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Mammals — 2000–2017

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Mammalogists currently recognize nearly 6,400 species of Recent mammals worldwide and the number of new species being recognized has increased dramatically in recent decades. It is estimated that perhaps as many as 7,500 species might occur when additional studies are completed. This increase in the number of mammal species known is a result of exciting new discoveries in the field, as well as additional study of scientific specimens housed in museums. Using new techniques, including genetic data, as well as traditional morphological studies, scientists are undertaking taxonomic revisions that significantly increase our understanding of the diversity of mammals and the relationships among species.

We are fortunate that a number of biologists have worked at Monteverde beginning in the 1960s and considerable information and voucher material are available for study. We now know that at least 90 of mammals occur in the greater Monteverde area. However, one of the outcomes of these studies is that a number of name changes are proposed each year. These better reflect relationships between species; however, a bewildering array of new names often makes it difficult to understand what is happening when authors refer to an animal for which more than one scientific name exists, sometimes surrounded by controversy. A scientific name associated with a species is a hypothesis. Eventually, usage of these new

names in scientific publications will lead to their acceptance (or refinement, in some cases). Meanwhile, it is up to researchers to make the sometimes difficult decisions as to whether to use the new names in our publications. Herein, our decisions are based on the current literature, our experience with these species both in the field and in study of museum specimens, and the best information currently available to us. Many of the name changes we provide below to the list of mammals of Monteverde appear in specialized systematic revisions; to assist researchers interested in Monteverde mammals, we provide the new name as well as a footnote to the older name.

At present, only one species of mammal, a newly described small-eared shrew, is apparently endemic to Monteverde. A single specimen of shrew found in the Reserve in 1973 was described recently as *Cryptotis monteverdensis*; extensive efforts to obtain additional specimens have proven futile to date (Woodman and Timm 2017). A species of harvest mouse of the genus *Reithrodontomys* found in the cloud forest also represents an undescribed species (see below). Additionally, intriguing observations suggest that one or more unrecognized species of rodents might be found in the cloud forest (LaVal, pers. obs.).

Researchers who wish to make comparisons between regions, habitats, or elevations should use this English version or the Spanish updated version (LaVal and Timm 2014; Apéndice 11) of our species lists of Monteverde mammals because a significant number of changes have been made since 2000. These changes are due in part to a more refined understanding of distributions and systematic relationships of the mammals, but also to improved ability to detect species and distributional changes due to climatic change. Because six life zones are represented in the updated species lists,

comparisons should be made for each zone and not the entire list as representative of Monteverde. Comparisons are best made with specific habitats (life zones) within the greater Monteverde area.

LaVal's (in press) extensive use of Anabat detection systems has added a number of species of bats new to the various life zones that were not detected via standard mist nets. This has been especially true for the emballonurid and molossid bats.

Life zones are generally agreed to be biologically defined areas in which there is notable similarity between the flora and fauna throughout the zone. These are often defined by the species of birds and plants that occur there because these are easily observed and that has been especially true at Monteverde. On mountain slopes, upper and lower elevational limits can help to define the zones, but it is generally agreed now that any boundaries between two adjacent zones are poorly defined and flexible over time. When climate change leads to warmer (or cooler or drier) conditions, these elevational limits may move up or down the mountain as organisms attempt to remain within the temperature and humidity limits to which they are adapted. Thus, a bat for example originally restricted to Zone 1 in Monteverde, might move up to Zone 2 under warming conditions (see LaVal 2004). In our 2000 list of distributions of mammals in the Monteverde region, we listed southern cotton rats as rare in zones 1 and 2. Today, cotton rats are abundant in those zones in disturbed habitats. The rain shadow on the Pacific slope, heavily disturbed grassy areas, and climate change have seemingly created abundant habitat for this grassland species at Monteverde as well as elsewhere on Costa Rica's Pacific slopes. At Monteverde, plants and birds were originally used to define the life zones, whereas most species of mammals were distributed across two or

more life zones (see Timm and LaVal 2000a, b, c).

