



# Human Dimensions of the Reintroduction of Brazilian Birds

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## OPEN ACCESS

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### Specialty section:

This article was submitted to  
Animal Conservation,  
a section of the journal  
Frontiers in Conservation Science

**Received:** 07 October 2021

**Accepted:** 04 January 2022

**Published:** 31 January 2022

### Citation:

Martins FdC, Engel MT, Schulz F and  
Martins CSG (2022) Human  
Dimensions of the Reintroduction of  
Brazilian Birds.  
*Front. Conserv. Sci.* 3:791103.  
doi: 10.3389/fcosc.2022.791103

People's acceptability for wildlife, stakeholders' engagement and involvement are acknowledged as key factors for the success of wildlife reintroduction projects. We analyzed the main National Action Plans (NAPs) (the Brazilian management participatory instrument for the conservation of endangered species) for eight bird species and conducted an online questionnaire with researchers and practitioners involved in those species reintroduction programs. The assessment of the main Brazilian bird's reintroduction programs showed that, in general, efforts have been made to integrate local people into it. Nevertheless, the actions were disconnected, isolated and fragmented. A formal protocol, designed, discussed and approved by experts aiming to address the human dimensions (HD) of human-bird interactions (HBI), preferably to be used in each stage of the reintroduction programs, was not found. Actions considered related to human dimensions are mainly under the umbrella of environmental education interventions or campaigns, more directed to children and youth; correspond to activities performed by locals with the birds and/or captive birds facilities; or, fostering artwork production or bird watching activities. The weak or sometimes absent human dimensions approach to this important conservation tool may indicate either the novelty for Brazilian researchers and managers of the science of human dimensions within the field of wildlife management or the lack of dialogue between natural and social sciences when wildlife conservation is at stake. Reintroductions are expensive, sensitive, and labor-intensive processes. It becomes necessary due the conservation status of the species and its implementation follows a careful research of biological, ecological and socio-institutional regional background that identifies the drivers of species extinction and plans according to it. Understanding and predicting people's behaviors and its triggers are paramount to successful reintroduction projects. Thus, making use of well-planned HD studies in HBI may be the watershed between success or failure of reintroduction programs. This study was a pioneer initiative of its kind and it aimed to provide sound recommendations for managers, researchers and practitioners to acknowledge the relevance of HD and its core role in the reintroduction of endangered bird species.

**Keywords:** conservation, endangered species, engagement, human-bird interaction, bird's release

## INTRODUCTION

Human population growth and the increasing use of natural resources have promoted significant modification on terrestrial and aquatic ecosystems, resulting in habitat loss, ecosystem's fragmentation, pollution and environmental degradation of soils and aquatic systems, overexploitation of species and introduction of exotic species (WWF, 2020). As a main consequence of these impacts, the biodiversity loss accelerates (Sodhi and Ehrlich, 2010; Galetti and Dirzo, 2013). Dirzo et al. (2014) describe the defaunation of the Anthropocene as the sixth big mass extinction in our planet. Amongst the vertebrates it is estimated that most species had reduced their abundance by 25% and among the invertebrates this number is greater, reaching about 45 in 67% of the species assessed. It is estimated that among bird species, 187 were extinct by the year 1500 (Butchart et al., 2018) and currently about 14% of bird species are under some level of threat (IUCN, 2021). Brazil is one of the countries with the greatest and most threatened bird diversity in the world (Develey, 2021). The high vulnerability of wild species loss in Brazil is evident (Scheffers et al., 2012) and threats include deforestation, fragmentation, and habitat loss (Sodhi and Ehrlich, 2010). The extinction of bird species is also related to the introduction of exotic and invasive species, poaching and illegal trade (Butchart et al., 2018). On average, 36 thousand birds are confiscated per year and taken to Brazilian Wild Animals Rehabilitation Centers (Destro et al., 2012). Beyond the ethical right to exist, assessing the causes of bird's extinction also matters for ecological reasons; many species are pollinators, others are scavengers, and all perform ecological roles and services in the ecosystems they inhabit (Whelan et al., 2008).

Conservation programs of threatened species in general have three stages: (I) Recognition and identification of the endangered species; (II) Implementation of immediate and short-term protection measures to species conservation; and (III) Reestablishment (recuperation) of species population through long term measures (Wilcove, 2010). The establishment of Protected Areas through private initiatives from landowners of important areas for conservation and the management focused on specific species has contributed to the conservation of many Brazilian birds (Develey, 2021).

In Brazil, among the 166 endangered birds' species, two are considered extinct, *Numenius borealis* and *Anodorhynchus glaucus*; and two are already extinct in nature, *Pauxi mitu* (Alagoas curassow) and *Cyanopsitta spixii* (Spix's macaw) (Pacheco et al., 2021). The conservation of these species depends on reintroduction efforts (White et al., 2012). On a global level, at least 25 bird species changed their conservation status because of conservation actions such as reintroduction. Some of these species are Brazilian examples: *Crax blumenbachii* and *Anodorhynchus leari* (BirdLife International, 2018). The process of reintroduction is defined as the intentional release of individuals from one species in a place that comprehends part of its natural distribution before the species disappears or becomes extinct (Armstrong and Seddon, 2008; Sutherland et al., 2010).

The success and effectiveness of conservation programs rely on local people's engagement (Dayer et al., 2020; Develey, 2021).

The difficulties and limitations of reintroduction programs have been historically attached to the inefficiency of modifying the scenario that caused the threats to the species, and human actions have often been determinant to cause the vicious circle, keeping the same scenario time after time (Gama et al., 2016). Seddon et al. (2007) reviewed articles published between 1990 and 2005 involving wildlife reintroduction and found that only 4% considered certain aspects of human dimensions (HD), such as people's attitudes toward reintroductions. Watkins et al. (2021) highlight that besides the growing actions for species reintroduction, the human dimensions of human-birds interactions and the reintroduction implications for the communities are still little known and explored.

Research in HD intends to identify, describe, understand, predict, and influence human thoughts, actions, and behaviors toward wildlife (Manfredo and Dayer, 2004). In Brazil, besides the operational difficulties, the low socioeconomic indexes among rural communities complicates the efforts to restrain illegal captures and wildlife trade (Barbosa et al., 2010). Thus, law enforcement alone is inefficient to minimize these practices (Bezerra et al., 2012). More suitable strategies are needed such as planning education for tolerance toward wildlife, and wildlife management aligned with the improvement of social and economic indexes of vulnerable human populations that co-occur with wild species. The guidelines, discussed by the working group in human and wildlife interactions (Consorte-McCrea and Bath, 2020) for reintroduction programs of wild species involve listening to and learning from local populations, before, during and after any action of reintroduction and translocation of animal species.

The overarching goal of this research is to analyze how the main projects of bird's reintroduction in Brazil approach the human dimensions of human-bird interactions in their different stages. The study intends to answer four questions: (1) How many actions within the project have human dimensions in their objectives? (2) What actions are these? (3) How detailed and clear are they? (4) How do people who plan and implement reintroduction efforts perceive the human dimensions within the projects?

