Adult male Utila Iguana (*Ctenosaura bakeri*) relying on crypsis against a dead tree trunk in the mangrove swamps of Utila. *Photograph by John Binns.*

Conservation Status of Spiny-tailed Iguanas (Genus *Ctenosaura*), with Special Emphasis on the Utila Iguana (*C. bakeri*)

Gunther Köhler

Forschungsinstitut und Naturmuseum Senckenberg, Sektion Herpetologie, Senckenberganlage 25, D-60325 Frankfurt a. M., Germany (gkoehler@senckenberg.de)

Photographs by the author.

Abstract.—None of the species in the genus *Ctenosaura* are currently listed under the Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES). Despite their protected status by national law in México and most Central American countries, living specimens and eggs of the large species (e.g., *C. acanthura*, *C. pectinata*, and *C. similis*) can be found in markets or offered for sale along major roads by local people. An increasing threat to some of the smaller species is the international pet trade. Species of *Ctenosaura* with small geographic distributions are particularly vulnerable to these pressures, considerably more than their widely distributed congeners. The Utila Iguana (*Ctenosaura bakeri*), for example, is an endangered species endemic to Isla de Utila, which is located off the Caribbean coast of Honduras. To preserve the Utila Iguana in its natural environment, the "Conservation Project Utila Iguana" was founded in 1994. The main activities of the project include a broad education and information program for the local community, investigations into the biology of the species, a headstart program, and the protection of iguana habitat.

Key Words: Spiny-tailed Iguanas, *Ctenosaura bakeri*, México, Central America, Utila Island, Conservation

Introduction

Ctenosaura, commonly known as Spiny-tailed Iguanas, is a genus of Neotropical lizards in the family Iguanidae (Frost and Etheridge 1989), which corresponds to the iguanines of Etheridge and de Queiroz (1988). *Ctenosaura* includes 17 valid species that are distributed from southeastern Baja California and Sonora in western México and from Tamaulipas in eastern México southward along both the Pacific and Caribbean versants through most of Central America to central Panamá (Buckley and Axtell 1997, Grismer 1999, Köhler et al. 2000): *Ctenosaura acanthura* (Shaw), *C. alfredschmidti* Köhler, *C. bakeri* Stejneger, *C. clarki* Bailey, *C. conspicuosa* Dickerson, *C. defensor* (Cope), *C. flavidorsalis* Köhler and Klemmer, *C. hemilopha* (Cope), *C. macrolopha* Smith, *C. melanosterna* Buckley and Axtell, *C. nolascensis* Smith, *C. oaxacana* Köhler and Hasbun, *C. oedirhina* de Queiroz, *C. palearis* Stejneger, *C. pectinata* (Wiegmann), *C. quinquecarinata* (Gray), and *C. similis* (Gray), as well as at least one undescribed species in the *C. quinquecarinata-flavidorsalis* complex (Köhler and Hasbun 2001; Hasbun and Köhler, unpublished data).

Most ctenosaurs inhabit arid and subhumid areas in open habitats such as dry forests and savannas. In the humid Caribbean lowlands, *Ctenosaura* is relatively scarce and localized in dry and open habitats. One species, the Honduran endemic, *C. bakeri,* is exceptional because it lives exclusively in humid mangrove forests (Köhler 1995). Ctenosaurs feed mostly on plant matter, including leaves, flowers, and fruits. However, juveniles and, to varying degrees, adults also consume a variety of invertebrates (mostly insects, crabs, and spiders) and vertebrates (e.g., smaller lizards). All species reproduce oviparously with a single clutch per year (Wiewandt 1982). However, ctenosaurs in captivity have been observed producing two clutches 2–3 months apart (personal observation for *C. bakeri*). Whether multiple clutches per season ever occur in the wild remains unknown. Clutch size differs significantly between species: 2–4 eggs in *C. defensor*; 5–15 in *C. bakeri, C. clarki, C. flavidorsalis,* and *C. quinquecarinata*; 11–33 in *C. melanosterna*; and usually 30–50, exceptionally to 88 eggs, in large species such as *C. pectinata* and *C. similis* (Köhler 1996, 1997, 1998a). Duration of egg incubation varies little across species, usually taking around 90 days at a temperature of 29–31 °C (Köhler 1997, 1998a).

