

# PRELIMINARY STUDIES ON THE BREEDING OF THE NILE CROCODILE *CROCODYLUS NILOTICUS*, IN ZULULAND

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## DISCUSSION

In literature, brief accounts on the breeding biology of the Nile crocodile appear in Gadow, 1901; Welman and Worthington, 1943; Stevenson Hamilton, 1947; Rose, 1950; Schmidt and Inger, 1957; Ditmars, 1959; Mertens, 1960; Pope, 1964; Hvaas, 1964; Cansdale, 1965; and Pienaar, 1966.

By far the most complete work on the crocodile is by Cott, 1961; whilst Modha (1967) studied the ecology of the Nile Crocodile on Central Island, Lake Rudolph, in Northern Kenya.

In former times, crocodiles extended southwards to the Eastern Cape Province and Hewitt (1937) quotes records of crocodiles from the Umkomaas River in 1835, Elliotdale district in 1903, and as far south as the Keiskama River in 1865.

The southern limit of the crocodile's distribution in Africa is now in Zululand and it only occurs in fair numbers, in two areas, the Ndumu Game Reserve and the St. Lucia Game Reserve. Small populations are found in the Hluhluwe and Umfolozi Game Reserves, whilst small numbers seasonally find their way from the St. Lucia Lake, up the Mkuze River into the pans within the Mkuze Game Reserve.

These game reserves afford full protection to the crocodile and are vital to the survival of an animal that has suffered a steady decline in numbers during recent years. The crocodile enjoys no legal protection in Zululand or in neighbouring Swaziland and Mozambique other than in proclaimed game reserves. Consequently, hunters have taken a heavy toll, farmers have destroyed crocodiles occurring in rivers or dams on or adjacent to their farms, and many crocodiles have been snared or trapped for medicinal purposes, and because they constitute a threat to livestock, by local Africans of the Thonga, Shangane and Zulu tribes.

Of great influence too, has been the rapid destruction of habitat in Zululand, caused by farming development. Rivers have been dammed, swamps reclaimed and riverine forest cleared to make way for cultivation. River pollution is also a serious menace to aquatic life in some areas. Not only have crocodile populations dwindled but suitable undisturbed breeding areas have diminished alarmingly in number.

Apart from one brief account (Pooley, 1962) little has been recorded on the breeding of the crocodile in Zululand. The present investigation began in October, 1962 when observations were made on breeding in the Ndumu Game Reserve and supplementary data collected from Lake St. Lucia. The object was to determine the number of crocodiles that remained and to survey the breeding success of crocodiles in these last remaining undisturbed habitats.

## NDUMU GAME RESERVE

The Ndumu Game Reserve, 25,000 acres in extent, lies at the foot of the Lebombo range. Its northern border is the Usutu River, the northern boundary of Natal and it is about 35 miles from the sea.

The area is low lying with altitudes of from 65 to 470 ft. above sea level. Within the reserve, the main habitat of the crocodile is the Pongola River and the many small pans and lakes along its flood plain. The Pongola River, which rises in the eastern Transvaal enters the game reserve in the south and joins with the Usutu River at three points in the north eastern corner of the reserve.

The Pongola River floods in summer, inundating large tracts of marshland and swamp, and filling the flood plain pans. In winter, many of the small pans dry up completely and levels of the lakes drop appreciably.

In addition to the flooding from this river, difference in river levels allow flood waters from the Usutu River to push up one arm of the Pongola to where this branches, after which the water flows down the other arm back into the Usutu. The Usutu has its source in the mountains of Swaziland. Of importance is the fact that water levels in either of these rivers may drop or rise to flood height without local rainfall. Local rainfall, unless heavy and of some duration, has little effect on the flooding of either river.

## THE NDUMU STUDY AREA

For the sake of convenience, this study area was divided into six sections.

### Area 1

The stretch of the Usutu River from the foot of the Lebombo range, down to the confluence of the new Pongola-Usutu course, a distance of approximately 15 river miles. No crocodile nests were found in this area although according to Game Guards, nests were found prior to 1962. Crocodiles were seldom floted in this river. The reason is probably that the northern bank is fairly densely populated and much destruction of riverine forest has taken place. Crocodile hunters have also operated along the northern banks, in Mozambique.

### Area 2

The old course of the Pongola River, from its Usutu confluence to the bifurcation point with the new course, a distance of about eight and a half river miles. Eight regularly used nests have been found along this stretch of river, which has dense riverine forest lining its banks.

### Area 3

Inyamithi Pan. One of the Pongola flood plain pans of about three miles in length. Five nesting sites were noted along the southern banks in 1962 and another was occupied in 1964, but Monitor Lizards *Varanus niloticus* opened the nest and incubation was not successful.

another reserve or to a game ranch, so the Director of the National Zoological Gardens in Pretoria was approached and asked whether he would accept the wildebeest. He kindly did so, and was at the same time asked, should the animal die, to ensure that a detailed dissection of the limbs be undertaken in order to determine the exact anatomical structure of the abnormalities.

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PARENTAL CARE IN THE NILE CROCODILE:  
A preliminary report on behaviour of a captive female

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INTRODUCTION

Observations on the breeding behaviour of the Nile crocodile *Crocodylus niloticus* in Natal, have been previously recorded by Pooley (1969). Furthermore, Cott (1971) reviewed all available data on breeding behaviour and parental care collected from many sources, covering most regions of Africa where this species occurs.

It is generally accepted that once eggs have been deposited, the female remains in attendance at, or near to her nest for the duration of the incubation period, and that the female liberates her young from the nest. The determination of the parent to remain at her nest site and liberate her young has been demonstrated by Pooley (1969). Many observers have stated that the parent is stimulated to exhume the eggs in response to sounds emitted by the unhatched young. In addition reports indicate that the parent may transport the young from the nest site to water and that parental care and defence of the young against predators may continue for a short time after hatching.

