

## CONTRIBUTED PAPER

# Prevalence and characteristics of illegal jaguar trade in north-western Bolivia

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## Abstract

Recent seizures of jaguar body parts in Bolivia have prompted concern about illegal trade to China, but a detailed understanding of this emerging trade continues to be lacking. We interviewed 1,107 people in a rural area implicated in the trade, using direct and indirect questions through the Ballot Box Method (BBM) to explore the prevalence and characteristics of the illegal jaguar trade and its links to foreign demand. Jaguar trade is a common, and mostly non-sensitive practice; 46% of respondents reported some involvement over the past 5 years. The most common behavior was owning jaguar body parts, such as skins, fat and teeth for decorative, medicinal, and cultural purposes. The most mentioned traders were Bolivian, followed by traders of Asian descent. However, regression analysis shows that the presence of traders of European descent was more significantly and positively associated with jaguar trade related behaviors, ahead of Asian descent and regional traders. Overall, jaguar trade in Bolivia has more diverse actors and drivers than seizures may suggest. Therefore, conservation interventions, in addition to targeting demand from Chinese wildlife markets, should address other foreign and domestic markets and trade chains.

## KEYWORDS

illegal wildlife trade, large carnivore conservation, *Panthera onca*, poaching, South America, traditional Chinese medicine

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## 1 | INTRODUCTION

Illegal wildlife trade (IWT) is among the most pressing threats to biodiversity. Due to IWT's concealed nature, those working to address it must often make decisions under high levels of uncertainty ('t Sas-Rolfes, Challender, Hinsley, Veríssimo, & Milner-Gulland, 2019). However, given its complex local and global drivers, strategies to address IWT should be rooted in cross-scale evidence in order to be effective (Milner-Gulland et al., 2018). This is particularly important in the case of wild felids, many of which are highly threatened by IWT due to domestic and international demand for their body parts (Nijman et al., 2019), adding to the pressures that they face from habitat loss and prey depletion (Macdonald & Loveridge, 2010). The illegal trade in tiger (*Panthera tigris*) bones and other body parts to supply Asian traditional medicine markets is of particular concern, having caused precipitous declines in wild tiger populations (Davis, Willemsen, Dang, O'Connor, & Glikman, 2020; Nowell, 2010; Sanderson et al., 2010).

The trade in tiger parts is also having repercussions for other felids that act as tiger substitutes (Villalva & Moracho, 2019). Since 2008, there has been an increase in legal exports of lion (*Panthera leo*) bones from captive-breeding facilities in South Africa to Asia for medicinal purposes (Williams, Loveridge, Newton, & Macdonald, 2017a). Similarly, leopards (*Panthera pardus*), clouded leopards (*Neofelis sp.*) and snow leopards (*Panthera uncia*) are being hunted or commercially bred to meet Chinese demand in addition to local traditional uses (Coghlan et al., 2015; D'Cruze & Macdonald, 2015; Stein et al., 2020). Since 2013, seizures of jaguar (*Panthera onca*) body parts destined for China in countries like Bolivia and Suriname suggest that Chinese demand for felids has reached Latin America (Nunez & Aliaga-Rossel, 2017; Verheij, 2019). Most of the seizures involved jaguar teeth, but the production of "jaguar paste," a suspected alternative to tiger paste in traditional Asian medicines has also been reported (Lemieux & Bruschi, 2019).

However, despite the current attention to Chinese demand for jaguar body parts, jaguar hunting and trading at the domestic level for cultural, commercial and safety reasons is longstanding and significant (Swank & Teer, 1989). Symbolizing war, kingship, and status, jaguars were traded across long distances by Latin American indigenous societies as early as the Pre-Ceramic Age (ca. 500 BC to AD 600) (Laffoon et al., 2014). Throughout most of the 20th century, thousands of rural communities in Latin America based their livelihoods on the commercial trade in jaguar skins for the occidental fashion industry (Antunes et al., 2016; Matos & Caldarelli, 2017; Smith, 1976). Although jaguar trade officially ended in

