ZOOLOGIA 39: e22007
ISSN 1984-4689 (online)

OPINION

Taxonomy as the first step towards conservation: an appraisal on the taxonomy of medium- and large-sized Neotropical mammals in the 21st century

Anderson Feijó[1], Marcus Vinicius Brandão[2]

[1]*Key Laboratory of Zoological Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences. 100101, Chaoyang District, Beijing, China.*
[2]*Museu de Zoologia, Universidade de São Paulo. Avenida Nazaré 481, Ipiranga, 04263-000 São Paulo, SP, Brazil.*
Corresponding authors: Anderson Feijó (andefeijo@gmail.com), Marcus V. Brandão (brandao.mvo@gmail.com)

https://zoobank.org/B0BA296C-9FC8-4BF3-8260-21692DAB564C

ABSTRACT. The Anthropocene brought an accelerated risk of extinction for species across the globe. However, extinction proneness is not even across groups. Past and current events show large-sized mammals at greater extinction risk than smaller ones. For practical reasons, conservation actions tend to focus on the species level; therefore, well-founded species limits are pivotal. Since 2005, the number of known mammal species is about 20% higher but largely due to taxonomic discoveries in small-sized taxa. Here we review the recent taxonomic advances on medium- and large-sized mammals (MLM) from the Neotropics, and discuss misperceptions concerning the taxonomy stability in this group and how this may hinder proper conservation actions. We advocate that apparent taxonomic inertia toward large-sized mammals is partly related to limited systematic inquiry rather than representing an accurate knowledge of their diversity. Fortunately, this scenario has slowly changed in recent years. Linked to integrative analyses that took place during the 21st century, the Neotropical region represents a major example of recent growth in MLM diversity. Taxonomic novelties were found in eight orders of MLM and occurred across taxonomic ranks, from family to subspecies. Most changes comprise subspecies or synonyms elevated to full species, but new taxa of Artiodactyla, Carnivora, Lagomorpha, Pilosa, Primates, Perissodactyla, and large rodents have also been discovered. Recent reshuffles in MLM classification clearly illustrate the risk that bias in taxonomy studies can bring to conservation. Considering the new findings, some species previously labeled as "least concern" for conservation, stand now in some level of threat. This appraisal challenges the misperception of MLM as well-known and shows that taxonomy is a conservation issue.

KEY WORDS. Biodiversity, conservation, IUCN, Mammalia, Neotropics, taxonomy.

The Anthropocene brought an accelerated risk of extinction across the globe for many taxa. Human-driven climate change coupled with unprecedented habitat loss rates defines the ongoing sixth mass extinction (Ceballos et al. 2017, 2020). The effects, nevertheless, are expected to vary across biological groups. While a small part of the extant fauna is being favored by the current impacts (i.e., generalist, urban-adapted taxa, commensal species), a great majority face massive population decline (Dirzo et al. 2014). Selective extinctions are often related to a set of species-specific traits (McKinney 1997, Fara 2000, Robertson et al. 2004). Body size is one of the most assessed extinction proneness traits as it relates to key ecological requirements, such as home range, population size, and litter size. For example, large-sized mammals often exhibit greater extinction risk than smaller ones (Cardillo et al. 2005, Dirzo et al. 2014). Ripple et al. (2017) found that increasing an order-of-magnitude of body mass in mammals relates to a 67% higher chance of being threatened. This extinction proneness of large mammals is consistent both with past (e.g., Cretaceous-Paleogene mass extinction and Pleistocene megafauna extinction; Fara 2000, Wilson 2013) and current (Dirzo et al. 2014, Ripple et al. 2017, Cooke et al. 2019) extinction events.

Species are the primary target for conservation actions and the focus of national and international conservation assessments and management (Isaac et al. 2004, Mace 2004, Dunning et al. 2006). For example, the IUCN based their threat status evaluation firstly in species-level units; among the 5968 mammal species currently classified in one of the IUCN's threat categories, information on infraspecific levels are available for only 411 subspecies and varieties and 42 subpopulations (IUCN 2021).

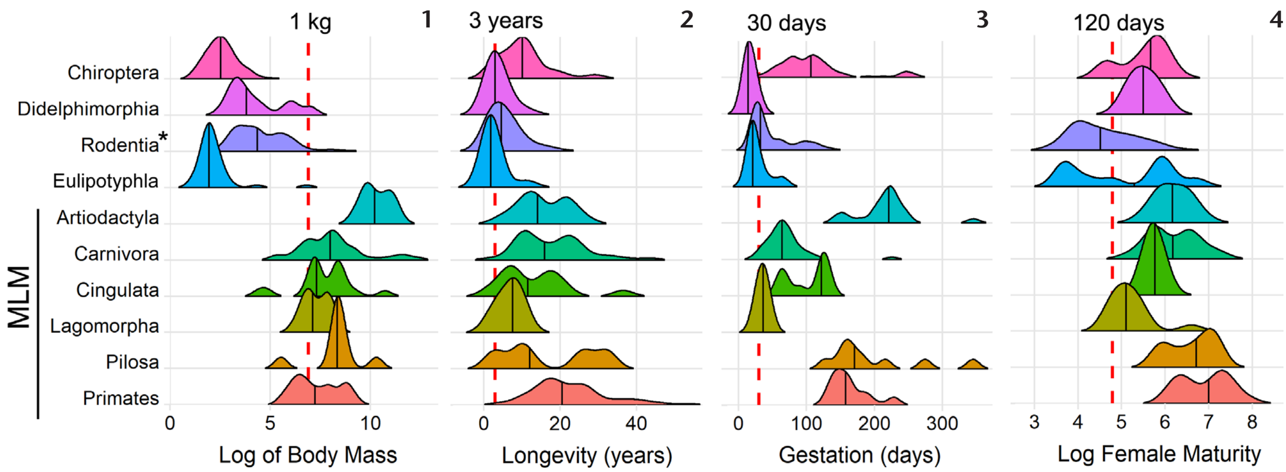
This emphasizes the importance of well-designed taxonomic studies in assessing species-level biodiversity.

The current focus in underscoring the mammalian diversity, however, seems to be highly skewed towards small mammals. The 21st century has witnessed the rise of integrative taxonomy studies at a broad scale (Dayrat 2005). As an example, 15 years after the publication of the third edition of "Mammal Species of the World" (Wilson and Reeder 2005—MSW3 hereafter), the number of mammal species increased by 1180 (ca. 22%), reaching a total of 6596 currently recognized species (Burgin et al. 2018, MDD 2022). This remarkable increase is made up mostly of small mammals, particularly rodents and bats, which represent about 64% of newly recognized species. Contrary to this upward trend, medium and large-sized mammals presented minor taxonomic changes over the last century¸ except for Neotropical primates and Malagasy lemurs (Patterson 2001, Isaac et al. 2004, Burgin et al. 2018). This unbalanced taxonomic novelties in small mammals likely relate to the fact they are better represented in zoological collections (both in number of specimens and geographic coverage), which in turn might reflect their higher abundance in the nature and less bureaucratic field surveys, making their taxonomic studies somewhat less challenging (Patterson 2000). On the other hand, part of the taxonomic inertia toward medium and large-sized mammals likely reflects a limited number of systematic studies. Compiling publications from three well-known systematic journals (Zootaxa, Zookeys, and Zoological Journal of the Linnean Society) in the last 20 years reveals that only 26% of the publications are related to medium and large mammals. Therefore, one could ask how much do we know about the level of cryptic diversity in medium and large-sized mammals?

In this essay, we review recent taxonomic advances on medium and large-sized mammals (MLM) distributed in the Neotropical realm, where both biodiversity and threat are high, address the misperception on the taxonomy stability in these groups, and discuss how this taxonomy inertia toward MLM can hinder proper conservation actions.

Defining medium and large mammals

Biologists commonly divide terrestrial mammals into three artificial groups: volants (bats), small non-volants, and medium and large non-volants (MLM). In the Neotropics, small non-volant mammals usually refer to members of the orders Didelphimorphia, Eulipotyphla, Microbiotheria, Paucituberculata, and Rodentia (except few families). Some authors have used 1, 2, or even 5 kg as a cutting point to differentiate "small mammals" from "MLM" (e.g., Emmons and Feer 1997, Merritt 2010), but this sole criterion can be misleading in some cases. For example, some species of Didelphimorphia can reach up to 2 kg, while silky anteaters and marmosets weigh less than 1 kg (Figs 1–4). Instead, this categorization could be viewed as reflecting a set of common life-history features. Longevity, gestation length, and time to reach sexual maturity are examples of intrinsic biological parameters that set apart small from MLM groups (Figs 1–4). These life-history metrics relate to population density and growth, which together with body size can be used as proxies of species' risk of extinction. Therefore, here our definition of medium and large mammals includes all species of the orders Artiodactyla, Carnivora, Cingulata, Lagomorpha, Pilosa, Perissodactyla, Primates, and part of Rodentia (Cuniculidae, Dasyproctidae, Erethizontidae, and Hydrochoerinae). Extrinsic factors such as collecting techniques bring additional support for this classification. Most field studies focusing on "small mammals" in the Neotropics use Tomahawk and Sherman live traps and pitfall traps to capture marsupials and small rodents. Other mammals, even those with body sizes similar to marsupials and



Figures 1–4. Distribution of (1) body size, (2) longevity, (3) gestation length, and (4) female maturity of Neotropical species clustered per order. Data based on Myhrvold et al. (2015). Black vertical lines indicate the median. Red dashed lines are reference values. Note that some species of Rodentia are also classified as medium and large mammals (MLM); see the text.

small rodents, are rarely registered with these traps. Their surveys nowadays rely mainly on non-collecting methods such as camera traps, footprints, vocalizations, and direct visualizations. Field collection of MLM is mostly opportunistic when individuals are found dead naturally or due to anthropogenic causes, like roadkills. These methodological differences between small and MLM surveys reflect the availability of specimens in scientific collections and ultimately the uneven number of taxonomic studies between these groups.

Recent taxonomic discoveries in MLM

By reviewing the literature, we found that about ca. 61% of the Neotropical MLM genera had no taxonomic-focused studies in the last 50 years (Fig. 5). On the other hand, those groups that underwent in-depth taxonomic studies often had synonyms or subspecies elevated to species level. Surprisingly, taxonomic novelties also included the description of new species of Carnivora (Helgen et al. 2013), Lagomorpha (Ruedas 2017), and Pilosa (Miranda et al. 2018—see Table 1 for a list of recent taxonomy discoveries in MLM). The increase in the number of MLM species is certainly linked to integrative analyses applied during the 21st century. Below we summarized the taxonomic changes for Neotropical MLM since the publication of MSW3 in 2005.

