ETHNOBIOLOGY AND CONSERVATION

SHORT COMMUNICATION

Ethnobiology and Conservation, 11:08 (20 March 2022)
doi:10.15451/ec2022-03-11.08-1-9
ISSN 2238-4782 ethnobioconservation.com

Freelisting as a suitable method to estimate the composition and harvest rates of hunted species in tropical forests

Marcela Alvares Oliveira[1,2*], Hani Rocha El Bizri [2,3], Thais Queiroz Morcatty[2,4], Mariluce Rezende Messias[2,5], Carolina Rodrigues da Costa Doria[1,5]

ABSTRACT

The aim of this study was to test the use of measures obtained from freelisting as possible surrogates of the harvest rate of hunted species. For this purpose, we interviewed 100 rural and urban hunters in southwestern Amazonia to obtain the frequency of citations of each hunted species through freelisting and gather information on the number of individuals hunted per species in the last five hunting events through hunting recalls. We assessed the relationship between the percentage of records per species by each method through a generalized linear model, and then compared the predicted values obtained from this model with the values observed in our dataset using Pearson's correlation. During freelisting, forty-three taxa were listed in 608 citations as hunted by the informants. Freelisting provided data on around twice the number of species obtained from recalls. During the last five hunting trips, urban hunters reported the hunting of 164 individuals of 18 species, representing 54.5% of the freelisted species. Rural hunters caught 146 individuals of 21 species, 60.0% of the freelisted species. We found a strong logistic relationship between the harvest rates, i.e., percentage of individuals hunted per species from recalls, and the freelisting percentage citations of hunted species, with the estimated and observed values of harvest rates highly matching (Pearson's $R = 0.98$, $p < 0.0001$). The freelisting method allowed a good estimate of the composition and harvest rates of hunted species. The formula produced in this study can be used as a reference for further studies, enabling researchers to use freelisting effectively to assess the composition of hunted species and to address the difficulty of obtaining reliable data on species harvest rates in tropical forests, especially in short-term studies and contexts in which hunters distrust research.

Keywords: Wildlife; Hunting; Participatory Methods; Local Communities; Amazon. .

1 Programa de Pós-graduação em Biodiversidade e Biotecnologia da Amazônia Legal (Rede BIONORTE), Universidade Federal de Rondônia, BR 364, Porto Velho, RO, 76801-059, Brazil.

2 Rede de Pesquisa em Diversidade, Conservação e Uso da Fauna da Amazônia (RedeFauna), Manaus, Brazil.

3 ComFauna, Comunidad de Manejo de Fauna Silvestre en la Amazonía y en Latinoamérica, Iquitos, Peru.

4 Oxford Wildlife Trade Research Group, Faculty of Humanities and Social Sciences, Oxford Brookes University, Oxford, OX3 0BP, UK.

5 Programa de Pós-Graduação em Conservação e Uso de Recursos Naturais, Universidade Federal de Rondônia, BR 364, Porto Velho, RO, 76801-059, Brazil.

* Corresponding author 🖂. E-mail address: MAO (marcela.mugrabe@gmail.com), HREB (hanibiz@gmail.com), TQM (tatamorcatty@gmail.com), MRM (messias.malu@gmail.com), CRCD (carolinarcdoria@unir.br)

Part of Special Issue:
Use, Management and Conservation of Wildlife in Latin America.
Edited by Hani R. El Bizri, Melina S. Simoncini, Jair H. Castro Romero, Alejandro Meléndez Herrada, Joaquín L. Navarro.

SIGNIFICANCE STATEMENT

In this study, we compare the estimates of harvest rates of hunted species obtained from hunting recalls and the frequency of citations of species hunted through freelisting with 100 hunters in southwestern Amazonia. We show that freelisting provided data on twice the number of species obtained from recalls, and the frequency of citations of hunted species was strongly correlated with recalls' harvest rates, both in urban and rural areas. Freelisting may be efficiently used in assessments of the composition of hunted species, and to estimate both the harvest rates and total number of animals harvested in tropical areas, especially in short-term studies and contexts in which hunters distrust research.

INTRODUCTION

Hunting is an ancient activity performed by several human societies around the world (Alves et al. 2018). Despite ensuring food security for local populations and benefits to conservation (Isaac et al. 2015; Nunes et al. 2019a; Sarti et al. 2015; Da Silva et al. 2020), hunting is also a major driver of biodiversity loss (Benítez-López et al. 2017; Scabin and Peres 2021). Uncovering the harvest rates of hunted species is key to determine the impacts of hunting and develop feasible strategies to sustainably managing them.

