

Challenges to IUCN Guideline Implementation in the Rehabilitation and Release of Trafficked Primates in Peru

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Abstract: The rehabilitation and release of nonhuman primates after confiscation, surrender, or abandonment during illegal wildlife trafficking has implications for conservation, animal welfare, and public health. Risks associated with primate release include ecosystem disruption, inability of released primates to engage in normal foraging and social behaviors, and pathogen spillover. The International Union for the Conservation of Nature (IUCN) has several guidelines for the rehabilitation and release of trafficked primates intended to minimize such risks, though little is known about the use of these guidelines during primate confiscation, rehabilitation, and release or about the challenges faced by those who attempt to implement such guidelines in specific contexts. As one of the leading sources of Neotropical primate trade in the world, Peru has a primate population particularly vulnerable to the negative consequences of trafficked primate release. This study used semi-structured interviews and structured questionnaires of 19 people involved in primate confiscation, rehabilitation, and/or release in Peru and found that awareness and implementation of the IUCN guidelines are minimal. Opportunities to increase guideline implementation in Peru include expanding government involvement and support, adapting guidelines to specific contexts and locations, and establishing a platform for increased communication, cooperation, and research amongst those performing this work.

Key Words: Primates, Peru, IUCN, guidelines, trafficking, confiscation, rehabilitation, release

Introduction

The rehabilitation and release of formerly captive nonhuman primates (NHPs) has implications for conservation, animal welfare, and public health alike. Release of genetically-distinct NHP species outside of their natural range can lead to gene pool dilution and unnatural competition that threaten conservation efforts. The release of long-term captive NHPs that have not developed natural behaviors such as predator avoidance, social and sexual responses, and appropriate foraging behaviors can lead to disaster for these NHPs in the wild (Karesh *et al.* 2005; Kumar *et al.* 2011; Guy *et al.* 2014; Schwartz *et al.* 2016; Campera *et al.* 2020).

Humans and NHPs also share susceptibility to many of the same pathogens, and at least 25% of human emerging infectious pathogens also affect NHPs (Pedersen

and Davies, 2009). Human pathogens such as Human Herpesvirus Type 1 and *Mycobacterium tuberculosis* have had profound consequences when introduced into NHP populations (Tarara *et al.* 1985; Mätz-Rensing *et al.* 2003; Costa *et al.* 2011). Recent human pandemics such as Zika and SARS-CoV-2 affect NHPs and could spread rapidly into immunologically naïve populations (Terzian *et al.* 2018; Favoretto *et al.* 2019; Melin *et al.* 2020). Zoonotic pathogens have also been transmitted from NHPs to humans, including the introduction of SIV from chimpanzees and SIV from sooty mangabeys and their evolution into HIV-1 and HIV-2 (Hirsch *et al.* 1989; Gao *et al.* 1999). Flaviviruses, such as dengue and yellow fever, are thought to have entered human populations from forest dwelling NHPs (Wolfe *et al.* 2007; Vasilakis *et al.* 2011). Release of NHPs carrying pathogens from their place of origin or from humans or other animals during their time in trafficking or

captivity without proper health screening could thus have negative health consequences for naïve NHP and human populations (Karesh *et al.* 2005). Despite these concerns, the rehabilitation and release of formerly captive NHPs, many from the illegal bush meat and pet trades, occurs worldwide and has positively contributed to the welfare of individual NHPs as well as conservation efforts for endangered species (Yeager 1997; Tricone 2018).

Given concerns such as those outlined above, the International Union for the Conservation of Nature (IUCN) developed the *IUCN Guidelines for the Placement of Confiscated Animals*, which provides a framework for determining the fate of animals confiscated from the wildlife trade (IUCN 2002). These guidelines have recently been updated in the *Guidelines for the Management of Confiscated, Live Organisms* (IUCN 2019). While the *IUCN Guidelines for the Placement of Confiscated Animals* provide a general outline for determining the placement of confiscated wildlife, they can be read in conjunction with the *IUCN/SSC Re-Introduction Specialist Group: Guidelines for Nonhuman Primate Re-Introductions* to determine specific recommendations for NHP protocols (Baker 2002). Previously captive NHPs released into the wild should meet specific requirements, such as quarantine, disease screening, behavioral assessment, and genetic compatibility with wild populations (Box 1). Although the IUCN guidelines have existed for almost two decades, their use to limit risks associated with the rehabilitation and release of NHPs is not well studied. What has been published suggests compliance worldwide is minimal (Guy *et al.* 2014). To understand why the IUCN guidelines may be minimally used in NHP rehabilitation and release projects, an assessment of the specific contexts in which this work occurs is needed.

Peru is a good candidate location for evaluating the use of the IUCN guidelines in more specific contexts. Home to 47 extant NHP species, including three that are Critically Endangered, Peru contains one of the greatest NHP species diversities in the world (Shanee *et al.* 2014;

Aquino *et al.* 2015). It is estimated that thousands of live NHPs are trafficked in Peru annually (Shanee *et al.* 2017), and at least 416 monkeys were confiscated in the country from 2017–2019 (Patricia Mendoza and Lorena Fernandez, unpubl. data). All illegally owned or traded NHPs, whether eventually confiscated, abandoned, or surrendered, are considered trafficked given the illegal nature of NHP ownership in the country outside of authorized captive settings.

When confiscated, abandoned, or surrendered, Peruvian NHPs are often relocated to zoos for permanent captivity or to privately owned and funded wildlife rehabilitation centers for rehabilitation and release. Although the exact number of NHPs released by each of the five existing NHP rehabilitation centers most likely varies, one center with an authorized spider monkey (*Ateles chamek*) reintroduction program released 60 NHPs from 2009–2019, representing 39% of their received NHPs. Because of their established reintroduction program, this center most likely releases a higher proportion of NHPs than others in the country (Raul Bello unpubl. data).

Although zoonotic parasites, bacteria, and viruses such as *Trypanosoma cruzi*, the cause of Chagas' disease, simian foamy viruses, and *Mycobacterium tuberculosis* have been documented in Peruvian NHPs, disease screening prior to NHP release in Peru is thought to be limited (Gherzi *et al.* 2015; Rosenbaum *et al.* 2015; Aysanoa *et al.* 2017). Tamarins and other small species may be occasionally released back into the wild shortly after confiscation by authorities without full medical screening (Deem *et al.* 2001; Karesh *et al.* 2005; Campera *et al.* 2020). Other rehabilitated Peruvian NHPs undergo soft release, which demands more time and resources, but has a greater probability of long-term success (Cowlshaw and Dunbar 2000; Fischer and Lindenmayer 2000; Guy *et al.* 2014). All Peruvian rehabilitation centers are required to obtain governmental authorization prior to NHP release, and the Peruvian government has created legislation for confiscated

Box 1. A summary of the *IUCN Guidelines for the Placement of Confiscated Animals* (IUCN 2002), when read in conjunction with the *IUCN/SSC Re-Introduction Specialist Group: Guidelines for Nonhuman Primate Re-Introductions* (Baker 2002). This summary was used to introduce study respondents to the *IUCN Guidelines for the Placement of Confiscated Animals* and to guide coding of questionnaire and interview responses about considerations in determining the fates of trafficked NHPs.

The *IUCN Guidelines for the Placement of Confiscated Animals* recommend release of confiscated animals under very specific circumstances, provided the following criteria are met:

1. Return to the wild will make a significant contribution to the conservation of the species.
2. There is a management program in place to track the animals post-release as well as a re-introduction program for the species.
3. The animals have been subjected to comprehensive screening and quarantine and have been found to be free of significant diseases.
4. The country and site of origin can be confirmed, and animals can be returned here. Return to the wild outside of a species' natural range is only considered in exceptional circumstances.
5. The animals do not exhibit behavioral abnormalities that would make them unsuitable for the wild.
6. Doing so will not stimulate future illegal trade.
7. Genetic differences between different populations of the species are understood and considered in determining where to place the confiscated animal.

If these criteria are not met, then permanent captivity is recommended. However, if the animal has an incurable illness, might stimulate further illegal trade, the permanent captivity facility does not have enough space or resources for the animal, and/or no other permanent captivity or research facilities are available for the animal, the IUCN recommends humane euthanasia of the confiscated animal.

or abandoned wildlife placement (Peru, MINAGRI 2012; Peru, MINAGRI 2015). Governmental expertise and involvement in the enforcement of wildlife legislation, and in the rehabilitation and release process, however, is thought to be lacking (Daut *et al.* 2015; Shanee *et al.* 2017).

