ARTICLES
Archives of Veterinary Science
UFPR
https://www.ufpr.br/

Clinical and behavioral markers of feather picking in trafficked Golden-capped parakeet (*Aratinga auricapillus*) in Brazil

Submitted: *19/05/2025*
Accepted: *16/12/2025*

Clara Pérola de Carvalho Ferraz[1], Edma Santos Antonio[2], Antônio Iderval Sodré Neto[2], Luma Mar Sousa Felício[3], Márcio Borba da Silva[1*], Laize Tomazi[1], Ricardo Evangelista Fraga[1]*

[1]Universidade Federal da Bahia, Instituto Multidisciplinar em Saúde, Campus Anísio Teixeira, Hormindo Barros Street, 58, Candeias, 45029-094, Vitória da Conquista, BA, Brazil. ORCID: 0009-0008-5477-4147; 0000-0002-6497-7924; 0000-0003-0977-8508; 0000-0001-9345-4869
[2]Universidade Estadual de Santa Cruz, Campus Soane Nazaré de Andrade, Departamento de Ciências Biológicas, Jorge Amado Highway, Km 16, Salobrinho, 45662-900, Ilhéus, BA, Brazil. ORCID: 0000-0003-1280-8472; 0000-0003-0136-7210
[3]Universidade Estadual do Sudoeste da Bahia, Campus Jequié, José Moreira Sobrinho Avenue, Jequiezinho, 45205-490, Jequié, BA, Brazil. ORCID: 0009-0006-6244-2885

Author for correspondence: Edma Santos Antonio – edmabiologa@gmail.com

Abstract: Feather-damaging behavior (FDB) is a frequent condition in psittacines under human care, with implications for animal welfare and post-rehabilitation evaluation. This case study documents behavioral, clinical, hematological, and sex-related patterns in 10 *Aratinga auricapillus* individuals held at the Wild Animal Screening Center in Vitória da Conquista, Bahia, Brazil. Birds were housed under standardized conditions and assessed using feather condition scoring, molecular sexing, leukocyte profiling, pathogen screening, and open-field tests. Five individuals exhibited plumage damage consistent with self-inflicted feather picking, predominantly affecting the chest, back, and legs. All feather-damaged individuals were female; all males presented intact plumage. Microscopy confirmed structural feather degradation, and no ectoparasites or infectious agents were detected. Feather-damaged birds showed modestly higher heterophil-to-lymphocyte ratios, suggesting increased physiological stress. However, these differences were modest and did not show statistical support for an association with feather condition. Temperament profiles (shy vs. bold) were evenly distributed and showed no apparent relation to feather condition. These findings suggest a sex-biased expression of FDB in *A. auricapillus* and reinforce the utility of integrated clinical, behavioral, and physiological assessments in triage routines. Although preliminary, the present study provides baseline reference data for future evaluations of confiscated psittacines, offering practical guidance for rehabilitation and release programs, based on the presented index of feather degradation.
Keywords: behavior; biology; captive birds; hematology; psittacines; sex.

1. Introduction

Brazil harbors the second-highest global diversity of psittacine species (IUCN, 2024), many of which are threatened by habitat loss and the illegal wildlife trade. The golden-capped parakeet (*Aratinga auricapillus*), endemic to the Atlantic Forest, is among the psittacines most frequently confiscated by environmental authorities and is regularly admitted to wildlife rehabilitation centers across the country (Destro et al., 2012; Costa et al., 2018; Mendonça et al., 2020).

In Brazil, reintroduction into the wild is the standard institutional goal for seized wildlife, following clinical stabilization and behavioral assessment. This is particularly relevant for Centro de Triagem de Animais Silvestres (CETAS - Wild Animal Screening Center), which serves as a centralized hub for triage and temporary holding of trafficked animals. However, behavioral syndromes developed during captivity, such as stereotypies or self-directed behaviors, may compromise release potential. Among psittacines, psychogenic feather-damaging behavior (FDB), including feather picking and chewing, is one of the most common captivity-induced conditions, often associated with chronic stress, rearing methods, and environmental deprivation (Costa et al., 2016; Ebisawa et al., 2021; Ebisawa et al., 2022).

