Shedding Light on the Trade in Nocturnal Galagos

Magdalena S. Svensson[1,2], Thais Q. Morcatty[2], Vincent Nijman[2] and Chris R. Shepherd[1]

[1]*Monitor Conservation Research Society, Canada*
[2]*Oxford Wildlife Trade Research Group, Oxford University, Oxford, UK*

Abstract: Primates are traded yearly in the tens of thousands for reasons such as biomedical research, as trophies and pets, for consumption and to be used in traditional medicine. In many cases, this trade is illegal, unsustainable and considered a major impediment to primate conservation. Diurnal primates make up the vast majority of this trade, but recent studies have found that the trade in nocturnal primates is more common than previously thought, and among them are the galagos. There are currently 19 galagos recognized but there is still a dearth of research on these species and subspecies. The purpose of our study was to provide a more comprehensive picture of the trade in galagos within and across their African range countries, to help determine whether it is illegal or its sustainability needs to be assessed, and to provide baseline data and management recommendations to better regulate this trade, including strengthening policy, enforcement and conservation interventions. We gathered information on trade and use of galagos using an online questionnaire (May–August 2020), and on country-specific legislation relating to wildlife trade, hunting and legal protection of galagos, and looked at each range country's Corruption Perception Index score to gain an understanding of the obstacles in the way of effective law enforcement. We received 140 responses to our online questionnaire, from 31 of the 39 galago range countries. Respondents from 16 of these countries reported on first-hand observations of galagos being traded or used. Out of these, 36% reported seeing galagos sold or used for consumption, 33% as pets and 25% had observed them sold or used for traditional practices (including medical and magical purposes and for witchcraft). Most reports came from West Africa followed by Central Africa, East Africa and Southern Africa. We found that the number of reports on galagos being traded was higher in countries with higher numbers of galago species. Countries with more restrictive legislation experienced a higher number of reports of trade. Galagos observed in the pet trade was more common in East Africa, whilst reports of them in the bushmeat trade were more common in Central and West Africa. Galagos observed in the trade for traditional practices was by far most common from West Africa. We found that all galago range countries have some level of legal protection for some or all of their native galago species. It is evident that use and trade of galagos occurs throughout their range, albeit localized to certain areas. We urge galago range countries to adequately protect all species and to ensure legal trade is effectively regulated. Range countries that prohibit the use and trade in galagos must ensure legislation is adequately enforced. Further research into the drivers behind the use and trade of galagos should be initiated in countries with high levels of use and trade to further inform conservation and policy actions and to catalyze enforcement actions against poaching and illegal trade.

Keywords: Bushbabies, bushmeat, legislation, pet trade, Strepsirrhini, traditional medicine

Introduction

The use and trade of wild animals has been occurring throughout the world's tropical forests for over 100,000 years (Milner-Gulland *et al.* 2003). These practices have increased by 60% since the turn of the century, and they threaten the survival of many wild animals, including primates (Milner-Gulland *et al.* 2003; Estrada *et al.* 2019). Unsustainable trade is now considered a major impediment to primate conservation, and trade and hunting is negatively impacting up to 90% of primate species in at least some parts of their range (Nijman *et al.* 2011; Estrada *et al.* 2017). Every year, tens of thousands of primates are traded, both legally and illegally, within countries as well as over international boarders, and the international trade has seen an increase over the last decades (Nijman *et al.* 2011; Harrington 2015; Estrada *et al.* 2017). Primates are traded for a wide variety of reasons including biomedical research, as trophies and pets, for consumption and to be used in traditional practices (including medical and magical purposes

and for witchcraft) (Alves *et al.* 2010; Nijman *et al.* 2011; Linder *et al.* 2013; Estrada *et al.* 2017). The bushmeat trade is an especially large threat to African primates, mainly in Central Africa and the countries around the Gulf of Guinea (Cronin *et al.* 2017). The use of primates in traditional practices continues to have an impact on wild primates, both in Asia and Africa. In most regions of Africa, the number of traditional medical healers is far greater than the number of western medical practitioners (Soewu 2008). According to Alves *et al.* (2010), 32% of the primate species in Africa and 59% of those in Asia are affected by these practices.

Diurnal primates make up the vast majority of the primates occurring in trade (Estrada *et al.* 2017), with 70% of the diurnal primates in Central Africa being hunted and traded unsustainably (Fa and Brown 2009). However, in other parts of the world, species composition in trade is changing. Nijman *et al*. (2017) reports on a shift in the Indonesian market trade; looking at a 25-year period, orangutans and langurs are now being observed less in markets, while macaques and nocturnal slow lorises can be observed in the same quantities or more. Other studies are also finding that the trade in nocturnal primates all over the world is more common than previously thought. Night monkeys (*Aotus* spp.) in the Neotropics are traded, mainly for biomedical purposes, both internationally and domestically (Maldonado *et al.* 2009; Svensson *et al.* 2016; Shanee *et al.* in prep.). In Madagascar, lemurs are mainly traded domestically, both as bushmeat and pets. Between 2010 and 2013, it was estimated that 28,000 lemurs were locally kept as pets (Jenkins *et al.* 2011; Reuter *et al.* 2016). In Asia, the trade in slow lorises (*Nycticebus* spp.) is now well documented in some parts of their range. They can be among the most commonly occurring primate species in wildlife markets for domestic trade, mostly for traditional medicine and for pets (Shepherd *et al.* 2004; Nekaris and Jaffe 2007; Nekaris *et al.* 2010; Nijman *et al.* 2014), but increasingly for the international pet trade, due largely to the increased presence of the species online (Nekaris *et al.* 2013). Pottos (*Perodicticus* spp.) and angwantibos (*Arctocebus* spp.) are found to be relatively common in the bushmeat trade of Central and West Africa (Svensson and Friant 2014; Svensson *et al.* 2015; Hofner and Svensson 2020). Svensson *et al.* (2015) also reported initial findings of galagos occurring in trade, mainly for the pet trade in East Africa.

