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Population density and proportion of used area of the Spix's night monkey (*Aotus vociferans*) in a nature reserve in Caquetá (Colombia)

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ABSTRACT

One of the eleven species of nocturnal primates, *Aotus vociferans* occurs in Colombia. It lives in different types of forests, agroecosystems and peri-urban areas and is listed as Least Concern due mainly to its wide distribution and its presumed large populations that have been little studied due to their nocturnal habits. However, further studies are needed to confirm the current status of its populations throughout its range, since despite its habitat flexibility, anthropogenic activities and illegal trafficking have led to changes in population densities and modification of the sites used by this species. To estimate population density and proportion of used area of *A. vociferans* in a secondary forest in the Colombian Andean Amazonian foothills, specifically in Florencia-Caquetá, we used the distance sampling method with linear transects and occupancy models. Sampling was carried out along 20 transects in a 25-ha area from November 2022 until February 2023, from 18:00 to 00:30 hours. The estimated population density for *A. vociferans* in the area was 47.34 ind km^{-2}. The occupation probability was 0.56, and 11 transects presented a probability of 1.0 of being used by *A. vociferans*. The population density was similar to other estimations for *Aotus* in secondary, floodplain, and mature forest, but was higher than that recorded in highland forests. The occurrence probability might be associated with the presence of plant species from the families Anonaceae, Anacardiaceae, Arecaceae, Euphorbiaceae, Melastomataceae and Solanaceae, which were observed in *Aotus* diet, but this hypothesis must be tested with a robust plant sampling. We report the highest known density for this species in the Amazon region and provide the first estimate of the proportion of area used by *A. vociferans.*

KEYWORDS: secondary forest, abundance, Colombian Amazon

Densidad poblacional y proporción de área usada del mono nocturno amazónico (*Aotus vociferans*) en una reserva natural en Caquetá (Colombia)

RESUMEN

En la Amazonía colombiana se encuentra una de las once especies de primates nocturnos, *Aotus vociferans.* Este habita en diferentes tipos de bosques, agroecosistemas y zonas periurbanas, y se encuentra categorizada como de Preocupación Menor debido principalmente a su amplia distribución y a sus presuntas grandes poblaciones que han sido poco estudiadas por su hábito nocturno. Sin embargo, se requieren más estudios para confirmar el estado actual de sus poblaciones en toda su área de distribución, ya que, a pesar de la flexibilidad de su hábitat, las actividades antropogénicas y el tráfico ilegal han provocado cambios en la densidad poblacional y la modificación de los sitios utilizados por esta especie. Para estimar la densidad poblacional y la proporción del área utilizada de *A. vociferans* en un bosque secundario del piedemonte andino amazónico colombiano, específicamente en Florencia-Caquetá, se utilizó el método de muestreo a distancia con transectos lineales y modelos de ocupación. El muestreo se realizó a lo largo de 20 transectos en un área de 25 ha desde noviembre de 2022 hasta febrero de 2023, de 18:00 a 00:30 horas. La densidad poblacional estimada de *A. vociferans* en el área fue de 47,34 ind km^{-2}. La probabilidad de ocupación fue de 0,56, y 11 transectos presentaron una probabilidad de 1,0 de ser utilizados por *A. vociferans*. La densidad poblacional encontrada fue similar a otras estimaciones para el género *Aotus* en bosques secundarios, de llanura aluvial y maduros; a su vez, fue mayor que la registrada en bosques de tierras altas. La probabilidad de ocurrencia podría estar asociada con la presencia de especies vegetales de las familias Annonaceae, Anacardiaceae, Arecaceae, Euphorbiaceae, Melastomataceae y Solanaceae, observadas en la dieta del género, pero esta hipótesis debe ser probada con un muestreo robusto de la vegetación. Este estudio documenta la mayor densidad encontrada hasta ahora para esta especie en la región amazónica y proporciona la primera estimación de la proporción del área utilizada por *A. vociferans.*