A 2019 report summarizing captive wildlife facilities in Peru identified 132 legal captive wildlife facilities, including 15 rescue centers (defined elsewhere as public or private facilities for the rehabilitation of confiscated or found wildlife prior to translocation back to their natural habitats or permanent captivity) and at least 12 unauthorized facilities in the country (Peru, MINAGRI 2015; Peru, SERFOR 2019a). Based on the enclosure space, carrying capacity, and number of animals at each rescue center, 35% (3295/9399) of the animals in these facilities were considered in excess of governmentally regulated housing capacities, not including the 3506 animals (367 mammals) considered surplus due to inadequate documentation. NHPs represented 40% (249/625) of the mammalian surplus. Given this situation, the Peruvian government recommended evaluation of threatened species translocation for surplus animals, modification of current legal guidelines to allow transfer of threatened species, such as spider monkeys (*Ateles chamek*), to noncommercial captive facilities in other countries, and euthanasia of surplus animals that cannot be released or relocated to other facilities (Peru, SERFOR 2019a). While euthanasia is considered an option and is practiced in some settings, it is not always used, especially for threatened species for which a current conservation program exists (Peru, MINAGRI 2015; Peru, SERFOR 2019a).

Several rescue centers currently releasing NHPs in Peru have approved translocation programs that aim to supplement the populations of threatened NHP species (for example, *Ateles chamek*, *Alouatta* spp., *Lagothrix lagothricha*). While these translocation programs are guided by conservation goals, they could also represent a solution for the current surplus of those species in captivity, though the extent to which such pressures affect rehabilitation and release is uncertain. The *Plan Nacional de Conservación de los Primates Amenazados del Perú, Periodo 2019–2029*, a recently released comprehensive set of objectives for protecting threatened NHPs in Peru, includes plans for the implementation of more rescue centers, which could also help address this animal surplus (Peru, SERFOR 2019b). These recommendations may result in more translocation programs and more rehabilitation and release of previously trafficked NHPs, making identification of the limitations, risks, and challenges of current translocation practices increasingly urgent.

Given the diverse and poorly characterized approach to rehabilitation and release of trafficked NHPs in Peru and the risks associated with NHP release, this study used standardized questionnaires and semi-structured interviews of key stakeholders in the placement of trafficked NHPs in Peru to: 1) identify themes in the rehabilitation and release practices for trafficked NHPs and compare them to those

recommended by IUCN (Baker 2001; IUCN 2002); 2) determine the awareness and use of IUCN guidelines for trafficked NHPs, specifically the *IUCN Guidelines for the Placement of Confiscated Animals* (IUCN 2002); and 3) identify common challenges faced in the implementation of these guidelines in Peru.

Methods

Study design and overview

This study was cross-sectional and mixed-methods in design. Data collection was completed from June–September 2018 through standardized questionnaires and semi-structured interviews. Approval was obtained from the Social, Behavioral and Educational Research Institutional Review Board (SBER IRB) at Tufts University in Boston, MA (IRB Study #1833050) and the Comité Institucional de Ética en Investigación del Instituto de Medicina Tropical “Daniel Alcides Carrión” de la Universidad Nacional Mayor de San Marcos in Lima, Peru (CIEI-2018-007).

Identification and recruitment of participants

Target participants included wildlife rehabilitators, veterinarians, government officials, and non-governmental organization (NGO) employees involved in NHP confiscation, rehabilitation, and/or release in Peru. Potential participants were initially identified by authors Patricia Mendoza and Raul Bello, followed by snowball sampling. Individuals were invited to participate if they were >18 years of age and were involved in any aspect of NHP confiscation, rehabilitation, or release, NHP research (including wildlife biologists), or local program/policy development and implementation related to trafficked NHP placement.

Standardized questionnaire and semi-structured interviews

The standardized questionnaire used in this study was developed using Qualtrics online survey development and administration software (Qualtrics, Provo, UT) and distributed via email. Paper copies were distributed for those with limited or no access to the internet. The questionnaire included both open-ended and closed questioning following the Knowledge, Attitudes, and Practices (KAP) survey method (Gumucio *et al.* 2011). Given the wide spectrum of potential participant involvement in NHP confiscation, rehabilitation, and release, and to avoid asking questions outside the realm of respondent experience, three questionnaire versions were created for: 1) wildlife rehabilitators; 2) veterinarians; and 3) government and NGO employees. Respondents were asked to identify which group aligned most closely with their role in NHP placement in order to determine which version they would receive.

Semi-structured interviews were also conducted in Lima, Puerto Maldonado, and via video conferencing or telephone for those who we were unable to interview in person. Interview questions were similar to those asked

in questionnaires but included more open-ended questions to allow for greater depth of data collection. Interviewees included people identified as important stakeholders in NHP confiscation, rehabilitation, and/or release. Questionnaire respondents were also asked if they would like to be interviewed as part of this study, and all who selected “yes” received follow-up from study personnel. Respondents were allowed to carry out the interview and complete the questionnaire, but their responses were combined and analyzed together to avoid bias in results towards those who did so. Themes covered in the questionnaire and interview included the respondent’s role and experience in trafficked NHP placement, protocols for NHPs during confiscation, rehabilitation, and/or release (depending on their role in NHP placement), and awareness of the IUCN guidelines (Table 1).

A summary of the *IUCN Guidelines for the Placement of Confiscated Animals* (IUCN 2002) was created with consideration of the *IUCN/SSC Re-Introduction Specialist Group: Guidelines for Nonhuman Primate Re-Introductions* (IUCN 2002; Box 1). This summary was used to introduce study participants to the general themes of the *IUCN Guidelines for the Placement of Confiscated Animals* in both the questionnaire and interviews as well as to guide study analysis. The study materials were based on the 2002 version of the *IUCN Guidelines for the Placement of Confiscated Animals* as the 2019 guidelines had not yet been

published (IUCN 2002, 2019). The general themes used for this study’s purpose remained the same in the updated version.

Questionnaires and interviews were created in English, translated to Spanish, and assessed for accurate translation (Patricia Mendoza and Raul Bello). Questionnaires and interviews were conducted in Spanish or English depending on respondent preference (Raul Bello and Siena Mitman). All interviews were recorded, transcribed, and translated to English when necessary prior to analysis (Siena Mitman).

Data analysis

Questionnaire respondents were asked to select the frequencies with which specific protocols were performed when NHPs arrived at their facility, prior to release, and during/after release. Responses were tallied and summed. Questionnaire and interview respondents were also asked for information regarding their quarantine, medical screening, genetic testing, and long-term monitoring practices. Reported protocols were compared to those recommended by the IUCN in the *IUCN Guidelines for the Placement of Confiscated Animals* and the *IUCN/SSC Re-Introduction Specialist Group: Guidelines for Nonhuman Primate Re-Introductions* (Baker 2002; IUCN 2002).

Responses to questions about the decision-making process for the placement of NHPs were coded into categories based on the seven summarized points from the

Table 1. Themes included in the three versions of standardized questionnaires and semi-structured interviews in this study. Respondents were asked to self-select which group most closely aligned with their role in NHP confiscation, rehabilitation, and release to determine which questionnaire or interview version they received: rehabilitators (R), wildlife veterinarians (WV), or governmental/NGO employees (G/NGO). An “X” indicates that the theme was included in the group’s questionnaire and semi-structured interviews.

Theme	R	WV	G/NGO
Study respondent’s role and experience in trafficked NHP placement	×	×	×
Protocols for NHP arrival	×	×	
Protocols prior to NHP release	×	×	
Protocols during and after NHP release	×	×	
Protocols for confiscation of trafficked NHPs			×
Considerations contributing to NHP placement (release, permanent captivity, or euthanasia)	×	×	×
Challenges to the placement of NHPs	×	×	×
General use of guidelines	×	×	×
Awareness of <i>IUCN Guidelines for the Placement of Confiscated Animals</i> (IUCN 2002)	×	×	×
Agreement with <i>IUCN Guidelines for the Placement of Confiscated Animals</i> (IUCN 2002)	×	×	×
Challenges facing implementation of these guidelines in Peru	×	×	×

IUCN Guidelines for the Placement of Confiscated Animals published (IUCN 2002, 2019): conservation status (included statements about whether the species was Vulnerable or Endangered), ability to monitor post-release, NHP health status, ability to return to site of origin, behavioral concerns (included statements about aggression, imprinting, foraging, predator awareness, and group dynamics), concern for stimulation of future illegal trade, and genetic considerations (Box 1). The sum of respondents that mentioned each consideration was then calculated.