In principle, to effectively estimate harvest rates, hunting activity should be monitored continuously through methods such as self-monitoring (Valsecchi et al. 2014), hunting calendars (Oliveira and Calouro 2019), or through recalls of hunting events (Nunes et al. 2019b). However, due to logistical hurdles, in particular the high costs of monitoring (Abrahams et al. 2018), the difficulties of accessing more isolated communities, and the distrust of hunters in research (Chaves et al. 2021; Oliveira et al. 2018), data acquisition on harvests through these methods is not always achievable (Garden et al. 2007; Rist et al. 2008).

As an alternative, researchers have been using the method of freelisting, in which hunters cite freely the species hunted or consumed in their household (El Bizri et al. 2020; Knoop et al. 2020; Tavares et al. 2020). These data are then used to calculate the representativeness of each taxon within the pool of species cited (Ramos et al. 2020; Santos et al. 2019). However, it is unclear whether freelisting provides a good measure of the composition of species hunted, and whether measures generated through freelisting, such as the frequency of citations per species, are suitable surrogates of the proportion with which each species is harvested. This is because citations may reflect cultural preferences for certain species rather than actual offtake, or species may be more or less cited because of specific traits, e.g., higher body mass.

Given the limitations related to surveying and monitoring hunting activities, the aim of this study is to test whether the measures obtained through freelisting may be used as surrogates of the composition and harvest rates of hunted species (here considered as the frequency with which each species is hunted). We interviewed Amazonian rural and urban hunters to compare the number of species cited and the frequency of citations of each hunted species obtained through freelisting with the hunters' recall of the species harvested during their last hunting events.

MATERIAL AND METHODS

Study area

This study was conducted in the state of Rondônia, located in the southwestern region of Northern Brazil (Figure 1). Rondônia occupies a territorial area of 237,765 km^2, distributed across 52 municipalities (administrative divisions containing rural areas and a seat city). The estimated population of Rondônia is 1,777,225 inhabitants, with the urban population (1,149,180 inhabitants) being almost thrice as large as the rural population (413,229 inhabitants) (IBGE 2017). The main river that flows through the state is the Madeira River, and the predominant vegetation coverage of the state is the Open Ombrophilous Forest within the Amazon domain (IBGE 2010). The study area presents a Humid Equatorial Climate, characterized by an average annual rainfall between 2,000 and 2,300 mm, and average temperatures between 24 and 27°C throughout the year. The seasonality is marked by a short dry season, between June and August, in which the rainfall is lower than 100 mm and temperatures can reach 37°C (Mendonça and Danni-Oliveira 2007). There is a wet season that starts in September and lasts until May, January being considered the rainy month, with 300 mm of rainfall and an average temperature of 25°C (Franca 2015).

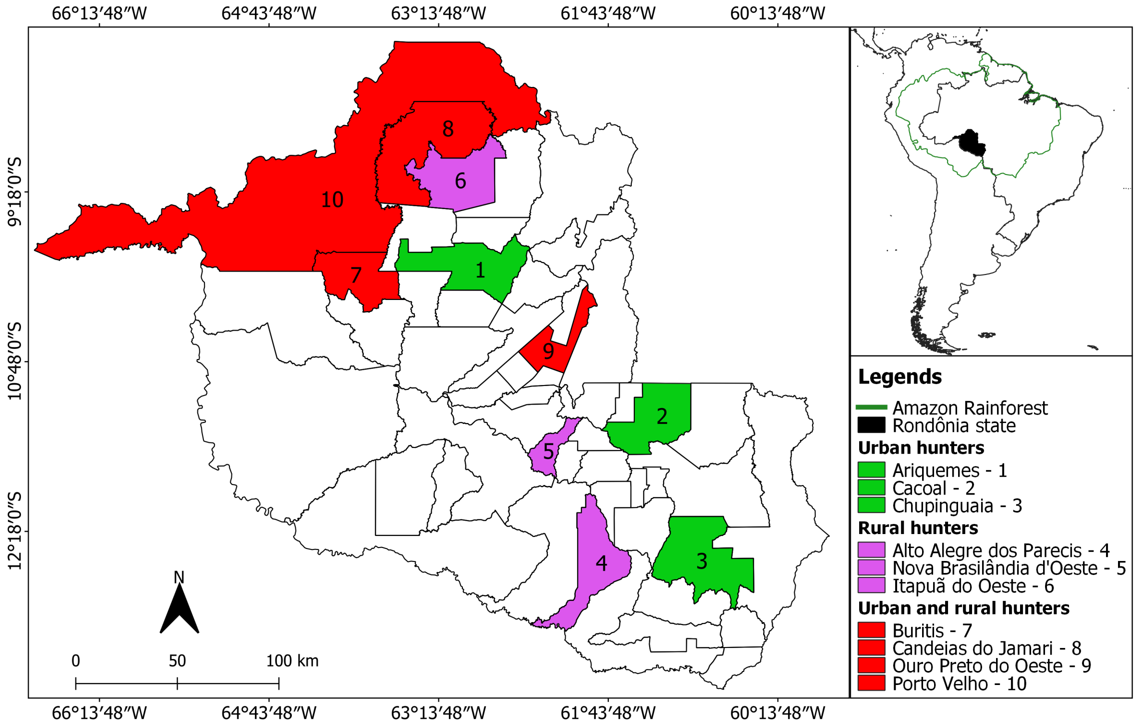

Figure 1. Municipalities of hunting interviews in the state of Rondônia, Southwestern Amazonia.