PALABRAS-CLAVES: bosque secundario, abundancia, Amazonia Colombiana

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INTRODUCTION

The decline, loss and fragmentation of natural habitats has led to changes in landscape configuration and this in turn has caused negative impacts on biodiversity (Santos and Telleria 2006; Fahrig, 2013, 2017). Vegetation loss increasingly reduces the space occupied by species and this leads to food resource scarcity, changes in area use and population density (Freitas et al. 2008; De La Ossa and De La Ossa- Lacayo 2014; Elizalde-Guerrero et al. 2021). Continuous deforestation in the Amazon region of Colombia has amounted to the loss of approximately 40.219 ha of forest in the first quarter of 2024 only, concentrated in the departments of Amazonas, Caquetá, Guaviare, Guainía, Meta, Putumayo, and Vaupés (IDEAM 2024). Deforestation is associated with socio-environmental conflicts in the region (MADS 2012), caused mainly by wood extraction, expansion of road infrastructure and livestock, agricultural crops and the extraction of minerals and hydrocarbons (Charry et al. 2017).

Mammals are among the first and most affected species by human impacts in the Colombian Amazon (WWF 2023; Ministerio de Ambiente y Desarrollo Sostenible, 2023; Negret et al. 2023). Among them is the night monkey (*Aotus vociferans* Spix 1823), a species characterized by its activity primarily at night. This primate has special adaptations for nocturnal life, such as excellent vision in low-light conditions. However, due to habitat degradation and other human threats, it is at risk (Defler 2010; Maldonado-Rodríguez 2011; Carrillo-Bilbao . 2018; Montilla et al. 2020). The genus comprises 11 species (Ford 1994; Wright 1994; Defler and Bueno 2007; Defler 2010; Tejedor and Muñoz 2013) distributed from Panama to northern Argentina (Hershkovitz 1983; Ford 1994; Wright 1994; Fernandez-Duque 2012; Defler 2010). It is distributed in the Colombian Amazon from the lowlands to 1.550 m of elevation in the Andes-Amazon transition, in primary and secondary forests (including fragmented forests), agroecosystems and peri-urban areas (Aquino and Encarnación 1994; Fernández-Duque 2007; Carrillo-Bilbao 2018).

The population density is the number of individuals per area or surface unit (Buckland et al. 2001; Buckland et al. 2010), and this estimate is affected by habitat characteristics and its quality. On the other hand, the proportion of area used allows to know which sites the species uses in a certain place (Mackenzie et al. 2004). Both these metrics allow: 1) to know the state of a population in a determined period of time, 2) to compare with other populations, 3) to understand the importance of different habitats for species conservation, 4) follow up on management plans for wildlife (Plumptre and Cox 2006). Long-term monitoring of these metrics provides key data for assessing how species respond to the loss and transformation of their ecosystems (Roncancio-Duque et al. 2010). Therefore, population density and the proportion of area used reflect the relationship between the species and its habitat, allowing the assessment of conservation status, identifying crucial habitats for the species and supporting the design of appropriate management plans (Mackenzie et al. 2004; Plumptre and Cox 2006). However, population density studies for *Aotus* are scarce as they are particularly difficult to survey due to its nocturnal habit (Roncancio-Duque et al. 2019; Helenbrook et al. 2020; Chica-Florez et al. 2022). There are density estimates for *Aotus* from Panama, Colombia and Peru (Aquino and Encarnacion, 1988; Svensson et al. 2010; Vargas-Madrid 2013; Helenbrook et al. 2020). In Colombia, *A. vociferans* has been investigated only in Mocagua, in the southeast of the country, near the Amazon River, in flooded forest habitats (Table 1) (Maldonado-Rodríguez 2011). It is clear then the shortage of information for this species.

The southern foothills of the Colombian Amazon constitute the northwestern limit of the distribution of A. *vociferans*, making them particularly vulnerable to local extinction. Located in this marginal strip, these populations are in an ecological transition zone, exposed to a series of environmental and human factors that affect their survival, such as deforestation, climate change, and habitat fragmentation. Since they are located on the margins of their range, connectivity with other populations is more limited, increasing the risk of local extinction. Furthermore, the environmental conditions in this region may not be ideal for their development, further increasing the species' vulnerability in this specific area (Laurance and Useche 2012; Ceballos and Rodríguez 2015). So, estimating population parameters at the limits of a species' distribution is essential. In this regard, the objective of our study was to estimate the population density and proportion of area used by *A. vociferans* in a peri-urban forest in the Amazonian foothills. To do so, we conducted a comprehensive review of the scientific and gray literature. We hypothesize that the population density of *A. vociferans* in our study will be lower compared to estimates for other species of the genus in larger fragments or continuous forests (Chica-Florez et al. 2022).