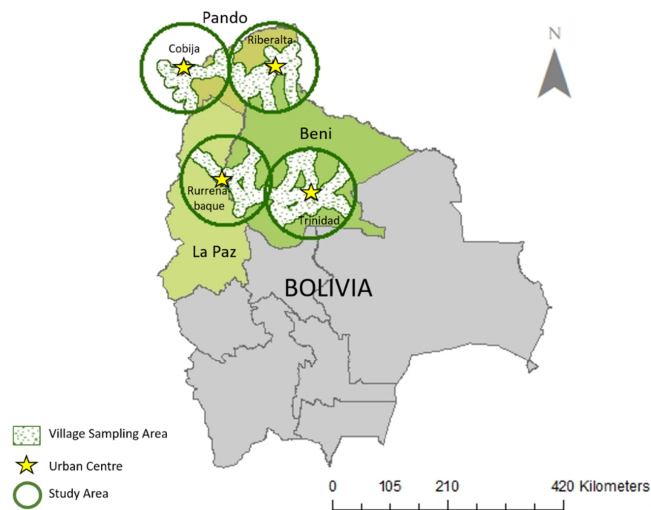
1975 with their listing on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, jaguar killing and trading continued in retaliation for livestock depredation and to supply households and craft markets with decorative, spiritual and medicinal jaguar-based products (Jędrzejewski et al., 2017; SERFOR and WCS, 2019). Like other countries in the region, jaguar killing is common in rural Bolivia, mainly as a response to depredation of livestock and domestic animals by jaguars and due to fear of attacks on humans, and it is facilitated by negative attitudes toward the species (Knox et al., 2019; Negroes et al., 2016).

However, since 2013, Bolivia has become the epicenter of jaguar body part seizures linked to demand from Chinese felid body part markets (Nunez & Aliaga-Rossel, 2017). The increase in seizures of jaguar body parts in Bolivia and elsewhere in the region has been associated with the growth of Chinese infrastructure investments in Latin America, along with poverty and corruption (Morcatty et al., 2020). As concerns over the role of foreign demand in the targeted illegal killing of jaguars grow, other studies have highlighted the large and well-evidenced importance of domestic markets for jaguar body parts, over a more uncertain demand from Asian wildlife markets (Arias et al., 2021; Arias, Hinsley, & Milner-Gulland, 2020a). Consequently, the relationship between jaguar killing, domestic use and the international trade in felids remains a contested issue, while the drivers of jaguar trade in Bolivia are only starting to be understood from a scientific perspective (Arias et al., 2021). Policies and interventions to address jaguar trade are being drafted and implemented at the domestic and international levels; it is important that these are based on evidence from source areas, rather than solely on seizures that risk misrepresenting the trade. Here, we report on a study of jaguar trade in rural communities in north-western Bolivia, in which we explored the prevalence and characteristics of people's engagement with jaguar killing and trading, focusing on their links to foreign and local markets.

## 2 | METHODS

### 2.1 | Study site and participant selection

Within Bolivia, we selected areas with jaguar presence and reported cases of jaguar killing or trading, where livestock ranching or hunting are common livelihood activities, and where there are current or recent Chinese infrastructure investments (Figure 1). While the specifics are not transferable beyond these locations, our study examines the role of foreign demand in an area with a



**FIGURE 1** Map of Study Areas in north-western Bolivia, based on a prioritization of rural lands around the main urban areas in the Departments of Beni, Pando and northern La Paz, available from Arias et al. (2021)

long and currently active history of interactions between humans and jaguars. We randomly sampled villages with populations of 250–2,000 inhabitants, within 150 km of the main urban areas. We then randomly sampled interviewing households from pre-numbered households along all village streets. In cases when the selected household was uninhabited or unwilling to participate, we approached the neighboring household instead. We interviewed one adult per household, prioritizing the household head (Appendix S1, Supporting Information).