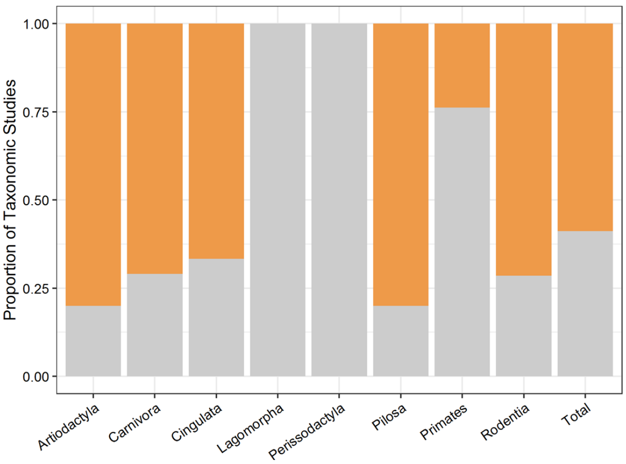


Figure 5. Proportion of Neotropical medium and large mammalian genera lacking (orange bars) taxonomic studies organized per order. It is noteworthy however that even for those genera that underwent recent taxonomic studies (gray bar), uncertainties in some species limits still remain and they should not be considered fully understood.

Xenarthra

The superorder Xenarthra (armadillos, sloths, and anteaters) is a group that went through dramatic taxonomic changes at family, genus, subgenus, species, and subspecies levels. In the order Cingulata, Gibb et al. (2016) classified extant armadillos in two different families (Chlamyphoridae and Dasypodidae) instead of the traditional one, as a long-stand view. Major changes occurred in the long-nosed armadillos (*Dasypus* spp.) in the last five years, including the recognition of three subgenera (*Hyperoambon*, *Muletia*, and *Dasypus*; Feijó et al. 2019), the split of a previous widely distributed Amazonian taxon into three species (Feijó and Cordeiro-Estrela 2016, Feijó et al. 2018, 2019), the description of a new subspecies (Feijó et al. 2018), and the rearrangement of a former species as a subspecies (Feijó et al. 2018, 2019). Furthermore, a recent revision of the naked-tailed armadillos, *Cabassous*, removed *C. squamicaudis* from the synonymy with *C. unicinctus*, raising the number of extant species of this genus to five (Feijó and Anacleto 2021). Within the order Pilosa, silky anteaters, the smallest anteaters of the world, had long been considered as a monotypic genus widely distributed in Central and northern South America and the sole extant member of Cyclopedidae. Recently, Miranda et al. (2018) uncovered seven species of *Cyclopes*, three previously hidden under *Cyclopes didactylus* for more than a century, and three newly described species (Table 1).

Carnivora

Once considered one of the best-known groups (Reeder et al. 2007), the iconic members of the order Carnivora represent another case of recent taxonomic changes, with important published studies on felids, mephitids, and procyonids. Taxonomic revisions of *Leopardus* resulted in major changes in felid taxonomy (Table 1). Studies revealed that the widely distributed oncilla, *L. tigrinus*, represents a complex of three species (Trigo et al. 2013, Nascimento and Feijó 2017, Trindade et al. 2021). Another striking taxonomic change concerns the pampas cats, where a previously polytypic species (*L. colocola*) was split into five species (Nascimento et al. 2021). Within extant mephitids, although a comprehensive taxonomic revision of hog-nosed skunks, *Conepatus*, is lacking, the genus had recent taxonomic changes. *Conepatus humboldtii* is now considered a junior synonym of *C. chinga* and *C. amazonicus* is treated as a valid species (Feijó and Langguth 2013, Schiaffini et al. 2013). Recently, McDonough et al. (2022) revised spotted skunks, *Spilogale*, and elevated three subspecies to full species, raising to seven the number of species in this genus.

Procyonids were also studied in recent years (Table 1). Helgen et al. (2013) not only made a substantial rearrangement on olingos, *Bassaricyon*, but also described the olinguito, *B. neblina*. The taxonomy and phylogeographic structure of coatis, *Nasua*, and mountain coatis, former genus *Nasuella*, were revised, leading to the lump into a single genus *Nasua* (Nigenda-Morales et al. 2019, Ruiz-García et al. 2020b) and the revalidation of *N. meridensis* (see Helgen et al. 2009). Nonetheless, the evolutionary history of the coatis is yet to be fully understood. Finally, the validity of species of raccoons, *Procyon*, has also been questioned, most of them proving to be conspecific to *P. lotor* (see Helgen et al. 2008), including the Caribbean endemic *Procyon pygmaeus*, as recently suggested by Louppe et al. (2020).

Table 1. Recent taxonomic changes of Neotropical medium- and large-sized mammals as compared to Mammal Species of the World, volume 3 (MSW3; Wilson and Reeder 2005). Marine mammals are not included in the present study. References are provided in Supplementary Table S1.

Taxa	MSW3	Current: Remarks	Current: Valid taxa	References
Pilosa				
Cyclopes	*C. didactylus* (Linnaeus, 1758)	Subspecies elevation	*C. didactylus*	1
			C. ida Thomas, 1900	
			C. dorsalis (Gray, 1865)	
			C. catellus Thomas, 1928	
		New species	*C. thomasi* Miranda et al., 2017	
			C. rufus Miranda et al., 2017	
			C. xinguensis Miranda et al., 2017	
Cingulata				
Dasypodidae	Dasypodidae Gray, 1821	Family split	Dasypodidae	2
			Chlamyphoridae Bonaparte, 1850	
Dasypus	*Dasypus* Linnaeus, 1758	Subgenus validation	*D.* (*Dasypus*)	3
			D. (*Hyperoambon*) Peters, 1864	
			D. (*Muletia*) Gray, 1874	
	D. kappleri Krauss, 1862	Synonym elevation	*D.* (*Hyperoambon*) kappleri	3, 4
			D. (*Hyperoambon*) beniensis Lönnberg, 1942	
			D. (*Hyperoambon*) pastasae (Thomas, 1901)	
	D. septemcinctus Linnaeus, 1758	Subspecies status validation	*D.* (*Muletia*) *septemcinctus septemcinctus*	3–5
	D. hybridus (Desmarest, 1804)	Treated as subspecies	*D.* (*Muletia*) *septemcinctus hybridus*	
		New subspecies	*D.* (*Muletia*) *septemcinctus cordobensis* Feijó, Patterson & Cordeiro-Estrela, 2018	
	D. yepesi Vizcaíno, 1995	Junior synonym of the revalidated *D. mazzai*	*D. mazzai* Yepes, 1933	6
Chaetophractus	*C. nationi* Thomas, 1894	Junior synonym	*C. vellerosus* (Gray, 1865)	7
Cabassous	*C. unicinctus* (Linnaeus, 1758)	Subspecies elevation	*C. unicinctus*	8
			C. squamicaudis (Lund, 1845)	
Carnivora				
Leopardus	*L. braccatus* (Cope, 1889)[a]	Subspecies elevation	*L. braccatus*	9
			L. munoai (Ximénez, 1961)	
	L. colocola (Molina, 1782)[a]	Treated as monotypic	*L. colocola*	
	L. pajeros (Desmarest, 1816)[a]	Subspecies elevation	*L. pajeros*	
			L. garleppi (Matschie, 1912)	
	L. tigrinus (Schreber, 1775)	Subspecies and synonym elevation	*L. tigrinus*	10, 11
			L. emiliae (Thomas, 1914)	
			L. guttulus (Hensel, 1872)	
Conepatus	*C. semistriatus* (Boddaert, 1785)	Subspecies elevation	*C. semistriatus*	12, 13
			C. amazonicus (Lichtenstein, 1832)	
	C. humboldtii Gray, 1837	Junior synonym	*C. chinga* (Molina, 1782)	13
Spilogale	*S. gracilis* Merriam, 1890	Subspecies elevation	*S. gracilis*	14
			S. leucoparia Merriam, 1890	
	S. angustifrons Howel, 1902	Subspecies elevation	*S. angustifrons*	
			S. yucatanensis Burt, 1938	
	S. putorius (Linnaeus, 1758)	Subspecies elevation	*S. interrupta* (Rafinesque, 1820)	
			S. putorius	
Nasuella	*Nasuella* Hollister, 1915	Junior synonym	*Nasua* Storr, 1780	15, 16
Nasua	*N. olivacea* (Gray, 1865)	Subspecies elevation	*N. olivacea*	17
			N. meridensis (Thomas, 1901)[b]	
Bassaricyon	*B. beddardi* Pocock, 1921	Junior synonym	*B. alleni* Thomas, 1880	18
	B. lasius Harris, 1932	Junior synonyms	*B. gabbii* J.A. Allen, 1876	
	B. pauli Enders, 1936			
		Species validation	*B. medius* Thomas, 1909	
		New species	*B. neblina* Helgen et al., 2013	
Artiodactyla				
Inia	*I. geoffrensis* (Blainville, 1817)	Subspecies elevation	*I. geoffrensis*	19
			I. boliviensis d'Orbigny, 1834	
		New species	*I. araguaiaensis* Hrbek, Farias, Dutra & da Silva, 2014	
Mazama	*M. gouazoubira* (G. Fischer, 1814)	Subspecies elevation	*M. gouazoubira*	20–22
			M. nemorivaga (F. Cuvier, 1817)	
	M. bricenii Thomas, 1908	Junior synonym	*M. rufina* Pucheran, 1851	23
	M. americana (Erxleben, 1777)	Synonym elevation	*M. rufa* (Illiger, 1815)	24
	M. bororo Duarte, 1996	Junior synonym	*M. jucunda* Thomas, 1913	25
Perissodactyla				
Tapirus		New species	*T. kabomani* Cozzuol, Clozato, Holanda, Rodrigues, Nienow, de Thoisy, Redondo & Santos, 2013[c]	26

Continues

Table 1. Continued.