Understanding the behavioral and physiological profiles of individuals affected by FDB is essential for informing reintroduction decisions and improving animal welfare protocols in captivity. Yet most literature on FDB derives from long-term captives or companion birds, with limited data available for wild-caught individuals undergoing temporary rehabilitation (Acharya and Rault, 2020; Ebisawa et al., 2021; Mahdavi et al., 2023).

This study presents a case series of 10 *A. auricapillus* individuals held at a CETAS facility in Bahia, Brazil, focusing on plumage condition, hematological stress indicators, temperament profiles, and sex. We highlight patterns in the occurrence of FDB and discuss their relevance to rehabilitation management.

The specific objectives of this study were to: (i) assess the body feather condition score of the animals included in the study; (ii) perform molecular sexing of the birds; (iii) evaluate pathogens of significance for psittacines; (iv) determine stress levels through leukocyte-based indicators; and (v) conduct a behavioral assessment of the animals.

2. Materials e Methods

2.1. Study context and animal housing

This study was conducted at the CETAS in Vitória da Conquista, Bahia, Brazil, as part of a broader rehabilitation protocol for wild birds destined for reintroduction (Health and Behavioral Assessment of Wild Birds – Contributions to Reintroduction, protocol 093/2021, UFBA Animal Ethics Committee). Ten adult *A. auricapillus* individuals were selected among birds previously seized from wildlife trafficking or voluntarily surrendered by the public. Due to their origins, information on age, time in captivity, and rearing history was unavailable.

After routine quarantine and initial clinical screening, birds were housed communally in a 5 × 4 × 3 m enclosure, which was enriched weekly with fresh eucalyptus branches. They received water *ad libitum* and a diet of seeds and seasonal fruits. Identification was performed using a photographic catalog and non-toxic color markings on the chest region.

2.2. Clinical examination and categorization by feather condition

All individuals underwent complete physical examination with emphasis on plumage and integumentary integrity. Feathers from the pectoral region were collected and examined under stereomicroscopy (20×) to rule out ectoparasites and assess feather structure. Based on the visual presence or absence of feather loss, individuals were retrospectively categorized into two subsets for descriptive analysis:

- Feather-damaged group (n = 5): individuals presenting visible feather loss or damage consistent with feather picking, sometimes accompanied by superficial skin lesions.
- Intact-plumage group (n = 5): individuals with no visible feather loss or structural abnormalities.

This categorization was used solely for comparative purposes and did not reflect prior experimental assignment or treatment.

2.3. Feather condition scoring

Feather condition was scored using the 10-point system described by Meehan et al. (2003), which evaluates five body regions (chest/flank, back, legs, wings, tail). Each region received a score from 0 (severe feather loss) to 2 (intact), and scores were summed for each bird (maximum = 10). Standardized photographs were evaluated independently by three blinded observers.

2.4. Molecular sexing and pathogen screening

Blood samples were collected according to protocols described by Silva et al. (2021) and Fraga et al. (2023). Sex was determined by PCR amplification of the CHD gene (Fridolfsson and Ellegren, 1999; Vucicevic et al., 2012) using primers 2550F and 2718R, following the protocol adapted from Antonio et al. (2021).

To exclude non-psychogenic causes of feather loss, cloacal swabs were screened for *Chlamydia psittaci* and Beak and Feather Disease Virus (BFDV) using established PCR protocols (Hewinson et al., 1997; Ypelaar et al., 1999; Mirabal-Santos et al., 2023; Antonio et al., 2025).

2.5. Hematology and stress index

Blood smears were prepared for hematological profiling. Total and differential leukocyte counts were performed manually, along with thrombocyte counts. The heterophil-to-lymphocyte ratio (H:L) was calculated for each individual as an indirect indicator of physiological stress (Campbell, 2012; Davis et al., 2008). Reference values were drawn from Mello et al. (2016), Silva (2010), and Vaz et al. (2015).

