

# Correlated evolution of distinct signals associated with increased social selection in female white-shouldered fairywrens

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## Abstract

Conspicuous female signals have recently received substantial scientific attention, but it remains unclear if their evolution is the result of selection acting on females independently of males or if mutual selection facilitates female change. Species that express female, but not male, phenotypic variation among populations represent a useful opportunity to address this knowledge gap. White-shouldered fairywrens (*Malurus alboscapulatus*) are tropical songbirds with a well-resolved phylogeny where female, but not male, coloration varies allopatrically across subspecies. We explored how four distinct signaling modalities, each putatively associated with increased social selection, are expressed in two populations that vary in competitive pressure on females. Females in a derived subspecies (*M. a. moretoni*) have evolved more ornamented plumage and have shorter tails (a signal of social dominance) relative to an ancestral subspecies (*M. a. lorentzi*) with drab females. In response to simulated territorial intrusions broadcasting female song, both sexes of *M. a. moretoni* are more aggressive and more coordinated with their mates in both movement and vocalizations. Finally, *M. a. moretoni* songs are more complex than *M. a. lorentzi*, but song complexity does not vary between sexes in either population. These results suggest that correlated phenotypic shifts in coloration and tail morphology in females as well as song complexity and aggression in both sexes may have occurred in response to changes in the intensity of social selection pressures. This highlights increased competitive pressures in both sexes can facilitate the evolution of complex multimodal signals.

Conspicuous female signals have recently received substantial scientific attention, but the degree to which female-specific selection drives their evolution remains unclear. Species that express female-specific phenotypic variation among populations represent a useful opportunity to address this knowledge gap. White-shouldered fairywrens (*Malurus alboscapulatus*) are tropical songbirds with a well-resolved phylogeny where female, but not male, coloration varies allopatrically across subspecies. We explored how four distinct signaling modalities, each putatively associated with increased social selection, are expressed in two populations that vary in competitive pressure on females. Females in a derived subspecies (*M. a. moretoni*) have evolved more ornamented plumage, more complex vocalizations, and shorter tails (a signal of social dominance) relative to an ancestral subspecies (*M. a. lorentzi*) with drab females. Moreover, in response to simulated territorial intrusions broadcasting female song, female *M. a. moretoni* are more aggressive and more coordinated with their mate in both movement and vocalizations. These results suggest that correlated phenotypic shifts in female color, morphology, song complexity, and behavior may have occurred in response to changes in social selection, consistent with the idea that female-specific selection has driven the evolution of these signals.

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