Taxa	MSW3	Current		References
		Remarks	Valid taxa	
Rodentia				
Echinoprocta	*Echinoprocta* Gray, 1865	Junior synonym	*Coendou* Lacépède, 1799	27, 28
Coendou	*C. bicolor* (Tschudi, 1844)	Subspecies elevation	*C. bicolor*	27, 28
			C. quichua Thomas 1899	
	C. villosus (F. Cuvier, 1823)	Junior synonym	*C. spinosus* (F. Cuvier, 1823)	
	C. rothschildi Thomas, 1902	Junior synonym	*C. quichua*	
		New species	*C. baturitensis* Feijó & Langguth, 2013	12
		New species	*C. speratus* Mendes Pontes et al., 2013	29
	C. prehensilis (Linnaeus, 1758)	Synonym elevation and subspecies status validation	*C.* (*Coendou*) *longicaudatus longicaudatus* Daudin, 1802	30
			C. (*Coendou*) *longicaudatus boliviensis* (Gray, 1850)	
		Subgenera validation	*Coendou* Lacépedè, 1799	
			Sphiggurus F. Cuvier, 1825	
		New subgenus	*Caaporamys* Menezes et al. 2021	
Dasyprocta		New species	*D. iacki* Feijó & Langguth, 2013	12
Primates				
Aotus	*A. lemurinus* (I. Geoffroy, 1843)	Subspecies elevation	*A. lemurinus*	31
			A. brumbacki Hershkovitz, 1983	
			A. griseimembra D.G. Elliot, 1912	
			A. zonalis Goldman, 1914	
		New species	*A. jorgehernandezi* Defler & Bueno, 2007	
	A. azarae (Humboldt, 1811)	Subspecies elevation	*A. azarae*	32, 33
			A. infulatus (Kuhl, 1820)	
			A. boliviensis (Elliot, 1907)	
	A. hershkovitzi Ramirez-Cerquera, 1983	Junior synonym	*A. lemurinus*	34
Alouatta	*A. belzebul* (Linnaeus, 1766)	Synonym elevation	*A. discolor* (Spix, 1823)	35
			A. ululata Elliot, 1912	
	A. seniculus (Linnaeus, 1766)	Subspecies elevation	*A. seniculus*	35, 36
			A. arctoidea Cabrera, 1940	
			A. puruensis Lönnberg, 1941	
Callithrix	*C.* (*Callithrix*) Erxleben, 1777	Genus elevation	*Callithrix*	37
	C. (*Cebuella*) Gray, 1866	Genus elevation	*Cebuella*	
	C. (*Mico*) Lesson, 1840	Genus elevation	*Mico*	
	C. (*Callibella*) Van Roosmalen & Van Roosmalen, 2003	Junior synonym	*Mico*	
Cebuella	*C. pygmaea* (Spix, 1823)	Subspecies elevation	*C. pygmaea*	38, 39
			C. niveiventris Lönnberg, 1940	
Cebus	*Cebus* Erxleben, 1777	Genus split	*Cebus*	40–42
			Sapajus Kerr, 1792	
		Subspecies elevation	*C. aequatorialis* Allen, 1921	43, 44
			C. cuscinus Thomas,1901	
			C. unicolor Spix, 1823	
			C. versicolor Pucheran, 1845	
		Synonym elevation	*C. brunneus* Allen, 1914	43, 44
			C. castaneus I. Geoffroy, 1851	
			C. cesarae Hershkovitz, 1949	
			C. imitator Thomas, 1903	
			C. leucocephalus Gray, 1866	
			C. malitiosus Elliot, 1909	
			C. yuracus Hershkovitz, 1949	
Sapajus		Species validation	*S. flavius* (Schreber, 1799)[d]	45
		Species validation	*S. cay* (Illiger, 1815)[d]	40, 41, 44
			S. robustus (Kuhl, 1820)	
Saimiri	*S. sciureus* (Linnaeus, 1758)	Subspecies elevation	*S. sciureus*	46, 47
			S. cassiquiarensis (Lesson, 1840)	
			S. macrodon Elliot, 1907	
		Synonym elevation	*S. collinsi* Osgood, 1916	
Mico		New species	*M. munduruku* Costa-Araújo, Farias & Hrbek, 2019	48
		New species	*M. rondoni* Ferrari, Sena, Schneider & Silva-Junior, 2010	49
		New species	*M. schneideri* Costa-Araújo et al., 2021	50
Cacajao	*C. melanocephalus* (Humboldt, 1812)	Synonym elevation	*C. melanocephalus*	51, 52
			C. ouakary (Spix, 1823)	
Callicebus	*Callicebus* Thomas, 1903	New genera	*Callicebus*	53
			Cheracebus Byrne et al., 2016	
			Plecturocebus Byrne et al., 2016	

Continues

Table 1. Continued.

Taxa	MSW3	Current		References
		Remarks	Valid taxa	
Plecturocebus		New species	*P. vierai* (Gualda-Barros, Nascimento & Amaral, 2012)	54
		New species	*P. urubambensis* (Vermeer & Tello-Alvarado, 2015)	55
		New species	*P. miltoni* (Dalponte, Silva & Silva Júnior, 2014)	56
		New species	*P. grovesi* Boubli et al., 2019	57
		New species	*P. parecis* Gusmão et al., 2019	58
		New species	*P. aureipalatii* (Wallace et al., 2006)	59
		New species	*P. caquetensis* (Defler, Bueno & J. Garcia, 2010)	60
	C. cupreus (Spix, 1823)	Synonym elevation	*P. cupreus*	55
			P. toppini Thomas, 1914	
Pithecia		New species	*P. cazuzai* Marsh, 2014	61
			P. isabela Marsh, 2014	
	P. irrorata Gray, 1843[e]	Synonym elevation	*P. irrorata*	61, 62
			P. vanzolinii (Hershkovitz, 1987)	
	P. monachus É. Geoffroy St. Hilaire, 1812	Subspecies elevation	*P. monachus*	61
			P. milleri (J. A.Allen, 1914)	
	P. pithecia (Linnaeus, 1766)	Subspecies elevation	*P. pithecia*	
			P. chrysocephala I. Geoffroy St.-Hilaire, 1850	
		Synonym elevation	*P. hirsuta* (Spix, 1823)	
			P. inusta (Spix, 1823)	
			P. napensis (Lönnberg, 1938)	
Saguinus	*Saguinus* Hoffmannsegg, 1807	Genus split	*Saguinus*	63
			Leontocebus Wagner, 1839	
	S. niger (Geoffroy, 1803)	Synonym elevation	*S. ursula* Hoffmannsegg, 1807	64
	Saguinus pileatus (I. Geoffroy & Deville, 1848)	Treated as subspecies	*S. mystax pileatus*	63
Leontocebus[f]	*L. fuscicollis* (Spix, 1823)	Subspecies elevation	*L. cruzlimai* (Hershkovitz, 1966)	63
			L. fuscus (Lesson, 1840)	
			L. illigeri (Pucheran, 1845)	
			L. lagonotus (Jimenez de la Espada, 1870)	
			L. leucogenys (J. E. Gray, 1866)	
			L. nigrifrons (I. Geoffroy Saint-Hilaire, 1851)	
Oreonax	*Oreonax* Thomas, 1927	Junior synonym	*Lagothrix*	65
Lagothrix	*L. cana* (É. Geoffroy St.-Hilaire, 1812)	Treated as subspecies	*L. lagotricha cana*	66
	L. lugens Elliot, 1907		*L. lagotricha lugens*	
	L. lagotricha (Humboldt 1812)		*L. lagotricha lagotricha*	
	L. poeppigii Schinz, 1844		*L. lagotricha poeppigii*	
	Oreonax flavicauda (Humboldt, 1812)	*Oreonax* tretead as subgenus	*L.* (*Oreonax*) *flavicauda*	
Lagomorpha				
Sylvilagus		New species	*S. parentum* Ruedas, 2017	67
	S. brasiliensis (Linnaeus, 1758)	Subspecies elevation	*S. brasiliensis*[g]	67–71
			S. andinus (Thomas, 1897)[g]	
			S. minensis Thomas, 1901[h]	
			S. tapetillus Thomas, 1913	
			S. paraguensis Thomas, 1901[i]	
			S. sanctaemartae Hershkovitz, 1950	
			S. apollinaris Thomas, 1920	
			S. fulvescens J.A. Allen, 1912	
			S. gabbi (Allen, 1877)	
			S. surdaster Thomas, 1901	
		Validation from synonym of *S. surdaster*	*S. daulensis* J.A. Allen, 1914	71
		Validation from synonym of *S. gabbi*	*S. incitatus* (Bangs, 1901)	
		Validation from synonym of *S. fulvescens*	*S. nicefori* Thomas, 1921	
			S. salentus J.A. Allen, 1913	

[a]After the MSW3, Kitchener et al. (2017) classified the pampas cat in one polytypic species (*L. colocola*) with seven subspecies.
[b]Also see Ruiz-García et al. (2020b) about the validity of *N. meridensis*.
[c]See Voss et al. (2014) for an alternative hypothesis.
[d]Not listed in the MSW3.
[e]Compare opposite hypothesis of Marsh (2014) and Serrano-Villavicencio et al. (2019)
[f] Garbino and Martins-Junior (2018) consider *Leontocebus*, *Saguinus* and *Tamarinus* as subgenera.
[g]See Diersing and Wilson (2017) for different hypothesis.
[h]Species that still need to be properly revalidated (see Silva et al. 2019).
[i]Needs further studies to confirm validity (see Silva et al. 2019).

Artiodactyla

The composition of the order Artiodactyla has greatly changed in the last 15 years. First, the inclusion of Cetacea (dolphins, porpoises, and whales) nested within Artiodactyla is now largely accepted (Bininda-Emmons et al. 2007, Asher and Helgen 2010). Second, there have been several changes in some artiodactyls taxa contents. We highlight here two particular cases concerning the Iniidae and Cervidae. River dolphins, *Inia*, are another case of MLM that had recently validated species and, most remarkably, a description of a new species: the Araguaian river dolphin, *Inia araguaiaensis* (Hrbek et al. 2014). Furthermore, several Neotropical cervids appear to be polyphyletic groups, with members of some genera known to be highly divergent lineages, such as *Mazama* and probably *Pudu* and *Hippocamelus* (Duarte et al. 2008, Gutiérrez et al. 2017, Cifuentes-Rincón et al. 2020, González and Duarte 2020, Heckeberg 2020). Therefore, it is likely that additional genera of cervids will be described or validated in upcoming years. Species-level changes include the validation of *Mazama nemorivaga*, the reallocation of *Mazama pandora* to the genus *Odocoileus*, the revalidation of *Mazama rufa* out of the *M. americana* complex, and most recently the recognition of *Mazama jucunda* as the valid name for the Atlantic Forest small red brocket deer (Gutiérrez et al. 2017, Heckeberg 2020, Peres et al. 2021, Mantellatto et al. 2022). These studies reveal that the diversity of Neotropical artiodactyls is still underestimated, and future changes are certain (González and Duarte 2020).

Perissodactyla

One debated taxonomic discovery concerns the description of the Kabomani tapir, *Tapirus kabomani* (Cozzuol et al. 2013). Although included in the recently updated mammal species list of Brazil (Quintela et al. 2020), Voss et al. (2014) highlighted that compelling data is still needed to corroborate the validity of this species (but see Cozzuol et al. 2014). Regardless of upcoming studies about this subject, it's certainly a fact that Cozzuol et al. (2013) revealed how little we know about tapirs, the largest extant terrestrial mammals of the American continent.

Primates

Major changes concern the Neotropical members of the order Primates. One is the recent split of the genera *Callicebus*, *Cebus*, and *Saguinus* into three, two, and three genera, respectively (Lynch-Alfaro et al. 2012a, 2012b, 2014, Byrne et al. 2016, Rylands et al. 2016—but see Garbino 2015, and Gutiérrez and Marinho-Filho 2017 for alternative arrangements at the subgenus level). Additional changes were due to the continuous rearrangement of subspecies or junior synonyms into valid species, and the description of new taxa (e.g., Boubli et al. 2019, Costa-Araújo et al. 2019, Gusmão et al. 2019, Costa-Araújo et al. 2021). Just in the last five years, four new species of platyrrhines were described in South America (see Table 1). One highly debated issue is the taxonomic review of *Pithecia* by Marsh (2014), which described five new species and elevated six synonyms or subspecies to full species. However, Serrano-Villavicencio et al. (2019) treated *P. mittermeieri*, *P. rylandsi*, and *P. pissinattii* as junior synonyms of *P. irrorata*. Therefore, even receiving great attention from taxonomists over decades, monkeys continue to be the group of Neotropical MLM with the highest number of taxonomic changes in recent years (Table 1).

