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Quantitative Study of Reptilia Received at Wild Animal Screening Centers of Bahia, Brazil, from 2009 to 2019

Estudo Quantitativo de Répteis Recebidos em Centros de Triagem de Animais Silvestres da Bahia, Brasil, de 2009 a 2019

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Abstract

The keeping of unconventional exotic species as pets can encourage indiscriminate illegal trade, affecting wildlife, especially reptiles. Information on the movement of these animals that have been improperly removed from the wild and sent to Wild Animal Screening Centers is an important tool for improving enforcement actions to combat the illegal trade of native and non-native wild animals. The aim of this study was to identify, quantify and analyze the species of reptiles received by three units in the state of Bahia: Salvador and Vitória da Conquista units - between 2009 and 2019 - and Porto Seguro unit between 2010 and 2016. The survey was carried out using the data contained in the Wild Animal Entry Terms, encompassing seizures, voluntary deliveries, rescues and transfers. Records were found for 12,007 reptiles, of which 6,405 (53.34%) came from rescues; 2,387 (19.88%) from voluntary deliveries; 1,988 (16.56%) from transfers and 1,141 (9.50%) from seizures. It was not

possible to establish the modality of reception for 86 (0.72%) specimens. The most frequent species to be recorded were: *Chelonoidis carbonaria* (red-footed tortoise, 55.03%), Boa constrictor (common boa, 13.13%), *Chelonoidis denticulatus* (yellow-footed tortoise, 6.47%) and *Iguana iguana* (green iguana, 5.72%). Data analysis revealed that the largest influx of reptiles into the three centers came from the municipalities of Vitória da Conquista, Salvador, Santo Antônio de Jesus and Feira de Santana. The data from this study indicates rescues as the most frequent modality of entry for reptiles into the Wild Animal Screening Centers of the state of Bahia.

Keywords: Iguana. Tortoise. Common Boa. Wildlife Rescue.

Resumo

A manutenção de espécies exóticas não convencionais como animais de estimação pode incentivar o comércio ilegal indiscriminado, afetando a fauna, especialmente os répteis. Informações sobre a movimentação desses animais retirados indevidamente da natureza e encaminhados aos Centros de Triagem de Animais Silvestres são uma ferramenta importante para aprimorar as ações de fiscalização no combate ao comércio ilegal de animais silvestres nativos e não nativos. O objetivo deste estudo foi identificar, quantificar e analisar as espécies de répteis recebidas por três unidades no estado da Bahia: unidades Salvador e Vitória da Conquista - entre 2009 e 2019 - e unidade Porto Seguro entre 2010 e 2016. O levantamento foi realizado utilizando os dados contidos nos Termos de Entrada de Animais Silvestres, abrangendo apreensões, entregas voluntárias, resgates e transferências. Foram encontrados registros de 12.007 répteis, dos quais 6.405 (53,34%) foram provenientes de resgates; 2.387 (19,88%) de entregas voluntárias; 1.988 (16,56%) de transferências e 1.141 (9,50%) de apreensões. Não foi possível estabelecer a modalidade de recepção para 86 (0,72%) espécimes. As espécies mais frequentemente registradas foram: *Chelonoidis carbonaria* (jabuti-de-patas-vermelhas, 55,03%), *Boa constrictor* (jiboia-comum, 13,13%), *Chelonoidis denticulatus* (jabuti-de-patas-amarelas, 6,47%) e *Iguana iguana* (iguana-verde, 5,72%). A análise dos dados revelou que o maior fluxo de répteis para os três centros veio dos municípios de Vitória da Conquista, Salvador, Santo Antônio de Jesus e Feira de Santana. Os dados deste estudo indicam os resgates como a modalidade mais frequente de entrada de répteis nos Centros de Triagem de Animais Silvestres do estado da Bahia.

Palavras-chave: Iguana. Tartaruga. Jiboia Comum. Comércio Ilegal.