Here we focus on the trade in galagos (also known as bushbabies), a group of nocturnal primates that are native to most of Sub-Saharan Africa (Fig. 1). At present, 19 species of galagos (*Euoticus* spp., *Galago* (*G.*) spp., *Galagoides* (*Gd.*) spp., *Otolemur* spp., *Paragalago* spp. and *Sciurocheirus* spp.) are recognized (Nekaris 2013; Masters *et al.* 2017; IUCN 2021). Twelve are listed on the IUCN Red List as Least Concern, four as Near Threatened, one as Vulnerable, one as Endangered and one as Data Deficient (Table 1; IUCN 2021). There is however still a dearth of data available on the status and conservation needs of most of them, and they are considered one of the least studied groups of primates (Nekaris and Bearder 2011; Svensson *et al*. 2015).

The purpose of our study was to provide evidence and get a more comprehensive picture of the trade in galagos within and across their range countries, to provide baseline data and to determine whether the trade is sustainable or not. We aimed for a comprehensive overview of the national level legislation relevant to galago trade in each of the African range countries in order to make recommendations for improved policy, enforcement and conservation interventions.

Methods

We gathered information on trade and usage of galagos through an online questionnaire created with the SurveyMonkey software (www.surveymonkey.com), collecting responses between May and August 2020. We chose to conduct the survey online as a suitable method to obtain a rapid assessment, allowing for inexpensive, anonymous and rapid collection of data (Couper *et al.* 2007). We created an English and a French version of the questionnaire to reach as many people as possible in galago range countries. We are aware that by only using these two languages, we may have excluded some potential respondents, but it would have been logistically difficult to include more languages,

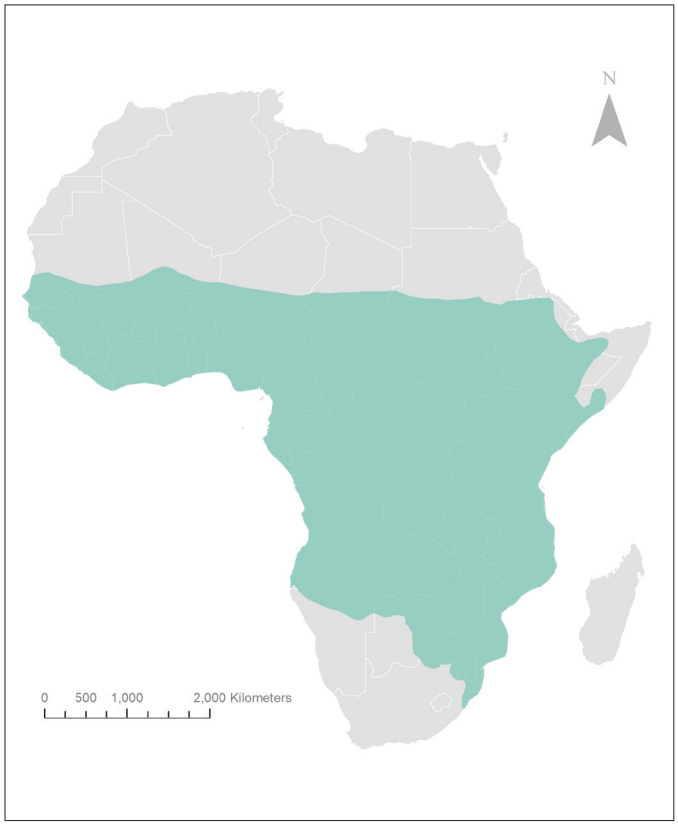

Figure 1. Total range of all galago species. Map created using IUCN shape files (IUCN 2021).

Table 1. Species and subspecies of galagos and their threatened status on the IUCN Red List. EN = Endangered; VU = Vulnerable; LC = Least Concern; NT = Near Threatened; DD = Data Deficient. From IUCN (2021).

