ate supper. Soon thereafter, we became painfully aware that Conce had never spent a night in the forest and was terrified of "El Tigre," numerous superstitions, and other demons, and, furthermore, had no intention of sleeping that night. To keep himself awake, he talked and talked and, if the unfortunate souls closest to him appeared to be sleeping, he would jostle them and talk even louder, and, in the process, managed to keep the rest of us awake for most of the night. When dawn finally arrived, Conce decided he wanted to sleep, but the rest of us delightfully turned the tables on him. While eating breakfast and drinking Melissa's coffee, we decided that we were going to give each of our campsites a Miskito name. In honor of Conce, the present campsite became "Conce Kiamp." I let it be know that I preferred the Spanish equivalent "Campamento Hablando M_____." Conce did not like either name.

The dangerously venomous *Bothrops asper* is known as "La Barba Amarillo" (The Yellow Beard) in Honduras because of the pale color on the side of its head.

After breakfast and breaking camp, most of the crew left with Herman and Conce, leaving only Tomás, Melissa, and me to work on trail-cutting. Most of our gear was piled and left under a tarp at Conce Kiamp. We worked until 2:30 PM, when we reached a small stream with a nice flat bank for camping. We started walking back to Conce Kiamp to retrieve some of our gear, but about halfway back, we met the rest of the crew carrying all of the gear. Best of all was the news that Herman and Conce had made it to the main road in the truck and were probably now in Rus Rus. Back at our new campsite, we were enjoying a nice clear afternoon when a group of White-faced Capuchin Monkeys (*Cebus capuchinus*) stopped overhead and hung around for about a half-hour watching the humans watching them, with both primate groups trying to communicate with each other in their own languages. This campsite was named "Wakling Kiamp" (wakling is the Miskito name for the White-faced Capuchin). After dark, Tomás and I took a short walk and saw several Rain Frogs (*Craugastor fitzingeri*), a ranid frog (*Lithobates vaillanti*), and a Crested Lizard (*Corytophanes cristatus*). At one point while walking in the small stream, I saw a lizard sleeping in some dense vegetation above the bank. I began working my way toward it, all the while thinking that it was a Common Basilisk (*Basiliscus vittatus*), but, upon getting closer, I realized that was not a basilisk, but a *Polychrus gutturosus*. In a few seconds, I was holding the spectacular lizard in my hands, the first *Polychrus* that I had ever seen alive. We returned to camp early and we all got much-needed sleep that night.

After breakfast the following morning, we obtained a GPS reading and studied the topo map. My suspicions were distressingly confirmed. We had traveled only about four of the 11 km needed to reach the Río Warunta. To make matters worse, we were still in the Rus Rus Reserve, and, according to the plans made in Rus Rus, we were supposed to have reached the Río Warunta by now. So, the trail-cutting began in earnest and continued uninterrupted until dark, with the exception of lunch and two short periods during serious downpours. The day proved to be uneventful, except when an Eyelash Viper (*Bothriechis schlegelii*) was dislodged from vegetation being cleared for the trail and when I was summoned to dispatch an adult "Barba Amarilla" (*Bothrops asper*) that was coiled in the path of our intended trail. Following a day of continuous rain, the day's campsite was set up in the dark on a somewhat flat area on an otherwise steep hillside above a small stream. While waiting for supper, Tomás and I obtained a GPS reading and studied the topo map. The evidence suggested that we were camped along a small tributary of the Río Warunta. Thus, sometime during the day we had left the Rus Rus Reserve and had entered the proposed Warunta National Park. Although we were still a long way from the Río Warunta, we were at least in the "park," and I could now begin collecting voucher specimens to document their occurrence in the reserve. The present campsite was dubbed "Auka Kiamp," because of the presence of a huge Auka Tree (*Tabebuia guayacan*).

The next day we awoke to clear skies. After breakfast and breaking camp, we began our daily routine of trail-cutting. The terrain was now very hilly and, because the rainy season was in its later stages, little leaf litter was left on the steep slopes, which quickly became slippery. After what seemed like an eternity of slowly climbing up and down the slopes during intermittent rains, we reached one hilltop where we could see across the hills in front of us to the Montañas de Colón on the other side of the Río Warunta. Better yet, with a new GPS reading and the topo map, we could see that it was only about the same distance to the Río Warunta that we had been averaging the last two days. Energized by that information, we cut a trail down the steep slope to a stream that we reached at about 2 PM. While most of us worked to set up camp along the stream, two members of the crew crossed the stream and continued cutting the trail. Later, a few of us explored downstream. Spider Monkeys (*Ateles geoffroyi*) were particularly abundant along this stretch of the stream, so we combined the Miskito words "Urus" (Spider Monkey) and "tingni" (stream) to name our new campsite "Urus Tingni Kiamp." Late in the afternoon, the trail-cutters returned with a dead Spider Monkey they had shot for food. I am generally easy-going about the "bush meat" the Miskito workers kill, because my prior experience with the Rus Rus Miskitos indicated that they kill only what they eat. For example, while a *ladino* hunter will kill any Baird's Tapir (*Tapirus bairdii*) when the opportunity presents itself, I have witnessed my Miskito friends passing up similar opportunities in remote areas because the tapir is so large that much of the meat will spoil before it can be eaten. Also, they have hunted in the rainforests near Rus Rus for at least a hundred years and their chief game animals (the peccaries *Tayassu pecari* and *T. tajacu*, the "Guatusa" *Dasyprocta punctata*, the "Tepescuintle" *Agouti pacca*, the "Currasow" *Crax rubra*, and the "Tinamou" *Tinamus major*) are still common in the area. However, the killing of the monkey was too much for me, and I sternly told the group to never kill another monkey on any trip with me. Melissa then refused to cook the monkey even though the only meat we had eaten in four days was one Tinamou and an unfortunate Nine-banded Armadillo (*Dasypus novemcinctus*) that made the fatal mistake of trying to cross the trail in front of Melissa and her ever-ready machete. After dark, we had a productive time collecting herps and were able to add some ten species to the Warunta Park list, including one individual each of two species of glass frogs (*Centrolene prosoblepon* and *Cochranella granulosa*) that were sitting on adjacent leaves of the same tree looking at each other. Particularly common were Green Basilisks (*Basiliscus plumifrons*) and a species of vine snake (*Oxybelis brevirostris*). One voucher specimen was taken of each of these two species, and the remaining individuals seen were left where they were found. The stream was teeming with shrimp and fish, and enough were taken to fill all of us at tomorrow's breakfast.

Dinner meat from the turtle *Rhinoclemmys funerea*, the Tepescuintle, and several species of fish.

The next morning, after filling ourselves with fish and shrimp, we began to break camp, just as the leading edge of a group of about 100 noisy White-lipped Peccaries (*T. pecari*) entered our campsite. Melissa quickly began climbing a tree while screaming for me to do the same. Before I could find a suitable tree to climb, Tomás shot one of the peccaries and the others quickly retreated in the direction from which they had come. One can only imagine the disaster that could have occurred if the group had continued into our camp and had become agitated while among our tents and other gear. Still, now we faced another delay. The crew began cleaning and carving up the meat of the unlucky peccary. Since we only had three days to spend at the next campsite, we decided that we would carry only enough meat to feed us for three days and would wrap the remaining meat (including the monkey meat) in palm leaves and bury it in the soil on the well-drained hillside above camp, a tactic about which the "gringo" was very skeptical. After finishing that task shortly before noon, we continued our journey toward the Río Warunta. Shortly after crossing the stream, we were met by an extremely agitated female Spider Monkey. The poor monkey followed us for the better part of a half hour, at times not more that two or three meters above our heads, and

The upper reaches of the Río Warunta near Warunta Tingni Kiamp during the rainy season of 2005.

Some members of the group relaxing in camp along the Río Warunta.

all the time clearly scolding us in monkey talk. One could not help but imagine that she was the mate of the male monkey shot the previous day. By mid-afternoon, we entered a flat area with lots of bamboo, suggesting that the much-sought river was nearby. Finally, at 3:30 PM, we reached the river in question. After five days of cutting a trail, during which time we had seen absolutely no evidence of humans having been in the area previously, we had arrived. The Miskitos in front of me stopped at the river's edge, and even though thirsty from the day's work, were obviously waiting for me to be the first person to enter and drink from the river. I cannot explain the feeling that came over me, combining the joy of having finally reached our destination with the probability that I was the first human to be standing in this portion of the river for many years, if not the first ever. Certainly. I was the first gringo to drink from the upper Río Warunta. The elevation of the river at this point is 150 m above sea level. Fortunately, the place where we had entered the river had a large flat area suitable for camping. Later, we would learn that nearly everywhere else in that area was too hilly or too swampy for a campsite. Shortly after setting up camp (we named it Warunta Tingni Kiamp), we were visited by a large group of Spider Monkeys that hung around for the better part of an hour. After dark, we tried to work the river below camp, but soon found it to be too deep in many places. Furthermore, a giant tree fall just below camp also prevented any progress. Therefore, we returned to camp and worked our trail back toward Urus Tingni Kiamp.

Shortly before dawn the following morning, several male Mantled Howler Monkeys (*Alouatta palliata*) serenaded us with their loud calls well into our breakfast time. After breakfast and on a clear morning, I began photographing some of the animals we had collected during the previous couple of days. During that process, an adult Guatusa walked up to us. Tomás quickly picked up one of my potato rakes and whacked the animal on the head. Now we had more meat. The incident with the Guatusa was unusual in that the animal showed no fear of us. After the photography session, the other men and I crossed the river and began climbing the karst geography of the Montañas de Colón. Melissa stayed in camp to wash clothes, hoping that the sunshine would last long enough to dry the clothes. At that point, dry clothes were much in demand. We started the slow climb up the limestone mountains and, at a point about 350 m in elevation, we startled a Jaguar (*Panthera onca*) that had been sleeping in a grassy area. The cat hairs present in the sleeping place left no doubt that the animal was the famous El Tigre. From that vantage point and with binoculars, we could see the Rus Rus–Awasbila road where we had started our adventure six days earlier. We returned to camp during mid-afternoon and were shortly joined by what appeared to be the same troop of Spider Monkeys as yesterday. Females carrying young on their backs were quite common. Also, we now had reasonably dry clean clothes. After dark, we worked the same limestone outcrops we had visited earlier in the day, but that proved to be difficult at night without having trails through the more level areas. We did find two individuals of a peculiarly colored snake of the genus *Tropidodipsas*. They appeared to be similar to *T. sartorii*, except that the adult had wide white rings not normally seen in adults of that species. We also found a fine adult of the large green anole (*Anolis* [*Norops*] *biporcatus*) and a young adult of the snake-eating, but gentle-toward-humans *Clelia clelia*. The snake was passed around by the men willing to handle it.

The following day (24 November), we worked in the vicinity of Warunta Tingni Kiamp, but heavy rains hampered our success, as well as drenching the dry clothes with which we had started the day. We were up before dawn the following morning because we had to walk at least halfway back to the pine savanna that day. Fortunately, the rains had stopped. We made the walk back to Urus Tingni Kiamp in about an hour, arriving around 9 AM, but my field notes called it a "brutal walk" because of the

Tropidodipsas sartorii from the Montañas de Colón are unusual in that the adults retain the white bands found in juveniles.

Anolis (*Norops*) *biporcatus* is a large arboreal anole that is usually bright green, but turns dull brown when stressed.

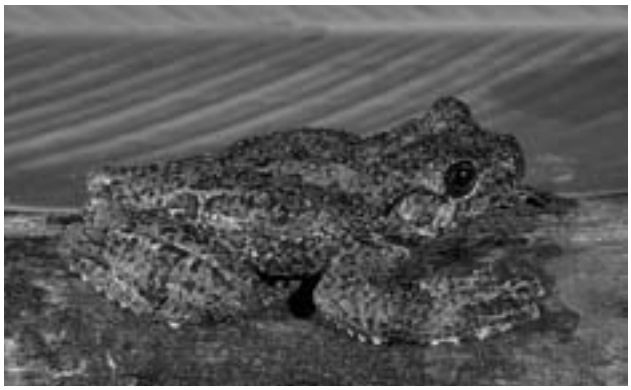
extremely slick hillsides. We dug up the meat we had buried three days earlier. The meat had a somewhat rotten smell to me, but the odor did not seem to bother my Miskito friends. We then climbed the slippery slopes above the campsite. Tomás, Melissa, and I were the last to leave the camp. About half way up the first slope, we found a leaf litter snake (*Rhadinaea decorata*) that had apparently been uncovered by members of our party walking in front of us. That was a very lucky find because it represented the first specimen of that species from Honduras. Once we worked past the sections with steep hills, we began making better time than expected. After stopping for lunch at about the halfway point, we continued walking and reached the pine savanna where we began the trip at the unbelievable hour of 3:30 PM. The strong sunlight felt great, and the wet clothes I had been wearing for two days were dry in a matter of minutes, and even the swarm of tiny biting black flies did not dampen our relief. Since we had run out of rice, beans, and flour, the evening meal consisted largely of the peccary meat that had been buried for three days and was now well into its fourth day. I forced down several pieces, which I decided were not too bad — if you did not inhale while chewing the meat. We spent a pleasant night camping in the pine savanna near a nice fire from the pinewood in the area.

We left our pine savanna campsite at 10:30 AM on the 26th to walk to the Rus Rus–Awasbila road, because Herman had indicated to us back in Conce Kiamp that he would not drive the "road" through the pine savanna again. Herman (without Conce) arrived in his truck about five minutes after we reached the road. We were back in Rus Rus shortly after noon. My trip total for the Warunta National Park was only 29 species, but I felt that we had done pretty well for the relatively little time actually spent collecting. I also figured that I had enough time to make another trip into the Warunta Reserve before Joe, Larry, and I would be able to finish the preparation of our Mosquitia book. I told Tomás that I would probably return to Rus Rus during May of the following year.

At 4:30 AM on the 7th of May 2004, I was in a taxi in La Ceiba, Honduras, on the way to the airport to catch a flight to Puerto Lempira, the "capital" of the Honduran Mosquitia. The plane left on schedule and I was in Puerto Lempira by 7:30 AM. I spent the day buying provisions for the second Warunta trip and trying to find someone with a car I could hire to drive me to Rus Rus. After several delays and much frustration, I left Puerto Lempira at 8 PM and arrived in Rus Rus at 2:30 AM.

Rhadinaea decorata was not previously known from Honduras until we found one near Urus Tingni Kiamp.

Tomas' house was filled with people that were in the village for a Catholic "revival," so I set up my tent in his front yard. I spent the next two days in Rus Rus making preparations for a 10-day Warunta trip. I also learned that during the previous December, Tomás, his wife Alicia, and a couple of other men from Rus Rus had hitched a ride on a truck passing through Rus Rus on its way to Awasbila and had made the walk to Warunta Tingni Kiamp, where they had cut two trails through the limestone outcrops in the Montañas de Colón in anticipation of my return. So, at 6:30 AM on the 11th of May, we left Rus Rus with Herman, who dropped us off just before 8:30 AM. While we were making final adjustments with the gear, I asked Melissa when she was going to put on her boots. She replied that her boots had worn out, and, because she did not have another pair of shoes, she was going to make the walk barefooted. Since our trail was still open and because we were in the late stages of the dry season, the walk was surprisingly easy. We reached Urus Tingni Kiamp by mid-afternoon and quickly set up camp. Melissa had no problems with the barefooted walk. The water in Urus Tingni lacked much of a current and contained many stagnant pools filled with decaying leaves. So, by the next morning almost everybody had developed diarrhea, which fortunately passed in the next couple of days. Since the rainy season began three days into our trip, we had no more problems with water. We spent the next eight days and nights collecting around Urus Tingni and Warunta Tingni kiamps, and then returned to Rus Rus on the 19th as previously planned. We rested in Rus Rus for a few days, bought new provisions, and returned to Urus Tingni Kiamp on the afternoon of 24 May (Melissa was still barefooted). We again worked the vicinity of Urus Tingni and Warunta Tingni kiamps, staying until the 30th. These two trips increased the Warunta species counts to 65, and included several seldom-seen species. Highlights were the spectacular frogs *Ecnomiohyla miliaria* and *Cruziohyla calcarifer* and the snakes *Anomalepis mexicanus* (the first record for the country; Tomás had also found one the previous December), *Typhlops costaricensis*, *Corallus annulatus* (three photographed and released), *Dendrophidion vinitor*, *Dipsas bicolor*, *Hydromorphus concolor*, *Nothopsis rugosus*, and *Micrurus alleni*. We also collected a single peculiar looking specimen of *Sibon* along one of the trails through the limestone outcrops. One other memorable occasion was the time the barefooted Melissa (without a flashlight) walked out of camp at dusk to heed nature's call. When she returned, she informed us that she thought she had seen a snake. So, Tomás and I grabbed our flashlights and followed Melissa's



Ecnomiohyla miliaria males call at night from water-containing tree holes. Males from the Mosquitia of Honduras have only been heard calling in May and early June.

