Field observations on a nesting site of *Norops utilensis* KÖHLER, 1996 (Reptilia, Squamata) with comments about its conservation status

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Abstract

Norops utilensis is a recently described anole endemic to Isla de Utila, Honduras. We present our observations of this little known member of the *N. pentaprion*-group. This arboreal species inhabits mangrove swamps and lays its eggs in tree holes. An aggregate nesting site was located in a hollow stilt root of a red mangrove (*Rhizophora mangle*) and contained 25 empty and five fertile eggs. Three of these fertile eggs were removed from the site and successfully incubated and hatched. Measurements and oberservations of the eggs and hatchlings, as well as natural incubation conditions are given. Evidence is presented that *N. utilensis* may be critically endangered.

Key words: Reptilia: Squamata: Polychrotidae: *Norops utilensis*; Honduras; Isla de Utila; aggregate nesting site; threats.

1 Introduction

Norops utilensis, an anole described by KÖHLER (1996) as a new species in the *N. pentaprion*-group, is endemic to Isla de Utila, situated off the Caribbean coast of Honduras. In contrast to the other members of the *N. pentaprion*-group that live in broadleaf tropical rain forest (AVILA-PIRES 1995, LEE 1996, SAVAGE 2002), *N. utilensis* have been found exclusively in a specialized habitat – the highly dynamic and salty mangrove swamps. Its lichenose pattern and the inaccessibility of the habitat make the species difficult to detect and observe; as a result almost nothing is known about its natural history. During a fieldtrip to the type locality (22 October 2001), we discovered a female *N. utilensis* at an aggregate egg-laying site and had the opportunity to incubate eggs successfully. Detailed data on the nesting site, eggs and hatchlings, as well as natural incubation conditions and actual threats for the survival of *N. utilensis* are described herein.

2 Material and Methods

The natural incubation temperature at the nesting cavity was recorded with an automatic data logger (Minidan $^{\text{Temp 0,5 w}}$, ESYS GmbH, Germany) with a reading interval of two hours. Temperature was measured for a period of nine weeks, from the date the eggs were found (22 October 2001) until the last juvenile hatched (26 November 2001). Space inside of the nesting cavity was limited and the data logger was placed in a hollow mangrove trunk about three meters from the nest. Both the data logger and the nest were at the same height and both positions were shaded throughout the day. Eggs were incubated in an automatic incubator (Jäger, Germany) in hand moistened Vermiculite at a constant temperature of 27 °C, the annual average air temperature (measured in the shade) of the habitat (A. GUTSCHE, unpubl. data). Snout-vent length (SVL), tail length (TL), egg length (all measured with calipers to the nearest 1.0 mm) and weight (electronic balance, Type 466-45 0.1 g, Kern/Germany) were recorded for the eggs after they were found and for the hatchlings one day after hatching.

3 Results

3.1 Nesting cavity

The nesting cavity was a fist-sized hole located in a hollow red mangrove (*Rhizophora mangle*) stilt root 110 cm above the water and was filled with moist detritus. From there, a small tunnel extended downward through the root with a gutter-like opening in the lower part offering full drainage (Fig. 1). Dark-brown ants (ca. 8 mm in length) inhabited the nesting place as well and attacked our hands furiously. However, these ants apparently do not bother the adult *Norops* or their eggs. A search of about 40 m around the nesting site for other or potential nesting places was unsuccessful, but we collected three adult females, and saw another adult female, at distances up to 4 m from the nesting tree. The nest contained 25 empty and five fertile eggs that were of an elongated-oval shape and creamy white in colouration, and had a fine, longitudinal net-like texture. Eighteen of the 25 empty eggs in the nest had successfully hatched, whereas seven unhatched eggs showed several small perforations of unknown origin. The three fertile eggs, removed for incubation, varied in length, width and weight (Tab. 1). The juveniles hatched in good condition after an incubation period of 7, 21 and 35 days (Tab. 1). Their measurements showed little differences in SVL, TL/SVL ratio and weight (Tab. 1). Dorsal colour of the hatchlings was grey-brown with pale grey spots, partly scattered or arranged in longitudinal rows, and about 15 dark crossbands were present on the tail (Fig. 2). Underside of limbs and belly was whitish-grey. Dewlap was red with a few rows of white granules, lining of the mouth and throat was black. On 27 November 2001, two new eggs were found in the nest and the two eggs remaining there on 22 October 2001 had successfully hatched. Of the 30 eggs found in the nest (eggshells plus fertile eggs), 23 successfully hatched for a hatching rate of 76.7 %. The natural incubation temperature over the whole incubation period of nine weeks changed strongly depending on the time of the day (Fig. 3). Lowest average temperature was in the early morning hours. The lowest recorded temperature was 18.4 °C and occurred around midnight as a result of heavy rainfall. After sunrise