MATERIAL AND METHODS

Study area

The study was carried out in the El Manantial Community and Ecotourism Natural Reserve (MCENR), located in El Caraño village, in the northeast of Florencia, department of Caquetá, Colombia (01°38'02"N, 075°34'30"W) (Figure 1). Its altitude oscillates between 393 and 638 m asl, with an average rainfall of 3793 mm year^{-1}, average temperature of 25 °C and relative humidity of 83% (Pérez-Rico et al. 2011).

MCENR has an extension of 45 ha, containing 72 houses. The inhabitants work communally to protect and promote tourism in the reserve. The MCENR has a variety of vegetation covers that form a mosaic of habitats. Secondary forest extends throughout the study area and, in many areas,

Table 1. Reported population densities for species of the genus *Aotus* in the Neotropics.

Species	Estimated density (ind km^{-2})	Group density (groupskm^{-2})	Group size	Effective width (m)	Inference area	Altitude (m asl)	Area features	Locality	Reference
COLOMBIA									
Aotus lemurinus	39	20	1.9	10.39	489 ha	1.750-2.276	Dense Andean Forest	Otún Quimbaya Wildlife Sanctuary	Chica-Florez *et al.* 2022
Aotus lemurinus	113	52.4	2.2	-	2.409 ha	1,000-2,200	Secondary Andean Forest	Dapa, Valle del Cauca	Hirche *et al.* 2017
Aotus vociferans	44	13.3-14.3	3.3-1.4	9.5	-	49	Flooded piedmont forest	Mocagua	Maldonado-Rodríguez 2011
Aotus nancymaae	23.9	8.8	-	-	19 km^2	-	Flooded piedmont forest	Puerto Nariño	Roncancio-Duque *et al.* 2019
Aotus vociferans	44	12.24	3.87	16	25 ha	393-630	Secondary piedmont forest	El Manantial Community Nature and Ecotourism Reserve	This study
PERU									
Aotus nancymaae	8.8	4.61	1.9	20	-	-	Dense piedmont forest	Loreto	Vargas-Madrid 2013
Aotus nancymaae	24.2-46.3	5.9-11.3	-	-	-	120-300	Dense piedmont flooded and non-flooded forest	Northeastern	Aquino and Encarnación 1988
Aotus nigriceps	19.2-50.0	5.8	-	-	30.65 km^2	-	Secondary forest	Manu Biosphere Reserve and Villa Carmen Biological Station	Helenbrook *et al.* 2020
Aotus vociferans	7.9-33	2.4-10	-	-	-	120-300	Dense piedmont flooded and non-flooded forest	Northeastern region	Aquino and Encarnación 1988
PANAMA									
Aotus zonalis	14.3-19.7	7.1-9-5	2.0-2.1	24-50	-	100-800	Semi-deciduous and riparian forests	Chagres National Park	Svensson *et al.* 2010

is found in association with riparian forest. Agroforestry systems are located in close proximity to dwellings, while grasslands and herbaceous vegetation are also present in the landscape. Trees in the reserve reach an average height of 10 to 15 meters (IDEAM 2021). Furthermore, this reserve forms part of a wider ecological corridor, as it connects with other forest fragments that, in turn, link with the Eastern Mountain chain, extending into the Amazonian foothills, reinforcing its importance for biodiversity conservation and ecological connectivity in the region (Pérez-Rico et al. 2011).

Several species of mammals and birds have been observed in the study area, such as the kinkajou (*Potos flavus*), the flying monkey (*Pithecia milleri*), the squirrel monkey (*Saimiri cassiquiarensis cassiquiarensis*), the porcupine (*Coendou prehensilis*) and the toucan (*Ramphastos toco*). An important diversity of anurans has also been reported, including the glass frog (*Teratohyla midas*), a species recognized for its sensitivity to environmental changes and its value as a bioindicator (Rodríguez-Cardozo et al. 2016).