Cruziohyla calcarifer is a seldom-seen, highly arboreal frog.

Anomalepis mexicanus is a burrowing "blind" snake only recently discovered in Honduras.

Nothopsis rugosus is a leaf-litter colubrid with fragmented scales on top of its head.

The highly arboreal tree boa *Corallus annulatus* seems to be fairly common along Urus Tingni.

tracks in the muddy terrain. What we found was a coiled subadult and dangerously venomous *Bothrops asper* lying less than one foot from one of Melissa's footprints.

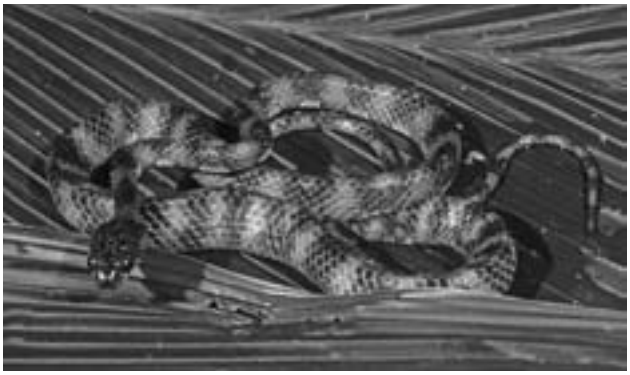
Upon examining the *Sibon* back in Miami, I became convinced that it represented an undescribed species. It was an adult male that was considerably smaller than adult *S. dimidiatus* to which it was apparently related. The specimen also had different numbers of ventral and subcaudal scales than those found in *S. dimidiatus*. Unfortunately, one specimen was not enough to describe it. I had to get more. I arrived back in Rus Rus on 19 January 2005 (carrying a new pair of boots for Melissa) and we left for the Warunta area the following morning, arriving at Urus Tingni Kiamp in late afternoon. The main objective of this trip was to collect additional specimens of the new *Sibon*, but I also wanted to work in some new areas. Early the following morning, the men started a new trail that began on top of the steep hill above camp and followed a ridge for a while before dropping into an area with several small streams. The new trail made several more ups and downs before descending to a river comparable in size to the Río Warunta at Warunta Tingni Kiamp. This river was not shown on the topo map, but, with a GPS reading, we were able to figure out more-or-less where we were. A flat area in a now dry flood plain of this river appeared suitable for a one-night campsite. With only about three hours of daylight left, we hotfooted it back to Urus Tingni Kiamp, where we spent the night. The following morning, we moved our gear to the new campsite, which we named Kipla (for the large boulders in parts of the river) Tingni Kiamp. The next morning, we began

cutting a trail north–northeast of Kipla Tingni Kiamp and, at about midday, we turned west to try to hook up with the Río Warunta, which we reached by mid-afternoon. As shown on the topo map, the Montañas de Colón rose quickly just across the river. Because of the late hour, we immediately started back to Kipla Tingni Kiamp, arriving just before dark. The following morning, we moved to our new site along the Río Warunta. In the afternoon, we cut two trails through the karst limestone outcrops on the opposite side of the river. Surely, we could find more specimens of the new *Sibon* in the three nights before we had to start the return trip. After dark, we split into two groups of four men each and began searching the trails through the rocks. As the night wore on, we concluded that finding more specimens of the new *Sibon* was not going to be easy. Close to midnight and still with no *Sibon*, my group returned to camp. The other group was already in camp, also without a *Sibon*. Earlier in the day, we had named this campsite Hiltara Kiamp, combining the words hil (a steep hill) and tara (large).

Rain started shortly before dawn the next day and continued until midday. A cold front apparently had moved through. The rains were not enough to raise the river level or cloud the clear water. We soon realized that American Crocodiles (*Crocodylus acutus*) and Black Turtles (*Rhinoclemmys funerea*) were in the river. The reason we had not seen these species on previous trips was that the river was deeper and silted at those times. Both groups returned to the limestone outcrops that night, but the air was cool — just not a "snake night." Again, no *Sibon*.

We spent the following day working downstream along the river. Back in camp in the late afternoon, I began regretting my decision not to go to the previous *Sibon* locality, and, to make matters worse, it was cooler than it had been the day before. I was seriously considering not even bothering to search for the *Sibon* that night. However, about 10 minutes after dark, since this was the last night at the limestone rocks, I got up and crossed the river, not even bothering to tell anyone else I was leaving. Tomás saw me cross the river, and he and another person were with me in a matter of minutes. Unbelievably, within five minutes, I was holding a specimen of the new *Sibon*. Its color pattern and size were similar to last year's specimen. We

The author with a subadult *Crocodylus acutus* found in the Río Warunta.

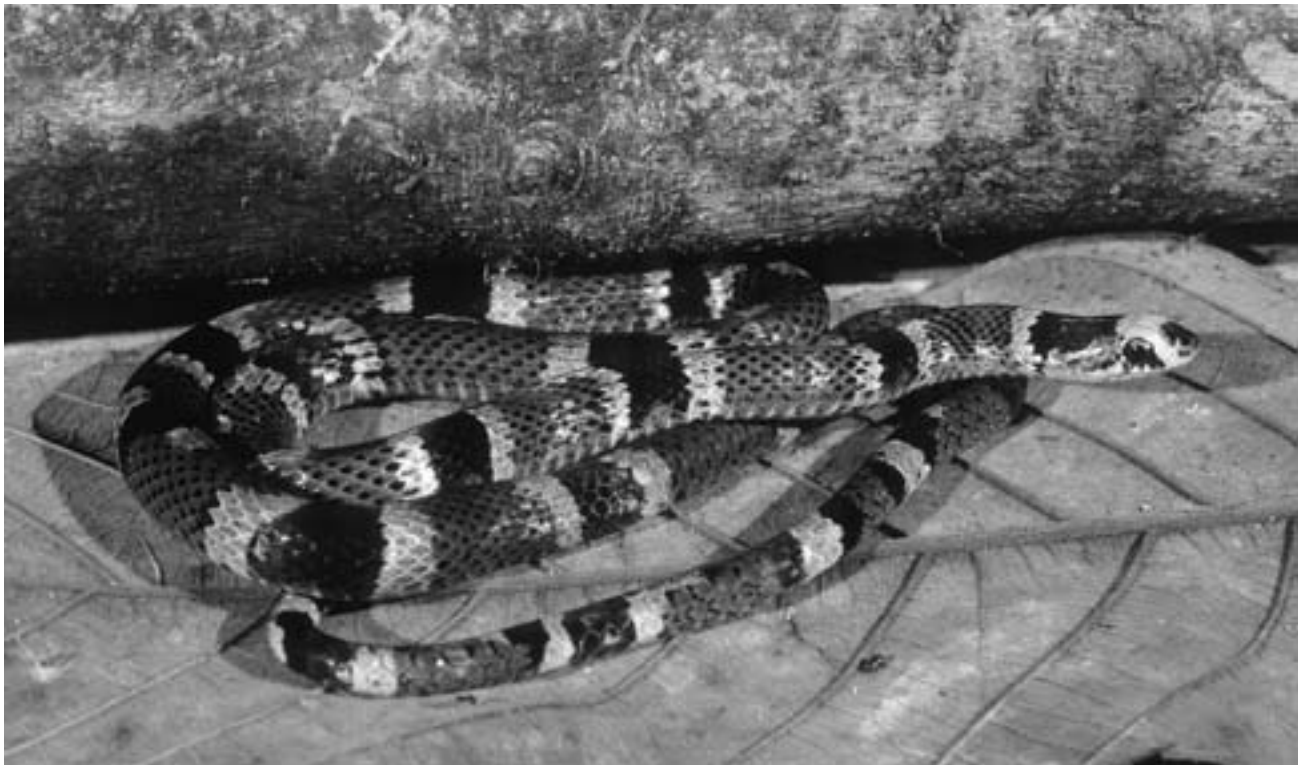


Sibon miskitus, the first of two new species of *Sibon* found around karst limestone outcrops in the Montañas de Colón.

continued on and, about an hour later, Carmelo, the second person with me, said, "Here is another *Sibon*." He was right and, not only that, it was the same small size and had the same color pattern as the previous two, but it was a gravid female with large eggs. I was extremely pleased that we had found two specimens on our last night in the Montañas de Colón. I named this new species *Sibon miskitus* in honor of my friends from Rus Rus.

Until now, I have not mentioned that when I had arrived in Rus Rus on 19 January, Tomás had shown me a juvenile of an even stranger *Sibon* that he had found in November 2004 in an isolated spur of the Montañas de Colón some 20 airline km from the *S. miskitus* localities. That juvenile differed from all other known Honduran *Sibon* by lacking dorsal bands and having an unmarked venter. The locality where he had found it was about three hours walking distance from a campsite called Bodega, which I had visited several times, including twice with Townsend and Wilson. So, after a day in Rus Rus, several of us departed for the locality of the unpatterned *Sibon*. Two days later, we were setting up camp at the base of that spur of the Montañas de Colón. The Rus Rus Miskitos call that spur San San Hil, so we named our new campsite San San Hil Kiamp. We spent five unsuccessful days and nights searching for the unpatterned *Sibon*. We did, however, collect an adult snake of the genus *Scaphiodontophis* that even had a complete tail, which is unusual for that genus. Its color pattern was unlike any I had previously seen from Honduras, but resembled those from populations farther south in Nicaragua and Costa Rica. Examination of that specimen back in Miami, and of all other *Scaphiodontophis* known from Honduras, led me to publish a paper suggesting that two species of *Scaphiodontophis* were involved. I resurrected the name *S. venustissimus* from the synonymy of *S. annulatus* for the second species.

Not one to give up easily, I returned to Rus Rus on 25 May 2005 to make another attempt at finding the unpatterned *Sibon*. We departed for San San Hil on the morning of 26 May, arriving at San San Hil Kiamp on the 28th. The Honduran Mosquitia was experiencing the longest and most severe drought in recent memory of the Rus Rus Miskitos. As a result, the "stream" near camp was dry. Several times a day, a group of us would walk to a stream that still contained water about 15 minutes away and bring water back to our camp. I wondered how the dry conditions would affect our chances of finding the *Sibon*



The snake *Scaphiodontophis venustissimus* was previously considered conspecific with *S. annulatus* until the author presented evidence that it was a distinct species.

in question (these snakes are snail-eaters and their prey is usually active only during wet conditions), but at least the cool weather of the previous January would not be a problem. The first night there, two groups spent a combined eight hours in the limestone outcrops. We found no *Sibon* although we did find about 12 snakes of several species. The second night produced a *Sibon*, but it was a *S. miskitus*. I began to wonder if the juvenile unpatterned *Sibon* found earlier by Tomás was just an aberrant individual, but, on the third night at about 9 PM, we found an adult male *Sibon* without dorsal bands or distinct ventral markings. Now I was really confused. Either *S. miskitus* came in two very different color phases or two species of small *Sibon* occurred sympatrically on San San Hil. During the following five nights, we found two more essentially unpatterned *Sibon*, but no others that resembled *S. miskitus*. Back in Miami, I examined the scale characteristics of the four specimens of unpatterned *Sibon* and compared them to the data for the five *S. miskitus* now available. No scale differences were evident, but the color differences were strong. I felt confident that the available evidence indicated that two species were involved. However, before I submitted a manuscript describing the unpatterned species, I wanted to return to San San Hil to collect tissues from both color types, something I was regretting not having done already.

I was back in Puerto Lempira on 15 October 2005. By that time, I had developed a relationship with one of Melissa's daughters, whose name is Dalmacia. Dalmacia was living in Puerto Lempira at the time, so I was spending most of my October time there. Shortly after my arrival, Hurricane Wilma began forming in the Caribbean Sea just off the coast near Puerto Lempira. After Wilma finally left the area, an unnamed tropical depression came ashore near Puerto Lempira and worked its way inland. That disturbance was quickly followed by a second tropical depression that came ashore in northeastern Nicaragua and worked its way through the Honduran Mosquitia. I eventually asked Dalmacia to go with me to San San Hil and she agreed, but she could not leave Puerto Lempira until the first week of November. With the nasty weather we had been having, I figured that waiting a few more days was probably a good idea anyway. So, on 2 November, we were in Rus Rus and I was busily arranging the trip to San San Hil. I also was anxious to see how Dalmacia would handle the trying conditions of such a trip, and I figured I would learn more about her in that relatively short period (and her about me) than I could in months of "normal" time. The workers I assembled were all well-known to me and included Tomás and, of course, Melissa. This time the only person in the village with a vehicle was Luís, Melissa's uncle. At 6:30 AM on 4 November, we left Rus Rus with Luís and followed a different dirt road that ended in pine savanna close to the confluence of the ríos Rus Rus and Tapalwás. That drive would save us five or six hours of walking, but Luís could not return for us when we wanted to be back, so we planned on walking all the way to Rus Rus at the end of the trip. We began our walk towards Bodega at about 8 AM. About an hour into the walk, the rain began, continuing off-and-on for most of the day. I usually make the walk from the pine savanna drop-off to Bodega in less than four hours. However, things were different this time. Because of the heavy rains associated with the recent tropical disturbances, much of the "tierra firme" along the trail could better be described as one large swamp. We did not reach Bodega

The nearly unpatterned *Sibon manzanaresi*, the second undescribed species of *Sibon* from the Montañas de Colón.

The author and Dalmacia relaxing at the campsite near Crique Wahatingni after a hard day.

until about mid-afternoon, thus the walk took almost four hours longer than usual. We set up camp, caught some fish in the adjacent Río Tapalwás, and had a much-needed nice supper.

The following morning we continued to San San Hil Kiamp, arriving there shortly after noon. The intermittent rain had continued throughout the previous night and during the day's walk. I was confident that we were going to find both types of *Sibon*, because snails would be everywhere. Wrong again. Snails were everywhere, but not a single *Sibon* could be found during five nights. To make matters worse (at least for me anyway), on our second day at San San Hil Kiamp, a tropical storm (one of the Roman Numeral ones used after the alphabetical names had been exhausted) passed through the area, and we experienced the better part of two days and nights of continuous rain, which turned our campsite into a swamp. Finally giving up on the *Sibon*, we broke camp early on the morning of 11 November, planning on walking as far as we could that day. Fortunately for us, no rain had fallen during the previous day and most of the day had been sunny, and the present day was equally nice. Thus, the Río Tapalwás was not extremely swollen, a boon for us because we would need to cross it six times before reaching the Río Rus Rus, where a trail along the river led all the way to Rus Rus. At 4 PM, we reached a seldom-used campsite near where the Crique Wahatingni enters the Río Tapalwás. We set up camp and strung up the hammock. I was feeling good again, although I knew that we still faced at least a seven-hour walk back to Rus Rus. Shortly before dark, five Miskitos (three men and two women) arrived in camp in a pipante they had been poling upriver for two full days. They had come to hunt for game. I began thinking about how nice a ride back to Rus Rus in the pipante would be. A little later, I asked Tomás about the possibilities of using the pipante. He replied that I should ask Santiago, because it was his pipante. Santiago happened to be one of the men working for me on that trip. Santiago said yes.

The following morning, we loaded our gear onto the pipante and Santiago, Tomás, Melissa, Dalmacia, and I climbed aboard. The rest of the crew would walk back to Rus Rus, but without having to carry gear. The hunters, however, would have to get back without the pipante. We left the campsite at 8 AM and had an enjoyable ride, arriving in Rus Rus around 4 PM. Emiliano, Dalmacia's father, was working on his own pipante. He would not let me carry my gear the short walk to the village, instead loading it and more on his back and those of his two youngest daughters.

In the title of this article, I posed the question: "Pleasure or how quickly we forget?" Working in rainforest is not all fun and pleasure. I have asked myself many times: "Why am I here" or "Why am I doing this." These questions usually come at times when I am soaking wet and the rain seems never ending, when I am dead tired and aching all over during a long day's walk, but knowing I cannot stop until reaching camp, while trying to sleep at night with numerous tiny ticks crawling across my skin, during the excruciating pain from the occasional bala ant bite, and during other trying times and conditions. However, after a day or two of rest at a village at the end of each trip, I always start thinking about my next trip, and the unpleasant times are quickly forgotten. As for how Dalmacia would handle an especially uncomfortable trip — well, she is now my wife. The unpatterned *Sibon* is officially *S. manzanaresi* — and other species of reptiles and amphibians that I have never seen alive are out there somewhere.

