

LOWER LIMB TRAUMA DUE TO FIREARM PROJECTILE IN CANINDE MACAW (*ARA ARARAUNA*) - A CASE REPORT

*TRAUMATISMO DE MEMBRO INFERIOR POR PROJÉTEL DE ARMA DE FOGO EM ARARA
CANINDÉ (*ARA ARARAUNA*) - RELATO DE CASO*

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SUMMARY

The study of traumatic injuries in wildlife, especially those caused by firearm wounds is of paramount importance in understanding the impact of human activities on natural ecosystems. This case report presents a study of a gunshot wound in the lower right limb of a blue-and-yellow macaw (*Ara ararauna*), shedding light on the potential threats faced by these birds in their natural habitats. Following the macaw's rescue, visual and manual examinations, along with radiography, were conducted to ensure the removal of any remaining projectiles from its body. Subsequently, the bird received a specialized medication protocol focused on the removal of myiasis and rigorous monitoring of the healing process. However, despite these efforts, the bird lost the ability to fly and developed a bony callus, making its reintroduction to the wild unfeasible, then it was sent to the São Carlos Zoo in São Paulo, Brazil, where it will coexist with other birds facing similar limitations. Understanding such incidents can provide insights into the complex interaction between human actions and the well-being of avian populations, prompting us to develop and implement effective strategies for treatment, clinical monitoring, release, and conservation.

KEY-WORDS: Bird Conservation. Gunshot trauma. Wildlife.

RESUMO

O estudo de lesões traumáticas em vida selvagem, especialmente aquelas causadas por ferimentos de armas de fogo é de suma importância para compreender o impacto das atividades humanas nos ecossistemas naturais. Este relato de caso apresenta um estudo de caso de uma lesão por projétil de arma de fogo em membro inferior direito de uma arara-canindé (*Ara ararauna*), lançando luz sobre as potenciais ameaças enfrentadas por essas aves em seus habitats naturais. Após o resgate da arara, foram realizadas uma verificação visual, manual e uma radiografia para assegurar que não houvesse mais projéteis em seu corpo e em seguida a ave recebeu um protocolo medicamentoso especializado, focado na remoção das miíases e no acompanhamento rigoroso do processo de cicatrização. No entanto, apesar dos esforços, a ave perdeu a capacidade de voar e desenvolveu um calo ósseo, tornando inviável sua reintrodução à vida livre, sendo encaminhada ao zoológico de São Carlos - SP, onde poderá conviver com outras aves que também enfrentam limitações semelhantes. Compreender tais incidentes pode oferecer *insights* sobre a complexa interação entre as ações humanas e o bem-estar da população aviária, instigando-nos a desenvolver e implementar estratégias eficazes de tratamento, acompanhamento clínico, soltura e conservação.

PALAVRAS-CHAVE: Conservação de aves. Trauma por tiro. Animal silvestre.

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INTRODUCTION

The Blue-and-Yellow Macaw (*Ara ararauna*) is a bird belonging to the psittacidae family, characterized by a distinctly curved beak, feathers displaying a combination of blue and yellow tones, and a face with a striking alternation between white and black feathers, complemented by some greenish plumes on top of its head, it is also known for its social and intelligent nature (VALLE et al., 2008). It can reach up to 90 cm in length and weigh up to 1.5 kg, being a species of forest and savanna habitats, inhabiting hot countries in South America such as Brazil, Colombia, Ecuador, Guyana, and French Guiana; they live in groups, displaying complex social behaviors, including intricate vocal communication and mutual care during the breeding process (BARROS; CATOJO, 2019). Their diverse diet, primarily composed of fruits, seeds, and nuts, plays a crucial role in seed dispersal and ecosystem balance in their habitats, contributing to the regeneration of forests and native vegetation (BARROS; PURIFICAÇÃO, 2020).