Sampling design and data collection

We estimated the population density of *A. vociferans* using the distance sampling method (Buckland et al. 2010) in a 25-ha area of secondary forest within the MCENR with an altitudinal range of 393 and 630 m asl. This method assumes that:1) the line transects are randomly located with respect to the individuals, 2) the individuals present along the transect are detected, 3) the individuals are detected in their initial position, 4) the distance measurements are precise, 5) the observations are independent events. The transects were established to approximate the recommended number of 25-30 sampling units, while respecting the minimum distance between parallel transects of at least twice the mean effective strip width for the target species (Buckland et al. 2001). As the mean effective strip width for *Aotus* is 8-13 m (Chica-Florez et al. 2022), including this study (see Results), we were able to establish 20 transects in the 25-ha area (Figure 1), which were positioned randomly with respect to the primate's presence and according to geomorphology (Buckland et al. 2010). Transects had and

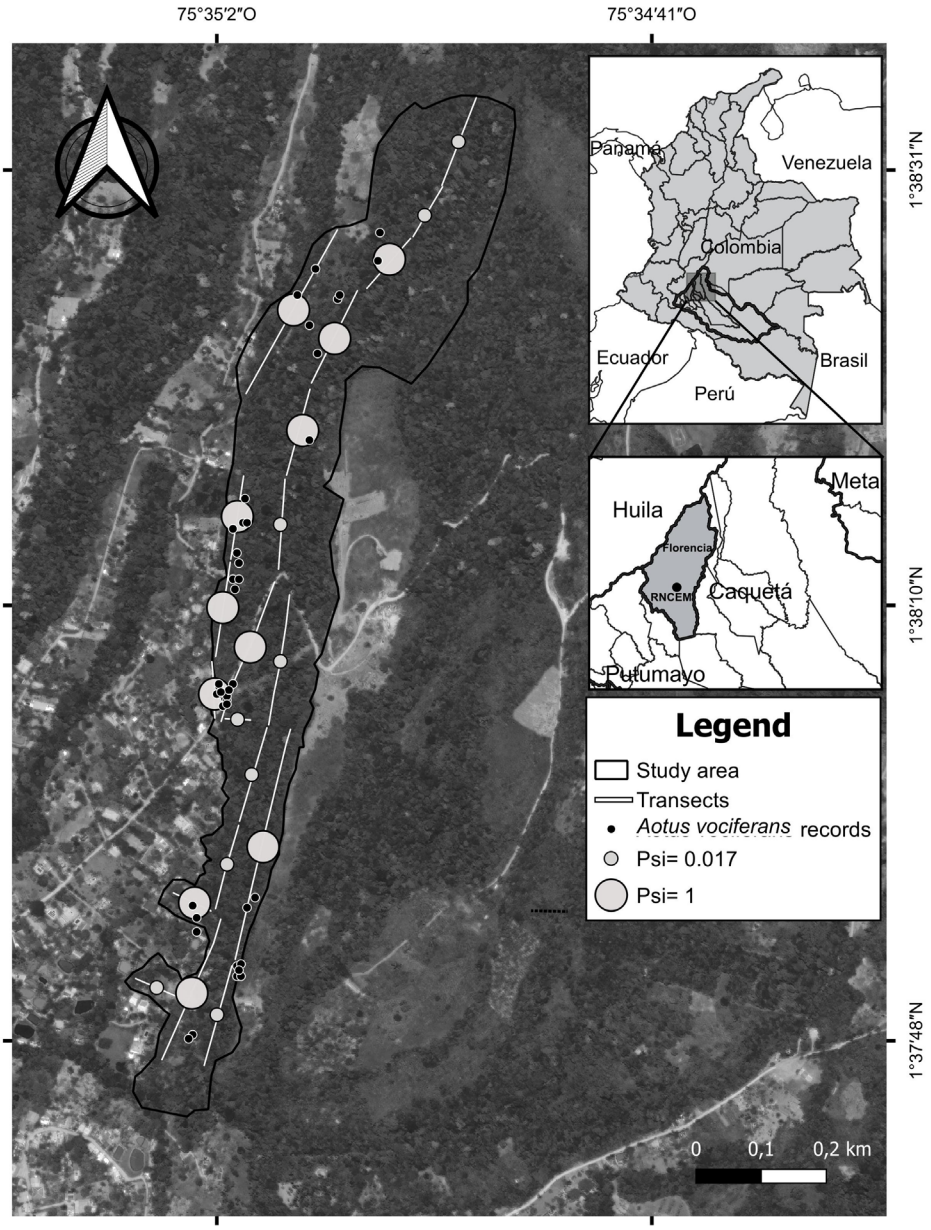

Figure 1. Location of the MCENR within Colombia and the department of Caquetá (incept maps). The larger map shows the sampling polygon within the MCENR, showing the survey transect lines. White dots indicate records of individuals or groups of *Aotus vociferans*; Yellow dots indicate the estimated occupation probability of *A. vociferans* presence for each of the 20 transects.

