Disappearing in the night: an overview on trade and legislation of night monkeys in South and Central America

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ABSTRACT

Night monkeys (*Aotus* spp.) are traded internationally, primarily legally for the biomedical industry. We present a quantitative analysis of this trade from all nine range countries, over four decades, and compare domestic legislation to CITES regulations. Night monkeys were exported from eight of the nine habitat countries, totalling 5,379 live individuals and 7,099 specimens, with trade of live individuals declining over time. In terms of species the most commonly traded was *Aotus nancymaae* (present in Brazil, Colombia, Peru) followed by *A. vociferans* (Brazil, Colombia, Ecuador, Peru) and *A. zonalis* (Colombia, Panama). There was no significant correlation between levels of trade and species' geographic range size or the number of countries in which a species occurs. Five countries have legislation that meet CITES' requirements for implementation, whereas the other four countries' legislation showed deficiencies. Research conducted in Colombia, Peru and Brazil suggests significant cross-border trade not captured in official international trade registers. Although international trade diminished, current trends suggest that populations of rarer species may be under unsustainable pressure. Further research is needed to quantify real trade numbers occurring between habitat countries.

KEY WORDS: *Aotus; CITES; douroucoulis; domestic legislation; malaria research; Neotropics; owl monkeys*

INTRODUCTION

Primates worldwide are threatened through habitat loss, forest fragmentation, overhunting as well as legal and illegal trade, including the trade for consumption, medicine and as pets [Duarte-Quiroga et al., 2003; Nekaris and Jaffe, 2007; Ceballos-Mago et al., 2010; Nijman et al., 2011; Strier, 2011; Svensson and Friant, 2014; Nijman and Healy, 2016]. Primates are traded domestically, for instance within a village or from one village to the next [Nekaris et al., 2010], regionally, for instance from one province to the next [Shanee et al., 2015b; Nijman et al., 2016], across international borders from one country to the next [Maldonado et al., 2009], and globally, from one continent to another [Mack and Mittermeier, 1984; Nijman et al., 2011]. This trade occurs within and amongst primate range countries and non-primate range countries [Nijman et al., 2011]. While much of the international primate trade follows domestic legislation and international agreements, some of it is illegal [Maldonado et al., 2009; Nijman and Healy, 2016]. Partially due to their cryptic nature, nocturnal species have often been excluded from studies on trade [Nekaris and Nijman, 2013; Svensson and Friant, 2014]. Recent work has, however, found them to be increasingly threatened by both domestic and international trade [Shepherd et al., 2005; Maldonado and Peck, 2014; Nijman and Nekaris, 2014; Svensson and Friant, 2014; Shanee et al., 2015b; Svensson et al., 2015].

In assessing the scale and traceability of the trade, the ever-changing taxonomy of many primate taxa is problematic as outdated taxonomies and synonyms lead to difficulties in identifying which species are traded from where [Mace, 2004]. Again, this is especially prominent in nocturnal primates, which have seen significant taxonomical changes as, until recently, their true diversity in terms of number of species has not been recognized [Hershkovitz, 1983; Groves, 2001; Nekaris and Bearder, 2011].

A case in point are the night monkeys (*Aotus* spp.), also referred to as owl monkeys or douroucoulis. Their range is vast, encompassing the Chaco plains of Argentina in the south to Coclé del Norte in Panama's rainforests in the north [Fig.1; Fernandez-Duque et al., 2013]. Since night monkeys were first described in 1802 by Félix de Azara [Goldman, 1914], the taxonomy and suggested arrangements of the number of species and subspecies has been greatly debated [Defler and Bueno, 2007]. Until 1983, when nine taxa were suggested, they were thought to comprise only one species, *Aotus trivirgatus* [Hershkovitz, 1983]. Here we follow the taxonomy used by Fernandez-Duque et al. [2013], recognizing 11 species, which also coincides with the International Union for Conservation of Nature's (IUCN) Red List. Two of these are listed as Least Concern on the 2016 assessment (*A. azarae* and *A. trivirgatus*), three as Near Threatened (*A. nigriceps*, *A. vociferans* and *A. zonalis*), four as Vulnerable (*A. brumbacki*, *A. griseimembra*, *A. lemurinus* and *A. nancymaae*), one as Endangered (*A. miconax*), and one as Data Deficient (*A. jorgehernandezi*) [C. Schwitzer, Pers. Comm]. The population trends for all species are either considered decreasing or unknown by the IUCN Red List, none is listed as having stable or increasing population trends [IUCN, 2008].

INSERT FIGURE 1 HERE

Like many other primate species, most night monkey species are threatened by varying levels of habitat loss throughout their range, mainly caused by expansion of the agricultural frontier, cattle ranching, logging, armed conflict and mining operations [Butchart et al., 1995; Strier, 2011; Shanee et al., 2015a]. Additionally to these threats, night monkeys have been, and continue to be, illegally traded domestically, regionally

114 and internationally [Mittermeier et al., 1994; Maldonado et al., 2009; Shanee, 2012;
115 Ruiz-García et al., 2013; Shanee et al., 2015b].

116 In this study we firstly provide an overview of the trade in night monkeys from
117 the 1960s onwards, and secondly we present the results of a quantitative analysis of the
118 international trade in night monkeys from all nine South and Central American range
119 countries. Finally we provide an overview of the relevant domestic legislation and how
120 well this complies with the rules and regulations of the Convention on International
121 Trade in Endangered Species of Wild Fauna and Flora (CITES), and how this compares
122 to recorded levels of international trade. We hypothesize that the combined effect of
123 legal and illegal trade is a real and emerging threat even for cryptic primate species and
124 we intend this overview document to be available for conservation planning.

125

126 **METHODS**

127 We downloaded data on the export of night monkeys from the CITES trade database
128 (http://trade.cites.org/) for the period 1975 – 2014 (data from 2015 were not yet
129 available). For four 10-year periods (Table 1) we established the number of live and
130 dead individuals that were exported from range countries as well as the number of
131 specimens. It is possible to overestimate the number of individuals when counting
132 specimens in the CITES database as specimens are defined as any readily recognizable
133 part or derivative of the animal (we use the definition of specimen as described by
134 www.CITES.org). To avoid this we excluded specimens where it was specified that the
135 export was in metric volume units or as shipments. We restricted dead individuals to
136 bodies and skins to avoid possible double counting (a skin and a skull exported on two

137 separate occasions could be derived from the same individual), as such our numbers
138 represent a minimum estimate.