Data collection

We conducted semistructured interviews between October 2018 and February 2020 with 49 urban hunters and 51 rural hunters living in 10 municipalities within Rondônia state (Figure 1). Hunters were all above 18 years of age and permanent residents of the Rondônia state. Participants were selected through the snowball sampling method (Goodman 1961), forming a network of urban and rural informants. We started with previously known hunters living in the city of Porto Velho who openly provided information regarding wild meat consumption and/or hunting activity. These initial informants led us to additional interviewees, strengthening bonds of trust with the new participant. Because of the proximity and constant displacement of people between rural and urban areas in the studied site, the classification of hunters into urban or rural inhabitant was based on self-declaration. We took into account: whether the hunter considered themselves a resident of a rural or an urban area; the place of permanent residence: whether their permanent house was settled in a rural or urban environment; and the length of stay in the location: whether the hunter spent around 90% of their weekly time in rural or urban areas. Interviews were conducted individually. We divided the interview in three stages: (1) we defined with the interviewee whether they should be considered an urban or rural hunter, (2) we asked the interviewee to freely list the species hunted by them in the area in the last year, and (3) we asked the interviewee to recall the species and number of specimens hunted in their last five hunting events. The freelisting method followed Albuquerque et al. (2010), in which the species hunted by the participant were noted down at the same order as presented by the informant.

The study was approved by the Research Ethics Committee (CEP) of Centro Universitário Aparício Carvalho (protocol 2 661 332), complying with the norms of Resolution 466/12 of the National Health Council. We used Abreu et al. (2021) for taxonomic classification of mammals, Pacheco et al. (2021) for birds and Costa et al. (2021) for reptiles.

Data analysis

We summed the number of citations per species per location (rural/urban) in the freelisting and calculated the representativeness of each species in terms of percentage of citations among all species cited. We did the same procedure for the number of individuals reported as hunted in the recall, calculating the harvest rates as the percentage of the number of individuals hunted of each species within the overall number of harvested individuals. We estimated the representativeness, in percentage, of the number of species reported during recalls in relation to those cited through freelisting.

After that, we assessed whether the percentage of citations generated from freelisting and the harvest rates from hunting recalls were related to each other. To do so, we used a generalized linear model (GLM) with the Zero-adjust Gamma family of distribution with the identity link function (Stasinopoulos and Rigby 2008), using harvest rates from recalls as a response variable and both freelisting percentage citations and location (rural/urban) as predictor variables. We used different combinations of the predictor variables, from the simplest model (no predictor variables) to the more complex model (all predictor variables), including a model with interaction between freelisting percentage citations and location, and a model fitting a logistic curve. We decided that a logistic curve would be appropriate to be tested because the variables are based on percentage of citations, and therefore an asymptote is expected. The best-fitted model was selected based on AIC values (the fit with lowest AIC was selected). At the end, we also compared the predicted values obtained through this model with observed values in our dataset through Pearson's correlation. We used Microsoft Excel for data tabulation and management, and R version 3.6.3 (R Core Team 2021) for statistical analyses, using the R-packages gamlss (Stasinopoulos and Rigby 2008) for the GLM and stats (R Core Team 2021) for the Pearson's correlation.

RESULTS

In total, 43 taxa were freelisted in 608 citations as hunted by participants, 33 by urban hunters and 35 by rural hunters. During freelisting, urban and rural participants cited 5.9 (± 3.5 SD) and 5.9 (± 3.3 SD) species on average, respectively. All species recorded from hunting recalls were cited through freelisting. During recalls, 25 species were reported as hunted by the interviewees. Urban and rural participants cited 3.4 (± 1.5 SD) and 2.7 (± 1.4 SD) species on average during recalls, respectively. In their last five hunting trips, urban hunters reported the capture of 164 individuals of 18 species, representing 54.5% of the freelisted species. Rural hunters caught 146 individuals of 21 species, 60.0% of the freelisted species (Table 1).