Lagomorpha

Although diverse in other parts of the world, the order Lagomorpha has been represented for decades in South America by only two species: *Sylvilagus brasiliensis* and *S. floridanus*, with the former being once considered the most widely distributed cottontail in the continent and with several subspecies recognized (Silva et al. 2019). Only recently the diversity of this genus in South America was raised with the description of *S. varynaensis* (Durant and Guevara 2001) and *S. parentum* (Ruedas 2017), and validation of *S. andinus*, *S. tapetillus*, and *S. sanctaemartae* (Bonvicino et al. 2015, Ruedas 2017, Ruedas et al. 2017, 2019), all three treated as subspecies of *S. brasiliensis* in MSW3. Additionally, Diersing and Wilson (2017) proposed a series of taxonomic changes for Central American and the North Andean cottontails. They considered *S. sanctaemartae* as subspecies of *S. gabbi*, both *S. fulvescens* and *S. apollinaris* as valid Andean species, and *S. andinus* and *S. defilippi* as a subspecies of *S. brasiliensis*. More recently, Ruedas et al. (2019) did not recognize the subspecific status of *S. defilippi*, considering it as a nomen nudum; and treated many taxa from Central America and the Andean region as valid: *S. andinus*, *S. apollinaris*, *S. daulensis*, *S. incitatus*, *S. fulvescens*, *S. gabbi* (now restricted to Mesoamerica), *S. nicefori*, *S. salentus*, and *S. surdaster*. Another recent study focuses largely on the *S. brasiliensis* species complex, suggesting *S. minensis* may be another valid taxon from South America, and others are yet to be clarified, like *S. paraguensis* (see Silva et al. 2019). Finally, Mora et al. (2020) treated *S. dicei* as a valid taxon now restricted to forested uplands in Costa Rica and western Panama. As summarized in Table 1, the recent scenario of *Sylvilagus* taxonomy is complex and despite the recent advances, the range distribution of all these species remains unclear, as well as the taxonomic status of several Neotropical populations.

Rodentia

Large-sized rodents have also gone through taxonomic changes that include different Neotropical families, with their phylogenetic relationships better clarified only recently (Upham and Patterson 2015). We restrict here to comment on large-sized members of the infraorder Hystricognathi that underwent marked recent changes at the genus and species levels. New World porcupines (Erethizontidae) are probably the most significant case, with many changes in nominal taxa at the genus and species level (Voss 2011, Voss et al. 2013, Menezes et al. 2021). Notably, among the 16 species of *Coendou* currently recognized, four were described in the last 20 years (Voss and da Silva 2001, Feijó and Langguth 2013, Mendes Pontes et al.

2013). In addition, Menezes et al. (2021) recently removed one species from the Brazilian porcupine *C. prehensilis* synonymy, leading to a marked rearrangement in the taxonomy of this previously widely distributed taxon. Another example concerns the description of a new species of agouti (Dasyproctidae) from Brazil (Feijó and Langguth 2013). Nonetheless, most genera of Hystricognathi rodents are in critical need of revision and their diversity is probably underestimated.

Unnamed MLM diversity

In addition to these formal taxonomic changes in large-sized Neotropical mammals in the last 15 years (Table 1), there is strong and increasing support for a largely hidden diversity. Gibb et al. (2016) and Feijó et al. (2019) identified an unnamed lineage of nine-banded armadillos in South America. Hautier et al. (2014) and Voss and Fleck (2017) reported morphologically distinct populations of the Amazonian brown-throated sloths *Bradypus variegatus*, which largely mirror the phylogenetic findings reported by Ruiz-García et al. (2020a). Investigating Neotropical deers, many studies (e.g., Heckeberg et al. 2016, Gutiérrez et al. 2017) report the existence of several species complexes (e.g., *M. americana, M. nemorivaga*, among others) and undescribed taxa. This also proved to be the case for the South American cottontails, with at least two species likely to be described in coming years (Ruedas et al. 2019, Silva et al. 2019), and for agouties, with recent molecular evidence suggesting a species complex in *Dasyprocta fuliginosa* (see Ruiz-García et al. 2022). The taxonomic rank of these groups needs clarification. This highlights that even for those genera that underwent some taxonomic studies in recent years, uncertainty remains and they should not be considered fully resolved.

The myth of MLM taxonomic stability

All these cases illustrate how far we are from an accurate view of the species richness of Neotropical mammals. Importantly, the taxonomic changes summarized above address less than 40% of the MLM genera present in the Neotropics (Fig. 5). This suggests a marked Linnean shortfall scenario—the discrepancy between species already described and the actual number of existing species (Horta et al. 2015)—is more widespread among MLM than previously thought. Patterson (2000), between the publication of the 2nd and 3rd edition of "Mammal Species of the World" (Wilson and Reeder 1993, 2005), highlights that Neotropical mammal species described in those years included six orders: Chiroptera, Didelphimorphia, Eulipotyphla, Paucituberculata, Primates, and Rodentia. Thus, as in Patterson's (2000) own words, "data was contrary to conventional wisdom since descriptions at that time were not restricted only to bats and rodents". Nonetheless, most of these orders still refer to small-sized mammals, and the idea that medium and large-sized mammals are taxonomically well known remains a popular misperception.

The recent taxonomic changes described herein (Table 1) show that eight orders of medium and large Neotropical mammals increased in diversity, especially during the last decade, which certainly falsifies the misperception of taxonomic stability in MLM. Importantly, these changes are not restricted to a specific group but seem to represent an overall pattern among MLM. We could thus expect that many taxa with long-term taxonomic stability likely reflect a lack of comprehensive taxonomic studies rather than actual knowledge of their diversity, especially for those with a wide distribution and subspecies recognized. Unfortunately, despite being now fully recognized species, the conservation scenario for most of these groups might be worrisome.

Taxonomy is a conservation issue

Numerous Neotropical MLM species are at some level of risk of extinction, mostly due to habitat loss, fragmentation, and overhunting (Ripple et al. 2016, Bogoni et al. 2020). However, because of their broader distribution, some species may inhabit somewhat healthy environments in part of their range but not in others, which leads to a disparity between the global and local conservation assessments. For instance, several Neotropical MLM taxa—e.g., *Atelocynus microtis* (Sclater, 1883), *Chrysocyon brachyurus* (Illiger, 1815), *Lycalopex vetulus* (Lund, 1842), *Speothos venaticus* (Lund, 1842), *Herpailurus yagouaroundi* (Berlandier, 1859), *Leopardus geoffroyi* (d'Orbigny & Gervais, 1844), *Sapajus cay* (Illiger, 1815)—are classified as Vulnerable in Brazil (ICMBio 2018), but only as Near Threatened or Least Concern globally (IUCN 2021). The recent increase of MLM diversity, in which most novelties are derived from taxon splits (valid species previously hidden either as subspecies or under a synonym), clearly illustrates the risk that lack of taxonomic studies represents for conservation.

Among the five criteria defined by the IUCN for listing species in one of the threatened categories (Critically Endangered, Endangered, or Vulnerable), taxonomic delimitation of species has a direct impact on four: geographic range (affecting extent of occurrence and area of occupancy; criteria A, B, and D; Fig. 6) and population size (criteria A, C, and D). To illustrate, we highlight recent changes in species delimitation of armadillos (*D. kappleri*), cats (*L. tigrinus* and *L. colocola*), porcupines (*C. prehensilis*), and cottontails (*S. brasiliensis*) resulting in a drastic reduction of their range and population size (Figs 7–10). They were all assumed to have a wide distribution and were long-term taxonomically accepted, but proved to be species complexes through recent taxonomic revisions (Feijó and Cordeiro-Estrela 2016, Nascimento and Feijó 2017, Feijó et al. 2018, 2019, Silva et al. 2019, Menezes et al. 2021, Nascimento et al. 2021). Notably, these examples are from ecologically distinct groups, living in distinct South American regions (Figs 7–10). Based on integrative methods combining evidence from multiple sources, taxonomists reshuffle their classification. With the split of these species complexes, some of these taxa proved to have much smaller distribution ranges, such as *L. colocola*, *L. munoai*, *C. prehensilis*, and *S. brasiliensis*, now restricted to areas with intense habitat

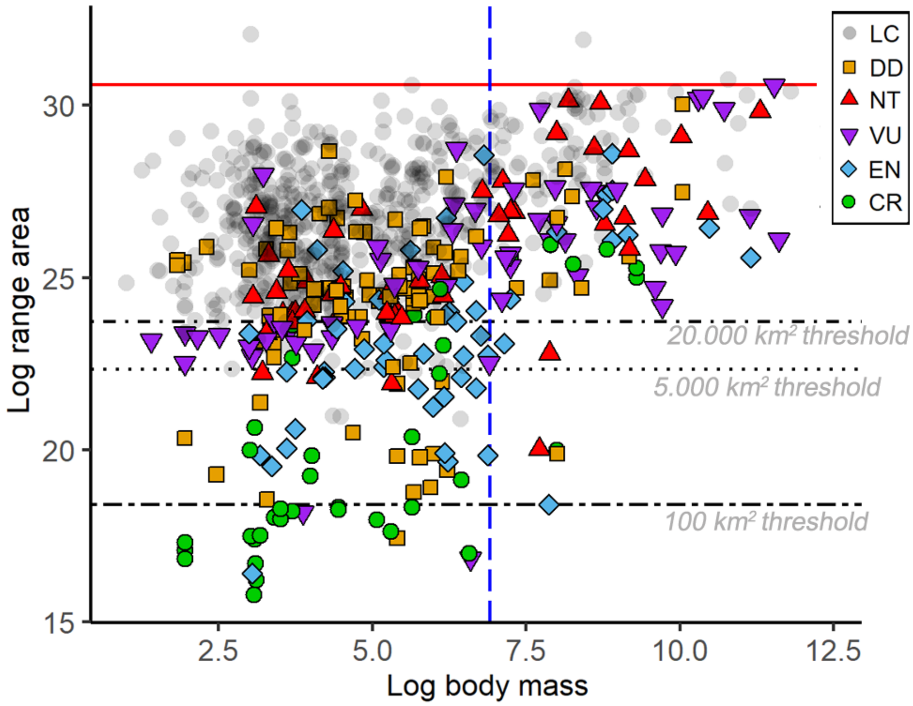


Figure 6. Log body mass as a function of log range area for Neotropical non-volant terrestrial mammals. Taxonomic studies help define species limits, which in turn affect species' geographic range and population size, key criteria defined by the IUCN for assigning species into a threatened category. Note that a reduced range increases the risk of a species being threatened. Polygons are color-coded by IUCN threatened status. Vertical blue line represents a body mass of 1.5 kg. Horizontal red line represents the area of the Neotropical region. Gray horizontal lines represent one of the IUCN thresholds (extent of occurrence) for classifying species as Vulnerable, Endangered and Critically Endangered. Note that extent of occurrence as defined by the IUCN is not the same as geographic range but they are correlated.

