



Wild animal trafficking in Brazil: challenges for fauna protection

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Abstract

This scientific article addresses the issue of wild animal trafficking, which ranks as the third largest form of illicit trade worldwide and demands special attention from society. In order to gain a better understanding of this phenomenon, we conducted a bibliographic data organization, searching for information from federal and state organizations spanning the period from 2016 to 2021. Additionally, we administered questionnaires to professionals involved in the environmental field, supervision, and direct community interaction. The results indicate a persistence in animal trafficking practices, with particular emphasis on the years 2018 to 2020, during which higher numbers of apprehensions were reported. It is evident that this crime has a direct impact on biodiversity, with species from the Passeriformes and Psittaciformes orders being most commonly found among rescued animals. Regarding legislation, the research highlights that the main challenges lie in the lack of supervision, delays in the judicial system, and the failure of specialized facilities to accommodate seized animals. In conclusion, it is essential for society to actively engage in supporting supervision efforts, prioritizing actions related to environmental education, and strengthening competent institutions. Only through collaborative actions can we effectively combat wild animal trafficking and preserve our natural heritage.

Keywords Passeriformes · Psittaciformes · Environmental education · Environmental laws

1 Introduction

One of the greatest challenges of the 21st century is to increase awareness of the interdependence of ecosystems and human well-being (Bennett et al., 2015), meaning there is an intimate relationship between ecological balance among Earth's different habitats and human quality of life. Within the biodiversity that an ecosystem harbors, each organism develops connections with other organisms and with abiotic components, resulting in a complex network system. According to Rockström et al. (2009), the intensification of biodiversity loss

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accelerated by our modern way of life has an extremely harmful effect on life on our planet, as the extinction of each species in an environment destabilizes a set of interactions, leaving the ecosystem fragile and vulnerable.

In this context, we can assume that actions such as wildlife trafficking, where an organism is removed, often an endemic and specific species of that environment, not only jeopardize that particular species but also negatively influence all the organisms it interacts with in the original habitat. Among the various types of trafficking, wildlife trafficking ranks as the third largest worldwide. It is estimated to generate approximately five billion dollars annually, with Brazil being one of the main targets of illegal animal trade, resulting in not only ecological but also socioeconomic and sanitary damage (Oliveira Grieser et al., 2019; Cioato, 2021).

Brazil is a country of continental size, harboring an immense biodiversity of organisms in unique ecosystems; however, protective actions such as the creation of conservation units may be insufficient (Oliveira et al., 2017). For instance, there is a lack of strong enforcement against species trafficking from preserved regions to other regions of the country or even internationally. One of the reasons may be due to a significant increase in the “Pet-Related Industry” in recent times, forming a culture that encourages people to have pets, and this growing market is fueled in part by the abduction of animals from their natural habitats (Sollund, 2011).

In line with this, the 1st National Report on Wildlife Trafficking (RENTAS, 2001) corroborates this trend by mentioning that when the animal trade became recognized as a profitable activity, it became a new branch of commerce, with specialized traders acquiring and selling animals. Thus, with urbanization and population growth, the international and national wildlife trade has evolved, with animals even being sold in popular markets (Oliveira Saldanha & Peixoto, 2021).

RENTAS (2001) reported on possible recipients, namely, the types of markets that this illegal activity serves, highlighting zoos and private collectors, biopiracy, animals for pet shops, and wildlife products. Additionally, an analysis was conducted to identify the factors that motivate and contribute to the continued existence of this activity, concluding that it is linked to cultural issues, education, poverty, lack of economic alternatives, easy and quick profit, status, and personal satisfaction in owning wild animals as pets. The consumption of wild meat can also have a significant impact in regard to animal trafficking, although such data are more challenging to account for, according to Charity and Ferreira (2020).

In this context, considering that fauna plays a prominent role in the majority of ecosystem services provided, the illegal removal of wildlife from nature, which results in trafficking in its various forms (RENTAS, 2001), is one of the most relevant issues in regard to animal and environmental protection. Brazil, hosting 15 to 20% of the world’s biodiversity, with over 9,000 species of vertebrates and 120,000 species of invertebrates (UN, 2019), should prioritize combating animal trafficking as one of the key focuses for nature preservation (Rodrigues-Junior, 2020).

However, in Brazil, there were no legal means to combat such actions. It was only with the advent of Law No. 5,197 on January 3, 1967, the Law on Fauna Protection, that animals became the property of the State, prohibiting their trade and their products (RENTAS, 2001; Morandini & Cunha, 2021). This does not mean that the State has rights over the use and disposal of fauna, but only with the expression of public authority, aiming at the protection of these animals (Stifelman, 2000).

The responsibility for monitoring and combating wildlife trafficking in Brazil falls upon multiple entities. The Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) plays a crucial role in enforcing environmental regulations and combating the illegal wildlife trade. IBAMA conducts inspections, investigates trafficking cases, and applies penalties to individuals or organizations involved in these activities. The Federal Police, through specialized units such as the Environmental Police, also participates in enforcement efforts, conducting operations to apprehend traffickers and dismantle criminal networks. In addition, nongovernmental organizations (NGOs) and other civil society groups actively contribute to the fight against wildlife trafficking, raising awareness, supporting conservation initiatives, and advocating for stronger legislation and enforcement measures. Collaboration between these various stakeholders is essential for effectively curbing wildlife trafficking and preserving Brazil's rich biodiversity (Pontes Filho et al., 2021).

Based on the existing legal support and current knowledge about this illegal practice, the objective of this research was to assess the impacts of wildlife trafficking in Brazil, with an emphasis on the states of Minas Gerais and São Paulo due to their high population density. Additionally, the aim was to analyze the legal procedures related to this crime. Furthermore, the perception of professionals and the general population regarding wildlife trafficking was investigated.

2 Materials and methods

The evolution of legislation has been related to inhibiting the current situation of trafficking in Brazil, associating it with the perception that those responsible for oversight, education, the recovery of seized animals, and the general population have on the subject. To accomplish this, an analysis of laws, regulations, and other official documents involving trafficking available on federal public websites in Brazil was conducted, focusing on those that regulated the control of such activities from 2016 to 2021.

The data related to seized animals were obtained through an official request made to the law enforcement agencies responsible for environmental oversight at the municipal, state (particularly in the states of Minas Gerais and São Paulo), and federal levels. This information was obtained from requirements registered in person or e-mail and registered on citizen information services through official websites. In addition, data were provided by the National Justice Council (CNJ on Portuguese) regarding judicialization cases in Brazil through *Justiça em Números* (Justice in Numbers).