## 2.2 | Survey instrument and questioning techniques

We showed participants photos of all felids present in our study area, and highlighted repeatedly that our focus was on the jaguar (including the melanistic variant). As part of a larger survey, we asked participants eight direct yes/no questions concerning their engagement with jaguar killing and trading (1—owned body parts, 2—been asked to kill, 3—asked others to kill, 4—killed, 5—bought, 6—sold, 7—raised a live jaguar, 8—killed more than 5 jaguars), along with semi-structured questions on the methods used to kill jaguars, the body parts that are traded and their uses, their awareness of the law regarding jaguar killing, and their knowledge about local and foreign traders. The larger survey contained questions about the potential drivers of jaguar killing and trading behaviors (e.g., attitudes toward jaguars, experiencing depredation by jaguars), reported in Arias et al. (2021), the results of which do not influence the answers reported here.

In addition to direct questions, we tested the Ballot Box Method (BBM) after the direct portion of the questionnaire on the same sample of participants, with the goal of reducing social desirability bias in participants' responses and to explore the sensitivity of the issue. The BBM requires participants to give their answer secretly by marking a ballot with “yes” or “no” and placing it inside a sealed ballot box (Arias, Hinsley, & Milner-Gulland, 2020b). Each ballot and paper questionnaire pair had a unique serial code, which enabled matching the anonymous ballot responses with the broader non-sensitive questions asked during the interview, to allow for assessing the factors (or predictors) that influence the sensitive behaviors. Ballots and questionnaires were matched at the end of the data collection process, and no personal, geographical, or other identifiable details were collected at any time, making it impossible to link responses to participants. Participants were informed of how the data they provided would be handled, and the steps taken to ensure their anonymity and confidentiality prior to granting their consent for participation, following the ethics protocols approved by the Central University Research Ethics Committee of Oxford University (Reference: R63986/RE001). We chose the BBM after conducting a pilot study ( $n = 100$ ) in Pando (Appendix S2, Supporting Information), involving other sensitive questioning techniques including the Randomized Response Technique, Crosswise Technique, Unmatched Count Technique and Nominative Technique (Nuno & St. John, 2015). We selected the BBM over the other methods based on the responses to questions at the end of the survey instrument, and interviewers' perceptions concerning the method's ease of understanding, perceived confidentiality and degree of comfort, following Nuno (2013). The semi-structured interviews, which were conducted from June to August 2019, took 20 to 40 min to complete, and were carried out by a team of five Bolivian and international researchers with experience investigating human-jaguar interactions. The Bolivian Ministry of Environment and Water granted permission to conduct this study (Reference: MMAYA/VMABCCGDF/DGBAP/MEG No. 0251/2019).

## 2.3 | Data analysis

We calculated the prevalence of jaguar killing and trading actions by obtaining the proportion of “yes” to “no” answers for each action, removing missing responses. We estimated 95% confidence intervals using package “prevalence” (Devleesschauwer et al., 2014) in R version 3.6.2 (R Core Team, 2019). We used a binomial GLM using the package “stats” (R Core Team, 2019) to determine