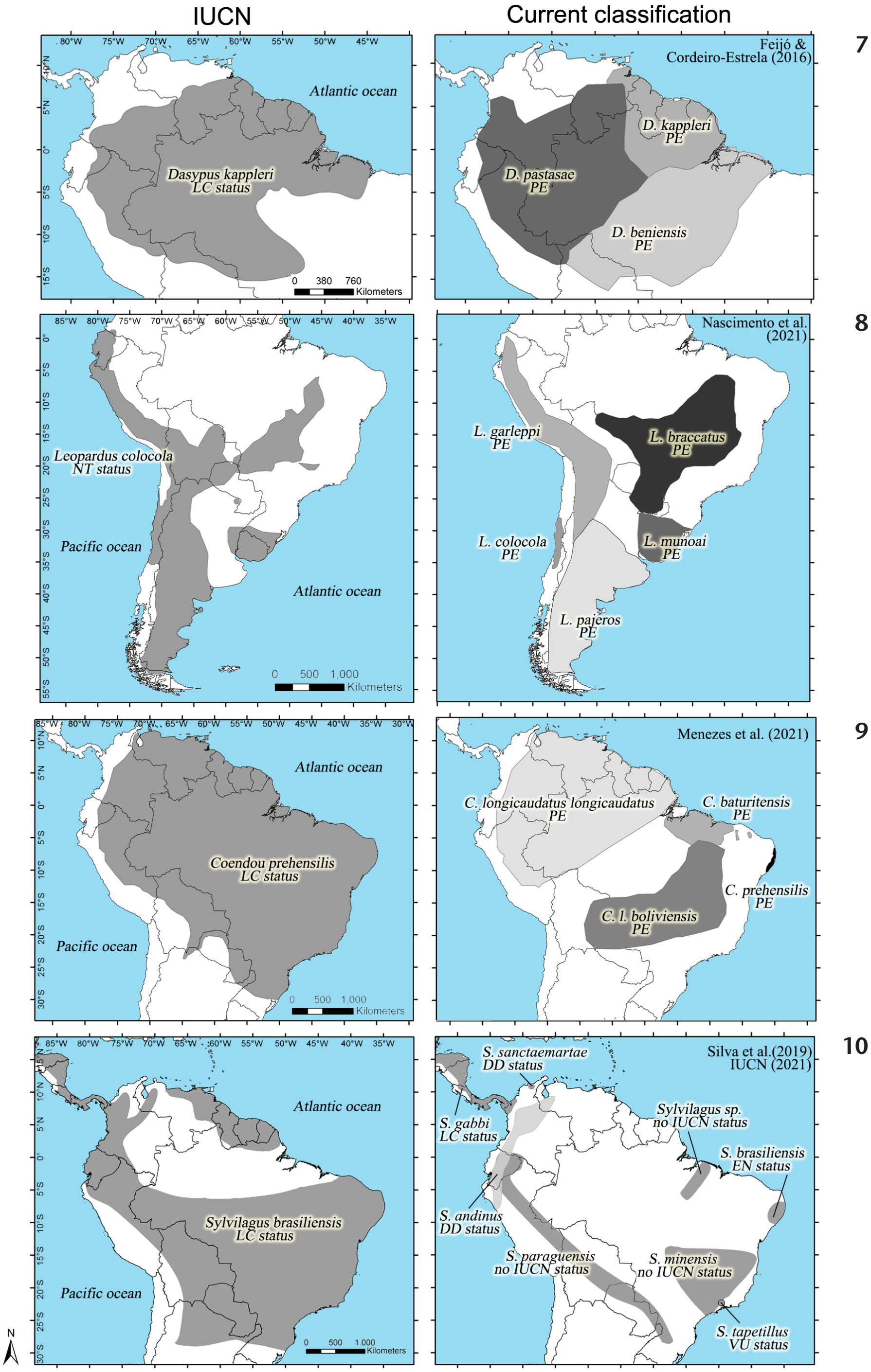
alteration (Figs 7–10). These cases clearly show how taxonomy can unveil the urgent conservation needs for some taxa.

It is critical that several MLM should have their IUCN status reevaluated considering their now much-reduced distribution and local threats. Among the above examples, only the cottontails had their threatened status updated according to the new taxonomic arrangement, although not all species have been evaluated yet (Fig. 10). Recent species checklists have been calling attention to the need for reassessments of conservation status, considering most MLM species (some listed herein in Table 1) as "Pending [re]evaluation" (Brandão et al. 2019, Quintela et al. 2020). This is particularly important to establish new conservation actions for these recently recognized/validated taxa.

In addition to properly revealing the conservation needs, taxonomy can also "save" a species from extinction as exemplified by two recent cases in South America. After integrative taxonomic studies, two species of mammals previously considered endangered—the mouse opossum, *Cryptonanus ignitus* (Diaz, Flores & Barquez, 2000) and the Andean hairy armadillo, *Chaetophractus nationi* Thomas, 1894—were synonymized to the Least-Concern species *Cryptonanus chacoensis* (Tate, 1931) and *Chaetophractus vellerosus* (Gray, 1865), respectively (Abba et al. 2015, Teta and Díaz-Nieto 2019). These findings reveal how taxonomic revisions are still needed even for those taxa that are currently considered endangered and rare. Moreover, with accurate taxonomic definitions, resources can be properly relocated for species facing higher risk of extinction, and conservation actions can be better planned for those populations at imminent regional extinction.

Moving forward

Species serve as the conceptual linchpin across biological disciplines (e.g., biogeography, ecology, public health, among many others), and their widespread application for conservation practices will certainly remain for a long time. These are compelling reasons for expanding efforts on systematic studies of MLM to provide the basic data of how many species of mammals are there and which are in urgent need of conservation and management efforts. Well-defined species limits should be seen as a priority in conservation actions, dedicating funds to taxonomy. Realizing that taxonomy and conservation are not separate areas but rather a continuum of "knowing to preserve" framework and that both taxonomists and conservationists share a common goal of preserving biodiversity are important



Figures 7–10. Examples of recent taxonomic changes in Neotropical medium and large mammals. For each taxon, maps on the left refer to distribution by IUCN and on the right refer to current literature (see Table 1). Split of greater long-nosed armadillo (*Dasypus kappleri*) into three species (7); of Brazilian porcupine (*Coendou prehensilis*) into four taxa (8); of pampas cats (*Leopardus colocola*) into five species (9), and of tapeti (*Sylvilagus brasiliensis*) into numerous species (10). Among those examples, the cottontails (*Sylvilagus*) are the only ones that had their conservation status reevaluated by the IUCN, leading to the recognition of a new threat scenario. The remaining taxa are all pending a (re)evaluation (PE). Note the drastic reduction in the geographic range of *L. colocola*, *C. prehensilis*, and most species of *Sylvilagus*.

steps. To reconcile the taxonomy and conservation, we suggest conservation organizations have a taxonomy committee that can update changes on species classification in a timely fashion. For example, IUCN Species Survival Commission groups play a key role in defining species priority which largely affects fund allocation. However, changes in taxonomy may take years to be recognized by IUCN, delaying appropriate implementation of actions. Surely, setting species limits is not an easier endeavor, and taxonomic dynamism due to distinct concepts and practices at play is sometimes a matter of debate between taxonomists. However, with the advance of analytical tools and the use of integrative methods to recognize species limits, new proposals tend to be based on multiple evidence and are better supported. It is therefore critical that taxonomy committees be formed by taxonomists and systematists that can properly incorporate new classification proposals. Most importantly, this can foster closer collaboration between taxonomists and conservationists.

Part of the challenges in conducting taxonomic studies of MLM is the limited material available, for both morphology and molecular analyses, and the logistics and bureaucracy to collect specimens. To help overcome these limitations, alternative ways to increase MLM museum specimens should be stimulated. For example, wildlife roadkill monitoring provides important information on species ecology (Schwartz et al. 2020), and can also supply valuable material (skin, osteological, DNA samples) for taxonomic studies. Similarly, specimens apprehended from illegal traffic can be preserved in museums. MLMs are one of the main groups affected by both roadkills and illegal traffic, but unfortunately, their specimen preservation remains an underutilized practice. Therefore, strengthening collaboration between museums, field biologists, and other government institutions (e.g., wildlife screening centers, environmental police, protected areas staff) can increase MLM material in scientific collections and foster their taxonomic studies.

Our review shows that most of the genera of MLM in the Neotropics lack comprehensive taxonomic studies. While we hope this piece will bring more attention to this group, we also recognize the challenges to conduct proper taxonomic revisions. Some of the recent studies took nearly a decade to be concluded (e.g., Nascimento and Feijó 2017, Menezes et al. 2021, Nascimento et al. 2021). On the other hand, habitat loss continues at a fast pace. Shifting our conservation policies from a species- to a population-level approach will allow us to prevent regional extinctions. Funding and stimulus for conservation programs should thus not be limited to those species with a high extinction risk but also target populations in high threatened habitats to avoid regional extinctions. Otherwise, by the time we understand the actual diversity some of the now unrecognized species might have already been lost.

Final considerations

The taxonomic impediment is a term claimed during the Convention on Biological Diversity (CBD) in Rio de Janeiro in 1992 as a recognition of i) taxonomic knowledge gaps, ii) insufficient numbers of trained taxonomists, and iii) lack of taxonomic infrastructure. Thirty years have passed since the CBD, and the scenario has not improved sufficiently on these three issues for most developing countries, as discussed by several authors (e.g., Paknia et al. 2015, Colleman and Radulovici 2020, Venera-Pontón et al. 2020, Raposo et al. 2021). Infrastructure in several scientific collections remains poor, taxonomic gaps are yet large, and students interested in taxonomy are becoming rare. Paradoxically, the need for experts in species identification, particularly taxonomists, might be as urgent as never before (Colleman and Radulovici 2020). Advances in taxonomic knowledge are needed not only for conservation issues, as discussed here, but it affects several other areas across biological disciplines. The information summarized here advocates the perspective that Neotropical MLM might be much more threatened than previously thought, indicating that this is certainly a conservation matter, but also a taxonomic issue that still needs much effort for the MLM, especially considering the current fast rate of change across the globe. We hope that we have provided enough evidence to challenge the misperception of MLM as a taxonomically well-resolved group and this will incite further studies.