The choice to focus on the states of Minas Gerais and São Paulo was due to their harboring of important biomes such as the Atlantic Forest, Cerrado, Mangrove, and Caatinga, among others (Correia Filho et al., 2023), their bordering with several other states, and having the largest number of municipalities and population, respectively. An analysis of what occurs in these locations and in a specific municipality (Poços de Caldas, MG) potentially reflects, on a smaller scale, the national issues.

The bodies contacted were the Federal Police, Federal Highway Police – Bases in Poços de Caldas, 18th Military Police Company of Environment of Minas Gerais, Military Police of São Paulo State, and State Institute of Forests (IEF) of Minas Gerais. The required information was as follows:

- Number of apprehensions on last year (if possible, the last five).
- Main environmental crimes linked to state/country fauna.
- Number of fines applied linked to fauna.
- Most apprehended species.
- Where in general, apprehensions were carried (on transport or residences).
- If apprehensions were carried through complaints or operations.
- What is done for captured animals.
- In which conditions they are founded.
- Which is the main route for trafficking in state/Brazil?
- If animals are sold in Brazil or sent for other countries.

Later, the questionnaires were applied for the following:

- Questionary 1: Biologists, veterinarians, and environmental analysis.
- Questionary 2: Military and Federal highway police.
- Questionary 3: Population In general.

Questions from questionnaires 01 and 02 were designed according to the area of action of the recipients to understand what the perceptions of professionals are who work directly with the trafficking of wild animals and if the information from the bibliographic survey is confirmed in practice. Questionnaire 03 (supplementary material) aimed to analyze the perception of the general population in relation to wild animals and trafficking (Ramos et al., 2019).

3 Results and discussion

Due to the importance of fauna, Brazil dedicated an entire paragraph to the 225th article on constitutional text in this regard. In addition, two laws were edited specifically for fauna protection and others for environmental crimes:

Art. 225. Anyone has the right to an ecologically balanced environment, which is for people's common use and essential to a healthy quality of life, imposing on the Public Power and to collectivity defend and preserve it to present and future generations.

§ 1st To assure the effectivity of this right, Public Power engage in:

I - Preserve and restore essential ecological processes and provide management for species and ecosystems.

VII – Protect fauna and flora, prohibited, according to law, practices that impose risk in its ecological function, provoke species extinction or submit animals to cruelty.

§ 3rd All conduct and activities considered harmful to the environment will subject offenders, physical or juridical persons, to penal and administrative penalties, independent of the obligation to restore the caused damages.

§ For the purposes of the final part of item VII of § 1 of this article, sports practices that use animals are not considered cruel, provided they are cultural manifestations, according to § 1 of art. 215 of this Federal Constitution, registered as an intangible

asset that is part of the Brazilian cultural heritage, and must be regulated by a specific law that ensures the well-being of the animals involved. (BRASIL, 1988).

In addition to the current legislation, through official documents, four out of the five contacted agencies provided responses that aligned with the objective of this research. Due to the pandemic situation, the State Forest Institute (IEF) of Minas Gerais was the only agency that could not contribute quantitative data. It is worth noting that the 18th Battalion of the Environmental Military Police Company of Minas Gerais (PM-MG) provided responses to all the questions presented in the official letter, while the others contributed with the data they had available.

It was observed that there is a lack of standardization in the data, as various agencies employ diverse record-keeping systems and make these records available in different ways. This highlights the necessity of Table 1 to facilitate a comparative analysis of the records from each entity. The diversity in record-keeping systems among the agencies complicates the effective analysis of wildlife trafficking, a situation further exacerbated by the lack of synergy among them. Such a context underscores the urgent importance of establishing a unified platform that integrates and standardizes the data, allowing for more accurate assessments and more effective combat strategies. The adoption of such a system would not only

Table 1 Data were provided by the Federal Police, Federal Highway Police, Military Police of the state of São Paulo, and Military Police of Minas Gerais

	Federal Police	Federal Highway Police	Military Police of the State of São Paulo	18th Battalion of the Minas Gerais Environment Military Police Company
Period	2016 a 2020	2018 a 2021	2018 a 2020	2016 a 2021
Number of animals seized	19,042	73,547	26,404	3514
Most seized species	passerines	birds	birds	Birds
Seizure procedure	investigations	operations	-	Complaints and operations
Destination of seized animals	Wild Animal Screening Centers (CETAS)	accredited institutions	-	Veterinary care and release in natural habitat when possible
Trade type	National and international	-	-	National and international
Main traffic routes	-	South-east and Northeast	Highways Presidente Dutra, Bandeirantes, and Castelo Branco	-
Main crimes related to fauna	animal trafficking	animal trafficking	Keeping wild fauna in captivity without a license. Transport without authorization. illegal trade	Keeping wild fauna in captivity without a license. Transport without authorization
Comments	-	Complaints are rare;	Most of the seizures occur in the metropolitan region of São Paulo and in remaining areas of native vegetation.	Acting cities: Andradas, Bandeira do Sul, Botelhos, Cabo Verde, Caldas, Camp-estre, Divisa Nova, Ibitiúra de Minas, Ipuiuna, Poços de Caldas, Santa Rita de Caldas

simplify the comparison and understanding of trends in this illicit field but also encourage a coordinated and more effective action (Browne et al., 2021).

This strategy could significantly bolster conservation efforts and biodiversity protection. Furthermore, the development of public policies promoting interagency collaboration is crucial, ensuring the efficient use of such information in combating wildlife trafficking (Oliveira Saldanha & Peixoto, 2021). A specific measure to overcome the challenges posed by the lack of standardization and interagency cooperation would be the development and implementation of a centralized digital platform, capable of integrating, standardizing, and making data available among all involved agencies, thereby improving comparative analyses and combat strategies (Browne et al., 2021; Andrighetto & Kraemer, 2023).

In a period that varies between 2016 and 2021, it was possible to verify through the data obtained that among the most seized animals, the birds of the passerine order stand out. Among the largest number of seizures, the Federal Highway Police (PRF) was the body that conducted the largest number, and the procedures adopted through the complaints are investigations and operations. The Federal Highway Police (PRF) plays a crucial role in combating wildlife trafficking, a result of a strategic combination of location, training, and institutional focus. Their operation on federal highways, the main routes used for the illegal transport of fauna, positions them strategically to effectively intervene against this illicit practice. This positioning is enhanced by the PRF's specific training and available resources, which include specialized knowledge of environmental legislation and inspection techniques (Costa et al., 2017).