2.6. Temperament evaluation

Temperament was assessed via a single-session open-field test following the procedures of Perals et al. (2017) and Silva et al. (2021). Each bird was filmed for 10 minutes in a novel environment after a 5-minute habituation period. Based on their behavior, birds were classified as:

- Bold: exited the transport cage and explored the arena.
- Shy: remained immobile or confined to the cage interior.

Latency to the first movement and the first step were recorded as secondary behavioral metrics.

2.7. Data Analysis

All data were treated descriptively due to the small sample size and observational design. Categorical variables (such as sex, feather condition, and temperament) were summarized using absolute frequencies. Continuous variables (such as feather scores, hematological values, and behavioral latencies) were described using summary statistics. Because the dataset fails to meet the core requirements for valid parametric inference, including normality, homoscedasticity, and independent random sampling, and presents severely unbalanced groups ($n \leq 5$), parametric tests would be statistically inappropriate and potentially misleading. To preserve rigor in the only planned comparison involving a continuous variable (heterophil-to-lymphocyte ratio across feather-condition groups), we used an exact Mann–Whitney U test. This nonparametric method is explicitly designed for small, non-normal samples and avoids inflated error rates that arise from forcing parametric models onto unsuitable data. Data processing and summarization were carried out in R version 4.1.0 (R Core Team, 2022).

3. Results

3.1. 3.1. Feather condition and clinical observations

Among the individuals evaluated, five presented visible feather loss, broken feathers, or localized skin lesions consistent with FDB. These birds were categorized as “feather-damaged” for comparative purposes. Feather damage predominantly affected the back, legs, chest, and tail, with feather fraying and worn barbs observed under stereomicroscopy. No ectoparasites or signs of pathogenic skin conditions were identified. The other five individuals exhibited intact plumage and no integumentary abnormalities (Figure 1).

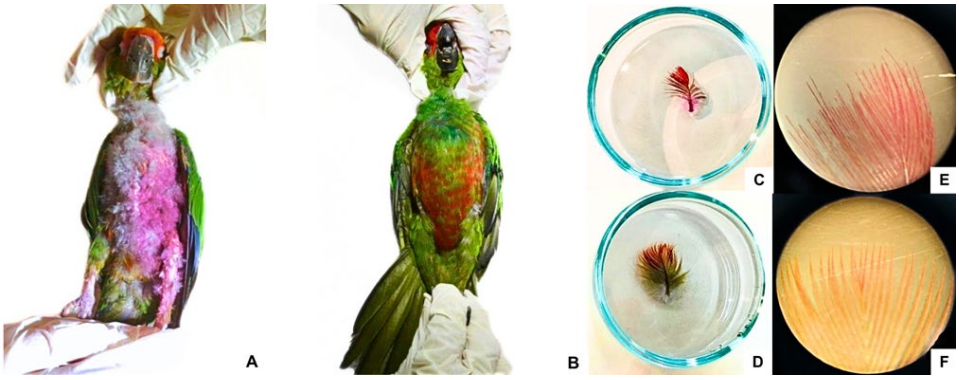

Figure 1 – (A, C, E) Feather-damaged individual: macroscopic view of ventral feather loss (a), isolated damaged feather (c), and frayed barbules under stereomicroscopy at 20× (e). (B, D, F) Individual with intact plumage: macroscopic view (b), undamaged feather (d), and organized barbules (f). Feather damage was associated with visible loss, frayed barbs, and structural disorganization.

Feather scoring revealed regional variation in the feather-damaged group, with the lowest scores in the back (mean 0.95 ± 0.41) and legs (1.00 ± 0.35), and relatively higher scores in the wings (1.8 ± 0.27). Total feather scores ranged from 4.5 to 6.25 in this group. All birds with intact plumage scored the maximum of 10. Examples of feather condition in affected (a–c) and unaffected (d–f) individuals are shown in Figure 2, with arrows indicating the anatomical regions used in the scoring system (chest/flank, wings, back, legs, tail).

