

**Crocodile Specialist Group Steering Committee Meeting
Double Tree Hilton, Darwin, Australia
(15 April 2024)**

East and Southern Africa

Information on the status of Nile crocodiles in the East & Southern Africa region

South Africa: The South African National Biodiversity Institute (SANBI) facilitated a workshop in 2022 to discuss and determine the national Non-Detriment Finding (NDF) for Nile crocodiles. CSG regional members collaborated actively with SANBI and provided guidance and comment on the NDF document produced. Dr. Jeanetta Selier, Senior Scientist at SANBI, reports that the NDF has now been finalised and will be presented to the Scientific Authority of South Africa within the next few months for approval. The Scientific Authority includes one representative from each of the nine provincial conservation agencies of South Africa, together with representatives from the Department of Environment, Forestry and Fisheries, SANBI, South African National Parks, and the National Zoological Garden.

The inaugural meeting for the South African Crocodile Monitoring Network was held at Nkwazi Lodge, Pongola Game Reserve, KwaZulu-Natal (26-28 September 2023). The event was organised through African Ecological Conservation Projects with sponsorship of selected travel allowances by Ubumthu Trust. The main objective of the meeting was to share information on the current situation regarding the monitoring of wild crocodile populations throughout South Africa and discuss factors affecting the conservation of these populations. A second objective was to use data from the meeting to assist with drafting a Biodiversity Management Plan (BMP) for the Nile crocodile in South Africa. Regional CSG members have been calling for a BMP for South Africa's Nile crocodile population to guide management to ensure long-term survival of the species in the wild. The BMP falls under the National Environmental Management Biodiversity Act (Act No. 10 of 2004). The event was attended by provincial herpetologists, conservation ecologists, representatives from academic institutions, and parties with an interest in the conservation of Nile crocodiles in South Africa. Several interested parties also attended the meetings virtually. The meeting included presentations on the status of monitoring programs throughout the provinces of KwaZulu-Natal, Limpopo, and Mpumalanga as well as the situation in the North-West province. The populations of Ndumo Game Reserve and Kruger National Park were discussed as well. A practical demonstration of crocodile veterinary procedures and fieldwork, including capture operations was conducted. Presentations on the hunting market for crocodiles, human-crocodile conflict, the South African crocodile farming industry, and ecotoxicology was also presented. Discussions on the introduction of crocodile ranching and hunting took place. During most discussions, the lack of funding for all aspects of crocodile conservation became apparent. Currently, the establishment of a non-profit entity, specifically for crocodile surveys and monitoring in South Africa is being discussed. It could facilitate funding as well as coordinate efforts across provinces and between different conservation agencies to proceed with the creation of the national Nile crocodile BMP.

Dr Krystal Tolley from SANBI reports that a lab in Cape Town (Diplomics) has agreed to sequence the entire genome for the Nile crocodile.

Ezemvelo KZN Wildlife, the provincial conservation agency for KwaZulu-Natal (KZN) province, hosted two internal workshops (with invited external participation) focusing on Nile crocodiles. The workshops were chaired by Mr Ian Rushworth, Scientific Manager Ecological Advice (West) of Ezemvelo KZN Wildlife. Issues that were discussed included: a) the genetic structure of southern African crocodiles and conservation implications; b) implications for mixing crocodiles from different areas, genetic supplementation of wild populations and the process for improving genetic understanding, including adding additional KZN samples to the analysis; c) the status of wild crocodiles in KZN, drafting a Nile Crocodile Biodiversity Management Plan and an update on Nile crocodile farming in KZN; d) permit conditions required to safeguard wild crocodile population genetics relating to import and keeping of live crocodiles, guidelines/rules for relocation of problem crocodiles from different river systems; e) Nile crocodile welfare on crocodile farms (ie single penning and dental management); and, f) welfare standards and general operating procedures for the South African crocodile industry, permit conditions for crocodile farming relating to animal welfare, wild crocodile hunting and permit conditions relating to this, understanding lead contamination, hunting of captive bred crocodiles in small dams and permit conditions for this. A key point highlighted by Ian Rushworth was that crocodile farming has resulted in the mixing of animals from historically separated major drainage basins, resulting in unnatural levels of genetic mixing. The escape, active release, and accidental release of these farmed crocodiles into natural systems is problematic. With climate change,

the frequency of escapes from flooded and/or damaged facilities is likely to increase. A genetics project will be initiated to better understand the implications.