Considering urban hunters only, the nine-banded armadillo, collared peccary, white-lipped peccary, and red brocket deer comprised 52.7% of all citations of species during freelisting, while paca, collared peccary and white-lipped peccary comprised 61.6% of the number of individuals reported as hunted in the last five hunting trips. Considering rural hunters only, the paca, nine-banded armadillo, collared peccary, white-lipped peccary, and agouti comprised 52.7% of all citations during freelisting, while paca, nine-banded armadillo, and collared peccary comprised 54.1% of the number of individuals reported as hunted in the last five hunting trips.

We found a strong logistic relationship between freelisting percentage citations and harvest rates from hunting recalls (GAMLSS Estimate = 0.96, t = 6.6, $p < 0.00001$) (Figure 2A) with no effect of location, according to the following formula: Harvest rate = $47.7/(1 + 78.5^{*}\ e^{-0.315^{*}\text{Freelisting percentagem citations}})$. There was also a strong match between the observed values of harvest rate from our dataset and the predicted values from our model (Pearson's R = 0.96, $p < 0.0001$) (Figure 2B).

DISCUSSION

Detailed and long-term studies on hunting usually depend on high community engagement, and a great presence of researchers in the study area (Oliveira et al. 2018). Therefore, having access to a network of informants along with applying less invasive methods may be beneficial to the success of hunting surveys, especially in urban environments, where gaining trust from hunters tend to be more challenging (van Vliet et al. 2015). Our results show that freelisting may be a cheaper, faster, and likely less invasive, yet reliable, methodological approach to make hunters more comfortable with research. This method proved to be efficient in both urban and rural contexts, which favours scalability for large-scale studies, and may be used as a gateway to the first contact of researchers with hunters.

Freelisting offers a good measure of the harvest rates, in terms of representativeness of each hunted species within the pool of species hunted. In addition, freelisting resulted in twice the number of species reported in hunting recalls. The lists included species that may be less frequently caught by hunters and therefore more difficult to be recorded in recalls or even through long-term methods, such as community-based monitoring. In addition, several species may be seasonally hunted and therefore were not cited in our recalls, since this method was applied only in one season. Therefore, freelisting may be suitable to have a first glance of the most impacted taxa and can be used complementarily to hunting recalls or other hunting survey methods to provide a better assessment of the composition of hunted species. To avoid bias, freelisting interviews should always be conducted individually, without the presence of third parties who can influence the response of the participant (Quinlan 2005). It is also important to bear in mind that, although not tested here, the order of citation of the species during freelisting may sometimes be as important as the number of citations, since in some situa-

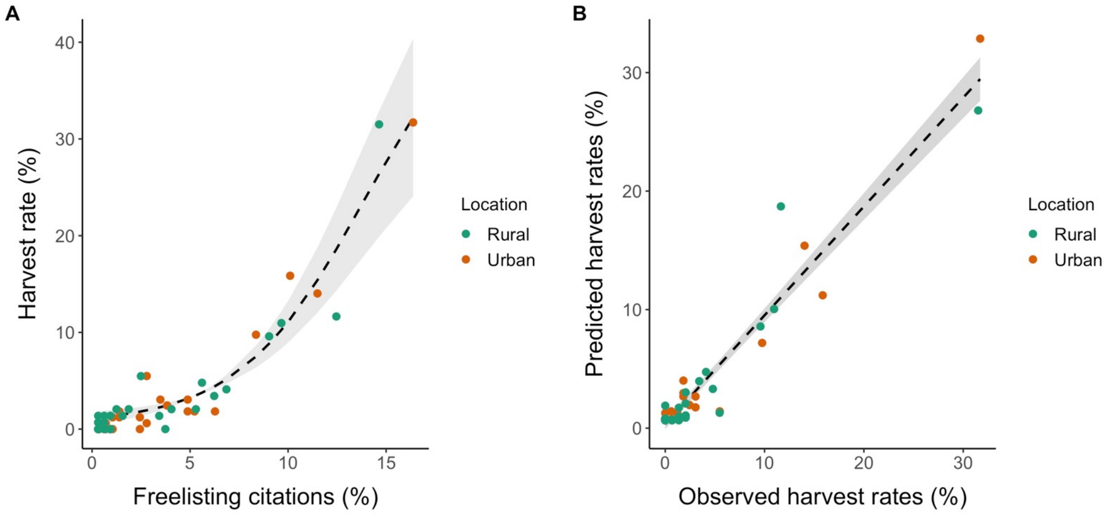

Figure 2. Relationship between A) the freelisting percentage citations and harvest rate (percentage of individuals hunted) through hunting recalls with urban and rural hunters from Rondônia, Southwestern Amazonia; and B) the observed and predicted harvest rates from the formula generated in this study.

tions hunters may tend to mention first the species with higher cultural or dietary importance (Albuquerque et al. 2010).