Awareness and public engagement have played fundamental roles in combating wildlife trafficking, driving society towards more active participation in the prevention of this crime, mainly through reporting. This trend is strengthened by community surveillance strategies, where environmental education programs and awareness campaigns increase community involvement in observing and reporting illicit activities, thereby improving the efficacy of regulatory actions (Junior, 2020; Cioato, 2021). Moreover, the emergence of social networks and digital platforms as communication tools has significantly simplified the reporting process, facilitating the rapid dissemination of information and enabling authorities to take immediate action. This scenario reflects progress in the fight against wildlife trafficking, demonstrating the power of collectivity and technology in protecting biodiversity (Browne et al., 2021).

After the different bodies collect the animals, they are sent to specialized locations such as CETAS, accredited institutions and, when possible, release them in fragments that correspond to the natural habitat. The effectiveness of CETAS, as highlighted by IBAMA (2019), in managing fauna affected by wildlife trafficking, underscores the urgent need for more comprehensive and integrated conservation policies. This aligns with IBAMA's observation on the critical role of these centers in the conservation chain. Formulating political strategies to enhance these institutions in handling the growing threat of animal trafficking is paramount. This effort should include sophisticated monitoring systems and international cooperation, as per IBAMA's recommendations, to address cross-border trafficking challenges. Additionally, aligning these policies with public awareness and environmental education initiatives can reinforce the societal role in biodiversity preservation, echoing IBAMA's focus on reducing the demand for wild animals. Such integrated actions would bolster CETAS's work and align with IBAMA's vision for a more holistic and sustainable wildlife conservation approach.

Furthermore, the Wildlife Protection Law defines wild fauna in its first article as “animals of any species, at any stage of development, living naturally outside captivity (...) February 12, 1998, defines in its article 29, § 3 the same deadline:

§ 3. Wild fauna specimens are those belonging to native, migratory, and any other aquatic or terrestrial species that have all or part of their life cycle occurring within the limits of Brazilian territory or Brazilian jurisdictional waters. (BRAZIL, 1998).

In addition, IBAMA Ordinance No. 93, dated July 7, 1998, defines the guidelines for the import and export of Brazilian wild or exotic fauna, whether living, products, or byproducts:

Article 2 - For the purposes of this Ordinance, the following are considered:

I - Brazilian Wildlife: all animals belonging to native, migratory, and any other aquatic or terrestrial species that have their life cycle occurring within the limits of Brazilian territory or Brazilian jurisdictional waters.

II - Exotic Wildlife: all animals belonging to species or subspecies whose geographical distribution does not include Brazilian territory and species or subspecies introduced by humans, including domestic animals in a wild or feral state. Species or subspecies that have been introduced outside the Brazilian borders and its jurisdictional waters and have entered Brazilian territory are also considered exotic.

III - Domestic Fauna: All animals that, through traditional and systematic processes of management and/or zootechnical improvement, have become domesticated, presenting biological and behavioral characteristics in close dependence on humans and may exhibit a variable phenotype, different from (...).

The main routes where seizures occur are in the Southeast and Northeast, with the Presidente Dutra, Bandeirantes, and Castelo Branco highways standing out. These routes are highlighted because they provide access to national and international trade and are patrolled by the Federal Police (PF) and the Military Police of Minas Gerais (PM-MG). According to the PM-MG, in response to the protocol, the southern region of Minas Gerais, having areas of still-preserved forests, contains ecosystems with various birds that, due to their beauty and song, attract the interest of people from other areas, especially those from the State of São Paulo.

The seizure routes of trafficked fauna are critical indicators of the dynamics of animal trafficking. The fact that these routes facilitate access to national and international trade and are under enhanced surveillance by the authorities suggests that enforcement efforts are strategically aligned with the most prevalent routes of this environmental crime.

Among the crimes highlighted, the maintenance of animals in captivity occurs most frequently, with other significant crimes including unauthorized transportation and illegal trade. Regarding the distribution of trafficked animals, it is estimated that 30% are transported to other countries, while the remainder are sold within Brazilian territory. The prevalence of offenses such as keeping animals in captivity, transportation, and trade without authorization points to gaps in control mechanisms and the need for more effective actions in prevention and education, as highlighted by Oliveira Grieser et al. (2019).

The distribution of trafficked animals positions Brazil as a significant supplier in the global wildlife trade, demanding a critical analysis of the efficacy of international conven-

tions and transborder cooperation policies to mitigate this illicit trade. These trafficking routes entail serious ecological consequences, including biodiversity loss and ecosystem imbalance, in addition to significant socioeconomic impacts, damaging the country's natural and cultural heritage (Carmo et al., 2020; Cioato, 2021). Such activities contribute, both in the supplying and receiving countries, to the increase in organized crime, weaken public safety and law enforcement, and can negatively affect the economy, particularly in sectors related to environmental conservation and ecotourism. The situation is further complicated by public health risks due to the potential transmission of zoonotic diseases, as discussed by Oliveira Saldanha and Peixoto (2021).

It is worth noting that the three crimes are interconnected, since the interest in wild animals as pets is one of the reasons that most moves the market (RENCTAS, 2001). Although the interaction between humans and animals has an ancient history, possibly since the first civilizations, lately, it has been noticed that this need has been growing due to the evolution of social dynamics, for example, animals with training to meet people with special needs, search animals for accident survivors and those that are known for emotional assistance due to the close ties created with their owner (Oliveira Grieser et al., 2019).

This analysis suggests the need for a more rigorous and coordinated approach at the international level, involving integrated policies that address both the prevention and repression of wildlife trafficking. Global initiatives aimed at strengthening national legislation, promoting intelligence sharing, and improving collaboration between countries are crucial. Additionally, implementing educational and awareness programs in key communities can play a significant role in reducing demand and protecting biodiversity. Policies that encourage the protection and valorization of Brazil's natural and cultural heritage are also fundamental to addressing the socio-economic roots of the problem, contributing to a more effective and sustainable solution.

Figure 1A shows the seizures conducted by Organs competent bodies at the federal level with data from the PRF. At the state level, more precisely the Military Police of the State of São Paulo (PM-SP) (Fig. 1B), the species of birds seized are identified by popular name, and the same occurs for the data obtained in the south of Minas Gerais. PM-MG (Fig. 1C) also presents data on seized birds, which are classified as domestic, wild and exotic.

Figure 1A deals with the seizures conducted by the PRF from the patrolling of Brazilian roads conducted between 2018 and 2021. It is noticed that the highest numbers of seizures are of live wild animals, with the incidence of exotic animals in second place, transported in motor vehicles, with the year 2020 with a greater number of seizures, which can be explained by the height of the pandemic period and less movement of the roads, making it possible to have better patrolling. Although the PRF does not differentiate which animals were seized, at the state level, it was recorded that birds are the main trafficked animals, as already observed and presented in Table 1.

