



**INSTITUTO LATINO-AMERICANO DE
CIÊNCIAS DA VIDA E DA NATUREZA**

**PROGRAMA DE PÓS-GRADUAÇÃO
EM BIODIVERSIDADE NEOTROPICAL**

DIMENSÕES HUMANAS DA CONSERVAÇÃO DE PSITACÍDEOS NO BRASIL

KATLIN CAMILA FERNANDES

Foz do Iguaçu
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Dissertação de mestrado apresentada ao Programa de Pós-Graduação Biodiversidade Neotropical, do Instituto Latino-Americano de Ciências da Vida e da Natureza, da Universidade Federal da Integração Latino-Americana, como requisito parcial à obtenção do título de Mestre em Ciências Biológicas.

Orientadora: Prof. Dra. Ana Alice Aguiar Eleutério

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Foz do Iguaçu, _____ de _____ de _____.

Catálogo elaborado pelo Setor de Tratamento da Informação
Catálogo de Publicação na Fonte. UNILA - BIBLIOTECA LATINO-AMERICANA - CENTRAL

F363

Fernandes, Katlin Camila.

Dimensões Humanas da Conservação de Psitacídeos no Brasil / Katlin Camila Fernandes. - Foz do Iguaçu, 2024.

30 f.

Dissertação (Mestrado) - Universidade Federal da Integração Latino-Americana, Instituto Latino-Americano de Ciências da Vida e da Natureza, Programa de Pós-Graduação em Biodiversidade Neotropical. Foz do Iguaçu - PR, 2024.

Orientadora: Ana Alice Aguiar Eleutério.

1. Pessoas e papagaios (Ave). 2. Papagaios (Ave). 3. Educação para a conservação de Psitacídeos. I. Eleutério, Ana Alice Aguiar. II. Título.

CDU 502.211:598.271.8

Dedico este trabalho ao meu filho
Eduardo Fernandes, à comunidade de
Águas Formosas/MG, em especial aos
Guardiões do Chauá.

AGRADECIMENTOS

Agradeço à minha orientadora Professora Doutora Ana Alice Aguiar Eleutério, por toda a atenção, paciência e dedicação ao me orientar neste trabalho. Muito obrigada pelas correções e sugestões quando necessário, sem nunca me desmotivar.

Agradeço também às minhas colegas de turma, Maria Carolina Boiarski, Marina Auricchio e Marina de La Barrera Cardozo, pelo acolhimento e apoio, ainda que à distância, diante do cenário de pandemia pelo qual todos passamos desde o início das aulas. Esse apoio foi fundamental para persistir, obrigada!

Agradeço a todos os pesquisadores que atuam ou já atuaram na conservação de psitacídeos no Brasil, que desde a concepção da ideia deste trabalho foram inspiração e me encorajaram a desenvolvê-lo. Muito obrigada especialmente a todos que disponibilizaram seu tempo, atenção e carinho para me conceder as entrevistas, essenciais para a realização deste estudo.

Agradeço especialmente à Bióloga Mestre Marina Somenzari pela ajuda com a elaboração do roteiro para as entrevistas e pela leitura e sugestões para o projeto. Muito obrigada por todo o apoio sempre, acolhimento, encorajamento e puxões de orelha quando necessário, você é essencial!

Agradeço também ao Professor Doutor Luiz Gustavo Eckhardt Valle que pacientemente contribuiu para a evolução deste estudo com suas sugestões, recomendações e, por vezes, alguns puxões de orelha. Muito obrigada!

Agradeço à minha família e amigos pelo suporte e incentivo.

*FERNANDES, Katlin Camila. **Human dimensions of parrot conservation in Brazil.** 2024. 30 p. Master's thesis of the Graduate Program in Neotropical Biodiversity - Federal University of Latin American Integration, Foz do Iguaçu, 2024.*

ABSTRACT

Illegal trade and habitat loss represent major threats to the conservation of parrot species. However, few studies directly explore how human dimensions (HD) affect parrot conservation. We used a literature review and interviews with researchers to investigate how parrot conservation research in Brazil incorporates HD. The results showed that HD are not fully incorporated into research and conservation projects. Of the 118 articles evaluated between 1997-2022, only four (3%) addressed the interaction between people and parrots as a primary objective. The interviews also indicated that researchers had difficulty in implementing and evaluating strategies aimed at people, mainly due to insufficient human and financial resources. Therefore, there is often little understanding of the effectiveness of such strategies for the conservation of parrot species. Financial support to conservation projects should allow for the hiring of specialized professionals, training, and the establishment of long-term actions to understand and increase people's engagement in parrot conservation.