Sharon Louw, District Ecologist Central East (iLembe & King Cetshwayo Districts, KZN Wildlife) reported on the most southern natural nesting location of Nile crocodiles, except for the re-introduction of Nile crocodiles to the Eastern Cape by Tony Pooley in the 1980's, followed by records of successful nesting.

Water levels in the Matigulu-Nyoni estuary and Nyoni River were low, making it easier to conduct a foot patrol to the Nile crocodile nesting grounds. Low water levels make the system accessible to poachers and cattle that are herded into the protected area. Increased activity and disturbances at the Nile crocodile breeding grounds, and the threat of excessive gillnetting, particularly in the Nyoni River, pose a threat to the survival of crocodile hatchlings. The population are restricted to the river systems within the protected area.

Illegal cattle grazing continues unabated within the protected area regardless of management's efforts to herd cattle out of the protected area. Aquatic alien invasive plant species present a threat to the natural functioning of the Nyoni River, including *Matshangula* pan in the adjacent grasslands. The Nyoni River channel is narrow, and although deeper channels exist, the river is a major corridor for Nile crocodile movements, largely restricted to the protected area. The movement of floating mats of common water hyacinth (*Pondedaria crassipes*) are restricted by antelope grass (*Echinochloa pyramidalis*) that compartmentalise the river. These barriers have been effective for the biological control program and the release of water hyacinth planthoppers (*Megamelus scutellaris*). Flood events dislodge aquatic invasive plants in the Nyoni River, washing them into the Matigulu-Nyoni estuary where plants die due to increased salinity levels.

Poaching levels in the protected area continue to increase. The planned 2023 crocodile nest survey planned to take place between 15 and 17 March had to be delayed due to a gang of armed gunmen taking refuge in the protected area after robbing retail outlets at Macambini. An illegal camping shelter was located during the Nile crocodile nest survey on 29 March. Poachers use these sites to manage gillnetting operations (including other illegal activities) in the protected area. Field rangers apprehended a person at the shelter, seven gill nets with a total length exceeding 900 m were retrieved and burnt in the fire at the shelter. Field Rangers requires reliable canoes (preferably kayaks which offer greater stability) on station to facilitate greater coverage of the Matigulu-Nyoni estuary and Nyoni River, especially at times when these waters are not navigable by boat.

HCC and public awareness:

Dr. Simon Pooley submitted a manuscript "Research and Management of the Nile crocodile (*Crocodylus niloticus*) in Ndumo Game Reserve". It is a historical overview and will be published as part of a special issue focusing on the past, present, and future research at Ndumo Game Reserve.

Of great concern is the increase in Nile crocodile escapees from crocodile farms and other facilities, often followed by crocodile attacks on people in that area. This is especially true in areas where crocodiles have not been seen in recent times, for instance, Northwest province.

Tanzania: Dr. Xander Combrink conducted a one-day Nile crocodile workshop in October 2022 in conjunction with Six Rivers Africa and the Tanzania Wildlife Research Institute (TAWIRI) with 16 Tanzanian veterinarians and TAWIRI and TANAPA ecologists in the Msolwa section of Nyerere National Park. The workshop covered topics such as the biology and ecology of crocodylians, catching methods, the marking of Nile crocodiles and transmitter attachment methods, Nile crocodile survey and monitoring methods as well as human-crocodile conflict and management. The workshop was followed by fieldwork in the Kilombero River consisting of setting 10 crocodile baited snare traps, daily trap checking and rebaiting, as well as active crocodile capture from boats during the day and night. In total, five Nile crocodiles were captured in the Kilombero River, and satellite transmitters were attached to four individuals. Reports summarised mean daily movements per crocodile, mid-river linear distance, and a visual overview of mapped GPS locations and home ranges. Unfortunately, the solar-powered transmitters did not last very long and transmitter efficiency, calculated as a percentage of recorded GPS locations from the scheduled duty cycle (ie six potential recordings per 24-hour day) was 6.8%, 26.3%, 48.9% and 63.5% for the four units until the day the last unit stopped transmitting. Due to the poor performance of the SpoorTrack satellite transmitters in 2022, Six Rivers Africa procured four satellite tags from African Wildlife Tracking based in Pretoria South Africa for the 2023 fieldwork, and they are non-solar units. A Memorandum of Understanding has been drafted between the Department of Nature Conservation of the Tshwane University of Technology and TAWIRI and is close to being finalised. Six Rivers Africa has agreed to sponsor two MSc students from TAWIRI/TANAPA to study through the Tshwane University of Technology in South Africa in 2024.