Common name	Scientific name	RL Status
Demidoff's Dwarf Galago	*Galagoides demidoff*	LC
4Demidoff's Dwarf Galago	*Galagoides demidoff demidoff*	LC
Bioko Dwarf Galago	*Galagoides demidoff poensis*	EN
Thomas's Dwarf Galago	*Galagoides thomasi*	LC
Angolan Dwarf Galago	*Galagoides kumbirensis*	NT
Mountain Dwarf Galago	*Paragalago orinus*	VU
Rondo Dwarf Galago	*Paragalago rondoensis*	EN
Mozambique Dwarf Galago	*Paragalago granti*	LC
Kenya Coast Dwarf Galago	*Paragalago cocos*	LC
Tanzania Coast Dwarf Galago	*Paragalago zanzibaricus*	NT
Zanzibar Dwarf Galago	*Paragalago zanzibaricus zanzibaricus*	EN
Udzungwa Dwarf Galago	*Paragalago zanzibaricus udzungwensis*	NT
Northern Lesser Galago	*Galago senegalensis*	LC
Senegal Lesser Galago	*Galago senegalensis senegalensis*	LC
Kenya Lesser Galago	*Galago senegalensis braccatus*	LC
Ethiopia Lesser Galago	*Galago senegalensis dunni*	LC
Uganda Lesser Galago	*Galago senegalensis sotikae*	LC
Somali Lesser Galago	*Galago gallarum*	LC
Southern Lesser Galago	*Galago moholi*	LC
Spectacled Lesser Galago	*Galago matschiei*	LC
Bioko Squirrel Galago	*Sciurocheirus alleni*	NT
Bioko Squirrel Galago	*Sciurocheirus alleni alleni*	EN
Cross River Squirrel Galago	*Sciurocheirus alleni cameronensis*	NT
Gabon Squirrel Galago	*Sciurocheirus gabonensis*	LC
Makandé Squirrel Galago	*Sciurocheirus makandensis*	DD
Southern Needle-clawed Galago	*Euoticus elegantulus*	LC
Northern Needle-clawed Galago	*Euoticus pallidus*	NT
Bioko Needle-clawed Galago	*Euoticus pallidus pallidus*	EN
Nigeria Needle-clawed Galago	*Euoticus pallidus talboti*	NT
Thick-tailed Greater Galago	*Otolemur crassicaudatus*	LC
South African Large-eared Galago	*Otolemur crassicaudatus crassicaudatus*	LC
Northern Silver Galago	*Otolemur crassicaudatus argentatus*	LC
Tanganyika Large-eared Galago	*Otolemur crassicaudatus kirkii*	LC
Miombo Silver Galago	*Otolemur crassicaudatus monteiri*	LC
Garnett's Greater Galago	*Otolemur garnettii*	LC
Zanzibar Small-eared Galago	*Otolemur garnettii garnettii*	VU
Kikuyu Small-eared Galago	*Otolemur garnettii kikuyuensis*	LC
White-tailed Small-eared Galago	*Otolemur garnettii lasiotis*	LC

and nonetheless hope that this would have reached as wide a range of participants as possible. Invitations to participate were distributed by e-mail targeting research groups across Africa and via the African Primatological Society, and we also shared the questionnaire on the social media sites Facebook and Twitter. The questionnaire was designed to take less than five minutes to complete. The target audience was people who had lived or worked for a minimum of one month in African galago range countries and included nationals as well as non-nationals. The questionnaire focused on observations of galagos being traded or used, and other information pertaining to their trade. The questions were generally closed-ended, marking one of several boxes. All multiple-choice questions included an optional "other" category and a text field where descriptive qualitative data could be added for clarification purposes. All respondents were informed of the purpose of the study and were able to withdraw at any moment. The questionnaires followed the ethical guidelines for internet-mediated research as proposed by the British Psychological Society (2017).

We also conducted a systematic literature review of publications (published research and gray literature) on any studies containing information or data on trade of galagos. We used the following keywords in our online searches: trade*, pet*, bushmeat*, traditional practices in combination with galago or bushbaby. This search was conducted in English and in French. We used Google, Google Scholar and ISI Web of Science. We are aware that a large number of languages are spoken in the galago range countries, but we focused on the English and French literature due to the prevalence of these languages in scientific reports coming out of Africa.

We gathered information on country-specific legislation relating to wildlife trade, hunting and protection of species using the searchable legislative and policy databases Legal Atlas (www.legal-atlas.net/) and the Food and Agriculture Organization of the United Nations' FAOLEX database (http://faolex.fao.org/), and by contacting people with knowledge and experience in wildlife legislation in galago range countries. We then determined whether galago species were specifically mentioned as protected and if so, to what degree the legislation protected them (i.e., if galagos were included in the legislation as fully or partially protected, or not included at all).

All galago range countries are parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and all galago species are included in Appendix II of CITES, meaning that international trade requires official permission and evidence that extraction does not negatively impact wild populations (CITES 2020a). CITES has a mechanism—the National Legislation Project—to encourage and assist CITES parties' legislative efforts, and places countries in three categories according to how well domestic legislation matches CITES legislation, with the aim to ensure CITES can be effectively implemented and enforced by Parties. These categories are: (1) legislation that is believed generally to meet the requirements for implementation of CITES; (2) legislation that is believed generally to meet only some of the requirements for the implementation of CITES; and (3) legislation that is believed generally not to meet the requirements for the implementation of CITES (Vasquez 2003; CITES 2020b).

To gain an understanding of the effectiveness of law enforcement in the galago range countries we used each country's Corruption Perception Index score 2019 as a proxy (0 = highly corrupted to 100 = very clean) (Transparency International 2019). We extracted data on gross national income (GNI) per capita for each country from the World Development Indicators (World Bank 2019) to explore the possible effect of purchasing power on levels of trade.

Data analysis

We descriptively analyzed the total number of reports (as reported by questionnaire respondents and in the literature) by regions and according to the purpose of the trade reported by the respondents or from the literature. We used a generalized linear model (GLM) for testing whether 1) richness in galago species, 2) the level of protection (fully protected vs. partially protected) of galago species according to the national law, 3) the GNI per capita, and 4) the Corruption Perception Index per country, influence the amount of reports on galagos traded in each of the 39 countries analyzed. For the GLM we used the total number of reports on traded galagos, including all purposes of trade (i.e., bushmeat, pet and traditional practices). We tested models with all possible combinations among the recorded variables. We selected the family of distribution and the final model based on the Akaike Information Criteria (AIC) for generalized models. We considered models with good support those which had ΔAIC values smaller than 2 in relation to the model with the smallest AIC (best-ranked model) (Burnham and Anderson 2004). No multicollinearity was found among variables.

