DAVIS EXPEDITION FUND

REPORT ON EXPEDITION/PROJECT

Expedition/Project Title: Do spotted bowerbirds (*Chlamydera maculata)* practice learnt vocal Batesian mimicry?.....

Travel Dates: 25/07/07 – 01/09/07 .....

Location: Taunton National Park, Queensland, Australia. .....

Group Members: Rob Heathcote.....

Aims: To determine whether spotted bowerbirds use vocal mimicry contextually to repel potential predators or competitive conspecifics. .....

OUTCOME (not less than 300 words):-

ARE SPOTTED BOWERBIRDS VOCAL BATESIAN MIMICS?

Introduction

Whilst avian vocal mimicry has been acknowledged for more than a century and is practiced by approximately 15-20% of bird species, only a single study to date has shown possible functions for this behaviour. Goodale and Kotagama (2006a & 2006b) showed that the racket-tailed drongos (*Dicrurus paradiseus*) of southern Africa often attract several species of other birds by mimicking their 'contact calls', and also mimic their alarm calls upon detecting a predator, both assumedly increasing their protection from predators.

The only other reported case where vocal mimicry has been shown to have a function is in the burrowing owl (*Athene cunicularia*). The warning hiss of these birds, usually directed at terrestrial mammals approaching the nest (almost always a hole in the ground), has a wavelength and frequency extremely similar to that of the rattle from a large rattlesnake (*Crotalus viridis*), and are thought to be the only known case of Batesian learnt mimicry (Rowe *et al*, 1986). These vocalisations are likely to have evolved from the begging calls of the juvenile owls as they are not learnt (Ownings *et al*, 2002). Playback experiments have shown that ground squirrels (a competitor for the nest holes the owls use to breed in) that have encountered rattlesnakes were more repelled by the owl vocalisations than snake-naive squirrels, suggesting true mimicry. Whilst this effect could be a by-product of the owls mimicking rattlesnakes to scare away the snakes themselves (which frequently attempt to shelter in burrows during the day, and thus clearly could represent a threat to the owl chicks or the adults), the snakes inner ear is almost completely insensitive to the frequencies its own 'rattling' resonates (Fenton & Licht, 1990).

This project investigated the role of context-specificity of vocal mimicry in the spotted bowerbird, *Chlamydera maculata*. Being a mostly solitary bird compared to the drongos in Goodale and Kotogama (2006a, 2006b), studying this species offers potentially novel ecological scenarios for the adaptive use of vocal mimicry. Also, the relatively reliable predictability of the location of males at their bowers over consecutive breeding seasons allows the possibility for long term monitoring of individuals. Given the time and energy a male bower bird invests into the construction of a mature bower, and the bower being a major factor by which females assess male quality, it may be expected that appropriate protective measures are likely to have evolved to protect it. The presence of large animals may affect male reproductive success by

either trampling/damaging the bower, repelling females, or by providing a direct threat to the male itself considering the large amount of time spent on the ground maintaining the bower (and thus relatively vulnerable to predation). Thus, vocally mimicking predators or aggressive species when encountering antagonists would be adaptive if it results in repelling the latter from the bower vicinity.

This study thus specifically investigated whether bowerbirds vocally mimic aggressive and threatening sounds and species more frequently than passive sounds during perceived predatory encounters at the bower.

Methods

All data was collected in Taunton National Park (Scientific), Queensland, from July to August 2007. The project was split into 2 parts; general observations and sound recordings of undisturbed birds (to obtain data on 'normal' behaviour), and 2 experimental phases. All data were collected from birds present at 'active' bowers, located by searching areas that previously contained active bowers using GPS logged data from past field seasons (Coe, 2005). Bowers were deemed active (i.e. being maintained by a male bowerbird to attract females) when 20mm glass beads placed 10m from a bower were placed into the ornamental pile in the bower avenue within 24 hours. All observations and sound recordings were recorded 20m from the bower to reduce disturbance to the birds.

Basic observations included identification (through previously attached leg bands) and the number of bowerbirds present at a bower, and the vocalisations made by particular bowerbirds, or those made by other bird species in hearing range of the bower. Vocalisations and sounds were recorded using a directional microphone and DAT audio recorder. Data was gathered for 6 hours each day, starting from sunrise till early afternoon. By this time most bowerbirds had departed from their bowers during the heat of the day.

The experimental phases of the experiment involved simulated 'predator' interactions, and the first experiments took the form of direct approaches to a bower by one experimenter, when the bird was present, till within a yard of the bower, with another experimenter positioned 20m away (to reduce any effects to the bird's behaviour) making behavioural and vocalisation recordings. The experiments were only conducted for 5 minutes to keep stress on the birds to a minimum.