Responses to questions about awareness of the IUCN guidelines were binary (aware or not aware) and summed for comparison. Responses to questions about challenges facing the use of the IUCN guidelines were coded based on common themes that emerged. Statements that included multiple themes were counted toward all themes mentioned (for example, responses about funding and government were scored in both categories). Frequencies of discussion of each theme were then calculated.

Results

Sample demographics

Over the course of the study, 12 people involved in trafficked NHP placement, rehabilitation, and/or release completed questionnaires. Interviews were also conducted with 12 people. As five people completed both the questionnaire and the interview, the study included insight from 19 people (Table 2). When asked to self-identify which facility they worked with/for, five respondents listed multiple facilities, and at least four facilities were represented by multiple respondents. Overall, 19 specific facilities, including rehabilitation centers, zoos, and NGOs, were mentioned by respondents (Table 2).

Themes in rehabilitation protocols

When asked where NHPs came from, respondents stated they were most often confiscated by the government or surrendered by people who had previously kept them as pets, confirming their origins from primarily situations of trafficking/illegal private ownership. Because respondents often shared information regarding all NHPs, whether confiscated in legal operations, abandoned, or surrendered to authorities or rescue centers, the data collected represents protocols used for all previously trafficked NHPs, not only those confiscated by legal authorities. The risks inherent in the eventual release of these NHPs and the IUCN decision-making framework are consistent (Baker 2002; IUCN 2002).

The reported fates of NHPs arriving at facilities varied and included release, permanent captivity, or transfer to other facilities for permanent captivity or rehabilitation and release. The majority of respondents (8/9, 89%) asked about what happens to NHPs that cannot be released or kept in permanent captivity stated that space at another rehabilitation center or zoo would be sought, although one respondent said that euthanasia often occurs in this

situation. Respondents rarely said that euthanasia was used, but most common considerations when making a euthanasia decision included medical necessity or suffering (mentioned by 15/17, 88%, of respondents that discussed euthanasia considerations), lack of adequate space or conditions or too many individuals of a species in a facility (7/17, 41%), other welfare concerns (5/17, 29%), dangerous/aggressive behaviors (2/17, 12%), and/or conservation status (2/17, 12%).

Overall, 11/19 (58%) study respondents reported working for facilities that currently or previously released NHPs, representing at least three rehabilitation centers (one respondent who reported working with facilities that released NHPs did not specify which facilities did so). Respondents who mentioned motives for release cited species conservation efforts, welfare concerns, and/or a desire to return NHPs to where they had lived prior to human interference. The main centers releasing NHPs primarily do so through conservation programs with the

Table 2. Summary of the characteristics of all (questionnaire and interview) study respondents and the facilities they reported working with/for. Five respondents stated they worked with/for multiple facilities, and multiple respondents worked with/for the same facility, thus the regions represented by respondents and facilities differ.

Respondent or Facility Characteristic	n (%)
Respondent role in NHP rehabilitation (N = 19 respondents)	
Veterinarian	11 (57.9%)
Rehabilitator	4 (21.1%)
NGO Employee	2 (10.5%)
Government Employee	2 (10.5%)
Regions represented by respondents (N = 19 respondents)	
Lambayeque	1 (5.3%)
Lima	5 (26.3%)
Loreto	3 (15.8%)
Madre de Dios	11 (57.9%)
Piura	1 (5.3%)
Facility types represented by respondents (N = 19 facilities)	
Rehabilitation centers	7 (36.8%)
Zoos	8 (42.1%)
Governmental agencies	1 (5.3%)
NGOs	1 (5.3%)
Research Stations	1 (5.3%)
Universities	1 (5.3%)
Regions represented by facilities (N = 19 facilities)	
Lambayeque	2 (10.5%)
Lima	6 (31.6%)
Loreto	6 (31.6%)
Madre de Dios	4 (21.1%)
Piura	1 (5.3%)

intent of supplementing populations of endangered NHP species. The majority of respondents that worked with zoos and in NGO/government capacities (8/9, 89%) did not report releasing NHPs. Those respondents who reported working for facilities that did not release NHPs said that release did not occur because of legal restrictions or a lack of ability to prepare appropriately.

When asked to select the frequencies with which certain knowledge was obtained or protocols completed during NHP arrival, rehabilitation, and release, questionnaire respondents that worked with NHPs upon arrival at rehabilitation centers and zoos reported that knowledge of NHPs' site of origin, prior location, health history, and other history items were uncommon, although NHPs were often placed in quarantine and evaluated for disease upon arrival (Table 3). Questionnaire respondents who worked at facilities releasing NHPs reported that health checks and behavioral observation were always completed prior to release, while other steps such as genetic testing and release at place of origin were reported less often (Table 3). Interview respondents were not asked to select specific frequencies of such knowledge and protocols but rather asked more broadly about practices at their facilities during NHP arrival, rehabilitation, and release. The general patterns expressed in the interviews were similar to those in the questionnaires. Overall, while protocols reported in both questionnaires and interviews for facilities that released NHPs included components of the IUCN recommendations, none adhered fully to the recommendations in the guidelines (Baker 2002; IUCN 2002).

When questionnaire and interview respondents from all rehabilitation centers were asked to discuss considerations when making decisions about the placement of NHPs, the majority of respondents mentioned health status (17/19, 89%) and behavior (15/19, 79%), while the ability to monitor post-release (4/19, 21%), genetics (4/19, 19.21%), conservation status (2/19, 11%), ability to return to site of origin (1/19, 5%), and concern for stimulation of illegal trade (1/19, 5%) were mentioned less often (Fig. 1).

Awareness of IUCN guidelines

When asked about their awareness of the *IUCN Guidelines for the Placement of Confiscated Animals* (IUCN 2002), 12/19 (68%) of respondents had no knowledge that these guidelines existed, but 16/19 (84%) of respondents reported using another form of guidelines in their work. After reading the summary of the *IUCN Guidelines for the Placement of Confiscated Animals* (Box 1), every respondent (19/19, 100%) stated they agreed with the guidelines, although 6/19 (32%) expressed disagreement with a specific part or parts of the guidelines. Topics of disagreement included the use of euthanasia in cases in which no other options are available (mentioned by 3/19, 16%, of respondents), that animals exhibiting behavioral abnormalities should not be released (2/19, 11%), that return to the wild will contribute to conservation (1/19, 5%), that

Table 3. Summary of frequencies of known information and protocols upon NHP arrival at rehabilitation centers, prior to NHP release, and during NHP release, as reported in questionnaires submitted by eight veterinarians and one wildlife rehabilitator in Peru.

Parameters Upon Arrival (N = 9 respondents)	n (%)
Knowledge of primate origin	
Always	--
Majority of the time	2(22.2%)
Approximately half of the time	--
Sometimes	2 (22.2%)
Never	5 (55.6%)
Knowledge of location prior to confiscation	
Always	--
Majority of the time	3 (33.3%)
Approximately half of the time	1 (11.1%)
Sometimes	5 (55.6%)
Never	--
Knowledge of time in captivity	
Always	--
Majority of the time	--
Approximately half of the time	1 (11.1%)
Sometimes	8 (88.9%)
Never	--
Knowledge of exposure to other animals	
Always	--
Majority of the time	--
Approximately half of the time	--
Sometimes	9 (100%)
Never	--
Knowledge of healthy history	
Always	--
Majority of the time	--
Approximately half of the time	--
Sometimes	5 (55.6%)
Never	4 (44.4%)
Placed in quarantine upon arrival	
Always	3 (33.3%)
Majority of the time	4 (44.4%)
Approximately half of the time	2 (22.2%)
Sometimes	--
Never	--
Evaluated for disease upon arrival	
Always	5 (55.6%)
Majority of the time	2 (22.2%)
Approximately half of the time	2 (22.2%)
Sometimes	--
Never	--

Table 3. Cont'd.

Parameters Prior to Release (N = 7 respondents)	
Health checks	
Always	7 (100%)
Majority of the time	--
Approximately half of the time	--
Sometimes	--
Never	--
Behavioral observation	
Always	7(100%)
Majority of the time	--
Approximately half of the time	--
Sometimes	--
Never	--
Genetic testing	
Always	--
Majority of the time	--
Approximately half of the time	--
Sometimes	2 (28.6%)
Never	5 (71.4%)
Taxon confirmation	
Always	3 (42.9%)
Majority of the time	--
Approximately half of the time	--
Sometimes	--
Never	4 (57.1%)
Conservation status considered	
Always	4 (57.1%)
Majority of the time	1 (14.3%)
Approximately half of the time	--
Sometimes	--
Never	2 (28.6%)
Parameters Upon Release (N = 7 respondents)	
Knowledge of existing disease in the wild	
Always	1 (14.3%)
Majority of the time	1 (14.3%)
Approximately half of the time	--
Sometimes	4 (57.1%)
Never	1 (14.3%)
Knowledge of genetic variation in wild populations	
Always	1 (14.3%)
Majority of the time	--
Approximately half of the time	--
Sometimes	3 (42.9%)
Never	3 (42.9%)

Table 3. Cont'd.