139 The reliability of the records in the CITES database is entirely dependent on the
140 accuracy at which CITES Parties report data. It has documented that there can be large
141 discrepancies between officially reported import and export figures and the actual
142 imports or export figures [Blundell and Mascia, 2005; Nijman and Shepherd, 2010].
143 Indeed, we found that some of the reported quantities differed significantly between the
144 importing and the exporting Party, and reporting rates for certain countries were
145 suspected to be lower than what was actually traded internationally. Unfortunately it
146 was not possible to assess to what extent these discrepancies are intentional. As import
147 data (reported by the importing country) and export data (reported by the night monkey
148 range country) did not always coincide, we cross-checked the data and included the
149 largest overall totals by comparing data from importing and exporting countries. We
150 checked all re-exports (when an individual is exported by one country after it has been
151 imported from another) to prevent double-counting. By its very nature, the CITES trade
152 database only holds records of international trade, trade that is reported (either by the
153 importing Party and/or the exporting Party), and, to a lesser degree, seizure data. It does
154 not hold information on domestic trade or the illicit trade. Reports of exports or imports
155 in the CITES trade database are conservative in the taxonomy employed, with the
156 majority of the entries being labelled as *A. trivirgatus* or simply as *Aotus* spp. We
157 corrected the species name where possible as to reflect our current understanding of
158 night monkey taxonomy and geographical distribution and to better understand the
159 impact of trade on each individual species. Where we were not able to identify or infer
160 the species involved, we use *Aotus* spp. We are aware that due to (illegal) cross-border

trade, it is possible that species additional to the ones that occur naturally within a country may be re-exported; we expect that in absolute terms this will concern a small number of individuals but we have no way to verify this.

Using annual totals of individuals exported we explored whether or not there has been an increase or decline in the number of night monkeys traded over the 40 year period. We then checked whether or not species with an overall larger geographic range or species that occurred in multiple countries were exported in larger numbers [IUCN, 2008; Fig. 1]. Geographic range sizes were converted to ranks prior to analysis.

All range countries provide some level of legal protection for night monkeys (Table 2), although in varying degrees according to the CITES National Legislation Project (NLP) (Table 2) [Vasquez, 2003; CITES, 2016a]. CITES' NLP is the mechanism for assisting and encouraging the CITES Parties' legislative efforts, and places the Parties in three different categories according to how well domestic legislation matches CITES legislation. These categories are: Category 1) legislation that is believed generally to meet the requirements for implementation of CITES; Category 2) legislation that is believed generally to meet only some of the requirements for the implementation of CITES; Category 3) legislation that is believed generally not to meet the requirements for the implementation of CITES [Vasquez, 2003; CITES, 2016a]. We gathered information on country specific legislation relating to CITES and wildlife trade using searchable legislative and policy databases such as Bagheera's Endangered Species Legislation Compendium (http://www.bagheera.com/endangered-species-laws-i), the Food and Agriculture Organization of the United Nations' FAOLEX database (http://faolex.fao.org/) as well as from our own extensive knowledge of working in many night monkey range countries (Argentina, Bolivia, Brazil, Colombia, Ecuador,

Panama, and Peru). We tested whether or not countries that had legislation that agreed with CITES regulations exported more or less night monkeys compared to those countries that had deficiencies in their primary legislation (i.e. legislation embracing main laws passed by the legislative bodies of the respective governments, thus excluding secondary or subordinate legislation, passed by lower levels of government).

Data were not normally distributed and we used non-parametric statistics (Spearman Rank Correlation Coefficient and Mann-Whitney U test), implemented in R, to test for statistical significance, with significance accepted when $P<0.05$ in a two-tailed test [Siegel, 1956].

RESULTS

Historic overview of night monkey trade

In the 1960s night monkeys were found to be the best suited primate model for medical research into malarial vaccines and for tests of anti-malarial drugs [Young et al., 1966; Collins, 1994]. Several species have since commonly occurred in the biomedical trade, such as *A. vociferans, A. nigriceps* and *A. nancymaae* [Mittermeier et al., 1994; Maldonado et al., 2009; Galinski and Barnwell, 2012] due to the similarity of their immune system with that of humans and their high susceptibility to several forms of malaria-causing *Plasmodium* parasites [Herrera et al., 2002]. Different species of night monkeys have different susceptibility to malarial parasites, and not all are suited as animal models [Groves, 2005]. Nowadays night monkeys are also used as animal models in biomedical research regarding the human immunodeficiency virus (HIV) as they are the only New World primate that is resistant to HIV-1 [Hofmann et al., 1999], as well as ophthalmologic research due to the easily viewed retina [Ogden, 1994]. In the

decades prior to 1975, when CITES was established, the trade in night monkeys and other primates for biomedical research was vast and uncontrolled, especially from the Amazon basin [Linder et al., 2013]. Exports of wild caught night monkeys were principally to the United States of America (USA) and Europe. Trade of night monkeys and other primates from South and Central America occurred at an alarming rate, leading to national bans being implemented on exports of primates in the mid-1960s and 1970s in Brazil, Colombia, Peru, Paraguay and Panama, with official licenses being issued for limited numbers of night monkeys allowed to be exported in any given year [Brasil, 1967; Mack and Mittermeier, 1984; Maldonado and Peck, 2014]. When trade became regulated, captive breeding programs were started in the 1970s and 1980s, particularly in the USA, Peru, Panama and Germany [Gozalo and Montoya, 1990; Rappold and Eckert, 1994; Málaga et al., 1997; Obaldía III, 2001]. Despite the availability of captive bred animals, several researchers have found evidence that the international trade of night monkeys for biomedical research is continuing illegally from at least part of their range [Maldonado et al., 2009; Rojas Briñez, 2011; Ruiz-García et al., 2013; Maldonado and Peck, 2014].