Keywords: Birds. Conservation education. People and parrots. Psittaciformes. Human-nature interaction.

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1. INTRODUCTION

Illegal trade and habitat loss are major drivers of the decline of Psittacidae populations (macaws, parakeets and parrots) in the Neotropical region (Wright *et al.*, 2001). Of the 88 registered species in Brazil, 18 (20%) are globally threatened (Birdlife, 2024) and 30 (34%) are on the National List of Endangered Species (Brazil, 2022). Illegal trade is associated with cultural and social issues. Psittacidae are commonly acquired as pets because they are considered attractive, and some species can imitate the human voice (Tella; Hiraldo, 2014). Other reasons, such as affective memory and positive experience from having owned birds as childhood pets, may influence the acquisition of parrots (Anderson, 2014).

Although human activities are among the main threats to the conservation of several species, research in the area focuses on ecological aspects, such as reproductive biology, diet and habitat use (Berkunsky *et al.*, 2017). In Brazil, studies seek to understand the reproductive, behavioral, dietary biology and genetic aspects of species (Caparroz *et al.*, 2006; Prestes *et al.*, 1997; Scherer-Neto; Toledo, 2007; Seixas; Mourão, 2018). In addition to providing information on the distribution and dynamics of natural populations, these studies also support conservation strategies such as species reintroduction and/or release (Klemann Júnior *et al.*, 2008).

On the other hand, a study conducted in the Brazilian Caatinga with local residents to assess the reasons why birds were commonly kept as pets showed that the practice was independent of socioeconomic aspects, being strongly related to local culture (Alves *et al.*, 2010). This example shows that understanding the social, economic, and cultural aspects of the human-fauna interactions is essential to build more effective conservation strategies, since conflicts and, therefore, conflict resolution, are determined by human conceptions and actions (Manfredo; Dayer, 2004).

In this sense, the Human Dimensions (HD) approach to environmental issues can be understood as a field of applied and multidisciplinary research, which aim at understanding people's conception and attitudes towards nature through social science methods (Manfredo *et al.*, 1995). In the field of wildlife conservation, management strategies should consider the different social, economic and cultural contexts associated with species conservation (Bennett *et al.*, 2017). In this study, we understand HD of parrot conservation as all strategies that address aspects not directly

related to the ecology of birds and their habitats, that consider the social, political, economic, cultural, ethical and historical aspects of the interactions between people and these birds (Dayer *et al.*, 2020).

Parrot conservation programs that address aspects of HD, such as the engagement of local communities, the promotion of knowledge about local biodiversity and educational campaigns have led to improvements in the conservation status of target species, resulting in the increase of their populations and lower rates of bird capture (Christian *et al.*, 1994; Briceño-Linares *et al.*, 2011). The combination of flexible strategies has been proven efficient to adapt to changing circumstances, and provide faster responses to threats, such as educational campaigns that involve local communities in protecting nests (Briceño-Linares *et al.*, 2011).

The National Action Plans for the Conservation (PAN) of threatened species constitute an important public policy tool for the biodiversity conservation in Brazil. These documents, prepared in collaboration with multiple actors, establish priorities and organize actions for the conservation of endangered species (ICMBio 2018). The PAN for Parrots' Conservation included, among its objectives, a specific action aimed at implementing a permanent awareness campaign about the species covered in the plan (Schunck *et al.*, 2011). After an assessment of the progress of the actions, it became clear that the methodologies used for planning and developing and, consequently, evaluating the results of the awareness campaigns were not uniform or capable of offering clear results on these actions (Fernandes *et al.*, 2019). More attention needs to be given to the social, cultural, and historical issues surrounding the conservation of those species, especially the endangered ones. This study seeks to contribute for the understanding of these gaps by evaluating how parrot conservation research in Brazil addresses HD in species protection strategies.

In this study, we analyzed how parrot conservation research in Brazil incorporate HD, through literature review and interviews with researchers who work or have worked on research in the field in the country. These methods were combined and used in a complementary way, contributing to a better analysis of the topic.