Released where came from ¹	
Always	--
Majority of the time	1 (20%)
Approximately half of the time	--
Sometimes	1 (20%)
Never	3 (60%)
Released inside native range	
Always	3 (42.9%)
Majority of the time	2 (28.6%)
Approximately half of the time	--
Sometimes	1 (14.3%)
Never	1 (14.3%)
Monitored post-release	
Always	4 (57.1%)
Majority of the time	1 (14.3%)
Approximately half of the time	1 (14.3%)
Sometimes	--
Never	1 (14.3%)
Funds reserved in the case of recapture	
Always	2 (28.6%)
Majority of the time	1 (14.3%)
Approximately half of the time	1 (14.3%)
Sometimes	2 (28.6%)
Never	1 (14.3%)

¹ Two participants responded N/A but answered the remaining questions.

post-release monitoring can be accomplished (1/19, 5%), that site of origin can be confirmed and the animal returned there (1/19, 5%), that release does not risk stimulation of illegal trade (1/19, 5%), and that genetic differences are understood and considered (1/19, 5%).

Challenges facing guideline implementation

The most common challenge to the implementation of the IUCN guidelines mentioned by study respondents was a lack of government support (mentioned by 11/19, 58%, of respondents), followed by a need for funding (9/19, 47%), public awareness (9/19, 47%), and trained personnel (7/19, 37%). Respondents also mentioned a need for realistic guideline adaptation (6/19, 32%), increased NHP research (5/19, 26%), access to health screening resources (5/19, 26%), and cooperation (4/19, 21%) amongst those involved in this work (Box 2).

Discussion

In this study, we identified a lack of awareness and use of the IUCN guidelines (Baker 2002; IUCN 2002) amongst those working with trafficked NHPs in Peru. While

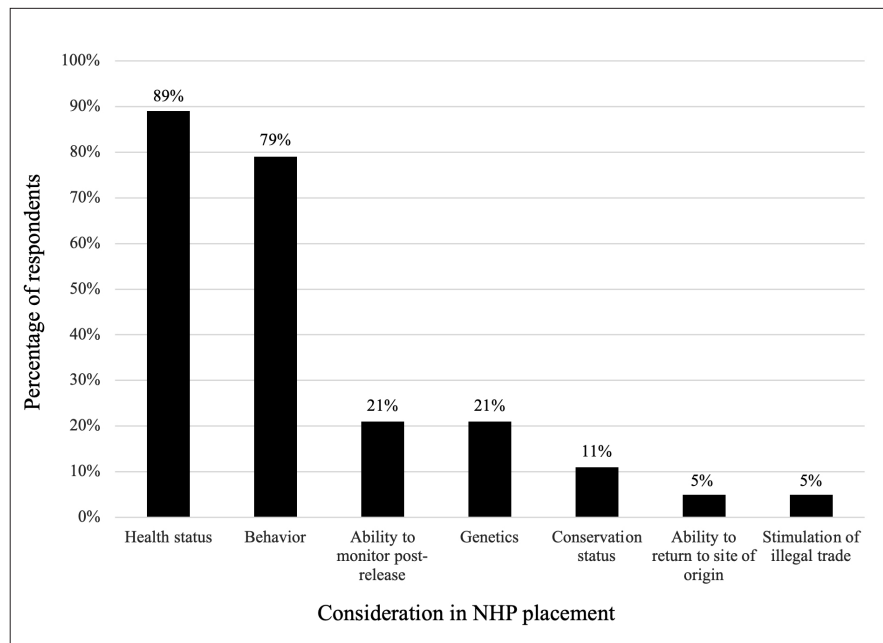


Figure 1. Frequencies of specific considerations mentioned by questionnaire and interview respondents when discussing their processes for making decisions regarding NHP release, euthanasia, or placement in permanent captivity (N = 19 respondents). “Health status” includes statements regarding general health/wellness of the NHP, disease screening, and other health assessments. “Behavior” includes statements about any NHP behavior that affects the decision-making process, including group dynamics or inappropriate social behaviors, such as dependency on humans, that would lower the chance of success in the wild or in permanent captivity. “Conservation status” includes statements regarding consideration of the current conservation status of the species whose placement is being considered (e.g., whether the species is considered threatened or not). “Ability to monitor post-release” includes statements regarding preparedness, sufficient personnel, and financial ability to perform follow-up and observation of released NHPs. “Genetics” includes statements regarding genetic testing and concerns about gene pool dilution if released into the wild. “Ability to return to site of origin” includes statements about unknown place of origin affecting the decision to release an NHP. “Stimulation of illegal trade” includes statements expressing concern NHPs may be hunted or re-captured if returned to the wild.

rehabilitation processes described by study participants varied, specific themes emerged. IUCN recommends collection of health history, completion of quarantine, and screening for infectious agents and other health problems upon NHP arrival at rehabilitation centers (Baker 2002). Failure to complete these steps introduces heightened risk to NHP rehabilitation projects (Guy *et al.* 2014). This study highlighted a common lack of information about NHP history upon arrival at rehabilitation centers, including place of origin, length of time in captivity, proximity to other animals, and health history. The absence of a history may result in the release of animals genetically unsuitable for a particular site of release, and animals previously exposed to infectious pathogens, and/or otherwise unfit to live in the wild (Guy *et al.* 2014). As those surrendering NHPs or having NHPs confiscated may be resistant or afraid to offer such details, especially to governmental authorities, an increased prioritization of the collection of such histories during confiscation or surrender could aid in this challenge. When a history is truly unavailable, a more robust genetic testing protocol would assist in identifying place of origin, allowing prioritization of screening for pathogens endemic to the area of origin and a return to the place of origin

upon release. Genetic analysis of wild NHP populations is necessary to effectively use this technology for determining captive NHP place of origin (Oklander *et al.* 2020). A comprehensive disease risk analysis, including assessment of those pathogens that are highest risk for the places of origin and species subject to reintroduction, would also minimize health risks. The lack of knowledge about time in captivity can additionally complicate the assessment of the degree of human imprinting and suitability for living in the wild, though this concern can be addressed with thorough behavioral observation, as described below.

The majority of respondents indicated that NHPs are quarantined and tested for infectious agents upon arrival at zoos or rehabilitation centers. Pathogens mentioned included those that cause tuberculosis, hepatitis, and herpes, all pathogens IUCN recommends testing for (Baker 2002), though no respondents reported consistent screening for all recommended infectious agents. Study participants mentioned the lack of a specific mandatory disease screening protocol, lack of access to reliable laboratories equipped to test for NHP pathogens, and lack of information about what diagnostics to prioritize when considering release into the wild as obstacles to thorough disease screening (Box 2).

Research efforts to identify infectious agents in NHPs have been limited and uneven in both NHP and pathogen studies. Current knowledge of pathogens, including arthropods, bacteria, fungi, protozoa, and viruses, in even the most well-studied NHPs, still miss an estimated 38–79% of diversity (Cooper and Nunn 2013). That the majority of study respondents reported minimal knowledge of the existing pathogens in wild Peruvian NHP populations reflects this reality. This lack of information about existing pathogens in local wild NHP populations complicates stakeholders' abilities to determine appropriate testing protocols. These factors demonstrate a need for NHP pathogen surveillance in the region and consequent specification of quarantine and disease screening protocols.

The lack of genetic testing and consistent taxon confirmation identified in this study is another risk factor for the conservation of species due to the potential for gene pool dilution or accidental introduction of inappropriate species into new regions (Baker 2002; IUCN 2002; Guy *et al.* 2014). Recent work in Argentina on genetic testing of black-and-gold howler monkeys (*Alouatta caraya*) and the creation of a genotype reference database highlight the utility of such research for not only identifying illegal capture hotspots but also guiding reintroduction locations (Oklander *et al.* 2020). In Peru, the return of trafficked NHPs to their specific site of origin is often not possible because it is unknown, a context in which genetic analysis could be helpful, as described above (Oklander *et al.* 2020). The current scarcity of genetic testing is unsurprising, however, as most respondents reported a lack of knowledge of the genetic variety that exists in the wild. Current information about genetic variation in Peruvian NHP species and populations is minimal, and what does exist is unclear, making it difficult to determine what genetic testing is required. For example, there has been historical confusion regarding red howler monkey (*Alouatta*) taxonomy and conflicting reports of the species and subspecies that exist in the country (Ruiz-García *et al.* 2016). While several respondents mentioned plans for future genetic testing of howler monkeys, many also stated that genetic testing was not feasible given the lack of options for laboratories to analyze genetic samples. Although capability for genetic analysis exists globally, cost and accessibility currently limit its use for Peruvian NHPs, and there is room for expansion of such work in the country.