Research and Publications:

In South Africa, the following post-graduate research projects are being carried out:

- Fortunate Davhana from the Department of Nature Conservation of the Tshwane University of Technology has finally started fieldwork for her Masters study titled “Experimental study investigating the effect of ingested lead (Pb) in captive Nile crocodiles (*Crocodylus niloticus*)”. The study aims to measure lead concentrations in captive sub-adult Nile crocodiles as well as several other parameters. The main supervisor is Dr. Xander Combrink with co-supervisors Prof. M. Humphries (WITS), Dr. Nimmi Seoraj-Pillai (TUT) and Dr. Juan Scheun (TUT).
- Nompumelelo Ngcobo from the Department Nature Conservation of the Tshwane University of Technology will continue with her Masters study that was delayed from 2020 due to Covid-19. The title of her study is “Population status and conservation conundrum of Nile crocodiles (*Crocodylus niloticus*) at Lake Sibaya, South Africa”. Her study aims to determine the Nile crocodile population size, establish likely causes for the decline, and investigate opportunities and benefits for lake users to conserve crocodiles in Lake Sibaya. The main supervisor is Dr. Xander Combrink with co-supervisors Prof. T. Nangammbi (TUT) and Dr. Nimmi Seoraj-Pillai (TUT).
- Joshua Smit from the University of Pretoria finished an Honours study titled “Behavioural sensitivity of Nile crocodiles (*Crocodylus niloticus*) to thermal environments” under the supervision of Prof. Stephan Woodborne, Prof. Jan Myburgh and Dr. Albert Myburgh.
- Albert Wilken from the University of Pretoria finished an Honours study titled “The suitability of census techniques for the management of threats to crocodylian populations” under the supervision of Prof. Stephan Woodborne, Prof. Jan Myburgh and Dr. Albert Myburgh.

Publications include:

- Du Plooy, K.J., Swan, G.E., Myburgh, J.G. and Zeiler, G.E. (2023). Electroencephalogram (EEG) assessment of brain activity before and after electrical stunning in the Nile crocodile (*Crocodylus niloticus*). *Scientific Reports* 13: 20250.
- Humphries, M., Benitez-Nelson, N. and Combrink, X. (2022). Trace metal accumulation in eggs of wild Nile crocodiles (*Crocodylus niloticus*) from Lake St Lucia, South Africa: Implications for biomonitoring in a global biodiversity hotspot. *Arch Environ Contam Toxicol* (doi: 10.1007/s00244-022-00960-5)
- Humphries, M., Myburgh, J., Campbell, R. and Combrink, X. (2022). High lead exposure and clinical signs of toxicosis in wild Nile crocodiles (*Crocodylus niloticus*) from a World Heritage Site: Lake St Lucia Estuarine System, South Africa. *Chemosphere* 303 (<https://doi.org/10.1016/j.chemosphere.2022.134977>).
- Lensink, A.V. (2023). Bacterial and Fungal Penetration of the Nile Crocodile (*Crocodylus niloticus*) Egg in Relation to the Eggshell and Eggshell Membrane Anatomy and Microstructure. PhD thesis, University of Pretoria, Pretoria, South Africa.
- Lensink, A.V., Swan, G.E. and Myburgh, J.G. (2023). The structure of the eggshell and eggshell membranes of *Crocodylus niloticus*. *Journal of Microscopy* (doi: 10.1111/jmi.13173).
- Meal Diets as a Potential for Replacement of Fishmeal Protein in Commercial Production of Mozambique Tilapia (*Oreochromis mossambicus*). PhD thesis, University of KwaZulu-Natal, Pietermaritzburg, South Africa.
- Myburgh, A., Botha, H., Combrink, X., Myburgh, J., Guillette, Jr., L.J., Hall, G., Chimimba, C. and Woodborne, S. (2022). Terrestrial diet dependence in an unprotected Nile crocodile (*Crocodylus niloticus*) population. *Journal of Herpetology* 56(4): 507-513.
- Myburgh, A., Myburgh, J., Steyl, J., Downs, C.T., Botha, H., Robinson, L. and Woodborne, S. (2023). The histology and growth rate of Nile crocodile (*Crocodylus niloticus*) claws. *Journal of Morphology* 284(10) (doi: 10.1002/jmor.21634).
- Price, C., Ezat, M.A., Hanzena, C. and Downs, C.T. (2022). Never smile at a crocodile: Gaping behaviour in the Nile crocodile at Ndumo Game Reserve, South Africa. *Behavioural Processes* 203 (<https://doi.org/10.1016/j.beproc.2022.104772>).
- Viljoen, D.M., Webb, E.C., Myburgh, J.G., Truter, J.C., Lang, J.W. and Myburgh, A. (2023). Adaptive thermal responses of captive Nile crocodiles (*Crocodylus niloticus*) in South Africa. *Applied Animal Behaviour Science* (<https://doi.org/10.1016/j.applanim.2023.106098>).