2. MATERIALS AND METHODS

2.1. Literature review

To understand how published studies on parrot conservation in Brazil incorporate HD, we conducted a literature review using the Web of Science (WoS), Scielo and Google Scholar platforms. Only studies conducted entirely or partially in Brazil were included in the search. The time limit applied was between 1997 and 2022, to allow capturing results of important parrot conservation projects, such as the Hyacinth macaw Project, which started in 1990.

The keywords selected covered three themes: i) Psittacidae, ii) conservation, and iii) human dimensions. We searched for the following terms iteratively, that is, they were combined in different ways in Portuguese and English: i) Psittacidae, Psittaciformes, parrots; ii) conservation, biology, ecology, reintroduction, translocation, release; iii) people, local, social community, environmental education, conservation education, human dimensions, coexistence, conflict and interaction between people and parrots.

Opinion, conference or duplicate articles, book chapters, and studies that were not specific about parrots (such as avifauna inventories) or had not been conducted in Brazil were excluded. The combination of searches (WoS = 190; Scielo = 32; Google Scholar = 79) resulted in 301 articles, with 118 articles selected after screening. The objective of this review was not to produce an in-depth assessment of the parrot conservation scenario in Brazil, but rather to understand how research addresses HD in its conservation strategies.

We analyzed the results from the literature review using the Content Analysis method (Bardin, 1995), which involves preparation for data collection, categorization of content based on analysis and grouping of responses by themes and organization of categories for analysis, interpretation of results and making inferences. The selected studies were organized into a matrix and characterized based on the presence of aspects of the relationship between people and Psittacidae. The context in which these aspects were portrayed was evaluated, determining whether they were merely mentioned, were part of the study's objectives, or if recommendations or results associated with these aspects were presented. To better systematize the results, the aspects present in each study were grouped by three themes: anthropogenic threats (hunting, capture and trafficking), *ex situ* components (strategies involving

reintroduction, rehabilitation, and release of individuals, as well as health and behavioral aspects of the birds), and the contributions or engagement of people (educational actions, citizen science, among others).

2.2. Interviews

In addition to the literature review, we conducted interviews with professionals who work or have worked on parrot conservation research in Brazil. We selected participants based on a combination of selected sampling and reference network methods (Newing, 2011) with the “Snowball” method (Handcock; Gile, 2011). An initial list of researchers was obtained from the reference network, and they were asked to recommend other professionals who met the selection criteria. New names were inserted, until no new indications emerged, thus covering the potential universe to be sampled.

We conducted interviews using a questionnaire divided into specific topics (Newing, 2011) to identify how HD are incorporated into the research and projects led by the participants. We invited the researchers to participate in the interview by email, containing the Free and Informed Consent Form. Authorization for research with human beings, in accordance with Brazilian legislation, was obtained under no. 5.149.733. The interviews were carried out on an online platform between February and July 2022, and were recorded with consent of the participants, resulting on a total of ten hours and ten minutes of video transcriptions.

Similarly to the literature review, the Content Analysis method (Bardin, 1995) was used to conduct the analysis of the transcripts. The collected material was organized into a matrix and grouped by themes according to the sections proposed in the questionnaire. We aimed to evaluate how the research incorporates strategies focused on human dimensions, the audiences to which the actions were directed, how and if they were part of the study objectives, what data were collected, and how the actions were implemented and evaluated. Additionally, the profiles of the research teams were characterized, and potential challenges and opportunities related to the topic were identified based on the interviewees' perceptions.

The participant recruitment process yielded 52 specialists, of whom 11 agreed to participate and were interviewed. Eight of the interviewees are currently involved or have been involved in long-term psittacine conservation projects, with research

experience ranging from 11 to 40 years, primarily affiliated with universities and NGOs. The research is funded by national and international funding institutions, private companies, universities, and NGOs. In some cases, the researchers used their own resources to supplement and support the studies.

Most of the interviewees have backgrounds in natural sciences (n=10), with some holding additional qualifications in administration (1) and psychology (1), while one has a background in social sciences. Among the other research team members, the majority have degrees in biological sciences (28%) and veterinary medicine (18%), with undergraduate students, mentees, and/or interns (23%) also part of these teams. The researchers operate in states across the Atlantic Forest, Cerrado, Pantanal, and Caatinga biomes.