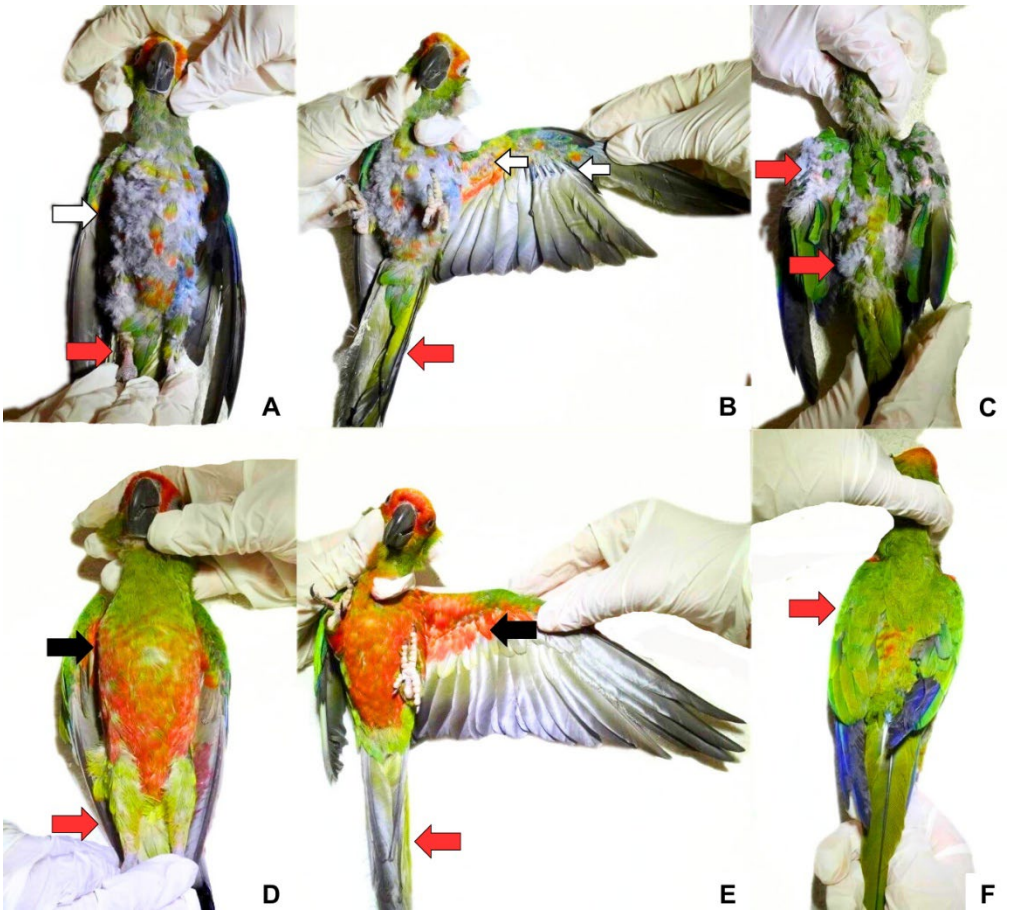

Figure 2 – Plumage condition in *Aratinga auricapillus* individuals with (A-C) and without (D-F) feather damage. Arrows indicate the five anatomical regions assessed in the feather condition scoring system: chest/flank, wings, back, legs, and tail (Meehan et al., 2003). Feather loss and structural disruption are visibly distributed across multiple regions in affected individuals (A-C), whereas plumage remains intact in unaffected individuals (D-F).

3.2. Sex distribution

Molecular sexing revealed that four of the five females in the sample were among the feather-damaged individuals. All birds with intact plumage were male. This complete overlap between sex and feather condition precluded statistical analysis of sex as an independent factor. However, the pattern observed is consistent with prior reports suggesting a higher prevalence of FDB in female psittacines (Ebisawa et al., 2022; Kinkaid et al., 2013).

