Southern Ground-Hornbill Research and Conservation Program

ExCo Quarterly Report

20 January 2014

Breeding season

Eleven Ground-Hornbill nests were found to be active this season and the harvest of second-chicks is now complete. Egg-laying and hatching peaked as expected in October and December, respectively. However this season was unusually long with nests becoming active early and late in the season. A total of four nests hatched both first- and second-hatch chicks with all second-hatch chicks successfully harvested. Five nests were recorded as hatching only a single chick as nests were noted as containing a single-egg clutch (n=2), containing infertile second eggs (n=2), or having the second egg disappear (n=1). Two nests were recorded as having a single egg in each but were later abandoned.

Harvested chicks were transported to Loskop Dam (n=3) and Joburg Zoo (n=1) for hand-rearing. Two chicks didn't make it beyond a few days but the remaining two chicks are healthy and nearing fledging.

First-hatch chicks are doing well and the first nestling of the season has just been ringed. We will continue to monitor the progress of nestlings in all remaining nests with the last nestling to be ringed on 1st April.

Window breakages and Ground-Hornbills

There have been a few reports this year of window-breaking by Ground-Hornbills in the APNR. Although it is distressing to hear the birds are breaking windows repeatedly, we are grateful that these incidents are being reported to us. Window-breaking is a nuisance to land-owners and lodge managers, and I am sure to wardens too. Although shattered glass can be a risk to the birds, an additional and more serious problem arises after the windows have been replaced. Hornbills in general have a habit of pecking and occasionally consuming soft, new window putty. This substance is toxic and, if ingested, can lead to deaths not only of Ground-Hornbills but the smaller Tockus species who also share the habit of picking at soft window putty. A two-page information pamphlet is now available in an effort to increase awareness. Included is a list of suggestions to make windows Hornbill-proof and to prevent repeated window breakages. I have asked that this be distributed by the wardens to all landowners.

Extension of existing Research Agreement

The current research agreement expires at the end of April 2014 with a possible extension to be discussed in February. With the next Joint Committee Meeting soon to take place, I would like to approach the APNR Executive Committee regarding the possibility of an extension for an additional three year period and to present my motivation.

The Project has secured funding for the next three years which includes project running costs and a salary for Cassie. In addition I have obtained a PhD studentship from UCT to investigate dispersal, spatial genetic relatedness and territorial systems in the Southern Ground-Hornbill. Although the formal proposal is only due for submission to the UCT doctoral board in the middle of the year, I would like to put forward an initial proposal (Appendix 1) for the Committee's consideration.

There will also be an increased need to replace old artificial nests - currently reaching the end of their life-span - with new ones constructed using the designs and suggestions that arose at the artificial nest box workshop held last year. Prototypes are currently being developed by the Action Group and once ready we can begin the replacement effort.

Acknowledgements

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APPENDIX I: Initial PhD proposal

PhD student: Kathleen Frances Carstens

Duration of study: 3 years full-time

Supervisors: Assoc. Prof. Peter Ryan (UCT) and (co) Dr Alan Kemp

Working title: Dispersal and group structure in a long-lived, cooperatively breeding bird

Background

Biology of the Southern Ground-Hornbill

The Southern Ground-Hornbill is the world's largest cooperatively breeding bird. They are long-lived and slow-breeding: this species is known to live to between 20-50 years, reach maturity at age 8, and raise one chick to fledging every 2-9 years (Kemp 1988, Theron 2013). They live in groups of 2-11 individuals which consist of a breeding pair, non-breeding sub-adults (mostly male helpers) and immature individuals. Breeding takes place in the spring and summer months (Sept-March) with females laying 1-3 eggs, 3-14 days apart, though only one chick is raised to fledging (the other succumbing to dehydration a few days after hatching). Groups are territorial and densities vary from 1 group / 100 km^2 in South Africa up to 1 group / 20 km^2 in the Mana Pools region of Zimbabwe (Hockey *et al.* 2005).

Dispersal and group structure in Southern Ground-Hornbills

The first detailed study on this species took place from 1968 to 1988, focussing mostly on 14 groups in the Satara region, Kruger National Park (KNP). During an intensive study period in 1973, each group was followed for up to 3 consecutive days over a five month period, providing detail on the species' biology and behavioural ecology. Although no individuals were marked, the fate of individuals could be followed using knowledge of group composition, territorial limits and a few distinctly formed individuals.