In the rural region of São Paulo state, Brazil, the presence of Blue-and-Yellow Macaws has been a distinctive feature, especially in areas with denser vegetation and near watercourses (BARROS; CATOJO, 2019). Their adaptability to semi-open environments and ability to find food resources in local fruit trees often lead them to approach inhabited areas, such as villages and small towns (CALDERAN et al., 2019). This proximity can result in interesting interactions between the local population and the birds, though it may also pose various dangers, including the risk of being targeted by firearms, resulting in severe injuries and even death (ROCHA et al., 2015; CORRAL; MENDES VALÉRIO, 2019). Furthermore, interaction with humans often increases the exposure of macaws to additional threats, such as illegal capture, road accidents, and accidental poisoning (DE ALEXANDRIA PAGANO. et al., 2010; AZEVEDO et al., 2021). Understanding these risks is crucial for implementing effective conservation measures and promoting peaceful coexistence between these wild birds and local communities.

This case report provides a detailed study of a gunshot injury in a lower limb of a Blue-and-Yellow Macaw (*Ara ararauna*), offering an in-depth analysis of potential threats faced by these birds in their natural environments.

CASE REPORT

In June 2019, the Environmental Police of Campinas rescued a fledgling Blue-and-Yellow Macaw in Atibaia, a city in the state of São Paulo, Brazil. The bird was found disoriented and identified with a closed leg band (RPS 6416). With its left wing cut and signs of mobility difficulties, the animal underwent treatment and was subsequently handed over to Center for Rehabilitation of Wild Animals (Centro de Triagem de Animais Silvestres - CRAS) Pró-Arara "Raul de Barros Winter" in Araras, also in the state of São Paulo. There, it was discovered that a caretaker had obtained the fledgling from an illegal source. After undergoing rehabilitation and receiving a new leg

band (PRÓ ARARA 13.5 098), the bird was released in October 2020 in an Area for Release and Wildlife Monitoring (Área de Soltura e Monitoramento de Fauna - ASMF), ensuring its safe transition to its natural habitat away from the city.

It's worth noting that the release area is distant from the city and the aviaries there are spacious and designated for flight training, a practice challenging to implement in some CRAS and Wildlife Triage Centers (Centro de Triagem de Animais Silvestres - CETRAS). During rehabilitation, the birds are introduced to native fruits and local seeds, a method to teach them to identify and adapt to the food they will encounter in the wild, promoting independence and minimizing human contact. The release is conducted gently and gradually; all aviary doors are left open for days, allowing the animals to decide when they feel comfortable to depart. The presence of water and feeding stations, along with fruit-bearing trees, aims to prevent the birds from returning to the city. Environmental education is crucial, as even successfully rehabilitated birds may maintain ties with humans, exposing them to risks in urban coexistence.

In April 2023, CRAS-Pró Arara received once again a Blue-and-Yellow Macaw with two leg bands, one open and one closed, found in the ASMF with suspected gunshot wounds. After an investigation, it was confirmed that the animal had been previously rehabilitated by the institution and released, emphasizing the crucial need for ongoing monitoring to ensure the safety of birds in the wild.

The bird presented a deep wound with a hematoma on the chest, next to the keel, where the presence of myiasis was detected. Additionally, there was a smaller but deep wound on the right leg, considered a possible exit point for the projectile, as both injuries were interconnected. Furthermore, there was an injury near the cloaca, indicating potential additional complications. The case required immediate care and interventions to ensure the bird's recovery and its potential reintroduction to the wild.

After its arrival, the macaw was sedated with 0.15 ml of Zoletil®. Over the course of five days, 0.2 ml of meloxicam, 0.2 ml of tramadol hydrochloride, 7 ml of dextrose solution, and 0.3 ml of enrofloxacin were administered, following the recommendations from the Manual of Avian Emergencies (MARIETTO-GONÇALVES, 2016) and Exotic Animal Formulary-E-Book (CARPENTER; HARMS, 2022). All medications were administered intramuscularly in the bird's chest and this method was continued for subsequent applications. The team proceeded to clean the chest wound using saline solution and performed debridement, removing feathers around the area to facilitate observation. All myiasis foci were eliminated, leaving the chest wound open, with sutures applied only to the leg wounds (Figure 1). Subsequently, a radiograph was taken to confirm the absence of any remaining projectiles.