average length of 165.5 ± 73.0 m (range 92-352 m), adding to an overall total length of 3,310 m sampling length.

Sampling was carried out from November 2022 to February 2023, between 18:00 and 00:30 (Chica-Florez et al. 2022). The sampling time was selected primarily for logistical and cost-effective reasons, rather than following the typical time slots for nocturnal primate surveys (6:00–9:00 PM and 3:00–6:00 AM). This was because the study area features a rocky structure that is difficult to access, with paths that only allow one entry and exit. Unlike other studies conducted in forest fragments, secondary forests in lowland areas, and riverine paths (Vargas-Madrid 2013; Roncancio-Duque et al. 2019), the terrain conditions in this case justified the choice of sampling time. Furthermore, the time selected in this study is appropriate, as night monkey activity occurs from 6:00 p.m. to 5:30 a.m (Defler 2010; Fernández-Duque 2012). The location of spotted animals was recorded as the perpendicular distance from the line transect to the position in which they were first observed, avoiding to count individuals two or more

times on the same transect and sampling occasion. The perpendicular distance measurement was carried out using a measuring tape, while the coordinates were determined using a GPS device. For sampling purposes, we assumed that animals at zero meters from the transect were always detected. Each observation was counted as an independent event (Buckland et al. 2010). The sampling was done with an average travel speed of 0.81 km per hour. The overall sampling effort amounted to 114.9 km traveled, with 60 nights of sampling and 3 repetitions in each transect. When an individual or group was observed, the observer remained on site for a maximum of 15 minutes to record the number of individuals, transect number, date, time, coordinate and perpendicular distance. No surveys were carried out when it rained to avoid biases due to low detectability (Buckland et al. 2010). Transects in which no night monkey was detected were always recorded as a sampling effort. The total sampling area was calculated using the ArcGIS 10.4.1 software (ESRI 2016). When an animal was found feeding, we marked and photographed the tree for posterior identification through comparison with virtual databases (The Plan List, Tropicos, GBIF) and the lists of plant species from the MCENR reported by Pérez-Rico et al. (2011) and Casallas-Núñez et al. (2018).

Data analysis

We used Distance 7.5 software to estimate population density (Thomas et al. 2010). The analysis was carried out with a database containing the total sampling effort for each transect, the perpendicular distance for each observed individual or group, and the number of individuals recorded in each observation. The detection function, i.e., the mathematical model used to describe how the probability of detecting an object decreases with increasing distance from the transect line (Buckland et al. 2010), was adjusted in order to estimate the proportion of individuals that were not detected during the surveys. For this, the program automatically adjusts the distribution of perpendicular distances to the best-fitting model (Buckland et al. 2001; Burnham and Anderson 2002). The detection function is used to estimate the detection probability, which is derived from the frequency distribution of observed perpendicular distances. The detection probability is then used to calculate the effective strip width i.e., the perpendicular distance from the transect line that determines the average width of the surveyed area in which detections effectively occur. This parameter is then used to calculate density or abundance estimates while accounting for objects that were missed during the survey by contrasting the records effectively counted (area under the curve drawn by the model) with the theoretical probability function through goodness-of-fit tests and Akaike's information criterion (Narvaez and Zapata-Ríos, 2020). The density variance was estimated assuming that the encounter rate distribution fit a Poisson distribution plus the empirical variance of detectability and group size.

As a complement We used the occupancy model (ψ) in the Presence 2.13.45 software to estimate the proportion of the sampling area used by the night monkeys. The occupancy estimate is useful to explain the variation in the density encounter rate, since it allows quantifying the probability of occurrence in each sample unit. The occupancy probability estimation, i.e., the mean probability that a site is occupied by the species, was run with a null model without environmental covariates, based solely on the estimated occupation probabilities and assuming that occupancy was constant among sites and detectability (the probability of detection) was constant among visits (Mackenzie et al. 2002).