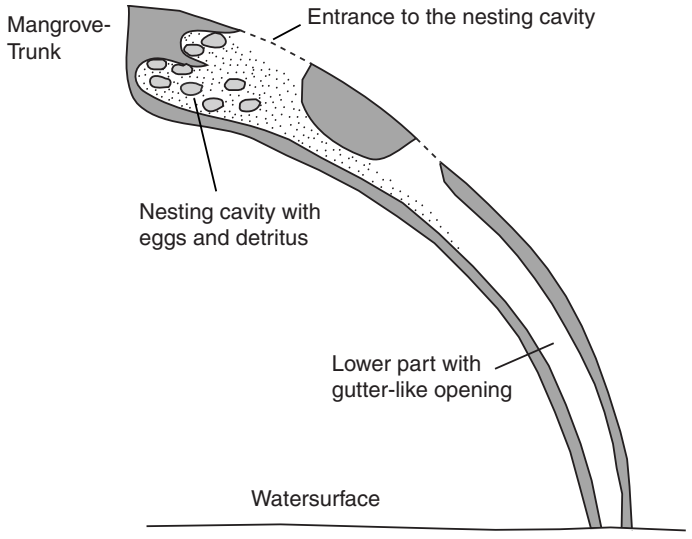

Fig. 1. Cross-section of the *N. utilensis* nesting cavity. Drawing by A. GUTSCHE.

Querschnitt der Nesthöhle von *N. utilensis*. Zeichnung: A. GUTSCHE.

at about 06:00, temperature rose up to 28.1 °C around midday. Differences of 9.7 °C between night and day temperatures were recorded. Temperatures fluctuated most during midday and least during early morning and early afternoon. Average temperature for the whole period was 23.2 °C.

Eggs	# 1	# 2	# 3
Length (mm)	13	12	11
Width (mm)	8	7	6
Weight (g)	0.6	0.6	0.4
Hatchlings			
Date of hatch	29.10.01	12.11.01	26.11.01
SVL (mm)	24	24	23
TL/SVL	1.38	1.42	1.45
Weight (g)	0.18	0.14	0.13

Tab. 1. Measurements of the three fertile eggs and the hatchlings of *N. utilensis*.
Maße der drei fertilen Eier und der Schlüpflinge von *N. utilensis*.

3.2 Discussion

The presence of four females close to the nesting tree, the number of eggs in the nesting cavity and the fact that adult *Norops* lay only a single egg at a time (JENSSEN & NUÑEZ 1994, KÖHLER 2000, LEE 1996) suggest that the site is an aggregate nesting place for *N. utilensis*. It also appears to be a long-term and frequently used nest site. During a subsequent check two years later (28 March 2003) by the first author, the nesting site contained several eggshells and two fertile eggs.

Aggregate nesting is usually due to special microclimatic conditions. Depositing of eggs in the ground is impossible in the mangrove swamp and tree holes might be the only relevant alternative for *N. utilensis*. The nesting cavity described herein offers protection, shade, rotten detritus as substrate, drainage against heavy rainfall, and even the biting ants could play an important role in protecting the tree against predators like snakes or birds. The unsuccessful search for other potential nesting places indicate that such places are limited within the mangrove area.

The different sizes of the three eggs represent different stages of development, and were later reflected by the chronological hatching of the juveniles. Juveniles showed the same, but more intensive colour pattern of adult *N. utilensis* (see description in KÖHLER 1996). Incubation period is unknown for *N. utilensis* and for other members of the *pentaprion*-group. For *N. bicaorum* (*lemurinus*-group), an endemic forest dweller on Utila, an incubation period of about three months (artificial conditions at 24-25 °C) was recorded (VAN BEEST & HARTMAN 2003).

The *N. utilensis* nesting site was shaded during the day and was discovered in the rainy season, which explains the low average incubation temperature of 23.2 °C. However, this monitored site also show, that even in tropical lowland areas, often described as constant habitats, remarkable daily shifts in temperature can occur. In addition, climate on Utila alternates between a rainy season (September to February) and a dry season (March to August) (A. GUTSCHE, pers. observ.).