Conservation Status of Ctenosaura

No species in the genus *Ctenosaura* is currently listed under the Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES). In México, only four species (*C. acanthura, C. hemilopha, C. pectinata,* and *C. similis*) are listed in the NOM-ECOL-059-94, first published in the Diario Oficial de la Federacion on 16 May 1994. In this document, *C. similis* and *C. pectinata* are listed as "amenazada" (threatened),

Adult male *Ctenosaura pectinata* from Oaxaca, México.

Adult female *Ctenosaura pectinata* from Oaxaca, México.

whereas *C. acanthura* and *C. hemilopha* are listed as "sujeta a proteccion especial" (with special protection) (Victor Hugo Reynoso, personal communication). None of the other Mexican species of *Ctenosaura* are listed.

Meat and eggs of most *Ctenosaura* are consumed by local people throughout the Mesoamerican range of the genus (Fitch and Henderson 1977, 1978). Despite being protected by national law in most Central American countries, living specimens and eggs of the large species (*C. acanthura, C. pectinata,* and *C. similis*) can still be found in markets or offered by local people for sale along major roads (unpublished observations for Nicaragua, Honduras, El Salvador, and México, 1994–2001). Iguana hunters still commonly sew the animals' mouths closed and pull out tendons to tie the legs together.

Some of the smaller species, such as *C. quinquecarinata* and *C. defensor*, are considered to have medicinal properties if consumed. In northern Nicaragua, local people believe *C. quinquecarinata* to be venomous. As a result, they try to eliminate this lizard whenever it is encountered. For example, they use small rocks to block the entrance to *C. quinquecarinata* retreats in hollow fence posts, making it impossible for the animal to leave. This usually leads to the death of the trapped iguana, evidenced by piles of bones in blocked hollow posts (Hasbun and Köhler, personal observations).

An increasing threat to some of the smaller species (especially *C. quinquecarinata*) is the international pet trade. We found evidence of commercial hunting of this species in Nicaragua. Even protected species endemic to countries that do not allow ctenosaurs to be exported for the pet trade (e.g., *C. defensor* from the Yucatán Peninsula, México) show up in international trade due to smuggling. In August 2000, ten living *C. defensor* were confiscated at the Frankfurt airport by German customs agents. A Mexican citizen had illegally shipped the animals hidden in a wooden pyramid addressed to a German citizen. According to a written document found within the pyramid, similar illegal transactions had occurred before this shipment was confiscated (R. Simon, German Custom Investigation Service, Frankfurt Branch, Wildlife Prime Unit, personal communication).

Species of *Ctenosaura* with small geographic distributions are more vulnerable to the pressures mentioned above than their more widely distributed congeners. In light of this, the insular forms deserve special attention. Off the northern coast of Honduras in the Caribbean Sea is an island chain known as the Bay Islands. The smallest and most westerly of these islands is Utila, with an area of 41 km^2. Despite its small size, Utila supports an impressive endemic ctenosaur, *C. bakeri*. Although four juveniles of *C. bakeri* were collected in the late 1960s, the adults were unknown to science until the early 1990s (de Queiroz 1990). In 1994, *C. bakeri* was rediscovered during an expedition to Utila by the Senckenberg Museum (Köhler 1995). Subsequent research revealed that this species is threatened with extinction as a result of intensive hunting pressure by the local community.

The Utila Iguana (*Ctenosaura bakeri*)

Ctenosaura bakeri inhabits mangrove swamps on Utila, which cover approximately 6 km^2 (14%) of the island. Temperatures during the day range from 30–35 °C and nighttime temperatures vary from 25–27 °C. Relative humidity ranges from 70–80% during the day to 95–100% at night. Males reach a total length of 80 cm (maximum recorded snout-vent length = 31 cm; maximum recorded weight = 900 g); females are about 30% smaller. Given that *C. bakeri* prefers hollow branches and trees as retreats, the few remaining old mangrove stands on Utila with hollow branches and dead upstanding trunks provide the most important habitat for iguanas on the island. The diet of *C. bakeri* consists primarily of mangrove leaves, buds, and flowers (Black Mangrove preferred), but also includes insects and crabs (mostly Fiddler Crabs).