ACKNOWLEDGEMENTS

We are grateful to Bruce D. Patterson, Ricardo Moratelli, and two anonymous reviewers for their comments on an earlier version of the manuscript. We also thank Fábio Nascimento, Guilherme Garbino, and José Serrano-Villavicencio for the previous discussion on the taxonomy of carnivores and primates.

AF was supported by the Second Tibetan Plateau Scientific Expedition and Research Program under Grants 2019QZKK0402 and 2019QZKK0501, and the Chinese Academy of Sciences President's International Fellowship Initiative under Grant number 2021PB0021; and MVB was supported by the Fundacão de Amparo a Pesquisa do Estado de São Paulo (FAPESP) under Grant number 2008/53522-6.

LITERATURE CITED

Abba AM, Cassini GH, Valverde G, Tilak M-K, Vizcaíno SF, Superina M, Delsuc F (2015) Systematics of hairy armadillos and the taxonomic status of the Andean hairy armadillo (*Chaetophractus nationi*). Journal of Mammalogy 96: 673–689. https://doi.org/10.1093/jmammal/gyv082

Asher RJ, Helgen KM (2010) Nomenclature and placental mammal phylogeny. BMC Evolutionary Biology 10: 102. https://doi.org/10.1186/1471-2148-10-102

Bininda-Emonds ORP, Cardillo M, Jones KE, MacPhee RDE, Beck RMD, Grenyer R, Price SA, Vos RA, Gittleman JL, Purvis A (2007) The delayed rise of present-day mammals. Nature 446: 507–512. https://doi.org/10.1038/nature05634

Bogoni JA, Peres CA, Ferraz KMPMB (2020) Effects of mammal defaunation on natural ecosystem services and human well being throughout the entire Neotropical realm. Ecosystem Services 45: 101173. https://doi.org/10.1016/j.ecoser.2020.101173

Bonvicino CR, Menezes AN, Lazar A, Penna-Firme V, Bueno C, Viana MC, D'Andrea PS, Langguth A (2015) Chromosomes and phylogeography of *Sylvilagus* (Mammalia, Leporidae) from eastern Brazil. Oecologia Australis 19: 158–172. https://doi.org/10.4257/oeco.2015.1901.10

Boubli JP, Byrnec H, Silva MNF, Silva-Júnior S, Costa-Araújo RC, Bertuol F, Gonçalves J, Melo FR, Rylands AB, Mittermeier RA, Silva FE, Nash SD, Canale G, Alencar RM, Rossi RV, Carneiro J, Sampaio I, Farias IP, Schneider H, Hrbeke T (2019) On a new species of titi monkey (Primates: *Plecturocebus* Byrne et al. 2016), from Alta Floresta, southern Amazon, Brazil. Molecular Phylogenetics Evolution 132: 117–137. https://doi.org/10.1016/j.ympev.2018.11.012

Brandão MV, Garbino GST, Semedo TBF, Feijó A, Nascimento FO, Fernandes-Ferreira H, Rossi RV, Dalponte JC, Carmignotto AP (2019) Mammals of Mato Grosso, Brazil: annotated species list and historical review. Mastozoología Neotropical 26: 263–307.

Burgin CJ, Colella JP, Kahn PL, Upham NS (2018) How many species of mammals are there? Journal of Mammalogy 99: 1–11. https://doi.org/10.1093/jmammal/gyx147

Byrne H, Rylands AB, Carneiro JC, Lynch-Alfaro JW, Bertuol F, Silva MNF, Messias M, Groves CP, Mittermeier RA, Farias I, Hrbek T, Schneider H, Sampaio I, Boubli JP (2016) Phylogenetic relationships of the New World titi monkeys (*Callicebus*): first appraisal of taxonomy based on molecular evidence. Frontiers in Zoology 13: 10. https://doi.org/10.1186/s12983-016-0142-4

Cardillo M, Mace GM, Jones KE, Bielby J, Bininda-Emonds ORP, Sechrest W, Orme CDL, Purvis A (2005) Multiple causes of high extinction risk in large mammal species. Science 309: 1239–1241. https://doi.org/10.1126/science.1116030

Ceballos G, Ehrlich PH, Dirzo R (2017) Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines. Proceedings of the National Academy of Sciences of the United States of America 114: E6089–E6096. https://doi.org/10.1073/pnas.1704949114

Ceballos G, Ehrlich PH, Raven PH (2020) Vertebrates on the brink as indicators of biological annihilation and the sixth mass extinction. Proceedings of the National Academy of Sciences of the United States of America 117: 13596–13602. https://doi.org/10.1073/pnas.1922686117

Cifuentes-Rincón A, Morales-Donoso JA, Sandoval EDP, Tomazella IM, Mantellatto AMB, Thoisy B, Duarte JMB (2020) Designation of a neotype for *Mazama americana* (Artiodactyla, Cervidae) reveals a cryptic new complex of brocket deer species. Zookeys 958: 143–164. https://doi.org/10.3897/zookeys.958.50300

Coleman CO, Radulovici AE (2020) Challenges for the future of taxonomy: talents, databases and knowledge growth. Megataxa 1: 28–34. https://doi.org/10.11646/MEGATAXA.1.1.5

Cooke RSC, Eigenbrod F, Bates AE (2019) Projected losses of global mammal and bird ecological strategies. Nature Communications 10: 2279. https://doi.org/10.1038/s41467-019-10284-z

Costa-Araújo R, Melo FR, Canale GR, Hernández-Rangel SM, Messias MR, Rossi RV, Silva FE, Silva MNF, Nash SD, Boubli JP, Farias IP, Hrbek T (2019) The Munduruku marmoset: a new monkey species from southern Amazonia. PeerJ 7: e7019. https://doi.org/10.7717/peerj.7019

Costa-Araújo R, Silva-Jr JS, Boubli JP, Rossi RV, Canale GR, Melo FR, Bertuol F, Silva FE, Silva DA, Nash SD, Sampaio I, Farias IP, Hrbek T (2021) An integrative analysis uncovers a new, pseudo-cryptic species of Amazonian marmoset (Primates: Callitrichidae: *Mico*) from the arc of deforestation. Scientific Reports 11: 15665. https://doi.org/10.1038/s41598-021-93943-w

Cozzuol MA, Clozato CL, Holanda EC, Rodrigues FHJG, Nienow S, Thoisy B, Redondo RAF, Santos FR (2013) A new species of tapir from the Amazon. Journal of Mammalogy 94: 1331–1345. https://doi.org/10.1644/12-MAMM-A-169.1

Cozzuol MA, Thoisy B, Fernandes-Ferreira H, Rodrigues FHG, Santos FR (2014) How much evidence is enough evidence for a new species? Journal of Mammalogy 95: 899–905. https://doi.org/10.1644/14-MAMM-A-182

Dayrat B (2005) Towards integrative taxonomy. Biological Journal of the Linnean Society 85: 407–415. https://doi.org/10.1111/j.1095-8312.2005.00503.x

Diersing VE, Wilson DE (2017) Systematic status of the rabbits *Sylvilagus brasiliensis* and *S. sanctaemartae* from northwestern South America with comparisons to Central American populations. Journal of Mammalogy 98: 1641–1656. https://doi.org/10.1093/jmammal/gyx133

Dirzo R, Young HS, Galetti M, Ceballos G, Isaac NJB, Collen B (2014) Defaunation in the Anthropocene. Science 345: 401–406. https://doi.org/10.1126/science.1251817

Duarte JMB, Gonzalez S, Maldonado J (2008) The surprising evolutionary history of South American deer. Molecular Phylogenetics and Evolution 49: 17–22. https://doi.org/10.1016/j.ympev.2008.07.009

Dunning JB, Groom MJ, Pulliam HR (2006) Species and landscape approaches to conservation. In: Groom MJ, Meffe GK, Carroll CR (Eds) Principles of Conservation Biology. Sinauer Associates, Sunderland, 419–466.

Durant P, Guevara MA (2001) A new rabbit species (*Sylvilagus*, Mammalia: Leporidae) from the lowlands of Venezuela. Revista de Biologia Tropical 49: 369–381.

Emmons LH, Feer F (1997) Neotropical rainforest mammals: a field guide. University of Chicago Press, Chicago, 2nd ed., 307 pp.

Fara E (2000) Diversity of Callovian-Ypresian (Middle Jurassic-Eocene) tetrapod families and selectivity of extinctions at the K/T boundary. Geobios 33: 387–396.

Feijó A, Langguth A (2013) Mamíferos de médio e grande porte do Nordeste do Brasil: distribuição e taxonomia, com descrição de novas espécies. Revista Nordestina de Biologia 22: 3–225.

Feijó A, Cordeiro-Estrela P (2016) Taxonomic revision of the *Dasypus kappleri* complex, with revalidations of *Dasypus pastasae* (Thomas, 1901) and *Dasypus beniensis* Lönnberg, 1942 (Cingulata, Dasypodidae). Zootaxa 4170: 271–297. https://doi.org/10.11646/zootaxa.4170.2.3

Feijó A, Patterson BD, Cordeiro-Estrela P (2018) Taxonomic revision of the long-nosed armadillos, Genus *Dasypus* Linnaeus, 1758 (Mammalia, Cingulata). PLoS ONE 13: e0195084. https://doi.org/10.1371/journal.pone.0195084

Feijó A, Vilela JF, Cheng J, Schetino MAA, Coimbra RTF, Bonvicino CR, Santos FR, Patterson BD, Cordeiro-Estrela P (2019) Phylogeny and molecular species delimitation of long-nosed armadillos (*Dasypus* Linnaeus, 1758) supports morphology-based taxonomy. Zoological Journal of the Linnean Society 186: 813–825. https://doi.org/10.1093/zoolinnean/zly091

Feijó A, Anacleto TC (2021) Taxonomic revision of the genus *Cabassous* McMurtrie, 1831 (Cingulata: Chlamyphoridae), with revalidation of *Cabassous squamicaudis* (Lund, 1845). Zootaxa 4974: 47–78. https://doi.org/10.11646/zootaxa.4974.1.2

Garbino GST (2015) Dening genera of New World monkeys: the need for a critical view in a necessarily arbitrary task. International Journal of Primatology 36: 1049–1064. https://doi.org/10.1007/s10764-015-9882-9.

Garbino GST, Martins-Júnior AMG (2018) Phenotypic evolution in marmoset and tamarin monkeys (Cebidae, Callitrichinae) and a revised genus-level classification. Molecular Phylogenetics and Evolution. 118: 156–171. https://doi.org/10.1016/j.ympev.2017.10.002

Gibb GC, Condamine FL, Kuch M, Enk J, Moraes-Barros N, Superina M, Poinar HN, Delsuc F (2016) Shotgun mitogenomics provides a reference phylogenetic framework and timescale for living xenarthrans. Molecular Phylogenetics Evolution 33: 621–642. https://doi.org/10.1093/molbev/msv250

González S, Duarte JMB (2020) Speciation, evolutionary history and conservation trends of neotropical deer. Mastozoologia Neotropical 27: 37–47.