Behaviors such as dependency on humans and group dynamics were commonly reported considerations in the placement of NHPs in Peru. Offering enrichment, forming compatible groups, identifying habituation or stereotypies, and providing natural foods that encourage foraging behavior are all implicated in the ultimate success of NHP release projects, at both individual and population levels (Clarke *et al.* 1992; de Veer and van den Bos 2000; Baker 2002; Mason *et al.* 2007; Cheyne *et al.* 2012; Guy *et al.* 2012, 2014; Schwartz *et al.* 2016). Minimizing human contact and providing predator awareness training during preparation for release are critical steps to minimize risks (Baker 2002;

Guy *et al.* 2014). Respondents in this study mentioned assessment of traits such as habituation to or dependency on humans, stereotypies, group dynamics, aggression, and unnatural behaviors. The majority of respondents mentioned the challenges that arise with achieving successful NHP group dynamics and/or dealing with NHPs imprinted on humans. Several respondents identified concerns such as a lack of predator avoidance preparation or a lack of facilities to sufficiently separate NHPs from human contact prior to release. While predator avoidance training may not be necessary for NHPs in captivity for a short period of time and may occur naturally for NHPs housed in the release area or a similar environment, it is important for those that live in captivity for a long time and/or are captured when very young (Guy *et al.* 2012, 2014; Schwartz *et al.* 2016), and some centers choose to do such training regardless. More specific protocols for behavioral assessment were not reviewed as part of this project and warrant further exploration given their importance in NHP release project success.

Post-release monitoring was not always reported in this study but is critical for determining success rates of reintroduction projects, the impacts on wild NHP populations and ecosystems, and future rehabilitation and release protocols (Baker 2002; IUCN 2002; Guy *et al.* 2014). Reported post-release monitoring varied in length of time monitored (from six days to years) and in method (visual observation, camera traps, and radio-collars). Several respondents who reported such monitoring also described its utility in responding to circumstances such as released NHP injury, group dispersal, or NHP return to the rehabilitation site. Post-release monitoring of reintroduced spider monkeys (*Ateles chamek*) in the southern Peruvian Amazon has yielded valuable information regarding release success, allowed intervention and recapture when necessary to ensure individual and group survival, and identified important areas of future focus to protect reintroduced populations (Bello *et al.* 2018; Carrasco-Rueda and Bello 2019). Consistent post-release monitoring for any rehabilitation and release program in the country would better elucidate the effects released NHPs have on their ecosystems and guide future rehabilitation and release projects in the country.

Several themes from the respondents' discussions of considerations for trafficked NHP placement were consistent with those highlighted by IUCN (Baker 2002; IUCN 2002). Most notably, 89% of respondents said that health concerns were considered, and no respondent expressed disagreement with the IUCN guidelines' emphasis on thorough disease screening prior to release. Additionally, 79% of respondents mentioned the importance of assessing group and individual behavior prior to releasing NHPs. The lack of adherence to the IUCN guidelines does not reflect, therefore, a lack of knowledge of the health and behavior risks associated with release nor a lack of emphasis placed on these concerns by those working with trafficked NHPs. Conservation status, ability to monitor post-release,

Box 2. Examples of questionnaire and interview quotes about challenges to IUCN guideline (IUCN 2002) use in the rehabilitation and release of trafficked NHPs in Peru expressed by 19 people involved in NHP confiscation, rehabilitation, and/or release in the country. Statements about multiple themes were counted toward all themes mentioned (e.g., responses about funding and government were scored in both categories).

<p>Government (n = 11): <i>Statements about the government/authorities, including a need for more support and/or efficiency</i></p> <ul style="list-style-type: none"> • “I think that the worst thing is the indifference of the government, that they don’t give us help. We need more tools to do the work better.” • “I think they are working in Peru with some guidelines for other locations, but in general, I think it would be good if the government was well-rounded, in the sense that, it bothers a lot with [...] things that are very difficult to achieve.” • “But the government do[es] need to get more involved [...] if there is a wild animal as a pet, confiscating [it] and trying to ensure that people know that they shouldn’t have them.” • “The decisions of the state do not coincide with what is recommended, there are professionals in Peru who release without protocols [...] and that must start with a leader or institution that orders it or imposes sanctions.” • “The delay of the release and study permits on the part of the [governmental] entities [is a challenge].”
<p>Funding (n = 9): <i>Statements about a lack of finances and/or resources</i></p> <ul style="list-style-type: none"> • “I think it is mainly economic, because it is expensive, the radio-collars, or satellites, super expensive.” • “The main problem is getting the money to do the tests prior to release.” • “Sometimes they don’t receive the funding, so they cannot do everything that should be done. So, they try to do the best with what they have, but if you don’t have the resources to do all the genetic tests, for example, in addition to the virology tests [...] there would definitely [be] more things that you could look at.”
<p>Public Awareness (n = 8): <i>Statements about a need for increased education and/or awareness in the general public</i></p> <ul style="list-style-type: none"> • “More awareness, because I believe that with an informed population, we are not going to have more confiscation.” • “Well, it is not just work [on] the end of the problem, it is work [on] the beginning [...] when the animal is taken. So, if we work more [on] the education of people [so they] don’t take the animals, we don’t have to spend much money in releasing the animals [...] the people must be more focused [on] [...] prevention than [on] release.” • “It is not only a problem of awareness here in Peru. I have seen how the tourists act, people who come from other places [...] they also do not know [...] and, well, because of this, we should also try to make them a little aware.”
<p>Trained Personnel (n = 7): <i>Statements about a need for more experienced people and/or training for those working in the field of primate confiscation, rehabilitation, and release</i></p> <ul style="list-style-type: none"> • “The centers are not necessarily experts or people who [...] come from veterinary background, or biology [...] so they might be people who got involved in these activities but [did] not necessarily [have] the preparation before, and even if they are biologists or vets, they might come from different backgrounds [...] so there is definitely a lack of preparation for staff members.” • “The challenge is, then, I believe, to have adequate professionals for working with primates and with all the fauna that are in the center [...] people with experience [...] It is important.” • “There [are] no staff [that] know where to go, weeks and weeks following monkeys [...] There are not people for [that].” • “I think the association that provides those guidelines, it would be interesting if they collaborate[d] with the local authorities to provide education to the staff members to make sure everyone understands the importance of the guidelines, and also [...] [found] a way to get all the tests and the resources that are necessary to follow them.”
<p>Realistic Adaptation (n = 6): <i>Statements about a need for adaptation to species, regional, or center-specific realities</i></p> <ul style="list-style-type: none"> • “It would also be good to consider recommendations from people working in the field, and also be very flexible with the reality of each center and each place.” • “I think it is good to have some gold standard that ideally we should follow, but [...] you have to look actually at the reality, so neither of the centers, I think, had the facilities or the funds to [completely] follow [...] those guidelines [...] I think they should adapt to the realities of the center.” • “Have to experience in real life, might not work in practice.” • “They ought to be adapted to the reality of each country.”

Box 2. Cont'd.