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This *Phelsuma klemmeri* demonstrates a possibly symbiotic behavior with arthropods that we observed during the expedition.

TRAVELOGUE

The Day Geckos of Madagascar

Michael D. Kern

Photographs by the author.

During the summer of 2006, I was fortunate enough to join Emmanuel Van Heygen and the Exo Terra Expedition to explore remote areas of Madagascar in search of *Phelsuma* (Day Geckos). Specifically, the team sought to better understand the habitat and behavior of the species in this genus and, if lucky, repeat the success of the 2004 Expedition to the same region, discovering and documenting a new species.

Phelsuma, or Day Geckos, as the common name implies, are among the few gecko genera that are almost completely diurnal. Because they also can be fantastically colored in vibrant greens, yellows, reds, and blues and have been successfully bred in captivity, they make for a good show in a home terrarium. *Phelsuma* can be found throughout the islands of the West Indian Ocean, although Madagascar is home to the greatest diversity of species. Our focus was on the northwestern region of the country, specifically the Ambasidava Peninsula, an area that still contains a reasonable amount of primary forest and bamboo thickets, excellent *Phelsuma* habitat. Plus, due to the difficulty of access to the region, it has not been heavily explored and is rarely visited by tourists — making it an ideal area to search for a new species.

Children take advantage of the low tide to hunt for seafood along the southern coast of Nosy Be.

Once in Madagascar, we had to travel by boat, because no roads lead to the places we wanted to explore. Within a day of landing in Nosy Be, we were on the water heading toward the Mozambique Channel hugging the northwestern coast, entering rivers and heading as far upstream as possible to the target areas that had been identified through knowledge gained from previous trips, data gleaned from maps, discussions with people who had recently visited or lived in the area, and satellite images downloaded from Google Earth.

Two members of the four-member team, Emmanuel Van Heygen and Achim Lerner, had journeyed to this region in 2004 and had discovered and documented a new Day Gecko species, *Phelsuma vanheygeni*. Within the last decade, a new species of Lemur also had been discovered in this area, bolstering our hopes that another new species of *Phelsuma* could be found. At the very least, we knew we would learn more about the herpetology of this relatively unexplored region.

Our first sighting of *Phelsuma* occurred immediately after our arrival in Nosy Be, an island north of the Madagascan mainland. Here we found both the abundant and beautiful *P. laticauda laticauda* as well as *P. dubia*. The hunt was not particularly difficult, as *P. laticauda* readily exploited human habitats. Within a few

Emmanuel van Heygen and Achim Lerner plot the course for the expedition using maps, GPS, and pictures from Google Earth.

A baby *Phelsuma madagascariensis grandis* perches on a leaf to survey its surroundings.

meters, we also found a hatchling *P. dubia* shedding, possibly for the first time. The vibrant blue dots only seen in juveniles were readily apparent beneath the shedding skin. We had only just arrived, and were already surrounded by exotic geckos!

Our first stop on the mainland was Ankify, which has roads that lead to large areas covered by untamed bamboo thickets. After only about an hour of searching, we found the boldly colored *P. klemmeri*, which we were able to confirm lives mostly in and on the dead brownish-yellow bamboo. At the time of the first sighting, several expedition members were trying to capture a Madagascan Hognose Snake (*Leioheterodon madagascariensis*), for which they had set aside a magnificently colored caterpillar. With the discovery of the *Phelsuma*, however, the snake was stashed in a backpack for later study, the caterpillar quickly for-

The floor of the bamboo jungle presents a number of challenges and surprises including this Madagascan Hognose Snake (*Leioheterodon madagascariensis*).

What this Oustalet's Chameleon (*Furcifer oustaleti*) lacks in size, it makes up in beauty.

Three members of the team relax at our Besovana campsite.

Although we did not realize it at the time, this Forest Night Snake (*Ithycyphus perineti*) was on the hunt. Note the frog hiding in the bamboo in the lower right corner of the upper frame. The snake completely ignored us during the hunt and throughout his meal.

gotten. Emmanuel's father, Guy, was filming the adventure while I was happy taking still shots as the action unfolded. We also found several species of Chameleons, including a distinctively marked *Furcifer pardalis* and the giant *F. oustaleti*. Ankify was the last contact with civilization we would have for the next ten days.

Our next major stop was outside the small village of Besovana. While seeking a suitable place to set up camp, we found the first *Phelsuma vanheygeni*. A campsite near a small stream gave us an opportunity to clean up and cool down from the hot and humid equatorial climate. Better yet, the campsite was surrounded by unspoiled bamboo. Our frequent treks from camp to the field were short — and almost immediately productive. We would venture out in the morning as animals began to bask, return and rest while geckos retreated from the extreme midday heat, hike out again during the later afternoon as temperatures began to drop, and journey out again after nightfall in search of nocturnal creatures. We spent four days in this region because of the density of Day Geckos. Species sighted included *P. vanheygeni*, *P. klemmeri*, *P. seippi*, *P. laticauda laticauda*, and *P. madagascariensis grandis*. We also saw geckos in the genus

The recently discovered *Phelsuma vanheygeni* lives on green bamboo stalks. When threatened it retreats into thickets of branches to hide.

The morning dew forms on a bamboo plant showing how geckos, chameleons, and other creatures get the water on which they depend.

A pair of camouflaged Leaftail Geckos (*Uroplatus henkeli*) sleep, well hidden in the primary forests of Madagascar.

This Madagascan Leaf-nosed Snake (*Langaha nasuta*) was one of the most interesting snakes found on the Expedition.

Lygodactylus and tree frogs of the genus *Mantidactylus*. A *Phelsuma* fantasy come true!

Also, we observed an unusual behavior in *Phelsuma*. Many individuals of several species were found positioned directly below a moth or cicada, almost touching them, and lying perfectly still as if in a trance. We suspected some form of symbiotic behavior, which will require additional study to fully understand. Additionally, we confirmed that *P. vanheygeni*, unlike *P. klemmeri*, which makes its home on dead bamboo, prefers living on green bamboo. Typically, *P. vanheygeni* also is found higher in the denser vegetation of the bamboo stalks. Before we left the area, the team was treated to a display of the hunting tactics of a local colubrid snake, *Ithycyphus perineti*, that ignored us as it moved from branch to branch on its way to a frog hiding in a broken bamboo branch. Only after the snake quickly struck the unsuspecting frog did we realize that it was "hiding" in plain sight right in front of us.

While camping in Besovana, I finally learned to appreciate the unique local climate and moisture patterns. As nighttime temperatures drop substantially, the atmospheric humidity is converted into water droplets. The result is so dramatic that, on many nights, I thought rain was falling on my tent. By morning, everything is soaked. Drops of moisture have formed on each leaf of every tree, giving the chameleons, geckos, and other wildlife a plentiful and renewable source of drinking water.

Hunting *Phelsuma* in dense bamboo thickets is an adventure in itself. The floors of the thickets are covered a foot deep in leaf litter and broken bamboo stalks. Each step could startle any creature away or, worse yet, the stalker could be impaled on one of the many spear-sharp bamboo stalks standing upright at knee to waist height, resulting in an injury that could prove lethal in such a remote part of the world. So, you move slowly, quietly, and as carefully as you can. Teams of two are best to quickly trace each stalk and branch up and down and side to side, alert for slight movements, flashes of color, or anything that appears abnormal. Most geckos will see you first and quickly

We found several rare "Pink Panther Chameleons" (*Furcifer pardalis*) during this trip.

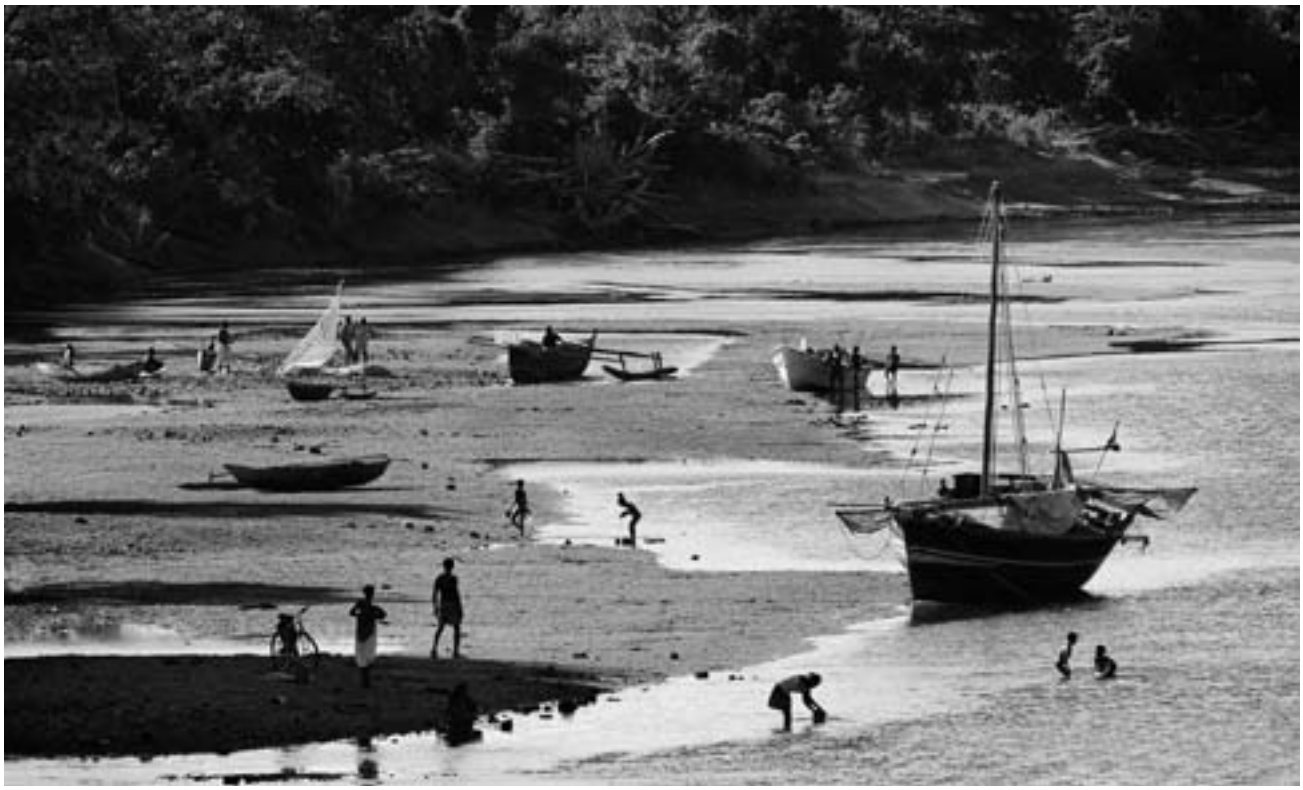
hide but, if you wait quietly for a few minutes, they often return to their previous basking spots and into clear view.

The journey continued to Ambaleha, a large river village of around 100 huts. Here we would climb to an elevation of nearly 400 m to get to a part of the remaining primary forests of Madagascar. Since our arrival time had been dictated by Mother Nature's tides rather than our comfort, the grueling hike took place during the heat of the day. The climb was worth it, however, for not only did we find primary forest where we were excited to find a sleeping pair of Leaftail Geckos (*Uroplatus henkeli*), but we also found more bamboo! At this campsite, we found several species of snakes, including the always-interesting Leafnose Snake (*Langaha nasuta*) and over seven different species of geckos. We also were pleasantly surprised to find a Pink Panther Chameleon, a unique variant of *Furcifer pardalis*.

Our final campsite was by a river in the village of Jungua, where we were presented with an idyllic scene. Some men were readying the large village fishing boat, while others paddled upstream in their one-person pirogues. Women were washing clothes, men and women were bathing, and children were running, playing, and splashing under the morning sun. For all its simplicity, the village had generator power; so, at the end of the day, we could venture over for a slightly cooled drink. We found many of our old friends (*Phelsuma vanheygeni*, *P. klemmeri*, *P. seippi*, *P. madagascariensis grandis*, and *P. laticauda laticauda*), but were unable to identify and document another new species of *Phelsuma*.

We did, however, gain new insights into the lives of geckos in the genus *Phelsuma*. We learned more about the distributions of several species and developed a better understanding of the natural history and behavior of others. Sadly, the ongoing loss of primary forest probably will affect the viability of many of Madagascar's endemics, but we take some solace in the fact that the many species of *Phelsuma* that live in the bamboo are safe for now and appear to be reasonably abundant. Much still remains to be learned and the team plans to return to the region in hopes of identifying new species before they are gone and find answers to questions that will lead to a better understanding of these rare and beautiful creatures.

For more information, including additional photos and video from the Expedition, visit the Exo Terra website (www.exo-terra.com).



The Jungua River is a major resource and center of activity for this small village in Madagascar.

HISTORICAL PERSPECTIVES

Notes on Butler's Garter Snake[1]

Leonhard Stejneger

The garter snakes of North America constitute one of the most difficult group with which the ophiologist has to deal. The geographical variation is recognized to be excessive, while at the same time the individual variation is so great as to obscure the boundaries between the species. The result is that there is a great diversity of opinion among authors as to the number of species and the proper limitations of the forms, and while one is inclined to recognize a long series of species, another will only allow a very limited number indeed, though admitting numerous "varieties," at least of some of the species.

While undoubtedly many a slight variety, or even individual freak, has been designated as a species, on the other hand, some of the most distinct species have suffered degradation to mere varieties or subspecies.

The *Thamnophis butleri* of Cope is an example of this. In 1889 Prof. Cope described a single specimen from Richmond, Ind., under the above name, dedicating it to Amos W. Butler. In describing it he stated expressly that "it is remarkably distinct from everything which occurs in the United States, and has only a superficial resemblance to the *E. flavilabris*[2], Cope, of Mexico." This statement alone should have prevented it from ever becoming associated with *Thamnophis sirtalis* as a subspecies until additional material should establish the incorrectness of Prof. Cope's standpoint, who, having himself endeavored to subordinate the various binomials under other forms as trinomials, would have been able to discover the relationship with *T. sirtalis*, if such relationship existed. But no such additional material has been forthcoming.

BRIAN S. EDMOND

At one time, Edward Drinker Cope, an esteemed herpetologist of the late 19th Century, sought to subsume a number of garter snakes as subspecies of the Common Garter Snake (*Thamnophis sirtalis*), illustrated here. Leonhard Stejneger's short note demonstrated that this approach was erroneous.

GARY S. CASPER

Butler's Garter Snake (*Thamnophis butleri*) serves as an effective illustration of the ever-changing nature of classification, but, in addition, has recently been the focus of a political controversy regarding the protected status of disjunct populations in Wisconsin (see Aprill. 2007. *Iguana* 14: 94–99).

It is therefore with great satisfaction that I announce that a second specimen has recently been obtained and added to the collection of the National Museum. It was collected by Mr. P. H. Kirsch, of the U.S. Fish Commission, at Cedar Creek, Waterloo, Ind., on July 17, 1893. This specimen, No. 21692 U.S.N.M., corroborates everything Prof. Cope said about the species in the original description and substantiates the characters relied upon for its separation. The number and size of the temporals (1+1) is the same, and the lateral stripe involves distinctly the second, third, and fourth scale rows. The size and shape of the head is also quite characteristic, it being remarkably small and conical. Moreover, the eye is proportionately much smaller than in any of our *Thamnophis* species, with the exception of *T. leptocephalus*[3] and *T. vagrans*[4].

This smallness of the eye is so striking, and it reminds one so much of the last-mentioned species, that I have a strong suspicion that the specimen which E. W. Nelson collected near Chicago, Ill., in 1874, and identified with *T. vagrans*,* was, in reality, a third specimen of the rare *T. butleri*, about the geographical range of which we can at present only guess. It is almost needless to add that *T. vagrans* does not occur in Illinois.

For the sake of completeness I add the synonymy of the species which is the subject of the present article.

1889.—*Eutania butleri*, COPE, Proc. U.S. Nat. Mus., XI, 1888, p. 399.

1892.—*Eutania butlerii*, COPE, Proc. U.S. Nat. Mus., XIV, 1891, p. 651.—*Eutania butlerii*, HAY, Batr. Rept. Indiana, p. 120 (1892).

1893.—*Tropidonotus ordinates* var. *butleri*, BOULENGER, Cat. Snakes Brit. Mus., I, p. 212.