Relying on information from the literature, the domestic trade of night monkeys appears to be low, and rarely quantified in publications when mentioned [but see Maldonado et al., 2009, Levacov et al., 2011 and Shanee, 2012 for examples from Colombia, Brazil and Peru]. Due to their small body size they are not a preferred meat source, and domestic trade for meat appears limited. Furthermore, Cormier [2006] found night monkeys to occur commonly in taboos and food avoidance throughout Amazonia, and in parts of their range night monkey meat is considered distasteful due to their pungent sub-caudal scent glands [Cornejo et al., 2008; Aquino et al., 2009;

233 Shanee et al., 2015a]. There are however reports of night monkeys being hunted for
234 consumption in Venezuela [*A. griseimembra*, Lizarralde, 2002], Colombia [*Aotus* spp.,
235 Parathian and Maldonado, 2010; Maldonado, 2012], Ecuador [*A. vociferans*, Mena et
236 al., 2000; Zapata-Rios et al., 2009] and Peru [*A. miconax*, Altherr, 2007; Shanee, 2012].
237 Alves et al. [2010] report on *A. azarae* being used in traditional medicine in Bolivia
238 where it is believed to cure dribbling in babies.

239 All primate families within South and Central America are represented in the
240 illegal pet trade, regardless of body size [Linder et al., 2013] and night monkeys are no
241 exception having been observed in the pet trade throughout their range: *A. miconax, A.*
242 *nancymaae* and *A. nigriceps* in Peru [Shanee, 2012: Shanee et al., 2015b], *A. zonalis* in
243 Panama [Altherr, 2007; Svensson, 2008], *A. vociferans* in Colombia [Parathian and
244 Maldonado, 2010], *A. griseimembra* in Venezuela [Lizarralde, 2002], *A. azarae* in
245 Brazil [Altherr, 2007] as well as *A. lemurinus* and *A. vociferans* in Ecuador [Tirira,
246 2013; Stafford et al., 2016].

247

248 ***Quantitative analysis of international trade***

249 Over the 40 years prior to 2014 we found international trade reported from eight range
250 countries, with only Venezuela not reporting trade in night monkeys. We found reports
251 of a total of 5,379 live individuals and 7,099 specimens of night monkeys exported by
252 range countries (Table 1). There has been a significant decrease in the number of live
253 individuals exported over time (Spearman Rank Correlation Coefficient, rho = -0.619, n
254 = 40, $p < 0.001$) whereas the trade in specimens has seen a significant increase (rho =
255 0.509, n = 40, p= 0.001). The majority of night monkeys were exported before 1994,
256 after this year only Peru continued to export live individuals. The live trade out of Peru

257 did not show an increase or a decrease over time when considering the entire 40 year
258 dataset (rho = -0.043, n = 40, p = 0.799) but there was a significant increase in the
259 period prior to the year 2000 (rho = 0.597, n = 25, p = 0.003) which changed to a
260 significant decrease in the years up to 2014 (rho = -0.853, n = 15, $p < 0.001$). Argentina,
261 Brazil and Ecuador only reported the export of specimens but no live night monkeys.
262 Exports of specimens comprised 57% of the total trade, mainly *A. zonalis* from Panama
263 (n = 2,702), *A. azarae* from Argentina (n = 1,508) and *Aotus* spp. from Colombia (n =
264 1,301). Trade in live individuals accounted for 43% of the total trade. The USA was the
265 main importer with 78% of import records (n = 152). We found no difference in the
266 levels of export between countries that had legislation that met the requirements of
267 CITES and ones that showed deficiencies (Mann-Whitney, $N_1 = 5$, $N_2 = 4$, $U = 3$, $p >$
268 0.10).

269 **INSERT TABLE 1 HERE**

270

271 For a subset of the exports, mostly from the 1990s onwards, we have
272 information on the origin of the night monkeys traded. Focussing on the live trade, just
273 over half (52%) is reported as being wild-caught (W in CITES terminology), with
274 smaller numbers being declared as captive-bred second generation offspring (C, 32%),
275 captive-born first generation offspring (F, 10%) and ranch-reared offspring (R, 6%).

276 Of the exports from night monkey range countries where it was possible to
277 determine the species (119 out of 195) *A. nancymaae* was the most commonly reported
278 (40%), followed by *A. vociferans* (28%), *A. zonalis* (16%), *A. azarae* (13%), *A.*
279 *nigriceps* (2%) and *A. miconax* (1%). We found no significant correlation between the
280 number of individuals traded and the species' geographic range size (rho = -0.086, n =

6, p = 0.919) or the number of countries in which a species occurred (rho = -0.463, n = 6, p = 0.355). *Aotus nancymaae* were all from Peru and almost all exported alive to the USA, mainly for scientific or commercial trade purposes.

Overview of legislation

All countries where night monkeys occur are Parties to CITES, with Peru, Ecuador and Brazil joining the Convention at the time of its inception in 1975 and Argentina and Colombia joining last in 1981 (Table 2). All night monkey species are listed under CITES Appendix II, meaning that international trade requires official permission and evidence that extraction does not negatively impact wild populations [CITES, 2016b].

All countries had at least some primary legislation in place (thus no country falling under NLP's Category 3), with some specifically addressing night monkeys and others providing general wildlife protection regulations (Table 2). Five of the range countries have legislation that generally met the requirements for implementation of CITES and thus falling under NLP's Category 1 (viz. Argentina, Brazil, Colombia, Panama and Peru), whereas the other four countries' legislation showed deficiencies for implementing CITES, falling under NLP's Category 2 (viz. Bolivia, Ecuador, Paraguay and Venezuela).

Collaboration amongst South American CITES management authorities does exist. In 1978 the Amazon Cooperation Treaty Organization (ACTO) was signed between Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela, as a legal instrument recognizing the transboundary nature of the Amazon region [CITES 2014]. In 2010 ACTO established the Amazonian Strategic Cooperation Agenda, including a Subtopic (A.3) with the objective to strengthen institutional and

technical capacity of member countries from a regional perspective to manage, monitor and control trade of endangered wildlife [Dorfler and Aragón, 2011]. ACTO is collaborating with CITES to reduce illegal and unsustainable wildlife trade more effectively, for example by developing an electronic CITES permitting system for the traceability of specimens of CITES listed species during the Rio+20 United Nations Conference on Sustainable Development in 2012 [CITES, 2014]. This method and the sharing of expertise are believed to improve the ability of member countries of ACTO to reduce illegal international wildlife trade.