<p>Increased Research (n = 5): <i>Statements about a need for increased research efforts focused on wild or captive NHPs and ecosystems of release sites</i></p> <ul style="list-style-type: none"> • “It [...] [would be] very cool if we knew more about the ecosystems where we are going to release them... and maybe we can evaluate the population [...] in that place and look [at] what kind of diseases they have or [...] the capacity[...] if this place is able to have many monkeys, for example [...] to study the environment or the place that we are going to release them and know if this is good for that place, because it is not just one animal. We are talking about a population of animals.” • “[There is] not enough known about evaluating health.” • “There are not studies of distribution, publications of studies that support release [...] lack of spatial distribution studies of species that they want to release [...] they do not have thorough studies of the release areas.” • “[There is] a lack of interest in forming a study team that trains and forms a discipline for the improvement of conservation of wildlife, completing censuses of the majority of species.” • “But for this we also need to see what there is in the wild [...] how can you release something when you do not know what’s out there?”
<p>Access to Disease Screening Resources (n = 5): <i>Statements about lack of availability of and information regarding health testing (does not include lack of access due to lack of research)</i></p> <ul style="list-style-type: none"> • “And technology [...] many tests cannot be done [...] and sometimes we use [human] laboratories, but the specific laboratories for animals are very small in terms of what you can do. The kits do not reach Peru either [...] it was very difficult to get them, and they do not come to Peru as there is not much demand.” • “[There is a lack of a] laboratory that gives us a diagnosis that is accurate and is not centralized and has specific diagnostic tests for wildlife.” • “To have easier access to the analyses and to define which to do in what species.” • “We wanted [...] to [do health testing] for ourselves, but it was difficult to find where [...] that is the theme [...] and there is no longer this kit to do the tuberculosis test [...] things get more complicated, right?”
<p>Cooperation (n = 4): <i>Statements about a need for collaboration and sharing of information, experiences, and resources</i></p> <ul style="list-style-type: none"> • “It could be a way to create an association between rescue centers, [a] kind of connection of knowledge, and sharing knowledge, and sharing protocols, and difficulties and funds [...] more cooperation would probably help to get more standardized work.” • “Normally, what they share is the nice stuff [...] And they do not share, ‘oh, it did not work for this [reason].’ So, those of us who work on this do not know why. These bad experiences help the rest do what they can. You have to fix this, you have to improve this, consider this. It would be nice if, in some way, there was someone who could collect these experiences [...] and put something out and publish it.” • “I believe [...] that [...] providing opportunities to work together with different centers would improve our work a lot.” • “I think this should be done from the authorities and cooperation between local authorities and international associations, or creating a community between the different rescue centers, and also different centers from different countries, so they can share experiences, and they can [...] split costs and get [...] funding.”

concerns about illegal trade stimulation, ability to return to site of origin, and genetic considerations were all mentioned by fewer than 30% of respondents, although the majority of respondents agreed with their importance after reading the summary of the IUCN guidelines (Box 1). Future guideline compliance efforts should focus on how emphasis can be placed on the importance of these factors in determining the appropriateness of individual NHP release.

Most respondents were unaware of the existence of the *IUCN Guidelines for the Placement of Confiscated Animals* (IUCN 2002). This lack of familiarity with the IUCN guidelines, however, is not due to a general disuse of guidelines, as the majority of respondents reported the use of some type of guidelines, IUCN or other, in their work. Those who were unfamiliar with the IUCN guidelines but reported using similar criteria in their work often adhered to similar published or informal guidelines and/or to national guidelines based on the IUCN criteria. The majority

of respondents agreed with the principles of the IUCN guidelines after reading their summary, suggesting these guidelines could be more broadly implemented if obstacles to their use are addressed.

Understanding the factors that impede IUCN guideline compliance could help policy makers develop more effective guidelines, implementation strategies, and support for those working with trafficked NHPs. The most commonly mentioned challenge to the implementation of guidelines such as the *IUCN Guideline for the Placement of Confiscated Animals* (IUCN 2002) was the need for more effective involvement by and support from the government. Concerns about the government included a lack of the following: collaboration and interest in NHP rehabilitation and release, enforcement of existing anti-trafficking laws, standardized NHP rehabilitation training and protocols, and financial support for facilities working with trafficked NHPs. There is a need for more effective government enforcement

and public education of wildlife trade laws, collaboration with rehabilitation centers, and creation of standardized confiscated and abandoned NHP placement guidelines. Several participants also mentioned that legislative delay and obstacles during permitting processes hindered their work. Local authorities often lack tools to act effectively in situations of wildlife trafficking. Previous hostility, risks involved in wildlife handling, and low priority given to wildlife trafficking contribute to the reluctance of authorities to intervene in such cases, contributing to a lack of sanctions imposed for trafficking offenses (Daut *et al.* 2015; Shanee *et al.* 2017). Similar factors, as well as a need for more appropriately trained personnel, may contribute to the reported lack of effective government involvement in the rehabilitation and release of trafficked NHPs in Peru.

The need for increased funding and greater awareness in the general public about conservation and wildlife trafficking were challenges mentioned with the second and third highest frequencies, highlighting that government could increase their support of NHP rehabilitation and release through the allocation of funds and public awareness campaigns. Peruvian NGOs have played a significant role in decreasing wildlife pet trade in the country, and cooperation between NGOs and government officials could be useful in effecting further change (Daut *et al.* 2015). One interview respondent shared that communication with local community members about animal releases and encouragement to report released animal sightings were beneficial for released animal survival. A continued focus on such collaborative efforts could also lessen the burden on government officials in community confiscations, making guideline compliance more feasible. The respondents' focus on public awareness also highlighted the multi-dimensional approach required for successful NHP conservation and rehabilitation and release projects, with participation and collaboration required from the government, those involved in rehabilitation and release, and the broader community.

The need to adapt guidelines to the realities of the field was another commonly discussed challenge to guideline implementation. Specificity is difficult to accomplish with the use of international guidelines written to apply to diverse species, locations, and circumstances. In fact, IUCN acknowledges this in their guidelines and recommends adaptation to specific species and regional contexts (Baker 2002; IUCN 2002). Some efforts have been made in other contexts to create NHP species-specific protocols (Cheyne *et al.*, 2011; Guy and Curnoe 2013). There has also been guideline adaptation in Peru for wildlife in general. The Ministerio de Desarrollo Agrario y Riego (MINAGRI) provides the legal framework for working with confiscated or abandoned animals in *Lineamientos Técnicos para las Disposición de Fauna Silvestre Viva Decomisada o Hallada en Abandono* (Peru, MINAGRI 2012), while *Guía: Manejo de Animales Silvestres Decomisados o Hallados en Abandono* (Mendoza *et al.* 2017) and *Guía: Identificación y Cuidados Iniciales de Animales Silvestres Decomisados o Hallados*

en Abandono (Murillo *et al.* 2016) provide guidance on working with and caring for these animals. While these efforts include many of the same general recommendations presented in the IUCN guidelines, none are specific to NHPs.

Since the completion of this study, the Servicio Nacional Forestal y de Fauna Silvestre (SERFOR) has released the *Plan Nacional de Conservación de los Primates Amenazados del Perú, Periodo 2019–2029*, creating national objectives for protecting threatened NHPs in Peru. Goals include identifying regions of heightened human-animal conflict and their causes, creating a “Studbook” of captive threatened NHPs, increasing research on the taxonomy, distribution, abundance, and diseases of wild threatened species, and establishing rehabilitation centers in regions with high demand given proximity to hunting, capture, and illegal trade routes (Peru, SERFOR 2019b). SERFOR has also begun working on translocation guidelines specific to NHPs, though they have yet to be approved and published. To date, no guidelines specific to the translocation, rehabilitation, or release of NHPs exist in Peru. The frequency with which respondents mentioned the need to adapt guidelines to specific realities highlights the urgent need for such work. The creation of specific and realistic guidelines for those working with NHPs in Peru during confiscations, rehabilitation, and/or release necessitates learning from those in the field and incorporating their knowledge in the development of future national guidelines. Without insight from those who directly experience the challenges of trafficked NHP placement, future guideline feasibility in Peru could be difficult.

The study's respondents also discussed the need for more communication between those working with NHPs, increased research in the field, access to and information about disease screening protocols, and adequately trained personnel. Taken together, these challenges represent the need not only for more information but also for dissemination of this information. Consistent with this idea, many of those interviewed mentioned their use of experience and learning from others when developing protocols for NHP rehabilitation and release. There may therefore be an opportunity for a platform that facilitates increased cooperation and knowledge-sharing among those involved in this work.

Such platforms exist on an international scale in other parts of the world where NHPs are rehabilitated and released. For example, the Pan-African Sanctuary Alliance (PASA) was developed to share best practices and connect sanctuaries working with rehabilitated NHPs in Africa (PASA n.d.). PASA has positively contributed to conservation efforts throughout the continent, producing beneficial social, economic, and environmental impacts (Ferrie *et al.* 2014). The Orangutan Veterinary Advisory Group (OVAG 2020) has recently expanded to include gibbons and siamangs and fills a similar role in Southeast Asia (OVAG 2020). Several organizations in Peru, including Neotropical Primate Conservation (NPC n.d.), the Wildlife

Conservation Society (WCS Peru 2019), and the Asociación Peruana de Primatología (APP 2019), work to increase access to information amongst those working with NHPs in Peru, and NPC has one additional branch in Colombia, but no such network exists on a broader, multinational scale (APP 2019; WCS Peru 2019; NPC n.d.). Expansion of studies such as this one in Peru and surrounding countries would aid in further determining need for such a platform.