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[1] Reprinted from the *Proceedings of the U.S. National Museum* 17: 593–594 (1895).

[2] *Eutania flavilabris* is recognized today as a synonym of *Thamnophis eques*.

[3] *Thamnophis leptocephalus* is recognized today as a synonym of *Thamnophis ordinoides*.

[4] *Thamnophis vagrans* is recognized today as a subspecies of *Thamnophis elegans*.

* See Davis and Rice, Bull. Chicago Acad. Sci., I, iii, 1883, p. 30 [from original].

A Statistical Study of *Thamnophis brachystoma* (Cope) with Comments on the Kinship of *T. butleri* (Cope)[5]

A. J. Barton

The short-headed gartersnake has had a stormy taxonomic history. Originally described by Cope in 1892 from Franklin, Venago County, Pennsylvania, the name *brachystoma* was suppressed by Ruthven (1908), who, while noting that he lacked sufficient specimens to reach any position of certainty, considered it to be a synonym for *Thamnophis butleri* (Cope) 1889. Albert G. Smith reviewed the *butleri* complex in 1945 and decided that two distinct species were recognizable. For the more eastern of these he resurrected Cope's name *brachystoma*.

SUZANNE L. COLLINS, CNAH

Conclusions

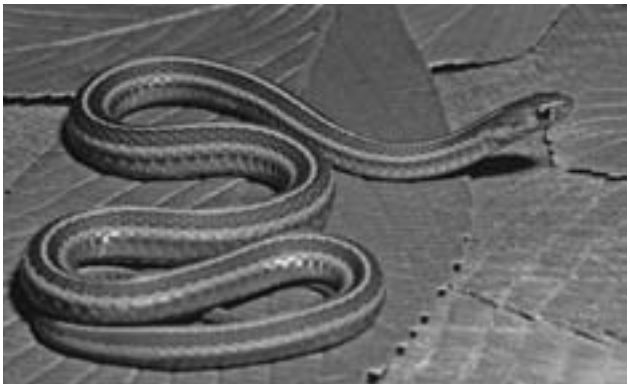
Application of Fisher's "t" test to comparable sets of data from *butleri* and *brachystoma* demonstrates conclusively that the two constitute separate populations. The question as to whether they be two discrete species, or merely two races of a single species having discontinuous ranges is a moot point. It is clear that two races of one single species can exist with definite gaps separating their geographical ranges. Indeed, if our present concept of the mechanics of speciation is correct, it is inescapable that such a

[5] Extracted from Barton (1956. *Proceedings of the Biological Society of Washington* 69: 71–82).

SUZANNE L. COLLINS, CNAH

The Northwestern Garter Snake (*Thamnophis ordinoides*; top) and the Western Terrestrial Garter Snake (*Thamnophis elegans*; bottom) are two species of garter snakes that share the relatively small eyes of Butler's Garter Snake. However, their distribution and a suite of other dissenting characters preclude any assumptions of close relationships, suggesting that small eyes evolved independently in these lineages.

condition must sometimes exist. During the long period of time following the isolation of one segment of a population from others of its kind, while the gradual accumulation of changes in its genetic pattern is developing to the point where they are great enough to render it a recognizably distinct species, that population must of necessity belong to the species from which it has been isolated. The position of the final point of departure in such a situation, that point where the isolated population ceases to be conspecific with the parent stock, depends ultimately upon a subjective evaluation by the reviewer, colored by his own species concept. While caution must be exercised in the erection and continued recognition of species, it seem advisable in the absence of concrete contrary evidence to allow the present practice of regarding *butleri* and *brachystoma* as distinct species to continue unchanged.



SUZANNE L. COLLINS, CNAH

The Shorthead Garter Snake (*Thamnophis brachystoma*) is another species that was historically confused with Butler's Garter Snake. A. J. Barton's short note clearly showed them to be distinct at the species level.

Editor's Remarks

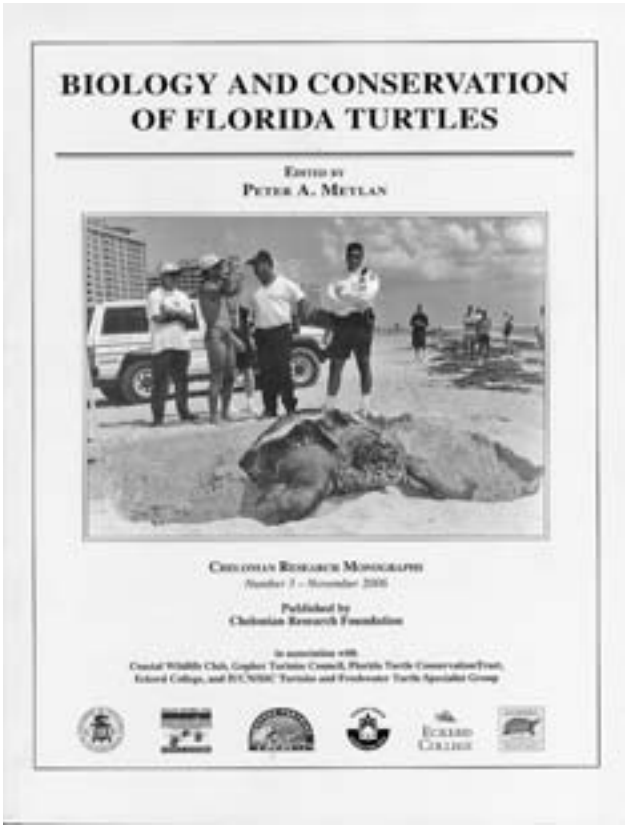
These two perspectives illustrate nicely the ongoing uncertainty and evolving definition of what constitutes a species (for non-technical reviews, see Powell. 2004. Species and subspecies: What do they mean and why should we care? *Iguana* 11: 108–113 and 2002. Understanding animal classification. *Iguana Times* 9: 18–26). At the time of Stejneger's article (1895), the scientific community was still adjusting to a classification based on relationships rather than mere similarities in appearance, although today's taxonomists still rely extensively on anatomical features. By the time of Barton's study (1956), the transition in philosophy had been completed, only to be replaced by disputes over varying applications of different species concepts. Our understanding of evolution and the role of DNA was still tentative (the structure of the molecule had been described only in 1953), and this remains an ongoing issue. However, the disagreements regarding the utility and relevance of different concepts of what a species is, which occasionally descend into lively debates, mean nothing to the organisms themselves. Still, the labels serve science and humanity by allowing us to identify groups of organisms in order to facilitate communication and to better understand evolutionary relationships and the complexities of nature.

That the subject of the selected pieces is Butler's Garter Snake (*Thamnophis butleri*) is no accident. This small snake (maximum known total length = 737 mm) not only serves as an effective illustration of the ever-changing nature of classification, but, in addition, has recently been the focus of a political controversy regarding the protected status of disjunct populations in Wisconsin (see Aprill. 2007. *Iguana* 14: 94–99). Using modern tools, studies of the Wisconsin populations may yet reveal them to represent a species distinct from *T. butleri* in the rest of the species' currently defined range, which extends from central Ohio and Indiana north through eastern Michigan and the extreme southern tip of Ontario. From a biological perspective, genetically unique populations deserve the same consideration by conservationists as recognized species. However, protection of the latter is certainly easier to justify to politicians, who may know little and care less about biology, but do understand the popular appeal of organisms — even snakes — found nowhere else but in their state.

BOOK REVIEWS

Conserving Florida's Turtles

Biology and Conservation of Florida Turtles. 2006. By Peter A. Meylan (ed.). Chelonian Research Monographs, No. 3, 376 pp. Hardcover Edition – ISBN: 0-9653540-2-4 – $ 60. Softcover Edition – ISBN 0-9653540-3-2 – $ 48.



Conant and Collins (1998. *A Field Guide to the Reptiles & Amphibians of Eastern and Central North America*. 3rd ed., expanded. Houghton Mifflin Co., Boston) provided the last scientific-based field guide of the amphibians and reptiles of Eastern and Central North America. Although that guide is utilized more frequently than any others by the scientific community as a single source for herpetofaunal information, it has become somewhat outdated. At last, Peter Meylan completed his long-awaited book that covers a single group (the turtles) from the State of Florida.

Contributions by 40 authors are arranged into seven main headings: Contributors, Dedication, Foreword, Introduction, Habitats and Ecosystems Utilized by Florida Turtles, Family and Species Accounts, and Epilogue. This volume is dedicated to the late Dr. Walter Auffenberg (1928–2004), former curator of Herpetology at the Florida Museum of Natural History, University of Florida.

The Foreword illustrates the association between turtles and humans, and also provides detailed information on turtle diversity, density, endemism, threat levels, and conservation priorities throughout the world. The exceedingly informative Introduction includes the ecological history of a few selected species, taxonomic arrangements of turtles and their correlation to the fossil record, and lists of Florida turtles accompanied by notes on geographic distribution and protection status (if any). The next section relates turtle conservation to habitat protection, specifically uplands, freshwater wetlands and aquatic ecosystems, coastal ecosystems, and artificial man-made habitats.

The majority of this volume (32 chapters, including 25 species accounts) falls under Family and Species Accounts. Species accounts are arranged by Family and begin with an introductory chapter to each Family. Each introduction consists of Family content, systematic placement, fossil record, extant geographic distribution, and ecological status. Species accounts are quite comprehensive and include a summary and coverage of conservation status, species recognition, taxonomic history, distribution, habitat relations, growth and reproduction, population biology, threats, ecological status, conservation options and solutions, and literature cited, along with numerous color photographs and range maps. The Florida map on page 32 is useful, especially for those not familiar with county names.

Referencing of voucher specimens in systematic collections is important and further illustrates the considerable amount of effort invested in these accounts. Although FLMNH is the correct acronym for the Florida Museum of Natural History, the recognized institutional code for this collection is incorrectly stated and should be UF (University of Florida).

On a positive note, the use of updated molecular techniques and changing philosophical points of view (i.e., evolving species concepts) may well lead to a number of unique turtle populations being recognized as full species in the near future. Unfortunately, a well-documented threat common to many species of turtles is their ongoing exploitation by humans for merchandise or food, not to mention the accidental toll of automobiles. A number of photographs (e.g., Figs. 2–7, 2–8, 5–16, 7–7, 20–11, 23–13, 23–14, 24–10, 25–8, 25–9) are particularly appalling. Concluding the book with the poem "Dead Turtle" is particularly appropriate. As the "summer sun tanned him to leather," this volume clearly demonstrates how humans have affected our beloved turtles.

The majority of illustrations, figures, maps, and photographs throughout this book are of high quality. Although including the number of records (i.e., sample size) in the figure heading of the geographic distribution for each species would have been beneficial, the amount of time and effort it took to compile these data using GIS is obvious. Despite these few criticisms, I highly recommend this book to anyone interested in North American turtles. It was written (and edited) in a style

suitable for either amateurs or professional herpetologists, and the price is eminently affordable.

Kenneth L. Krysko
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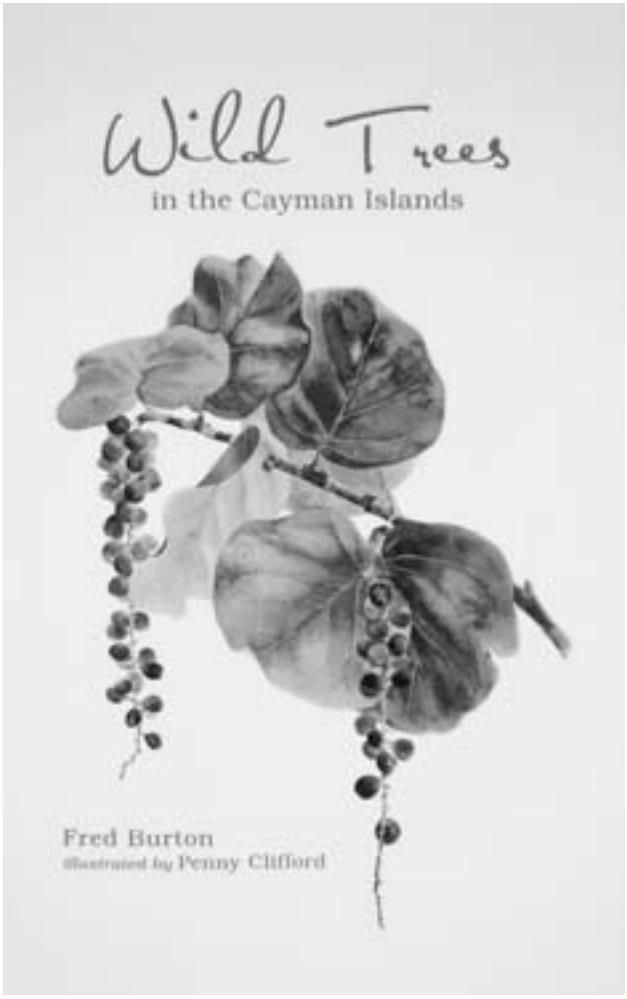
Contributors

Matthew J. Aresco, Ray E. Ashton, Jr., William J. Barichivich, Joan E. Berish, Michael Bresette, Kurt A. Buhlmann, Joseph A. Butler, C. Kenneth Dodd, Jr., Michael A. Ewert, Terence M. Farrell, J. Whitfield Gibbons, Margaret S. Gunzburger, George L. Heinrich, Richard Herren, John B. Iverson, Dale R. Jackson, Kevin P. Jansen, Chris Johnson, Peter G. May, Earl D. McCoy, Brian K. Mealey, Walter E. Meshaka, Jr., Anne Meylan, Peter A. Meylan, Paul E. Moler, Henry R. Mushinsky, Larry H. Ogren, Peter C. H. Pritchard, Anthony Redlow, Anders G. J. Rhodin, Jeffrey R. Schmid, Richard A. Seigel, Robert M. Shealy, Kelly Stewart, R. Brent Thomas, George E. Wallace, Dawn S. Wilson, Blair Witherington, Robert T. Zappalorti.

Plants and the Animals that Eat Them

Wild Trees in the Cayman Islands. 2nd ed. 2007. By Fred Burton, illustrated by Penny Clifford. International Reptile Conservation Foundation (IRCF), San Jose, California, on behalf of the National Trust for the Cayman Islands. 240 pp. Softcover – ISBN 987-1-4276-2168-9 – $ 20. Copies may be ordered from the National Trust (www.nationaltrust.org.ky) or from the IRCF (www.IRCF.org).



I once defined biology as the study of animals and their food, when an acquaintance, who happened to be a botanist, corrected me by saying that biology was really the study of plants and their parasites. Regardless of whose definition you favor, the reality is that all life forms on earth are inextricably intertwined, which explains in a round-about fashion how the International Reptile Conservation Foundation (IRCF) came to publish a book about trees. In fact, the Foundation's statement of purpose says that the organization works both for the conservation of reptiles and the natural habitats and ecosystems on which they rely. So, a book about trees, especially "wild" trees is not such a bizarre concept, particularly when one considers that the book also is about the Cayman Islands, home of the Grand Cayman Blue Iguana (*Cyclura lewisi*), the conservation of which the IRCF has supported from the organization's inception. In fact, all proceeds from the book are earmarked for the Blue Iguana Recovery Programme.

The most obvious purpose of a book about the trees of the Cayman Islands is to help the reader identify the myriad different species found on the three islands that comprise the nation. How well does it work? I'm not sure, but am inclined to think it does quite well. Unfortunately, I could not put it to a real test, since I haven't had the good fortune to visit the islands in several years. However, using photographs of trees and leaves and some material gleaned from herbaria that contained Caribbean species, the keys worked reasonably well, even for a biologist more inclined toward animals than their food. The only problems I encountered involved specimens from other West Indian islands, which might well have represented different varieties than those found in the Caymans (common, cosmopolitan species were easily and accurately identified). Regardless of my success, the choices were obvious, the language clear (even to one not entirely familiar with botanical jargon), and the options provided at each step generally corrected mistakes before venturing too far along the wrong path. The individual descriptions were

adequate to confirm (or deny) a proper identification, with drawings of the most critical features nicely complemented by the same clear language I found in the keys. An additional feature is that the bark of all species covered is illustrated in color. In some instances, bark can be definitive, but in many others, one looks just like the next. I might have preferred color photographs of flowers or fruits to those of the bark, but that's quibbling over a minor point. In the end, the tool worked, at least to the extent that I could test it. Maps and indices to common and scientific names round out the utilitarian features of this volume.