1 Introduction

In Brazil, the demand for unconventional species as pets is growing, especially reptiles. It is estimated that 26.4% of pets are wild animals (native and non-native species) (Barbosa *et al.*, 2018; Marques *et al.*, 2020; Souza *et al.*, 2008). This practice has encouraged the illegal and indiscriminate wildlife trade (Clark *et al.*, 2014; Ferreira; Costa, 2017; Stehmann; Sobral, 2017).

Wildlife trafficking is the third most lucrative illicit activity in the world, surpassed only by the illegal sale of drugs and arms (Lawson; Vines, 2014; RENCTAS, 2014). Globally, this market size is estimated to be between 5 and 23 billion dollars, according to Kar and Spanjers (2017). In Brazil, an estimated 38 million specimens are taken from the wild every year (RENCTAS, 2014; Vasconcelos, 2023).

According to Fonseca, Both and Cechin (2019) and Fonseca *et al.* (2021), pet trade may be the main factor responsible for the introduction of non-native reptiles into the country. Muraoka (2019), reports that between 2011 and 2018 there were 4,832 infraction notices issued by the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) regarding the introduction of non-native species into Brazil through the Brazilian Post and Telegraph Corporation along with international express courier companies.

The import of reptiles from non-native fauna for the purpose of serving as pets is prohibited in Brazil, according to Article 31 of IBAMA Ordinance 093/1998. Despite the legal ban, a study by Alves *et al.* (2019) revealed that 23 non-native species are kept as pets in Brazil.

The insertion of wild animals living outside their original habitat can cause a loss of biodiversity, genetic impoverishment, species extinction and the spread of pathogens that can contaminate other animals and humans (zoonotic diseases). In addition, a relevant economic impact takes place as a result of unpaid taxes on these illegal transactions (Borges *et al.*, 2006; Cavalcanti; Nunes, 2019; Clark *et al.*, 2014; Stehmann; Sobral, 2017; Vilela; Barreto; Oliveira, 2016).

Another consequence of trafficking is the indiscriminate release of wild animals, due to guardians losing interest in keeping them, evidenced by the large number of reptiles rescued and sent to Wild Animal Screening Centers (CETAS) (Pessoa *et al.*, 2014; Souza *et al.*, 2007).

IBAMA's Normative Ordinance Nº 169 of June 25th, 2008, as amended by Normative Instruction Nº5 of May 13th, 2021, designates CETAS units as responsible for wildlife management to provide services for the reception, identification, marking, screening, evaluation, recovery, rehabilitation and destination of wild animals.

Animals arrive at screening centers by seizure, voluntary delivery and rescue, occasionally there may be transfers between units due technical reasons. Seizure is defined as the deposit of specimens, as a result of inspection actions carried out by government agencies consisting of IBAMA; the Public Prosecutor's Office; municipal, state and federal environmental inspectors; the Federal, Military, and Civil Highway Police Departments; the Fire Department and agents from Zoonosis Control Centers. For animals seized by government agencies during inspections, a Notice of Infraction and Term of Seizure and Deposit are drawn up and attached to the records of entry into the units (Cavalcanti; Nunes, 2019).

Voluntary delivery involves the individual spontaneously handing over specimens in their custody at CETAS units. As for rescues, wild animals are captured by public agencies in response to

popular requests. Animals sent to CETAS are registered using the Wild Animal Entry Form, which includes species identification, sex (when possible), municipality of origin, date, modality of reception and identity of the responsible for the animal deposit.

Therefore, the aim of this study was to identify, quantify and analyze the species of reptiles received by all three CETAS units of the state of Bahia: Salvador and Vitória da Conquista units (2009 -2019) and Porto Seguro (2010-2016).

2 Material and Methods

The study was approved by the Ethics Committee for the Use of Animals (CEUA) of the Universidade Federal da Bahia (UFBA), under protocol number 50/2019, and was carried out through an exploratory analysis of the Terms of Entry of Wild Animals, compiled at the Wild Animal Screening Centers (CETAS), from 2009 to 2019, at the Salvador and Vitória da Conquista units, and from 2010 to 2016 at the Porto Seguro unit, given that the use of data for the same time period as the others was not authorized.