3. RESULTS

3.1. Literature review

We reviewed a total of 118 articles related to parrot conservation in Brazil, published between 1997 and 2022. Studies covered 31 species; of these, the most present in publications were *Amazona aestiva* (17), *Amazona brasiliensis* (12), *Amazona vinacea* (10), *Anodorhynchus hyacinthinus* (13) and *Ara ararauna* (12).

Aspects of HD were cited 264 times in the 118 articles analyzed. The *a posteriori* organization of these aspects resulted in three categories: a) anthropogenic threats: hunting, illegal trade and habitat loss; b) *ex situ* components: species reintroduction, rehabilitation or release strategies, in addition to the work of CETAS, zoos and commercial breeding facilities, and c) contribution and involvement of people: educational actions, engagement and contribution of local communities. Table 1 presents the main recommendations and/or results found in the studies.

Only four (3%) of the revised studies addressed HD as a primary objective of the research (Table 1). These studies aimed at evaluating the effectiveness of educational actions, investigating the local knowledge about species, understanding farmers' perceptions of conflicts associated with predation, and evaluating the effectiveness of citizen science platforms in contributing to data collection. The methods used were interviews, use of audiovisual presentations, plays, workshops and field activities. The evaluation of the results of these actions showed an increase in knowledge about the species after the interventions. Furthermore, the actions

highlighted the importance of valuing popular knowledge about the species investigated, as the evaluations showed that, in several instances, it was similar to the knowledge available in the literature. In general, the studies recommended continuing the proposed actions, involving communities in research, and considering the knowledge of local residents to resolve conflict situations with parrots.

Table 1 – Characterization of human dimensions (HD) in studies on parrot conservation, published between 1997 and 2022, in Brazil (N=118).
* Recommendations or results presented by studies that focused on aspects of HD.

| Category | Aspects | Recommendations (Rec) and/or Results (Res) related to human dimensions |
|------------------------------|---|---|
| Anthropogenic threats | Hunting, poaching, illegal trade, pet trade, illegal pet trade, human interest in parrot species, introduction of species | (Rec) Implement improvements to control and monitor the trade in wild birds and parrot illegal trade (Berkunsky <i>et al.</i> , 2017; Fernandes <i>et al.</i> , 2019; Lima-Rezende <i>et al.</i> , 2019; Gomides <i>et al.</i> , 2021). (Rec) Use molecular techniques to identify species when seizing eggs or when morphological identification is not possible (Formentão <i>et al.</i> , 2021; Gonçalves, 2015). (Rec) Understand the problems associated with wildlife trafficking to mitigate its negative effects (Martins <i>et al.</i> , 2018). (Res) Nestling capture rates are related to profits made from the illegal trade of the species and to poverty in many rural communities where the species occurs (Wright <i>et al.</i> , 2001). |
| | Loss, alteration, destruction and fragmentation of habitat, deforestation, biodiversity loss, fires, human invasions, agricultural expansion, logging | (Rec) Establish the protection of areas of interest to species, both in forested areas and in open areas such as the Cerrado and in urban fragments (Marsden <i>et al.</i> , 2000; Bianchi, 2009; Pichorim <i>et al.</i> , 2014; Santos ; Ragusa-Netto, 2014; Seixas; Mourão, 2018; Tinoco <i>et al.</i> , 2022). |
| | Human-wildlife conflicts (persecution due to predation on agricultural crops, damage caused by parrots in electrical wiring, poisoning by pesticides) | (Res) The knowledge and perception of local farmers are significant for building a solution to the conflict. (Saiki; Estevinho, 2009). * (Res) Environmental, sociocultural and economic aspects must be considered for effective management of human-wildlife conflict (Carvalho <i>et al.</i> , 2019). * |
| | Urbanization and infrastructure (road projects, roadkill, installation of a wind farm) | (Rec) Propose mitigating measures to prevent birds from colliding with wind farm turbines and power transmission lines (Gomides <i>et al.</i> , 2021; Biasotto <i>et al.</i> , 2022). |
| | Ex situ components | <i>Ex situ</i> management (CETAS, zoos, commercial breeders), strategies for reintroduction and |