A less obvious purpose of the book, especially if you skip the introduction and go directly to the key and species descriptions, is to promote an appreciation of nature and stress its value to an island nation. As in so many other West Indian nations, the impact of European settlement was felt much earlier here than on the mainland, and ongoing development to accommodate population growth and a burgeoning tourism industry is threatening the few remaining wild places. As the Governor of the Cayman Islands stated in the preface to this second edition, nature "will become increasingly valuable, only if it is conserved." The destruction caused by Hurricane Ivan in 2004 clearly illustrated how an appreciation of trees is most intense when no trees are standing. Consequently, however, Ivan renewed interest in propagating native species, which generally are more tolerant of the hurricanes with which they evolved than more recent arrivals that never had to cope with 150-mph winds. A very brief section on propagation acknowledges that interest, less with detailed instructions than by pointing readers to resources available at the Queen Elizabeth II Botanic Park.

Aside from the principal functions, I very much enjoyed the historical perspectives presented in the introduction (presumably frustrated by impenetrable forests and an inability to find water in 1586, the men in Sir Francis Drake's fleet set fire to the woods and sailed away, beginning the deforestation that continues today). I laughed at the inclusion in the instructions on how to use this book the very prominent warnings about those trees that can cause considerable discomfort to those foolish enough to handle them (Maiden Plum, Manchineel, and, if you're on Little Cayman, Poison Tree). The reason for my wry humor is that many West Indians fear reptiles, especially snakes, but I've never encountered anyone who fears trees. Apparently, people distinguish between trees that can inflict pain and those that don't, but do not make the same distinction for animals… I also sympathized with the need to explain the use of names. Despite an effort to use local names when possible, that just didn't work in all cases. Sometimes a name applied to several species, sometimes a species had several names, and sometimes a species was so insignificant (no obvious utility and/or rare and inconspicuous) that it had no name at all. Having encountered similar situations that apply to animals, I long for the day when we all learn only the scientific names of species. Could that be so much harder? As a child learning to speak, I can only guess that one name is as good as another. I realize that scientific names sometimes change when we reclassify plants or animals to accommodate new information about their relationships, but at least each species generally has only one name. I also appreciated the necessary subjectivity of having to distinguish between trees and shrubs, which represent a continuum in which some species straddle the line (like lizards, trees and shrubs apparently don't read the textbooks that tell them what they are and how they should behave).

Criticisms essentially boil down to a single issue. I understand the reasons for including only wild trees (endemic and native species along with several "naturalized" forms, such as Coconut Palms, Mangos, and Tamarind, that are reproducing and sustaining populations in the wild), and I can relate to the desire to push people onto trails and into the bush where they can encounter and maybe learn to appreciate nature. However, I also face the reality that the animals I study often associate with introduced orchard or ornamental species in the less than pristine habitats in gardens and on the grounds of hotels and businesses. To truly understand these associations, I need also to identify the "real" interlopers in paradise. Including all introduced forms might quickly have become unwieldy, but the most common ornamentals surely could have been accommodated for those of us who often work along the boundaries between nature and artifice. Maybe in the third edition…

Robert Powell
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Kansas City, Missouri

CONSERVATION RESEARCH REPORTS

Amphibians and Reptiles Declining at La Selva, Costa Rica

Amphibians stand at the forefront of a global biodiversity crisis. More than one-third of amphibian species are globally threatened, and over 120 species probably have become extinct since 1980. Most alarmingly, many rapid declines and extinctions are occurring in pristine sites lacking obvious adverse effects of human activities. The causes of these "enigmatic" declines remain highly contested. Still, lack of long-term data on amphibian populations severely limits our understanding of the distribution of amphibian declines, and therefore the ultimate causes of these declines. WHITFIELD ET AL. (2007. *Proceedings of the National Academy of Sciences (USA)* 104: 8352–8356) identified a systematic community-wide decline in populations of terrestrial amphibians at La Selva Biological Station, a protected old-growth lowland rainforest in lower Central America. The authors used data collected over 35 years to show that population densities of all species of terrestrial amphibians had declined by 75% since 1970, and they demonstrated identical trends for all species of common reptiles. The trends are neither consistent with recent emergence of chytridiomycosis nor the climate-linked epidemic hypothesis, two leading putative causes of enigmatic amphibian declines. Instead, the data suggest that declines are due to climate-driven reductions in the quantity of standing leaf litter, a critical microhabitat for amphibians and reptiles in this assemblage. These results raise further concerns about the global persistence of amphibian populations by identifying widespread declines in species and habitats that are not currently recognized as susceptible to such risks.

GAD PERRY

Declines in populations of amphibians and reptiles, such as the Speckled Racer (*Drymobius margaritiferus*), at La Selva, Costa Rica, have been attributed to climate-driven reductions in the quantity of standing leaf litter.

Herpetofauna of Longleaf Pine Savannas

MEANS (2006. Chapter 6. Vertebate Faunal Diversity in Longleaf Pine Savannas. Pp. 155–213 in S. Jose, E. Jokela, and D. Miller (eds.), *Longleaf Pine Ecosystems: Ecology, Management, and Restoration*. Springer, New York) thoroughly reviewed the vertebrates (including 9 salamanders, 26 frogs, 29 snakes, 14 lizards, 1 amphisbaenian, and 10 turtles) that are characteristic species residing in longleaf pine savannas. The author discusses at length each of the specialists (species whose geographic limits are confined within or closely associated with the limits of longleaf pine, and which live in the longleaf pine community itself) and then the importance of temporary ponds, dead trees (snags, fallen logs), stumpholes or tree bases, fire, problems associated with pine plantation silviculture, habitat fragmentation, and declining species.

KENNETH L. KRYSKO

The Florida Worm Lizard (*Rhineura floridana*) is probably the most unusual of the 54 reptilian species known to occur in longleaf pine savannas.

Large Snakes in North-Central Florida

Little is known concerning home range and activity of large terrestrial snakes. During the course of an inventory of a large biological preserve in north-central Florida, DODD AND BARICHIVICH (2007. *Florida Scientist* 70: 83–94) tracked five snakes (Eastern Indigo Snakes, *Drymarchon couperi*, and Coachwhips, *Masticophis flagellum*) for periods of 49–322 days. A single Eastern Indigo Snake had a home range of 100–185 ha, depending on estimator, whereas the Coachwhips used smaller home ranges that varied individually and by season. The authors provided information on ecdysis, feeding activity, and retreat sites for the five tracked individuals, which includes the first such data on free-ranging Coachwhips. Gopher Tortoise and small mammal burrows were important retreat sites for both species, particularly during ecdysis. Both species frequented upland habitats, with Coachwhips using longleaf pine and xeric oak sandhills and former pastures, and the Eastern Indigo Snake preferring upland mixed pine and hardwoods. Although sample sizes are small, these results, coupled with data on the movements of other upland species, suggest that large terrestrial snakes require substantial amounts of contiguous habitat in order to maintain populations.

KENNETH L. KRYSKO

Eastern Indigo Snakes (*Drymarchon couperi*) in Florida had a home range of 100–185 ha and preferred upland mixed pine and hardwoods.

Movements and Home Ranges of Otago Skinks

Otago Skinks (*Oligosoma otagense*) are among New Zealand's largest and rarest lizards. GERMANO (2007. *Journal of Herpetology* 41: 179–186) examined movements and home ranges using

JENNIFER M. GERMANO

Otago Skinks (*Oligosoma otagense*) are among New Zealand's largest and rarest lizards. These individuals, bearing radio-transmitters, were part of a study to determine movements and home ranges.

radio-telemetry at the Redbank Reserve near Macraes Flat, Central Otago. She tracked 13 skinks from December 2003–April 2004 for 26–111 days. Neither distances moved nor frequencies of movements differed significantly between males and females. Home range estimates (using the 100% minimum convex polygon method) ranged from 200–5,400 m^2, with male home ranges significantly larger than those of females, and those of non-gravid females significantly larger than those of gravid females. Home range overlap was substantive and interactions between individuals occurred frequently. Capturing animals increased frequency of movements, especially on days immediately following capture. Data generated by this study will be incorporated into a management plan for the species.

NATURAL HISTORY RESEARCH REPORTS

Desert Tortoise Hibernation

NUSSEAR ET AL. (2007. *Copeia* 2007: 378–386) examined the onset, duration, and termination of hibernation in Desert Tortoises (*Gopherus agassizii*) over several years at multiple sites in the northeastern part of their geographic range in Utah, Arizona, and Nevada, and recorded the temperatures experienced by tortoises during winter hibernation. The timing of hibernation by Desert Tortoises differed among sites and years. Environmental cues acting over the short-term did not appear to influence the timing of the hibernation period. Different individual tortoises entered hibernation over as many as 44 days in the fall and emerged from hibernation over as many as 49 days in the spring. This range of variation in the timing of hibernation indicated a weak influence at best of exogenous cues hypothesized to trigger and terminate hibernation. Regional trends do appear, as hibernation tended to begin earlier and continue longer at sites that were higher in elevation and generally cooler. The emergence date was generally more similar among study sites than the date of onset. While the climate and the subsequent timing of hibernation differed among sites, the average temperatures experienced by tortoises while hibernating differed by only about five degrees from the coldest to the warmest site.

THOMAS WIEWANT, WILD HORIZONS

Local climate affected timing of hibernation, but average temperatures experienced by hibernating Desert Tortoises (*Gopherus agassizii*) differed very little.

Feeding Ecology of Rattleless Rattlesnakes

Crotalus catalinensis is a rattleless rattlesnake endemic to Santa Catalina Island, in the Gulf of California, Mexico. Some authorities have hypothesized that the lack of a rattle in this species is a stealth adaptation for hunting birds in vegetation. AVILA-VILLEGAS ET AL. (2007. *Copeia* 2007: 80–84) provided detailed data on the diet of these snakes from samples obtained during nine trips to the island in 2002–2004. Over two-thirds (70%) of the diet was composed of the Santa Catalina Deer Mouse (*Peromyscus slevini*). The remaining prey were lizards (*Dipsosaurus catalinensis*, *Uta squamata*, and *Sceloporus lineatulus*). The diet shifted ontogenetically, and feeding activity was greater during the dry season. The diet of this species is only a small subset of the diet of its supposed closest relative, *C. ruber*, probably as a result of limited prey diversity on the island. The lack of birds in the diet argues against the hypothesis relating the lack of a rattle with a stealth hunting technique for birds in vegetation. However, because *P. slevini* is partially arboreal, the lack of a rattle might be an adaptation for stealth hunting for mice in vegetation.

L. LEE GRISMER

Rattleless Santa Catalina Island Rattlesnakes (*Crotalus catalinensis*) feed primarily on mice and lizards, arguing against the hypothesis that the lack of a rattle facilitates stealthy hunting for birds in vegetation.

Habitat Affects Predator Attack Frequencies

Predators use characteristics such as pattern and shape in forming search images of prey, thereby influencing the evolution of prey morphology. In lizards, sit-and-wait foraging species are thought to have body shapes that enhance their ability to remain cryptic to predators. Structurally complex habitats provide more opportunities for prey to avoid detection, thus predator foraging efficiency is predicted to be higher in structurally simple habitats. SHEPARD (2007. *Herpetologica* 63: 193–202) used clay lizard models to test whether predation varies among lizards with different body shapes and whether predation varies among habitats in the Brazilian Cerrado with different structural characteristics. Predator attack frequency was highest in the most structurally complex habitat, but the probability of being attacked was higher in more open microhabitats. Attack frequencies did not differ significantly among the four lizard model shapes. Lizards and birds were the main attackers of models, and attacks were primarily directed toward the models' heads. Results demonstrated that predator-prey interactions are largely influenced by the environmental context and scale, and that body shape alone does not efficiently promote crypsis.

NEWSBRIEFS

Suspect Sliders Stopped

The Florida Fish and Wildlife Conservation Commission approved new regulations concerning many species that are not native to Florida. The new rules add the Red-eared Slider (*Trachemys scripta elegans*) to a list of "conditional species" that are covered under this rule. The rule will prohibit the possession of any Red-eared Slider less than four inches (10 cm) carapace length after 1 July 2008, except by special permit. Red-eared Sliders possessed prior to 1 July 2007 (when the rules are proposed to become effective) will be exempt, as will those with distinctive aberrant color patterns (e.g., albino, amelanistic); the latter sell for high prices, are unlikely to be released, and probably have low survival value in the wild. The rule does not prohibit breeders from exporting sliders out of state. The Florida reptile pet industry expressed its support for the new rules. Thanks go to everyone who wrote to the Commission last year in support of establishing rules that would help to prohibit the mass sales of Red-ear Slider hatchlings in Florida (at least some of which are released into the wild to compete or hybridize with native turtles).

KEVIN ENGE

Red-eared Sliders (*Trachemys scripta elegans*) have become a plague in Florida, where they have been introduced, presumably via the pet trade. Many have been released into the wild, where they are breeding and competing or even hybridizing with native turtles. The female (top) was collected in Miami, the adult (middle) was photographed in Oak Grove Park (Miami), and the 28 turtles in the tubs (bottom) were trapped in one night using 12 traps at Crandon Park on Key Biscayne.

E. PIERSON HILL

Redbelly Water Snakes (*Nerodia erythrogaster*) are essentially ubiquitous in the Carolinas. This image graces the Carolina Herp Atlas homepage (www.carolinaherpatlas.org).

Carolina Herp Atlas on the Web

The Carolina Herp Atlas, a new online database developed by Davidson College and partly funded by the N.C. Wildlife Resources Commission (WRC), will harness the power of "backyard biologists" with an interactive website that could shed new light on countless animals across North and South Carolina. "Many species of amphibians and reptiles are very difficult to sample because they're either rare, difficult to find, or active at times that make it tough," said Mike Dorcas, an associate professor with Davidson's biology department. "The Carolina Herp Atlas provides a method where we can rapidly collect information on the distribution of amphibians and reptiles, and that information is desperately needed for us to make management decisions."

"In the past, we've relied on a small number of herpetologists to provide the critical information that is used by the Wildlife Resources Commission to prioritize conservation activities for reptiles and amphibians," said Chris McGrath, a biologist with the N.C. WRC. "The Carolina Herp Atlas is a powerful new tool that gives all citizens an opportunity to contribute scientific information that will help the Commission achieve our wildlife conservation goals."

For more information or to become a member, visit the Carolina Herp Atlas at www.carolinaherpatlas.org.

Raleigh, North Carolina

Funding Cut for the Savannah River Ecology Laboratory

The Savannah River Ecology Laboratory (SREL) is a research unit of The University of Georgia, located on a U.S. Department of Energy (DOE) facility and primarily funded by DOE. Founded in 1951, SREL provides independent evaluations of the ecological effects of the nuclear reactor located on the site. Activities include extensive research, including many valuable herpetological studies, as well as education and outreach. A major benefit of the Savannah River Ecology Lab has been its long-term research and steady accumulation of detailed field records that can provide insights into, among other things, the possible consequences of climate change on the complex ecology of the region. Unfortunately, we may lose this valuable resource. Funding was exhausted at the end of May 2007, and the lab will be forced to close unless additional funds can be obtained.

During the past year, SREL has worked with Savannah River Site (SRS) representatives to implement a new 5-year cooperative agreement with task-based funding, similar to what has been used for the past 20+ years. According to written and verbal communications from DOE, the funds have been budgeted for SREL tasks that have been underway since September 2006, and the funds are actually at the SRS to complete these

tasks. However, the funds have not been released to SREL, a decision made by officials at DOE Headquarters in Washington, D.C. The nature of the tasks proposed and approved by SRS managers appears not to have played a role in this decision.

The SREL has been home to herpetologists Drs. J. Whitfield Gibbons and Justin D. Congdon and their colleagues, collaborators, and students for 30+ years. Gibbons, who received the esteemed Henry S. Fitch Award for Excellence in Herpetology in 2006, and his colleagues have conducted ecological research on reptiles and amphibians since 1967, producing over 700 research papers and 15 books. The SRS has been a host to several long-term ecological studies, resulting in the marking of over 20,000 turtles, and the capture and re-release of 1.4 million amphibians and 20,000 snakes. Closure of SREL would also bring to an end an ongoing, long-term study of an amphibian community at Rainbow Bay that was initiated in 1978 and continues today with the help of researcher David Scott. The loss of this long-term amphibian study comes at a critical time, when amphibian population declines are being reported globally and as many as 32% of amphibian species are threatened. SREL was one of the founding constituents of Partners in Amphibian and Reptile Conservation (PARC; www.parcplace.org), and members of SREL were present at the first stakeholder meeting to establish PARC in Atlanta in 1998.

