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BRIEF REPORT

# It takes two to tango, but not two pairs! Rare record of two reintroduced pairs of vinaceous-breasted Amazons sharing the same nest-box

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**Abstract**
Cavity-nesting birds, such as the endangered vinaceous-breasted Amazon (*Amazona vinacea*), are particularly vulnerable to habitat loss and nest-site competition. Released amazons may face challenges to form mating pairs and choose a nest site. This study documents a rare case of two released pairs of *A. vinacea* sharing the same artificial nest box in the surroundings of the Araucárias National Park, Brazil. Behavioral interactions were monitored using camera traps over 65 days. The implications for reproductive success were evaluated, and management strategies to mitigate nest competition in reintroduction programs were proposed. Both pairs frequently visited the same nest box, occasionally with different partners, and exhibited aggressive interactions. A female laid two eggs that failed to hatch. These findings suggest that limited availability of artificial nest boxes may elicit atypical behaviors in released individuals, potentially influenced by captivity related factors. To improve reproductive success, it is recommended to install nest boxes≥300 m apart, adopt weather-resistant designs and promote local engagement in monitoring through citizen science.

**Keywords** Nest management · Parental care · Reintroduction · Reproductive behavior

The availability of nesting cavities is a key factor influencing the breeding success of bird species that rely on existing tree holes (Bonaparte and Cockle 2017; Medina et al. 2022). In ecosystems like the Atlantic Forest, this limitation is intensified by habitat degradation, selective logging and increased competition (Bonaparte and Cockle 2017; James Reynolds et al. 2019; Ye et al. 2019). The installation of artificial nest boxes can be used in areas where natural cavities are scarce (Bonaparte and Cockle 2017).

The vinaceous-breasted Amazon (*Amazona vinacea*) is a secondary cavity-nesting parrot endemic to the Atlantic Forest and currently listed as endangered (BirdLife International 2017). Consequently, artificial nest boxes may be an important tool in facilitating reproduction. However, it may lead to unexpected social interactions, especially among translocated individuals whose behavior may be shaped by captivity. In this study, we document a rare case in which two *A. vinacea* pairs shared a single artificial nest box. Our objectives were to (1) describe the pairs' behavioral dynamics, (2) evaluate the implications for their reproductive success, and (3) propose management strategies to mitigate nest competition in reintroduction programs.

Amazons were released to the Araucárias National Park (ANP) as part of the project "Reintroduction of the vinaceous-breasted Amazon in the ANP". Birds were victims of wildlife trade, received rehabilitation as adults and underwent health checks and behavioral training between 2017 and 2018. Before release, animals were marked with leg

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bands, microchips, and a numbered neck collar for long-distance identification.

During the 2022 reproductive season, a pair of amazons (female 9 and male 15) released to the PNA in August 2021 was observed opening a cavity in a wooden roof of a private rural property located in Passos Maia, Santa Catarina, Brazil (26°46'51.5"S; 52°03'52.7"W). To avoid further damage, an artificial nest box was installed in a nearby *Annona* sp. tree in November 2022 (Fig. 1a) along with two feeders. The property owners, Mr. and Mrs. Gabiatti, were oriented to seal the roof opening. In the same month, they independently built a nest box in a *Morus* spp. tree (Fig. 1b). Artificial nests were around 38.3 m apart.

During the 2023 reproductive season, two breeding pairs were identified in the area: pair 1, composed by the female 65 and male 87, released to the ANP in October 2022, and pair 2, formed by the female 9 and male 56, reintroduced in August 2021. Following initial observations of the birds inspecting the artificial nest boxes, a camera trap was installed on September 22nd, 2023, and remained in place until November 26th, 2023, recording amazons activity over a 65-day period. Weekly visual inspections were also conducted by our team, complemented by videos made with handheld cameras and with


**Fig. 1** (**a**) Artificial and (**b**) improvised nest boxes installed in the rural property. (**c**) A pair of *A. vinacea*

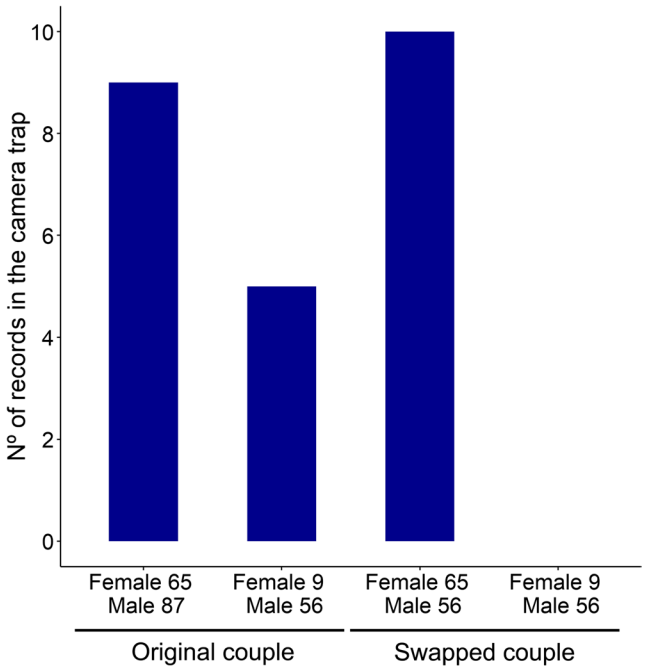


**Fig. 2** Number of camera-trap records of original and swapped pairs of *A. vinacea* in the same artificial nest box

verbal reports from Mr. and Mrs. Gabiatti. The artificial nest boxes were removed by the end of the season.