Females disperse usually at a younger age than males, thereafter very little is known of their movements or their survival. Non-breeding females have been observed as 'floaters', alone, or have been observed in all-female groups up to three birds. As sub-adults, they

masquerade as males before they get their full, blue throat colour, and are subordinate to the breeding female (Kemp 1988). As a subordinate, she seldom takes on any of the sub-adult helper roles but presumably gains greater protection being in a group than being out on her own. Her dispersal from a natal group at a young age may also be an affect of the males' tendency to remain in the natal group, and thus serves to counter inbreeding.

Males delay dispersal and assist the natal group with rearing the next generation, territory defence and predator detection. They remain in their natal territories for many years, in one case as long as 6 years where after they presumably inherit the natal or a neighbouring territory (Kemp 1988). If this is true, one would find (a) high relatedness between males in neighbouring groups, (b) low relatedness between females in neighbouring groups, (c) relatedness between males would decrease with distance, and lastly (c) females would have to disperse further than males in order to avoid inbreeding.

An investigation into SGH dispersal and relatedness using molecular methods was initially undertaken by Theron (2013) using groups from the Limpopo River Valley (LRV). Molecular methods use relatedness between individuals as a means of identifying unrelated individuals (immigrants) in a group. The Ground-Hornbill population in the LRV declined rapidly after the 1970s, likely due to several factors such as persecution, secondary poisoning or the severe drought in the 1960's (Theron 2013). Theron's findings supported a recent re-colonisation of the area by showing (a) high levels of dispersal by sub-adults (age 3-6), (b) overall low estimates of relatedness between adult males, adult females, and all adults, and finally (c) no bias for male or female dispersal. His was also the first to confirm that the species is not as monogamous as previously thought, with evidence for extra-pair copulation in several focal groups.

Theron's study provided insight into spatial group relatedness at a time of a recent re-colonisation event. But how does spatial group relatedness in the APNR compare? Dispersal has only recently been visualised using field observations of individuals banded with colour rings in the APNR. Field observations have shown (a) sub-adult males remaining in their natal territories up to six years (b) females dispersing within 3 years (c) males dispersing both into neighbouring groups and well beyond neighbouring groups up to 80 km (e) females dispersing out of the study area between 25-70 km (f) an adult male dispersing into a neighbouring group and successfully acquiring alpha status. However field

observations often underestimate true dispersal events and distances (Koenig, van Vuren & Hooge 1996). Coupling molecular and field observations will allow for a more accurate understanding of spatial relatedness and dispersal, and bring clarification on how individuals and groups arrange themselves in the APNR.

Aims

To gain a thorough understanding of group dynamics and dispersal patterns of Ground-Hornbill individuals in north-eastern South Africa .The Southern Ground-Hornbill has undergone a drastic population decline in recent times and has disappeared from some areas of its former range. A Species Action Plan was set into motion in 2011, highlighting gaps in the knowledge and listing objectives to halt the decline. Knowledge on dispersal ability and processes of dispersion is currently needed as population dynamics remains poorly understood (Jordan 2011). The aims of this Project are to:

(1) Investigate spatial genetic relatedness of groups in the APNR field study site.

(2) Investigating dispersal to determine (a) dispersal distances and (b) whether there is a sex-bias

Key questions

1. How do individuals and groups arrange themselves in the environment?
2. What is the relationship between physical distance and genetic relatedness between groups?
3. Are males in neighbouring groups more closely related than females?
4. Do females usually disperse further than males?
5. Are field observations of dispersal accurate indicators of true dispersal distance?
6. What is the success rate of individuals who disperse, acquiring a territory and successfully breeding (raising a chick to fledging)?

Study area

This study will focus on wild groups at the Fitztitute's long-term project site in the Associated Private Nature Reserves, Mpumalanga Province, South Africa.

Outline

The Fitz's Ground-Hornbill Project has been collecting sightings and breeding data for over 13 years. This database will be used to extract the necessary information pertaining to the key questions when needed.

1. Catch multiple groups in the APNR and obtain samples from as many individuals in each group as possible. Include samples already obtained from ringed individuals.
2. Extract DNA and obtain genotypes from each individual using existing species-specific microsatellite markers. Identify sex of each individual using universal genetic markers.
3. Use genotypes to determine relatedness of individuals within and between groups.
4. Build pedigree using existing data from field observations and molecular methods.
5. Provide a visual representation of groups in the APNR showing related and unrelated individuals, and their origins.
6. Determine dispersal distance by combining direct observations existing in the database with spatial autocorrelation estimated of genetic data. Compare dispersal distances of male and female individuals.