INSERT TABLE 2 HERE

National level trade mitigation initiatives

There have been a number of initiatives to curb the domestic and international trade in night monkeys; we here focus on Bolivia and Colombia representing opposite ends of the night monkey trade. While official statistics (Table 1) suggest that the number of night monkeys exported from Bolivia has declined, this is thought to be caused mainly by a reduction of monitoring activities resulting in incomplete information (A.D. Mollo Vino, Pers. Obs.). Recognizing this, the Bolivian government has been working over the last five years on increasing the implementation of CITES regulation and improving monitoring of wildlife trafficking. Practically this has led to an increase in enforcement efforts at international borders and airports, targeting a wide range of species. Its General Directorate of Biodiversity and Protected Areas has created national guidelines and actions for wildlife conservation such as the Action Plan for the Conservation of Bolivian Threatened Mammals 2014-2018 [MMAyA, 2013] and the Action Plan for the

329 Conservation of Threatened Vertebrate Species in the National Protected Areas System
330 [MMAyA, 2015].

331 Until 2015, permits for malarial research in Colombia allowed the capture of *A.*
332 *vociferans* [Maldonado and Peck, 2014]. However, due to over-extraction it became
333 hard to source the species, which led to the biomedical laboratory Fundación Instituto
334 de Inmunología de Colombia (FIDIC) requesting permits to capture *A. nancymaae* as
335 well [FIDIC, 2013]. *Aotus nancymaae* was recently described to be present in
336 Colombia, with a small distribution at the southern part of the Colombian Amazon,
337 therefore extraction of individuals could be detrimental for the population's survival
338 [Bloor et al., 2012]. Initiatives such as the agreement between the Colombian Ministry
339 of the Environment, the National Police, and the Institute of Genetics at the National
340 University of Colombia have enabled the creation of tools for tracing wildlife trade and
341 attempt to improve decision making, research, sanctioning, and post-confiscation
342 management [MADS, 2012]. Despite this, in August 2016 the regional environmental
343 authority Corporación para el Desarrollo Sostenible del Sur de la Amazonía
344 (Corpoamazonia) permitted the capture of *A. nancymaae* for malarial research [A.
345 Maldonado, Pers. Obs.; Corpoamazonia, 2016]. This new permit lacks information on
346 population status of this species, and the decision obeys the political and economic
347 influence of FIDIC. In addition, Colombian indigenous collectors resident in Peru, were
348 allowed to be part of the team of trappers [Corpoamazonia, 2016], promoting the illegal
349 trade of *A. nancymaae* from Peru [A. Maldonado, Pers. Obs.], thus hampering the
350 implementation, compliance, and enforcement of CITES regulations at the border
351 between Colombia and Peru, inhabited mainly by indigenous people. In Colombia, as
352 indeed in other night monkey range countries, ethnic groups have been recognized as

353 autonomous communities, with the authority to manage their natural resources. These
354 local regulations are not necessarily framed within international legislation thus
355 weakening community management capacity [MADS, 2012].
356
357 **DISCUSSION**
358 We have demonstrated that over the last four decades trade has affected at least eight of
359 the 11 currently recognized species of night monkeys, and that, with respect to the legal
360 international trade, night monkey, or their derivatives, have been exported from eight of
361 the nine range countries. The level of legal international trade of live individuals
362 continues to decline. Only five countries have legislation that meet CITES'
363 requirements for implementation, whereas the remaining four countries' legislation
364 showed deficiencies. However, it is important to consider that just because legislation
365 exists it does not mean that sufficient law enforcement is in place or that governance is
366 high. Whilst the ACTO collaboration amongst some of the South American CITES
367 management authorities is a step in the right direction, it is vital to increase management
368 of the international night monkey trade. Improvements in legislation in Bolivia,
369 Ecuador, Paraguay and Venezuela are imperative to meet the requirements for
370 implementation of CITES.
371 Investigative research conducted in countries such as Colombia, Peru and Brazil
372 suggests significant cross-border trade that is not captured in the official international
373 trade registers [Maldonado et al., 2009; Rojas Briñez, 2011; Ruiz-García et al., 2013;
374 Maldonado and Peck, 2014]. This illegal trade is not easily captured under CITES and it
375 is imperative that domestic legislation extends to address and strengthen illegal in-

376 country activities more efficiently, as well as implement cross-border cooperative
377 efforts involving border officials and environmental authorities.

378 The numbers we report here for legal trade agree largely with those reported by
379 Maldonado et al. [2009], with any differences being attributable to the six years of
380 additional data we had at our disposal. With respect to the numbers of night monkeys
381 exported out of Peru our data show significantly lower levels of international trade than
382 reported by Maldonado and Peck [2014]. They reported 3,258 animals exported from
383 Peru, over the period 1994 to 2011, whereas we recorded a maximum of 1,925 animals,
384 both dead and alive, being exported over this period. The discrepancy stems from the
385 inclusion of specimens and derivatives, which cannot be attributed to individual
386 animals, in their total.

387 Further research is needed to verify if the very low levels of international trade
388 reported to the CITES Secretariat by Brazil, Ecuador and Venezuela is representative of
389 the current situation regarding cross-border night monkey trade from these countries.
390 While it is possible that underreporting from range countries masks higher levels of
391 trade, it is worth noting that similar low levels of trade from Brazil, Ecuador and
392 Venezuela were reported from importing countries thus suggesting genuinely low levels
393 of trade. A lack of taxonomic identification ability in the relevant authorities,
394 institutional deficiencies with respect to recording and reporting trade, or corruption
395 could also be the cause of the apparent low levels of international trade.

396 While the large-scale international trade in night monkeys for biomedical
397 research has diminished, probably due to the proliferation of breeding centres in the
398 USA, considerable numbers of night monkeys are still traded internationally, both
399 legally and illegally. *Aotus nancymaae* was most commonly reported as traded, and is

among the most commonly used night monkey in malarial research [Maldonado et al., 2009; Ruiz-García et al., 2013]. Concerns have been raised regarding the ethical issues and the viability of using primates as biomedical research models [Pound et al., 2004; Bailey, 2005; Knight, 2008]. Further, studies of avian malarial parasites have shown to be efficient and show promise in research on malarial vaccines [Marzal, 2012].