We consider that the formula produced in this study could be used as a reference for subsequent studies on wildlife hunting. This formula can be especially useful when the number of species harvested is similar or higher than the number we obtained here. If researchers ask hunters for an estimate of the number of specimens they catch over a year, this formula could also be used to extrapolate the total yearly extraction per species without requiring an extensive and long-term monitoring.

CONCLUSION

Our assessment offers evidence that freelisting can be used effectively to overcome the challenge of obtaining reliable data on hunted species composition and harvest rates, especially in short-term studies and contexts in which hunters distrust research. Freelisting is also useful for research conducted within one season only, as we did here, since in these cases hunting recalls may not yield the overall number of species potentially hunted by locals over the year. Recalls or other hunting survey methods should therefore be used in conjunction with freelisting to complement and offer a better overview of the composition of species harvested by hunters. The measures produced by freelisting were related to the harvest rates obtained from hunting recalls in southwestern Amazonia, and freelisting provided twice as large the number of species obtained through recalls. The formula we generated can be used as a reference for further studies. The freelisting method is a less invasive approach that can facilitate and complement studies involving hunting of wildlife. Future studies should be directed towards validating our formula, and also comparing the measures obtained through freelisting with long-term hunter offtake methods, i.e. community-based monitoring.

ACKNOWLEDGEMENT

To the hunters who kindly provided information on their hunting events for the development of this study. TQM was supported by the Christensen Conservation Leaders Scholarship (WCS Graduate Scholarship Program); Sidney Byers Scholarship award (Wildlife Conservation Network Scholarship Program) and Funds for Women Graduates (British Federation of Women Graduates). This publication is partially funded by the Gordon and Betty Moore Foundation through Grant No. GBMF9258 to the Comunidad de Manejo de Fauna Silvestre en la Amazonía y en Latinoamérica (COMFAUNA).

DATA AVAILABILITY

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

CONTRIBUTION STATEMENT

Conceived of the presented idea: MAO, HREB, TQM.
Carried out the experiment: MAO.
Carried out the data analysis: HREB, TQM.
Wrote the first draft of the manuscript: MAO, HREB, TQM.
Review and final write of the manuscript: MAO, HREB, TQM, MRM, CRCD.
Supervision: MRM, CRCD.

REFERENCES

Abrahams MI, Peres CA, Costa HCM (2018) **Manioc losses by terrestrial vertebrates in western Brazilian Amazonia.** *Journal of Wildlife Management* 82(4):734–746. doi:10.1002/jwmg.21443.

Abreu EF, Casali D, Costa-Araújo R, Garbino GST, Libardi GS, Loretto D, Loss AC, Marmontel M, Moras LM, Nascimento MC, Oliveira ML, Pavan SE, Tirelli Flávia P (2021) **Lista de Mamíferos do Brasil (2021-2)**. [https://zenodo.org/record/5802047#.Ye2wiv7MKUl] Accessed 19 January 2022. doi: 10.5281/zenodo.5802047.

Albuquerque UP, Lucena RFP, Alencar NL (2010) **Métodos e Técnicas para coleta de dados etnobiológicos.** In: Albuquerque UP, Lucena RFP, Cunha LVFC (eds). Métodos e Técnicas na Pesquisa Etnobiológica e Etnoecológica. NUPPEA, Recife, pp. 41-64..

Alves RRN, Souto WMS, Fernandes-Ferreira H, Bezerra DMM, Barboza RRD, Vieira WLS (2018) **The Importance of hunting in human societies.** In: Alves RRN, Alburquerque UP (eds) Ethnozoology Animals in our Lives. 1 ed. Elsevier Inc., Amsterdam, pp. 95–118. doi: 10.1016/B978-0-12-809913-1.00007-7.

Benítez-López A, Alkemade R, Schipper AM, Ingram DJ, Verweij PA, Eikelboom JAJ, Huijbregts MAJ (2017) **The impact of hunting on tropical mammal and bird populations.** *Science* 356(6334): 180–183. doi: 10.1126/science.aaj1891.

Costa HC, Guedes TB, Bérnilis RS (2021) **Lista de répteis do Brasil: padrões e tendências.** *Herpetologia Brasileira* 10(3):110–279. doi: 10.5281/zenodo.5838950.

El Bizri HR, Morcatty TQ, Ferreira JC, Mayor P, Vasconcelos Neto CFA, Valsecchi J, Nijman V, Fa JE (2020) **Social and biological correlates of wild meat consumption and trade by rural communities in the Jutaí River basin, central Amazonia.** *Journal of Ethnobiology* 40(2):183–201. doi: 10.2993/0278-0771-40.2.183.