## MATERIALS AND METHODS

### Bird Reintroduction Projects

Data were collected from eight bird reintroduction projects in Brazil. These projects have as focal species and its conservation status: *Aburria jacutinga*—EN (endangered) (ICMBio, 2018a; IUCN, 2021); *Crax blumenbachii*—CR (critically endangered) (ICMBio, 2018a), EN (IUCN, 2021); *Pauxi mitu*—EW (extinct in the wild) (ICMBio, 2018a); *Amazona vinacea*—VU (vulnerable) (ICMBio, 2018a), EN (IUCN, 2021); *Anodorhynchus leari*—EN (ICMBio, 2018a; IUCN, 2021); *Cyanopsitta spixii*—CR (ICMBio, 2018a); EW (IUCN, 2021); *Guarouba guarouba*—VU (ICMBio, 2018a; IUCN, 2021) and *Sporophila maximiliani*—CR (ICMBio, 2018a); EN (IUCN, 2021). These projects were chosen because they represent the main and most prominent projects currently known for bird reintroduction in Brazil.

Three of the species (*P. mitu*, *A. jacutinga* and *C. blumenbachii*) belong to the Cracidae family. They are large frugivorous birds that require large areas with more preserved vegetation and are hunted in large numbers. Traditional communities in the Brazilian Amazon often interact with these species, hunting them in large numbers (Peres, 2000).

*Pauxi mitu* has just 120 individuals living in captivity (ICMBio, 2008). The “Alagoas Curassow” Reintroduction Project, coordinated by the 4th Prosecutor of Maceió, the Capital of Alagoas state, resulted in the release of three pairs of the species in September 2019. Since then, the individuals released have been monitored, and two males and one female were found dead for unknown reasons (Francisco et al., 2021). The same project planned the release of more individuals in 2021 and 2022. Before the *P. mitu* reintroduction, in 2014, Gama et al. (2016) interviewed 402 people from the hinterland communities in a 5 kms radius from the reintroduction site and found that most people were favorable to the *P. mitu* reintroduction. Also, the acceptability of the program was positively related to the age and level of formal education of interviewees (Gama et al., 2016).

*Aburria jacutinga* is a species that depends on forested areas with a good conservation status in the Atlantic Forest domain and has different conservation status in its occurrence area (See details in Endangered Galliformes National Action Plan). Where this species forms populations, it must share territory with traditional communities and tourists, facing habitat loss, anthropic perturbations and poaching. Bernardo et al. (2011) estimated that in 11 areas in São Paulo state, this species density varied between 1.2 and 2.2 individuals/km<sup>2</sup>, and poaching represented its main threat. The *A. jacutinga* reintroduction project has been coordinated by the NGO SAVE Brazil since 2010. In 2016 some individuals started to be released in different areas, up to 30 releases. Since then, post-release monitoring has registered reproductive activities among individuals (Phalan et al., 2020). The SAVE Brazil produced several educational materials focused on jacutinga conservation such as “Guia de Práticas e Saberes com a Natureza—Projeto Jacutinga” (available in: [https://savebr-site.s3.amazonaws.com/guia\\_ativ\\_web.pdf](https://savebr-site.s3.amazonaws.com/guia_ativ_web.pdf)).

*Crax blumenbachii* is a species with native populations only in the states of Bahia and Espírito Santo, Brazil (ICMBio, 2012). The largest population is on Vale Natural Reserve, Espírito Santo state, and was estimated at 325 individuals (Alves et al., 2015). Rocha et al. (2019) studied three vegetation fragments in Bahia state, finding between 0.13 and 0.29 sightings/10 km. Phalan et al. (2020) estimate 200 individuals living in captivity, totaling about 500 individuals in nature and captivity. From 2006 to 2008, 53 individuals were reintroduced in a protected area in Rio de Janeiro state (Bernardo, 2012; Bernardo and Locke, 2014). Despite the reproduction evidence among the individuals in the releasing site (Bernardo and Locke, 2014), there is no assurance to maintain a minimum viable population of the species in the state, especially considering the presence of poaching in the area (Bernardo et al., 2014). The “Project Mutum” developed by CENIBRA Company (Celulose Nipobrasileira S.A.) and CRAX Foundation (Society for Research, Management and Reproduction of Wild Fauna), released a total of 480 birds from 1990 and 2018, and some of these species

were the *A. jacutinga* (180 individuals) and *C. blumenbachii* (Phalan et al., 2020), both analyzed in this research. Of the 251 *C. blumenbachii* individuals that were reintroduced, 44 died and 116 were born from the new population (ICMBio, 2012).

Amongst the Psittacidae family, the reintroduction projects analyzed represented four species (*C. spixii*, *A. leari*, *A. vinacea* and *G. guarouba*). This birds’ family is the one with the largest number of endangered species in the world (White et al., 2012). *Cyanopsitta spixii* has 129 individuals estimated to be living in captivity (ICMBio, 2018b). In June 2019, the ICMBio approved the second stage of the National Action Plan for the conservation of *C. spixii* that plans the reintroduction of the species individuals up to the year 2024. To achieve this goal, 52 individuals of *C. spixii* were brought from a private breeding center in Germany to the city of Curaçá, Bahia state, northeastern Brazil (Marcuk et al., 2020). A socioeconomic assessment in the region of Curaçá was done immediately before the creation of a polygon of protected areas under the management of ICMBio and redone as part of an Interamerican Bank of Development request as sponsor of a project for degraded areas restoration, to confirm the safeguards of the protected areas’ creation. A pioneer participatory rural appraisal (PRA) (Newing et al., 2011) and a short-term’ research within the area where the specimens will be released were conducted to correlate socioeconomic factors with community and children and youths’ knowledge and perceptions about wild birds’ species and the use values given by the community to them (Martins, in preparation).

*Anodorhynchus leari* is an endemic species from Caatinga, restricted to a small area in Bahia state (Lugarini et al., 2012). There is a population of the species in the ecoregion called “Raso da Catarina,” where population surveys, undertaken from 2001 to 2012 by the National Center of Research and Conservation of Wild Birds (CEMAVE) have shown a population increase from 228 to 1263 individuals (Lugarini et al., 2012). Because of this increase, the species conservation status was updated from Critically Endangered to Endangered in 2008 by the IUCN (BirdLife International, 2018). The reintroduction project of the species (“Lear’s Macaw: Research and Conservation”), has been developed by Loro Parque Fundación, in partnership with “Arara Azul” Institute, SAVE Brazil and ICMBio. According to the project’s coordinator, in 2018 six individuals were brought from Loro Parque Fundación to “Boqueirão da Onça,” a polygon of federal protected areas located in the northeastern of Bahia state, where the species was locally extinct, and released in January 2019; the second release occurred in 2021, with another six individuals released and monitored. Apart from the potential birdwatching as an alternative source of income to the region of “Raso da Catarina,” other activities to generate income to the local communities include handicraft and artisanal products from “licuri,” a regional palm tree (*Syagrus coronata*), valuable to people and food source for the birds (Andrade et al., 2015).