3.3. Hematological profiles and stress indicators

Blood smears were successfully analyzed for nine of the ten birds. Mean leukocyte counts were slightly higher in feather-damaged birds (15.16 × 10³/µL) compared to birds with intact plumage (13.95 × 10³/µL). The mean heterophil-to-lymphocyte (H:L) ratio, an indirect indicator of chronic stress, was also elevated in the feather-damaged group (1.99 ± 0.20) relative to the intact group (1.69 ± 0.48). The exact Mann–Whitney U test did not detect a statistically significant difference between groups for the H:L ratio (two-tailed p = 0.25). However, values for all individuals fell within the general reference ranges reported for psittacine species (Mello et al., 2016; Silva, 2010; Vaz et al., 2015). These values are summarized in Table 1. A visual comparison of H:L ratio distributions by feather condition is presented in Figure 3. No hematological abnormalities or strong group-wise divergences were detected.

Hematological parameter	**Feather-damaged (n=5)** (mean±standard deviation)	**Intact plumage (n=4)** (mean±standard deviation)
Total Leukocytes	15.16±1.84 (x10³/µL)	13.95±0.95 (x10³/µL)
Monocytes	0.98±0.20 (x10³/µL)	0.94±0.33 (x10³/µL)
Heterophils	8.83±0.89 (x10³/µL)	7.70±0.66 (x10³/µL)
Lymphocytes	4.44±0.72 (x10³/µL)	4.69±0.90 (x10³/µL)
Eosinophils	0.89±0.34 (x10³/µL)	0.59±0.19 (x10³/µL)
Basophils	0.00±0.00 (x10³/µL)	0.00±0.00 (x10³/µL)
Heterophil:lymphocyte ratio (H:L)	1.99±0.20	1.69±0.48
Thrombocyte	15.12±1.06 (x10³/µL)	15.40±1.27 (x10³/µL)

Table 1 – Hematological parameters in *Aratinga auricapillus* individuals with and without feather damage. Values are presented as mean ± standard deviation. All counts expressed in ×10³/µL, except H:L ratio (unitless). Blood smear data were unavailable for one individual with intact plumage.
Note: All values expressed in ×10³/µL, except for the H:L ratio (unitless). Smear data missing for one individual with intact plumage.

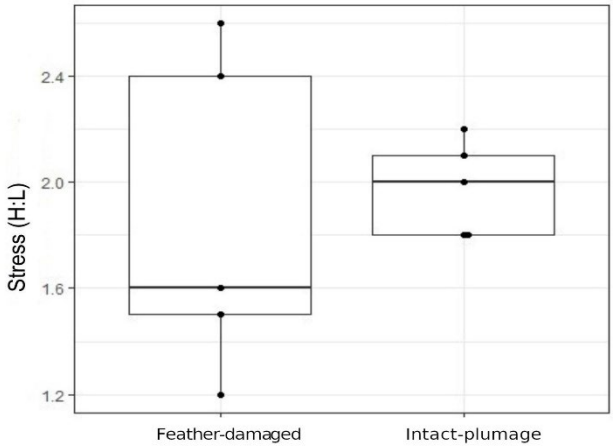

Figure 3 – Heterophil-to-lymphocyte (H:L) ratio in *Aratinga auricapillus* individuals categorized by feather condition. Boxplots display the distribution of values for each group (n=5 feather-damaged, n=4 intact-plumage). No statistical tests were performed; overlap between groups suggests only modest differences.

3.4. Temperament profiles

Based on the open field test, six birds were classified as shy and four as bold. The distribution of temperament types was the same across plumage categories, with three shy and two bold individuals in each group. Shy birds exhibited longer latencies to initiate movement and more prolonged freezing behavior, consistent with the behavioral criteria used for classification. No apparent association was observed between temperament type and feather condition in this sample.

