

## REPORT FROM A BOU-FUNDED PROJECT

Bain, G. 2018. Living with the enemy: chronic stress in Superb Fairy-wrens occupying Noisy Miner dominated remnant woodlands.

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### **Living with the enemy: chronic stress in Superb Fairy-wrens occupying Noisy Miner dominated remnant woodlands**

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#### **Background**

Predator-induced fear is a source of stress for many species (Clinchy et al. 2013). Indeed, chronic stress is likely to underpin many of the non-lethal effects predators have on their prey. For example, in an experimental study of song sparrows, Zanette et al. (2011) hypothesised that sustained psychological stress from repeated predator vocalisations caused females to lay fewer eggs, provision young less often, and ultimately produce 40% fewer offspring. In small woodland birds of Australia, intimidation by a hyperaggressive native honeyeater has the potential to drive a stress response comparable to a predator.

Noisy Miners (*Manorina melanocephala*) form colonies that exclude small birds from suitable woodland habitat. They have been described as a “despotic” and “reverse keystone” species and are frequently implicated in the decline of other Australian avifauna (Thomson et al. 2015). Stress induced by interference competition with miners presents one mechanism by which they could exclude competing species. Sustained stress could either compel other birds to leave areas colonised by miners or reduce individual fitness in those birds that persist, for example, by reducing foraging efficiency or increasing vulnerability to disease. Miner bird presence is associated with fragmented woodlands that have a degraded midstory, and with the dominance of other large-bodied predatory birds (e.g. kookaburra, butcherbird Thomson et al. 2015). An abundance of predators and lack of cover could further escalate stress levels in resident small bird species.

We used the heterophil : lymphocyte ratio (HLR) to measure levels of chronic stress in a small (10g) insectivorous passerine, the Superb Fairy-wren (*Malurus cyaneus*), and compared stress in birds occupying remnant woodlands dominated by miners with those living in undisturbed nature reserves. The HLR has been found to be a reliable measure of chronic stress in birds, with higher ratios indicating greater stress levels (Goessling et al. 2015). The HLR offers a means of investigating stress over an extended period of time and, unlike hormone concentrations, does so without exaggeration from the stress of capture and blood sampling itself.

#### **Study sites**

We captured fairy-wrens across six study sites in the Tasmanian Midlands, one of Australia's oldest agricultural landscapes and a nationally recognised biodiversity hotspot. Three sites were noisy miner occupied remnant woodlands on farmland (Tervue, Lewisham & Greenhill). Here, the understory comprised of a patchy mosaic of pasture grasses, bracken (*Pteridium esculentum*), sagg (*Lomandra longifolia*) and exotic weeds (e.g. *Ulex europaeus*). Remnants were isolated by

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agricultural pastures on all sides and ranged from 32 to 72 hectares in size. Predatory birds and noisy miners were frequently observed at remnants with their densities ranging from 0.43 birds/ha to 3.47 birds/ha. Of the other sites, two were nature reserves (Tom Gibson & Powranna) and one was a large conservation area (Gravelly Ridge); hereafter referred to as reserves. All reserve sites were >1200 hectares and had a more complex midstory than remnants. The understory was similar to remnants but with an absence of weeds and a greater diversity of herbaceous groundcovers. Noisy miners were never observed in reserves.

## Measures of condition and chronic stress

Using mist nets, we captured 43 fairy-wrens in remnant woodlands and 44 from reserves. Birds were sampled from reserves and remnants alternately to account for any differences in stress levels that might occur over time. Each bird was colour banded, weighed, and a score of fat stored in the bird's furculum (0-5) was noted. Blood samples were taken by brachial venipuncture. We used the wedge method to make up to 3 blood smears per individual on glass slides, which were later stained using May-Grunwald Giemsa stain following a standard procedure. Remaining blood was spun in a haematocrit centrifuge. Haematocrit was measured as the length of the capillary tube containing packed cells divided by the total blood column length. Each slide was examined at 100X magnification under oil immersion until 100 leukocytes were counted and the HLR could be determined. In each field of view, we also noted the number of blood parasites that were present.

## Results

Superb fairy-wrens had significantly higher HLR in remnant woodlands than in reserves ( $t_{84}=2.45$ ,  $p=0.016$ ). In remnants, the HLR was highest at the site with the greatest noisy miner density, Greenhill, and lowest at the site with the least miners, Tervue (Figure 1). There was no difference in HLR between the sexes ( $t_{84}=0.75$ ,  $p=0.45$ ). Birds in reserves had a significantly higher prevalence of blood parasites (*spp. Haemoproteus*) than birds in remnants (69% versus 31% respectively,  $P=0.01$ , Fisher's exact test). However, we found no difference in residual mass, furcular fat, or haematocrit between birds living in remnants and reserves and none of our condition measures were related to the prevalence of blood parasites. There was no significant relationship between HLR and the presence or absence of blood parasites.