*Amazona vinacea* inhabits the Atlantic Forest domain, mainly in higher altitudes (from 500 to 1,700 m) (Schunck et al., 2011). It is estimated that there are between 1,000 and 2,500 individuals in the wild (Kanaan, 2016), but it is hard to assess a real number because this species makes seasonal displacements (Schunck et al., 2011). In the region of Curitiba,

Paraná state, the species population is estimated by 1,000 individuals and in Rio Grande do Sul state this number reaches 911 individuals (Schunck et al., 2011). The *A. vinacea* Reintroduction Project is coordinated by the “Espaço Silvestre” Institute, launched in 2010. The Institute website informs that from 2011 to 2021 in the state of Santa Catarina, 222 individuals were introduced at the protected area “Araucárias” National Park (available in: <https://www.espacosilvestre.org.br/papagaiodepeitoroxo>). Environmental actions and educational material were produced by “Espaço Silvestre” Institute and distributed at local schools, aiming to promote species’ conservation. Furthermore, a group of local artisans popularly known as little purple’s friends make and sell different products inspired by *A. vinacea*, generating income to the community.

*Guarouba guarouba* is endemic from the Amazon region and has an estimated population of 500 individuals in the west of Pará state (Laranjeiras, 2011). The same author estimates that the global species population is about 10,000 individuals and it is common to find the species in captivity (Vilarta et al., 2021). The “Ararajubas” (*G. guarouba*) Reintroduction and Monitoring Program is coordinated by the Forest Development and Biodiversity Institute from Pará state (acronym in Portuguese Ideflor-bio), in partnership with the Lymington Foundation, and developed within protected areas in the Metropolitan region of Belém, the capital of Pará state. Through this program, 14 individuals arrived at the reintroduction site in 2017 and 10 individuals in 2018. About 20 individuals were released in two different moments; the authors do not specify the dates (Vilarta et al., 2021).

Finally, the unique Passeriformes project assessed was the *Sporophila maximiliani* project. *Sporophila maximiliani* population in captivity, registered at the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA), is estimated at 180,000 individuals (Machado et al., 2020). The species is rare in the wild (Ubaid et al., 2018) and is locally extinct in several areas of its original distribution area. Ubaid et al. (2018) highlighted that the main threat to the species is poaching and capture to illegal trade. The reintroduction project of this species in key areas of the Cerrado biome is developed by the “Ariramba” Nature Conservation Institute. The project plans the reintroduction of individuals from 2017 to 2021 at the protected areas of “Grande Sertão Veredas” National Park and “Cajueiro” Private Reserve of Natural Heritage, in the states of Minas Gerais and Bahia (available in: <http://cepcerrado.iieb.org.br/projetos/reintroducao-do-bicudo-em-areas-chave-para-conservacao-do-cerrado/>). Ubaid et al. (2021) reported the release of 12 pairs of this species since 2018 in this region. Another project that plans this species reintroduction is the “*Sporophila maximiliani* Biology and Conservation Project in Minas Gerais: the return of the species,” developed by Waita Institute for Research and Conservation, since 2016, but it is in prior phases to the releases (available in: <https://waita.org/projetos-waita/2018/06/08/projeto-bicudos>).

## Data Collection and Analyses

We analyzed the Conservation National Action Plans (NAPs) related to the reintroduction projects of eight bird species

through a systematic reading of their planning matrix. The NAP is a management tool for public policies used by the Brazilian central government, namely ‘Chico Mendes’ Institute for Biodiversity Conservation (acronym in Portuguese ICMBio). The instrument is built through a participatory process including different stakeholders, and aims to organize and prioritize effective strategies of conservation for Brazilian endangered species (ICMBio, 2018c). Given that the effectiveness of reintroduction projects depends on the agreement with public policies related to species conservation, we choose to analyze how human dimensions are present (or not) in these documents.

The planning matrix brings the objectives and strategic actions to promote improvements on endangered species conservation status. We examined the integration of a human dimensions’ approach, either directly or indirectly, within the various actions in the most recent bird NAPs. Actions considered related to human dimensions were those that depend on the local community directly (e.g., changing behavior) or indirectly (e.g., land use restrictions). The NAPs are planned and evaluated every 5 years and they are based on methods used by IUCN (ICMBio, 2018c), thus we searched for the most recent NAPs that addressed the eight bird species focus of the reintroduction projects analyzed.

Additional data were collected through an online questionnaire targeting the reintroduction project’s coordinators or researchers directly involved in these projects. These individuals were contacted by email or phone to be firstly presented to the main objectives of this study and its possible implications in future reintroduction programs. Prior to conducting interviews, the study was submitted and approved by the Ethical Committee of Research Involving Human Beings of University of Pernambuco (protocol number CAAE: 46639421.9.0000.5191). We used Qualtrics XM to collect data. Questionnaires had a total of 26 questions divided into four categories: (I) researcher involvement in the reintroduction program (five questions); (II) basic information about the reintroduction project (three questions); (III) how human dimensions were approached and investigated in the reintroduction project (13 questions); and (IV) personal information (five questions) (**Supplementary Material 1**).

## RESULTS

### Respondents Profile

Invitations to participate in the research were sent to 23 individuals involved in eight different projects. Fifteen agreed to participate (65.3% response rate), yet only nine completed the entire questionnaire. Among the 15 respondents, five were coordinators (33%), three were project collaborators (20%), one was an operational person from staff (7%), and six had other form of involvement (40%). Respondents worked with the reintroduction of six species: *C. blumenbachii* (n = 1), *C. spixii* (n = 3), *A. leari* (n = 2), *S. maximiliani* (n = 2), *A. jacutinga* (n = 1), and *G. guarouba* (n = 2). No participants from *A. vinacea* and *P. mitu* projects answered the questionnaire. One of the projects has already ended (carried out between 2006 and 2010; *C. blumenbachii*), and another one (*C. spixii*) has the birds in an

“adaptation to the habitat” phase before the reintroduction begin. The other four projects were ongoing by the time this research was carried out.

## How Many Actions Within the Project Are Aimed at Human Dimensions?

We analyzed eight National Action Plans (NAP) (Supplementary Table 1). Four of the eight focal species (*P. mitu*, *C. blumenbachii*, *C. spixii*, *A. leari*) had a specific NAP. Currently, only *C. spixii* has its own NAP. *Pauxi mitu*, *C. blumenbachii* and *S. maximiliani* were included in the general NAP of the Atlantic Forest Bird Species, *A. vinacea* was included in the NAP of Parrots’ Conservation, and *G. guarouba* was included in the NAP of Amazonian Bird Species.

A total of 327 actions were analyzed. Of those, 109 (30%) related to human dimensions (Supplementary Table 1). Actions listed in the NAPs were mainly related to managing birds in captivity, release sites, and post-release monitoring. Most of the human dimension actions were found in the *A. leari* (48%), and in the *C. spixii* (37%) NAPs; the *P. mitu* NAP only accounted for 22% of the human dimension related actions (Figure 1).