At a global level the legal trade in night monkeys is still significant compared to most other primate taxa. Estrada et al. [2016] provided a global overview of the international trade in primates (live and dead) for the period 2005 to 2014, tabulating levels of trade at the genus level. From these data it is clear that while two genera show comparable levels of trade to that seen in night monkeys (chimpanzees and bonobos, genus *Pan*, and patas monkeys, genus *Erythrocebus*), only eight taxa showed higher levels of trade (often significantly so as in the case of macaques, genus *Macaca*) whereas 47 genera were traded in smaller numbers.

It is possible that the most heavily traded populations (such as *A. nancymaae* and *A. vociferans*) and some of the rarer species (e.g. *A. miconax*), are under excessive pressure from the current international legal and illegal trade [Maldonado et al., 2009; Shanee, 2012; Ruiz-García et al., 2013; Maldonado and Peck, 2014; Shanee et al., 2015b]. It is noteworthy that in countries like Colombia, Peru and Brazil that have domestic legislation in place that meets the requirements for implementation of CITES and that have regulatory bodies at provincial and national levels, night monkeys are evidently still subject to illegal cross border trade. This ongoing illegal cross border trade has been ongoing for decades; with Mittermeier et al. [1994] warning that trade in the northern Colombian night monkeys (*A. griseimembra* and *A. zonalis*) could be

423 detrimental to population levels. The effectiveness of CITES enforcement in these
424 countries in particular are in great need of evaluation and improvement.

425 It is vital that night monkeys in trade are accurately and consistently identified to
426 species level; if the taxonomy used by, for example CITES, does not reflect our current
427 understanding of the richness in species number of night monkeys it hampers the
428 traceability and assessment of the scale and impact of the trade. Furthermore, wildlife
429 authorities and border personnel do not use genetic methods to determine species and
430 are often not trained in identifying species [Shanee et al., 2015b]. The morphological
431 similarity between night monkey species suggests the possibility of confusion or even
432 laundering of rarer species under the guise of commoner ones. It would be beneficial to
433 implement protocols for rapid genetic testing throughout night monkey range countries.
434 To reduce the problematic policing of borders a more practical approach might be to
435 control biomedical facilities.

436 Regulating international trade requires the cooperation of importing, exporting
437 and re-exporting countries. With respect to the trade in night monkeys in selected range
438 countries significant progress has been made to regulate this trade and to curb the illegal
439 domestic and international trade; other countries still lag behind in this respect. We feel
440 that at present a greater involvement by importing countries in ensuring that the
441 international trade in night monkeys abides by the rules and intentions of CITES and
442 other multinational agreements may result in the greatest benefits for night monkey
443 populations. In more general terms, the trade in night monkeys clearly illustrate that
444 changes in primate taxonomy need to be reflected in conservation assessments of these
445 new taxa. For small or cryptic species occurring in trade, including night monkeys but
446 also taxa such as galagos, slow lorises and (nocturnal) lemurs, the extent of

(international and domestic) trade is often poorly documented [Nekaris et al., 2010; Svensson et al., 2015; Reuter and Schaefer, 2016], and true levels of trade may well be a significant impediment to their conservation.

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REFERENCES

Altherr S (2007). *Going to pot: the Neotropical bushmeat crisis and its impact on primate populations*. Munich: Care for the Wild & Pro Wildlife.

Alves RRN, Souto WMS, Barboza RRD (2010). Primates in traditional folk medicine: a world overview. *Mammal Review* 40(2): 155-180.

Argentina (1982). *Ley 22344 Convención sobre el comercio internacional de especies amenazadas de fauna y flora silvestres*. Buenos Aires: Ministerio de Ambiente y Desarrollo Sustentable.

Aquino R, Terrones W, Navarro R, Terrones C, Cornejo FM (2009). Caza y estado de conservación de primates en la cuenca del Río Itaya, Loreto, Perú. *Revista Peruana de Biología* 15: 33–39.

Bailey J (2005). Non-human primates in medical research and drug development: a critical review. *Biogenic Amines* 19(4): 235-255.

Bloor P, Ibáñez C, Arciniegas S, Hoyos M, Hernández S, Pedraza L (2012). Informe final del convenio de cooperación científica y tecnológica No. 10F del 15 de diciembre de 2011 entre el Fondo Nacional Ambiental – FONAM; la Universidad Nacional de Colombia – Instituto de Genética – IGUN; el Instituto Amazónico de Investigaciones Científicas – SINCHI y la Corporación para el Desarrollo Sostenible del Sur de la Amazonia – CORPOAMAZONIAR. Bogotá: Instituto de Genética Universidad Nacional de Colombia.

Blundell AG, Mascia MB (2005). Discrepancies in reported levels of international wildlife trade. *Conservation Biology* 19: 2020-2025.

Bolivia (1992). *Ley Nro. 1333. Ley de 27 de Abril de 1992* [cited 2016 September 05]. Available at: http://faolex.fao.org/docs/pdf/bol6919.pdf

Brazil (1967). *Lei Federal n° 5.197, de 03 de janeiro de 1967* [cited 2016 July 27]. Available at: http://www.planalto.gov.br/ccivil_03/leis/L5197.htm

Brazil (1998). *Lei Federal n° 9.605, de 12 de fevereiro de 1998* [cited 2016 July 27]. Available at: http://www.planalto.gov.br/ccivil_03/leis/L9605.htm

Brazil (2000). *Decreto n° 3.607, de 21 de setembro de 2000* [cited 2016 July 27]. Available at: http://www.planalto.gov.br/ccivil_03/decreto/D3607.htm

Butchart SM, Barnes R, Davies CWN, Fernandez M, Seddon N (1995). Observations of two threatened primates in the Peruvian Andes. *Primate Conservation* 16: 15-19.