The second experiment was a pilot study (due to time constraints) to investigate variations in behaviour of the bower birds based on variations in perceived threat. Here, a model, green rubber snake was placed 1 metre adjacent to the bowers when the bower owner was not present. Recordings were then taken once the bower owner returned, and the snake removed after 5 minutes to keep stress to a minimum.

Both experimental procedures, once terminated, immediately resulted in the bower owner continuing to maintain its bower, and did not appear to result in any long term negative effects.

Mimicked vocalisations will be assigned to their possible 'models' using Primary Component Analysis of sonogram data.

Results and Discussion

Terrestrial predator simulations

Analysis is still being conducted at the time of writing this report, so unfortunately conclusions must be limited to an anecdotal theme before firm conclusions can be made. The only contexts where vocal mimicry was frequently heard was during the 'human predator' simulations, and when male birds vocalised from the top of trees in the absence of any obvious threats. Species mimicked possibly include kookaburras, whistling kites, wedge-tailed eagles, white headed babblers, pied currowongs and humans. Other non-species specific sounds possibly include 'bangs' and 'breaking branches'. Behaviour during these encounters typically included the bower owner flying within 15 yards of the researcher into low vegetation, and starting to vocalise. There would almost always be vegetation between the researcher and the bowerbird during these vocalisations, which included mostly hisses interspersed with the mimicry of a single species at a time. The bowerbird would frequently move to different positions every few seconds, and would noticeably be

stationary during mimicry episodes, although hissing would often be carried out during flight. No crest or other type of noticeable display seemed to be occurring during these encounters.

Vocally mimicking aggressive species more often than passive species during an encounter with predators could be explained by an instinctive response of which the bird has no understanding, but where it simply filters sounds perceived as aggressive and selectively mimics these in predatory encounters. Australia is home to notably few large, terrestrial carnivores. The terrestrial species that would represent a realistic threat to a bowerbird include possibly the several species of quoll, feral cats, and several snake species. All of these are 'ambush' predators, and are thus vulnerable to mobbing once being spotted, as the advantage of surprise has been lost. This opens up another dimension for the function of mimicry, where the aggressive species being mimicked may be attracted to the bower, and provide a means of repelling the threat. This is probably an unlikely explanation for vocal mimicry however, as attracting an additional predator would simply produce an added threat to the bowerbird.

Snake experiment

The bower owner often took several minutes to noticeably spot/recognise the 'snake'; one trial taking 5 minutes with the model in clear view before a response was observed. The bower owner responded with repetitive hissing whilst moving ~1m around the snake. There was no mimicry heard during the 5 trials with 5 different birds, when only hisses (an innate bowerbird call) were heard. This is fascinating, since the hearing apparatus of many snakes is poorly adapted to hearing airborne sounds above 700Hz; below the range of most bird vocalisations (Fenton & Licht, 1990). This provides some evidence that vocal mimicry during bower disturbances is used in a Batesian context since vocalisations would be useless to an animal that cannot hear. Should this be the case, an interesting further study would be to discern the function of the 'hissing', as unless this call has properties detectable by snakes, their presence in the absence of vocal mimicry during the snake experiments suggests they may not be used as an antagonistic signal directed at predators themselves.

Conclusions

Whilst the data for this study has not yet been fully analysed, this field season funded by the Davis Fund provided many interesting directions to pursue in the future. Vocal mimicry is still an extraordinarily understudied behaviour given its widespread acknowledgement in both the professional and popular scientific world. Hopefully with the results gained from this study, and those published from the ongoing study on spotted bowerbirds in Australia, this area of behaviour may start to receive more attention in the near future.

Acknowledgments

Many thanks to the Davis Expedition Fund for providing the means that allowed this fieldwork to take place. Also, a big thank you to Laura Kelley for her greatly appreciated help and advice in the field (and the beers when trying to find a car in Brisbane!).

References

Coe, R. L (2005). Vocal mimicry in the spotted bowerbird *Chlamydera maculata*. **PhD Thesis, University of Edinburgh.**

Goodale & Kotogama (2006a). Vocal mimicry by a passerine bird attracts other species involved in mixed-species flocks. *Animal Behaviour*. **72:** 471-477

Goodale & Kotogama (2006b). Context dependant mimicry in a passerine bird. *Proceedings of the Royal Society.* **273:** 875-880

Fenton, M. B. & Licht, L. E. (1990) Why rattle snake? *Journal of Herpetology.* **24:** 274-279.

Ownings, D. H., Rowe, M. P., & Rundus, A.S. (2002) The rattling sound of rattlesnakes (*Crotalus viridis*) as a communicative resource for ground squirrels (*Spermophilus beecheyi*) and burrowing owls (*Athene cunicularia*). *Journal of Comparative Psychology.* **116:** 197-205.

Rowe, M. P., Coss, R.G., & Ownings, D. H. (1986) Rattlesnake rattles and burrowing owl lines: a case of acoustic Batesian mimicry. *Ethology*. **72**: 53-71.