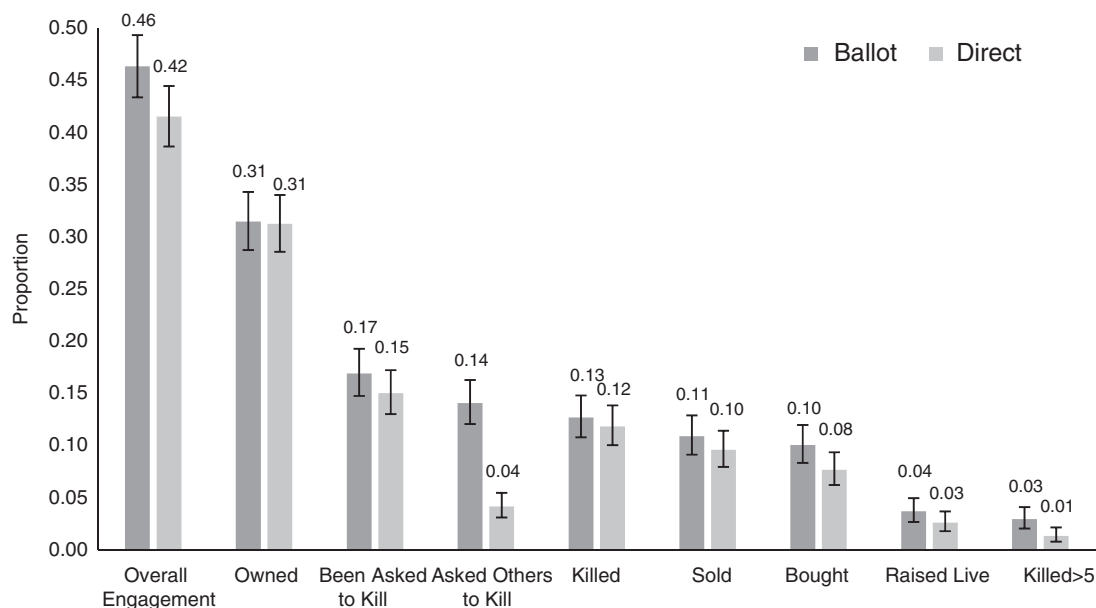
whether there was a significant difference between the BBM and direct questioning for each jaguar killing and trading behavior. In this model, the binary answers for each behavior constituted a single response variable while the method used (BBM vs. direct questioning) and its interaction with the question were set as the predictors. Using BBM responses, we ran another GLM using the study area and its interaction with each question as a predictor, to identify differences in behaviors by study area. In a different analysis, we identified cases where participants admitted to any of the behaviors of interest using the BBM but not through direct questioning (an indication of the sensitivity of the questions) and vice versa (an indication of non-adherence to the instructions of the BBM). Coding these differences as binary response variables (e.g., participants who found the questions sensitive and participants who did not adhere to the BBM), we examined the factors associated with these differing responses to the questioning method used. We used participants' socioeconomic characteristics, including gender, age, livelihood (hunting/fishing, home activities, agriculture, small business, public services, ranching), education and income; awareness about jaguar protection, study area and surveyor id as predictors. Of these, age and years in education were considered numerical variables, while the remaining predictors were either binary or categorical factors. All categorical and continuous dependent and independent variables used in the models were tested for association applying Cramer's V (for categorical variables) and point-biserial correlation (for continuous and categorical variables) through the

packages "DescTools" in R (Signorell, 2021) and "lrm" (Rizopoulos, 2006), in R version 3.6.2 (R Core Team, 2019). Medium and low levels of association ( $<0.5$ ) were found, ruling out collinearity. To determine the association between jaguar killing and trading actions (response variables) and the mention of traders of different nationalities (separate dummy variables for each nationality), we applied separate mixed effects binomial GLMs using package "lme4" (Bates, Maechler, Bolker, & Walker, 2015) to the BBM responses, with community within study area as random effects.

### 3 | RESULTS

#### 3.1 | Jaguar killing and trading prevalence

We interviewed 1,107 people across our four study areas, with varying socioeconomic characteristics (Appendix S3, Supporting Information). All participants were of Bolivian nationality. Forty-six percent of our sample had personally engaged with at least one of the jaguar killing and trading behaviors of interest during the past 5 years (Figure 2). Additionally, 6% of the 1,107 respondents stated that their partners had engaged in jaguar killing or trading in the past 5 years, and 9% that they had themselves done so more than 5 years ago (both categories are not included in Figure 2). The most prevalent activity was owning jaguar body parts, followed by being asked to kill a jaguar and asking others to kill a jaguar. We did not



**FIGURE 2** Proportion of participants that engaged in jaguar killing and trading actions in our study areas. Sample size varies per question, ranging from 1,044 to 1,064 participants who answered both directly and through the ballot box method (BBM). 95% confidence intervals calculated using the Jeffrey's interval method for binomial proportions



quantify what proportion of these requests was of a commercial nature, as compared to other motivations, such as retaliation for livestock losses. Killing, selling, and buying jaguars were less prevalent, while raising a live jaguar, and killing more than five jaguars were the least common actions. When combining direct and BBM responses provided by the same participant, owning jaguars (including live animals and body parts) reached 42.1% of the sample ( $n = 1,107$ ), followed by being asked to kill (24.3%), killing (18.6%), asking others to kill (15.5%), selling (14.6%), and buying (13.1%) jaguar body parts, as reported in Arias et al. (2021). There were no statistically significant differences in the prevalence of jaguar killing and trading actions between study areas, with the exception of owning jaguar body parts, which was significantly higher in Trinidad (OR 2.56, 95% CI 1.06–6.15,  $p < .05$ ) than in the other study regions.