493 Ceballos-Mago N, González CE, Chivers DJ (2010). Impact of the pet trade on the
494 Margarita capuchin monkey Cebus apella margaritae. *Endangered Species*
495 *Research* 12: 57-68.
496 [CITES] Convention on International Trade in Endangered Species of Wild Fauna and
497 Flora (2012). *Informes sobre las medidas adoptadas por los representantes*
498 *regionales e información complementaria de las Partes, relevantes para la*
499 *cooperación regional y la labor del Comité de Fauna (AC26 Doc. 27.3)* [cited
500 2016 June 20]. Available from: https://cites.org/common/com/ac/26/S26-27-
501 03.pdf
502 CITES (2014). *Amazon countries join efforts against illegal wildlife trade* [cited 2016
503 April 1]. Available from: https://goo.gl/CnJAgb
504 CITES (2016a). *National laws for implementing the Convention* [cited 2016 Sept 06].
505 Available from: https://cites.org/eng/legislation
506 CITES (2016b). *Member countries* [cited 2016 March 21]. Available from:
507 https://cites.org/eng/disc/parties/index.php
508 Collins WE (1994). The owl monkey as a model for malaria. In *Aotus the owl monkey*
509 (Baer JF, Weller RE, Kakoma I, eds), pp 217-244. San Diego: Academic Press.
510 Cormier L (2006). A preliminary review of Neotropical primates in subsistence and
511 symbolism of indigenous lowland South American people. *Ecological and*
512 *Environmental Anthropology* 2(1): 14-32.
513 Cornejo FM, Aquino R, Jimenez C (2008). Notes on the natural history, distribution and
514 conservation status of the Andean night monkey, *Aotus miconax* Thomas, 1927.
515 *Primate Conservation* 23: 1-4.

516 Corpoamazonia (2016). *Resolucion 00993*. Putumayo: Corporación para el Desarrollo
517 Sostenible del Sur de la Amazonía
518 Defler TR, Bueno ML (2007). *Aotus* diversity and the species problem. *Primate*
519 *Conservation* 22: 55-70.
520 Dorfler M, Aragón C (2011). *Amazonian strategic cooperation agenda*. Brasilia
521 (Brazil): Amazonian Cooperation Treaty Organization.
522 Duarte-Quiroga A, Estrada A (2003). Primates as pets in Mexico City: An assessment
523 of the species involved, source of origin, and general aspects of treatment.
524 *American Journal of Primatology* 61(2): 53-60
525 Estrada A, Garber PA, Rylands AB, Roos C, Fernandez-Duque E, Di Fiore A, Nekaris
526 KAI, Nijman V, Heymann EW, Lambert JE, Rovero F, Barelli C, Setchell JM,
527 Gillespie TR, Mittermeier RA, Arregoitia LV, de Guinea M, Gouveia S,
528 Dobrovolski R, Shanee S, Shanee N, Boyle SA, Fuentes A, MacKinnon KC,
529 Amato KR, Meyer ALS, Wich S, Sussman RW, Pan R, Kone I, Li B (2016).
530 Impending extinction crisis of the world´s primates: why primates matter. *Science*
531 *Advances* (under review).
532 Fernandez-Duque E, Corley MK, Spence-Aizenberg A (2013). Aotidae (night
533 monkeys). In *Handbook of the mammals of the world* (Mittermeier RA, Rylands
534 AB, Wilson DE, eds.), pp 414-431. Barcelona: Lynx Edicions / Conservation
535 International / IUCN.
536 FIDIC (2013). Solicitud de ampliacion y modificacion al permiso de estudio en
537 diversidad biologica a la fundacion insitituto de inmunologia de Colombia,
538 FIDIC, en el marco de la realizacion del proyecto "Captura y estudio de
539 investigacion cientifica en diversidad biologica de primates en la cuenca del rio

amazonias en el trapecio amazonico Colombiano". Bogotá: Fundación Instituto de Inmunología de Colombia.

Galinski MR, Barnwell JW (2012). Nonhuman primate models for human malaria research. In *Nonhuman primates in biomedical research: Diseases* (Abee CR, Mansfield K, Tardif S, Morris T, eds.), pp. 299–323. San Diego: Academic Press.

Goldman E (1914). Description of new mammals from Panama. *Smithsonian miscellaneous collections* 63: 1-7.

Gómez JU (2015). *Ley Forestal y de Fauna Silvestre Nº 29763*. Quito (Peru): Minesterio de Agricultura, Direccion General Forestal y de Fauna Silvestre.

Gozalo A, Montoya E (1990). Reproduction of the owl monkey (*Aotus nancymai*) in captivity. *American Journal of Primatology* 21(1): 61–68.

Groves C (2001). *Primate taxonomy*. Washington: Smithsonian Institution Press.

Groves C (2005). The taxonomy of primates in the laboratory context. In *The laboratory primate-definition of the primate model* (Wolfe-Coote S, ed.), pp 3-15. San Diego: Academic Press.

Herrera S, Perlaza BL, Bonelo A, Arevalo-Herrera M (2002). Aotus monkeys: their great value for anti-malaria vaccines and drug testing. *International Journal for Parasitology* 32(13): 1625 – 35.

Hershkovitz P (1983). Two new species of night monkeys, genus *Aotus* (Cebidae, platyrrhini): A preliminary report on *Aotus* taxonomy. *American Journal of Primatology* 4: 209-243.

Hofmann W, Schubert D, LaBonte J, Munson L, Gibson S, Scammell J, Ferrigno P, Sodroski J (1999). Species-specific, postentry barriers to primate immunodeficiency virus infection. *Journal of Virology* 73(12): 10020-10028.