The PM-SP, from 2018 to 2020, recorded which species were most seized and how many individuals were trafficked. These species are shown in Fig. 1B, with the “canário-da-terra” and the “coleirinha-papa-capim” being the two most apprehended species and all the others being passerines that are highly sought after for their singing skills and beauty and only one parrot, the “green parrot”, in fourth place in the number of apprehensions.

In Fig. 1C, data analysis provided by the Military Police of Minas Gerais (PM-MG) for the period from 2016 to 2021 reveals that birds represent the highest volume of seizures within the category of wildlife, with a peak in frequency observed in the year 2018.

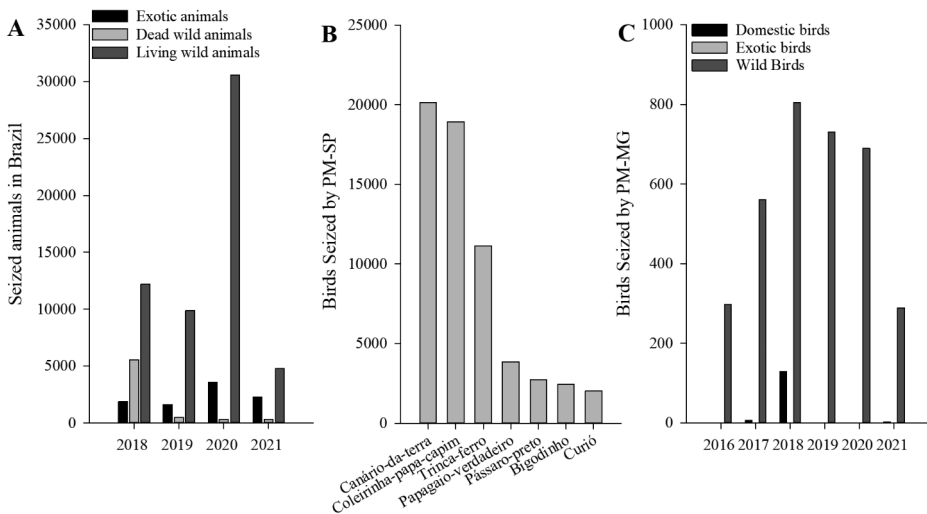


Fig. 1 (A) Number of animals seized in Brazil between 2018 and 2021 by the Federal Highway Police; (B) number of birds seized by the Military Police of the State of São Paulo; (C) number of birds seized by the 18th Battalion of the Minas Gerais Environment Military Police Company

This predominance in bird trafficking suggests a specific demand, driven by characteristics such as song and sexual dimorphism of these animals. According to Oliveira Saldanha and Peixoto (2021), such attributes not only encourage illegal trade but also result in adverse biological impacts, including the imbalance of natural populations.

An integrated analysis of the data collected by the Pristino Institute and the Military Police of Minas Gerais (PM-MG), in conjunction with information from the state of São Paulo, points to a regional preference for specific species, such as the ‘canário-da-terra’ and the ‘trinca-ferro’. This observation further suggests the existence of trafficking routes that cross state borders. Such a scenario underlines the urgency of adopting conservation strategies that are both integrated and collaborative among the various states, highlighting, furthermore, the relevance of educational initiatives aimed at reducing demand and increasing awareness of the ecological consequences resulting from bird trafficking (Carmo et al., 2020).

Given this reality, it becomes essential that public policies be directed towards the implementation of stringent enforcement actions on already identified trafficking routes, in addition to strengthening environmental legislation aimed at eradicating this illicit practice. Concurrently, it is imperative to expand environmental education programs and public awareness campaigns, with the aim of mitigating the demand for trafficked birds and emphasizing the importance of biodiversity conservation (Costa et al., 2017; Carmo et al., 2020; Cioato et al., 2021).

Inter-state collaboration and the exchange of information between environmental and security agencies emerge as fundamental pillars for dismantling trafficking networks and the effective protection of endangered species. This strategy reinforces the need for a centralized integrated system that will optimize environmental management and enforcement (Browne et al., 2021).

Illustrating the three most prevalent crimes against wildlife, and also emphasizing the result that highlights trafficking in the Minas Gerais region, the case study of the Toco Toucan (*Ramphastos toco*) (Fig. 2), named “Ray Charles”, currently housed at the Zoo das Aves in Poços de Caldas, had both eyes pierced by traffickers, leaving him completely blind in the left eye and partially blind in the right eye, making his reintroduction to nature impossible. He was referred by the competent state environmental agencies to the Zoo das Aves.

Continuing with the analysis at the state level, Tables 2 and 3 provide quantitative data on seizures and fines applied by the states of São Paulo and Minas Gerais through the activities of the Military Police. Table 2 deals with the data provided by PM-SP in the period from 2018 to 2020, showing the number of seizures made and the fines applied related to the act of infraction, highlighting the year 2018 with the highest number of seizures and, consequently, application of fines.

Fig. 2 Toco toucan (*Ramphastos toco*) kept at Zoo das Aves in Poços de Caldas

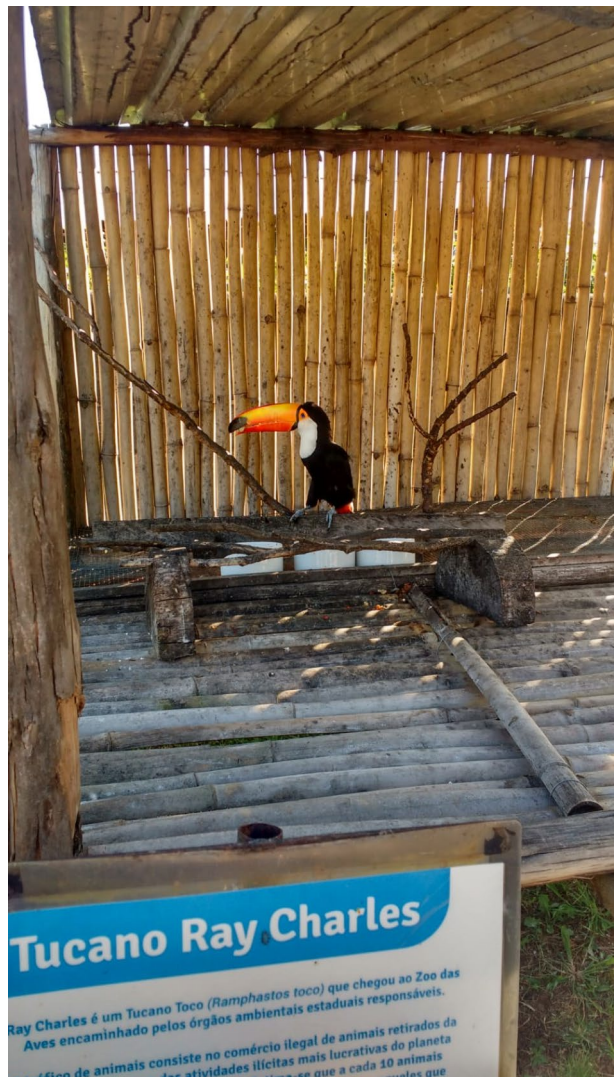


Table 2 Apprehensions conducted by the Military Police of the state of São Paulo and the amount applied through fines