### 3.2 | BBM versus direct questioning

The BBM resulted in a higher prevalence of all jaguar killing and trading actions than direct questioning. Averaging across actions, 6.7% of respondents admitted to actions through the BBM but not directly, suggesting they found the question sensitive, while 4.3% admitted to actions directly but not through the BBM, suggesting that they did not understand, trust or feel comfortable with the BBM. However, the only action for which the BBM led to a significantly higher prevalence than the direct question was asking others to kill a jaguar (OR 3.27, 95% CI 2.17–4.97,  $p < .001$ ). Older participants were less likely to find the questions sensitive (OR 0.99, 95%CI 0.97–1.00,  $p < .01$ ), contrary to those with agricultural livelihoods (OR 1.49, 95%CI 1.05–2.12,  $p < .05$ ). Participants who did not know the legal status of jaguars were less likely to find questions sensitive (OR 0.37, 95%CI 0.31–0.43,  $p < .001$ ) than those who were aware of their protected status. The predictors of the behaviors of participants who admitted to undertaking the different jaguar killing and trading actions through both methods are presented in Arias et al. (2021).

### 3.3 | Traded jaguar body parts and their uses

The majority (78%) of survey respondents were aware that jaguar body parts are traded and used in their communities, and were able to describe their uses (Table 1). The most commonly used jaguar body part was the skin, followed by jaguar fat, teeth, meat, claws and tails, skulls, live animals, bones and other jaguar body parts. Most body parts were locally used for decorative, medicinal,

nutritional or cultural purposes. However, jaguar teeth, skulls and bones were also mentioned in the context of foreign demand. Three participants living near Trinidad had witnessed the preparation of “jaguar paste” (gelatine made with jaguar bones and meat), while one participant near Rurrenabaque had seen refrigerators filled with jaguar corpses at the residence of an Asian trader.

Participants also commented on the methods used to kill jaguars (Appendix S4, Supporting Information) and the prices of jaguar body parts (Appendix S5, Supporting Information). By far the most common method used to kill jaguars in our study areas, as described by 97% of participants, was to shoot them with firearms whenever an opportunity arose. Other mentioned killing methods included baiting (36%), hunting with dogs (28%), snaring (including gun snares, 21%), sound luring (8%), using other hunting methods (e.g., arrows, harpooning, 6%), and poisoning (3%). Jaguar body part prices varied widely, which as has been suggested in other studies (Kelly, 2018), may be indicative of differences in supplier location with respect to the market, the level of the trade chain at which the prices are quoted or informational constraints about the price.

### 3.4 | Actors in the jaguar body part trade

Sixty seven percent of participants were aware of the existence of jaguar traders in and around their communities and were able to comment on their characteristics and interactions with them (Table 2). Forty three percent of respondents reported that Bolivian nationals (local or from major cities) traded jaguar body parts. Seventeen participants from our Trinidad study area mentioned that jaguar body parts are sold to local prisons, where convicts use them to make crafts to pay for prison fees. During an ad hoc visit to the “El Campesino” market in Trinidad on August 2019, we were able to confirm the presence of these crafts, and sellers said that these came from prisons in Beni Department.

The next most mentioned trader group was people of Asian descent, which included mainly Chinese nationals but also Japanese, Korean and Thai people. Asian buyers, some of whom were described as workers at Chinese infrastructure companies or long-term residents in Bolivia approached villagers directly, speaking Spanish or with the help of a translator. Nine percent of participants had had direct interactions with people of Asian descent, and 29% of those interactions specifically involved jaguar trade. Another 4.5% of participants mentioned that someone else in their community had been approached by jaguar traders of Asian descent. These traders also requested other species, particularly snakes, caiman, psittacines, and dogs. Participants

**TABLE 1** Jaguar body part uses in participant's communities, described by percentage of participants in the sample ( $n = 1,107$ ) who mentioned each part and use