It is not known whether or not *N. utilensis* exhibits seasonal variation in reproduction. Most anoles are known to reproduce year round, although egg laying may decrease in very dry or cold periods (e. g. ANDREWS & RAND 1974, GUYER 1986, JENSSEN & NUÑEZ 1994, LEE et al. 1989). Seasonal reproduction cycles (restricted to the dry

Fig. 2. Released juvenile *N. utilensis* at the nesting place one day after hatching. Photo by A. GUTSCHE.

Freigelassenes Jungtier von *N. utilensis* am Ablageplatz einen Tag nach dem Schlupf.

season) are known for some lizards on Utila, e. g. *Ctenosaura bakeri*, *C. similis*, *Cnemidophorus lemniscatus* (A. GUTSCHE, pers. observ.). The record of fertile *N. utilensis* eggs in the rainy season (22.10./27.11.2001) and in the dry season (28.03.2003) might indicate that *N. utilensis* reproduce over the entire year. On the other hand, successful incubation is dependent on suitable moistness of the substrate and during the dry season, two or three weeks without any rain can occur. It is more

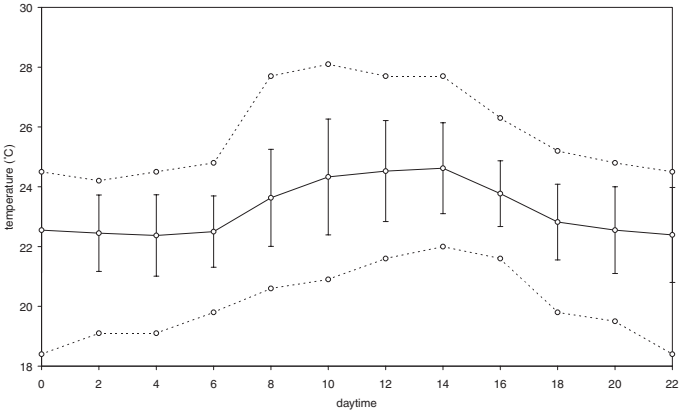

Fig. 3. Daytime profile of the natural incubation temperature of the *N. utilensis*-nest from 22 October -26 November 2001 (Mean, Standard Deviation, min/max).

Tagesprofil der natürlichen Inkubationstemperatur im *N. utilensis*-Nest vom 22. Oktober-26. November 2001 (Mittelwert, Standardabweichung, min/max).

likely, then, that *N. utilensis* reproduces mainly in the rainy season but also in the dry season when favorable conditions exist, which is also assumed for *N. bicaorum* on Utila (BAUERFEIND 2002).

4 Threats

The entire mangrove swamp around the known habitat of *N. utilensis* had a total size of only 115 ha in 1999. From 1999 to 2003 about 15 ha (13 %) of this mangrove area was lost due to several human impacts, e. g.: extension of Utila Town towards the southern and western parts, tourism development on the eastern part and airport construction in the northern part of the mangrove area. In 2002, a new dumpsite was opened only 40 m from the *Norops*-nesting site reported herein. Direct threats to the survival of *N. utilensis* at the site are the pollution of the area by discarded batteries, burned oil etc. Flocks of the Great-tailed Grackle (*Quiscalus mexicanus*) are now attracted to the dumpsite. Observations of these birds reveal that they are very effective hunters of juvenile *Ctenosaura bakeri* (A. GUTSCHE, pers. observ.), which are arboreal like *N. utilensis*, and could form an additional predation pressure. Since 1995 only 13 specimens of *N. utilensis* have been seen or collected and very little is known about the distribution and abundance in the Utila mangrove swamps. Nevertheless, due to the specialized and very limited habitat and the current threats, *N. utilensis* should be placed in the IUCN category "Critically endangered" (IUCN 2001).

Freilandbeobachtungen an einem Nestplatz von *Norops utilensis* KÖHLER, 1996 (Reptilia, Squamata) nebst Bemerkungen zum Schutzstatus