The breeding season for *C. bakeri* begins at the end of the rainy season. Copulation has been observed between mid-January and mid-March. During the nesting season (mid-March through late April), females migrate from mangrove to sandy coastal regions, covering distances up to a kilometer. The females spend several days digging before they complete their nest burrows. Burrows are composed of a tunnel approximately 40–60 cm long, reaching a depth of 25–40 cm, and ending in a nest chamber with a diameter of 12–15 cm. Females lay from 5–19 eggs before backfilling the hole and leaving an air space over the clutch. After egg deposition, females promptly return to the mangrove swamp. The eggs incubate at a temperature of 30–31 °C, and juveniles hatch after approximately three months. In contrast to the adults, young *C. bakeri* are usually observed on dead wood near the ground. With the onset of the rainy season, they start climbing higher in the vegetation. The uniform gray-brown coloration of the juveniles is remarkable for the genus, as juveniles of other *Ctenosaura* species exhibit either brown and green markings (*C. palearis, C. quinquecarinata*) or are almost entirely green (*C. acanthura, C. hemilopha, C. pectinata,* and *C. similis*). The absence of green coloration in juvenile *C. bakeri* is probably related to their preferred habitat. The young of this species are ground dwellers who inhabit the edges of mangrove swamps, where their gray-brown coloration provides excellent camouflage. Together with fallen trees, the abundant aerial roots of mangroves provide important hiding places for the juveniles (Köhler 1995).

An adult male *Ctenosaura similis* is about to be caught with a noose; Yoro, Honduras.

Bound *Ctenosaura pectinata* in a market in Tehuantepec, Oaxaca, México.

Conservation Project Utila Iguana

To preserve *C. bakeri* in its natural environment on Utila, I founded the "Conservation Project Utila Iguana" in 1994 in cooperation with the Honduran Nature Conservation Office (AFE-COHDEFOR) and German and international organizations. Since 1997, this project has been a joint project of the Zoological Society Frankfurt (ZGF) and the Senckenberg Nature Research Society (SNG), Frankfurt. The primary goals of the project are to: (1) develop a broad education and information program for the local community, (2) investigate the natural history and reproductive ecology of *C. bakeri*, (3) begin a headstart program, and (4) protect iguana habitat on Utila. In addition, a survey of the herpetofauna of Utila resulted in many new records for amphibians and reptiles on the island, as well as the discovery of two undescribed species of endemic anoles (Köhler 1998b).

With funding from the ZGF, the project's Iguana Research and Breeding Station was constructed and officially put into operation on 25 April 1998. The Station makes effective and continuous work possible, serves as a base for scientists and conservationists, and has become an important center for environmental awareness and education on Utila. In 1999, a headstart program was initiated with encouraging results. Our strategy is to capture gravid females on nesting beaches and to move them to enclosures equipped for nesting where they can deposit their eggs in a safe environment. When egg laying is complete, the iguanas are released at their site of capture. The spent females swiftly return to the protection of the mangrove swamps, where, without their eggs, they are of little interest to poachers. Using this strategy, we are able to improve the likelihood that these particular animals will survive the current nesting season and reproduce again the following year. The eggs are then artificially incubated in vermiculite at 28–32 °C. Half of the hatchlings are released into the mangrove swamp immediately after hatching, while the remainder is raised for 12 months to help surpass the period of maximum vulnerability to predators.

The Visitor Center on the ground floor of the Station offers an attractive presentation of information about the Utila Iguana, as well as other aspects of Utilan flora and fauna, to both Utilians and tourists. Informing the local people of the threats to their unique iguana is vital to the long-term success of the project. The people of Utila must become aware that this creature will disappear forever unless protective measures are implemented. This presents a challenge, particularly given that the islanders widely believe that replacement iguanas can be brought in from the mainland if those on the island should die out. Only through continuing education will local people become convinced that the Utila Iguana exists nowhere else in the world.