Body part	Use category	Percentage of sample	Use detail
Skin	Accessories	53.7	Home decoration: Tapestries, rugs, chairs, hammocks; personal accessories: Belts, wallets, purses, hats, shoes, saddles, briefcases
	Cultural	5.3	Costumes and drums for traditional dances
	Medicine	0.3	Treatment for headaches (by burning the pelt)
Fat	Medicine	35.9	Rubbing ointment: Rheumatism, arthritis, swelling, muscle pain, cramping, burnt or inflamed skin, varicose veins, complicated child births; drinking syrup: Common cold, pneumonia, embolism, asthma, bronchitis, uric acid, kidney disease
	Repellent	5.2	Repellent for crop-raiding animals (by scattering the fat in crops); to keep cattle in their corrals; to manage untamed cattle
Teeth	Accessories	24.3	Jewellery and key chains; sold to locals and foreigners
	Medicine	1.9	Treatment for facial paralysis caused by a spell of misfortune (by grinding and burning the teeth); dental fillings
	Cultural	0.9	Necklaces worn at traditional festivals; amulets to protect against bad luck or evil spirits
Meat	Nutrition	20.6	Food for humans and domestic animals like dogs
	Cultural	0.4	Consumed for vitality and strength, particularly amongst hunters
Tail & Claws	Accessories	16.9	Jewellery and key chains; recipients to hold small objects (paws)
	Cultural	1.5	Amulet for good luck and strength
Skull	Accessories	13.4	Trophies; painted and turned into lamps; sold to foreigners
	Cultural	2.3	Amulet for good luck in business; witchcraft; traditional dance masks
	Repellent	0.3	Repellent for crop raiding animals; prevents encounters with jaguars
	Studies	0.8	Purchased by students to conduct studies on jaguar strength
Live	Pets	6.1	Pets; attractions for zoos or circuses
Bones	Medicine	0.9	Medicine for strength; sell to foreigners
	Cultural	0.7	Kept at home for luck; keeps thieves away
	Studies	0.5	Purchased by students to conduct studies on jaguar strength
	Repellent	0.2	Repellent for crop raiding animals
Others	Medicine	0.6	Eyes are used as a treatment for poor eyesight
	Cultural	0.3	Brain and heart are used for rituals
	Other	0.1	Whiskers and penis can be sold to foreigners

provided details about their perceptions toward Asian people (Appendix S6, Supporting Information).

Foreigners of European descent, described as tourists, wildlife collectors and religious missionaries were the next most mentioned traders, followed by regional foreigners from Latin American countries (including Brazil, Peru, Argentina, Chile, Paraguay, Venezuela, and Colombia).

Some participants mentioned that the requests for jaguar body parts came from radio advertisements asking people to deposit the items at specific locations such as hotels in urban centers; while others said that university students of both Chinese and Bolivian nationality had

been purchasing jaguar bones and skulls to conduct a study on the strength of the jaguar (Table 2).

Even though the most often-mentioned traders were Bolivian, awareness of the existence of traders of regional and European descent increased participants' odds of engaging in almost all jaguar killing and trading actions (Table 3). Conversely, awareness of the existence of traders of Asian descent played a significant role in increasing the likelihood of being asked to kill a jaguar, selling jaguar body parts, and asking others to kill a jaguar; while awareness of Bolivian traders was only significantly associated with ownership of jaguar body parts.

**TABLE 2** Jaguar body part trader types, and the percentage of respondents mentioning these people. Total percentage is >100% as people could mention multiple trader types. Total sample size = 1,107

Trader types and interactions	Characteristics	Percentage of Total sample
Jaguar trader types as reported by participants <sup>a</sup>	Bolivian	42.6
	Asian-descent	20.1
	European-descent	14.5
	Regional	5.9
	Radio advertisements	3.3
	Universities/students	2.4
Participants who had interacted with people of Asian descent	No	91.2
	Yes	8.9
Sources of information about traders of Asian descent purchasing jaguar body parts	Unaware	79.9
	Word of mouth	13.1
	Family and community	4.5
	Personal	2.5

<sup>a</sup>These percentages are based on participants' accounts of the ethnicities of jaguar traders, which can be anecdotal or second-hand accounts, and should therefore not be considered the actual prevalence of different trader groups. Moreover, we highlight that ethnicity does not equate to nationality, and traders of Asian or European descent could in fact be Bolivian nationals, particularly since China does not allow dual citizenship.