"Closure of SREL would be a tragic loss to the global science of reptile and amphibian ecology," stated Brian Todd, SREL graduate student and doctoral candidate at the University of Georgia. "The attempted closure of SREL is yet another warning of the increased hostility against independent environmental oversight and ecological research that we have seen in recent years. Today it may be SREL, but tomorrow it could undoubtedly be any other ecological research lab. It saddens me deeply that the closure of SREL may come so soon after the losses of SREL founder Dr. Eugene Odum and vocal SREL advocate and alumnus Dr. Frank Golley. It does no honor to their memory to dismantle the lab that they put on the map. We must come together and take a stand to declare that 'enough is enough' or we will see no end to the loss of important institutions like SREL and others."

In late May, the Investigations and Oversight (I&O) Subcommittee and the Energy and Environment (E&E) Subcommittee of the House Committee on Science and Technology called on Energy Secretary Samuel Bodman to continue funding for the Savannah River Ecology Lab. "We are currently unsure why and how the decision was made to terminate the Department's support for the facility," wrote I&O Subcommittee Chairman Brad Miller (D-NC). "We ask that you continue to provide support to the lab until the Committee can thoroughly review the Department's actions in this case." "The Subcommittees deserve a chance to review the logic that led DOE to terminate support for a lab that has been doing world-class research since 1951," added E&E Subcommittee Chairman Nick Lampson (D-TX). "On the face of it, this is a difficult action to understand."

Miller and Lampson called the lab indispensable in tracking the environmental conditions around the Savannah River site and providing unbiased information to the public and the government about those conditions. The Chairmen have asked for continued support for the lab from DOE pending further review by the Subcommittee. They have also asked that the Department provide all records since 1 August 2006 regarding the lab and the decision to terminate support.

All citizens, including researchers, parents, teachers, and children, who want to urge DOE to release the funding for SREL to continue tasks approved by SRS managers should contact individuals who could make this happen. The more people who express their concern, the more likely it is that action will be taken. You should write letters to your congressional representatives, newspapers, or anyone else you think should know.

SUZANNE L. COLLINS, CNAH

Ornate Chorus Frogs (*Pseudacris ornata*) are among the 1.4 million amphibians that have been examined in long-term studies conducted at the Savannah River Ecology Laboratory since 1967. The lab will be forced to close unless additional funds can be obtained after threatened cuts in federal support.

Kansas River Flood Triggers Snake Movements

Alfred Cramer and Lisa Bryson had been sitting on large, jagged rocks watching the rapid flow of the Kansas River when they suddenly realized they had close company. "There was a snake and a muskrat, or something like a rat," Cramer said of a couple of critters they saw crawling among the rocks near the river's edge just east of the Bowersock Dam. Cramer and Bryson decided it was time to move off the rocks to the dirt path behind them. They were among a steady stream of people who continued to gather Tuesday on the banks of the Kaw (= Kansas) to watch the slowly receding river and the tremendous amount of debris it carried.


SUZANNE L. COLLINS, CNAH

Flooding causes snakes along rivers to move to higher ground. The Northern Water Snake (*Nerodia sipedon*) is a common species in the Kaw River system, and probably accounts for most sightings of snakes during springtime floods.

Lawrence residents Jonathan Doerr and Steve Dahlberg also saw snakes on the bank. "We thought there was a Copperhead over there, but someone said it was something else," Dahlberg said, pointing to a now-vacant slab of rock. The flood may cause more snake sightings near the river, but that doesn't mean there are more of them, said John Simmons, collections manager in the division of herpetology at Kansas University's Natural History Museum. Simmons indicated that the rising water has flooded the snakes' usual places to sit and hide, causing them to move around, looking for places to go. Water snakes in the Lawrence area are not venomous, and Water Moccasins, which are venomous, to not occur in the area.

Mike Belt
Lawrence Journal-World, 9 May 2007

Adding Insult to Injury

A Chesterton man faces possible charges of illegal possession of venomous snakes after one of his "pets" bit him. Robert Urbanski, 66, was airlifted to Methodist Hospital in Indianapolis after suffering the snake bite. Urbanski told rescue personnel he was handling a Western Diamondback Rattlesnake (*Crotalus atrox*) when it bit him.

An Indiana Department of Natural Resources (DNR) conservation officer arrived at the home and learned that two rattlesnakes were still inside the house. Urbanski told investigators that he had purchased the snakes five days earlier at a swap meet in Hamburg, Pennsylvania. One was a Western Diamondback and the other a Dusky Pygmy Rattlesnake (*Sistrurus miliarius*). Owning venomous snakes without a permit is illegal in Indiana. The DNR said Urbanski did not have a permit. The case was referred to the Porter County Prosecutor's Office for possible charges for illegal possession of venomous snakes.


SUZANNE L. COLLINS, CNAH

A "pet" Western Diamondback Rattlesnake (*Crotalus atrox*) bit its owner, who may face charges for illegal possession of a venomous snake.

The snakes are being held at the DNR's Michigan City office and will be destroyed. They cannot be returned to the wild. Western Diamondbacks are commonly found in the southwest, whereas Pigmy Rattlesnakes are found in Florida. Neither is indigenous to northwestern Indiana.

Tom Wyatt
Northwest Indiana Post-Tribune
7 & 8 May 2007

A License to Kill Gopher Tortoises

Workers buried the 30-pound Gopher Tortoise (*Gopherus polyphemus*) on a Lee County construction site, its shell crushed by a backhoe. Two weeks later, despite a spinal injury, the determined tortoise dug its way out. The remarkable resurrection led a wildlife expert to nickname the 16-inch-long tortoise "Phoenix." It was the largest Gopher Tortoise ever found in the wild. It died last week.

For 16 years, Florida officials have allowed developers to bury Gopher Tortoises alive and pave over their burrows, in exchange for paying money into a fund to buy land for tortoises elsewhere. Because of their low metabolic rate, tortoises can take months to suffocate under convenience store parking lots, shopping centers, and new subdivisions.

By this year, the state's pay-to-pave program had issued permits to bury more than 94,000 Gopher Tortoises. Now the species is in sharp decline, and tortoise experts blame the permitting program. "It's a massive loss of tortoises," said George Heinrich of Heinrich Ecological Services in St. Petersburg and a former co-chairman of the Gopher Tortoise Council, a group of biologists concerned about the animal's future.

State wildlife officials have decided to end the program by 31 July 2007, prompting a rush by developers to beat the deadline. Up to a dozen applications a week have been sent in for the last permits to kill Gopher Tortoises, according to Rick McCann, who runs the permit program for the Florida Fish and Wildlife Conservation Commission.

Four months ago, for instance, the Orlando-Orange County Expressway Authority got a permit to kill more than 400 Gopher Tortoises whose burrows were in the path of a new highway. Before the bulldozers could crank up, the Humane Society of the United States


CHUCK SCHAFFER

Florida's "pay-to-pave" program had issued permits to bury more than 94,000 Gopher Tortoises (*Gopherus polyphemus*).

lodged a protest. Last month the expressway authority agreed to drop its plans to kill the tortoises and agreed to move them to a Gopher Tortoise preserve area in the 48,000-acre Nokuse Plantation in the Panhandle.

The Humane Society is eager to see the pay-to-pave program end, said Jennifer Hobgood, program coordinator in the society's Tallahassee regional office. But Hobgood is concerned about the rush to beat the deadline. The permits the state wildlife commission are issuing now have no expiration date, so developers who get them can use them any time in the future. "They would be permitted to kill limitless numbers of tortoises indefinitely," Hobgood said.

No one knows for sure how many Gopher Tortoises remain, but more live in Florida than anywhere else. However, the habitat Gopher Tortoises favor also is popular with developers. By 2003, more than 1.7 million acres of Florida land that was once tortoise habitat had been turned into home sites, roads, shopping centers, and the like, according to the wildlife commission. In 1979, state wildlife officials included them on a list of imperiled animals as a "species of special concern." That meant no one could harm or harass one without the state's permission.

Since 1991, developers who wanted to build in Gopher Tortoise habitat could choose between two state-authorized solutions: Write a check to the state and pave over the burrows, suffocating the occupants, or pay someone to find all the Gopher Tortoises and move them. Moving tortoises was the feel-good choice, McCann said, but it didn't always work. The tortoises often tried to find their way home, only to be run over; or they carried a respiratory disease that then spread to other tortoises already on their new home turf. For a while, the state required developers who wanted to relocate Gopher Tortoises to pay to test them for the disease first, making that option much more expensive than paying to kill the tortoises.

McCann contended that the pay-to-pave program was, in a way, better for Gopher Tortoises, because the money collected from developers was used to buy and preserve 25, 000 acres of tortoise habitat. Unfortunately, that makes up for only one-fifth of the habitat that's been wiped out, Hobgood said. Meanwhile, the government has sanctioned suffocating tens of thousands of the animals.

In a report last summer, a panel of state wildlife experts estimated that the population of Gopher Tortoises in Florida has declined by more than half in the past 60 to 90 years. That persuaded state officials to take the first step toward bumping the tortoise up to "threatened," one rung below "endangered." The change is long overdue, said Matt Aresco, conservation director of Nokuse Plantation.

Craig Pittman
St. Petersburg Times
7 May 2007

Monitor Lizard Shot in Orlando

A 4½-foot monitor lizard that made waves in the Lost Lake subdivision earlier this month is believed to be dead, Casselberry police said. A police officer caught the lizard sunning on the bank of a pond and shot it twice. The creature crawled back into the water after being struck, and authorities have not been able to locate the body.

Officers had been given the go-ahead to take out the vicious lizard after several attempts to trap it, including one in which it dragged a trapper into the water. Police think the creature once was a house pet that either escaped or was released when it grew too large to be confined. Residents in the area feared for their pets' and children's safety after close encounters with the lizard.

Sarah Langbein
Orlando Sentinel
27 May 2007

Cairo Snake Smuggler Snared

Customs officers were stunned when a passenger was caught trying to smuggle 700 live snakes onto a plane. The man was stopped at Cairo's international airport with the serpents stashed in small cloth sacks in a carry-on bag. Among the snakes were two poisonous cobras. The would-be smuggler said he had hoped to take them into Saudi Arabia and sell them.

Police confiscated the snakes and turned the passenger over to the prosecutor's office, accusing him of violating export laws and endangering the lives of other passengers. According to customs officials, the would-be smuggler claimed that the snakes are wanted by Saudis who display them in glass jars in their shops, sell them to research centers, and keep them as pets.

news.sky.com
25 May 2007

WOLFGANG WÜSTER

Customs officers in Cairo arrested a passenger trying to smuggle 700 live snakes, including two Egyptian Cobras (*Naja haje*), onto a plane. The snakes were destined for Saudi Arabia.

TODD CAMPBELL

An Orlando police officer shot a Monitor Lizard (*Varanus niloticus*) sunning on the bank of a pond. Residents in the area feared for their pets' and children's safety.

Los Angeles Gator Captured

One of America's most-wanted has finally been caught — after spending the past two years lounging in a Los Angeles lake. For months, the 2-m American Alligator (*Alligator mississippiensis*) called Reggie evaded authorities and made more headline news than the average A-list celebrity. The late "Crocodile Hunter" Steve Irwin had even offered to help nab Reggie at one point, when the local newspaper kept a "Reggie Watch" on its masthead.

DESIREE WONG

"Reggie," a 2-m long American Alligator (*Alligator mississippiensis*) became quite a celebrity before his capture in a Los Angeles (California) lake.

Reggie even inspired a song, two children's books, and innumerable T-shirts. Every day, crowds of people converged on Harbor City's Lake Machado, hoping to catch a glimpse of the elusive creature that was dumped in the park by its owner back in 2005.

However, when Reggie's time was up — as he sunbathed in a secluded area of the park — he refused to surrender without a fight. In true Hollywood style, as TV helicopters hovered above, and fans and paparazzi gazed on, Reggie thrashed around as six men attempted to restrain him while reptile expert Ian Recchio hooked his neck so the alligator's jaws could be taped shut. Reggie was then loaded onto a truck by firefighters bound for the Los Angeles Zoo, where he will be kept in quarantine for up to two months. Clearly fame doesn't come without a price.

www.itv.com
25 May 2007

New Texas Regulations Protect Nongame Wildlife

On 24 May, the Texas Parks and Wildlife Commission approved a measure that will prohibit commercial collection of all wild turtles from public waters and public land in the state, but will still allow collection of three varieties of turtles on private property, including ranch stock tanks and farm ponds. The turtle provisions are part of new Texas nongame regulations that create a "white list" of 84 species that can be collected and sold and prohibit the commercial collection of all other nongame animals not on the list.

The new regulations are designed to help monitor and regulate the escalating commercial collection and sale of wild turtles, snakes, and other nongame animals (species not covered under hunting and fishing regulations) in Texas. The change would protect at least 15 species of turtles and more than 200 other nongame wildlife species that are not on the white list.

The Texas Parks and Wildlife Department (TPWD) staff had proposed new nongame regulations in April that would have prohibited the commercial collection of turtles everywhere in the state. However, public comments during the past few months showed that while about 90 percent of those who commented support turtle protection, some landowners expressed concerns about not being able to effectively manage turtles within their property.

"We currently have a huge and growing demand for turtle meat, coupled with unrestricted commercial collection, and we need to move toward sustainability," said Matt Wagner, Ph.D., TPWD wildlife diversity program leader, in a briefing to commissioners on 23 May. "It is a fact that unrestricted take of any species from the wild, including turtles, over the long term leads to population declines. If we need to further restrict activity in the future, based on ongoing monitoring, we can."

The new regulations will allow commercial collection of three varieties of turtles from private property in Texas, including the Red-eared Slider (*Trachemys scripta elegans*), the Common Snapping Turtle (*Chelydra serpentina*), and the five varieties of softshell turtles (*Apalone* spp.). Commercial collection of all wild turtles will be prohibited on public land and in public waters of the state, such as rivers and public lakes.

Wildlife biologists say the new nongame regulations are needed in part because of increased pressure from out-of-state collectors and dealers, fueled in part by a growing demand for turtle meat sold to China and other Asian markets. In recent years, an average of 94,442 turtles per year were collected or purchased by at least 50 Texas dealers, mostly for export from the state.

Wildlife experts are expressing particular concern about the turtle trade. Abundant scientific research indicates that unregulated commercial turtle harvest from the wild is not sustainable. At least four southeastern states have prohibited commercial collection of turtles from the wild, and most others are more restrictive than Texas.

A total of 84 species are on the new white list, with annual permitting and rigorous reporting required for anyone possessing more than 25 specimens in the aggregate of listed animals for commercial purposes.

"For any nongame species not on the white list, there will be a possession limit of up to six nongame animals at one time for personal use," said Matt Wagner, TPWD wildlife diversity program director. "We want kids, for example, to be able to keep a pet turtle or two."

SUZANNE L. COLLINS, CNAH

Spiny Softshell Turtles (*Apalone spinifera*) may still be collected for commercial use on private land after implementation of new Texas regulations addressing the unrestricted take of turtles from the wild.

Box Turtle Conservation Workshop

A Box Turtle Conservation Workshop will be held 9–10 November 2007 at Patuxent Research Refuge's National Wildlife Visitor Center in Laurel, Maryland. This is the third in a series of workshops aimed at bringing together individuals actively engaged in box turtle research and conservation to assess the status of these species, the challenges they face, and to devise strategies to help secure their future. The workshop is sponsored by the Jug Bay Wetlands Sanctuary, The Humane Society of the United States, and the North Carolina Zoological Park.

This workshop will focus exclusively on research studies of box turtle population status, ecology, and life history strategies. Box turtle populations are declining throughout their range, yet few efforts have been made to assess current population status in the interest of developing long-term conservation strategies. The principal goals of this workshop will be to provide current information, where it exists, on population size assessment throughout the species' ranges, and to initiate population studies in as many states as possible where these turtles occur.

SUZANNE L. COLLINS, CNAH

Box turtle populations are declining throughout their range, a November workshop will focus exclusively on research studies of box turtle population status, ecology, and life history strategies.

Nature Museums are Threatened

The great American natural history museum could be headed for the vulnerable species list, alongside the polar bear and the redwood tree. A national survey last year showed nature museums' annual bottom lines sinking chronically into the red, and some of the leading institutions have winnowed their staffs since the decade began.