We ran a Principal Coordinate Analysis (PCoA) for assessing whether the purposes of use and trade in galagos reported differ among the geographical regions sampled. To present the data, we divided the galago range countries into subregions (West, Central, East and Southern Africa) based on the UN Statistics Division (United Nations 2020). As a complementary approach, we performed an Analysis of Similarity (ANOSIM) to obtain the statistical significance of the dissimilarities/similarities between the geographical regions. For both analyses, we used the Mahalanobis Similarity Coefficient as the measure of proximity among the respondents based on the purposes reported.

We used R 3.6.3 (http://www.R-project.org/) for all statistical analyses. We used the R-packages GGally (version 1.4.0) for testing multicollinearity, gamlss (version 5.1-6) for running the GLM, vegan (version 2.5-6) for running PCoA and ANOSIM, and ggplot2 (version 3.3.0) for plotting the graphs. Significance was accepted when $p < 0.05$.

Results

Reasons for trade

We received 140 responses to our online questionnaire from 31 of the 39 galago range countries. Respondents from 16 of these countries, representing 33% of all the respondents (n = 46), reported on first-hand observations of galagos being traded or used. Of these first-hand accounts, 36% reported seeing galagos sold/used for consumption (n = 26), 33% said they had observed galagos being sold/used as pets (n = 24), 25% had observed galagos being sold/used for traditional practices (n = 18), and four respondents recorded seeing galagos being sold online (Fig. 2). Of all the respondents, 27% (n = 37) reported that they had not made first-hand observations of galagos being traded or used but provided anecdotal information and reported some knowledge of it.

In the literature review, we mainly found galagos reported as being sold/used for consumption (n = 15), followed by sold/used for traditional practices (n = 8), and one source reported on galagos in the pet trade (Fig. 2).

Numbers and extent of the trade

Of the respondents reporting both first-hand and anecdotal galago trade and usage, 34% (n = 36) of the reports were from West Africa, 28% (n = 30) from Central Africa, 24% (n = 26) from East Africa, and 14% (n = 15) from Southern Africa. We found that the number of galagos traded, as reported by respondents to the questionnaire and from the literature, was higher in countries with higher richness of galago species (Fig. 3a; Table 2), for all purposes (i.e., bushmeat, pet, traditional practices). The level of

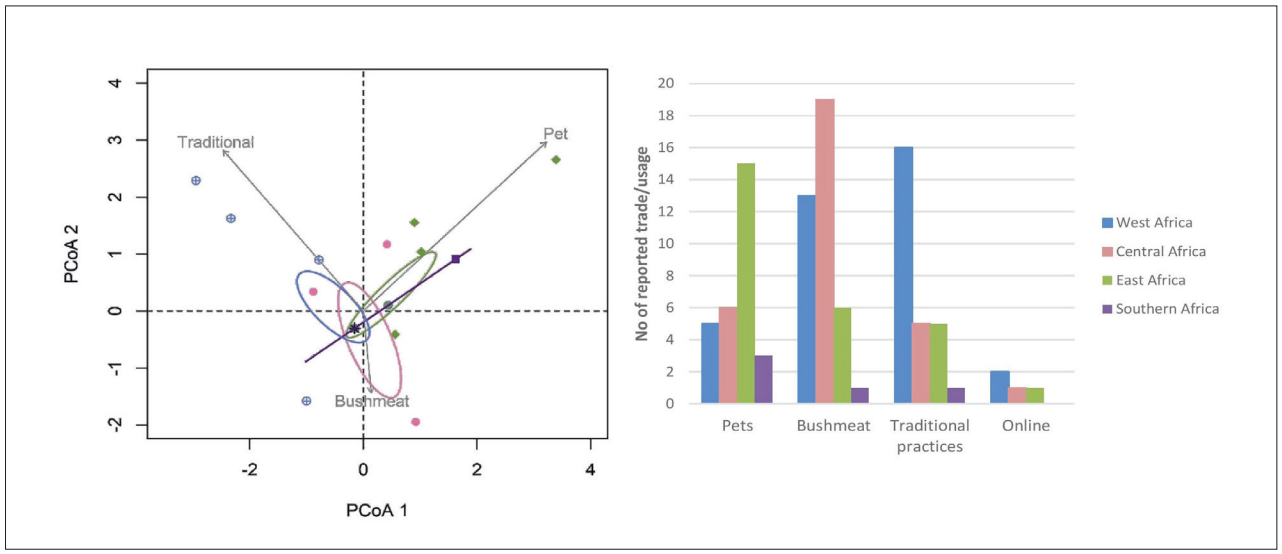

Figure 2. Trade and use of galagos by regions, as reported by respondents to our online questionnaire and in the literature. Principal Coordinate Analysis (PCoA) scattergram of different purposes for using and trading galagos according to the regions, as reported by respondents to our online questionnaire (ANOSIM: R= -0.03, p= 0.64). Traditional stands for traditional practices.

Table 2. Details of the best-fit Generalised Linear Model for the number of reports of trade involving galago species in the 39 countries analysed according to the richness of galago species present in the country, the level of protection according to the current national law (if full or partially protected), Gross National Income (GNI) per capita and the Corruption Perception Index.