## 4 | DISCUSSION

We found that jaguar killing and trading is a common and mostly non-sensitive activity throughout our study areas. These results mirror those of Knox et al. (2019) who found that jaguar killing is common and socially acceptable in nearby locations in Bolivia. While recent seizures of jaguar body parts destined to China raised awareness about illegal jaguar trade in Bolivia, one of the most significant outcomes of our study was the scale of illegal domestic possession, use, and trade in jaguar body parts. Domestic wildlife markets in Bolivia are not well understood in the scientific literature, even though a large scale trade in parrots, lizards, turtles and tortoises, for companionship and consumption, has been reported and deemed unsustainable, despite national level prohibitions

on wildlife trade (Herrera & Hennessey, 2007; MMAyA et al., 2013). The significance of illegal domestic trade in jaguar body parts had already been raised in Mesoamerica (Arias et al., 2020a; Reuter et al., 2018), but we were

able to uncover an unexpectedly high level of local ownership of jaguar body parts and awareness of their traditional uses. This may be indicative of poor law awareness and enforcement, as has been reported for other species (Herrera & Hennessey, 2007), or a reflection of a problematic interpretation of laws concerning wildlife use in the country, which prohibit the trade of nationally protected species like the jaguar, while also granting traditional wildlife use rights to indigenous communities (MMAyA, 2020). This may have led some of our participants, who were predominantly non-indigenous; to believe that laws protecting jaguars and other wildlife did not apply to them. Moreover, the use of jaguar body parts appeared to be engrained in rural people's cultural practices, from typical dances to therapeutic beliefs and hunting identities. In particular, the high number of participants who mentioned the use of jaguar fat for medicinal and pest control purposes was surprising. Studies elsewhere in the jaguar range have also reported the use of jaguar fat, suggesting that more conservation attention should be directed toward this use (Garcia-Alaniz, Naranjo, & Mallory, 2010; Gonzalez-Maya et al., 2010). Bolivians were also the most mentioned traders of jaguar body parts, and while some may act as intermediaries for other trader groups, the possession of jaguar body parts and their commercialization in physical markets within Bolivia stresses the importance of domestic demand for jaguars, as has been shown in other countries like Peru (SERFOR and WCS, 2019). Local uses and traditional beliefs have also been identified as an important threat for other felid species throughout the world (Alves et al., 2013; Williams, Loveridge, Newton, & Macdonald, 2017b) and they should be a key component of efforts to address the illegal jaguar trade.

Another noteworthy finding was the presence of foreign traders of European descent or from other countries in the region, and its association to participants' engagement with jaguar trade. This had already been suggested by studies on the links between tourism and jaguar trade in other countries (Braczkowski et al., 2019; Reuter et al., 2018), but our results indicate that jaguar trade in Bolivia may be more international in scope than originally thought. It is worth considering that Europe and North America, like Asia, are important IWT demand regions for a range of taxa (Rosen & Smith, 2010), and that their nationals' interest in purchasing jaguar items has been reported in recent years in countries like Costa Rica (Kelly, 2018).

As expected, given recent seizure events in Bolivia, we corroborated the involvement of individuals of Asian descent in the illegal jaguar trade. In addition to teeth, traders of Asian descent in our study areas were reportedly also interested in buying jaguar skulls and bones,

**TABLE 3** Odds Ratios of the association between a respondent being aware of the existence of a particular type of trader in and around their communities and them reporting having carried out a jaguar killing or trading action based on responses provided to the BBM. Estimates based on a mixed effect binomial GLM, with community and study area as random effects. 95% confidence intervals in parenthesis. Values above and below one indicate whether traders are associated with higher or lower odds of jaguar trading actions, respectively. Values in bold represent statistical significance ( $p < .05$ )