| | | |
|--|--|---|
| | release (animal behavior in the presence of humans), health protocols (clinical and health aspects of birds, transmission of diseases with zoonotic potential) | <p>(Rec) Establish partnerships between research and zoos, given the potential for disseminating information from these institutions, as well as the available structure (Bianchi, 2009; Vanstreels <i>et al.</i>, 2010).</p> <p>(Rec) Establishing adequate health protocols, ensuring that threats that led to local extinctions have been eliminated, carrying out anti-predation training, including against humans, and considering the birds' previous history, length of captivity and relationship with humans should be issues observed by programs that involve the release of parrots (Saidenberg <i>et al.</i>, 2015; Lopes <i>et al.</i>, 2018; Gomides <i>et al.</i>, 2021).</p> <p>(Rec) Conduct studies to monitor the health of captive birds to assess the effects of human-bird interactions (Saidenberg <i>et al.</i>, 2012; Simi <i>et al.</i>, 2019).</p> |
| Contribution/engagement of people | Environmental education, conservation education, environmental awareness, integrated conservation | <p>(Rec) Establish educational campaigns that take into account available literature to promote knowledge and change people's behavior in relation to species (Pichorim <i>et al.</i>, 2014; Carvalho-Roel; Marçal Júnior, 2021).</p> <p>(Rec) Involve the participation of birds originating from trafficking in educational campaigns in institutions such as zoos, to raise public awareness (Vanstreels <i>et al.</i>, 2010).</p> <p>(Rec) Promote integrated conservation strategies, associating the ecological aspects of species with the social contexts of the communities in which they occur (Berkunsky <i>et al.</i>, 2017; Pacifico <i>et al.</i>, 2020).</p> <p>(Rec) Equip teachers to address biodiversity conservation (Carrillo; Batista, 2007). *</p> <p>(Res) Educational strategies, applied in a school context, resulted in an increase in popular knowledge about the species (Carrillo; Batista, 2007). *</p> <p>(Res) The engagement of a local community resulted in an improvement in the conservation status of the species (Guedes, 2004).</p> |
| | Contribution from local residents, informal interviews, information gathering, support from farmers and landowners, ethnecology, man's relationship | <p>(Rec) Promote the engagement of local communities through approach such as ecotourism and artisanal manufacturing to create economic benefits with the aim of promoting pride and a sense of belonging, which contributes to the conservation of local biodiversity (Guedes, 2004; Carvalho-Roel; Marçal Júnior, 2021).</p> |

| | |
|---|---|
| with nature, citizen science and birdwatching, alternative revenue generation | (Rec) Promoting studies on the interrelationship between people and parrots can contribute to putting conservation strategies into practice (Saiki; Estevinho, 2009). |
| | (Rec) Involving people in ethnobiological research favors the practice of conservation actions and promotes the cultural recovery of knowledge (Saiki; Estevinho, 2009). |
| | (Rec) Stimulate cooperation with landowners, given that populations are found in particular fragments (Scherer-Neto <i>et al.</i> , 2019). |
| | (Res) Partnerships between conservation research and private companies are important for successful biodiversity management (Tinoco <i>et al.</i> , 2022). |
| | (Res) Popular knowledge about species associated with the use of online citizen science platforms contributes to the development of research (Klemann Júnior <i>et al.</i> , 2008; Saiki; Estevinho, 2009; Pichorim <i>et al.</i> , 2014; Zulian <i>et al.</i> , 2021). * |
| Public policies | (Rec) Establish international alliances to control parrot trafficking (Carvalho-Roel; Marçal Júnior, 2021). |
| | (Rec) Incorporate the protection of non-threatened species, which are also targets of traffickers, into conservation strategies (Formentão <i>et al.</i> , 2021). |
| | (Rec) Incorporate the use of molecular techniques to identify seized specimens into conservation plans (Gonçalves <i>et al.</i> , 2015). |
| | (Rec) Develop public policies aimed at local communities, to protect biodiversity in highly sensitive habitats (Pacífico <i>et al.</i> , 2020). |

Of the 118 articles evaluated, 92 (78%) presented aspects of HD and 47 (39%) presented recommendations or results (Figure 1) while only four (3%) addressed the relationship between people and psittacines as an objective (Table 1). Anthropogenic threats represented the category most cited by the studies, where 74 (62%) mentioned hunting and illegal trade, 39 (33%) habitat loss, five (4%) human-wildlife conflicts and six (5%) urbanization and infrastructure. Of these, 17 (14%) studies presented recommendations or results associated with hunting and illegal trade, eight (6%) with habitat loss and one study (0.8%) with human-wildlife conflict and urbanization and infrastructure each. The aspects included in *ex situ* components were cited by 26 studies (22%), of which 17 included recommendations and/or associated results. Contribution and engagement of people were cited in 13 studies (11%) as environmental education, 16 studies (13%) as engagement and contribution of local residents, and four studies (3%) cited public policies. Of these, eight (6%) presented recommendations and/or results associated with environmental education, 12 (10%) with people's participation and engagement, and four (3%) with public policies (Figure 1).