Selected Model[a]		Estimate	Standard Error	t-value	p value	AIC (ΔAIC_{null})[b]
Number of reports of trade	(Intercept)	0.131	0.426	0.31	0.76	197.5 (52.9)
	Galago species richness	0.274	0.039	7.0	0.001*	
	Level of protection	-0.848	0.221	-3.8	0.005*	
	GNI per capita	0.001	0.002	0.5	0.63	
	Corruption Index	0.009	0.010	0.9	0.39	

a Family of distribution: Poisson distribution

b AIC is the Akaike Information Criterion for the selected model and ΔAICnull is the difference between the AIC of the selected model and the AIC of the null model.

* $p < 0.05$

protection of galago species was also related to the number of reports of traded galagos. Countries with more restrictive legislation, where galagos are fully protected, experienced higher numbers of reports of trade (Fig. 3b; Table 2). GNI per capita and the Corruption Perception Index were not significantly related to the number of reports of trade in galagos (Fig. 3c–d; Table 2).

Of all first-hand observations, three respondents (7%) reported seeing galagos traded/used once a week or more, six reported to observe this once a month (14%), and 32 reported to observe this less regularly (78%). One respondent, from Nigeria, reported that galagos tend to be sold only opportunistically, but that it was more common during festive seasons.

Pet trade

The observation of galagos in the pet trade was more common in East Africa (38% of the reports, n = 9), followed by 29% in West Africa (n = 7), 21% in Central Africa (n = 5) and 13% in Southern Africa (n = 3). Galagos were mainly reported as pets for personal use, but one respondent reported a lodge on the coast having a galago on a chain in their bar as entertainment (Kenya). One respondent reported that galagos were sold for pets or for consumption in the Yaoundé city markets (Cameroon). A respondent from Nigeria said that galagos were often kept as pets in the houses of hunters who captured them. Another respondent from Cameroon said that pet sales were very discreet and took place in small villages and that live animals were