Raising environmental awareness in children is of particular importance to the project. Since 1994, we have visited the schools of Utila numerous times each year to work with teachers and pupils regarding nature and species conservation on Utila. Integrative tasks have been carried out with the students in addition to slide shows.

Subadult male *Ctenosaura flavidorsalis* from La Paz, Honduras.

Once the Station opened, groups of schoolchildren could visit and learn through public exhibits about the flora and fauna of Utila and their endangered status. The problem of waste disposal on Utila is also being addressed within the framework of the education program.

Given that hunting and habitat destruction still occur, a nature sanctuary will also be needed. Although the activities of the project have been important and positive steps, iguana hunting has yet to be significantly reduced. While legislation exists to protect the Utila Iguana, hunters are not actively deterred and hunting continues daily. We commonly observed hunters with three to eight adult iguana carcasses in their bags. During the egg-laying season, hunters not only kill gravid females, but also plow through beach sand to find iguana eggs.

Most recently, the Utila Iguana has become threatened by destruction of its habitat. A large-scale international airport has been opened on Utila, part of a rapid and extensive development program that neglects to take ecological considerations into account. Several new resorts and hotels are being built, as well as a four-lane highway from the airport to the town. On the north side of the island, where the most important iguana nesting sites are located, beach areas have been "cleaned" by burning and divided into marketable lots. Once the beach areas have been sold, the mangrove swamps will also be cleared and filled with coral debris and garbage, similar to past activity on the southern part of the island. Pristine sections of beach are crucial egg-laying habitat for female Utila Iguanas. Without these nesting areas, the Utila Iguana population will quickly decline as development eradicates their nesting sites. Because these iguanas have no other suitable place to lay their eggs, they will inevitably begin their journey into extinction.

If conservation areas of considerable size cannot be established in the face of this development, the future of Utilan animals and plants is not optimistic. Based on our field research and because of their outstanding ecological value, the regions of Iron Bound and eastern Rock Harbor would provide the most suitable core zone for a planned nature sanctuary. This core zone contains rocky coast, beach (behind the rocky belt), Caribbean dry forest, seasonal rain forest, and mangrove swamps. In this area, we have been able to record all vertebrate species identified on Utila to date (including the three endemic lizards), as well as the three species of mangroves. In no other location on the island are these five habitats found in such close proximity. The connecting corridor to the Turtle Harbor Reserve would protect other ecologically valuable and beautiful habitat, including the oldest Red Mangrove forest, the mangrove area with the highest density of epiphytes on the island, and extensive areas of wet savanna. Most of the total area comprising the planned nature sanctuary (the wetlands, mangrove, and wet savanna) is owned by the community of Utila, and chances are good that protection of this area can be negotiated. On the other hand, all of the beach areas and the Caribbean dry forest along the coast are privately owned and would need to be purchased to safeguard them from development.

Aside from its ecological and conservation benefits, the creation of a nature sanctuary on Utila, if properly managed, would provide the island with another tourist attraction. Through the use of nature trails and guided tours in protected areas, visitors could be given the opportunity to discover and observe a diversity of unique reptiles and other animals in their natural environment. Most tourism on Utila today is based on diving. By persuading tourists to spend more time on the island, the nature reserve would have a positive economic impact for the Utilan community, as well as for Honduras as a whole. Simultaneously, it would significantly enhance the long-term prospects for conservation of the biodiversity of Utila.

Acknowledgments

I am grateful to all the individuals, institutions, and organizations that have supported the Conservation Project Utila Iguana in the past, especially to the Zoological Society of Frankfurt of 1858 – Help for the Endangered Animal World (ZGF),

Adult male *Ctenosaura bakeri* from Utila, Honduras.

Environmental education: School children participating in a workshop at the Iguana Station on Utila.