Gusmão AC, Messias MR, Carneiro JC, Schneider H, Alencar TB, Calouro M, Dalponte JC, Mattos FS, Ferrari SF, Buss G, Azevedo RB, Santos Júnior EM, Nash S, Rylands A, Barnett A (2019) A new species of titi monkey, *Plecturocebus* Byrne et al. 2016 (Primates, Pitheciidae), from Southwestern Amazonia, Brazil. Primate Conservation 33: 21–35.

Gutiérrez EE, Helgen KM, McDonough MM, Bauer F, Hawkins MTR, Escobedo-Morales LA, Patterson BD, Maldonado JE (2017) A gene-tree test of the traditional taxonomy of American deer: the importance of voucher specimens, geographic data, and dense sampling. ZooKeys 697: 87–131. https://doi.org/10.3897/zookeys.697.15124

Gutierrez EE, Marinho-Filho J (2017) The mammalian faunas endemic to the Cerrado and the Caatinga. ZooKeys 644: 105–157. https://doi.org/10.3897/zookeys.644.10827

Hautier L, Billet G, Eastwood B, Lane J (2014) Patterns of morphological variation of extant sloth skulls and their implication for future conservation efforts. The Anatomial Record 297: 979–1008. https://doi.org/10.1002/ar.22916

Heckeberg NS, Erpenbeck D, Worheide G, Rossner GE (2016) Systematic relationships of five newly sequenced cervid species. PeerJ 4: e2307. https://doi.org/10.7717/peerj.2307

Heckeberg NS (2020) The systematics of the Cervidae: a total evidence approach. PeerJ 8: e8114. https://doi.org/10.7717/peerj.8114

Helgen KM, Maldonado JE, Wilson DE, Buckner SD (2008) Molecular confirmation of the origin and invasive status of west Indian raccoons. Journal of Mammalogy 89: 282–291. https://doi.org/10.1644/07-MAMM-A-155R.1

Helgen KM, Kays R, Helgen LE, Tsuchiya-Jerep MTN, Pinto CM, Koepfli KP, Eizirik E, Maldonado JE (2009) Taxonomic boundaries and geographic distributions revealed by an integrative systematic overview of the mountain coatis, *Nasuella* (Carnivora: Procyonidae). Small Carnivore Conservation 41: 65–74.

Helgen KM, Pinto CM, Kays R, Helgen LE, Tsuchiya MTN, Quinn A, Wilson DE, Maldonado JE (2013) Taxonomic revision of the olingos (*Bassaricyon*), with description of a new species, the Olinguito. Zookeys 324: 1–83. https://doi.org/10.3897/zookeys.324.5827

Horta J, Bello F, Diniz-Filho JAF, Lewinsohn TM, Lobo JM, Ladle RJ (2015) Seven shortfalls that beset large-scale knowledge of biodiversity. Annual Review of Ecology, Evolution, and Systematics 46: 523–549. https://doi.org/10.1146/annurev-ecolsys-112414-054400

Hrbek T, Da Silva VMF, Dutra N, Gravena W, Martin AR, Farias IP (2014) A new species of River Dolphin from Brazil or: how little do we know our biodiversity. PLoS ONE 9: e83623. https://doi.org/10.1371/journal.pone.0083623

ICMBIO (2018) Livro Vermelho da Fauna Brasileira Ameaçada de Extinção. Brasília, Instituto Chico Mendes de Conservação da Biodiversidade, Ministério do Meio Ambiente, vol. 2.

Isaac NJB, Mallet J, Mace GM (2004) Taxonomic inflation: its influence on macroecology and conservation. Trends in Ecology and Evolution 19: 464–469. https://doi.org/10.1016/j.tree.2004.06.004

IUCN (2021) The IUCN Red List of Threatened Species. Version 2021-2. https://www.iucnredlist.org [Accessed: 10/07/2021]

Kitchener AC, Breitenmoser-Würsten C, Eizirik E, Gentry A, Werdelin L, Wilting A, Yamaguchi N, Abramov AV, Christiansen P, Driscoll C, Duckworth JW, Johnson WE, Luo SJ, Meijaard E, O'Donoghue P, Sanderson J, Seymour K, Bruford

M, Groves C, Hoffmann M, Nowell K, Timmons Z, Tobe S (2017) A revised taxonomy of the Felidae: The final report of the Cat Classification Task Force of the IUCN Cat Specialist Group. Cat News Special Issue (11): 1–80. http://www.catsg.org/fileadmin/filesharing/5.Cat_News/5.3._Special_Issues/5.3.10._SI_11/CatNews%20Special%20Issue11%20revised%20taxonomy%20small.pdf

Louppe V, Baron J, Pons J-M, Veron G (2020) New insights on the geographical origins of the Caribbean raccoons. Journal of Zoological Systematics and Evolutionary Research 58: 1303–1322. https://doi.org/10.1111/jzs.12382

Lynch-Alfaro JW, Boubli JP, Olson LE, Di Fiore A, Wilson B, Gutiérrez-Espeleta GA, Chiou KL, Schulte M, Neitzel S, Ross V, Schwochow D, Nguyen MTT, Farias I, Janson CH, Alfaro ME (2012a) Explosive Pleistocene range expansion leads to widespread Amazonian sympatry between robust and gracile capuchin monkeys. Journal of Biogeography 39: 272–288. https://doi.org/10.1111/j.1365-2699.2011.02609.x

Lynch-Alfaro JW, Silva-Júnior JS, Rylands AB (2012b) How different are robust and gracile capuchin monkeys? An argument for the use of *Sapajus* and *Cebus*. American Journal of Primatology 74: 273–286. https://doi.org/10.1002/ajp.22007

Lynch-Alfaro JW, Izar P, Ferreira RG (2014) Capuchin monkey research priorities and urgent issues. American Journal of Primatology 76: 705–720. https://doi.org/10.1002/ajp.22269

Mace GM (2004) The role of taxonomy in species conservation. Philosophical Transactions B 359: 711–719. http://doi.org/10.1098/rstb.2003.1454

MDD (2022) Mammal Diversity Database (Version 1.9) [Data set]. American Society of Mammalogists, Zenodo. http://doi.org/10.5281/zenodo.4139818

Mantellatto AMB, González S, Duarte JMB (2022) Cytochrome b sequence of the *Mazama americana jucunda* Thomas, 1913 holotype reveals *Mazama bororo* Duarte, 1996 as its junior synonym. Genetics and Molecular Biology 45: e20210093. http://doi.org/10.1590/1678-4685-GMB-2021-0093

Marsh LK (2014) A taxonomic revision of the saki monkeys, *Pithecia* Desmarest, 1804. Neotropical Primates 21: 1–168. https://doi.org/10.1896/044.021.0101

McDonough MM, Ferguson AW, Dowler RC, Gompper ME, Maldonado JE (2022) Phylogenomic systematics of the spotted skunks (Carnivora, Mephitidae, *Spilogale*): Additional species diversity and Pleistocene climate change as a major driver of diversification. Molecular Phylogenetics and Evolution 167: 107266. https://doi.org/10.1016/j.ympev.2021.107266

McKinney ML (1997) Extinction vulnerability and selectivity: combining ecological and paleontological views. Annual Review of Ecology, Evolution, and Systematics 28: 495–516. https://doi.org/10.1146/annurev.ecolsys.28.1.495

Mendes Pontes AR, Gadelha JR, Melo ERA, Sá FB, Loss AC, Caldara V Jr, Costa LP, Leite YLR (2013) A new species of porcupine, genus *Coendou* (Rodentia: Erethizontidae) from the Atlantic Forest of northeastern Brazil. Zootaxa 3636: 421–438. https://doi.org/10.11646/zootaxa.3636.3.2

Menezes FH, Feijó A, Fernandes-Ferreira H, Costa IR, Cordeiro-Estrela P (2021) Integrative Systematics of Neotropical porcupines of *Coendou prehensilis* complex (Rodentia: Erethizontidae). Journal of Zoological Systematics and Evolutionary Research 59: 2410–2439. https://doi.org/10.1111/jzs.12529

Merritt JF (2010) The biology of small mammals. The Johns Hopkins University Press, Baltimore, Maryland, 313 pp.

Miranda FR, Casali DM, Perini FA, Machado FA, Santos FR (2018) Taxonomic review of the genus *Cyclopes* Gray, 1821 (Xenarthra: Pilosa), with the revalidation and description of new species. Zoological Journal of the Linnean Society 183: 687–721. https://doi.org/10.1093/zoolinnean/zlx079

Mora JM, Silva SM, López LI, Burnham-Curtis MK, Wostenberg DJ, French JH, Ruedas LA (2020) Systematics, distribution, and conservation status of Dice's cottontail, *Sylvilagus dicei* Harris, 1932 (Mammalia, Lagomorpha, Leporidae), in Central America. Systematics and Biodiversity 19: 74–88. https://doi.org/10.1080/14772000.2020.1827075

Myhrvold NP, Baldridge E, Chan B, Sivam D, Freeman DL, Ernest SKM (2015) An amniote life-history database to perform comparative analyses with birds, mammals, and reptiles. Ecology 96: 3109–3109. https://doi.org/10.1890/15-0846R.1

Nascimento FO, Feijó A (2017) Taxonomic revision of the tigrina *Leopardus tigrinus* (Schreber, 1775) species group (Carnivora, Felidae). Papéis Avulsos de Zoologia 57: 1–34. https://doi.org/10.11606/0031-1049.2017.57.19

Nascimento FO, Cheng J, Feijó A (2021) Taxonomic revision of the pampas cat *Leopardus colocola* complex (Carnivora: Felidae): an integrative approach. Zoological Journal of the Linnean Society 191: 575–611. https://doi.org/10.1093/zoolinnean/zlaa043

Nigenda-Moralesa SF, Gompperb ME, Valenzuela-Galvánc D, Layd AR, Kapheime KM, Hassf C, Booth-Binczik SD, Binczik GA, Hirsch BT, McColgin M, Koprowski JL, McFaddenl K, Wayne RK, Koepfli KP (2019) Phylogeographic and diversification patterns of the white-nosed coati (*Nasua narica*): Evidence for south-to-north colonization of North America. Molecular Phylogenetics and Evolution 131: 149–163. https://doi.org/10.1016/j.ympev.2018.11.011

Paknia O, Rajaei Sh H, Koch A (2015) Lack of well-maintained natural history collections and taxonomists in megadiverse developing countries hampers global biodiversity exploration. Organisms Diversity & Evolution 15: 619–629. https://doi.org/10.1007/s13127-015-0202-1

Patterson BD (2000) Patterns and trends in the discovery of new Neotropical mammals. Diversity & Distributions 6: 145–151. https://doi.org/10.1046/j.1472-4642.2000.00080.x

Patterson BD (2001) Fathoming tropical biodiversity: the continuing discovery of Neotropical mammals. Diversity &

