Australian Field Ornithology 2025, **42**, 131–133
http://dx.doi.org/10.20938/afo42131133

Repeated nest failure precedes group dissolution and joining a neighbouring group by a female Variegated Fairy-wren *Malurus lamberti*

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Abstract. Natural history observations can provide critical insights into the circumstances that promote unique behaviours that can be otherwise difficult to document, and in doing so act as a platform for more substantive research. Variegated Fairy-wrens *Malurus lamberti* live in complex social groups composed of a primary breeding pair as well as male and female helpers, but the circumstances that can influence group augmentation remain little studied. Here, we provide observational evidence at Lake Samsonvale, Queensland, which suggests that repeated nest failure can prompt a female to dissolve her group and join a neighbouring group as an auxiliary helper. Our observations provide new insights into the factors that may affect decision-making processes in the Variegated Fairy-wren, and suggest that factors other than direct fitness benefits may shape social decisions in this species.

Introduction

The Variegated Fairy-wren *Malurus lamberti* is a small passerine distributed east of the Great Dividing Range in south-eastern Queensland and northern New South Wales (Rowley & Russell 2020). Like other fairy-wrens (Maluridae), it breeds cooperatively, whereby multiple individuals contribute to the care of offspring (Buchanan & Cockburn 2013; Joseph *et al.* 2013; Thrasher *et al.* 2018). Although many fairy-wren species live in simple family groups consisting of a primary breeding pair that is assisted by auxiliary helpers (e.g. Rowley *et al.* 1989; Brouwer *et al.* 2011; Johnson & Pruett-Jones 2018), Variegated Fairy-wrens often live in complex social groups with multiple breeding pairs and helpers (i.e. plural breeding: Boersma *et al.* 2023). Recently, Boersma *et al.* (2023) found that this species exhibits high instances of plural breeding (47% of social groups) compared with other fairy-wren species (e.g. Rowley *et al.* 1989; Brouwer *et al.* 2011; Johnson & Pruett-Jones 2018), where groups contained two or more breeding females. Plurally breeding females were never closely related (Boersma *et al.* 2023), suggesting that the creation of groups with multiple breeding females likely results from females joining established groups. However, although potential influences such as breeding failure or territory have been suggested (Boersma *et al.* 2023), the ecological circumstances that influence the decision of a female to join an established group remain poorly understood. Observations on natural history constitute an important first step in understanding such traits, which can subsequently be used to generate more substantive hypotheses. Here, we present field observations describing the ecological circumstances that preceded a female Variegated Fairy-wren disbanding her social group and separating from her mate to join another social group.

Study site

This study was conducted on the western side of Lake Samsonvale (27°16′S, 152°52′E), south east Queensland, in October–December 2024. The breeding biology and ecology of the Variegated Fairy-wren is being monitored as part of a long-term (10+ years) program investigating various aspects of avian ecology at this location (e.g. Feeney *et al.* 2018; Thrasher *et al.* 2018; Kennerley *et al.* 2019; Poje *et al.* 2019; Richardson *et al.* 2019; Carr *et al.* 2020; Boersma *et al.* 2023; Kessler *et al.* 2024; Resendiz *et al.* 2024). Individuals are fitted with an Australian Bird and Bat Banding Scheme (ABBBS) band and three colour bands either as adults, following targeted mist-netting, or as nestlings in the days before they fledge. Each unique colour-band combination allows for the identification of individual birds in the field, enabling observers to study their behaviour under natural conditions.

Observations

11 October

LC observed an adult female Variegated Fairy-wren [colour band combination: OSOS (right leg orange over silver, left leg orange over silver)], banded as an adult (1+ according to the ABBBS ageing protocol) in August 2024, feeding a recently fledged Variegated Fairy-wren [CALH (right leg crimson over gold, left leg light blue over hot pink)] that had been reared in a neighbouring territory. Before this feeding event, OSOS was the primary female of a pair (1M, 1F) (social group N06). Her mate was a 2-year-old fully ornamented male, CALO (right leg crimson over gold, left leg light blue over orange), which was banded as a nestling in October 2022. OSOS had also recently

presided over two unsuccessful nesting attempts that had failed because of nest depredation, the most recent of which occurred 5 days before the observation of her feeding CALH.