Throughout the entire treatment process, a combination of 0.1 ml ketamine plus 0.1 ml diazepam was administered on one day, alternating with the exclusive application of 0.09 ml Zoletil® on subsequent days. The bird received iron supplementation (0.1 ml), vitamin K (0.1 ml), and a supplement of vitamins A, D, and E (0.2 ml) on the arrival day and as needed throughout the treatment,

following recommendations from the Manual of Avian Emergencies (MARIETTO-GONÇALVES, 2016) and Exotic Animal Formulary-E-Book (CARPENTER; HARMS, 2022). The treatment routine included cleaning, wound disinfection, and debridement of necrotic tissues and muscles on the chest, as needed. Alternating applications of Terra Cortril® spray, rifamycin spray, anti-infective and healing ointment Vetaglós®, ointment with collagenase-based enzymatic debriding agent, Fitoscar®, and ointment for myiasis treatment were applied, keeping the wounds open. Cleaning and medication administration were performed daily; however, after the animal stabilized, sedation was reduced to alternate days and later to once a week, with debridement performed only when the bird was sedated.

In May of the same year, the scab formed on the wounds detached, and sedation was no longer necessary. Cleanings were spaced according to necessity. In June, a second cycle of antibiotic therapy with enrofloxacin (0.1 ml) was initiated for a period of seven days.

At the end of June, the Blue-and-Yellow Macaw was transferred to an outdoor aviary with others of the same species. Weekly assessments were conducted and wound cleaning was done as needed to facilitate natural healing. By August, all wounds were completely healed; however, difficulties in mobility were observed, with the bird dragging its chest at times. During palpation, a bony callus was identified on the right leg where the wounds were located. The challenge in flying persisted, leading to the implementation of a flight training program in the macaw aviary and physiotherapy sessions.

DISCUSSION

The situation of the rescued Blue-and-Yellow Macaw highlights the illegality and associated risks of purchasing wild birds from unauthorized sources. The illegal trade of wildlife poses a significant threat to biodiversity, contributing to the exploitation and potential extinction of species (RIBEIRO; SILVA, 2007; DE AVELAR et al., 2015). The initial claim by the caretaker of legally acquiring the fledgling was debunked through the investigation, revealing an illegal transaction. This emphasizes the importance of awareness and enforcement to curb environmentally harmful practices. Proper identification through leg bands, as observed in this case, was crucial for tracing the origin and history of these animals. Monitoring, even after reintroduction, is essential to ensure their well-being and adaptation to the natural environment (LYRA-NEVES et al., 2004; ARAUJO, 2014).

Firearm attacks pose a significant threat to biodiversity, affecting birds and disrupting ecosystems (LEWIS et al., 2001; RODRIGUEZ et al., 2004). Such attacks can result in severe injuries, flight incapacity, and death, negatively impacting populations and ecosystem integrity (GUEDES, 2004; PANKOWSKI et al., 2018). Beyond physical harm, these events can disturb social structures of macaws, impairing mating, communication, and vital interactions for species reproduction and survival (LOCATELLI et al., 2013). Combating these threats requires stringent enforcement measures, public education on conservation, and effective policies to discourage illegal

hunting and the irresponsible use of firearms in natural environments.

The opening resulting from the wound in the Blue-and-Yellow Macaw not only represented a vulnerability to its mobility but also served as an entry point for myiasis, infestations by fly larvae (ALMEIDA et al., 2008), significantly worsening the wound's condition and complicating the healing process. In this case, debridement (CUEVA et al., 2020), an essential procedure during treatment, not only helped control the presence of parasites but also allowed for a more precise monitoring of the macaw's healing progression.

The use of antibiotics, notably enrofloxacin, a broad-spectrum drug, was administered to combat potential secondary infections, providing effective coverage against a variety of pathogens. Thus, it not only controlled existing infections but also prevented additional complications that could compromise the healing process (DA SILVA et al., 2012). The constant addition of vitamin complexes, including iron, vitamin K, and vitamins A, D, and E, was also crucial to strengthen the bird's immune system during the treatment period (SANTOS et al., 2008; NAHUM et al., 2015).