This study had several important limitations. The small sample size, particularly for NGO and government employees involved in NHP confiscations, is not representative of the entire population of people working with trafficked NHPs in Peru. Government employees may have been unable to respond during the course of this study given professional constraints. The lack of representation of government employees led to a lack of data surrounding the decision-making process for those who interact with confiscated NHPs prior to their arrival at zoos or rehabilitation centers. We were also unable to compare responses of participants in different roles of NHP confiscation, rehabilitation, and release because of the small sample size for each role. The majority of questionnaire and interview respondents were veterinarians. While this reflects the frequent participation of veterinarians on NHP rehabilitation and release teams, this over-representation may have affected the awareness of, and agreement with, the need for health screening and other protocols. The majority of respondents also worked with/for facilities in Madre de Dios: while this geographic bias is in part because much of this work is done in this region, it is not representative of the entire population of people working with trafficked NHPs (Peru, SERFOR 2019a). Certain rehabilitation centers were also represented more often than others by study respondents, and several respondents answered questionnaires based on experience at multiple facilities, making it difficult to determine specific protocols for each setting. As all protocols and challenges were self-reported, there was the potential for inaccurate recall, as respondents may have forgotten or misreported specific protocol details. Information about specific facility practices included in this study are thus descriptive in nature and meant to provide a general picture of the practices surrounding trafficked NHP rehabilitation and release in Peru. More specific practices would be better determined through rigorous review of facility protocols and records, which was beyond the scope of this study. Regardless, the results presented here provide a strong foundation for future evaluation of the use and awareness of the IUCN guidelines in specific contexts and areas for improvement in their local implementation.

Conclusions

In this study, we identified a lack of awareness and use of the *IUCN Guidelines for the Placement of Confiscated Animals* (IUCN 2002) among those working with trafficked NHPs in Peru. While most respondents working in NHP

confiscation, rehabilitation, and release generally agreed with the guidelines, there is a need for more effective government involvement, the development of regionally specific protocols, and a platform for increasing cooperation and access to information, research, and training to maximize guideline use. A focus on addressing these challenges could increase future guideline compliance and minimize potential negative consequences associated with trafficked NHP release in Peru.

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Literature Cited

- APP. 2019. Asociación Peruana de Primatología (APP), Lima, Peru. URL: <<http://www.mono.pe/asociacion-acuten-peruana-deprimatologiacutea.html>>. Accessed: 21 Feb 2021.
- Aquino Y., R., F. M. Cornejo, F. Encarnación, E. W. Heymann, L. K. Marsh, R. A. Mittermeier, A. B. Rylands and J. Vermeer. 2015. *Primates del Perú. Guía de Identificación de Bolsillo*. Tropical Pocket Guide Series, Series, Conservation International, Arlington, VA.
- Aysanoa, E., P. Mayor, A. P. Mendoza, C. M. Zariquiey, E. A. Morales, J. G. Pérez, M. Bowler, J. A. Ventocilla, C. González, G. C. Baldeviano and A. G. Lescano. 2017. Molecular epidemiology of trypanosomatids and *Trypanosoma cruzi* in primates from Peru. *Ecohealth* 14(4): 732–742.
- Baker, L. R. 2002. IUCN/SSC Re-Introduction Specialist Group: Guidelines for Nonhuman Primate Re-introductions. *Re-introduction News* 21: 1–32.
- Bello, R., F. Rosemberg, S. Timson, S. and W. Escate. 2018. Importancia del monitoreo postliberación de monos araña (*Ateles chamek*) reintroducidos en el sureste de la Amazonia peruana. In: *La Primatología en América Latina. Tomo II. Costa Rica-Venezuela*, B. Urbani, M. Kowaleski, R. Cunha, S. de la Torre and L. Cortés-Ortiz (eds.), pp.625–639. Ediciones IVIC, Instituto Venezolano de Investigaciones Científicas (IVIC), Caracas, Venezuela.

- Campera, M., E. Brown, M. A. Imron and K. A.-I. Nekaris. 2020. Unmonitored releases of small animals? The importance of considering natural dispersal, health, and human habituation when releasing a territorial mammal threatened by wildlife trade. *Biol. Conserv.* 242: 108404.
- Carrasco-Rueda, F. and R. Bello. 2019. Demographic dynamics of Peruvian black-faced spider monkeys (*Ateles chemek*) reintroduced in the Peruvian Amazon. *Neotrop. Primates* 25(1): 1–10.
- Cheyne, S. M., C. O. Campbell and K. L. Payne. 2011. Proposed guidelines for *in situ* gibbon rescue, rehabilitation and reintroduction. *Int. Zoo Yearb.* 46(1): 265–281.
- Clarke, M. R. and D. J. Mayeaux. 1992. Aggressive and affiliative behavior in green monkeys with differing housing complexity. *Aggress. Behav.* 18(3): 231–239.
- Cooper, N. and C. L. Nunn. 2013. Identifying future zoonotic disease threats: where are the gaps in our understanding of primate infectious diseases? *Evol. Med. Public Health* 1: 27–36.
- Costa, É. A., M. M. Luppi, M. de C. C. Malta, A. P. M. F. Luiz, M. R. de Araujo, F. M. Coelho, F. G. da Fonseca, R. Ecco and M. Resende. 2011. Outbreak of Human Herpesvirus Type 1 infection in nonhuman primates (*Callithrix penicillata*). *J. Wildl. Dis.* 47(3): 690–693.
- Cowlshaw, G. and R. Dunbar. 2000. *Primate Conservation Biology*. The University of Chicago Press, Chicago, IL.
- Daut, E. F., D. J. Brightsmith and M. J. Peterson. 2015. Role of non-governmental organizations in combating illegal-wildlife pet trade in Peru. *J. Nat. Conserv.* 24: 72–82.
- Deem, S. L., W. B. Karesh and W. Weisman. 2001. Putting theory into practice: wildlife health in conservation. *Conserv. Biol.* 15(5): 1224–1233.
- Favoretto, S. R. *et al.* 2019. Zika Virus in peridomestic Neotropical primates, Northeast Brazil. *Ecohealth* 16(1): 61–69.
- Ferrie, G. M., K. H. Farmer, C. W. Kuhar, A. P. Grand, J. Sherman and T. L. Bettinger. 2014. The social, economic, and environmental contributions of Pan African Sanctuary Alliance primate sanctuaries in Africa. *Biodiv. Conserv.* 23: 187–201.
- Fischer, J. and D. B. Lindenmayer. 2000. An assessment of the published results of animal relocations. *Biol. Conserv.* 96(1): 1–11.
- Gao, F. *et al.* 1999. Origin of HIV-1 in the chimpanzee *Pan troglodytes troglodytes*. *Nature* 397: 436–441.
- Gherzi, B. M., H. Jia, P. Aiweesakun, A. Katzourakis, P. Mendoza, D. G. Bausch, M. R. Kasper, J. M. Montgomery and W. M. Switzer. 2015. Wide distribution and ancient evolutionary history of simian foamy viruses in New World primates. *Retrovirology* 12: 89.
- Gumucio, S. *et al.* 2011. *Data Collection. Quantitative methods: the KAP survey model (Knowledge, Attitudes & Practice)*. IGC Communigraphie. Sainte Etienne, France.
- Guy, A. J., and D. Curnoe. 2013. Guidelines for the Rehabilitation and Release of Vervet Monkeys. *Primate Conserv.* (27): 55–63.
- Guy, A. J., O. M. L. Stone and D. Curnoe. 2012. Assessment of the release of rehabilitated vervet monkeys into the Ntendeka Wilderness Area, KwaZulu-Natal, South Africa: a case study. *Primates* 53(2): 171–179.
- Guy, A. J., D. Curnoe, D. and P. B. Banks. 2014. Welfare based primate rehabilitation as a potential conservation strategy: does it measure up? *Primates* 55(1): 139–147.
- Hirsch, V. M., R. A. Olmsted, M. Murphey-Corb, R. H. Purcell and P. R. Johnson. 1989. An African primate lentivirus (SIVsm) closely related to HIV-2. *Nature, Lond.* 339: 389–392.
- IUCN. 2002. *IUCN Guidelines for the Placement of Confiscated Animals*. IUCN, Gland, Switzerland.
- IUCN. 2019. *Guidelines for the Management of Confiscated, Live Organisms*. N. Maddison, (ed.). IUCN, Gland, Switzerland.
- Karesh, W. B., R. A. Cook, E. L. Bennett and J. Newcomb. 2005. Wildlife trade and global disease emergence. *Emerg. Infect. Dis.* 11(7): 1000–1002.
- Kumar, R., S. Radhakrishna and A. Sinha. 2011. Of Least Concern? Range extension by rhesus macaques (*Macaca mulatta*) threatens long-term survival of bonnet macaques (*M. radiata*) in peninsular India. *Int. J. Primatol.* 32: 945–959.
- Mason, G., R. Clubb, N. Latham and S. Vickery. 2007. Why and how should we use environmental enrichment to tackle stereotypic behaviour. *Appl. Anim. Behav. Sci.* 102(3–4): 163–188.
- Mätz-Rensing, K., K. D. Jentsch, S. Rensing, S. Langenhuyzen, E. Verschoor, H. Niphuis and F. J. Kaup. 2003. Fatal Herpes Simplex infection in a group of common marmosets (*Callithrix jacchus*). *Vet. Pathol.* 40(4): 405–411.
- Melin, A. D., M. C. Janiak, F. Marrone, P. S. Arora and J. P. Higham. 2020. Comparative ACE2 variation and primate CoVID-19 risk. Preprint *bioRxiv* 2020.04.09.034967.
- Mendoza, P., Y. Murillo, R. Piana, M. De la Puente, J. Gálvez-Durand. 2017. *Guía: Manejo de Animales Silvestres Decomisados o Hallados en Abandono*. 3a edición. Wildlife Conservation Society (WCS) and Servicio Nacional Forestal y de Fauna Silvestre (SERFOR) del Ministerio de Agricultura y Riego del Perú (MINAGRI). Lima, Perú. URL: <<https://www.serfor.gob.pe/portal/wp-content/uploads/2018/11/Guia-de-manejo-de-fauna-silvestre-2017.pdf>>. Accessed: 22 May 2021.
- Murillo, Y., P. Mendoza, R. Piana, M. De la Puente, J. Gálvez-Durand and R. Vento. 2016. *Guía: Identificación y Cuidados Iniciales de Animales Silvestres Decomisados o Hallados en Abandono*. Segunda edición. Wildlife