The social group in which CALH had been reared (social group S09) consisted of two males [ISRW (right leg ivy-green over silver, left leg purple over white)], banded as a young adult (1+) in December 2011, and CEBY (right leg crimson over emerald, left leg blue over yellow), banded as a 1+ in October 2022)] and one female [BEGB (right leg blue over emerald, left leg blue over yellow), banded as an adult (2+) in September 2023]. BEGB had been the primary female of a social group that had several nests in 2023 and again was the primary female of her social group in 2024. Before the provisioning event, OSOS was observed carrying a large stick insect *Acrophylla* sp. (~4 cm long) towards fledgling CALH, and subsequently feeding this to CALH when it begged for food. The members of the social group (social group S09) were foraging nearby during this time, including alongside OSOS. Over the course of 1 hour, three separate provisioning events were observed by OSOS to CALH before the entire group moved into dense Common Lantana *Lantana camara* and could no longer be tracked.

13 October

Approximately 70 m from where the previous provisioning events between OSOS and CALH had occurred, LC observed a similar interaction. OSOS was foraging in the lantana along the edge of a ravine. Shortly after, OSOS was observed carrying a smaller insect and delivering it to the begging CALH. Over the subsequent 2 hours, only one additional provisioning event by OSOS to CALH was observed; however, CALH was also fed during this time by its mother, BEGB. Once again, male CALO followed the group of five birds, but never directly interacted with its members, seemingly waiting for OSOS to move on.

18 October

LC observed OSOS allopreening male CEBY near where the initial provisioning events were recorded. Over the following 2 hours, OSOS was also observed provisioning CALH. OSOS's original mate, CALO, was not seen during this observation period. During the remainder of the 2024 field season (until late December 2024), OSOS associated with her new social group and was regularly located rotating around the margins of its territory. CALO typically remained on the fringes of the group and, with exception of several apparent attempts to isolate OSOS, rarely interacted with the other birds within the group. Although no other nesting behaviours by the group were observed, all birds involved remained, including ISRW, CEBY and BEGB. OSOS and CALH appeared to spend the most time in proximity to each other and were observed allopreening each other on various occasions.

Discussion

Here, we provide field observations on the Variegated Fairy-wren that offer new insights into the circumstances that can promote the disbanding of a social group by a primary female and the decision to join a neighbouring group as a secondary female.

Plural breeding is an uncommon breeding strategy in birds, and examples of plural breeding where females within a social group are unrelated are especially rare (Cockburn 1998). It has been correlated with population density in the Splendid Fairy-wren *M. splendens* and as a way to reinforce nesting success in the Red-winged Fairy-wren *M. elegans*, although in these species females within the same social groups are often genetic relatives of one another (Rowley *et al.* 1989; Brouwer *et al.* 2011, 2014). Although we cannot exclude the possibility that OSOS and BEGB are genetically related, we suspect that it is unlikely given that Boersma *et al.* (2023) found secondary females being genetic relatives of the primary female very rare in this species at this location. Nonetheless, our observations contribute new insights into the role that ecological pressures, such as recurrent nest failures, may have on a female's decision to disband her breeding group in favour of joining another to likely queue for a secondary breeding role. Although the decision by OSOS to join a neighbouring group is unlikely to be explained through a process such as kin selection, our observations suggest that the benefits of joining a larger group (e.g. enhanced territory defence) in a secondary role outweighed the benefits of continuing breeding following unsuccessful attempts in a pair. Our observations also highlight the role that female choice appears to play in group composition in this species, as they suggest that OSOS's original mate (CALO) was unable to retain her as his breeding partner.

Acknowledgements

We are grateful to Seqwater for access to the field site and for support of our research. This research was conducted with approval from Griffith University's Animal Ethics Unit (ENV/06/23/AEC), the Queensland Department of Environmental Science (P-PTUKI-100283615), and Seqwater (NPD20250326). It was supported by the Wildlife Research and Education Institute (Brisbane, Queensland), Cornell University (United States of America), and the Doñana Biological Station (Spain).

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Received 2 February 2025, accepted 24 May 2025, published online 7 August 2025