Norops utilensis, ein neu beschriebener und kaum bekannter Vertreter der *pentaprion*-Gruppe, ist endemisch auf der Isla de Utila, Honduras. Während andere Vertreter der *pentaprion*-Gruppe vorwiegend tropischen Regenwald bewohnen, siedelt *N. utilensis* exklusiv im Mangrovensumpf. Während einer Exkursion (22.10.2001) zur Typus-Lokalität wurde ein Massenablageplatz der Art entdeckt. Die Nesthöhle befand sich in einer hohlen Mangrovenwurzel, circa 110 cm über der Wasserfläche und war mit feuchtem Mulm gefüllt (Abb. 1). Weitere Nester im Umkreis von 40 m wurden nicht gefunden, aber vier *Norops*-Weibchen wurden innerhalb von 4 m um den Nestbaum gefangen beziehungsweise gesichtet. Im Nest waren 25 leere und fünf volle Eier. Drei volle Eier wurden bei konstant 27 °C, der mittleren Jahrestemperatur im Habitat (A. GUTSCHE, nicht publ. Daten), künstlich inkubiert. Die natürliche Inkubationstemperatur wurde mittels eines automatischen Temperatur-Loggers registriert. Aufgrund geringen Platzes in der Gelegehöhle wurde der Logger 3 m weiter in einem benachbarten hohlen Baum plaziert. Logger und Gelegehöhle waren beide in gleicher Höhe und ganztägig beschattet. Die drei entnommenen Eier hatten unterschiedliche Maße und repräsentierten verschiedene Entwicklungsstadien. Die Maße der Jungtiere waren in etwa vergleichbar (Tab. 1) und ihre Färbung ähnlich der adulter Tiere (siehe KÖHLER 1996) jedoch intensiver. Am 27.11.2001 wurden in der Nesthöhle zwei neue Eier gefunden, die zwei dort verbliebenen Eier waren erfolgreich geschlüpft. Die Schlupfrate aller 30 im Nest gefundenen Eier betrug 76,7 %. Die mittlere Inkubationstemperatur im Nest lag bei 23,2 °C (18,4-28,1 °C) mit tageszeitlichen Schwankungen von bis zu 9,7 °C (Abb. 2). Der Nachweis von vier *Norops*-Weibchen am Nestbaum, die Eizahl und die Ablage von jeweils nur einem Ei (JENSSEN & NUÑEZ 1994, KÖHLER 2000, LEE 1996) sprechen für einen bekannten und auch langjährig genutzten Massenablageplatz von *N. utilensis*, wie weitere Eifunde am 28.03.2003 seitens des Erstautors belegten. Daten zur Zeitigung bei *N. utilenis* sowie der *pentaprion*-Gruppe sind unbekannt. Für den ebenfalls auf Utila endemischen *N. bicaorum* wurde unter Terrarienbedingungen eine Zeitigungsdauer von drei Monaten ermittelt (VAN BEEST & HARTMAN 2003). Das Klima auf Utila gliedert sich in eine Regen- (September-Februar) und eine Trockenzeit (März-August). Unbekannt ist, ob *N. utilensis* einen saisonalen Reproduktionszyklus hat. Die meisten Anolis reproduzieren ganzjährig, mit Anpassungen an trockenes oder kaltes Klima (z. B. ANDREWS & RAND 1974, GUYER

1986, JENSSEN & NUÑEZ 1994, LEE et al. 1989). Eine strikte Fokussierung der Reproduktion auf die Trockenzeit haben auf Utila zum Beispiel: *Ctenosaura bakeri*, *C. similis*, *Cnemidophorus lemniscatus* (A. GUTSCHE, pers. Beob.). Der Nachweis fertiler *Norops*-Eier sowohl in der Regen- (22.10./27.11.2001) als auch in der Trockenzeit (28.03.2003) lassen eine ganzjährige Reproduktion vermuten. Zur erfolgreichen Entwicklung benötigen die Eier jedoch eine gewisse Substratfeuchte, was in der Trockenzeit nicht permanent gegeben ist. Es ist wahrscheinlicher, das *N. utilensis* vorwiegend in der Regenzeit reproduzieren und in der Trockenzeit nur bei geeigneten Bedingungen, was auch für *N. bicaorum* auf Utila angenommen wird (BAUERFEIND 2002).

Das Mangrovenareal mit dem derzeit bekannten Lebensraum von *N. utilensis* hatte 1999 eine Größe von 155 ha. Bis 2003 waren davon etwa 15 ha (13 %) aufgrund anthropogener Einflüsse vernichtet. Seit 1995 wurden insgesamt nur 13 *N. utilensis* gefunden und wenig ist über die Verbreitung bekannt. Aufgrund des kleinflächigen und sehr speziellen Habitates sowie der aktuellen Gefährdungen sollte *N. utilensis* in die IUCN Kategorie „Critically endangered" (IUCN 2001) aufgenommen werden.

Schlagwörter: Reptilia: Squamata: Polychrotidae: *Norops utilensis*; Honduras; Isla de Utila; Massenablageplatz; Gefährdungen.

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