Owing to our ever-increasing knowledge of Monteverde mammals and the long-term work that has been done there, interesting changes in distributional and ecological patterns are being discovered. Distributions of mammals across the elevational zones clearly are changing. LaVal documented that vampire bats moved up into the Monteverde area in the 1990s and cotton rats moved up and became abundant in the past decade. LaVal noted that cotton rats first started appearing in zone 2 in the early 2000s, whereas they were previously known only from zone 1. An intriguing example of a truly sympatric distribution is the discovery of the two species of mouse opossums—*Marmosa mexicana* and *M. zeledoni*—in LaVal's home. The observations were made years apart so the two similarly appearing species may not be temporally sympatric, but the dry forest species (*M. mexicana*) and the wet forest species (*M. zeledoni*) are now documented from a single residence in Monteverde. Three similarly-sized species of small-eared shrews are known from the Reserve with *Cryptotis nigrescens* widespread and common throughout the area, whereas *C. merriami* and *C. monteverdensis* are known only in the reserve and are both rare. Considerable differences in the forearm bones of the three similarly-appearing shrews were documented by Woodman and Timm (2017), and they speculated that the differences reflected more ambulatory above ground versus more semi-fossorial foraging.

This chapter was undertaken along with two companion chapters (apéndices 10, 11) to update the research and findings in the field of mammalogy that have taken place since the publication of the Monteverde

book in 2000. The first in this series, Apéndice 10 (Timm and LaVal 2014), is a Spanish translation of the original Appendix 10 from the Monteverde book. The second (LaVal and Timm 2014) is a Spanish updated version of that original listing of Monteverde mammals and their distributions and abundance. Herein, we update the distributions of mammals in the six life zones represented in the greater Monteverde region, add species newly discovered in the region, and provide literature updates. In these updated versions, we provide brief comments explaining taxonomic changes that have occurred since the original listing was published in 2000 provided as footnotes to the original appendix. In the References below, we include the 25 publications that have appeared based on the study of mammals at Monteverde since our 2000 overview, as well as references that we cite in preparation of these updated versions.

Keys to the bats of Costa Rica based extensively on our experience at Monteverde were provided in English (Timm and LaVal 1998) and Spanish (Timm et al. 1999). A very useful and beautifully illustrated key to the rodents of Costa Rica was provided by Villalobos-Chaves et al. (2016).

On a positive note, two factors favor a bright future for Monteverde mammals: 1) An immense area of contiguous pristine habitat and regenerating forest, around 50,000 hectares, has been preserved and is relatively well-protected in the Monteverde area; 2) Most, although not all, Monteverde mammals have distributional and ecological ranges that cover several life zones and thus are less threatened by climate change than many birds and herps that may be restricted to one or two life zones.

Table 1. Mammal distributions and abundances in the Monteverde region—2017.

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Scientific Name	Common Name	Abundance ¹	Life Zone ²
Didelphimorpha	Marsupials		
Didelphidae	American Opossums		
<i>Caluromys derbianus</i>	Woolly Opossum	uncommon	1, 2, 3
<i>Chironectes minimus</i>	Water Opossum	uncertain	1
<i>Didelphis marsupialis</i>	Common Opossum	abundant	1, 2, 3, 4, 5, 6
<i>Marmosa mexicana</i>	Mexican Mouse Opossum	uncommon	1
<i>Marmosa zeledoni</i>	Mouse Opossum	common	2, 3, 5, 6
<i>Metachirus nudicaudatus</i>	Brown Four-eyed Opossum	rare	6
<i>Micoureus alstoni</i>	Alston's Opossum	uncommon	2, 3, 6
<i>Philander opossum</i>	Gray Four-eyed Opossum	uncommon	1, 2, 3, 5, 6
Eulipotyphla	Shrews		
Soricidae	Shrews		
<i>Cryptotis merriami</i>	Merriam's Small-eared Shrew	rare	3
<i>Cryptotis nigrescens</i>	Blackish Small-eared Shrew	common	2, 3, 4, 5, 6
<i>Cryptotis monteverdensis</i> ³	Monteverde Small-eared Shrew	rare	3
Chiroptera	Bats		
Emballonuridae	Sac-winged Bats		
<i>Balantiopteryx plicata</i>	Gray Sac-winged Bat	uncommon	1, 2
<i>Cormura brevirostris</i>	Wagner's Sac-winged Bat	rare	6