Science leaders worry that financial pressures and demands to boost attendance could prompt natural history museums to self-lobotomize, cutting away brain matter — the pure scientific research that's largely hidden from the public — to save the exhibits and educational programs that are the institutions' visible cash generators. Research is what makes natural history museums special: The mandate to venture into nature and bring back new finds and fresh questions, while maintaining millions of specimens. Some scientists say that amid global warming and a rapid die-off of species, these collections encompassing the world's life forms, living and extinct, have become especially valuable for the clues they might hold. How have creatures through the eons adapted or failed as their environments have changed? What's happening now? Biologists say those questions are vital in coping with today's challenges, and they can't be answered fully without museum collections. "With some major exceptions, there's been a 20-year retraction" in museum-based natural history research, said Leonard Krishtalka, who directs the museum at the University of Kansas. "We're slowly witnessing, by the whittling of curatorial positions, the extinction of incredible knowledge. For many organisms there are only one or two world experts, and they retire with no one to replace them."

Officials with the American Assocation of Museums, which conducted the 2006 survey that tags natural history as an underperforming sector, cautioned against drawing strong statistical conclusions, but there's no shortage of anecdotal woe. The Milwaukee Public Museum lies fiscally prostrate. The Academy of Natural Sciences in Philadelphia, the deficit-ridden, 195-year-old granddaddy of American natural history museums, sold some of the family jewels to prop up its finances last year, earning $1 million for a chunk of its mineral collection. The Smithsonian Institution's natural history museum in Washington, D.C., which draws more than 5 million visitors a year and has the nation's largest collection, with more than 126 million specimens, is seen as deeply troubled; the staff has shrunk almost a third since 2000. Even the American Museum of Natural History in New York, which stands with the Smithsonian and the Field Museum in Chicago as the Big Three of natural history exhibits and research, has had to economize. The museum has reduced its staff about 11% this decade, although curators were untouched. The L.A. museum, which vies with San Francisco's California Academy of Sciences for fourth place in national rankings, turned to shock therapy in 2003, laying off 7% of its staff to save $2 million and reverse a long string of deficits. Most remaining employees endured a wage freeze that ended this year.

Universities aren't a strong alternative, scientists say, because many have given up their expensive-to-maintain natural history collections and focused their efforts elsewhere, including biomedical research, genetics, and technology.

Experts even worry that the very name "natural history museum" has a Victorian tinge that makes it harder to compete for audiences and funding. "It harks back 300 years and doesn't resonate anymore," said Krishtalka, the University of Kansas museum director who reclassified his venue as a "biodiversity institute." The challenge and potential salvation, he believes, lie in making visitors and donors understand the connection between the fate of the Earth and all those seemingly inert specimens tucked into drawers or arrayed on back-room shelves in jars of alcohol. "Our collections and knowledge help inform solutions to the problems the planet's facing," Krishtalka said. "Our time is now, and museums that reach out and grab that mission strongly will be the ones who survive."

Mike Boehm (*mike.boehm@latimes.com*)
Los Angeles Times
3 June 2007

JOHN BINNS

Natural History museums are essential for addressing many different kinds of questions. For example, the study elevating the Grand Cayman Blue Iguana (*Cyclura lewisi*) to full-species status involved the examination of museum specimens.

2007 Gopher Tortoise Council Meeting

The 29th annual meeting of the Gopher Tortoise Council (GTC) is scheduled for 11–14 October 2007 at Adventures Unlimited, a private retreat facility north of Milton, Florida, in the western Florida Panhandle. GTC is a group of scientists, agency personnel, educators, and laypersons who are interested in the ecology and conservation of the Gopher Tortoise (*Gopherus polyphemus*) and the upland ecosystems in which it lives, especially longleaf pine-wiregrass habitats. The annual meeting is an informal venue to share ideas and research results. Students are especially encouraged to attend and present their research. Friday's special session, "Real World Solutions for Conservation," will highlight the application of scientific research, unique approaches, and new partnerships to solving conservation challenges.

SUZANNE L. COLLINS, CNAH

The Gopher Tortoise Council is a group of scientists, agency personnel, educators, and laypersons who are interested in the ecology and conservation of the Gopher Tortoise (*Gopherus polyphemus*) and the upland ecosystems in which it lives.

EPA Sued Over Pesticide Poisoning of San Francisco Bay Area Endangered Species

The Center for Biological Diversity filed a lawsuit against the U.S. Environmental Protection Agency (EPA) for violating the Endangered Species Act (ESA) by registering and allowing the use of 60 toxic pesticides in habitats for nearly a dozen San Francisco Bay Area endangered species without determining whether the chemicals jeopardize their existence. May 27th would have been the centennial birthday of Rachel Carson, whose pioneering 1962 book *Silent Spring* raised awareness about the deadly impacts of pesticides on the environment and human health, and led to a federal review of pesticide policy and an eventual ban on DDT in the United States.

"Ending the use of known poisons in habitat for our most endangered wildlife is an appropriate 100th birthday tribute to Rachel Carson, who alerted us to the hazards of exposure to toxic chemicals almost half a century ago," said Jeff Miller, conservation advocate with the Center. "Unfortunately, the EPA has not learned from her legacy and still has no plan to adequately assess impacts while registering and approving pesticide uses that pose a clear and present danger both to imperiled species and human health."

At least 61 million pounds of pesticide active ingredients were applied in Bay Area counties from 1999 through 2005 — over 8.5 million pounds annually. Actual pesticide use may have been several times this amount since most home and commercial pesticide use is not reported to the state. Under the Bush administration, the EPA has consistently failed to consult with the U.S. Fish and Wildlife Service (USFWS) on endangered species impacts when registering and authorizing use of toxic pesticides.

Studies by the USFWS, EPA, U.S. Geological Survey (USGS), and California Department of Pesticide Regulation show that at least 60 pesticides of concern are used or accumulate in or adjacent to (upstream or upwind) habitat for 11 Bay Area endangered species, including freshwater and wetlands habitat for the California Tiger Salamander (*Ambystoma californiense*) and San Francisco Garter Snake (*Thamnophis sirtalis tetrataenia*) and terrestrial habitat for the Alameda Striped Racer (*Masticophis lateralis euryxanthus*). According to the Service, pesticide use may threaten an additional 19 of the 51 Bay Area animal species listed under the ESA.

The EPA is required under the ESA to consult with the USFWS over registration, re-registration, and approved uses of pesticides that may endanger listed species or adversely affect their designated critical habitat. The consultation is designed to ensure that the EPA avoids authorizing pesticide uses that jeopardize the existence of endangered species. The Center is seeking pesticide-use restrictions in habitat for the 11 Bay Area species until EPA and USFWS assessments of pesticide impacts have been completed. The consultations should result in some permanent use restrictions for harmful pesticides.

Similar protections were obtained by the Center for the California Red-legged Frog (*Rana aurora draytonii*) under a settlement signed by the EPA and the pesticide industry last October. The use of 66 pesticides is now prohibited in and adjacent to core frog habitats statewide for three years, until the EPA completes consultations.

"The registrations of contaminants known to be deadly to endangered species and harmful to human health, such as atrazine, should be cancelled," said Miller. "Given the proximity of agricultural pesticide spraying to some Bay Area residential areas, surveys that have detected accumulation of pesticides in local creeks and San Francisco Bay, and what we know about movement of pesticides through drift and runoff, we should be wondering if we are next when we see endangered species poisoned by these chemicals."

In 2006, the Center published "Poisoning Our Imperiled Wildlife: San Francisco Bay Area Endangered Species at Risk from Pesticides" (www.biologicaldiversity.org/swcbd/Programs/science/pesticides/BayAreaPesticidesReport.pdf), a report analyzing the EPA's dismal record in protecting endangered species and the agency's ongoing refusal to reform pesticide registration and use in accordance with scientific findings. Despite mounting evidence of harm to endangered species and human health, the Bush administration keeps dodging use restrictions for dangerous pesticides and has tried to exclude wildlife agency oversight of the pesticide-registration process. In 2004, the Center published "Silent Spring Revisited: Pesticide Use and Endangered Species" (www.biologicaldiversity.org/swcbd/programs/science/pesticides/ REPORt.pdf), detailing the decades-long failure of the EPA to regulate pesticides harmful to endangered species despite numerous lawsuits, three of which have been filed by the Center. The EPA still has no meaningful plan to protect endangered species from pesticides.

Numerous studies have definitively linked pesticides with significant developmental, neurological, and reproductive damage to amphibians. Pesticide contamination can cause deformities, abnor-

mal immune system functions, diseases, injury, and death of frogs and salamanders. Studies by Dr. Tyrone Hayes at the University of California have strengthened the case for banning atrazine, a potent chemical that is the most common contaminant of ground, surface, and drinking water nationwide. Dr. Hayes demonstrated that atrazine is an endocrine disruptor that "assaults male sexual development," interfering with reproduction by chemically castrating and feminizing male frogs. Atrazine has also been linked to increased prostate cancer, decreased sperm count, and high risk of breast cancer in humans. Thousands of pounds of atrazine are used each year in the Bay Area in close proximity to habitat for the Red-legged Frog and Tiger Salamander.

The Bush administration has attempted to undercut Endangered Species Act protections by changing how pesticide impacts on wildlife are evaluated and making it easier for pesticide manufacturers to ignore the effects of their products on endangered plants and animals. The EPA proposed new regulations in 2004 that would have removed input from expert wildlife agencies in determining whether pesticides threaten endangered species, but a federal court overturned these new rules in 2006.

The lawsuit, report on pesticide impacts to Bay Area species, maps of pesticide use, and information about the listed species are available at: www.biologicaldiversity.org/swcbd/programs/science/pesticides/bay-area.html

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Freshwater and wetlands habitat used by the endangered San Francisco Garter Snake (*Thamnophis sirtalis tetrataenia*) has been contaminated by pesticides. A lawsuit seeks to prevent further applications until a thorough review of the effects of potentially harmful agents has been properly assessed.

OBITUARY

George Thomas McDuffie (1927–2007)

George McDuffie, a well-known Ohio herpetologist, passed away on 15 April 2007. Born in Cincinnati, Ohio, on 25 August 1927, George received his Bachelors (1952), Masters (1956), and Doctoral degrees (1960) from the University of Cincinnati, the latter doing research on the natural history of Copperheads in the Buckeye State. His research on these snakes was published in 1963 [Studies on the size, pattern, and coloration of the Northern Copperhead (*Agkistrodon contortrix mokasen* Daudin) in Ohio. *Journal of the Ohio Herpetological Society* 4: 15–22]. He was one of the founding members of the Ohio Herpetological Society, which evolved into the Society for the Study of Amphibians and Reptiles.

During the 1950s and 1960s, George mentored many young herpetologists in southwestern Ohio, and most of them experienced their first real snake hunt under his watchful eye. He is remembered for his sense of humor, and on field trips to Shawnee State Forest in southern Ohio, many students and colleagues on their first field trip listened in stunned silence to the plethora of risqué limericks that he sang with gusto (and which they eventually memorized and sang also). More importantly, he took the time and made the effort to teach them how to find amphibians and reptiles, and much of what they know today about field herpetology can be traced directly back to George.

At the first Shawnee Herpetological Weekend held at Shawnee State Forest in May 2006, keynote speaker Joseph T. Collins (who grew up in Cincinnati and was mentored by George during his teenage years) dedicated the event to George McDuffie, and spoke fondly of his influence. Memorial contributions should be sent to the Torch Lake Protection Alliance, P.O. Box 706, Bellaire, MI 49615.

George McDuffie with a Western Diamondback Rattlesnake (*Crotalus atrox*) ca. 1960. Photograph courtesy CNAH files.

SPECIAL AWARD

Fred Burton Honored[1]

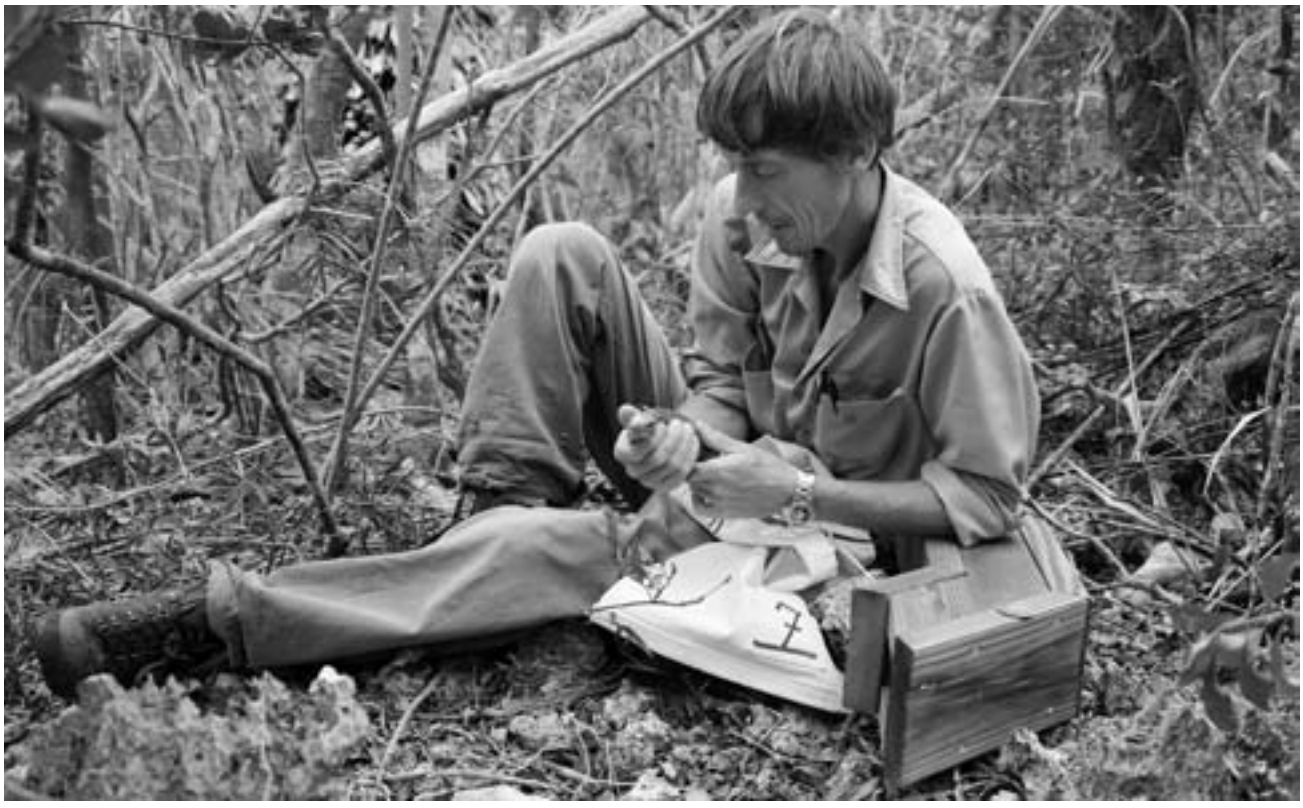
Natural scientist Frederic James Burton's decision not to pursue a career in academia has proved to be a singular and far-reaching blessing for the Cayman Islands. Mr. Burton is this year's Queen's Birthday Honors recipient of the Member of the Most Excellent Order of the British Empire (MBE) award for "services to the conservation of endangered species in the Cayman Islands."

Mr. Burton's unflagging efforts, characterized by his dedication, devotion, diligence, innate modesty, and unassuming approach, provide the backdrop for his contribution to conservation in general and endangered species in particular. He also has found time to write two books, bringing attention to native vegetation, some of which is in imminent danger of vanishing without protection. He also has coauthored a number of research papers in natural history journals. However, he is best known locally and internationally for his stellar work in ongoing attempts to save from extinction Grand Cayman's largest land animal, the Blue Iguana (*Cyclura lewisi*).

He has been exceedingly effective and committed to conservation advocacy and education, fund-raising, and elevating public awareness. He has secured international funds and volunteers for ongoing initiatives to preserve the Islands' natural resources for present and future generations. He helped start several of these initiatives aimed at protecting and cataloging the flora and fauna on all three of the nation's islands, as well as mapping vulnerable tracts of land and identifying native vegetation.

"I felt very strongly that I wanted to make a difference in the world in some shape or form rather than sit in an academic ivory tower," Mr. Burton recalled about his decision not to go for a doctoral degree. After he obtained a master's degree in natural sciences from Cambridge University, Mr. Burton, who was born in the picturesque Lake District in England in 1957, rejected Ph.D. prospects and took instead a position as Research Assistant in Cayman's Mosquito Research and Control Unit in 1979. Spending much of his early life in Kuwait, where his father was employed, translated into his acquiring a strong interest in reptiles and other fauna of the Arabian Desert.

[1] Fred Burton and the Blue Iguana Recovery Programme were featured in *Iguana* 10(2):53–55 (2003).