Variables regarding scientific nomenclature according to Order, Family and Species; modality of reception (seizures, voluntary deliveries, rescues and transfers); quantity and municipality of origin were collected. The data were tabulated, organized and analyzed using descriptive statistics (Microsoft Office® Excel software).

The global conservation status of Brazilian reptiles and their risk of extinction were classified according to Ministry of Environment (MMA) Ordinance 148/2022, which provides the Official National List of Endangered Fauna Species (Brasil, 2022). The scientific nomenclature of the species was based on the List of Reptiles of Brazil and its States (Costa; Bérnils, 2018), the Web Service of the Taxonomic Catalog of Brazil's Fauna (Wang; Canalli; Zimbrão, 2018) and the Catalogue of life (Bank *et al.*, 2023). The obtained data were tabulated, organized and described as percentage.

3 Results and Discussion

A total of 12,007 reptile specimens were sent to the CETAS of three municipalities in Bahia, divided into 3 orders (Testudines, Squamatas and Crocodylia), 20 families and 116 species, of which *Chelonoidis carbonarius* (red- footed tortoise, 55.03%), *Boa constrictor* (common boa, 13.13%), *Chelonoidis denticulatus* (yellow-footed tortoise, 6.47%) and *Iguana iguana* (green iguana, 5.72%)

were the most common native species (Table 1).

Table 1 - Absolute number of reptile specimens received in CETAS ofBahia, from 2009 to 2019

Order	Family	Species	Nº Specimens
Crocodylia	Alligatoridae	*Caiman latirostris*	60
		Paleosuchus palpebrosus	23
		Paleosuchus trigonatus	2
Squamata	Agamidae	*Pogona vitticeps*	1
	Amphisbaenidae	*Amphisbaena alba*	28
		Amphisbaena sp.	2
		Leposternon infraorbitale	1
		Leposternon octostegum	3
	Anguidae	*Ophiodes striatus*	1
	Boidae	*Boa constrictor*	1576
		Corallus caninus	3
		Corallus hortulanus	11
		Epicrates assisi	2
		Epicrates cenchria	48
		Eunectes murinus	287
	Colubridae	*Chironius bicarinatus*	4
		Chironius carinatus	7
		Chironius exoletus	4
		Chironius flavolineatus	12
		Chironius fuscus	1
		Chironius laevicollis	2
		Chironius multiventris	1
		Chironius sp	1
		Lampropeltis getulacalifforniae	7
		Leptophis ahaetulla sp	1
		Oxybelis aeneus	3
		Pantherophis guttatus	5
		Spilotes pullatus	18
		Spilotes s. sulphureus	1
	Dipsadidae	*Apostolepis cearensis*	2
		Atractus trihedrurus	119
		Boiruna sertaneja	1
		Clelia plumbea	4
		Coronel Aps lepidus	7
		Dipsas indica petersi	1
		Dipsas variegata	3
		Echinanthera melanostigma	2
		Elapomorphus quinquelineatus	38
		Elapomorphus wuchereri	2
		Gomesophis brasiliensis	12
		Helicops angulatus	3
		Helicops carinicaudus	5
		Helicops leopardinus	76
		Imantodes cenchoa	2
		Leptodeira annulata	4
		Oxyrhopus clathratus	2
		Oxyrhopus guibei	5
		Oxyrhopus petola	12
		Oxyrhopus sp.	6
		Oxyrhopus trigeminus	84
		Philodryas aestiva	19