Franca, RR (2015) **Climatologia das chuvas em Rondônia – período 1981-2011.** *Revista Geografias* 11(1):44–58. doi: 10.35699/2237-549X.13392.

Chaves WA, Valle D, Tavares AS, von Mühlen EM, Wilcove DS (2021) **Investigating illegal activities that affect biodiversity: the case of wildlife consumption in the Brazilian Amazon.** *Ecological Applications* 31:e02402. doi: 10.1002/eap.2402.

Garden JG, McAlpine CA, Possingham HP, Jones DN (2007) **Using multiple survey methods to detect terrestrial reptiles and mammals: What are the most successful and cost-efficient combinations?** *Wildlife Research* 34:218–227. doi: 10.1071/WR06111.

Goodman L (1961) **Snowball sampling.** *Annals of Mathematical Statistics*. 32(1):148–170..

IBGE (2017) **IBGE Cidades - Porto Velho.** [https://cidades.ibge.gov.br/brasil/ro/porto-velho/panorama] Accessed January 27, 2021.

Isaac VJ, Almeida MC, Giarrizzo T, Deus CP, Vale R, Klein G, Begossi A (2015) **Food consumption as an indicator of the conservation of natural resources in riverine communities of the Brazilian Amazon.** *Anais da Academia Brasileira de Ciencias* 87(4):2229–2242. doi: 10.1590/0001-3765201520140250.

Knoop SB, Morcatty TQ, El Bizri HR, Cheyne SM (2020) **Age, religion, and atboos influence subsistence hunting by indigenous people of the lower Madeira river, Brazilian Amazon.** *Journal of Ethnobiology* 40(2):131–148. doi: 10.2993/0278-0771-40.2.131.

Mendonça F, Danni-Oliveira IM (2007) **Climatologia: noções básicas e climas do Brasil.** Oficina de Texto, São Paulo, Brazil..

Nunes AV, Peres CA, Constantino P de AL, Santos BA, Fischer E (2019a) **Irreplaceable socioeconomic value of wild meat extraction to local food security in rural Amazonia.** *Biological Conservation* 236:171–179. doi: 10.1016/j.biocon.2019.05.010.

Nunes AV, Guariento RD, Santos BA, Fischer E (2019b) **Wild meat sharing among non-indigenous people in the southwestern Ama-**

zon. *Behavioral Ecology and Sociobiology* 73:26. doi: 10.1007/s00265-018-2628-x.

Oliveira MA, Calouro AM (2019) **Hunting agreements as a strategy for the conservation of species: the case of the Cazumbá-Iracema Extractive Reserve, state of Acre, Brazil.** *Oecologia Australis* 23:357–366. doi: 10.4257/oeco.2019.2302.13.

Oliveira RD, Calouro AM, Botelho ALM, Oliveira MA (2018) **Calendário de caça na gestão da fauna cinegética Amazônica: implicações e recomendações.** *Biodiversidade Brasileira* 8:304–316. doi: 10.37002/biobrasil.v%25vi%25i.788.

Pacheco JF, Silveira LF, Aleixo A, Agne CE, Bencke GA, Bravo GA, Brito GRR, Cohn-Haft M, Maurício GN, Naka LN, Olmos F, Posso SR, Lees AC, Figueiredo LFA, Carrano E, Guedes RC, Cesari E, Franz I, Schunck F, Piacentini, VQ (2021) **Annotated checklist of the birds of Brazil by the Brazilian Ornithological Records Committee—second edition.** *Ornithology Research* 29(2):94–105. doi: 10.1007/s43388-021-00058-x.

Quinlan M (2005) **Considerations for collecting freelists in the field: examples from ethnobotany.** *Field methods* 17(3):219–234. doi: 10.1177/1525822X05277460.

R Core Team (2021) **R: A language and environment for statistical computing.** (In: Foundation for Statistical Computing 2021). R-project. [https://www.R-project.org/] Accessed 02 November 2021.

Ramos CGS, Santos RB, Santos RWC, Oliveira MA (2020) **Hunting in a community of waste pickers of recyclable materials in Rondônia, Brazil.** *Revista Brasileira de Ciências da Amazônia* 9:4–15. doi: 10.47209/2317-5729.v.9.n.3.p.4-15.

Rist J, Rowcliffe M, Cowlishaw G, Milner-Gulland EJ (2008) **Evaluating measures of hunting effort in a bushmeat system.** *Biological Conservation* 141(8):2086–2099. doi: 10.1016/j.biocon.2008.06.005.

Santos S da S, Soares HK de L, Soares VMDS, de Lucena RFP (2019) **Traditional knowledge and use of mammals in a rural community in the sertaneja depression (Paraíba state, northeast Brazil).** *Indian Journal of Traditional Knowledge* 18(1):94–103.