Year	Apprehensions	Fines
2018	10,772	R\$ 54.725.360,27
2019	8303	R\$ 41.207.316,92
2020	7329	R\$ 37.100.669,71
Total	26,404	R\$ 133.033.346,90

Table 3 Crimes against fauna - PM/MG

Ano	M31008 – Keeping wild fauna specimens in captivity without a license		M31010 – Transporting specimens of native wildlife without authorization	
	Violation notice numbers	Amount collected (R\$)	Number of acts of infringement	Amount collected (R\$)
2016	1	664.58	0	0
2017	28	236,419.72	6	114,559;84
2018	110	939,653.89	20	233,534.11
2019	91	3,117,863.68	5	170,712.63
2020	107	1,163,605.27	12	230,050.91
2021	44	652,901.80	4	43,778.40
(Until June)				

The PM-MG distinguishes between the two most common crimes in its area of operation, namely, having wild fauna specimens in captivity without a license and transporting specimens of native wild fauna without authorization. Table 3 shows the number of infraction notices drawn up and the amount collected. It is worth noting that in 2018, PM-MG, as well as PM-SP, had more seizures.

The allocation of funds collected from environmental fines in Brazil is directed to the National Environmental Fund (FNMA) or to state and municipal environmental funds, as established by Law 9.605/1998 (Environmental Crimes Law) and its regulations. The FNMA, created by Law No. 7.797, dated July 10, 1989, aims to finance projects that contribute to environmental management and the sustainable development of the country. Thus, the funds collected from fines can be used in various actions such as the recovery of degraded areas, environmental education, enforcement, protection, and sustainable development.

The quantitative data from São Paulo and Minas Gerais, as shown in Tables 2 and 3, outline a pattern of punitive measures as a direct reflection of the number of seizures by the military police forces, with 2018 as a significant year of action. The correlation between seizures and fines, especially that year, may indicate either a stricter response from authorities or an increase in illegal wildlife activities. The Military Police of Minas Gerais (PM-MG) distinguishing between the two most frequent offenses provides insight into common infractions, highlighting illegal capture and unauthorized transport as the main focuses of illicit activities. These findings reveal the need for more robust enforcement and specific preventive strategies, as well as a reflection on the effectiveness of current wildlife conservation policies and the adequacy of penalties imposed (Andrighetto & Kraemer, 2023).

This context demands a review and strengthening of public conservation policies and a more integrated and collaborative approach among states and enforcement agencies. Adopting advanced technologies for monitoring and surveillance, increasing penalties for environmental infractions, and promoting greater public awareness are essential steps. Additionally,

developing policies that encourage international collaboration to effectively combat wildlife trafficking and implementing educational programs in local communities to reduce demand are crucial. Detailed data analysis and current trends should inform the creation of more effective strategies for biodiversity protection and curbing animal trafficking.

From the analysis of data provided by the National Council of Justice - CNJ, between 2017 and 2020, it is possible to perceive that the largest number of cases of judicialization of crimes related to fauna occurred in the states of Minas Gerais (TJMG) in 2019 (Fig. 3) and São Paulo (TJSP) and Santa Catarina (TJSC) in 2017. Most of the cases, when separated by instance, were judged by the Special Courts in all the years analyzed, and few, if any, cases came to be judged by the Superior Tribunal of Justice (STJ) (Fig. 4).

Cases of environmental crimes related to fauna are often judged in Special Courts and rarely reach the Superior Court of Justice (STJ) due to various structural and procedural factors of the Brazilian legal system. The Special Courts were established to provide a faster and less formal judicial process for cases of lesser complexity and with lighter penalties. Many environmental crimes, especially those related to fauna, are classified as minor offensive infractions. This means that the prescribed penalties are relatively light (maximum detention of up to two years or a fine), which fits perfectly within the jurisdiction of the Special Courts (Junior, 2020).

The concentration of judicial cases related to wildlife crimes, as indicated by data from the National Council of Justice (CNJ), reflects regional disparities in environmental infraction incidence or enforcement strategies. The predominance of these cases in Special Courts, as shown in Fig. 4, and their rarity in reaching the Superior Court of Justice (STJ) can be interpreted in light of current legislation favoring lighter penalty alternatives such as community service or fines. This trend suggests a legislative view that environmental crimes are lesser offenses, potentially underestimating their cumulative ecological and biodiversity impact (Junior, 2020).

It is necessary to rethink and reformulate environmental legislation to recognize the severity of wildlife crimes. Adopting a stricter legislative approach and public policies for environmental education and societal awareness about biodiversity importance and the negative impacts of environmental crimes is crucial. These changes will not only strengthen environmental protection but also send a clear message about nature conservation importance and legal and social responsibility in combating these crimes.

The survey conducted with environmental professionals revealed a diversified educational background, with 38% of respondents being biologists and 38% veterinarians, indicating a significant representation of these fields in work with animals seized from trafficking. The vast majority of professionals (91%) reported working directly with animals resulting from trafficking, highlighting the active involvement of these professionals in the rehabilitation and management of these animals (Table 4).

Regarding the consequences of wildlife trafficking, professionals highlighted the loss of diversity (37%) and the spread of zoonoses (22%) as the main impacts, underscoring the severe risks to public health and biodiversity. This occurs because trafficked animals are not subjected to sanitary controls and, due to the physical and immunological weaknesses resulting from transportation and sale conditions, face such adversities after being removed from their natural habitat (Oliveira Saldanha & Peixoto, 2021).