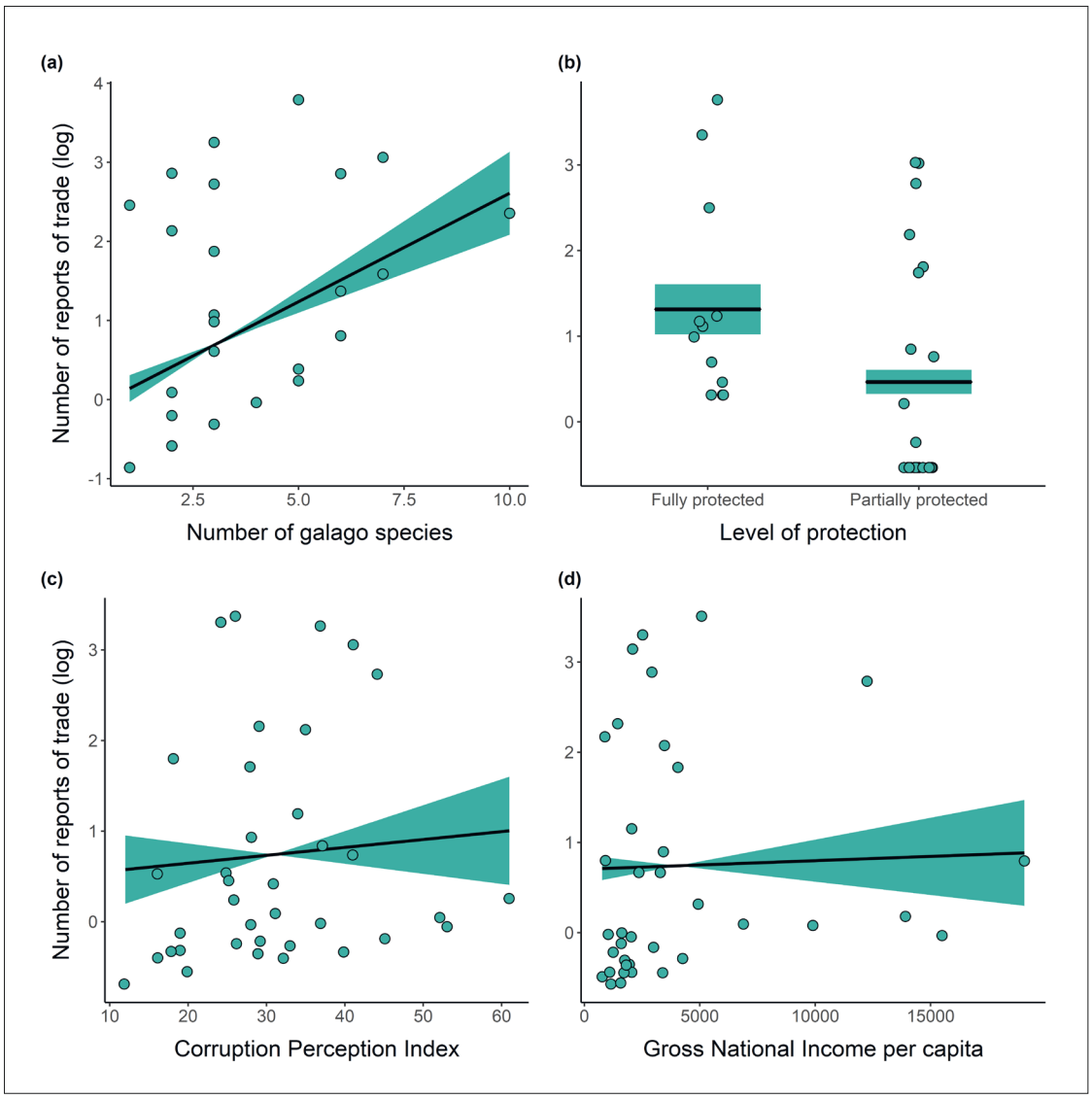

Figure 3. Relationship between the number of reports of trade in galagos (as reported by respondents to our online questionnaire and in the literature) per sampled country and (a) the richness of galagos species present in the country, (b) the level of protection according to the current national law, (c) the Corruption Perception Index and (d) the Gross National Income per capita. Data points are normalized residuals around the mean (μ=0.80) and Y-axis is presented in natural logarithm (Log ln) scale. The shaded area represents the 95% confidence interval.

sold to traders who would visit the villages mainly to buy other forest products but would opportunistically purchase pets. Most of these traders were from the bigger cities of neighboring Nigeria, where the demand for such products is reportedly high. A wildlife rescue center in Malawi reported receiving galagos confiscated from the illegal pet trade. Some respondents specified the species they had seen in the pet trade: Cross River squirrel galago (*S. cameronensis*) had been observed as a pet many times in Cameroon, and Garnett's greater galago (*O. garnettii*) and northern lesser galago (*G. senegalensis*) were reported to be traded in Kenya. In Tanzania, *G. senegalensis* and *O. garnettii* were reported to be traded live along with the Tanzania coast dwarf galago (*P. zanzibaricus*) in Dar es Salaam.

Bushmeat trade

Observations of galagos in the bushmeat trade were mostly from Central Africa (50%, n = 13), followed by West Africa (38%, n = 10), East Africa (8%, n = 2) and Southern Africa (4%, n = 1). Several respondents believed that galagos were only opportunistically caught and sold, and not hunted intentionally (Equatorial Guinea), and that galagos were considered too small, and worth too little money for the effort, and therefore were normally eaten upon capture (Cameroon, Ghana, Nigeria and Zambia). One respondent from Nigeria, however, said that galagos were often hunted and eaten but rarely sold, and they referred to it as meat that children eat. A respondent from Zambia reported that general bushmeat is only occasionally openly traded in cities/

Figure 4. Trade in galagos in Africa: (a) *Otolemur crassicaudatus* sold as bushmeat in Angola, Luanda Norte Province (©Renato Spaggiari); (b) *O. crassicaudatus* sold as bushmeat in Angola, Bengo Province (© Christopher Hines); (c) *Galagoides thomasi* sold as a pet in Togo (from Facebook).

towns due to legislation. On the other hand, another respondent, also from Zambia, reported that although southern lesser galagos (*G. moholi*) seem to be hunted only opportunistically, thick-tailed greater galagos (*O. crassicaudatus*) were commonly hunted in the Bangweulu region and that people would go to great efforts to catch them, cutting, for instance a whole stand of mature trees to bring a galago down. The respondent indicated that this was a regular practice in rural areas. The same respondent reported that people from Mwinilunga, again in Zambia, commonly eat Thomas's dwarf galago (*Gd. thomasi*), and that galagos were often found when poachers were arrested. Demidoff's dwarf galagos (*Gd. demidoff*) were also reported to be traded as bushmeat in Nigeria. Several respondents from Equatorial Guinea reported on Allen's galago (*S. alleni*) being sold as bushmeat along roadsides. In Angola and South Africa *O. crassicaudatus* were reported to be sold, alive and dead, on roadsides for meat consumption (Fig. 4).

Trade for traditional practices

Reports of galagos in the trade for traditional practices were most common by far from West Africa (72%, n = 13), followed by East Africa (17%, n = 3) and Central Africa (11%, n = 2).

In Togo, one respondent reported galagos being sold in the fetish markets (markets focusing on traditional medicine) of Lomé, and having a considerable value as such. A respondent from Cameroon said that galagos were rarely targeted when hunting except when for traditional practices. Another respondent from Cameroon reported on trade in galago skins. Respondents from Benin reported galagos being traded in fetish markets in all the major cities/towns as well as in small markets in remote villages, and that although *Gd. thomasi* was not commonly sold it could be quickly provided if ordered. From Côte d'Ivoire, it was reported that the dried hands of *Gd. demidoff* were used in traditional practices, and were commonly sold in front of Muslim mosques. Galagos in dried and powdered form were reported to be used as a love potion in Gabon. A respondent from Nigeria reported on galago skulls being used to cast spells and for witchcraft. One Nigerian respondent reported regularly seeing galagos captured alive, especially during the farming season when community dwellers embark on slash-and-burn agricultural activities, resulting in bush fires forcing the galagos to the tips of branches where adults and children could easily capture them or shoot them down with catapults. The respondent also said that cattle grazers in northern Nigeria trade galagos for use in traditional practices. Galago skulls and dried carcasses were reported for sale in Nigerian fetish markets.

Trading locations

The locations where galagos were traded most commonly were city/town markets (37%, n = 23), followed by roadsides (32%, n = 20) and small village markets (25%, n = 16). In West Africa, this trade was mostly in city/town markets (43%, n = 12) and small village markets (36%, n = 10). In Central Africa, the galago trade was mainly at roadsides (50%, n = 10) and in city/town markets (35%, n=7). In East Africa, trade was reported equally from city/town markets, small markets and roadsides (33%, n = 4 for each).