4. Discussion

FDB in psittacines under human care is well-documented and is typically associated with chronic stress, inadequate environmental stimulation and rearing methods, or underlying physiological imbalances (Costa et al., 2016; Ebisawa et al., 2021; Ebisawa et al., 2022). In this study, feather loss and structural feather damage were observed in half of the sampled *A. auricapillus* individuals housed at a CETAS facility. Microscopic feather analysis, clinical inspection, and pathogen screening supported the diagnosis of psychogenic feather picking rather than an infectious or parasitic origin.

The most striking pattern observed was that all individuals with feather damage were female. While this is consistent with previous findings in other psittacine species, in which females have shown a higher incidence of FDB (Ebisawa et al., 2022; Kinkaid et al., 2013), the complete overlap between sex and feather condition in our sample precludes any conclusion regarding causality. It

remains unclear whether the pattern reflects biological predisposition, housing history, or sampling artifact. Larger and sex-balanced datasets will be necessary to assess the role of sex more rigorously.

Physiological stress, as estimated by leukocyte profiles and the heterophil-to-lymphocyte (H:L) ratio, was slightly elevated in birds with feather damage. However, these differences were modest, fell within psittacine reference ranges (Mello et al., 2016; Silva, 2010), and did not show statistical support for an association with feather condition, given the sample size and sex collinearity. Moreover, because H:L ratios are sensitive to handling and baseline fluctuations, they may be insufficient to capture stress dynamics in rehabilitation settings. Complementary markers, such as fecal glucocorticoid metabolites, could provide more robust assessments (Davis and Maney, 2018; Grundei et al., 2024), though they were beyond the scope of this study.

Temperament evaluation via the open field test identified both shy and bold individuals, but no apparent association was found between behavioral profile and feather condition. This result should be interpreted cautiously, as the sample size was small and temperament was assessed through a single exposure. Nevertheless, the use of temperament profiling remains relevant to rehabilitation planning, particularly given its potential influence on post-release behavior and stress-coping capacity (Ramos et al., 2021; Silva et al., 2021).

Importantly, all birds in this study were part of a broader institutional program to evaluate health and behavior before reintroduction. FDB, by compromising thermoregulation and flight ability, poses a significant obstacle to release and long-term survival (Brando and Norman, 2023; Pough et al., 2013). Understanding the behavioral and physiological profiles of seized individuals is therefore essential not only for individual welfare but also for the success of conservation translocation programs.

5. Conclusion

The results of this study are preliminary, indicating a sex-biased expression of FDB in *A. auricapillus*. The data highlight the importance of integrated behavioral and physiological assessments of birds during triage routines. While the present findings are limited by a small sample size and categorical overlap among key variables, they offer preliminary insights into the occurrence and correlates of FDB in *A. auricapillus* during rehabilitation.

Acknowledgments: We would like to express our gratitude to the Centro de Triagem de Animais Silvestres (CETAS - Wild Animal Screening Centers) of Vitória da Conquista, BA, Brazil, for opening their doors to facilitate the completion of this research.

6. References

Acharya, R.; Rault, J. L. Risk factors for feather-damaging behavior in companion parrots: a social media study. J Vet Behav, v. 40, p. 43–49, 2020.

Antonio, E. S.; Sacramento-Batista, P.; Teixeira, S. B.; Barros, J. S.; Gobbo, G. D.; Fraga, R. E.; Tomazi, L. Levantamento da proporção sexual em *Ara chloropterus* Gray, 1859 em CETAS da Bahia, Brasil. Rev Bras Ciênc, v. 28, p. 218–224, 2021.

Antonio, E. S.; Fraga, R. E.; Sacramento, P.; Freitas, A. L. D.; Santana, A. C. B.; Barbosa, S.; Dominato, R. C.; Silva, J. G. Molecular assessment of *Chlamydia psittaci* and *Circovirus* in psittacines from a CETAS in Bahia, Brazil. Brazilian Journal of Microbiology, v. 56, p. 927–938, 2025.

Brando, S.; Norman, M. Handling and Training of Wild Animals: Evidence and Ethics-Based Approaches and Best Practices in the Modern Zoo. Animals, v. 13, p. 2247, 2023.