The species most frequently illegally traded were identified as parrots (44%) and passerines (41%), reflecting the high demand for these species in the illegal market. The predomi-

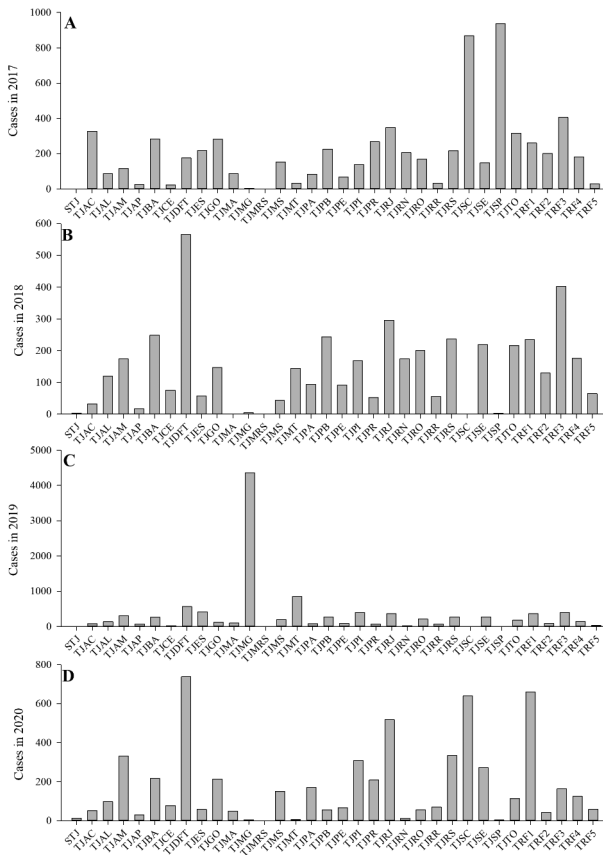


Fig. 3 Total cases per court between 2017 and 2020. STJ - Superior Tribunal of Justice; TJAC - Tribunal of Justice of Acre; TJAL - Tribunal of Justice of Alagoas; TJAM - Tribunal of Justice of Amazonas; TJAP - Tribunal of Justice of Amapa; TJBA - Tribunal of Justice of Bahia; TJCE - Tribunal of Justice of Ceara; TJDFT - Tribunal of Justice of Distrito Federal; TJES - Tribunal of Justice of Espirito Santo; TJGO - Tribunal of Justice of Goias; TJMA - Tribunal of Justice of Maranhão; TJMG - Tribunal of Justice of Minas Gerais; TJMRS - Tribunal of Justice of Rio Grande do Sul; TJMS - Tribunal of Justice of Mato Grosso do Sul; TJMT - Tribunal of Justice of Mato Grosso; TJPA - Tribunal of Justice of Para; TJPB - Tribunal of Justice of Paraiba; TJPE - Tribunal of Justice of Pernambuco; TJPI - Tribunal of Justice of Piaui; TJPR - Tribunal of Justice of Parana; TJRJ - Tribunal of Justice of Rio de Janeiro; TJRN - Tribunal of Justice of Rio Grande do Norte; TJRO - Tribunal of Justice of Rondonia; TJRR - Tribunal of Justice of Roraima; TJRS - Tribunal of Justice of Rio Grande do Sul; TJSC - Tribunal of Justice of Santa Catarina; TJSE - Tribunal of Justice of Sergipe; TJSP - Tribunal of Justice of São Paulo; TJTO - Tribunal of Justice of Tocantins; TRF1 - Federal Regional Court of the 1st Region; TRF2 - Federal Regional Court of the 2nd Region; TRF3 - Federal Regional Court of the 3rd Region; TRF4 - Federal Regional Court of the 4th Region; TRF5 - Federal Regional Court of the 5th Region

nance of the trafficking of psittacines and passerines, along with the notable mention of the order Testudines (15%), is due to factors that include aesthetic and emotional appeal. Psittacines, such as parrots and macaws, are valued for their vocal abilities and vibrant colors, while passerines, such as canaries and blackbirds, are sought for their singing. Testudines, including turtles and terrapins, are often traded as exotic pets (Morandini & Cunha, 2021; Oliveira Saldanha & Peixoto, 2021).

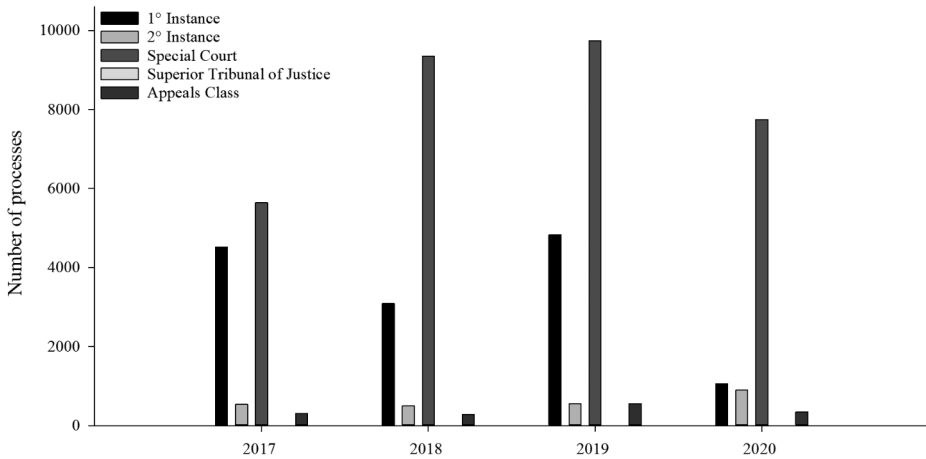


Fig. 4 Number of cases per instance from 2017 to 2020

Regarding the behaviors observed in animals resulting from seizures, stress was the most reported (33%), followed by stereotypic behaviors and chronic diseases (both 17%), highlighting the negative impact of trafficking and illegal capture on animal welfare. It is important to recognize that the process of capture and transportation imposes a high level of acute stress on animals, due to forced handling, confinement in restricted spaces, and often, inadequate conditions of ventilation, feeding, and hydration during transport. These conditions trigger a series of physiological and behavioral stress responses, such as increased levels of corticosteroids, which can compromise the immune system and increase susceptibility to diseases (Pohlin et al., 2020).

Professionals identified ecological imbalance (39%) and loss of diversity (35%) as the main impacts of trafficking on ecosystems, highlighting the consequences of this environmental crime. This occurs due to the removal of individuals from the population in which they lived or due to the introduction and invasion of exotic species that will compete with native species for natural resources (Oliveira Saldanha & Peixoto, 2021).

Finally, the transmission of pathogens (40%) was considered the greatest risk of keeping wild animals in captivity, highlighting the associated public health risks and the need for effective policies to prevent animal trafficking. The interaction between humans and captive wildlife, especially in unregulated or illegal contexts such as animal trafficking, increases the risk of the emergence and re-emergence of zoonotic diseases. The COVID-19 pandemic, for example, underscored the risks associated with human interaction with wild animals and the potential for spillover of animal pathogens to humans (Zhou et al., 2020).

The results obtained from the questionnaire detailed in Table 5 reflect the perceptions and experiences of professionals active in the sphere of environmental enforcement, particularly those involved with the issue of wildlife trafficking. This objective and scientific analysis unfolds in various dimensions that characterize both the profile of the respondents and the practices associated with animal trafficking, its consequences, and the current combat strategies.