Key References

* represents those studies with similar objectives to this study

Arnold KE, Owens IPF (1998) Cooperative breeding in birds: a comparative test of the life history hypothesis. *Proceedings of the Royal Society of London. Series B: Biological Sciences*, **265**, 739–745.

Dieckmann U, O'Hara B, Weisser W (1999) The evolutionary ecology of dispersal. *Trends in Ecology & Evolution*, **14**, 88–90.

Greenwood PJ (1980) Mating systems, philopatry and dispersal in birds and mammals. *Animal Behaviour*, **28**, 1140–1162.

Handel CM, Pajot LM, Talbot SL, Sage GK (2006) Use of Buccal Swabs for Sampling DNA from Nestling and Adult Birds. *Wildlife Society Bulletin*, **34**, 1094–1100.

Hatchwell BJ (1999) Investment Strategies of Breeders in Avian Cooperative Breeding Systems. *The American Naturalist*, **154**, 205–219.

Hockey PAR, Ryan PG, Dean WRJ (Eds.) (2005) *Roberts - Birds of southern Africa*. Trustees of the John Voelcker Bird Book Fund, Cape Town.

Jordan M (Ed.) (2011) Southern Ground Hornbill (Bucorvus leadbeateri) Species Recovery Plan for South Africa. Johannesburg Zoo and the Endangered Wildlife Trust, Johannesburg.

Kemp AC (1988) The behavioural ecology of the southern ground hornbill: are competitive offspring at a premium? *Int. 100th Deutsche Ornithologen Gesellschaft Meeting. Current Topics in Avian Biology*, 267–271.

Kemp AC, Kemp MI (1980) The Biology of the Southern Ground Hornbill Bucorvus leadbeateri (Vigors) (Aves: Bucerotidae). *Annal of the Transvaal Museum*, **32**, 65–100.

Koenig WD, Pitelka FA, Carmen WJ, Mumme RL, Stanback MT (1992) The evolution of delayed dispersal in cooperative breeders. *The Quarterly review of biology*, **67**, 111–150.

Lynch M, Ritland K (1999) Estimation of Pairwise Relatedness With Molecular Markers. *Genetics*, **152**, 1753–1766.

Nathan R (2001) The challenges of studying dispersal. *Trends in Ecology & Evolution*, **16**, 481–483.

*Nelson-Flower MJ, Hockey PAR, O'Ryan C, Ridley AR (2012) Inbreeding avoidance mechanisms: dispersal dynamics in cooperatively breeding southern pied babblers. *Journal of Animal Ecology*, **81**, 876–883.

Nutt K (2008) A comparison of techniques for assessing dispersal behaviour in gundis: revealing dispersal patterns in the absence of observed dispersal behaviour. *Molecular ecology*, **17**, 3541–3556.

Pasinelli G, Schiegg K, Walters JR (2004) Genetic and Environmental Influences on Natal Dispersal Distance in a Resident Bird Species. *The American Naturalist*, **164**, 660–669.

Ridley AR, van den Heuvel IM (2012) Is there a difference in reproductive performance between cooperative and non-cooperative species? A southern African comparison. *Behaviour*, **149**, 821–848.

Rollins L, Browning L, Holleley C *et al.* (2012) Building genetic networks using relatedness information: a novel approach for the estimation of dispersal and characterization of group structure in social animals. *Molecular ecology*, **21**, 1727–1740.

Russell AF (2001) Dispersal costs set the scene for helping in an atypical avian cooperative breeder. *Proc. R. Soc. Lond. B*, **268**, 95–99.

*Temple HJ, Hoffman JI, Amos W (2006) Dispersal, philopatry and intergroup relatedness: fine-scale genetic structure in the white-breasted thrasher, Ramphocinclus brachyurus. *Molecular Ecology*, **15**, 3449–3458.

Theron N, Dalton D, Grobler JP, Jansen R, Kotze A (2013) Molecular insights on the re-colonization of the Limpopo Valley, South Africa, by Southern Ground-Hornbills. *Journal of Ornithology*, **154**, 727–737.

Wang J (2002) An Estimator for Pairwise Relatedness Using Molecular Markers. *Genetics*, **160**, 1203–1215.

*Woxvold IA, Adcock GJ, Mulder RA (2006) Fine-scale genetic structure and dispersal in cooperatively breeding apostlebirds. *Molecular Ecology*, **15**, 3139–3146.

Zack S, Stutchbury BJ (1992) Delayed Breeding in Avian Social Systems: The Role of Territory Quality and "Floater" Tactics. *Behaviour*, **123**, 194–219.