

**THE GENETIC AND SOCIAL MATING SYSTEM OF
A WHITE-BACKED POPULATION OF THE
AUSTRALIAN MAGPIE
(*GYMNORHINA TIBICEN TYRANNICA*)**

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For my Dad, Dr Graham Durrant.

PRÉCIS

The Australian magpie (*Gymnorhina tibicen*) is a large, sedentary, omnivorous passerine. In some populations, individuals live in groups, and some of these groups breed cooperatively. The white-backed magpie (*G. t. tyrannica*) from the south-eastern corner of the continent, has had relatively little study, and few details are known of its mating system, social structure, and method of parental care. I conducted an observational study on a population of white-backed magpies, recording details of their demography, dispersal, breeding system, and parental care. In conjunction, I conducted a genetic analysis of the population, to determine if the genetic mating system matched the observed social system, to detect instances of extra-group mating, and to sex juvenile birds.

Extra-pair paternity (EPP) is a common feature of the mating systems of many birds. The rate of EPP may vary between species, races and populations. I made a comparison of extra-group paternity (EGP) rates between two races of the Australian magpie, to determine if similar mating systems were being employed. The two populations had similar social structure, but differed in group size and dispersal. I predicted that dispersal differences would have a profound effect on the rate of EGP between the populations, as the population with the lower rate of dispersal and higher chance of breeding with a close relative would engage in EGPs more frequently. Eight microsatellite loci were used to determine parentage in the white-backed Australian magpie. The rate of EGP was found to be 44%. Dispersal rates were estimated from observational data. Over half of the juvenile magpie cohort from the previous breeding season leave the territorial group. These results contrast sharply with the results found by other researchers in a population of western Australian magpies (*G. t. dorsalis*). In this population, 82% EGP is recorded and dispersal of juveniles is close to nil. The results indicate

that dispersal rate is a potentially important predictor of rates of extra-group fertilisations between populations of this species, and suggest that females maximise their reproductive output by avoiding breeding with close kin.

The reproductive success of a male bird is often correlated with measurable traits that predict his intrinsic quality. Females are thought to select mates based on their quality to gain their 'good genes'. Male Australian magpies of the white-backed race were trapped in two breeding seasons. Measurements were taken of morphometric and other characteristics in order to discover whether particular traits of males were associated with: a) number of fledglings produced in the territory per season; b) percentage of offspring sired in the territory; and c) whether females select males for their 'good genes'. The only variable that was correlated with number of territorial offspring was feather lice load. Males with high numbers of lice were less likely to produce territorial fledglings in one season and across both seasons. Males of inferior quality may be subject to increased conspecific territorial intrusions, leading to more time spent on defence, more failed breeding attempts, less time allocated to grooming and thus high parasite loads. Males that produced many territorial fledglings were more likely to gain genetic paternity of at least some of them, although again this was significant for only one season. Also, across both seasons, a high number of females in the group was correlated with increased paternity within the group. The general lack of correlation between the variables and level of genetic paternity may be due to females engaging in extra-group mating primarily to avoid breeding with a close relative rather than to choose a quality male. In this scenario, males would not have to be 'high quality', but merely genetically different to the female's social mate.

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Extra-group paternity (EGP) can affect paternal effort. It may also influence the helping effort of auxiliary birds in cooperatively breeding species. If helping is driven by kin selection, helpers should decline to provision unrelated young. Relatedness becomes difficult to assess however, when females mate outside the group. Alternative rewards may then become important in helper decisions. In my study population of Australian magpies, 38% of fledglings were sired by males outside the territorial group. In a second population (*G. t. dorsalis*), 82% of fledglings were sired by extra-group males. I observed within-group male and helper feeding effort over three breeding seasons in the first population and obtained data recorded over a single season in the second population. In both populations, males provisioned young regardless of relatedness, as did helpers. Males provisioned less than the nesting female on average. Paternal effort did not reduce with an increase in the rate of EGP between populations. In the population with intermediate levels of EGP, the white-backed magpies, I observed helpers in about half of the sampled territories that produced fledglings. Helpers did not increase the production of young. In the population with high levels of EGP, western magpies, I detected helping behaviour in proportionally more territories. It appears that Australian magpie helpers provide help in order to pay 'rent' and remain on the natal territory. I discuss these results in light of the differences between the two races of magpie and the major theories regarding male parenting decisions and helper activity.

Finally, I examine the relatively high rates of EGP's in the Australian magpie from a phylogenetic perspective. Although inbreeding avoidance is strongly supported by this study as the major reason EGP is so common in magpie populations, there may be an element of phylogenetic inertia that maintains the frequency of this behavioural trait. I comment upon the use of single-population estimates of species EGP rates in comparative analyses, given the intraspecific variation discovered between Australian magpie populations. Future directions

for the study of mate choice in the Australian magpie are outlined with a proposal to study variation at the major histocompatibility complex between mated pairs.

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DECLARATION:

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

Kate Durrant