Traders	Jaguar killing and trading actions							
	Raised live ( $n = 1,053$ )	Owned body parts ( $n = 1,064$ )	Bought body parts ( $n = 1,054$ )	Been asked to kill ( $n = 1,057$ )	Killed ( $n = 1,055$ )	Killed > 5 ( $n = 1,049$ )	Sold body parts ( $n = 1,054$ )	Asked others to kill ( $n = 1,044$ )
Asian	0.71 (0.03–1.54)	1.34 (0.94–1.80)	1.19 (0.73–1.90)	<b>2.22</b> ( <b>1.50–3.09</b> )	0.96 (0.58–1.46)	1.77 (0.66–3.46)	<b>2.09</b> ( <b>1.31–3.11</b> )	<b>1.53</b> ( <b>0.97–2.20</b> )
Caucasian	<b>3.44</b> ( <b>1.63–6.94</b> )	<b>2.19</b> ( <b>1.58–3.22</b> )	<b>2.41</b> ( <b>1.47–3.89</b> )	<b>2.37</b> ( <b>1.48–3.31</b> )	<b>2.25</b> ( <b>1.43–4.50</b> )	1.44 (0.58–3.52)	<b>3.18</b> ( <b>1.95–4.86</b> )	<b>1.92</b> ( <b>1.28–3.07</b> )
Regional	<b>4.88</b> ( <b>1.97–10.8</b> )	<b>2.47</b> ( <b>1.46–4.15</b> )	<b>3.00</b> ( <b>1.66–5.91</b> )	1.68 (0.88–2.98)	1.24 (0.55–2.46)	0.55 (0.03–2.51)	<b>2.38</b> ( <b>1.14–4.34</b> )	1.75 (0.87–3.19)
Bolivian	0.84 (0.43–1.63)	<b>1.41</b> ( <b>1.18–2.01</b> )	0.86 (0.58–1.33)	0.95 (0.71–1.39)	1.23 (0.88–1.86)	1.29 (0.74–3.19)	0.82 (0.55–1.24)	1.18 (0.83–1.69)

suggesting that jaguar paste may be being made in Bolivia as a potential substitute for tiger paste in traditional Asian medicines, as has been documented for the case of Surinam (Lemieux & Bruschi, 2019; Verheij, 2019). However, given the small number of participants who mentioned jaguar paste in our surveys, we recommend more research into this potential market. As China's international cultural influence and investments expand across the world through the Belt and Road Initiative, there are increasing concerns about its potential risks to wildlife overseas (Farhadinia et al., 2019; Hinsley et al., 2019). For example, there are reports of in-country Chinese demand for bushmeat and high value items like elephant ivory and rhino horn in several African countries (Cao, 2015; Mambeya et al., 2018). The connection between Chinese foreign investments and jaguar trade in Latin America has begun to be explored (Morcatty et al., 2020), and its potential impacts on jaguars and other wildlife, including bushmeat species, should continue to be investigated.

The wider significance of these findings is that counter-trade interventions for jaguars and other felids need to disentangle domestic and international forms of trade, and consider local behaviors and cultural drivers just as much as international ones. While the role of Asian wildlife markets in the illegal jaguar trade should continue to be explored, our results reinforce the message of Margulies, Wong, and Duffy (2019), and Arias et al. (2020a) of being cautious about mainstream discourses in IWT, such as that of the “Asian super-consumer”, which may deflect focus away from the diversity of players and complex feedbacks between IWT drivers across scales, including in source areas.

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## CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

## AUTHORS CONTRIBUTIONS

**Melissa Arias:** Conceptualization, Methodology, Formal analysis, Investigation, Data Curation, Writing—Original draft, Visualization, Writing—Review & Editing, Project Administration, Funding acquisition. **Amy Hinsley:** Conceptualization, Methodology, Writing—Review & Editing, Supervision. **Paola Nogales-Ascarrunz:** Investigation, Writing—Review & Editing. **Nuno Negroes:** Resources, Funding acquisition, Writing—Review & Editing. **Jenny A. Glikman:** Funding acquisition, Writing—Review & Editing, Supervision. **EJ Milner-Gulland:** Conceptualization, Methodology, Writing—Review & Editing, Supervision.

## ETHICS STATEMENT

The University of Oxford's Social Sciences and Humanities Research Ethics Committee for granted ethical approval for this study (Reference: R63986/RE001), and the Bolivian Ministry of Environment and the Museum of Natural



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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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