The distribution of specialty areas among respondents reveals a diversified involvement, with 40% representing the environmental police, 20% working in environmental surveil-

Table 4 Information on professionals in the environmental area

Questions	Answers (%)
What is your area of training?	Environmental Analyst (13%); Teacher (13%); Veterinarian (38%); Biologist (38%).
Do you work or have you worked with animals resulting from trafficking seizures?	Does not work (0%); Indirectly (9%); Directly (91%).
What are the main consequences of trafficking in wild animals?	Biopiracy (4%); Mistreatment (7%); Exotic species introduction (7%); Inbreeding (7%); Environmental unbalance (7%); Species Extinction (7%); Spread of zoonoses (22%); Diversity loss (37%).
What are the main species of animals traded illegally?	Testidines (15%); Passerines (41%); Parrots (44%)
What are the main behaviors of animals resulting from the seizure of trafficking?	Apathy (8%); Interaction difficulties (8%); Nutritional deficit (17%); Chronic diseases (17%); Behavioral stereotypes (17%); Stress (33%).
What are the impacts of trafficking on ecosystems?	Exotic Pathogens (4%); Genetic variety decrease (9%); Species Introduction (13%); Diversity loss (35%); Ecological unbalance (39%).
What are the risks of keeping a wild animal in captivity?	Loss of ecosystem services (7%); Animal death (7%); Administrative sanctions (13%); Accidents and injuries (33%); Pathogen transmission (40%).
What are the reasons that lead people to acquire an animal without legal origin?	Not knowing legal trade (4%); Impunity sensation (4%); Lack of environmental education (4%); Easiness of illegal commerce (4%); Animal-related empathy (7%); Lack of law knowledge (11%); Incentives from media (11%); Species-linked tendencies (26%); Price (30%).
Why is Brazil one of the main targets of animal trafficking?	Culture (5%); Lack of environmental education (9%); Lack of legislation (14%); Failure in penalties complying (14%); Lack of fiscalization (18%); Biodiversity (41%).

Table 5 Information obtained from PM-MG and PRF

Questions	Answers (%)
What is your area of expertise?	Public security (20%); Environmental surveillance (20%); Delegate (20%); Environmental police (40%).
Do you work or have you worked with animals resulting from trafficking seizures?	Indirectly (20%); Does not work (20%); Directly (60%).
What are the main consequences of trafficking in wild animals?	Illegal commerce promotion (20%); Population decrease (40%); Death in transporting (40%).
Why is Brazil one of the main targets of animal trafficking?	Easy access (17%); Culture (17%); Slowness of the judicial system (17%); Species diversity (50%).
What are the main species of animals traded illegally?	Parrots (44%); Passerines (56%).
Are seizures made through complaints or operations?	Operations (20%); Denounces (80%).
Which species are most seized?	Parrots (23%); Passerines (77%).
What is your perception regarding the environmental legislation related to fauna?	Efficient (40%); Need changes (60%).
What are the reasons that you believe lead a person to acquire an animal without legal origin?	Lack of knowledge (14%); Easyness (14%); Lack of surveillance (14%); Price (57%).
What is done with rescued animals?	Natural habitat (14%); Depositary (29%); CETAS (57%).
What are the conditions in which the animals are found?	Domesticated (13%); Healty (13%); Dehydrated (25%); Mistreatment (50%).
What are the best environmental education strategies to raise awareness of the issue?	Awareness (25%); Actions trough media (25%); Exposition of consequences (50%).
Which environmental crime is most evident?	Hunting (13%); Wildfires (13%); Possession of wild animals (38%); Animals in captivity (38%).
What conditions could be improved to help them in their work?	CETAS creation (20%); Free veterinarian clinics (20%); Increase on credited entities (20%); More surveillance (20%); Special delegations (20%).

lance, 20% in public security, and 20% holding positions as delegates. This broad spectrum of specialties underscores the interdisciplinarity required in approaches to combating wildlife trafficking.

Among the main consequences of trafficking pointed out by professionals, the death of animals during transport and the population decline of species stand out, both with 40% of

the mentions. These data highlight the devastating impacts of trafficking on the population viability of the involved species and the physiological integrity of the trafficked individuals, underscoring the urgency of effective preservation strategies. From the analysis of this response, it is observed that Brazil becomes one of the main targets of trafficking due to its species diversity and lengthy judicial system, which, consequently, reduces the population of trafficked species, the vast majority of which end up dying during transport and encourages illegal trade. Thus, it is estimated that for every ten animals captured, only one arrives at its destination alive, while the others die during transport (Morandini & Cunha, 2021).

The results indicate a prevalence of trafficking in passerines (56%) and psittacines (44%), emphasizing the high commercial demand these groups of birds face in the illegal market. The popularity of these species as pets contributes to the perpetuation of the trafficking cycle, demanding specific actions to mitigate this demand. Through reports and operations, the police have identified that the most trafficked animals in the region are birds, with the orders of passerines and psittacines being the most sought after, as evidenced in the first questionnaire applied to environmental professionals. Regarding the reasons that lead a person to acquire an animal of illegal origin, the main ones include the more affordable price and the lack of knowledge and supervision.

The demand for wild animals as pets fuels illegal trafficking, especially in light of their scarcity and high cost in the legal market. This pursuit reflects not just the desire to own an exotic companion but also a perceived social status, exacerbating the exploitation of these species and triggering serious ecological and legal repercussions (Oliveira Grieser et al., 2019).

The information that 80% of seizures are made through reports highlights the crucial role of citizen participation in the identification and reporting of animal trafficking. This interaction between society and authorities reinforces the importance of awareness campaigns and efficient communication channels for reporting environmental crimes. Research in environmental psychology suggests that awareness and knowledge about environmental issues are key factors that motivate citizen participation in conservation actions (Pontes Filho et al., 2021). Awareness campaigns that highlight the negative consequences of animal trafficking on biodiversity and ecosystems can, therefore, increase the likelihood of the public reporting such illegal activities to the authorities. The effectiveness of these campaigns is also linked to their ability to generate empathy for the affected animals, promoting an emotional connection that encourages action (Oliveira Grieser et al., 2019).

The perception that changes are needed in environmental legislation, indicated by 60% of respondents, signals the need for a review and strengthening of public policies and the current legal frameworks. Such a need suggests that the current measures may not be robust enough to curb animal trafficking. In terms of legislation and the judiciary system, although there are some differences, all respondents agree that current laws and the slowness of the judiciary facilitate trafficking activities. The enforcement agencies interviewed believe that, as part of environmental education strategies, it is essential to communicate the consequences to those who act illegally, in order to increase public awareness about the importance of environmental well-being. Furthermore, they mentioned improvements that could assist in their work, among which the need to create CETAS (Wildlife Screening Centers), free veterinary hospitals, specialized police stations, and more effective supervision among agents stands out.