Campbell, T. W. Hematology of Birds. In: Thrall, M. A.; Weiser, G.; Allison, R. W.; Campbell, T. W. (eds.) Vet Hematol Clin Chem, 2nd ed., Wiley-Blackwell, Hoboken, p. 507–593, 2012.

Costa, P.; Macchi, E.; Valle, E.; Marco, M.; Nucera, D. M.; Gasco, L.; Schiavone, A. An association between feather damaging behavior and corticosterone metabolite excretion in captive African grey parrots (*Psittacus erithacus*). PeerJ, v. 4, e2462, 2016.

Costa, F. J. V.; Ribeiro, R. E.; de Souza, C. A.; Navarro, R. D. Espécies de aves traficadas no Brasil: uma meta-análise com ênfase nas espécies ameaçadas. Fronteira: Journal of Social, Technological and Environmental Science, v. 7, n. 2, p. 324-346, 2018.

Davis, A. K.; Maney, D. L. The use of glucocorticoid hormones or leucocyte profiles to measure stress in vertebrates: What's the difference? Methods Ecol Evol, v. 9, p. 1556–1568, 2018.

Davis, A. K.; Maney, D. L.; Maerz, J. C. The use of leukocyte profiles to measure stress in vertebrates: a review for ecologists. Funct Ecol, v. 22, p. 760–772, 2008.

Destro, G. F. G.; Pimentel, T. L.; Sabaini, R. M.; Borges, R. C.; Barreto, R. Efforts to Combat Wild Animals Trafficking in Brazil. In: Lameed, G. A. (ed.) Biodivers Enrich Divers World. InTechOpen, London, p. 421–436, 2012.

Ebisawa, K.; Nakayama, S.; Pai, C.; Kinoshita, R.; Koie, H. Prevalence and risk factors for feather-damaging behavior in psittacine birds: Analysis of a Japanese nationwide survey. PloS one, v. 16, n. 7, p. e0254610, 2021.

Ebisawa, K.; Kusuda, S.; Nakayama, S.; Pai, C.; Kinoshita, R.; Koie, Hl. Effects of rearing methods on feather-damaging behavior and corticosterone metabolite excretion in the peach-faced lovebird (*Agapornis roseicollis* Vieillot). Journal of Veterinary Behavior, v. 54, p. 28–35, 2022.

Fraga, R. E.; Santos, C. M. R.; Silva, R. S.; Teixeira, R. E. R.; Tomazi, L.; Silva, M. B.; Zapelini, C.; Schiavetti, A. Reintroduction and monitoring of the bird Amazona aestiva (Psittaciformes: Psittacidae) in Brazil. Rev Biol Trop, v. 71, e53145, 2023.

Fridolfsson, A. K.; Ellegren, H. A simple and universal method for molecular sexing of non-ratite birds. J Avian Biol, v. 30, p. 116–121, 1999.

Grundei, L. L.; Wolf, T. E.; Brandes, F.; Schütte, K.; Freise, F.; Siebert, U.; Touma, C.; Pees, M. Validation of fecal glucocorticoid metabolites as non-invasive markers for

monitoring stress in common buzzards (*Buteo buteo*). Animals, v. 14, n. 8, p. 1234, 2024.

Hewinson, R. G.; Griffiths, P. C.; Bevan, B. J.; Kirwan, S. E. S.; Field, M. E.; Woodward, M. J.; Dawson, M. Detection of Chlamydia psittaci DNA in avian clinical samples by polymerase chain reaction. Vet Microbiol, v. 54, p. 155–166, 1997.

IUCN. The IUCN Red List of Threatened Species, version 2024-1. Disponível em: https://www.iucnredlist.org. Acesso em: 15 ago. 2024.

Kinkaid, H. Y. M.; Mills, D. S.; Nichols, S. G.; Meagher, R. K.; Mason, G. J. Feather-damaging behaviour in companion parrots: an initial analysis of potential demographic risk factors. Avian Biol Res, v. 6, p. 289–296, 2013.