564 [IUCN] International Union for Conservation of Nature (2008). *Aotus spp. The IUCN*
565 *Red List of Threatened Species. Version 2016-1* [cited 2016 July 12]. Available
566 from: http://www.iucnredlist.org
567 Knight A (2008). Systematic reviews of animal experiments demonstrate poor
568 contributions toward human healthcare. *Reviews of Recent Clinical Trials* 3: 89-
569 96.
570 Levacov D, Jerusalinsky L, Fialho MS (2011). Levantamento dos primatas recebidos
571 em Centros de Triagem e sua relação com o tráfico de animais silvestres no
572 Brasil. In *A primatologia no Brasil, vol. 11* (Melo FR, Mourthé I, eds.), pp 281-
573 305. Belo Horizonte: Sociedade Brasileira de Primatologia.
574 Linder JMS, Sawyer SC, Brashares JS (2013). Primates in trade. In *Primate ecology*
575 *and conservation – a handbook of techniques* (Sterling EJ, Bynum N, Blair ME,
576 eds.), pp 323-345. Oxford: Oxford University Press.
577 Lizarralde M (2002). Ethnology of monkeys among the Barí of Venezuela: perceptions,
578 use and conservation. In *Primates face to face: the conservation implications of*
579 *human-nonhuman primate interconnections* (Fuentes A, Wolfe LD, eds.), pp 85-
580 100. Cambridge: Cambridge University Press.
581 Mace GM (2004). The role of taxonomy in species conservation. *Philosophical*
582 *Transactions of the Royal Society B: Biological Sciences* 359(1444): 711-719.
583 Mack D, Mittermeier RA (1984). *The international primate trade, volume 1:*
584 *legislation, trade and captive breeding.* TRAFFIC USA, WWF-US Primate
585 Program, IUCN SSC Primate Specialist Group.
586 [MADS] Ministerio de Ambiente y Desarrollo Sostenible (2012). *Estrategia Nacional*
587 *para la Prevención y Control del Tráfico Ilegal de Especies Silvestres: Avances*

588 *en su Implementación, Plan de Acción 2012-2020* [cited 2016 June 21]. Available
589 from: https://goo.gl/m23lZp
590 Málaga CA, Weller RE, Buschbom RL, Baer JF, Kimsey BB (1997). Reproduction of
591 the owl monkey (*Aotus* spp.) in captivity. *Journal of Medical Primatology* 26(3):
592 147-152.
593 Maldonado AM (2012). *Hunting by Tikunas in the Southern Colombian Amazon.*
594 *Assessing the impact of subsistence hunting by Tikunas on game species in*
595 *Amacayacu National Park, Colombian Amazon*. Saarbrücken, Germany: LAP
596 Lambert Academic Publishing GmbH & Co. KG.
597 Maldonado AM, Peck MR (2014). Research and *in situ* conservation of owl monkeys
598 enhances environmental law enforcement at the Colombian-Peruvian border.
599 *American Journal of Primatology* 76(7): 658-669.
600 Maldonado AM, Nijman V, Bearder SK. (2009). Trade in night monkeys *Aotus* spp. in
601 the Brazil-Colombia-Peru tri-border area: international wildlife trade regulations
602 are ineffectively enforced. *Endangered Species Research* 9(2): 143–149.
603 Marzal A (2012). Recent advances in studies on avian malaria parasites. In *Malaria*
604 *parasites* (Okwa OO, ed.), pp 135-158. Rijeka, Croatia: InTech.
605 Mena VP, Stallings JR, Regalado JB, Cueva RL (2000). The sustainability of current
606 hunting practices by the Huaorani. In *Hunting for sustainability in tropical forests*
607 (Robinson JG, Bennett EL, eds.), pp. 57-78. New York: Columbia University
608 Press.
609 Ministerio Del Ambiente (2011). *Libro IV de la biodiversidad. Control de cacerías y*
610 *vedas de especies de fauna silvestre*. Quito: Ministerio del Ambiente.
611 http://www.ambiente.gob.ec/sites/default/files/users/mponce/libroIV_TIII.pdf

612 Ministerio de Medio Ambiente y Agua (2016). *Informe bienal 2014-2015 Estado*
613 *plurinacional de Bolivia*. Report for CITES.
614 Mittermeier RA, Konstant WR, Mast RB (1994). Use of Neotropical and Malagasy
615 primate species in biomedical research. *American Journal of Primatology* 34: 73-
616 80.
617 [MMAyA] Ministerio de Medio Ambiente y Agua (2013). *Plan de acción para la*
618 *conservación de mamíferos amenazados*. La Paz. Bolivia: PGD Impresiones.
619 MMAyA (2015). *Plan de Acción para la conservación de Especies Amenazadas de*
620 *Vertebrados en el Sistema Nacional de Áreas Protegidas (2015-2020)* La Paz,
621 Bolivia.
622 Nekaris KAI, Bearder SK (2011). The Lorisiform primates of Asia and mainland
623 Africa. In *Primates in perspective* (Campbell CJ, Fuentes A, MacKinnon KC,
624 Bearder SK, Stumpf RM, eds.), pp 34-54. Oxford: Oxford University Press.
625 Nekaris KAI, Jaffe S (2007). Unexpected diversity of slow lorises (*Nycticebus* spp.)
626 within the Javan pet trade: implications for slow loris taxonomy. *Contributions to*
627 *Zoology* 76(3): 187-196
628 Nekaris KAI, Nijman V (2013). The ethics of conducting field research – do long-term
629 great ape field studies help to conserve primates? In *Ethics in the field* (Macclancy
630 J, Fuentes A, eds.), pp 108–123. New York: Berghahn Books.
631 Nekaris KAI, Shepherd CR, Starr CR, Nijman V (2010). Exploring cultural drivers for
632 wildlife trade via an ethnoprimatological approach: a case study of slender
633 and slow lorises (Loris and Nycticebus) in South and Southeast Asia.
634 *American Journal of Primatology* 72: 877-886.

635 Nijman V, Healy A (2016). Present-day international primate trade in historical context.
636 In *An Introduction to Primate Conservation* (Wich SA, Marshall AJ, eds.). pp
637 129-142. Oxford: Oxford University Press.
638 Nijman V, Nekaris KAI (2014). Traditions, taboos and trade in slow lorises in Sudanese
639 communities in southern Java, Indonesia. *Endangered Species Research* 25(1):
640 79–88.
641 Nijman V, Shepherd CR (2010). The role of Asia in the global trade in CITES II-listed
642 poison arrow frogs: hopping from Kazakhstan to Lebanon to Thailand and
643 beyond. *Biodiversity and Conservation* 19(7): 1963-1970.
644 Nijman V, Nekaris KAI, Donati G, Burford M, Fa J (2011). Primate conservation:
645 measuring and mitigating trade in primates. *Endangered Species Research* 13;
646 159-161.
647 Nijman V, Spaan D, Rode-Margono EJ, Wirdateti, Nekaris KAI (2016). Changes in the
648 primate trade in indonesian wildlife markets over a 25-year period: Fewer apes
649 and langurs, more macaques, and slow lorises. *American Journal of Primatology*
650 Early View.
651 Obaldía III N (2001). *Evaluation of drug and vaccine candidates in the human malaria/*
652 *Aotus monkey model*. Report for U.S. Army Medical Research and Materiel
653 Command. Fort Detrick (MD).
654 Ogden TE (1994). Opthalmologic research in the owl monkey. In *Aotus the owl monkey*
655 (Baer JF, Weller RE, Kakoma I, eds.), pp 263-286. San Diego: Academic Press.
656 Panama (1995). *Asamblea legislativa Ley No. 24 (de 7 de Junio de 1995).* Panama City:
657 Government of Panama.

