

MN224 Population ecology of Nile crocodiles in Madagascar

Worshiped and feared, the Nile crocodile is the last surviving member of Madagascar's megafauna. Western Madagascar has long been seen as a stronghold for the Nile crocodile with some isolated areas known to be home to large populations e.g. Besalampy wetlands. Although relatively well studied throughout its range on continental Africa little is known about the population ecology of *Crocodylus niloticus* in Madagascar.

Lately, reports have suggested that populations of wild crocodiles in Madagascar are yet again in decline which in turn has led to the suspension of the trade in crocodilians and crocodilian products from Madagascar.

From previous surveying in 2010 and 2011, some rivers within the Mahamavo region seem to support small populations of crocodiles. The larger animals within these populations exhibit profound wariness towards humans that suggests they once were or are still hunted. This wariness has led to complications in accurately determining the demographics of the populations present in the Mahamavo region. Therefore a long term monitoring programme is the best way to ascertain the extent to which this species occurs throughout the region and to generate a better estimate of the sizes of the individual populations.

A speed boat will be used to conduct numerous diurnal and nocturnal surveys of the main rivers and their tributaries most of which are intertidal. Surveying of smaller water bodies (lakes, ponds etc.) that are inaccessible by boat will be done on foot. The spotlight surveying technique will be employed for the nocturnal surveys. GPS coordinates will be taken of each encountered crocodile as well as estimates of size and also distance and angle if distance sampling is the survey method being employed.

When possible, multiple photographs will be taken of each encountered crocodile with particular attention aimed towards both sides the tail. Photographic manipulation software will be used to identify individuals based on colour patterns on the tail and other identifying features e.g. scars, missing limbs etc. The photographs will then be compared with those in the photo database and used to generate encounter histories for each individual.

Depending on surveying technique used, the computer programs MARK or DISTANCE will be used to calculate the local crocodile population density. These population estimates can then be compared with the actual number of animals seen/encountered during the surveys.

In addition to surveying, details of the habitat in which the animals are encountered will also be taken and any other information deemed relevant to the aims of the project e.g. destruction of mangrove forest, sandbanks etc. It will also be possible and encouraged for students to undertake observational studies to document behaviours such as basking site selection, hunting and prey choice and interactions with conspecifics. These 'opportunistic' observations have proven to themselves to be valuable sources of information during previous field seasons.

Suggested Reading:

- Bourquin, S. L and Leslie, A. J. 2011. Estimating demographics of the Nile crocodile (*Crocodylus niloticus* Laurenti) in the panhandle region of the Okavango Delta, Botswana. African Journal of Ecology. 10.1111/j.1365-2028.2011.01285.x
- Buckland, S. T., Anderson, D. R., Burnham, K. P., Laake, J. L., Borchers, D. L., & Thomas, L. 2001. Introduction to distance sampling. Oxford: Oxford University Press.
- Cooch, E. and White, G. Program MARK - A Gentle Introduction (9th Edition).
<http://www.phidot.org/software/mark/docs/book/>
- Elphick, C.S. 2008. How you count counts: the importance of methods research in applied ecology. Journal of Applied Ecology. 45, 1313–1320.
- Fergusson, R.A. 2010. Nile Crocodile *Crocodylus niloticus*. pp. 84-89 in Crocodiles. Status Survey and Conservation Action Plan. Third Edition, ed. by S.C. Manolis and C. Stevenson.
http://www.iucncsg.org/ph1/modules/Publications/ActionPlan3/ap2010_15.html
- Hutton, J. 1989. Movements, home range, dispersal and the separation of size classes in Nile Crocodiles. American Zoologist 29: 1033-1049.
- Hutton, J. and Woolhouse, M.E.J. 1989. Mark-Recapture to assess factors affecting the proportion of a Nile Crocodile population seen during Spotlight counts at Ngezi, Zimbabwe, and the use of spotlight counts to monitor crocodile abundance. Journal of Applied Ecology. 26 (2) 381-395.
- Kuchling, G., Lippai, C. and Behra, O. 2003. Crocodylidae: *Crocodylus niloticus*, Nile Crocodile, Voay, Mamba. The Natural History of Madagascar, ed. Goodman, S.M. & Benstead, J.P., Chicago & London, University of Chicago Press, pp 1005-1008.
- Magnusson, W. E. 1980. 'Techniques of surveying for crocodilians', in: Crocodiles: Proceedings of the Fifth Working Meeting of the IUCN/SSC Crocodile Specialist Group. Florida, USA, 12-16 August 1980. IUCN: Gland, Switzerland.
- Magnusson, W.E. and Caughley, G. 1978. A double-survey estimate of population size from incomplete counts. Journal of Wildlife Management. 42 (1) 174-176.

- O'Brien, T. G. 1990. A comparison of three survey methods for estimating relative abundance of rare crocodilians. Crocodiles: Proceedings of the 10th Working Meeting of the IUCN-SSC Crocodile Specialist Group. Florida, USA, 23-27 April 1990. IUCN: Gland, Switzerland.
- Ottley, B., Lippai, C. and Rakotondrazafy, A.M.A. 2008. Surveys of Wild Crocodile Populations in Madagascar. Final Report to GTZ.
- Sutherland, W. J. 2006. Ecological Census techniques: a handbook. Second edition. Cambridge University Press, Cambridge, UK.
- Swanepoel, D. G. J. 1996. Identification of the Nile crocodile (*Crocodylus niloticus*) by the use of natural tail marks. Koedoe 39: 113–115.
- Yoshizaki, J., Pollock, K. H., Brownie, C., and Webster R. A. 2009. Modeling misidentification errors in capture–recapture studies using photographic identification of evolving mark. Ecology, 90(1) 3–9.