## What Actions Were Identified? How Detailed Were They?

The 109 human dimension actions were divided into seven categories: (1) Environmental Education and Awareness; (2) Public administration/wildlife management (e.g., protected areas, compensation); (3) Law enforcement; (4) Infrastructure (e.g., visitor center); (5) Communication and information dissemination; (6) Sustainable livelihoods (e.g., birdwatching, training); and (7) Research involving Human Dimensions. Category two has the higher number of actions listed in NAPs (44), followed by Category one (26) (Figure 2). Category four has just a single action (Figure 2).

Actions within Category two, related to land use and natural resources management concerning public administration are mainly land demarcation, creation and establishment of protected areas, habitat conservation and restoration of degraded areas, and ecological corridors (with people living within and surrounding protected areas). The actions in Category one, environmental education and awareness, had a low level of detail compared to actions within objectives related to the management of captive birds or to study of bird ecology; these actions are described as “To promote environmental education programs” (see Supplementary Table 1). Actions related to improving socioeconomic context refers to the promotion of sustainable livelihoods and fostering and diversifying local economic activities with artisanal honey production, birdwatching, and crafts using the bird as a symbol. These actions were found in the *A. leari*, *C. spixii* and *A. vinacea* NAPs, corresponding to 13% of those 109 actions (Figure 2). Actions that foster bird watching activities are also determined in the NAP of Atlantic Forest Bird Species.

The *A. leari* NAP was the only one mentioning conflict between people and the threatened bird species, which occurs when birds feed on corn plantations causing economic loss

to farmers. A compensation scheme is anticipated to mitigate the conflict. Concerning mitigation or compensation schemes given by development projects causing environmental impacts, the resource would go to bird conservation efforts, and do not include the local communities.

From the questionnaires we found that six of the eight reintroduction projects (with the exception of *P. mitu* and *A. vinacea* which representatives did not answer to this question) performed actions designed to include a human dimension approach, namely: offering public visits to the project facilities; providing information about the species and the importance to preserve it through lectures and booklets predominantly at schools; opening job opportunities in activities linked directly (e.g., research assistant) or indirectly (e.g., park ranger, art craft) to projects’ activities; conducting interviews and informal conversations to gather information about the species; facilitating direct participation in the projects’ activities (e.g., training on birds’ release, participatory monitoring), and citizen science. One respondent stressed the importance of these participatory monitoring activities in the *A. leari* project during the COVID-19 pandemic when local communities were essential in the absence of researchers in the field conducting work.

Other actions, cited by the researchers in the *C. spixii* project, included the creation of the management board of protected areas where the project happens; call for and social participation in the protected areas management; socio-environmental planning and professional training. These last actions brought a different perception of local communities’ participation, availing them the chance of being stakeholders, listening, speaking, and taking decisions. In the *A. jacutinga* project it was mentioned the effort to establish a sense of pride among the local communities to promote species conservation.

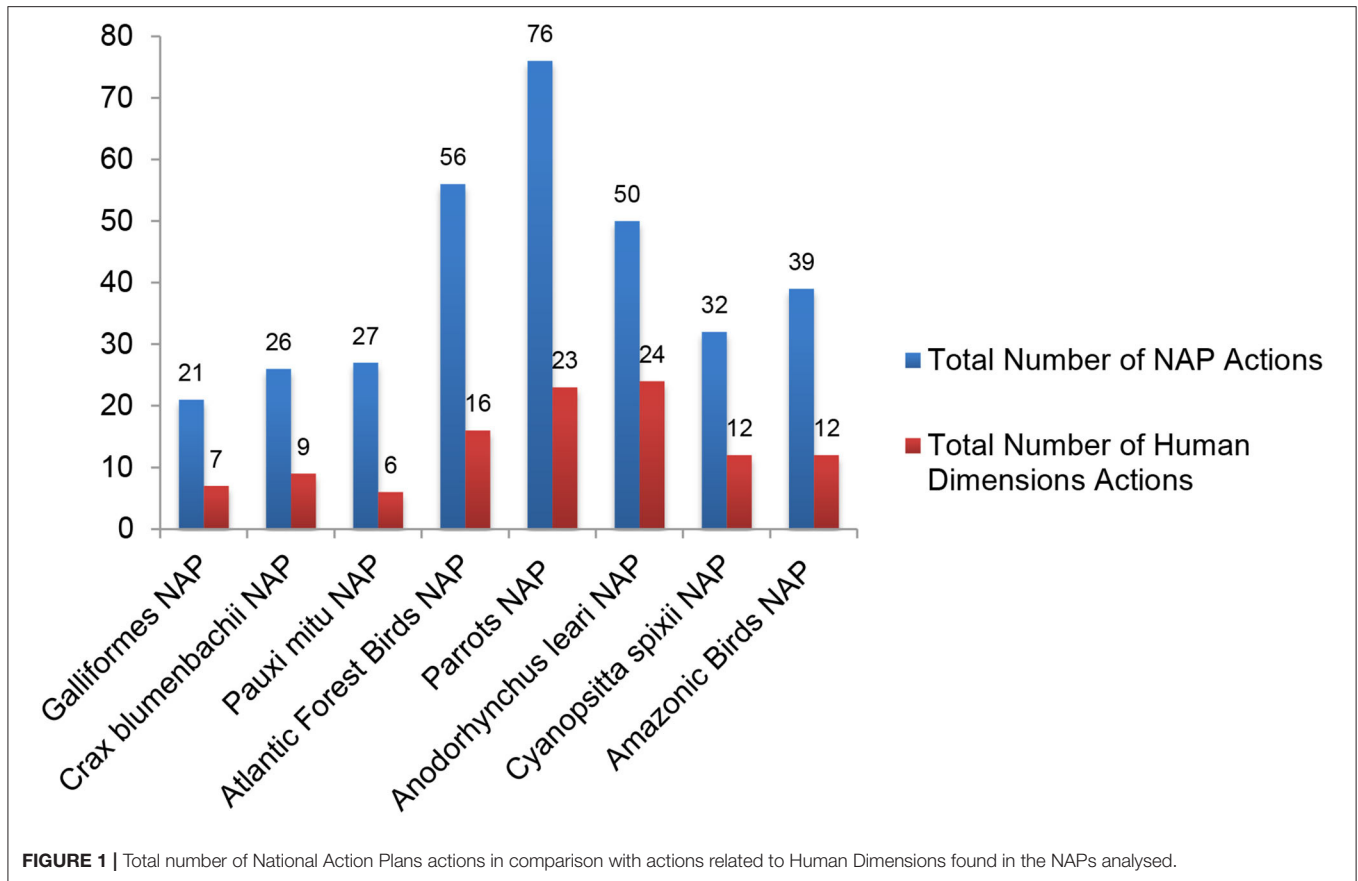
## In Which Phases of the Projects Did Actions Take Place?

Data from the questionnaires showed that the *C. spixii* project adopted a human dimension approach only during the pre-release phase (they have not moved forward the next phases of the project). The *S. maximiliani* project developed activities within this approach close to the release and post-release phases. The other four projects worked with the local communities during all reintroduction phases.