Dead or alive, whole animals or body parts

Trade in galagos was most often reported as consisting of live animals live (40%, n = 21) or fresh body parts (43%, n = 23), with fewer reports of them being sold as fresh whole carcasses (9%, n = 5) or smoked whole carcasses (8%, n = 4). Live galagos were mostly reported from East Africa (38%, n = 8), followed by West Africa and Central Africa (29%, n = 6 in each region) and one report from Southern Africa.

Two respondents from Togo reported that people mainly buy and use the fur of *G. senegalensis* but it is also possible to order live animals (Fig. 4). From Equatorial Guinea, it was reported that *S. alleni* is sold as fresh whole carcasses, and likewise from Angola fresh carcasses of *O. crassicaudatus* (Fig. 4). In Zimbabwe, *O. crassicaudatus* and *G. moholi* were reported to be sold live. A respondent from Benin reported on having seen about one hundred live *Gd. demidoff* being traded over a period of time.

Fresh whole carcasses were only reported from West (n = 2) and Central Africa (n = 3). Body parts were reported mainly from West Africa (65%, n = 15), followed by Central Africa (26%, n = 6) and East Africa (9%, n = 2). Smoked whole carcasses were reported only from West and Central Africa (n = 2 and 3, respectively).

Legislative protection

Galagos are protected to some degree in all 39 range countries, although in 17 they are protected under general legislation falling under the category of 'all wildlife' or 'all primates' (see supplementary material Table S1). Two countries fully protect these categories (Equatorial Guinea and Liberia). Seventeen of the range countries list all native galagos as protected within the national legislation, either as bushbabies/galagos, or with all the species named, with six countries listing them as fully protected. Seven countries have legislation with some of the native galagos listed as protected, but of these only three list them as fully protected. Overall, galagos are listed as fully protected in 10 countries, as well as being listed in CITES Appendix II that regulates trade in the species across borders. In seven countries, the legislation lists galagos using outdated and/or incorrect taxonomy.

Discussion

This study contributes to a much-needed understanding of the usage and trade of galago species throughout Africa, how this varies between regions, and the present protective legislation in the countries where they occur, indicating the threats galagos are facing from their exploitation for human consumption, as pets and in cultural practices and traditions. The responses from our questionnaire were, on occasion, contradictory, with some, for example, reporting galagos not being traded at all, and others reporting seeing them being traded in great numbers. It is evident, however, from our data that galagos are hunted, used and traded throughout their range, albeit varying in extent depending on the country and it would seem localized to certain areas and cultures within each country. We achieved no responses from eight countries. One of them was Somalia, for which there are not even any reports in the literature of exploitation or trade of galagos, nor other primate species (Amir 2006).

As stated by Nekaris and Bearder (2011), galagos are among the least studied primates, and they are generally overlooked in both general ecological studies and in market surveys (Nekaris and Nijman 2013; Svensson *et al.* 2015). The more that African and Asian lorises are studied, the more their trade and usage is exposed as a serious threat (Nekaris and Jaffe 2007; Nekaris *et al.* 2010; Nijman *et al.* 2014; Svensson and Friant 2014; Svensson *et al.* 2015), and this might well be the case for the galago species as well.

Trade in galagos as pets appears to be more common in East Africa, which supports the findings of Svensson *et al.* (2015). Although, the species involved were mostly not identified by the respondents, four galagos were named as occurring in the pet trade. It seems, however, that the trade in galagos as pets in general is only small scale and often opportunistic, as has been found for the nocturnal pottos and angwantibos (Svensson and Friant 2014). Capture and trade of wild ring-tailed lemurs (*Lemur catta*) is similarly opportunistic (Reuter *et al.* 2016) but, once believed to be wide ranging and common, they were estimated to have suffered a population decline of nearly 95% since 2000, mainly driven by bushmeat and the pet trade (LaFleur *et al.* 2016).

Reports of galagos sold as bushmeat came mostly from Central and West Africa and this mirrors findings on bushmeat trade of diurnal primates (Cronin *et al.* 2017; Estrada *et al.* 2017). As mentioned earlier, many respondents stated that galagos were too small to be hunted intentionally and were even referred to as meat for children. The common belief has been that smaller animals are less threatened because the return is much greater when hunting larger animals is still feasible. It is still reported that small nocturnal primates are hunted opportunistically (Svensson and Friant 2014; Fominka *et al*. 2021) but this seems to be changing, and we did indeed have 26 respondents reporting on galagos in the bushmeat trade, sometimes even reported as commonly traded and even including small species such as those of the genus *Galagoides*. Three decades ago, Anadu

et al. (1988) reported that smaller species, such as nocturnal primates, were being targeted in increasing numbers due to overhunting of the larger species in southwestern Nigeria. Svensson and Friant (2014) further report on angwantibos being targeted by hunters in the Republic of Congo due to the scarcity of larger and more traditionally targeted game. In Madagascar, mouse lemurs (*Microcebus murinus* and *M. griseorufus*), similar in size to *Galagoides*, are hunted as bushmeat for local consumption and for sale in markets (Gardner and Davies 2014). In Angola, small squirrels are commonly observed in the bushmeat trade (Bersacola *et al.* 2014).