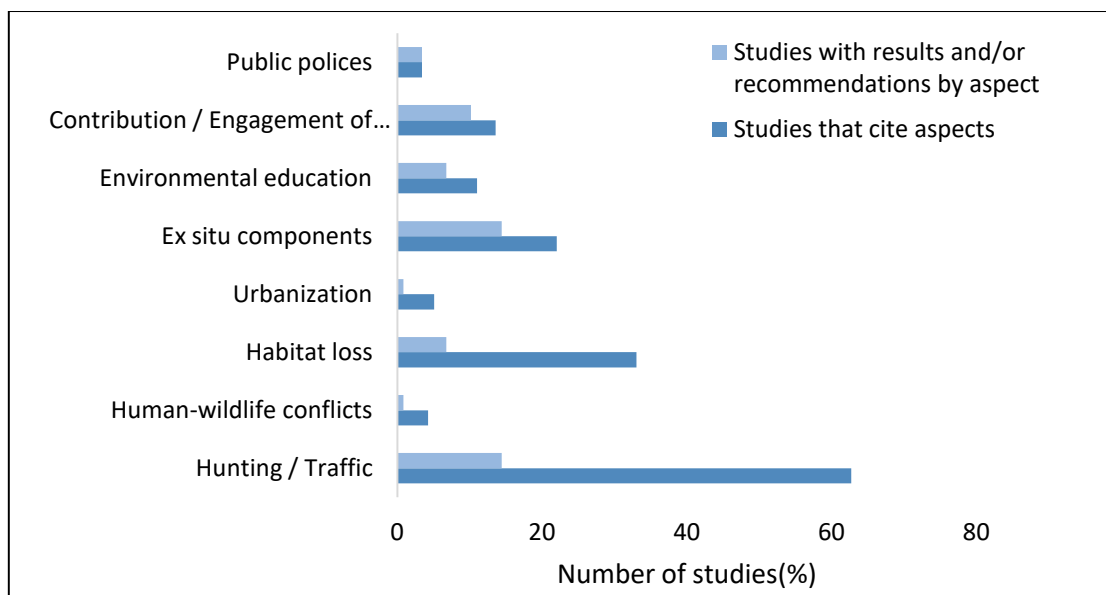


Figure 1 – Frequency of studies containing the different aspects of Human Dimensions (HD) in the total number of studies analyzed on parrot conservation in Brazil, between the years 1997 and 2022 (N=118).

3.2. Interviews

Resources for research development

Financial resources come from NGOs (N=8), universities (N=6), international institutions (N=4), national private companies (N=3), and research and biodiversity conservation funding institutions (N=4). Some research projects seek to raise funds through donations from individuals (N=2), but the results of these initiatives have not yet been satisfactory. Two researchers reported using their own resources to ensure the continuity of actions and cover personal expenses. Resources are primarily allocated to the core activities of the research (N=5), logistics and transportation (N=2), and equipment (N=2).

If additional financial resources were available, they would be invested in hiring permanent professionals (N=7) for both field research and strategies that address human rights issues. According to the interviewees, the research lacks professionals "with a more social perspective, focused on communities (1)," such as environmental educators and communicators, as well as resource mobilizers. One researcher noted, "In our training as biologists, we are not accustomed to working with communities, especially traditional communities that rely on (natural) resources for survival, and at the same time, we go there and tell them not to take parrots to survive (2)".

Additionally, actions for allocating extra resources mentioned include alternative income generation (N=2), acquisition of equipment (N=1), improvement in ecological data collection (N=1), and purchasing priority areas for conservation (N=1).