The persistent sequelae in the Blue-and-Yellow Macaw, even after treatment, highlight the challenges faced by traumatized birds (WILL, 1991), such as gunshot victims. The inability to fly, despite effective terrestrial mobility, suggests a permanent functional limitation, possibly due to irreversible structural damage caused by the wound. The bony callus on the leg, an adaptive response, compensates for the injuries but indicates that the bone damage was significant enough to prevent complete recovery. Despite seemingly intact muscles and nerves, the formation of the bony callus suggests limitations in restoring normal functionality (BENNETT; KUZMA, 1992; TULLY, 2002).

CONCLUSION

After intensive physiotherapy and flight training sessions, it was observed that the macaw had completely lost the ability to fly. Despite numerous attempts, the bird couldn't properly support the affected limb, which had developed a bony callus, rendering it incapable of reintroduction into the wild. Faced with this scenario, the decision was made to relocate the animal to São Carlos Zoo in São Paulo, Brazil, where it will have the opportunity to live with other members of its species who, like this bird, are not suitable for rehabilitation to return to their natural habitat.

The clinical case of the blue-and-yellow macaw exposes the intricate challenges associated with treating birds subjected to severe traumas, such as gunshot wounds. The persistence of sequelae, despite dedicated rehabilitation efforts, underscores the need for holistic and multidisciplinary approaches. The urgency of effective measures to combat the illegal wildlife trade, which often contributes to these harmful incidents, is also emphasized. The experience of this macaw serves as a call to ongoing action for the conservation and preservation of vulnerable species, reinforcing the importance of sustainable coexistence between humans and wildlife.



Figure 1 - In images 1 to 3, the initial condition of the Blue-and-Yellow Macaw (*Ara ararauna*) at CRAS is documented, revealing a deep gunshot wound. In image 3, a black arrow highlights the necrotic degree of the injured tissue and the presence of myiasis. In images 4 to 6, the team is seen cleaning the wound, conducting debridement, and removing feathers for closer observation while maintaining continuous monitoring of the case. Image 5, with a black arrow, emphasizes treatment for the presence of myiasis. Images 7 and 8 show signs of improvement and recovery. Finally, in images 9 to 11, the final health condition of the macaw is observed, where healing is complete, but it presents sequelae, being unable to support the foot on the ground.