RESULTS

We obtained 45 observational records of *A. vociferans*. The model that best fit our data was the uniform-cosine. The effective strip width was 16 m and the probability of detection was 1.0. The estimated population density was 47.3 individuals per km^2 [95% confidence interval (CI) = 34.6 - 64.9, coefficient of variation (CV) = 15.7%], the group density was 12.2 groups per km^2 (95% CI = 9.1 - 16.5, CV = 14.9%), and the mean group size was 3.9 individuals (95% CI = 3.5 - 4.3, CV = 5.0%). Density CV was influenced by the encounter rate in 90% and the size of the group in 10%. On the other hand, the occupation probability was 0.56 (95% CI = 0.34 - 0.76), and the detection probability was 0.12 (95% CI = 0.09 - 0.15). Eleven of 20 transects were used by the species with a probability of detection of 1 (Figure 1).

Finally, the plant species consumed by *Aotus vociferans* during our observations were: Annonaceae (*Xylopia frutescens*), Anacardiaceae (*Spondias mombin*), Arecaceae (*Euterpe precatoria*), Euphorbiaceae (*Alchornea triplinervia*), Melastomataceae (*Bellucia pentamera*) and Solanaceae (*Solanum erianthum*).

DISCUSSION

We set out to estimate the population density of *A. vociferans* at a site on the edge of its distribution. We found that its density is around 44 individuals/km², which does not differ much from other estimates. Occupancy (ψ = 0.56) in this area explains the differential encounter rate per transect. Other estimates of *Aotus* density have been reported for primary and secondary forests in Colombia, Peru and Panama (Table 1). The population density of *A. vociferans* we found in the MCENR was similar to the values found for the species (44 ind km^{-2}) in floodplain forest in the Colombian Amazon (Maldonado-Rodríguez 2011), for *A. lemurinus* (39 ind km^{-2}) in dense forest in the Otún-Quimbaya Fauna and Flora Sanctuary (Chica-Florez et al. 2022), for *A. nancymaae* (46.3 ind km^{-2}) in lowland *terra-firme* forest in the Peruvian Amazon (Aquino and Encarnación 1988) and for *A. nigriceps* (50 ind km^{-2}) in a secondary forest of the Manu Biosphere Reserve (Helenbrook et al. 2020). These variations

in density are likely due to the ecological characteristics of the habitat and the degree of anthropic intervention, with well-preserved environments with low disturbance, such as alluvial plain and terra firme forests in the Amazon, favoring higher population densities (Aquino and Encarnación 1988; Maldonado-Rodríguez 2011). In contrast, the density of *A. lemurinus* was lower in an Andean Forest with a history of intervention, although currently protected, highlighting the influence of historical and structural landscape factors on the abundance of these species (Chica-Florez et al. 2022).

It has also been noted that secondary forests, despite their lower degree of conservation, may offer a high availability of food resources compared to primary forests, which may favor high population densities of some primates (Pinto et al. 1993; Castillo-Ayala and Palacios 2007). This suggests that species of the genus *Aotus* have some environmental tolerance, with their abundance closely linked to both habitat quality and continuity, as well as to the availability of key resources. This adaptive capacity could explain the relatively high-density values of *A. lemurinus* (113 ind km^{-2}) in forest fragments in the cloud forest of Dapa, Valle del Cauca (Hirche et al. 2017). This number exceed those reported in more continuous and less disturbed habitats, which has been attributed to several factors. First, habitat fragmentation can concentrate individuals in small areas with available resources, generating high densities, which is considered a crowding effect (Gómez-Posada et al. 2009; Helenbrook et al. 2020). Second, sampling of limited areas tends to overestimate density if landscape heterogeneity is not considered (Di Fiore et al. 2011). Finally, the presence of favorable local conditions, such as high food supply, low competition and low predation pressure, may also contribute to these high population concentrations (Wright 2005). However, population density is a variable parameter and could change in this reserve given the current intensity of human activities, its isolation, and the size of the population. Therefore, it is a priority to establish a comprehensive monitoring plan with sufficient statistical power.