Distributions 7:191–196. https://doi.org/10.1111/j.1472-4642.2001.00109.x

Peres PHF, Luduvério DJ, Bernegossi AM, Galindo DJ, Nascimento GB, Oliveira ML, Sandoval EDP, Vozdova M, Kubickova S, Cernohorska H, Duarte JMB (2021) Revalidation of *Mazama rufa* (Illiger 1815) (Artiodactyla: Cervidae) as a distinct species out of the complex *Mazama americana* (Erxleben 1777). Frontiers in Genetics 12: 742870. https://doi.org/10.3389/fgene.2021.742870

Quintela FM, Rosa CA, Feijó A (2020) Updated and annotated checklist of recent mammals from Brazil. Anais da Academia Brasileira de Ciências 92(Suppl. 2): e20191004. https://doi.org/10.1590/0001-3765202020191004

Raposo MA, Kirwan GM, Lourenço ACC, Sobral G, Bockmann FA, Stopiglia R (2021) On the notions of taxonomic 'impediment', 'gap', 'inflation' and 'anarchy', and their effects on the field of conservation. Systematics and Biodiversity 19: 296–311. https://doi.org/10.1080/14772000.2020.1829157

Reeder DM, Helgen KM, Wilson DE (2007) Global trends and biases in new mammal species discoveries. Occasional Papers, Museum of Texas Tech University 269: 1–36. https://doi.org/10.5962/bhl.title.156951

Ripple WJ, Abernethy K, Betts MG, Chapron G, Dirzo R, Galetti M, Levi T, Lindsey PA, Macdonald DW, Machovina B, Newsome TM, Peres CA, Wallach AD, Wolf C, Young H (2016) Bushmeat hunting and extinction risk to the world's mammals. Royal Society Open Science 3: 160498. https://doi.org/10.1098/rsos.160498

Ripple WJ, Wolf C, Newsome TM, Hoffmann M, Wirsing AJ, McCauley DJ (2017) Extinction risk is most acute for the world's largest and smallest vertebrates. Proceedings of the National Academy of Sciences of the United States of America 114: 10678–10683. https://doi.org/10.1073/pnas.1702078114

Robertson DS, McKenna MC, Toon OB, Hope S, Lillegraven JA (2004) Survival in the first hours of the Cenozoic. Bulletin of the Geological Society of America 116: 760–768. https://doi.org/10.1130/B25402.1

Ruedas LA (2017) A new species of cottontail rabbit (Lagomorpha: Leporidae: *Sylvilagus*) from Suriname, with comments on the taxonomy of allied taxa from northern South America. Journal of Mammalogy 98: 1042–1059. https://doi.org/10.1093/jmammal/gyx048

Ruedas LA, Silva SM, French JH, Platt II RN, Salazar-Bravo J, Mora JM, Thompson CW (2017) A prolegomenon to the systematics of South American cottontail rabbits (Mammalia, Lagomorpha, Leporidae: *Sylvilagus*): designation of a neotype for *S. brasiliensis* (Linnaeus, 1758), and restoration of *S. andinus* (Thomas, 1897) and *S. tapetillus* Thomas, 1913. Miscellaneous Publications Museum of Zoology University Michigan 205: 1–67.

Ruedas LA, Silva SM, French JH, Platt II RN, Salazar-Bravo J, Mora JM, Thompson CW (2019) Taxonomy of the *Sylvilagus brasiliensis* complex in Central and South America (Lagomorpha: Leporidae). Journal of Mammalogy 100: 1599–1630. https://doi.org/10.1093/jmammal/gyz126

Ruiz-García M, Chacón D, Plese T, Shostell JM (2020a) Molecular phylogenetics of *Bradypus* (Three-Toed Sloth, Pilosa: Bradypodidae, Mammalia) and phylogeography of *Bradypus variegatus* (Brown-Throated Three-Toed Sloth) with mitochondrial gene sequences. Journal of Mammalian Evolution 27: 461–482. https://doi.org/10.1007/s10914-019-09465-w

Ruiz-García M, Jaramillo M, Cáceres-Martínez CH, Shostell J (2020b) The Phylogeographic structure of the mountain coati (*Nasuella olivacea*; Procyonidae, Carnivora), and phylogenetic relationships with the other coati species (*Nasua nasua* and *Nasua narica*) by means of mitochondrial DNA. Mammalian Biology 100: 521–548. https://doi.org/10.1007/s42991-020-00050-w

Ruiz-García M, Cáceres AM, Luengas-Villamil K, Aliaga-Rossel E, Zeballos H, Singh MD, Shostell JM (2022) Mitogenomic phylogenetics and population genetics of several taxa of agouties (*Dasyprocta* sp., Dasyproctidae, Rodentia): molecular nonexistence of some claimed endemic taxa. Mammal Research 67: 367–397. https://doi.org/10.1007/s13364-022-00626-6

Rylands AB, Heymann EW, Alfaro JL, Buckner JC, Roos C, Matauschek C, Boubli JP, Sampaio R, Mittermeier RA (2016) Taxonomic review of the New World tamarins (Primates: Callitrichidae). Zoological Journal of the Linnean Society 177: 1003–1028. https://doi.org/10.1111/zoj.12386

Schiaffini MI, Gabrielli M, Prevosti FJ, Cardoso YP, Castillo D, Bo R, Casanave E, Lizarralde M (2013) Taxonomic status of southern South American *Conepatus* (Carnivora: Mephitidae). Zoological Journal of the Linnean Society 167: 327–344. https://doi.org/10.1111/zoj.12006

Schwartz ALW, Shilling FM, Perkins SE (2020) The value of monitoring wildlife roadkill. European Journal of Wildlife Research 66: 18–30. https://doi.org/10.1007/s10344-019-1357-4

Serrano-Villavicencio JE, Hurtado CM, Vendramel RL, Nascimento FO (2019) Reconsidering the taxonomy of the *Pithecia irrorata* species group (Primates: Pitheciidae). Journal of Mammalogy 100: 130–141. https://doi.org/10.1093/jmammal/gyy167

Silva SM, Ruedas LA, Santos LH, Silva JS Jr, Aleixo A (2019) Illuminating the obscured phylogenetic radiation of South American *Sylvilagus* Gray, 1867 (Lagomorpha: Leporidae). Journal of Mammalogy 100: 31–44. https://doi.org/10.1093/jmammal/gyy186

Teta P, Díaz-Nieto JF (2019) How integrative taxonomy can save a species from extinction: The supposedly extinct mouse opossum *Cryptonanus ignitus* (Diaz, Flores and Barquez, 2000) is a synonym of the living *C. chacoensis* (Tate, 1931). Mammalian Biology 96: 73–80.

Trigo TC, Schneider A, Oliveira TG, Lehugeur LM, Silveira L, Freitas TRO, Eizirik E (2013) Molecular data reveal complex hybridization and a cryptic species of Neotropical wild cat. Current Biology 23: 2528–2533. https://doi.org/10.1016/j.cub.2013.10.046

Trindade FJ, Rodrigues MR, Figueiró HV, Li G, Murphy WJ, Eizirik E (2021) Genome-wide SNPs clarify a complex radiation and support recognition of an additioncal cat species. Molecular Biology and Evolution 38: 4987-4991. https://doi.org/10.1093/molbev/msab222

Upham N, Patterson BD (2015) Evolution of the caviomorph rodents: a complete phylogeny and timetree of living genera. In: Vassallo AI, Antenucci D (Eds) Biology of caviomorph rodents: diversity and evolution. SAREM, Buenos Aires, Series A, 63–120.

Venera-Pontón DE, Driskell AC, De Grave S, Felder DL, Scioli JA, Collin R (2020) Documenting decapod biodiversity in the Caribbean from DNA barcodes generated during field training in taxonomy. Biodiversity Data Journal 8: e47333. https://doi.org/10.3897/BDJ.8.e47333

Voss RS (2011) Revisionary notes on Neotropical porcupines (Rodentia: Erethizontidae) 3. An annotated checklist of the species of *Coendou* Lacépède, 1799. American Museum Novitates 3720: 1–36. https://doi.org/10.1206/3720.2

Voss RS, da Silva MNF (2001) Revisionary notes on Neotropical porcupines (Rodentia: Erethizontidae). 2. A review of the *Coendou vestitus* group with descriptions of two new species from Amazonia. American Museum Novitates 3351: 1–36. https://doi.org/10.1206/0003-0082(2001)351<0001:RNONPR>2.0.CO;2

Voss RS, Hubbard C, Jansa SA (2013) Phylogenetic relationships of New World porcupines (Rodentia, Erethizontidae): Implications for taxonomy, morphological evolution, and biogeography. American Museum Novitates 3769: 1–36. https://doi.org/10.1206/3769.2

Voss RS, Helgen KM, Jansa SA (2014) Extraordinary claims require extraordinary evidence, a comment on Cozzuol et al. (2013). Journal of Mammalogy 95: 893–898. https://doi.org/10.1644/14-MAMM-A-054

Voss RS, Fleck DW (2017) Mammalian diversity and Matses ethnomammalogy in Amazonian Peru. Part 2, Xenarthra, Carnivora, Perissodactyla, Artiodactyla, and Sirenia. Bulletin of the American Museum of Natural History 417: 1–118. https://doi.org/10.1206/00030090-417.1.1

Wilson DE, Reeder DM (1993) Mammal species of the world: a taxonomic and geographic reference. Smithsonian Institution Press, Washington, D.C., 2nd ed., 1206 pp.

Wilson DE, Reeder DM (2005) Mammal species of the world: a taxonomic and geographic reference. Johns Hopkins University Press, Bucknell University, Baltimore, 3rd ed., 2142 pp.

Wilson GP (2013) Mammals across the K/Pg boundary in northeastern Montana, U.S.A.: dental morphology and body-size patterns reveal extinction selectivity and immigrant-fueled ecospace filling. Paleobiology 39: 429–469. https://doi.org/10.1666/12041

Submitted: February 7, 2022
Accepted: April 20, 2022
Editorial responsibility: Ricardo Moratelli

Author Contributions
The authors contribute equally to this work.

Competing Interests
The authors have declared that no competing interests exist.

How to cite this article
Feijó A, Brandão MV (2022) Taxonomy as the first step towards conservation: an appraisal on the taxonomy of medium- and large-sized Neotropical mammals in the 21st century. Zoologia (Curitiba) 39: e22007. https://doi.org/10.1590/S1984-4689.v39.e22007

Published by
Sociedade Brasileira de Zoologia at Scientific Electronic Library Online (https://www.scielo.br/zool)

Supplementary material 1
Table S1. References for the publications listed in Table 1.
Authors: Anderson Feijó, Marcus V. Brandão.
Data type: Bibliographic references.
Copyright notice: This dataset is made available under the Open Database License (http://opendatacommons.org/licenses/odbl/1.0/). The Open Database License (ODbL) is a license agreement intended to allow users to freely share, modify, and use this Dataset while maintaining this same freedom for others, provided that the original source and author(s) are credited.
Link: https://doi.org/10.1590/S1984-4689.v39.e22007