Fifty-nine percent of Africa's 107 primate species are known to be used in traditional practices (Alves *et al.* 2010), and it is not surprising that galagos are among them. Superstitions and beliefs are often attached to nocturnal animals, including primates (Svensson 2008; Svensson *et al.* 2015). In our study, trade of this type was reported mostly from West Africa, and this is mirrored to some extent in previous studies (Djagoun *et al.* 2012; Svensson *et al.* 2015). Galagos in Togo were reported to be valuable in fetish markets, and seven respondents from West Africa reported seeing them at least once a month in these kinds of markets. In their market survey in southern Benin, Djagoun *et al.* (2018) found that *G. senegalensis* and *Gd. demidoff* were sold by 30.5% and 23.6%, respectively, of the fetish market sellers. Although other primate species found in these markets were sold as body parts, *G. senegalensis* were more commonly sold live, due to customer preferences and ease of discreet transport due to size. People bought these nocturnal primates for both medicinal (*G. senegalensis*: bones used to cure wounds and burns, *Gd. demidoff*: fat/bile used to cure malaria, jaundice, gout, burns and wounds), and magical purposes (*G. senegalensis*: head/skull used to make spirit association with a fetish, *Gd. demidoff:* skull used to frighten witches and other enemies).

Animals traded in fetish markets for traditional practices are also traded across borders. Djagoun *et al.* (2012) reported that 32% of traded species in these markets in Benin came from other countries, mainly West African, but also from Central, North and East Africa. We received few reports of cross-border trade. One respondent said that galagos traded in Cameroon were often brought in from Nigeria. Given that all galago species are listed in the appendices of CITES, any cross-border trade without proper permits from national CITES authorities is illegal.

In a survey related to the *Symposium on Strengthening Legal Frameworks to Combat Wildlife Crime in Central and West Africa*, 100% of South and East African countries, and 94% of the Central and West African countries responded that their countries have appropriate legislation to prevent, detect and penalize illegal wildlife trade (United Nations Environment Programme 2019). However, a review on judicial processes of 14 countries (all galago range countries) found that laws dealing with wildlife crime often had serious loopholes (Abotsi *et al.* 2015). Legislations in these countries were appropriate in theory but often relied on subsidiary regulations to be implemented, which were frequently not in place, and/or administrative agencies that were not yet formed. Enforcement and prosecution in relation to wildlife crimes were also low in these countries (Abotsi *et al.* 2015). CITES is the most appropriate convention to counter international illegal trade and should be used as the principal tool to regulate and/or prohibit international trade in galagos, and other wildlife species, and derivatives thereof.

In our study, we found all galago range countries to have some level of protection for some or all of their native galago species in their national legislation. It also became evident that the terminology used in the legislation was often similar but could mean very different things, fully or partially protected, for example, meaning different levels of protection in each country. It is also problematic that seven of the range countries are using outdated and/or incorrect taxonomy within their legislation. It has been seen in previous studies that nocturnal, small strepsirrhines are often neglected by those enforcing these legislations, as seen, for example, in the slow lorises, that are protected throughout their range just as the galagos are (Nekaris and Nijman 2007; Shepherd 2010; Beyle *et al.* 2014).

We found that countries with more restrictive legislation, where galagos are fully protected, experienced higher number of reports of trade. This might be because countries that experience higher levels of wildlife trade put stricter legislation in place to curb these wildlife crimes, but this warrants further investigation. The socio-economic development and livelihoods of communities in many African countries, both in urban and rural areas depend heavily on the use of wild fauna and flora (African Union 2015). High levels of corruption and poverty may lead to the involvement of local people in illegal activities (Morcatty *et al.* 2020), but in our study neither the Corruption Perception Index nor GNI per capita were significantly related to the number of reports of trade in galagos. Clearly the trade in galagos is a little-known yet important threat to the conservation of these species. As such, we make the following recommendations:

Range countries should ensure that galago species are included in national legislation using the most current taxonomy and adequately protected. Range countries allowing use and trade in these species must ensure legal trade is effectively regulated and is not a threat to the conservation of these species. Range countries that prohibit the use of and trade in galagos must ensure legislation, enforcement and prosecution efforts, and that resulting penalties serve as effective deterrents.

Where cross-border or international trade is concerned, countries must ensure that CITES is used efficiently and effectively, and that efforts are international and collaborative in their approach. Further research should be carried out to determine the levels of trade in galagos outside of the range countries, including countries outside of Africa.

Further research into the drivers behind the use and trade of galagos should be implemented in countries with high levels of use and trade, such as Benin, Cameroon, Equatorial Guinea, Côte d'Ivoire, Kenya, Nigeria, South Africa, and Tanzania, in order to further inform conservation and policy actions and to catalyze enforcement actions against poaching and illegal trade.

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Supplementary Material

Table S1. Galago species occurring in each country, country-specific legislation regarding wildlife trade and penalties relating to each legislation (all fines converted to US$), and what category the countries fall in according to the CITES National Legislation Project. URL: <http://www.primate-sg.org/storage/pdf/PC35_Suppl_Mat_Svensson_et_al_Galago_trade_Table_S1.doc>.

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Authors' addresses:
Magdalena S. Svensson, **Thais Q. Morcatty**, **Vincent Nijman,** Oxford Wildlife Trade Research Group, Oxford Brookes University, Faculty of Humanities and Social Sciences, Gipsy Lane, Oxford OX3 0BP, UK; and **Chris R. Shepherd**, Monitor Conservation Research Society, Box 200, Big Lake Ranch, B.C., V0L 1G0, Canada.

Corresponding author: Magdalena S. Svensson
email: <m.svensson@brookes.ac.uk>

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