Order	Family	Species	Nº Specimens
		Philodryas nattereri	1
		Philodryas olfersii	13
		Philodryas patagoniensis	12
		Philodryas viridissima	3
		Pseudoboa haasi	1
		Pseudoboa nigra	23
		Psomophis joberti	1
		Sibynomorphus mikanii	2
		Sibynomorphus neuwiedi	2
		Siphlophis compressus	1
		Taeniophallus occipitalis	1
		Thamnodynastes hypoconia	2
		Thamnodynastes sp.	2
		Tropidodryas serra	10
		Tropidodryas striaticeps	1
		Xenodon merremii	19
		Xenodon neuwiedii	5
	Elapidae	*Micrurus corallinus*	6
		Micrurus decoratus	16
		Micrurus sp.	6
		Micrurus ibiboboca	92
		Micrurus lemniscatus	3
	Eublepharis	*Eublepharis macularius*	3
	Iguanidae	*Iguana iguana*	687
	Polychrotidae	*Malayopython reticulatus*	6
		Polychrus marmoratus	2
		Python molurus	6
		Python bivittatus	8
		Python regius	3
		Polychrus acutirostris	1
		Python moluru	10
	Teiidae	*Ameiva ameiva*	3
		Salvator merianae	52
		Teius oculatus	5
		Tupinambis teguixin	4
	Tropidophiidae	*Tropidophis paucisquamis*	2
	Viperidae	*Bothrops erythromelas*	1
		Bothrops fonsecai	8
		Bothrops itapetiningae	27
		Bothrops jararaca	192
		Bothrops jararacussu	111
		Bothrops leucurus	58
		Bothrops moojeni	1
		Bothrops neuwiedi	15
		Bothrops pirajai	3
		Crotalus durissus	3
		Crotalus durissus cascavella	57
		Erythrolamprus m. miliaris	32
		Erythrolamprus p. poecilogyrus	8
		Erythrolamprus v. viridis	1
Testudines	Chelidae	*Acanthochelys radiolata*	29
	Hydromedusinae	*Hydromedusa maximiliani*	3
		Ranacephala hogei	2
		Mesoclemmys tuberculata	213
		Phrynops geoffroanus	164
	Cheloniidae	*Chelonia mydas*	8
		Eretmochelys imbricata	8
		Mesoclemmys tuberculata	37

Order	Family	Species	Nº Specimens
	Emydidae	*Caretta caretta*	3
		Trachemys dorbigni	33
		Trachemys scripta elegans	14
	Geoemydidae	*Rhinoclemmys p. punctularia*	52
	Prodocnemididae	*Podocnemis unifilis*	2
	Testudinidae	*Chelonoidis carbonarius*	6607
		Chelonoidis denticulatus	777
		Total	**12007**

Source: reserach data.

A total of 19 reptile specimens of endangered native species entered the CETAS of Bahia between 2009 and 2019, comprising 2 orders, 3 families and 5 species. They were classified as endangered (En) or vulnerable (Vu), according to Art. 1 and 2 of the Ordinance 444/2014 from the Brazilian Ministry of Environment (MMA) (Brazil, 2014) as shown in Table 2.

Table 2 - Entries of native reptile species to CETAS of Bahia, classified by their risk of extinction according to Brazilian Ministry of Environment Ordinance Nº 444/2014

Order	Family	Species	Nº Specimens	En/Vu
Squamata	Amphisbaenidae	*Leposternon octostegum*	3	En
		Bothrops pirajai	3	En
Testudines	Chelidae	*Ranacephala hogei*	2	Vu
	Cheloniidae	*Caretta caretta*	3	Vu
		Eretmochelys imbricata	8	En
		Total	19	

En: Endangered; Vu: Vulnerable
Source: research data.

A total of 63 non-native reptile specimens entered the CETAS of Bahia between 2009 and 2019, comprising 2 orders, 5 families and 9 species. Among them, Python molurus and Trachemys scripta elegans were the most frequent (Table 3).

Table 3 - Entries of non-native reptile species to CETAS of Bahia, from 2009 to 2019

Order	Family	Species	Nº Specimens
Squamata	Agamidae	*Pogona vitticeps*	1
	Colubridae	*Lampropeltis getula californiae*	7
		Pantherophis guttatus	5
	Eublepharidae	*Eublepharis macularius*	3
	Pythonidae	*Python bivittatus*	8
		Python molurus	16
		Python regius	3
		Malayopython reticulatus	6
Testudines	Emydidae	*Trachemys scripta elegans*	14
		Total	**63**

Source: research data.

Rescues accounted for 6,405 (53.34%) of all animals received; voluntary deliveries: 2,387 (19.88%); seizures 1,141 (9.50%), and transfers between units accounted for 1,988 (16.56%). In the records, it was not possible to determine the modality of reception for 86 (0.72%) specimens.