Relationship between people and parrot species

According to the interviewees (N=8), the most striking relationship between people and parrots was the practice of capturing birds in the wild, motivated by factors such as having had a specimen as a childhood pet, or by the identification and charisma that people have with these species. This practice favors illegal trade at local, national, and international scales. Conflicts initiated by the damage that some parrots species cause to agricultural crops have also been reported (N=2): "often there were small plantations that were completely devastated by the birds, so they were partially exterminated (4)". As a result, "for

some people, illegal trade is a positive thing (5)", since capturing birds for illegal trade would partially eliminate the predation problem. The relationship described as "memory of the parrots," which refers to older members of a community recalling sightings of psittacine populations that no longer occur in those regions, was also reported by researchers (N=4).

Strategies aimed at human dimensions

The majority of researchers (N=10) reported that their studies included activities aimed at people. These activities, however, were not among the main objectives of the research and, in general, were incorporated into the fieldwork routine to optimize the use of time and resources.

Strategies that involved HD consist of actions regarding: i) environmental awareness and/or education; ii) scientific dissemination and communication and iii) articulation between research, environmental agencies, and other institutions. The target audience comprised communities adjacent to the areas where research is conducted, residents, school and academic communities, farmers, and landowners. Coordinated actions with nonacademic institutions, such as state environmental agencies, other researchers, and organized groups, such as birdwatchers, were also mentioned. These usually took place as informal conversations, lectures, workshops, plays, training and field practice activities. The dissemination of information about species and research results involved visits, delivery of technical reports, publication of studies and, in some cases, publication in digital and social media and radio channels.

Assessment of the results of actions aimed at human dimensions

Actions aimed at people were rarely evaluated formally, partly because they were occasional and because of the lack of technical criteria for analyzing the results: "some researchers did not understand and did not value the potential that these conversations had. As we did not do it in a structured way, nor is it our background base, this activity was often neglected (1)". A researcher reported having administered a questionnaire to assess the community's perception of a certain species before an intervention, with the intention of repeating it after, to assess possible changes.

Quantitative assessments referring, for example, to the number of people who participated in the promoted activities, were carried out as a way of highlighting the scope of the actions in technical reports. Despite this, researchers highlighted having observed changes in behavior and engagement in the communities and attributed this to the success of the actions proposed. In those, communities, they mentioned, there were reports of an increase in the number of trafficking reports, a decrease in species seizure records and the establishment of a species as a symbol bird of a municipality. The contribution of residents in obtaining and validating data on the occurrence and distribution of species is also an indicator of the success of the actions, according to the researcher's perception.

Challenges and opportunities to work with human dimensions

The limitation of financial resources (N=5) and the lack of a permanent team (N=5) were identified as major barriers to effectively incorporating human rights into the research. As noted, "there were always more tasks to be completed than available resources (1)," leading to the marginalization of issues not directly aligned with the primary objectives of the studies. The challenges include planning and integrating actions into the scope of the projects, the implementation itself, and evaluation methods. The geographical range of certain species also posed some difficulties for data collection. This was considered a relevant obstacle when the research was conducted in areas that were not private nor protected by law. In such instances, interventions aimed at mitigating the removal of psittacines from the wild (N=4) could represent threats to the safety of the research team, due to the strong presence of wildlife trafficking, reported by the interviewees.

The continuity and duration of initiatives involving HD represented a challenge for researchers. "We need to be more careful when dealing with communities, especially needy ones, because we do something that really affects their lives, we go there and extract data, they welcome us very well and we don't come back, we don't give any kind of support feedback (1)". In this sense, the composition of the teams becomes a concern given the delicate relationships that are established between researchers and communities. It also emphasized the need for an "exit strategy," described by one of the researchers as a more

effective communication approach with the communities involved in the actions. These communities should be informed about the aims of the study performed, duration of the activities, type of results produced, how these results would be transmitted to the public involved. This way, expectations would be better aligned.

Cooperation between researchers from different projects was cited both as a challenge (N=1) and an opportunity (N=2). Diverging viewpoints on research lines and practices were identified as a challenge for the integration of the research groups focused on Psittacidae conservation in Brazil. One researcher noted difficulties in accessing colleagues working on the same species due to the adoption of different conservation strategies: "the groups are closed off to other ideas and conservation tools, to the point of not considering the project's actions as a conservation tool (3)." Additionally, the source of funding was highlighted as a factor that can generate distrust regarding the credibility of projects, as some funding sources stem from compliance with conditions related to ventures that require environmental licensing.