## How Did People who Plan and Carry out Reintroduction Projects Perceive Human Dimensions as Part of Their Projects?

Eight of the fifteen respondents (53.3%) strongly agreed and one agreed (6.7%) with involving communities as part of the reintroduction projects. One of the respondents (6.7%) neither agree nor disagree with community involvement.

A total of 19 answers about how people can positively impact the reintroduction projects were collected. These answers were ordered into four categories (Figure 3): (1) participating directly in the project (human resources and monitoring); (2) protecting the species (reporting illegal actions, being species guardians); (3) obtaining and disclosing important information (citizen science);



**FIGURE 1** | Total number of National Action Plans actions in comparison with actions related to Human Dimensions found in the NAPs analysed.

and/or, (4) acting as co-responsible in the project (making individual and collective conscious choices; directly involved in some profitable activity related to the project; feeling of pride and species appreciation).

Although 21% of the answers referred to the fourth category, it corresponds to data provided only by two (13%) of the 15 interviewees. These individuals highlighted the active participation of local people to the conservation of the focal species by fostering community behavior changes, such as stopping captures. One respondent mentioned improving livelihoods through extra income coming from the species' conservation, such as birdwatching. Another respondent mentioned that the projects could be positively impacted if local people were proud of the fact that in their region the focal species is preserved.

Seven out of nine respondents pointed out that people in communities had the opportunity to share their appreciation toward, and knowledge about the focal species during the social engagement activities.

Participants were also asked how communities could negatively impact the reintroduction efforts. A total of four threats were indicated among 14 responses (respondents could cite more than one action). All respondents related poaching and illegal captures as negative impacts. Two respondents referred to artificial bird feeding, bird attraction and habitat destruction as threats to the projects. One respondent mentioned

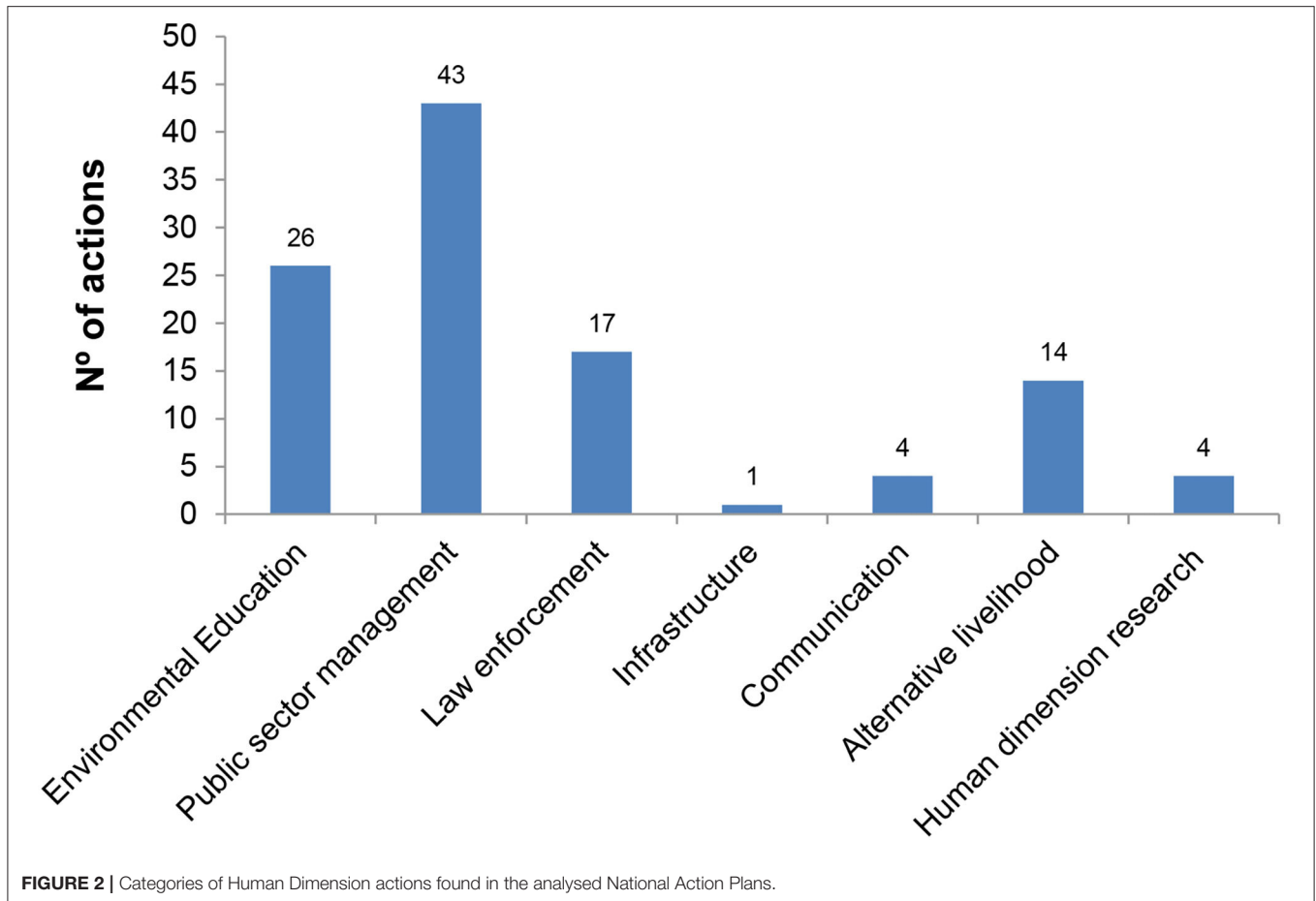
the resistance that some communities may have to cooperate with the dissemination of relevant conservation information and the lack of engagement in environmental education actions.

Finally, of the nine answers about the main challenges to birds' reintroduction in Brazil, four (44%) mentioned the availability of viable individuals to be reintroduced, three (33%) mentioned poaching and illegal capture of the species, the lack of financial sponsorship and post-release monitoring (Figure 4). Two respondents mentioned community engagement as a challenge, and one pointed to the socio-environmental development of communities in balance with species conservation. These points were not mutually exclusive. Participants of this research were asked to explain how interviews with locals were conducted, if it occurred. It is noteworthy that three projects conducted interviews based on public engagement protocols that were available from other reintroduction projects, whilst four created their own protocols.