Table 4 - Absolute frequency of the ten reptile species that had the highest number of rescues in CETAS-Bahia units from 2009 to 2019

Species	Nº Specimens
Chelonoidis carbonarius	2397
Boa constrictor	1461
Others	834
Iguana iguana	593
Chelonoidis denticulatus	407
Eunectes murinus	250
Mesoclemmys tuberculata	124
Bothrops jararaca	94
Phrynops geoffroanus	87
Micrurus ibiboboca	82
Oxyrhopus trigeminus	76
Total	**6405**

Source: research data.

Literature shows that the Reptilia Class represents the second largest group of animals entering Brazil's CETAS (Destro *et al.*, 2012; Moura *et al.*, 2012; Nascimento *et al.*, 2016). Despite many legal restrictions, a considerable expansion of illegal keeping and commerce of reptiles has been registered in Brazil (Alves *et al.*, 2019). This is reflected in the large number of animals (12,005 reptiles) that entered CETAS of Bahia between 2009 and 2019.

When analyzing the modalities of animals' entry into CETAS, it was observed that rescue (53.34%) was responsible for the largest number, outnumbering voluntary surrender (19.88%) and seizure 1,141 (9.50%), in line with findings by Borges *et al.* (2006) and Oliveira, Torres and Alves (2020).

The significant number of rescues and voluntary deliveries may be related to loss of interest from the guardian, considering the risk of legal punishment as a result of possessing an illegally obtained specimen. This can result in animal abandonment (with subsequent rescue by public authorities) or spontaneous delivery to CETAS (Melo *et al.*, 2020; Oliveira; Torres; Alves, 2020; Souza *et al.*, 2007).

According to Mayer, Bays and Lightfoot (2006), reptiles may not be good pets for domestic environments due to their lack of interactivity, which for Vilela (2012) can lead to people losing interest in animals over time, a fact that can further contribute to animal abandonment.

The fear of punishment is warranted, as the Environmental Crimes Act No. 9.605/1998 (Brasil, 1998) provides for penalties for those who illegally keep wild animals in captivity, including fines and even imprisonment. Considering rescue as an entry modality resulted from giving up possession of the animal, it could be inferred that abandonment is the main modus operandi used by those seeking exemption from legal penalties.

Another important aspect is the use of campaigns to encourage voluntary deliveries, organized by the Integrated Preventive Inspection (FPI), an initiative of various government agencies and coordinated by Bahia State's Public Prosecutor's Office (Franco; Torezani; Pigozzo, 2016). Individuals are encouraged to hand over the animal they have in their possession, usually by saying that it "appeared" or "was found" near their home. However, it is observed that many of these animals present a gentle and calm behavior towards humans, suggesting that they are used to such coexistence (Pereira; Dalla Nora, 2021).

Although the law penalizes those who acquire and keep animals irregularly in their possession, there is no administrative sanction for people who spontaneously hand over animals to environmental agencies that are part of the National Environment System (SISNAMA), under CONAMA Resolution 457 of June 25th, 2013 (Brazil, 2013). However, this lack of liability may favor illegal activities with wild animals, as there is no investigation regarding the origin of the delivered animal, setting a precedent for the occurrence and recurrence of illegal acquisitions as a result of the sense of impunity.

The least frequent entry modality was represented by seizures, which are the result of inspections and issue of Notice of Infraction or Term of Seizure and Deposit, generating warnings and fines (Borges, 2006; Dias; Cunha; Dias, 2014). Seizures usually occur as a result of complaints, highway police operations or inspections at post offices, ports and airports. In such situations, the animals are also sent to CETAS.

The present study found that in the time period analyzed, 99.48% of the reptiles sent to CETAS were native. Furthermore, the most referred species were *Chelonoidis carbonarius* (55.03%), *Boa constrictor* (13.13%), *Chelonoidis denticulatus* (6.47%) and *Iguana iguana* (5.72%), corroborating findings of Destro (2018), Melo *et al.* (2020), and Santos *et al.* (2021).