During the 2024 reproductive season, three artificial nest boxes were installed on the same rural property. One of the boxes was quickly occupied by invasive bees and subsequently removed. The remaining two nest boxes were installed approximately 333 m apart, one in an *Araucaria angustifolia* tree and the other in a *Zanthoxylum rhoifolium* tree. Interactions with the nest boxes were monitored using a combination of camera traps, direct field observations conducted by the research team, and reports from citizen scientists.

In December 2002, male 15 was found dead and no reproductive success was recorded as female 9 remained without a mate for the season. In 2023, pair 1 (female 65 and male 87) primarily used the nest installed in the *Morus* spp. tree, while pair 2 (female 9 and her new mate, male 56) used the artificial nest box in the *Annona* sp. tree. Each pair accessed both nest boxes during the season. On October 11th, 2023, heavy rains caused the interior of the *Morus* spp. tree nest box to become moist. By October 13, the nest was completely soaked, and pair 1 significantly reduced its use. During this period, both pairs increased their activity around the artificial nest box in the *Annona* sp. tree.

Between September and November 2023, we recorded 117 videos with a camera trap. Female 65 appeared in 52 videos, male 87 in 29, female 9 in 9, male 56 in 30, and unidentified individuals in 39. Pair 1 was recorded more than pair 2, and female 65 was frequently recorded in the presence of male 56 (Fig. 2). In only one video, three individuals interacted, during which males exhibited aggressive behaviors (Supplementary Material Video S1).

During November and December 2023, both females spent time inside the nest box, and the two males also were recorded entering and exiting the structure. Female 65 was inside the nest box more often than female 9. On November 11th, 2023, we recorded female 65 inside the nest box incubating and caring for two eggs (Supplementary Material Video S2). However, we cannot confirm parentage, as both pairs visited the nest box and were occasionally seen with different partners (Fig. 2).

On March 13th, 2024, only one egg remained inside the nest box, and female 65 was still caring for it. The egg was not viable, did not hatch and was discarded. The nest box was removed from the rural property to avoid occupancy by bees and other species.

In 2024, two artificial nest boxes were used by the released pairs. In one of the boxes, pair 1 laid three eggs between November 27 and December 19. By January 24, 2025, three chicks approximately 35 days old were observed in the nest. In the second box, pair 2 laid four eggs, one of which was hatching on December 19. However, no chicks were found alive in the nest in January 2025.

Nest management is a key component of reintroduction programs aimed at establishing viable populations. In cavity-nesting birds, nest site selection is primarily influenced by cavity and tree characteristics, rather than broader habitat features (Cockle et al. 2015). Captive-reared birds may exhibit behaviors rarely observed in wild populations (Crates et al. 2023). For example, even when natural cavities available, amazons may prefer artificial nest boxes, a pattern reported in other species (Bortolotti 1994; Newton 1994). The shared use of a single nest box by released *A. vinacea* pairs was likely due to the preference for the artificial nest box in the area selected for reproduction. Based on long-term field observations, we suggest that this area may have been chosen due to lower predator pressure and competition compared to previous breeding attempts in the ANP, in addition to food availability at feeders increasing nest perceived value. This hypothesis needs to be systematically tested in future studies. Similarly, *Parus major* prefers nesting in the food-rich habitat (Mänd et al. 2005). Alternatively, nest competition among inexperienced pairs may be more frequent than reported in wild populations, where individuals are not individually marked.

Both pairs frequently visited the same nest box, occasionally with different partners, and exhibited aggressive

interactions, suggesting increased competition, which is common in many species (Wyndham 1980; Saunders 1982; Waltman and Beissinger 1992). This intrasexual competition may negatively impact nesting success. However, due to their time in captivity, released amazons may show greater tolerance for conspecifics and humans. One female laid two eggs even under possible intense competition, suggesting that captivity may influence social flexibility. Their altered behavior could be a reflection of their captive-rearing background (Ramos et al. 2021), possibly explaining atypical nest sharing.

Heavy rains and extreme weather, which are becoming increasingly common in the region, reduced nest usability and increased competition, which are causes of population decline (BirdLife International 2017). Providing additional artificial nests could mitigate this, but improper nest design or placement can negatively impact success (Zhang et al. 2023). For instance, installation of artificial nests for *P. major* attracted more individuals to the food-rich habitat, but increased competition and impaired breeding success (Mänd et al. 2005). Therefore, artificial nests should be distributed to reduce territorial overlaps. In 2024, applying these strategies resulted in greater fertilization success, highlighting the importance of management in the *A. vinacea* reintroduction project in the ANP.

This study documented the uncommon behavioral dynamics of two pairs of *A. vinacea* sharing the same nest box, providing new insights into reproductive patterns in translocated individuals. Future research should focus on optimizing artificial nest management and investigate the factors affecting nest choice between artificial and natural cavities, considering the individuals' previous experiences. We suggest installing nest boxes≥300 m apart to minimize competition (Zhang et al. 2023), using weatherproof designs to prevent rain damage and engaging local communities in monitoring through citizen science. Collaboration with residents has proven valuable for monitoring and reporting. Reintroduction projects can provide valuable scientific information to understand the behavior of threatened species.

**Supplementary Information** The online version contains supplementary material available at https://doi.org/10.1007/s43388-026-00274-3.

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**Author contributions** R.R.M. wrote the manuscript, K.C.S monitored amazons and analyzed camera trap videos, and V.T.K. coordinated the project, obtained financial resources and wrote the manuscript.

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**Data availability** All data and materials were described in the manuscript.

## Declarations

**Ethical approval** Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio: license number 41776).

**Competing interests** The authors declare no competing interests.

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