May 2015
The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

TECHNICAL BRIEF

Biodiversity

Status of Nile Crocodile in north-eastern KwaZulu-Natal

An intensive study funded by the Water Research Commission (WRC) has provided important insights into the crocodile populations of KwaZulu-Natal.

Background

Crocodilians are increasingly being viewed as 'sentinel species' because as top predators they are good models for studying environmental threats to their respective ecosystems and the associated food web therein.

Recent Nile Crocodile (Crocodylus niloticus) deaths in South Africa have revealed the vulnerability of the species – and the aquatic ecosystems they inhabit – and highlighted the need for urgent study of crocodile populations. As a top predator, crocodiles are a valuable ecosystem component but also a source of management concern due to their potential threats to humans.

Present threats to the major Nile Crocodile populations in South Africa include pollution, habitat alteration/ destruction and poaching. This highlights the importance of identification and protection of other viable and unthreatened Nile crocodile populations which are imperative in the conservation of the species in the country.

Crocodiles in KwaZulu-Natal

The Nile Crocodiles in KwaZulu-Natal are an important component of the South African population, but effects of the current threats on the separate populations need investigation.

The Lake St Lucia estuarine system, Africa's largest and oldest protected estuary, contains the largest Nile Crocodile population in a single waterbody in South Africa. Other large populations are situated at Ndumo Game Reserve and Pongolapoort Dam.

A captured crocodile.

Methodology

Aerial surveys were conducted, while radio-transmitters helped the team to track a number of crocodiles in each study area. The study team also investigated the distribution and abundance of crocodile nests, nest predation, hatchling liberation and nest-guarding activities of nesting Nile Crocodile females.

When Nile Crocodiles were captured, morphological measurements were taken. Each individual was marked uniquely by scute clipping and fitting of coloured caudal tags. In addition, urine and blood samples were taken. Analysis of blood, serum and urine were conducted specifically for crocodile nutritional, environmental contaminant, and epidemiological analyses to construct health/nutrition indexes of wild crocodiles, and analyses of bioaccumulation of environmental pollutants.

Study results

A tagged crocodile being released.

The concurrent research of Nile Crocodiles in Lake St Lucia, Ndumo Game Reserve and Pongolapoort Dam showed how these differed in their ecology and human pressures so affecting the crocodiles in different ways and illustrating that 'one size does not fit all'.

Lake St Lucia

From 2009-2013 the majority of Nile Crocodiles at Lake St Lucia were recorded in the Narrows, a 27 km, low-salinity channel south of the lake. Above average rainfall at the end of 2010 resulted in the refilling of the lake, and most Nile Crocodiles moved north to the lake. There are about 1 005 sub-adults and 137 adult crocodiles.

The overall activity level of Lake St Lucia Nile Crocodiles was 41%, and it differed significantly throughout the day. There was a significant seasonal effect on activity, peaking during autumn.

The study team recorded complex and varied home range patterns for 14 Nile Crocodiles, resulting from differences in size, sex, reproductive status and habitat. The median home range and core-use area of adults were significantly greater than for sub-adults.

Adult males revealed an inverse correlation between home range size and crocodile size, while the home range sizes of adult females were generally more homogeneous. All nesting females displayed an explosive increase in mobility and space-use subsequent to the nesting period. All adults, except one female in the central lake, moved during winter in the drought period to large crocodile congregations south of the lake.

Sub-adults occupied significantly smaller home ranges than adults, which were habitat specific with strict spatial partitioning. They remained in shallow vegetated areas adjacent to deep water, avoiding open deep water altogether.

The macro-level heterogeneity of nesting habitats reflect the spatio-temporal diversity of the Lake St Lucia system, and is possibly unique within a single Nile Crocodile population. Changes in nest abundance and distribution were seemingly related to increased human disturbance and habitat transformation in the northern and southern parts of the lake.

Hydrological variability, especially during droughts, combined with the state of the estuary mouth (i.e. open or closed), affected prey abundance/availability contributing to large variation in nest effort from 1982-2013.

All nests were located close to freshwater streams or seepage areas. The reuse of identical nest sites were confirmed, while other females oviposited in nest-sites occupied by different females during previous years.

Despite variable nest effort, the St Lucia nesting population remains the largest recorded nesting population in South Africa, and least vulnerable to flooding.

Ndumo Game Reserve

The population of crocodiles here is estimated at about 846. The population structure is currently skewed towards sub-adults and adults, and the current population is in decline.

This is a result of low recruitment levels in the reserve that is unable to sustain the artificially high population size created by a restocking programme in the 1960s-1970s. Also contributing to this decline is the poaching of crocodiles, and the destruction of suitable and historical nest sites.

Sex ratios were skewed towards females in juveniles and sub-adults and towards males in adults, while the overall sex ratio in the population was even.

The reserve acts as a winter refuge and spring breeding site for crocodiles which also inhabit the Rio Maputo during summer months. Nile Crocodile movement out of the reserve and into the Rio Maputo started in November and crocodiles returned to the reserve as water levels in the floodplain recede in May. These movement patterns show the role that the reserve plays in the conservation of the greater Ndumo-Rio Maputo Nile Crocodile populations.

Pongolapoort Dam

The effect of the impoundment on the Phongola river on Nile Crocodile numbers and status was studied. Initial surveys from 1981 and 1989 described few crocodiles in the system.

Currently Pongolapoort Dam contains a significant Nile Crocodile population that was previously not considered as substantial. A minimum population number of 273 crocodiles was determined for Pongolapoort Dam in 2009-2010, including a high percentage of juveniles (42%).

The high percentage of juveniles suggests a reproductively active population, which is likely to support a viable population into the future. Continued long-term monitoring of this population is required to determine if the impoundment continues to support a viable population and determine accurate and precise population estimates.

Generally impoundments negatively affect biodiversity and the integrity of the ecosystem. Consequently the historical and current spatial distribution and use of habitat by Nile Crocodile in Pongolapoort Dam was investigated.

From the construction of the dam in 1972, water levels fluctuated and the surrounding landscape had been altered. As a result the Nile Crocodiles residing in the area had to adapt to this changing environment.

The first general distribution changed after dam wall completion when the dam began to fill. First distributional change was a movement out of the Phongola river gorge section into the newly-flooded areas. Following the Domoina floods in the 1980s the dam level rose by over 70%, and the crocodiles moved mainly to the current inlet section.

Although dam levels have fluctuated greatly within and between years, crocodiles appear to have adapted successfully here. The majority of the crocodile population is now found concentrated in the inlet section of the Pongolapoort Dam, utilising the Phongola river in summer months and residing in the inlet section as historical basking sites during the winter months.

Conclusions

The study revealed numerous novel insights into the ecology, behaviour and health of Nile Crocodiles in KwaZulu-Natal. It is hoped that the results will guide the management and conservation of this threatened species and the waterbodies they are associated with.

There are concerns about the protection of nesting sites, increased anthropogenic disturbance, illegal poaching of crocodiles and human wildlife conflict.

It is especially the trade in Nile Crocodile products that need to be understood as well as neighbouring local people's attitude, behariours and perceptions of Nile Crocodiles, in order to formulate effective conservation programmes for these animals in KwaZulu-Natal.

Further reading:
To order the report, ***Status of Nile Crocodile in north-eastern KwaZulu-Natal and conservation management recommendations*** (**Report No. 2188/1/15**) contact Publications at Tel: (012) 330-0340, Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.