Frederic James Burton, shown here releasing a captive-bred Grand Cayman Blue Iguana (*Cyclura lewisi*) in order to augment wild populations, is this year's Queen's Birthday Honors recipient of the Member of the Most Excellent Order of the British Empire (MBE) award for "services to the conservation of endangered species in the Cayman Islands."

In 12 years' service with MRCU, he became Deputy Director and sometimes single-handedly managed three roles as research officer, deputy head, and Acting Director. "It was a very difficult and stressful time," he remembers. However, through his work he learned first-hand of the rapid destruction of his mangrove forest study sites, which succumbed to tourism and residential development, especially along the West Bay corridor.

When the National Trust was established in 1988, he began volunteering until he was seconded by government full-time to the Trust in 1991. His important work in environmental conservation covering a number of areas began as a volunteer in 1990, and includes: (1) Surveying the land given to the 624-acre Salina Reserve in the eastern districts of Grand Cayman and mapping its biodiversity; (2) Coordinating work to start the QEII Botanic Park and being mainly responsible for the development of the park until its official opening in 1996; and (3) Spearheading conservation efforts to help save the critically endangered Grand Cayman Blue Iguana from the brink of extinction. As a Trust staff member, his main achievements include: (1) Starting the acquisition of the Mastic Reserve; (2) A 10-year effort to fully protect the Booby Pond Nature Reserve in Little Cayman; and (3) Acquisition of a block of land to start the Cayman Brac Parrot Reserve to help conservation of this endangered species, which is one of two parrot subspecies endemic to the Cayman Islands. "I am very proud to have been a part of that," Mr. Burton says. He also led a public awareness campaign on the Central Mangrove Wetlands. "A huge amount of work needs to be done there; we also need a policy on that."

Of the award, he takes it in stride with his characteristic modesty, but hopes the recognition that it brings to environmental protection will lead to a better future for Cayman. "I hope it helps bring some attention to the fact that environmental issues are becoming important," he comments.

"There are many others who like me are working way beyond the point of duty and equally deserving of this kind of recognition, especially my colleagues at the National Trust and the Department of Environment. I hope that happens. For instance, DOE has been working for years to modernize our environmental legislation. If one thing happens this year, I do hope it is the passage of the National Conservation Law," he adds. Currently, only about 6.5% of the entire Cayman Islands land is preserved. "It is generally accepted that at least 10% of unique habitats, and 20% or more of ecologically critical habitats, should be protected in all countries. We have a ways to go," he notes.

Cayman is indeed distinct from many other Caribbean islands in that much of its natural habitat is intact, albeit largely in private ownership. This is especially the case with the dry forests on all three islands, which manifest distinct characteristics. "Dry forests are endangered worldwide, and the Caribbean dry forests are in a dire state," he observes. "It is in our national interest to save those forests."

On all three islands, and particularly on Grand Cayman, ongoing and potential development threatens the status quo, he says. It is against this backdrop that he hopes that the current Development Plan review will be successful in designating specific areas as protected after the previous two attempts failed, thereby futilely involving hours upon hours of involvement from the community seeking better conservation.

Cayman's plus factors include our "charismatic flagship species," our parrots and Blue Iguanas, which catch the eye of tourists. "There is no question that Cayman's natural environment and unique Caymanian species are huge capital assets that underwrite our tourism marketing, both official DOT's and the private sector's," he comments. Environmental sustainability will not be achieved "unless we are prepared to set aside areas to underpin our tourism product and maintain our national identity — or the reasons why the Cayman Islands are recognized as the Cayman Islands," he posits.

One such success story is the Blue Iguana Recovery Programme. Credit for the success lies directly at Mr. Burton's door, sometimes literally, such as when he had to play surrogate parent to young hatchlings housed in adequate, airy cages in his own backyard. Over a half-dozen organizations in the US and UK have been directly involved in various aspects of the ongoing iguana conservation program, primarily through his efforts. The Programme has seen a remarkable level of volunteerism, and local corporate financing has contributed as much as 50% of the funding. A number of hitherto innovative steps for Cayman such as radio-tagging and micro-chip implanting became possible through Mr. Burton's engagement of the international community.

He started the Blue Iguana captive breeding program in 1990 from a pair obtained from Florida to help boost the numbers of animals in the wild by releasing captive-reared iguanas into designated areas. With international volunteers, he undertook a census of the wild population that revealed a grim picture of a species teetering on the verge of extinction with a mere 10–25 animals clinging to life in 2002. Since then, through controlled releases of two-year-old hatchlings at the Botanic Park and the Salina Reserve, the Blue population has spurted to 250 following a recent release of two-year-old hatchlings. The day the captive breeding program ceases will be a day of rejoicing for all — and especially Mr. Burton.

His first book, in collaboration with Ms. Penny Clifford, titled *Wild Trees in the Cayman Islands*, first published in 1997, will be out in an expanded second edition with photographs in July. His second book, titled *Threatened Plants of the Cayman Islands*, is a red-list assessment, will also contain a number of photographs, and is close to publication. The style displayed in both the books is typical of his practicality and pragmatism. "There is no use creating information if people cannot access it," he comments.

Mr. Burton has a lot of work ahead in analyzing the huge body of information gathered over the last three years from radio-tracking Blue Iguanas released in the Salina Reserve. Those data will guide the next steps in the conservation program. This is something to which he is looking forward with his customary incisiveness in the coming months.

Pat Eubanks

IRCF ON THE MOVE

Pharmaceutical manufacturer **Eli Lilly and Company** has awarded a $24,000 grant to Project Heloderma partners Zootropic, IRCF, and Zoo Atlanta for the preservation of the Guatemalan Beaded Lizard, *Heloderma horridum charlesbogerti*. The project will receive $8,000 a year for the next three years. Lilly has developed and marketed a medication for the treatment of Type II diabetes under the trade name "Byetta." The drug is a synthetic version of the exendin peptides found in *Heloderma* venom.

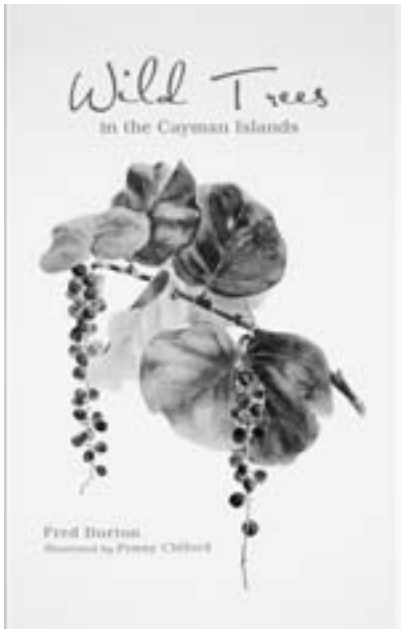
A $19,600 grant from the **Disney Wildlife Conservation Fund** has also been awarded to Project Heloderma, specifically to cover the cost of the local environmental education program. The program reaches 6,000 school children and 4,000 local farmers from 20 Mayan Chorti and Ladino communities in the Motagua Valley, home to the remnant population of the Guatemalan Beaded Lizard. The grant will help cover the cost of personnel and equipment, as well as providing environmental awareness T-shirts, posters, and interactive magazines for students from June 2007 through July 2008.

Project Heloderma/Project Palearis

The late model Suzuki Samurai donated by the IRCF to Project Heloderma/Project Palearis has just received a custom graphic treatment featuring the logos of partners Zootropic, IRCF, and Zoo Atlanta. The vehicle graphics complement the Project Heloderma/Project Palearis environmental education program theme, which is recognized by thousands of local school children and farmers.

Wild Trees in the Cayman Islands

The IRCF recently published *Wild Trees in the Cayman Islands*, 2nd ed. (see Book Review, p. 194). The book will be distributed in the Cayman Islands; however, limited quantities will be available through the IRCF. The IRCF contributed time and resources with the intention of providing revenue for the Blue Iguana Recovery Program.



IRCF ID Cams

The IRCF recently fabricated cases and assembled ten customized battery-operated CCTV camera units to help the Blue Iguana Recovery Program assess survival and dispersal of Blue Iguanas released into the Salina Reserve on Grand

Cayman. Based on a commercial indoor-grade surveillance unit, the cameras have been mounted in airtight dry cases with an optical window for the lens. The cameras will be placed in front of rock holes where they will be used to determine if the holes are in use as iguana retreats, and to identify occupants by their bead-tag combinations. Team Blue 2007 is currently laying out 20 x 40 m sampling areas and counting active iguana retreats in them; the cameras will substitute for constant human monitoring. The results will be used to estimate the population of released Blues surviving and still occupying the protected release areas.

Volunteers Sought for Fieldwork on Little Cayman, Cayman Islands

Sister Isles Rock Iguana (***Cyclura nubila caymanensis***)**.** Two or three Little Cayman fieldworkers are required to work with the project leader during October–November. Primary tasks (in three phases) include (instructions provided): (1) mapping nest sites in various habitats, (2) conducting a structured population assessment using distance sampling methods, and (3) excavating hatched nests to measure nest fecundity in key habitats. Please visit www.ircf.org/volunteer.html, and select Sister Isles Rock Iguana.

Skills and challenges: Demands extreme physical exertion in tropical heat and humidity, off-trail in densely vegetated terrain. Expect thorny plants and extremely hostile rock in some areas. A high level of physical fitness and stamina is essential. Color vision (to distinguish red, orange, green, blue, yellow, and white glass beads through binoculars) is important. Aptitude for recording quantitative data (GPS, data entry forms, etc.). Exposure to toxic plants may cause allergic reactions. Scratches, cuts, and bruises are to be expected!

Rewards: Learning and practicing wildlife conservation research techniques; exploring the Cayman Islands' least populated, most natural island, teeming with wildlife; working with a healthy, abundant wild iguana population.

What we expect: That you will be available to carry out tough fieldwork involving long hours on at least a three-days-on, one-day-off schedule; that you will carefully follow guidance and instructions from the group leader while on duty; and that you will commit to collecting the most accurate and highest quality information possible.

What we offer: Free shared accommodations (probably project-rented space with bedding, etc. provided), local transportation, and access to the specialized equipment and information you need to be effective and productive.

Team Blue Volunteers Sought for the Blue Iguana Facility

Year-round Team Blue volunteer opportunities are available at the Blue Iguana breeding facility in the Queen Elizabeth II Botanic Park on Grand Cayman. Please visit www.ircf.org/volunteer.html to learn more.

The IRCF expresses sincere gratitude and appreciation to the many individuals and organizations whose support and contributions help further the Foundation's mission of preserving endangered reptiles and the natural habitats and ecosystems that support them.

IRCF

CaribSea
Michael D. Kern
Susan Solomon
Joel Friesch
Jim Schauf (FAST)
Desiree Wong
Marianne Lee
Ivan Schwab
Miki England
Virginia Huang
Atla Brewer
Ron Greenberg
Horned Lizard Conservation Society
Alex Jones
Richard and Victoria Burt
David Friant

Project Heloderma

Disney Wildlife Conservation Fund
Eli Lilly
Zoological Society of San Diego
Wildlife Discovery Center
Oklahoma City Zoo
Jacksonville Zoo
VIN Foundation
BowTie, Inc. (*Reptiles Magazine*)
Sandy Quinn
Erik Anderson
Sterling Williamson

Blue Iguana

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IRCF
International Reptile Conservation Foundation

Editors' Remarks

The mission of the IRCF is working "to conserve reptiles and the natural habitats and ecosystems that support them." This journal is a part of that effort, but with the additional goal of educating our readers. Because our readers represent considerable diversity, ranging from academic researchers and agency and zoo professionals to hobbyists, education must be equally diverse, using various "tools" such as articles presenting new information about reptiles, ecosystems, and conservation efforts, and features about people (profiles), places (travelogues), and ongoing conservation efforts (IRCF on the Move and Focus on Conservation). In addition, we try to broaden the range of what we can cover with the inclusion of historical perspectives, book reviews, short summaries of previously published material (Conservation Research Reports and Natural History Research Reports) and "newsbriefs." Although we frequently receive feedback about specific articles or features, we would be most interested in hearing from readers about the kinds of items they most enjoy and, maybe more importantly, things they would like to see us include in future issues. Please feel free to contact any of the editors at any time. We'd like to hear from you.


DURRELL WILDLIFE CONSERVATION TRUST

The Giant Montserrat Galliwasp (*Diploglossus montisserrati*), featured in a 2006 newsbrief, is one of the most endangered lizards in the world. Threatened by an active volcano, the species was thought to be extinct until recently. This is an example of information that is educational for all readers of *Iguana*, regardless of experience, education, or profession.

The Editors of *IGUANA*

Statement of Purpose

The International Reptile Conservation Foundation works to conserve reptiles and the natural habitats and ecosystems that support them.

The International Reptile Conservation Foundation, Inc. is a non-profit 501 c(3) California corporation.

Membership Information

IGUANA, the Journal of The International Reptile Conservation Foundation, is distributed quarterly.

Annual Rates:

Individual U.S. Membership	$25.00
Individual Membership, Digital (Adobe PDF)*	$25.00
Institutional U.S. Subscription	$30.00
International Membership (including Canada)	$55.00
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Additional copies are available upon request at $6.00 each plus postage.

*The Adobe PDF is optimized for web publishing and does not provide the quality and resolution of the archival printed version, especially noticeable in photographs and complex graphics.

www.IRCF.org

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Membership Questions?

Email: info@IRCF.org, or contact AJ at 860-236-8203, or write to: IRCF, 3010 Magnum Drive, San Jose, CA 95135

Solicitations

The IRCF encourages contribution of articles, letters to the Editor, news items, and announcements for publication in IGUANA. General articles can deal with any aspect of reptilian biology, including conservation, behavior, ecology, physiology, systematics, or husbandry. Submission of photographs to accompany articles is encouraged. Manuscripts may be submitted via e-mail (send to AJ@IRCF.org). Authors of one page or more of print will receive a free copy of the journal in which their contribution appears, and will receive a PDF file of their article for distribution.

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Advertising Policy

We advertise only non-living products (except feeder insects). For advertising rates and options contact Sandy Binns, Advertising Director, at SB@IRCF.org or 3010 Magnum Drive, San Jose, CA 95135.

 Iguana, Conservation, Natural History, and Husbandry of Reptiles (ISSN 1098-6324) is published quarterly by the International Reptile Conservation Foundation, a nonprofit, tax-exempt organization, 3010 Magnum Drive, San Jose, CA. Periodical postage paid at San Jose, CA.

FOCUS ON CONSERVATION

Sonoran Mountain Kingsnake (*Lampropeltis pyromelana*)

POLLY CONRAD

The Sonoran Mountain Kingsnake (*Lampropeltis pyromelana*) inhabits rocky montane habitats from 850 m to almost 2800 m (2800–9100 ft) in the western United States and adjacent regions in Mexico. In Nevada, the documented distribution of the species is limited to isolated populations in mountain ranges along the state's eastern border. However, due to the remoteness of this area and the secretive habits and low densities of the species, the distribution of the Sonoran Mountain Kingsnake is unknown. Data on distribution, population trends, and genetics of Nevada populations are needed to properly manage the species.

POLLY CONRAD

Sonoran Mountain Kingsnakes are protected in Nevada and also are listed as a "Species of Conservation Priority" in the state's Wildlife Action Plan (www.ndow.org). The Nevada Department of Wildlife and Great Basin National Park have formed a partnership to conduct surveys to determine the species' distribution, abundance, and habitat preferences. Genetic samples are collected for comparisons with other populations to determine what relationships exist between Nevada kingsnakes and the closest metapopulations. The results of these surveys and genetic analyses will aid greatly in the management of this protected reptile. In addition to the local conservation efforts, the Southwest Chapter of Partners in Amphibian and Reptile Conservation (PARC) is addressing the conservation of the Sonoran Mountain Kingsnake on a regional — or range-wide — level. Partners from a wide range of organizations representing management, education, research, non-governmental and not-for-profit organizations, Native American tribes, the pet trade, zoos, and hobbyists are working together to identify and implement the conservation needs of this species throughout its range.

Polly Conrad, Nevada Department of Wildlife, Las Vegas NV 89108
Bryan Hamilton, Great Basin National Park, Baker NV 89311

TOMAS WALLER

Yellow Anacondas (*Eunectes notaeus*) harvested as part of the Yellow Anaconda Management Program (YAMP) in Formosa Province, Argentina. Snakes are held alive for biological studies before being killed and skinned. See article on p. 160.

The Green Basilisk (*Basiliscus plumifrons*) is a large, arboreal, bright-green lizard found along streams throughout lowland Central America. See article on p. 172.

JAMES R. MCCRANIE