## DISCUSSION

### Actions Using a Human Dimensions Approach and the Lack of Detail

The assessed NAPs of Brazilian endangered birds highlights the paradox of being a very-well conceived instrument for wildlife management within and surrounding protected areas and an indication that the human dimensions of human-bird

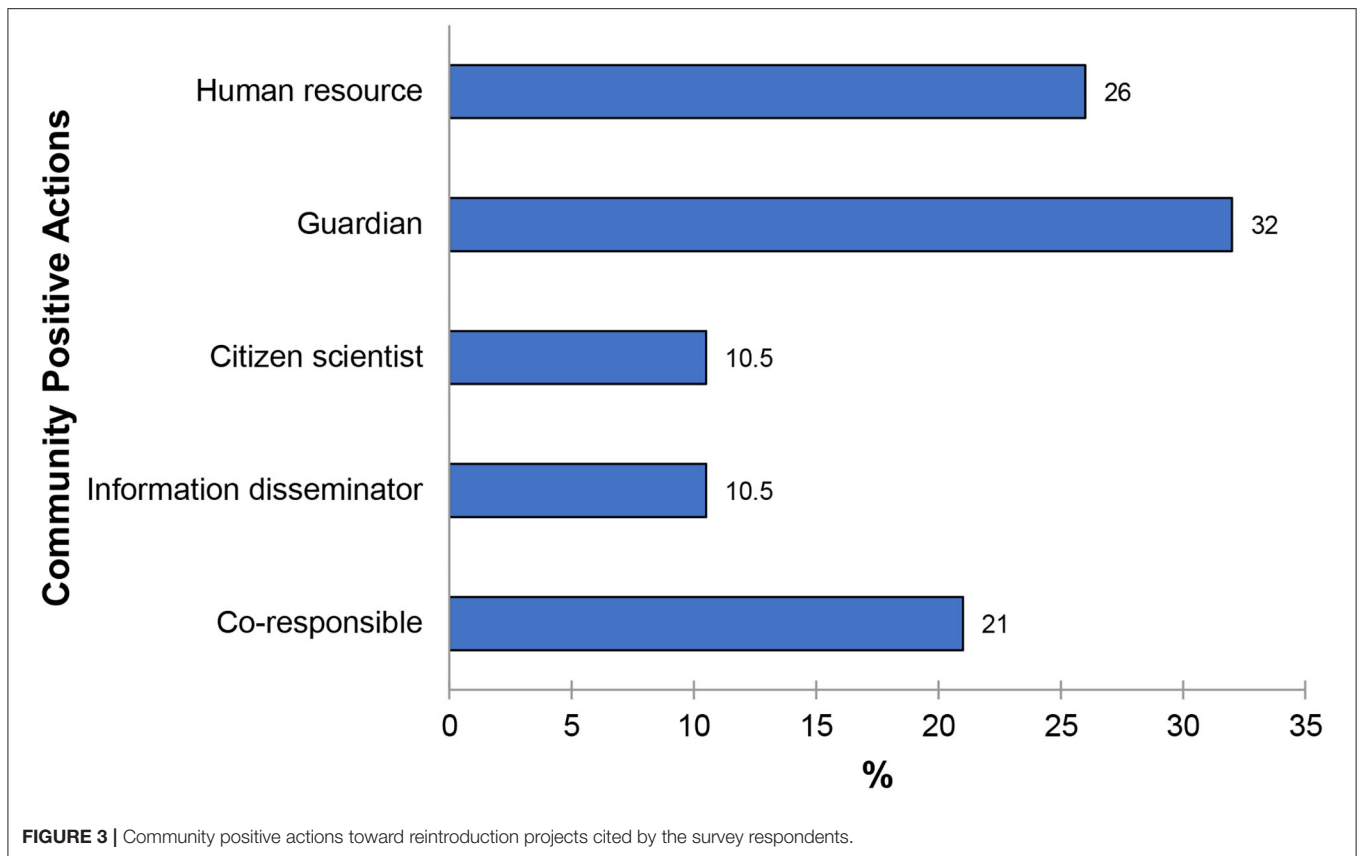


interactions is in its infancy. The NAPs also point to the imbalance between goals and actions related to biology and ecology of birds and goals and actions related to variables of human behavior toward the birds and their determinants. The gap between how people are framed in the current NAPs and what people could perform in all stages of a life-cycle project of bird reintroduction weakens governance and compromises conservation of species and its habitats.

When looking at the conservation and reintroduction projects of birds in the world, compiled by IUCN SSC Conservation Translocation Specialist Group (CTSG) (Soorae, 2008, 2010, 2013, 2016, 2021), we see that editions from 2016 and 2021 have more projects with objectives related to human dimensions than in the previous years. The number of the projects with human dimensions objectives in 2016 (46% of the 13 case studies) was twice the number of 2008 (23% of the 17 case studies). The Conservation Project of *Vultur gryphus* in Argentina, developed by Jacome and Astore (2016) focused on three of four objectives related to human dimensions. The authors argued that educational and extension projects are essential to promote changes in behavior and perceptions in favor of focal species and environmental conservation. The *A. vinacea* reintroduction project (Kanaan, 2016) has as one of its goals to create sustainable socioeconomic opportunities to the local communities of species

occurrence area. Ewen et al. (2018) highlight among the four main objectives of Hihi (*Notiomystis cincta*) Recovery Group, in New Zealand, to increase public appreciation. To work on this matter the group promotes public knowledge about the species and comprehension about the causes that threaten the species and how people can help to preserve it; they also encourage volunteer work (national and international). It is likely that because of greater inclusion of human dimensions factors in the early planning stage of the project, greater success was reported in community participation in all the project editions since 2013.

Actions with the objective of reducing and controlling illegal trade of birds covered aspects of improving enforcement and involved those vulnerable populations who are typically part of the hunting, capture and trade of birds. In these actions, some NAPs mention the possibility of changing the legislation to improve enforcement. Few actions mention behavior change *per se*, although they mention promoting environmental education to mitigate illegal trade. Actions aiming to develop scientific knowledge about the species did not include the opportunity of integrating social sciences. Research including cultural and socioeconomic context of local people and their interactions with bird species were absent as well as local population knowledge, values, and norms about the focal species. The only exception is the *C. spixii* NAP which acknowledges the need to know



the socioeconomic profile of the communities and the hunting activities eventually performed by locals.