- Viljoen, D., Webb, E., Myburgh, J., Truter, C. and Myburgh, A. (2023). Remote body condition scoring of Nile crocodiles (*Crocodylus niloticus*) using uncrewed aerial vehicle derived morphometrics. *Front. Anim. Sci.* 4:1225396. doi: 10.3389/fanim.2023.1225396

Namibia: Research and Publications

- Zan Le Roux finished his Master's study titled "The state of crocodiles in the Kunene River, Namibia: Population dynamics and socio-ecological interactions". The main supervisor was Dr. Alison Leslie, and the co-supervisors were Dr. Patrick Aust and Vince Naude.

South Sudan: Research and Publications:

- Benansio, J.S., Demaya, G.S., Dendi, D. and Luiselli, L. (2022). Attacks by Nile crocodiles (*Crocodylus niloticus*) on humans and livestock in the Sudd Wetlands, South Sudan. *Russian Journal of Herpetology* 29(4): 199-205.

Uganda: Research and Publications:

- Amana, S. (2023). Conservation and Management of the Nile crocodile "*Crocodylus niloticus*" in Uganda, a case study of Lake Victoria and Victoria Nile River at Murchison Falls National Park. MSc thesis, Universidad Internacional de Andalucía, Spain.
- Hüge, J. (2023). The state and perceptions of human-crocodile interactions around Murchison Falls Conservation Area, Uganda. *Human Dimensions of Wildlife* (<https://doi.org/10.1080/10871209.2023.2212692>).
- Melo, K., Horvat, T. and Ijspeert, A.J. (2023). Animal robots in the African wilderness: Lessons learned and outlook for field robotics. *Sci Robot* 8(85) (doi: 10.1126/scirobotics.add8662).

Zimbabwe: Research and Publications:

- Matanzima, J., Marowa, I. & Nhwatiwa, T. (2023). A Negative human-crocodile interactions in Kariba, Zimbabwe: data to support potential mitigation strategies. *Oryx*. 57 (4): 452 - 456. (doi:10.1017/S003060532200014X)
- Hocutt, C.H. (2022). Seasonal variation in thermoregulation of wild free-ranging Nile crocodiles: Recovery of a 36-year old data set. *International Journal of Current Microbiology and Applied Science* 11(10): 101-11.
- Simakani, A., Mashapa, C., Muboko, N., Mutanga, C.N. and Gandiwa, E. (2023). Trends and local perceptions of human-crocodile conflicts in Kariba town, northern Zimbabwe. *Human Dimensions of Wildlife* (<https://doi.org/10.1080/10871209.2023.2243970>).
- Te Velde, K., Peeters, E., Verdegem, M. and Beijer, J. (2022). Aquaculture carrying capacity of Nile tilapia *Oreochromis niloticus* and Nile crocodile *Crocodylus niloticus* in Lake Kariba, Zambia and Zimbabwe. *Aquaculture Environment Interactions* 14: 113-125.
- Makumbe, P., Mapurazi, S., Jaravani, S. and Matsilele, I. (2022). Human-Wildlife Conflict in Save Valley Conservancy: Residents' attitude toward wildlife conservation. *Scientifica (Cairo)* (doi:10.1155/2022/2107711).
- Hungwe, H., Utete, B. and Madamombe, H. (2024). Assessing human crocodile conflicts in the Dande Area, Zimbabwe: Data on potential mitigation strategies. *Human Wildlife Interactions* (*in press*).

Prepared by: Xander Combrink

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