Frankfurt a. M., and the Senckenberg Nature Research Society (SNG), Frankfurt a. M. Thanks are especially due to the many volunteers who have done a wonderful job on Utila over the years. I would particularly like to express my gratitude to John Binns, Lutz Dirksen, Karoline Franz, Karsten Gees, Sven Knapinski, AJ Gutman, Alexander Gutsche, Lori King, and Sven Zoerner for the important work they are doing on behalf of the Utila Iguana. Without their help the Conservation Project Utila Iguana could never have taken place in its present form.

References

Buckley, L. J. and R. W. Axtell. 1997. Evidence for specific status of the Honduran lizards formerly referred to *Ctenosaura palearis* (Reptilia: Squamata: Iguanidae). *Copeia* 1997:138–150.

de Queiroz, K. 1990. *Ctenosaura bakeri. Catalogue of American Amphibians and Reptiles* (465):1–2.

Etheridge, R. E. and K. de Queiroz. 1988. A phylogeny of Iguanidae, pp. 283–367. In: R. Estes and G. Pregill (eds.), *Phylogenetic Relationships of the Lizard Families*. Stanford University Press, Stanford, California.

Fitch, H. S. and R. W. Henderson. 1977. Age and sex differences in the ctenosaur (*Ctenosaura similis*). *Milwaukee Public Museum Contributions in Biology and Geology* (11):1–11.

Fitch, H. S. and R. W. Henderson. 1978. Ecology and exploitation of *Ctenosaura similis. The University of Kansas Science Bulletin* 51:483–500.

Frost, D. R. and R. Etheridge. 1989. A phylogenetic analysis and taxonomy of iguanian lizards (Reptilia: Squamata). *Miscellaneous Publication, University of Kansas, Natural History Museum* (81):1–65.

Grismer, L. L. 1999. An evolutionary classification of reptiles on islands in the Gulf of California, México. *Herpetologica* 55:446–469.

Köhler, G. 1995. Freilanduntersuchungen zur Morphologie und Oekologie von *Ctenosaura bakeri* und *C. oedirhina* auf den Islas de la Bahia, Honduras, mit Bemerkungen zur Schutzproblematik. *Salamandra* 31:93–106.

Köhler, G. 1996. Freilanduntersuchungen zur Morphologie, Verbreitung und Lebensweise des Yucatan-Schwarzleguans (*Ctenosaura defensor*). *Salamandra* 32:153–162.

Köhler, G. 1997. *Inkubation von Reptilieneiern.* Herpeton, Offenbach.

Köhler, G. 1998a. Schutz- und Forschungsprojekt Utila-Schwarzleguan: Die Nachzucht von *Ctenosaura bakeri* STEJNEGER, 1901 im ex-situ-Zuchtprogramm. *Salamandra* 34:227–238.

Köhler, G. 1998b. Further additions to the known herpetofauna of Isla de Utila (Islas de la Bahia, Honduras) with notes on other amphibians and reptiles, and a key to herpetofauna of the island. *Senckenbergiana Biologica* 77:139–145.

Köhler, G. and C. R. Hasbun. 2001. A new species of Spiny-tailed Iguana from México formerly referred to *Ctenosaura quinquecarinata* (Gray 1842) (Reptilia, Squamata, Iguanidae). *Senckenbergiana Biologica* 81:257–267.

Köhler, G., W. Schroth, and B. Streit. 2000. Systematics of the *Ctenosaura* group of lizards (Reptilia: Sauria: Iguanidae). *Amphibia-Reptilia* 21:177–191.

Wiewandt, T. A. 1982. Evolution of nesting patterns in iguanine lizards, pp. 119–141. In: G. M. Burghardt and A. S. Rand (eds.), *Iguanas of the World: Their Behavior, Ecology, and Conservation*. William Andrew Publishing, Noyes, New Jersey.

Author Biography

Gunther Köhler is curator of herpetology at the Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main, Germany. He has published several books and over 100 scientific articles. His research specialties are the taxonomy and biogeography of the amphibians and reptiles of Central America, especially iguanid lizards. Dr. Köhler has had extensive field experience in Central America and has published the first two volumes of a book series on the diverse reptilian fauna of Central America, now available as a single volume in English. An English edition of *Spiny-tailed Iguanas* is in preparation.