## Conclusions

The heterophil to lymphocyte ratio was highest among birds occupying remnant woodlands on farms, suggesting that they were more stressed than birds living in nature reserves. Without experimental manipulation of factors like food abundance or vegetation cover, it is difficult to separate the effects of social stressors, like conflict with noisy miners, from environmental causes of chronic stress. Having said this, we found no difference in measures of individual condition in wrens between remnants and reserves. This could be an indication that food availability was not the reason for differences in stress that we observed. Interestingly, we found a very high prevalence of blood parasites in wrens occupying reserves. In fact, parasite prevalence was much higher among all wrens in our study when compared to superb fairy-wren

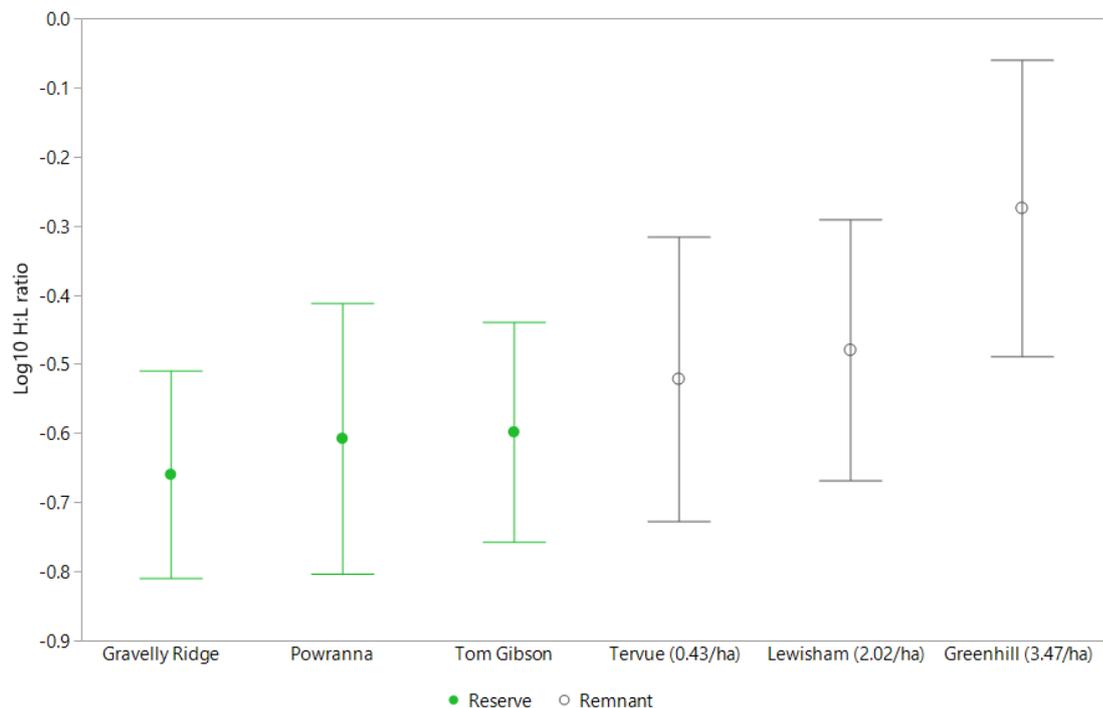
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populations studied on mainland Australia. This is likely due to a greater abundance of blood parasite vectors, midges and mosquitos, at our study sites. Predator-induced stress and stress caused by conspecifics, for example, through territorial disputes, is increasingly well-studied (Clinchy et al. 2013, Creel et al. 2013). However, physiological stress triggered by interspecific competition remains largely unexplored.



**Figure 1.** There was a significant positive increase in the heterophil : lymphocyte ratio (HLR log-transformed) of birds occupying remnants compared to those in reserves. For remnant sites, the density of noisy miners is specified (birds/hectare). Data points indicate the mean HLR for each site and error bars represent 95% confidence intervals.

## Acknowledgements

We are very appreciative for the financial support of the British Ornithologists' Union and Australian Wildlife Society. While this is not the study that we had endeavoured to carry out and that was initially described in our grant application to the BOU, this work has sought to answer a closely related question, at the same study sites and in the same study system, using an alternative technique.

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