On the other hand, articulation and cooperation between research projects provided advances such as organizing joint expeditions to optimize efforts and resources, organizing workshops, and sharing data.

4. DISCUSSION

Although considered relevant, and despite the effort of research teams, aspects of Human Dimensions are not fully incorporated into parrot conservation research in Brazil. Research projects often lack specific human and financial resources to develop actions that include HD. Furthermore, initiatives that address social aspects are generally isolated and fragmented, involving more palliative actions than preventive ones (Martins *et al.*, 2022). The results showed that few studies analyze the effectiveness of environmental education strategies in conserving species and environments, showing that the evaluation of implemented awareness strategies is still one of the main barriers to the implementation of long-term actions involving people.

The most notable relationship between people and parrots mentioned in the literature review and in interviews with researchers was poaching. This practice is associated with the illegal trade in parrots, which extends from local scales to international trafficking (Carvalho-Roel; Marçal Júnior, 2021; Seixas;

Mourão, 2022), corroborating what is identified as one of the main causes of threat of extinction to these species (BirdLife 2024). *A. aestiva* was the species most mentioned in studies (N=17; 54%). Despite not appearing on lists of threatened species, it is the most found in CETAS in Brazil, due to seizures from illegal trade, once the species is usually taken as pet given its ability to interact with humans (Matos *et al.*, 2017).

Researchers, who work in biodiversity conservation, for the most part, have background in distinct areas of natural sciences and, therefore, tend to conduct studies focused on the ecological aspects of species (Marchini *et al.*, 2016). The lack of permanent professionals in research teams constitutes an obstacle for planning, carrying out, evaluating and continuing actions aimed at people. Low salaries and short-term funding require constant changes, and produce unstable research teams, impacting capacity building and skills development, specially in the field of HD (Rodríguez *et al.*, 2006).

Research funding, based on the reports from the interviewed researchers, is mostly allocated to specific purposes such as the acquisition of materials and logistics, due to demands of funding institutions. Accountability is ensured through technical reports that summarize quantitative data. Research funding for biodiversity conservation is mostly directed to ecological strategies, as they present tangible and quantifiable results (Massarella *et al.*, 2021). The combination of these factors presents a challenge for research to integrate strategies focused on HD. Funding for these purposes is scarce and, due the absence of criteria for planning and implementation, actions aimed at people are not formally assessed.

From a broader perspective on how interactions between people and wild animals vary in different geographic, cultural and socioeconomic contexts, it is possible to explore opportunities to implement more effective conservation interventions, optimizing often scarce resources and efforts (Madden, 2004; Alves *et al.*, 2013; Soga; Gaston, 2020). These strategies need to be planned in an integrated manner, considering local contexts where the species occur and where research is conducted. Investment in interdisciplinarity is necessary, regarding, for example, the appropriation of methods and concepts from social sciences for an effective approach to HD. The use of social science methods involves planning and gathering information about the demographic, social,

cultural and political contexts of the locations where conservation research will be conducted (Crandall *et al.*, 2018). These methods involve identifying people or factors that may influence the research and involve conducting observations and interviews to build relationships with communities, in addition to collecting and analyzing data that support more effective and place-based decision-making (Crandall *et al.*, 2018).

Actions aimed at people must be continuous and communication must be clear. Goals, time frames, and limitations must be disclosed, and research and conservation projects must develop strategies to disseminate research results to the communities. Research funding must consider the importance and influence of social, cultural, historical and economic aspects for parrots' conservation.

5. FINAL CONSIDERATIONS

Parrot conservation research in Brazil need to advance in interdisciplinarity to address HD strategies. Engaging people in the actions is essential, as the hunting and capture of parrots is one of the main threats to the conservation of the species. Actions aimed at people must therefore be integrated in the core objectives of these initiatives so that they can receive the attention and resources necessary for efficient management, which demand proper planning, application and evaluation. Research funding should provide capacity building and the stability of research teams. Public policies for parrot conservation should include strategies for improving the quality of life of populations that cohabit the species' areas of occurrence. Special attention must be given to the most vulnerable communities, such as traditional and rural communities, and areas with a high poverty rate, aiming to mitigate threats such as hunting and capture. Place-based research that consider social, economic, cultural and historical contexts will provide the means to effectively incorporate HD into conservation strategies for parrot conservation.

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