- Conservation Society (WCS) and Servicio Nacional Forestal y de Fauna Silvestre (SERFOR) del Ministerio de Agricultura y Riego del Perú (MINAGRI). Lima, Perú. URL: <<https://www.serfor.gob.pe/portal/wp-content/uploads/2016/08/Guia-de-identificacion-final12ago.pdf>>. Accessed: 22 May 2020.
- NPC. n.d. Neotropical Primate Conservation. URL: <<https://neoprimate.org/tag/npc/>>. Accessed: 22 May 2020.
- Oklander, L. I., M. Caputo, A. Solari and D. Corach. 2020. Genetic assignment of illegally trafficked neotropical primates and implications for reintroduction programs. *Sci. Rep.* 10: 3676.
- OVAG. 2020. Orangutan Veterinary Advisory Group (OVAG). URL: <<https://www.ovag.org/>>. Accessed: 22 May 2020.
- PASA. n.d. Pan African Sanctuary Alliance (PASA), Portland, OR. URL: <<https://pasa.org/>>. Accessed: 22 May 2020.
- Pedersen, A. B. and T. J. Davies. 2009. Cross-species pathogen transmission and disease emergence in primates. *Ecohealth* 6(4): 496–508.
- Peru, MINAGRI. 2012. *Lineamientos Técnicos para la Disposición de Especímenes Vivos de Fauna Silvestre Decomisada o Hallado en Abandono. Resolución Ministerial N° 0361-2012-AG, de 27 de septiembre de 2012.* Ministerio de Agricultura y Riego (MINAGRI) de la República del Perú. URL: <http://minagri.gob.pe/portal/download/pdf/marcolegal/normaslegales/resolucionesministeriales/2012/setiembre/lineam_rm_361-2012.pdf>.
- Peru, MINAGRI. 2015. *Decreto Supremo que Aprueba el Reglamento para la Gestión de Fauna Silvestre. Decreto Supremo N° 019-2015-MINAGRI, de 29 de septiembre de 2015.* Ministerio de Agricultura y Riego (MINAGRI) de la República del Perú. URL: <<https://www.minagri.gob.pe/portal/decreto-supremo/ds-2015/13918-decreto-supremo-n-019-2015-minagri#:~:text=Decreto%20Supremo%20que%20aprueba%20el%20Reglamento%20para%20la%20Gesti%C3%B3n%20de%20Fauna%20Silvestre>>.
- Peru, SERFOR. 2019a. *Situación Actual de los Especímenes de Fauna Silvestre Mantenidos en Cautiverio a Nivel Nacional. Informe Técnico N° 1137-2019-MINAGRI-SERFOR/DGGSPFFS-DGSPFS, de 30 de diciembre de 2019.* Servicio Forestal y de Fauna Silvestre (SERFOR), Perú.
- Peru, SERFOR. 2019b. *Plan Nacional de Conservación de los Primates Amenazados del Perú 2019–2029. Resolución de Dirección Ejecutiva N° 237-2019-MINAGRI-SERFOR-DE, de 12 de noviembre de 2019.* Servicio Forestal y de Fauna Silvestre (SERFOR), Perú. URL: <<https://sinia.minam.gob.pe/normas/aprueban-plan-nacional-conservacion-primates-amenazados-peru-periodo-2019>>.
- Rosenbaum, M. *et al.* 2015. Detection of *Mycobacterium tuberculosis* complex in New World monkeys in Peru. *Ecohealth* 12(2): 288–297.
- Ruiz-García, M., A. Cerón, M. Pinedo and G. A. Gutiérrez-Espeleta. 2016. Which howler monkey (*Alouatta*, Atelidae, Primates) taxa is living in the Peruvian Madre de Dios River basin (southern Peru)? Results from mitochondrial gene analyses and some insights in the phylogeny of *Alouatta*. In: *Phylogeny, Molecular Population Genetics, Evolutionary Biology and Conservation of the Neotropical Primates*, M. Ruiz-García and J. M. Shostell (eds.), pp.395–434. Nova Science, New York.
- Schwartz, J. W., M. E. Hopkins and S. L. Hopkins. 2016. Group prerelease training yields positive rehabilitation outcomes among juvenile mantled howlers (*Alouatta palliata*). *Int. J. Primatol.* 37(2): 260–280.
- Shanee, N., A. P. Mendoza, and S. Shanee. 2017. Diagnostic overview of the illegal trade in primates and law enforcement in Peru. *Am. J. Primatol.* 79(11): e22516.
- Shanee, S., N. Shanee, N. Campbell and N. Allgas. 2014. Biogeography and conservation of Andean primates in Peru. In: *High Altitude Primates*, S. Gursky-Doyen and A. Krzton and N. Grow (eds.), pp.63–83. Springer, New York.
- Tarara, R., M. A. Suleman, R. Sapolsky, M. J. Wabomba and J. G. Else. 1985. Tuberculosis in wild olive baboons, *Papio cynocephalus anubis* (Lesson), in Kenya. *J. Wildl. Dis.* 21(2): 137–140.
- Terzian, A. C. B. *et al.* 2018. Evidence of natural Zika virus infection in Neotropical non-human primates in Brazil. *Sci. Rep.* 8(1): 1–15.
- Tricone, F. 2018. Assessment of releases of translocated and rehabilitated Yucatán black howler monkeys (*Alouatta pigra*) in Belize to determine factors influencing survivorship. *Primates* 59(1): 69–77.
- Vasilakis, N., J. Cardosa, K. A. Hanley, E. C. Holmes and S. C. Weaver. 2011. Fever from the forest: prospects for the continued emergence of Sylvatic Dengue virus and its impact on public health. *Nat. Rev. Microbiol.* 9(7): 532–541.
- de Veer, M. W. and R. van den Bos. 2000. Assessing the quality of relationships in rehabilitating lar gibbons (*Hylobates lar*). *Anim. Welfare* 9(2): 223–224.
- Wolfe, N. D., C. P. Dunavan and J. Diamond. 2007. Origins of major human infectious diseases. *Nature, Lond.* 447: 279–283.
- WCS Peru. 2019. Wildlife Conservation Society (WCS), Bronx, NY. URL: <<https://peru.wcs.org/en-us/home.aspx>>. Accessed: 22 May 2020.
- Yeager, C. P. 1997. Orangutan rehabilitation in Tanjung Puting National Park, Indonesia. *Conserv. Biol.* 11(3): 802–805.

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