Recent experiments on a small captive population of adult crocodiles housed at the Natal Parks Board's Crocodile Restocking Station in the Ndumu Game Reserve, indicate that parental care in the Nile crocodile is far more advanced than has been previously realised. This preliminary report is primarily concerned with describing the response of a nesting female to the sound of tape-recorded calls of hatchlings and live hatchlings introduced into the pen housing the adult crocodiles. A more comprehensive report on the capture of adult crocodiles, subsequent behaviour in captivity, nest guarding, and parental care is in preparation.

METHODS AND RESULTS

On 1 November 1973 a captive female of 3,5 m was noted continually guarding what was obviously a newly excavated nest. By 27 February 1974 (119 days later) no hatching had been noted and the female began to leave the nest unattended for long periods. It was deduced that the eggs were probably infertile as the incubation period has previously been noted to vary from 84 to 96 days in Zululand, Natal.

During the late afternoon of 27 February, tape recordings of normal hatchlings were played from a concealed position close to the nest site. In addition a box containing unhatched eggs and some live hatchlings were placed nearby, also concealed from the crocodile by a screen of reeds. In response to the recordings, the parent emerged from the pool and walked past the nest to the fence and the source of sounds of young. With her forefeet she commenced digging at the base of the fence, scraping away earth and grass and small shrubs to a depth of 15 cm, directly in line with both recorder and box containing live young and eggs. This behaviour was disturbed by the arrival of a group

of tourists to the pen.

Thereafter the equipment used was removed from the site and the experiment discontinued.

On 28 February 1974 experiments were continued. The parent was noted lying on the nest again. At 0500 hours the box of hatchlings was concealed in the same position as before. At 0730 hours vocal activity was heard from the box as this became warmed by the sun. The parent immediately moved to the fence. A live hatchling was introduced into the pen and the parent lunged forward with head angled sideways and attempted to pick up the hatchling with her teeth. The hatchling yelped several times and commenced climbing through the fence. Delicately grasping it between her teeth, the adult pulled it back. With a quick gulping motion it was manoeuvred into her jaws, and with a second upward lift of the head, into her gular pouch. Over the next two hours a further 18 live hatchlings were introduced and each was captured and taken into the gular pouch. A complete photographic record was obtained and, briefly, the following points are of particular interest:—

- a) The female unhesitatingly accepted the foster brood.
- b) Maternal instinct overcame all fear of humans as she accepted some hatchlings from my hand when previously she would growl or exhale loudly at any near approach whilst nest-guarding.
- c) Those young that did disperse into long grass nearby were located mainly by sound and not by scent. The parent followed them into the long grass, but waited motionless with the head just above the place from which the last call had emanated, then captured the hatchling when it commenced yelping again.
- d) Some hatchlings walked straight towards the jaws of the parent and, of their own accord, climbed inside her jaws as she opened them.
- e) Other hatchlings became excited at the close approach of the adult, yelped almost continuously and flicked their tails from side to side as if to draw attention.
- f) As both the number and the weight of the live young contained in the gular pouch increased, the pouch was seen to hang like a large bag beneath her jaws. Furthermore, when all 19 young were contained in the pouch there appeared to be space available for at least that many again.
- g) Once inside her jaws, and although the jaws were often half open, not one hatchling attempted to escape. In fact several appeared to be sleeping when observed closely.
- h) Vocal communication between hatchlings was seen to be important, as the arrival of a newly caught young inside the jaws stimulated those within to yelp and, in turn, any left on the ground answered.
- i) Once the full complement of available young had been captured by the female, and after observing that apparently no more were forthcoming, the female became aggressive towards me, exhaling and growling loudly and making mock thrusts against the fence at any movement made.
- j) After an interval of five minutes from the time the last hatchling had been picked up, the adult turned around and lumbered off down to the pool 15 m from the fence, entered the water and disappeared into thick floating vegetation. Almost immediately a

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chorus of young could be heard yelping as these were presumably released.

- k) This female never returned to the nest again.

#### DISCUSSION

It has been suggested by several authorities that the parent transports her young from the nest site to water, often a considerable distance overland. Theories advanced have been that the young ride upon her snout, on her head, across the neck and upon her back.

Hadley (1969) described how a female dealt with unhatched eggs in Livingstone Game Park. Having dug her eggs from the ground, the mother *C. niloticus* carried three or four of them at a time to the water. They were held very lightly in her mouth and she moved her head from side to side slowly in the water as though washing the eggs. She then applied pressure to the eggs and cracked them. One young crocodile emerged from the egg and swam out of her mouth and a second dropped to the bottom of the pool and shortly afterwards the young crocodile surfaced. This was witnessed twice.

Subsequent tests at Ndumu confirm Hadley's observations.

#### SUMMARY

Observations on a female Nile crocodile *Crocodylus niloticus* that carried 19 hatchlings a distance of 15 m to water, in her gular pouch, indicate that this is the usual method of transporting young. The manner in which the young were captured and the obvious capacity of the gular pouch, which could possibly carry twice the observed load, substantiated this opinion. It was observed that some hatchlings climbed into the adult's jaws of their own accord and once inside did not attempt to escape. Hatchlings did not attempt to climb upon the adult's body at any stage. Vocal communication from the young enabled the parent to locate and capture them, and some flicked their tails from side to side as if to indicate their whereabouts when the parent approached. Finally, it was noted that once the parent was satisfied that all of the brood had been accounted for, she transported them to water.

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