658 Panama (2004). *Decreto Ejecutivo 43 (De 7 de Julio de 2004)*. Panama City:
659 Government of Panama.
660 Paraguay (1976). Ley N° 583. Asunción: Congreso Nacional del Paraguay.
661 Paraguay (2012). *Decreto N° 9701*. Asunción: Ministerio de Agricultura y Ganadería.
662 Parathian HE, Maldonado AM (2010). Human-nonhuman primate interactions amongst
663 Tikuna people: perceptions and local initiatives for resources management in
664 Amacayacu in the Colombian Amazon. *American Journal of Primatology* 72(10):
665 855-865.
666 Pound P, Ebrahim S, Sandercock P, Bracken MB, Roberts I (2004). Where is the
667 evidence that animal research benefits humans? *BMJ* 328 (7438): 514-517.
668 Provincia de Formosa (2012). *Leyes provinciales* [cited 2016 July 26]. Available from:
669 http://www.legislaturaformosa.gob.ar/?seccion=verley&nro=1582
670 Rappold I, Erkert HG (1994). Re-entrainment, phase-response and range of entrainment
671 of circadian rhythms in owl monkeys (*Aotus lemurinus*) of different age.
672 *Biological Rhythm Research* 25(2): 133–152.
673 Reuter KE, Schaefer MS (2016). Captive conditions of pet lemurs in Madagascar. *Folia*
674 *Primatologica* 87(1): 48-63.
675 Rojas Briñez DK (2011). *Comercio de fauna silvestre en el departamento del Tolima-*
676 *Colombia bajo el contexto de la demanda internacional de especies* [MSc
677 dissertation]. Universidad Internacional de Andalucía, Spain.
678 Ruiz-García M, Vásquez C, Camargo E, Castellanos-Mora LF, Gálvez H, Leguizamón
679 N, Shostell JM (2013). Molecular genetics analysis of mtDNA COII gene
680 sequences shows illegal traffic of night monkeys (*Aotus*, Platyrrhini, Primates) in
681 Colombia. *Journal of Primatology* 2(1): 1-9.

682 Shanee N (2012). Trends in local wildlife hunting, trade and control in the Tropical
683 Andes Biodiversity Hotspot, northeastern Peru. *Endangered Species Research*
684 19(2): 177–86.
685 Shanee S, Allgas N, Shanee N, Campbell N (2015a). Distribution, ecological niche
686 modelling and conservation assessment of the Peruvian night monkey
687 (Mammalia: Primates: Aotidae: *Aotus miconax* Thomas, 1927) in northeastern
688 Peru, with notes on the distributions of *Aotus* spp. *Journal of Threatened Taxa*
689 7(3): 6947-6964.
690 Shanee N, Mendoza AP, Shanee S (2015b). Diagnostic overview of the illegal trade in
691 primates and law enforcement in Peru. *American Journal of Primatology* Early
692 View.
693 Shepherd CR, Sukumaran J, Wich SA (2005). *Open season: an analysis of the pet trade*
694 *in Medan, north Sumatra, 1997–2001*. TRAFFIC Southeast Asia, Petaling Jaya,
695 Selangor, Malaysia.
696 Siegel S (1956). *Non-parametric statistics for the behavioral sciences*. New York:
697 McGraw-Hill.
698 Stafford CA, Alarcon-Valensuela J, Patiño J, Prezioso RF, Sellers WI (2016). Know
699 your monkey: identifying primate conservation challenges in an indigenous
700 Kichwa community using an ethnoprimatological approach. *Folia Primatologica*
701 87(1): 31-47.
702 Strier KB (2011). Conservation. In *Primates in perspective* (Campbell CJ, Fuentes A,
703 Mackinnon KC, Panger M, Bearder SK, eds.), pp 664-675. Oxford: Oxford
704 University Press.

705 Svensson MS (2008). *Assessing the distribution and abundance of night monkeys*
706 *(Aotus zonalis) in Alto Chagres, Panama* [MSc dissertation]. Oxford: Oxford
707 Brookes University.
708 Svensson MS, Friant SC (2014). Threats from trading and hunting of pottos and
709 angwantibos in Africa resemble those faced by slow lorises in Asia. *Endangered*
710 *Species Research* 23: 107–114.
711 Svensson MS, Ingram DJ, Nekaris KAI, Nijman V (2015). Trade and ethnozoological
712 use of African lorisiforms in the last 20 years. *Hystrix the Italian Journal of*
713 *Mammology* 26(2): 153-161.
714 Tirira DG (2013). Tráfico de primates nativos en el Ecuador.35-37. *Boletín Técnico 11*.
715 *Serie Zoológica* 8-9: 36-57.
716 Vasquez J (2003). Compliance and enforcement mechanisms of CITES. In *The trade in*
717 *wildlife: regulation for conservation* (Oldfield S, ed.), pp 63-69. London:
718 Earthscan.
719 Venezuela (1970). *Ley de proteccion a la fauna silvestre*. Caracas: the Congress of the
720 Republic of Venezuela.
721 Venezuela (2012). Ley Penal del Ambiente (Gaceta Oficial N° 39.913 del 02 de mayo
722 de 2012). Caracas: the Congress of the Republic of Venezuela.
723 Young MD, Porter JA, Johnson CM (1966). Plasmodium vivax transmitted from man to
724 monkey to man. *Science* 153: 1006-1007.
725 Zapata-Ríos G, Urgiles C, Suárez E (2009). Mammal hunting by the Shuar of the
726 Ecuadorian Amazon: is it sustainable? *Oryx* 43(03): 375-385.