In Brazil, the use of chelonians has already been reported for food, medicinal, religious and pet purposes. Aspects such as the need for little food, easy handling, beauty, gentleness and adaptation to captivity are decisive to these reptiles being preferred as pets or mascots (Alves *et al.*, 2009a, 2009b; Alves; Rocha, 2018).

The keeping of snakes as pets has become popular worldwide, and in Brazil, according to Alves *et al.* (2019), it is the group with the largest number of species used as non-conventional pets. For Lima *et al.* (2019), the preference for Boa constrictor may be associated with the fact that this species is robust, docile, with a diverse color pattern and a varied diet, including birds, lizards and small

mammals. Given that they are seen as animals that require little care, most of them are severely neglected and abandoned, something that can be observed in the large number of entries from this species in the CETAS of Bahia.

In this study, five species were found to be at some degree of risk of extinction, as shown in Table 2. In particular, Eretmochelys imbricata has a worldwide distribution and is popularly known as the hawksbill sea turtle. Threatened to become extinct due to fishing practices around the world, in 2014 the International Union for Conservation of Nature (IUCN) classified the species as critically endangered. The Ministry of Environment of Brazil, in the Ordinance No. 148, of June 7th, 2022 (Brazil, 2022) classified this species as in danger. Countries such as China and Japan use the meat of these animals for food and their hooves for decorative purposes.

The Ranacephala hogei species, popularly known as the Hoge's side- necked turtle, is an endangered freshwater turtle with a restricted geographical distribution in the Atlantic Forest of southeastern Brazil. The main threats to its survival are habitat degradation - as a result of deforestation, discharge of urban and industrial sewage, pollution related to agriculture and construction of dams - and direct mortality caused by sport fishing (Boeloni, 2014 ; Moreira *et al.*, 1995). In 2016 it was included on the IUCN list as one of the 25 most endangered chelonian species in the world, and is currently listed as critically endangered. In Brazil, according to Ordinance No. 148, of June 7th, 2022 (Brasil, 2022), from the Ministry of Environment, this species is classified as vulnerable.

Among the nine non-native species registered, 33 specimens were from the Pythonidae family, a group of non-venomous snakes found in South Africa, Southeast Asia, Malaysia, New Guinea and Australia. In Brazil, the breeding of snakes in captivity has been developing, but it cannot be concluded that all animals included in this study came from authorized breeders. Studies show that they are heavily trafficked, without any sanitary standards (Marques *et al.*, 2020; Vilela, 2012; Okulewicz; Kaźmiercza; Zdrzalik, 2014).

It is important to note that the introduction of non-native species without due observance has a potential impact on native species populations, contributing to the spread of infectious diseases and being considered the second main direct cause of diversity loss, potentially leading to extinction or hybridization (Herrel; Van Der Meijden, 2014; Beninde *et al.*, 2015; Fonseca *et al.*, 2021; Souza *et al.* 2007).

4 Conclusion

This research emphasized the considerable quantity of indigenous, non-native, and threatened reptiles delivered to the Bahia State Conservation Agency (CETAS) from 2009 to 2019. This issue is closely linked to the abandonment and surrender of these creatures on public streets. Therefore, it is

crucial to take measures to prevent the extraction of these animals from their natural environments, as well as their abandonment. There is a need to enhance surveillance and bolster efforts against the illegal wildlife trade.

Although the significant findings were achieved, certain limitations must be acknowledged. The absence of published standardized and cohesive data concerning Bahia whales hindered the ability to perform comparative analyses throughout the studied timeframe, particularly due to the lack of updated records from some units post-2016. Additionally, the existing data did not provide details on the ultimate animals' fate, which obstructs the evaluation of the success of their rehabilitation and reintegration into the wild.

Consequently, it is advisable to consolidate data from various organizations and environmental agencies to create a cohesive system of georeferenced information regarding reptile trafficking and rescue. Research into public attitudes towards illegal reptile ownership and the socioeconomic backgrounds of volunteer reptile rescuers is also recommended. The findings from this study are crucial for bolstering educational efforts that promote awareness about the significance of conserving local wildlife and ensuring that animals stay in their natural environments.

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