Sarti FM, Adams C, Morsello C, van Vliet N, Schor T, Yagüe B, Tellez L, Quiceno-Mesa MP, Cruz D (2015) **Beyond protein intake: bushmeat as source of micronutrients in the amazon.** *Ecology and Society* 20(4):22. doi: 10.5751/ES-07934-200422.

Scabin AB, Peres CA (2021) **Hunting pressure modulates the composition and size structure of terrestrial and arboreal vertebrates in Amazonian forests.** *Biodiversity and Conservation* 30:3613–3632. doi: 10.1007/s10531-021-02266-9.

Silva JS, Nascimento ALB, Alves RRN, Albuquerque UP (2020) **Use of game fauna by Fulni-ô people in Northeastern Brazil: Implications for conservation.** *Journal of Ethnobiology and Ethnomedicine* 16:1–12. doi: 10.1186/s13002-020-00367-3.

Stasinopoulos DM, Rigby RA (2008) **Generalized additive models for location scale and shape (GAMLSS)** in R. Journal of Statistical Software 23(7):1–46. doi: 10.18637/jss.v023.i07.

Tavares AS, Mayor P, Loureiro LF, Gilmore MP, Perez-Peña P, Bowler M, Lemos LP, Svensson MS, Nekaris KA-I, Nijman V, Valsecchi J, Morcatty TQ (2020) **Widespread use of traditional techniques by local people for hunting the yellow-footed tortoise (*Chelonoidis denticulatus*) across the Amazon.** *Journal of Ethnobiology* 40(2):268–280. doi: 10.2993/0278-0771-40.2.268.

Valsecchi J, El Bizri H, Figueira J (2014) **Subsistence hunting of Cuniculus paca in the middle of the Solimões river, Amazonas, Brazil.** *Brazilian Journal of Biology* 74(3):560–568. doi: 10.1590/bjb.2014.0098.

van Vliet N, Cruz D, Quiceno-Mesa MP, Aquino LJN, Moreno J, Ribeiro R, Fa J (2015) **Ride, shoot, and call: wildlife use among contemporary urban hunters in Três Fronteiras, Brazilian Amazon.** *Ecology and Society* 20(3):8. doi: 10.5751/ES-07506-200308.

Received: 03 December 2021
Accepted: 10 March 2022
Published: 22 March 2022

Table 1. Freelisting citations and number of specimens hunted from recalls reported by urban and rural hunters in Rondônia, Southwestern Amazonia.