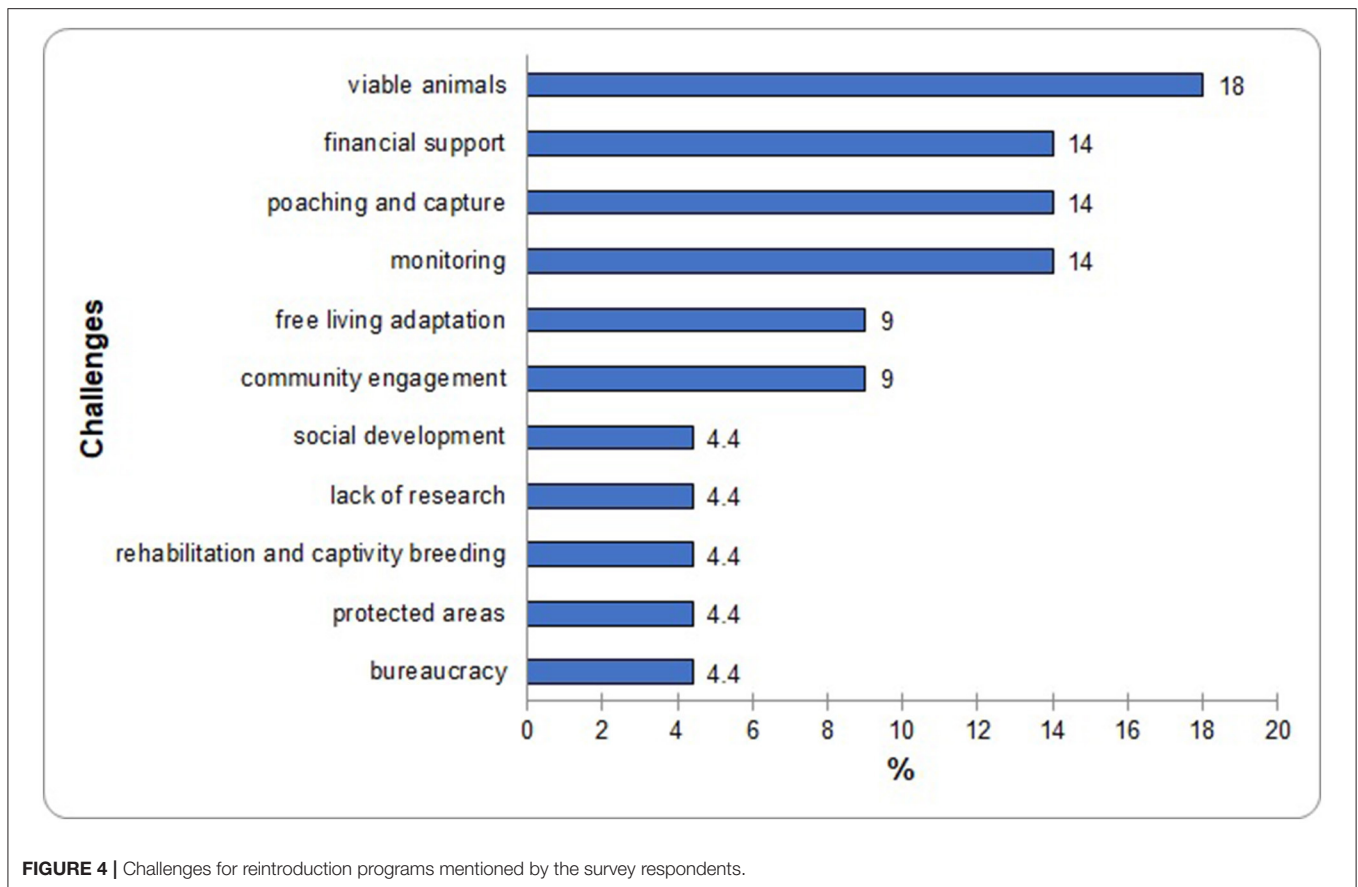
Looking at the results from the interviews conducted with representatives of six reintroduction projects, it appears that most of them had a human dimension approach, which was expressed mainly through public presentations carried out in schools, and meetings with different stakeholders. Engagement with communities living close to release sites were sometimes promoted before the reintroduction, but for most of the projects, locals were involved in all phases, i.e., pre-release, during, and post-release. These findings indicate that, in general, efforts have been made to integrate local people to bird reintroduction projects. However, the actions were planned isolated, disconnected, and fragmented, involving more palliative actions, and less preventive and/or behavioral change actions. Approximately one quarter of the answers mentioned employment or volunteer work as ways to engage society in the reintroduction projects. This may be linked to the fact that this is the fastest and most effective way to integrate locals in project actions. The difficulties to maintain financial support to the projects interfere in its capacity to propose and maintain long-term educational programs focusing on species conservation.

Local people are seen especially as human resources and instruments to protect the focal species, but rarely as a real participatory tool to make decisions that would affect them directly and indirectly. Few researchers associated engagement

with the projects as improvement for local quality of life, environment, and economic activities. This fact is also evident in the responses given about community participation in the projects, which were related to locals being recipients of education and information about focal species and local people monitoring and collecting scientific data about species. The same reasoning is displayed in the NAPs, where engaging local people comes restricted to their support to the already designed, and planned activities proposed, with no local participation during the early stages of objectives, aims and goals' conception.

Engagement means the active involvement and participation of others, as many and diverse as possible, spontaneously or attending a call for it, and it is one of the first steps to a "good" governance of natural resources, which in its turn, must consider norms, values, and principles that underpin a dialogical decision-making management (Borrini-Feyerabend et al., 2013). Values, norms, and principles are rooted in human dimensions beyond cognitive processes, and include psychological, emotional, and cultural aspects, embedded of complexity and emerging unpredictably during a project life cycle, not only while someone performs his role in some operational stage of the process. Being a reintroduction project a management strategy, the agencies, programs, and projects leading need to acknowledge its relevance, sensitivity, and time-consumption, to make it a routine, which conducted in a safe interpersonal and institutional environment promotes learning





and trust among participants and prevents (reduces or mitigates) conflicts. Trust and confidence in management agencies are important to reduce risk perception and to gain support for reintroduction (Watkins et al., 2021).

To identify, describe, understand, and predict local people values, beliefs, norms, attitudes, and perceptions toward species reintroduced in the wild and the historical development of these interactions is important to understand the key factors that will influence people's attitudes and behaviors toward the reintroduction projects and toward the reintroduced species (Castillo-Huitrón et al., 2020; Dayer et al., 2020) and is crucial to the success of any reintroduction project (Owens, Consorte-McCrea, Kolipaka, Ruiz-Miranda and Waters, 2019). The code and guidance to reintroductions and conservation translocations in England (DEFRA, 2021) highlights the importance of not engaging the community, but to engage with community and other stakeholders since the planning stage of the program, creating and providing potential benefits, and consequently, reducing conflicts and possible local economic losses. The decisions must be shared, guaranteeing a listening, and speaking space to all stakeholders: people cannot cooperate with the reintroduction project if the decisions which affect them are not clearly shared with them (DEFRA, 2021).

The same pattern is observed in indicators related to HD goals—46% and 45% of the indicators respectively, then in the

previous year's programs (2008—12%; 2010—14% and 2013—10%). Some of these indicators are not clear on operational variables such as good local awareness related to the program (Bernardo, 2008) or comprehension and cooperation from local communities promoting coexistence (Stoykov and Grozdanov, 2010). Some indicators are more specific, and therefore, have greater chances to be effective, monitored and measured as the indicators used in *Vultur gryphus* conservation program in Argentina: number of educational campaigns; communication strategies where the program is mentioned and associated; number of popular events and parties that the program participates; number of volunteers per year; and number of conservation partner certifications (Jacome and Astore, 2016). Kanaan (2016) defined the total indicator of socioeconomic opportunities according to the green (sustainable) economy. In the project of *Ara macao* (Williams and Haines, 2021) the success indicator is the number of local people, greater than 10 per year, who benefit directly from the program. Apparently, a perspective change is happening in the reintroduction programs worldwide, as in Brazil may be seen in the last NAPs. Currently the programs are more concerned about defining goals, actions and indicators that involve HD, since the planning phases. Thus, it is important to work with an interdisciplinary team to plan, execute and evaluate the HD aspects in the reintroduction programs (Consorte-McCrea and Bath, 2020).