On the other hand, high densities in secondary forests have also been reported for other neotropical primates such as *Callicebus personatus* E. Geoffroy 1812 (Pinto et al. 1993; Chiarello 1995), *Plecturocebus ornatus* Gray 1866 (Wagner et al. 2009), *Alouatta seniculus* C. Linnaeus 1766 (Gómez-Posada et al. 2009), *A. palliata* Gray 1849, *Cebus capucinus* C. Linnaeus 1758 (Rodríguez-Matamoros et al. 2012), *Callithrix geoffroyi* Geoffroy 1812 (Chiarello 1995), *Oedipomidas leucopus* K. Günther 1876 (Bonell et al. 2018, Roncancio et al. 2024) and *Sapajus nigritus* Goldfuss 1809 (Pinto et al. 1993).

Our estimates of group size and group density coincide with those of Maldonado-Rodríguez (2011) for *A. vociferans*, while Chica-Florez et al. (2022) reported a quite higher group density and lower group size for *A. lemurinus* (Table 1). While these figures may reflect differences in habitat productivity (Garcés-Restrepo et al. 2014), they can also reflect interspecific differences in social organization.

The occupancy by night monkeys decreases with increasing altitude due to changes in forest structure (Campbell et al. 2019). Higher occupancy at lower altitudes is likely due to the forest structure with higher productivity (greater availability of food), adequate shelter and denser, more stratified vegetation allowed by the warmer conditions. This notion is supported by our results of an estimated occupancy of 0.56 for *A. vociferans* at about 400-600 m altitude in the MCENR, in contrast to an occupancy of 0.33 estimated for *A. miconax* at an altitude of 2,000 m (Campbell et al. 2019). The MCENR is located in the geomorphological piedmont region, which has a high biodiversity with many endemic plant species (Pérez-Rico et al. 2011; Cárdenas-López and Mantilla-Cárdenas 2023). Further studies should estimate the population density and habitat occupancy by *A. vociferans* at the higher altitudes of its distribution range (up to 1,550 m asl) (Castaño and Cardona 2005).

Despite the small sampling area of only 25 ha within the MCENR, only about half of the survey transects were used by night monkeys during the sampling period, indicating a differential use of the habitat, which may be due to the distribution of plants that serve as food resource for the species (Sánchez-Londoño et al. 2013; Helenbrook et al. 2020), as was indicated by our records of feeding animals at sites where they were encountered. Our records of fruits consumed by the night monkeys coincide with the botanical families of plants consumed by the genus *Aotus* (Puertas et al. 1992; Castaño et al. 2010; Helenbrook et al. 2020). The absence of the species in nine of our 20 transects assessed could be explained by the lack of fruit trees during the sampling period, which lasted four months. This absence of fruit not only limits direct food supply, but may also have reduced the presence of insects attracted to these trees, secondarily affecting the food availability (De La Ossa and De La Ossa-Lacayo 2014). It will be necessary to characterize the structure, composition and phenology of the forest species in the MCENR in order to integrate these factors in the occupation model to better understand the population density of and habitat use by night monkeys and other mammals present in the reserve and surrounding areas.

The estimated population size for the MCENR is too small, and probably not viable in the long term. It is necessary to evaluate the presence of *A. vociferans* in nearby forests as well as the connectivity among suitable habitat fragments for the species. It is also urgently recommended to design and implement habitat-based conservation strategies for suitable sites, including restoration, control of introduced species such as dogs, and connectivity promotion and/or improvement.

The effective strip width is a mandatory parameter for the estimation of population density using transect surveys, as it reflects the effect of habitat structure, animal behavior and surveyor experience on detectability (Coburn et al. 2009; Buckland et al. 2010). In our review, only three studies informed values for effective strip width (Table 1).

For the sake of comparability, effective strip width should be systematically reported in studies using distance sampling to estimate population densities.

CONCLUSIONS

The population density, group size and proportion of used area of *A. vociferans* in the El Manantial Community and Ecotourism Natural Reserve in the Colombian Amazon piedmont were the highest estimated to date for the species. The distribution of the species within the small sampling area of 25 ha was apparently highly influenced by the presence of fruiting trees of species consumed these night monkeys. Further studies on the influence of this and other habitat factors on the population density and habitat use by *A. vociferans* are needed.

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