Taxon	Local name	Popular name	Freelisting citations (%)			Hunting recalls (%)		
			Urban	Rural	Total	Urban	Rural	Total
Mammalia								
Nasua nasua	Quati	Coati	0	3 (0.9)	3 (0.5)	0	0	0
Puma concolor	Onça-parda	Puma	2 (0.7)	5 (1.6)	7 (1.2)	0	2 (1.4)	2 (0.6)
Panthera onca	Onça-pintada	Jaguar	1 (0.3)	6 (1.9)	7 (1.2)	0	3 (2.1)	3 (1.0)
Mazama americana	Veado-mateiro	Red brocket	18 (6.3)	17 (5.3)	35 (5.8)	3 (1.8)	3 (2.1)	6 (1.9)
Mazama nemorivaga	Veado-roxo	Amazonian brown brocket	8 (2.8)	12 (3.7)	20 (3.3)	1 (0.6)	0	1 (0.3)
Ozotoceros bezoarticus	Veado-galheiro	Pampas deer	1 (0.3)	0	1 (0.2)	0	0	0
Dicotyles tajacu	Catitu	Collared peccary	33 (11.5)	29 (9.0)	62 (10.2)	23(14.0)	14 (9.6)	37 (11.9)
Tayassu pecari	Queixada	White-lipped peccary	24 (8.4)	31 (9.7)	55 (9.0)	16 (9.8)	16 (11.0)	32 (10.3)
Dasypus novemcinctus	Tatu-galinha	Nine-banded armadillo	29 (10.1)	40 (12.5)	69 (11.3)	26 (15.9)	17 (11.6)	43 (13.9)
Dasypus beniensis	Tatu-15kg	Greater long-nosed armadillo	15 (5.2)	4 (1.2)	19 (3.1)	3 (1.8)	3 (2.1)	6 (1.9)
Euphractus sexcinctus	Tatu-peba	Yellow armadillo	3 (1.0)	2 (0.6)	5 (0.8)	2 (1.2)	1 (0.7)	3 (1.0)
Cabassous unicinctus	Tatu-rabo-mole	Southern naked-tailed armadillo	2 (0.7)	3 (0.9)	5 (0.8)	0	0	0
Priodontes maximus	Tatu-canastra	Giant armadillo	4 (1.4)	3 (0.9)	7 (1.2)	2 (1.2)	0	2 (0.6)
Didelphis marsupialis	Mucura	Common opossum	0	2 (0.6)	2 (0.3)	0	2 (1.4)	2 (0.6)
Tapirus terrestris	Anta	Tapir	14 (4.9)	20 (6.2)	34 (5.6)	3 (1.8)	5 (3.4)	8 (2.6)
Alouatta puruensis	Guariba	Purús red howler monkey	1 (0.3)	2 (0.6)	3 (0.5)	0	0	0
Ateles chamek	Macaco-aranha	Black-faced Black spider monkey	1 (0.3)	3 (0.9)	4 (0.7)	0	0	0
Saguinus weddelli	Soin	Weddell's saddle-back tamarin	1 (0.3)	0	1 (0.2)	0	0	0
Saimiri ustus	Macaco-de-cheiro	Golden-backed squirrel monkey	1 (0.3)	0	1 (0.2)	0	0	0
Sapajus apella	Macaco-prego	Black-capped capuchin	1 (0.3)	1 (0.3)	2 (0.3)	0	2 (1.4)	2 (0.6)
Hydrochoerus hydrochaeris	Capivara	Capibara	10 (3.5)	18 (5.6)	28 (4.6)	5 (3.0)	7 (4.8)	12 (3.9)
Cuniculus paca	Paca	Paca	47 (16.4)	47 (14.6)	94 (15.5)	52 (31.7)	46 (31.5)	98 (31.6)
Dasyprocta spp.	Cutia	Agouti	11 (3.8)	22 (6.9)	33 (5.4)	4 (2.4)	6 (4.1)	10 (3.2)
Coendou longicaudatus	Coendu	Long-Tailed Porcupine	0	2 (0.6)	2 (0.3)	0	0	0
Hadrosciurus spadiceus	Quatipuru	Southern Amazon red squirrel	0	1 (0.3)	1 (0.2)	0	1 (0.7)	1 (0.3)
Aves								
Tinamus solitarius	Macuco	Solitary Tinamou	7 (2.4)	3 (0.9)	10 (1.6)	2 (1.2)	0	2 (0.6)
Tinamus guttatus	Nambu-galinha	White-throated Tinamou	0	1 (0.3)	1 (0.2)	0	1 (0.7)	1 (0.3)
Dendrocygna spp.	Marreca	Whistling-Duck	2 (0.7)	0	2 (0.3)	1 (0.6)	0	1 (0.3)
Cairina moschata	Pato-do-mato	Muscovy Duck	4 (1.4)	3 (0.9)	7 (1.2)	3 (1.8)	2 (1.4)	5 (1.6)
Penelope jacquacu	Jacu	Spix's Guan	11 (3.8)	13 (4.0)	24 (3.9)	4 (2.4)	3 (2.1)	7 (2.3)
Ortalis guttata	Aracuã-pintado	Speckled Chachalaca	0	1 (0.3)	1 (0.2)	0	0	0
Pauxi tuberosa	Mutum	Razor-billed Curassow	14 (4.9)	11 (3.4)	25 (4.1)	5 (3.0)	2 (1.4)	7 (2.3)

Sarcoramphus papa	Urubu-rei	King Vulture	0	1 (0.3)	1 (0.2)	0	0	0
Psophia viridis	Jacamim-das-costas-verdes	Green-winged Trumpeter	1 (0.3)	0	1 (0.2)	0	0	0
Ara spp.	Arara-vermelha	Macaw	0	1 (0.3)	1 (0.2)	0	0	0
Patagioenas spp.	Pomba	Pigeon	3 (1.0)	0	3 (0.5)	0	0	0
Leptotila spp.	Juriti	Dove	1 (0.3)	0	1 (0.2)	0	0	0
Crotophaga major	Anu-coroca	Greater Ani	0	1 (0.3)	1 (0.2)	0	0	0
Ramphastos spp.	Tucano	Toucan	0	1 (0.3)	1 (0.2)	0	0	0
Reptilia								
Boa constrictor	Jiboia	Common boa	1 (0.3)	0	1 (0.2)	0	0	0
Eunectes murinus	Sucuri	Green anaconda	1 (0.3)	1 (0.3)	2 (0.3)	0	0	0
Melanosuchus niger	Jacaré-açu	Black caiman	7 (2.4)	8 (2.5)	15 (2.5)	0	8 (5.5)	8 (2.6)
Caiman crocodilus	Jacaretinga	Common caiman	8 (2.89)	3 (0.9)	11 (1.8)	9 (5.5)	2 (1.4)	11 (3.5)
Total			287	321	608	164	146	310