Mahdavi, I.; Abdi-Hachesoo, B.; Ansari-Lari, M.; Haddad-Marandi, M. R. Prevalence and risk factors of feather damaging behavior in companion parrots: a cross-sectional study in Iran. Appl Anim Behav Sci, v. 266, p. 106028, 2023.

Meehan, C. L.; Millam, J. R.; Mench, J. A. Foraging opportunity and increased physical complexity both prevent and reduce psychogenic feather picking by young Amazon parrots. Appl Anim Behav Sci, v. 80, p. 71–85, 2003.

Mello, R. H.; Martins, R. F.; Bonissi, D. A.; Junior, J. L. B.; Melotti, T.; Bianchi, H.; Bianchi, M. A. F. Haematological reference for red-browed parrot (Amazona rhodocorytha, Salvadori, 1890) captive in the Atlantic Forest in Eastern Brazil. Arq Bras Med Vet Zootec, v. 68, p. 1275–1282, 2016.

Mendonça, R.; Amaral, A. A. N.; Voltolini, J. C. Recepção, triagem e soltura de psitacídeos no Centro de Triagem de Animais Silvestres (CETAS) IBAMA Lorena, SP. Revista Biociências, v. 26, n. 1, p. 70-79, 2020.

Mirabal-Santos, B.; Antonio, E. S.; Pereira, D. C.; Dourado, A. T. T.; Silva, M. B.; Fraga, R. E.; Tomazi, L. Determining the prevalence of avian chlamydiosis in wild Amazona species from Brazil using molecular testing and clinical signs. J Avian Med Surg, v. 37, p. 32–40, 2023.

Perals, D.; Griffin, A. S.; Bartomeus, I.; Sol, D. Revisiting the open-field test: what does it really tell us about animal personality? Anim Behav, v. 123, p. 69–79, 2017.

Pough, F. H.; Bemis, W. E.; McGuire, B. A.; Janis, C. M. Vertebrate Life, 11th ed. Oxford: Oxford University Press, 2022.

R Core Team. R: A language and environment for statistical computing. Disponível em: https://www.r-project.org. 2022.

Ramos, G. D. A.; Azevedo, C. S. D.; Jardim, T. H.; Sant'Anna, A. C. Temperament in captivity, environmental enrichment, flight ability, and response to humans in an endangered parrot species. Journal of Applied Animal Welfare Science, v. 24, n. 4, p. 379–391, 2021.

Silva, G. F. N. Perfil hematológico de psitacídeos mantidos em cativeiro. Dissertação, Universidade Federal do Vale do São Francisco, 2010.

Silva, R. S.; Fraga, R. E.; Tomazi, L.; Andrade, T. S.; Silva, M. S.; Schiavetti, A. Temperament assessment and pre-release training in a reintroduction program for the Turquoise-fronted Amazon *Amazona aestiva*. Acta Ornithol, v. 55, p. 199–214, 2021.

Vaz, F. F.; Locatelli-Dittrich, R.; Sipinski, E. A. B.; Abbud, M. C.; Sezerban, R. M.; Schmidt, E. M. S.; Dittrich, J.; Cavaleiro, M. L. Hematologic and total plasma protein values in free-living red-tailed Amazon parrot nestlings (Amazona brasiliensis) in Parana State, Brazil. J Avian Med Surg, v. 29, p. 187–191, 2015.

Vucicevic, M.; Stevanov-Pavlovic, M.; Stevanovic, J.; Bosnjak, J.; Gajic, B.; Aleksic, N.; Stanimirovic, Z. Sex determination in 58 bird species and evaluation of CHD gene as a universal molecular marker in bird sexing. Zoo Biol, v. 32, p. 269–276, 2012.

Ypelaar, I.; Bassami, M. R.; Wilcox, G. E.; Raidal, S. R. A universal polymerase chain reaction for the detection of psittacine beak and feather disease virus. Vet Microbiol, v. 68, p. 141–148, 1999.