REFERENCES

- ALMEIDA, M. Â. O. et al. Ocorrência de ectoparasitos em avestruzes (*Struthio camelus*) criadas no semi-árido baiano. **Revista Brasileira de Parasitologia Veterinária**, v.17, p.155-157, 2008.
- ARAÚJO, R. H. D. Aves-Anilhar para proteger. **Acervo da Iniciação Científica**, n.1, 2014.
- AZEVEDO, M.; MIX, P.; SCHUNCK, F. A IMPORTÂNCIA DOS REMANESCENTES NATURAIS DE ÁREAS PÚBLICAS E PARTICULARES PARA A CONSERVAÇÃO DAS AVES DO MUNICÍPIO DE SÃO PAULO, SUDESTE DO BRASIL. **Biodiversidade**, v.20, n.4, 2021.
- BARROS, L. T. S.; CATOJO, A. M. Z. Recebimento, reabilitação e destino de Psitacídeo Arara-canindé (*Ara ararauna*, Linnaeus, 1758), na região de Araras, interior de São Paulo. **Anais do Evento**, p. 66, 2019.
- BARROS, S. P.; PURIFICAÇÃO, K. N. Predação de sementes por *Ara ararauna* e *Ara chloropterus* (Aves: Psittacidae) em uma área urbana no Vale do Araguaia, Brasil. **Acta Biológica Catarinense**, v.7, n.1, p.5-14, 2020.
- BENNETT, R. A.; KUZMA, A. B. Fracture management in birds. **Journal of Zoo and Wildlife Medicine**, p.5-38, 1992.
- CALDERAN, A. et al. Percepção dos moradores sobre as araras-canindé (*Ara ararauna*), na área urbana de Campo Grande (MS). **Revista Brasileira De Educação Ambiental (RevBEA)**, v.14, n.2, p.277-294, 2019.
- CARPENTER, J. W.; HARMS, C. (Ed.). **Exotic Animal Formulary-E-Book**. Elsevier Health Sciences, 2022.
- CORRAL, A.; MENDES VALÉRIO, L. Efeito do tamanho e distância de fragmentos florestais urbanos na composição de aves no perímetro urbano de Campo Grande-MS. **Atualidades Ornitológicas**, n.210, 2019.
- CUEVA, L. O. B. et al. Considerações sobre fraturas em aves. **Veterinária e Zootecnia**, v. 27, p. 1-11, 2020.
- DA SILVA, C. R. A. et al. Afecção oftálmica periocular causada por *Pseudomonas* sp em Amazona aestiva-relato de caso. **Pubvet**, v.6, p. Art. 1270-1276, 2012.
- DE ALEXANDRIA PAGANO, I. S. et al. Aves depositadas no Centro de Triagem de Animais Silvestres do IBAMA na Paraíba: uma amostra do tráfico de aves silvestres no estado. **Ornithologia**, v.3, n.2, p.132-144, 2010.
- DE AVELAR, E. R.; DA SILVA, R.; BAPTISTA, L. A. M. L. Ameaças à sobrevivência de animais silvestres no Estado de Goiás. **Uniciências**, v.19, n.2, 2015.
- GUEDES, N. M. R. Management and conservation of the large macaws in the wild. **Ornithologia Neotropical**, v. 15, n. Suppl, p.279-283, 2004.
- LEWIS, L. A. et al. Lead toxicosis and trace element levels in wild birds and mammals at a firearms training facility. **Archives of environmental contamination and toxicology**, v.41, p.208-214, 2001.
- LOCATELLI, A. C. et al. Comportamento reprodutivo e materno de araras Canindé (*Ara ararauna* Linnaeus, 1758) mantidas em cativeiro para conservação. **Comunicata Scientiae**, v.4, n.4, p.316-323, 2013.
- LYRA-NEVES, R. M.; AZEVEDO JÚNIOR, S. M.; TELINO-JÚNIOR, W. R. Monitoramento do maçarico-branco, *Calidris alba* (Pallas) (Aves, Scolopacidae), através de recuperações de anilhas coloridas, na Coroa do Avião, Igarassu, Pernambuco, Brasil. **Revista Brasileira de Zoologia**, v.21, p.319-324, 2004.
- MARIETTO-GONÇALVES, G. A. Manual de emergências aviárias. São Paulo: Editora MedVet. Moschioni, C., Faria, HP, Reis, MAS, & Silva, EU (2001). **Pneumonia grave por "Chlamydia psittaci"**. **Jornal de Pneumologia**, v.27, n.4, p.219-222, 2016.
- NAHUM, M. J. C. et al. Perigos do consumo monótono de sementes pelas aves: Revisão. **Pubvet**, v.9, p.158-194, 2015.
- PANKOWSKI, Filip et al. Fatal gunshot injuries in the common buzzard *Buteo buteo* L. 1758—imaging and ballistic findings. **Forensic Science, Medicine and Pathology**, v.14, p.526-530, 2018.
- RIBEIRO, L. B.; SILVA, M. G. O comércio ilegal põe em risco a diversidade das aves no Brasil. **Ciência e Cultura**, v.59, n.4, p.4-5, 2007.
- ROCHA, C. et al. Caracterização da avifauna em áreas de cerrado no Brasil Central. **Acta Biológica Catarinense**, v.2, n.2, p.49-63, 2015.
- RODRIGUEZ, E. N.; TISCORNIA, G.; TOBIN, M. E. Bird depredations in Uruguayan vineyards. In: **Proceedings of the Vertebrate Pest Conference**. 2004.
- SANTOS, G. G. C. et al. Doenças de aves selvagens diagnosticadas na Universidade Federal do Paraná (2003-2007). **Pesquisa Veterinária Brasileira**, v.28, p.565-570, 2008.
- TULLY, T. N. Basic avian bone growth and healing. **Veterinary Clinics: Exotic Animal Practice**, v.5, n.1, p.23-30, 2002.
- VALLE, S. F. et al. Parâmetros de bioquímica sérica de machos, fêmeas e filhotes de Araras canindé (*Ara ararauna*) saudáveis mantidas em cativeiro comercial. **Ciência Rural**, v.38, p.711-716, 2008.
- WILL, T. Birds of a severely hurricane-damaged Atlantic coast rain forest in Nicaragua. **Biotropica**, p. 497-507, 1991.