It is noteworthy that difficulties related to human dimension factors frequently are listed among birds' conservation and reintroduction projects as compiled by Soorae (2008; 2010; 2013; 2016; 2021). These difficulties are related to poaching and bird's illegal captures (Mari et al., 2010; Cremades et al., 2016; Tritto, 2016; Ubaid et al., 2021); bird's poisoning by the use of pesticides and other toxic substances in the release sites (Swanepoel, 2013; Parish and Hunt, 2016; Kemp and Alexander, 2021; Reynolds, 2021); presence of semi-wild cats and dogs (Bernardo, 2008; Burbidge et al., 2010); frequent interactions with people who feed birds and make them vulnerable and dependent on humans (Kanaan, 2016); and fires, intentional or accidental (Burbidge et al., 2010; Menkhorst, 2010; Ubaid et al., 2021). All the difficulties named as key to achieve success in the reintroduction projects are hard to solve without changing paradigms. To restore biodiversity, it is essential to seek new ways of thinking and doing conservation, adding the coexistence perspective, where interactions between people and wildlife are managed to keep wild species population sharing space and resources with human communities in a socially fair way (Pascual et al., 2021; Pooley, 2021; Pooley et al., 2021).

The main lessons left by these projects are the need to identify and involve different stakeholders, to inform local populations about the project's aims and actions, to extend stakeholders participation and cooperation in the projects (Adams and Cash, 2010; Stoyanov and Grozdanov, 2010; Saidenberg et al., 2013; Steiner et al., 2013; Bridge, 2016; Parish and Hunt, 2016; Tritto, 2016; Williams, 2021), that coexistence between people and wildlife requires a long-term and well-studied work plan, but if well performed it brings a strong impact and real awareness of people to the environment and species conservation (Cremades et al., 2016); and that citizen science perform great help to monitoring bird (Islam et al., 2010; Ingwersen and Johnson, 2016; Kanaan, 2016). The main reasons for the success of the reintroduction project, related to human dimension, are real engagement of local communities and the economic benefit generated to the communities in the areas of species reintroduction (Jacome and Astore, 2016; Kanaan, 2016; Williams and Haines, 2021; Woinarski et al., 2021).

After analyzing the Brazilian National Action Plans for the conservation of at least eight bird species, it is clear that the public policies are more focused on actions of surveillance, law enforcement and controlling illegal trade. Some NAPs bring actions involving the creation of the management board and the economic ecological zoning of the protected areas where the species are being reintroduced. The NAPs that went through recent review include more actions involving local communities in the planned actions as: important community assessment of human-bird interactions with the focal species; what people think, feel, perceive and know about the species; motivations to certain types of behaviors that can lead to conflict with focal species conservation; and socioeconomic variables that can affect the interactions with the focal species. An example of a NAP bringing these aspects is the *A. leari* NAP. It

is important to say that this kind of research and practice must happen before, during and after the reintroduction of focal species.

## CONCLUSIONS

National Action Plans for the conservation of threatened species are a valuable tool for conservation planning and management. Human dimensions of human-bird interactions are only implicitly present in the NAPs and starting to emerge, as seen from the data obtained through the questionnaire.

Despite the clarity about the common subject to the causes of threat for endangered bird species (e.g., people, directly or indirectly, through poaching, illegal trade, or habitat destruction, just to mention few), conflict is mentioned only related to *A. learii* (in NAP) and its rides on corn plantations, affecting small farmers livelihoods, thus proposing compensation schemes to increase tolerance toward co-occurrence with the species.

All the other aspects connected to human populations co-occurring with the species (before its local extinction in the wild or after its reintroduction) identify people either as a potential labor force in the reintroduction project or program; either as an artisan, beekeeper or guide for tourists and birdwatchers within or surrounding the area where birds are to be released; or as a "strange in the nest," as children or adults unaware of birds' biology and ecology or threats to its conservation and motifs underneath; either, and the worst category, as hunters or wildlife traders requesting surveillance and punishment, or as competitors for natural resources, in need to be taught on how to dwell in the territory they share with its wild neighbors. It lacks a leveling amidst stakeholders in understanding, acting, and communicating human-bird interactions, beyond conflicts, economy, and ecology. It remains a gap between scientific knowledge and real-world demands, focused on behavior change and researchers triggering that change.

Wildlife conservation includes wild species management, habitat conservation and habitat restoration, within or surrounding protected areas, research, education, and law enforcement. Coexistence of humans and wildlife requires that multi and interdisciplinary approach, assessing and influencing human dimensions of cognitive, psychological, cultural, social, and economic background. People are more prone to engage and involve with conservation if acknowledged as stakeholders, a step further of being subjects whose quality of life may be not a priority of conservation projects or whose traditions, knowledge, and voices are displayed as incompatible with biodiversity conservation. Especially while dealing with traditional communities within protected areas, management agencies and researchers will assure effectiveness depending on the fulfillment of governance principles, based on wide and democratic participatory processes, transparency and accessibility of information, distributive justice, and social equity together with biodiversity conservation. Instead

of labeling human populations co-occurring with wildlife based on the threats to its conservation status and/or its environment, and on potential ways to improve its conservation status, people will answer more positively to any initiative concerning biodiversity if they acknowledge a non-judgmental move toward their livelihoods, behaviors and motivations from wildlife management agencies, researchers, and organizations.

The contribution of this research includes the acknowledgment of the imbalance between biological and ecological assessments when threatened birds' species are to be reintroduced and the assessment of determinants of behaviors that led or ease their population decline or extinction (in the wild). This is displayed in the NAPs, which fail to detail objectives and actions on how to engage people, especially locals, from planning stages up to wildlife and its habitats managements, at the same level as objectives, actions, and indicators related to birds' biology and ecology.

*Cyanopsitta spixii* is an exception in several aspects, followed by *A. leari*, which reinforces the leadership of Caatinga biome in scientific research and practice related to HD in HBI. The timing of the study, especially the questionnaire application, amidst COVID-19 pandemic, provided an unforeseen but robust answer if any doubt remained about the relevant role of social engagement and communities' participation in conservation: in the absence of researchers, locals were close to the release sites and within and neighboring protected areas with reduced surveillance. Being stakeholders since the design of a birds' reintroduction project or program paves the path for the dialogue between scientific and traditional knowledge, for the establishment of trust and values gridlock conciliation that diminishes the resistance to spread conservation information

and develops and strengthen the sense of pride for co-occurring with wildlife.

## DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethical Committee of Research Involving Human Beings of University of Pernambuco. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

FM and FS organized the NAPs database. ME did the on-line questionnaire. FM analyzed the data. FM, ME, FS, and CM wrote the previous and current version of the document. All authors contributed to the article and approved the submitted version.

## ACKNOWLEDGMENTS

We thank all the people who agree to participate in this study. We also thank the reviewers and editor for valuable feedback provided to improve the manuscript.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcosc.2022.791103/full#supplementary-material>

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