Inadequate legislation and the slow pace of the judiciary are seen as facilitators of animal trafficking, a consensus that points to the need for more agile legislative and judicial reforms. The emphasis on environmental education and communication of the legal consequences of trafficking suggests a potential path to mitigate this illicit trade. The proposed improvements, such as the creation of CETAS (Wildlife Screening Centers) and specialized police stations, as well as the provision of free veterinary hospitals, indicate practical measures to strengthen wildlife protection and combat trafficking, highlighting the importance of an integrated and effective conservation strategy (Oliveira Saldanha & Peixoto, 2021; Andrighetto & Kraemer, 2023).

Finally, the emphasis on environmental education as an awareness-raising strategy highlights the belief in the power of information and the formation of a collective consciousness geared towards conservation. The exposure of the consequences of trafficking, for the animals, biodiversity, and public health, is seen as a viable path to change paradigms and behaviors.

The results shown in Table 6 reflect the population's perception of wildlife trafficking. This analysis reveals the level of public awareness regarding this critical issue.

The age range of respondents shows a distribution with a higher concentration between 18 and 29 years (24%) and 30 to 49 years (35%), indicating that the majority of participants are from the economically active population. This age group is more likely to be connected to social networks and other digital platforms, which increases their exposure to environmental awareness campaigns and global issues, including wildlife trafficking (Thaler et al., 2018). The scientific literature suggests that younger people tend to show greater concern for the environment and are more open to behavioral changes that promote sustainability and conservation (Otto & Kaiser, 2014).

Regarding the level of education, the majority of respondents completed higher education (30%), followed by those with postgraduate/specialization (19%), reflecting a relatively educated audience. Studies show that individuals with a higher level of education have more knowledge about environmental issues and are more likely to engage in pro-environmental behaviors (Zsóka et al., 2013).

The majority of respondents (60%) are unaware that wildlife trafficking is the third largest trafficking in the world, highlighting a significant gap in public knowledge about the magnitude of this problem. A large percentage (74%) claim to know the difference between domestic, wild, and exotic animals, indicating a reasonable level of understanding about fundamental animal categories.

The vast majority (85%) of respondents have never had a wild animal as a pet, and 91% state they would not purchase a wild animal to keep as a pet, suggesting a general disposition against the possession of wild animals. However, 64% of participants admit they do not know how to identify the origin of a wild animal for sale, highlighting the need for better education and information to enable responsible choices. The difficulty in measuring these data through the use of questionnaires arises because this practice may intimidate respondents who, consequently, may conceal information due to illegally owning animals. Another hypothesis that also corroborates the presented data is the culture of obtaining animals through third parties as a form of gift or donation, and thus, not knowing how to identify the origin of these animals (Oliveira Grieser et al., 2019).

A considerable majority (79%) believes that having a wild animal as a pet is problematic, reflecting awareness of the ethical and environmental implications. Moreover, 58%

Table 6 Information obtained from the population

Questions	Answers (%)
How old are you?	Less than 18 (02%); From 50 to 60 (17%); More than 60 (21%); From 18 to 29 (24%); From 30 to 49 (35%).
What is your level of education?	Incomplete elementary school (02%); PhD (02%); Complete elementary school (02%); Master degree (04%); Incomplete high school (05%); Incomplete graduation (17%); Post-graduation (specialization) (19%); Complete high school (19%); Complete graduation (30%).
Did you know that trafficking in wild animals is the third largest trafficking in the world?	Uncertain (07%); Yes (33%); No (60%).
Do you know the difference between domestic, wild and exotic animals?	No (12%); Uncertain (14%); Yes (74%).
Have you ever had or have a wild animal as a pet?	Uncertain (01%); Yes (14%); No (85%).
Would you buy a wild animal to have as a pet?	Yes (03%); Uncertain (06%); No (91%).
Do you know how to identify the origin of a wild animal for sale?	Uncertain (12%); Yes (24%); No (64%).
Do you believe having a wild animal as a pet is a problem?	No (06%); Uncertain (15%); Yes (79%).
Did you know that illegal trade and domestication of wild animals are directly related to zoonosis?	Uncertain (04%); Yes (38%); No (58%).
Do you know what to do if you find a wild animal?	Uncertain (14%); No (27%); Yes (59%).

were unaware that the illegal trade and domestication of wild animals are directly related to zoonoses, underscoring the need to expand education about the public health risks associated with animal trafficking. This information becomes concerning in light of the pandemic scenario that began in 2020. From a health perspective, the trafficking of wild animals represents a risk to human and other animal health, as the transported animals can be carriers of endemic diseases from their place of origin, thus becoming vectors of pathogens (Pohlin et al., 2020; Zhou et al., 2020; Oliveira Saldanha & Peixoto, 2021).

The results highlight the critical importance of targeted environmental education programs to increase knowledge and awareness about the impacts of wildlife trafficking. Campaigns should focus on the magnitude of the problem, the differences between domestic, wild, and exotic animals, the legal and environmental consequences of owning wild

animals, and the risks of zoonoses associated with animal trafficking. This could not only reduce the demand for wild animals as pets but also encourage the public to actively participate in biodiversity conservation and the prevention of animal trafficking.

4 Conclusions

This study highlights the ongoing issue of wildlife trafficking, particularly noting the significant seizures of Passeriformes and Psittaciformes species. The analysis suggests that, despite ongoing efforts, there are significant gaps in strategies to combat this environmental crime. An urgent recommendation is the unification of information systems among enforcement agencies to improve coordination and operational efficiency. Additionally, intensifying environmental awareness actions, tailored to local cultural realities, is imperative to effectively discourage the illegal trade of wild species.

CETAS play a crucial role in the rehabilitation and reintegration of animals into their natural habitat but face operational and financial challenges. Thus, ensuring continuous public support and adequate resources for their efficient operation is essential. Legislatively, reviewing and strengthening environmental laws, expediting judicial processes, and improving reception facilities for seized animals are critical for a swifter and more effective judicial response.

Environmental education and societal engagement are key to addressing the root of the problem. The public must be informed about the negative impacts of animal trafficking on biodiversity and ecosystems. Public policies that encourage reporting and combating this trade are fundamental. In conclusion, a joint and coordinated effort between authorities, environmental organizations, and society is necessary to confront and mitigate wildlife trafficking, protecting biodiversity and natural heritage for future generations.

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Declarations

Competing interests The authors declare no competing interests.

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