<i>Cyttarops alecto</i>	Short-eared Bat	rare	3
<i>Diclidurus albus</i>	Northern Ghost Bat	rare	2, 4, 6
<i>Peropteryx kappleri</i>	Greater Dog-like Bat	uncommon	2, 6
<i>Peropteryx macrotis</i>	Lesser Dog-like Bat	rare	2
<i>Rhynchonycteris naso</i>	Proboscis Bat	rare	2
<i>Saccopteryx bilineata</i>	Greater White-lined Bat	common	1, 6
Mormoopidae	Mustached Bats		
<i>Pteronotus davyi</i>	Lesser Naked-backed Bat	uncommon	2, 5
<i>Pteronotus gymnonotus</i>	Big Naked-backed Bat	uncommon	1, 2, 3, 4, 5, 6
<i>Pteronotus mesoamericanus</i> ⁴	Mesoamerican Mustached Bat	uncommon	1, 2, 3, 4, 5, 6
<i>Pteronotus personatus</i>	Lesser Mustached Bat	uncommon	5
Phyllostomidae	American Leaf-nosed Bats		
Phyllostominae	Gleaning Bats		
<i>Glyphonycteris sylvestris</i>	Tri-colored Big-eared Bat	rare	2
<i>Lonchorhina aurita</i>	Sword-nosed Bat	uncommon	5, 6
<i>Lophostoma brasiliense</i>	Pigmy Round-eared Bat	rare	1, 6
<i>Micronycteris hirsuta</i>	Hairy Big-eared Bat	rare	2, 6
<i>Micronycteris microtis</i>	Little Big-eared Bat	uncommon	1, 2, 3, 4, 6
<i>Micronycteris minuta</i>	Tiny Big-eared Bat	rare	6
<i>Micronycteris schmidtorum</i>	Schmidt's Big-eared Bat	uncertain	5, 6
<i>Mimon cozumelae</i>	Cozumel Spear-nosed Bat	rare	2
<i>Phylloderma stenops</i>	Northern Spear-nosed Bat	rare	6
<i>Phyllostomus discolor</i>	Pale Spear-nosed Bat	common	1, 2
<i>Phyllostomus hastatus</i>	Greater Spear-nosed Bat	rare	5, 6
<i>Tonatia saurophila</i>	Stripe-headed Bat	rare	6

<i>Trachops cirrhosus</i>	Frog-eating Bat	uncommon	1, 2, 3, 4, 5, 6,
<i>Vampyrum spectrum</i>	False Vampire Bat	rare	1, 2, 3, 4, 6
Glossophaginae	Pollen- and Nectar-feeding Bats		
<i>Anoura cultrata</i>	Handley's Tailless Bat	uncommon	2, 3, 4, 5, 6
<i>Anoura geoffroyi</i>	Geoffroy's Tailless Bat	common	1, 2, 3, 4, 5, 6
<i>Choeroniscus godmani</i>	Godman's Long-nosed Bat	rare	1, 2, 3, 4
<i>Glossophaga commissarisi</i>	Commissaris' Long-tongued Bat	common	1, 2, 3, 4
<i>Glossophaga soricina</i>	Pallas' Long-tongued Bat	common	1, 2, 3, 6
<i>Hylonycteris underwoodi</i>	Underwood's Long-tongued Bat	common	2, 3, 4, 5
Lonchophyllinae	Long-tongued Bats		
<i>Lonchophylla robusta</i>	Panama Long-tongued Bat	rare	2, 3, 4, 5, 6
Carollinae	Short-tailed Bats		
<i>Carollia castanea</i>	Allen's Short-tailed Bat	uncommon	1, 2, 5, 6
<i>Carollia perspicillata</i>	Short-tailed Fruit Bat	uncommon	1, 2, 3, 5, 6
<i>Carollia sowelli</i> ⁵	Silky Short-tailed Bat	common	1, 2, 3, 4, 5, 6
<i>Carollia subrufa</i>	Gray Short-tailed Bat	rare	1
Stenoderminae	Fruit-eating Bats		
<i>Artibeus intermedius</i>	Davis' Fruit Bat	uncommon	1, 2
<i>Artibeus jamaicensis</i>	Jamaican Fruit Bat	common	1, 2, 3, 4, 5, 6
<i>Artibeus lituratus</i>	Big Fruit Bat	common	1, 2, 3, 4, 6
<i>Dermanura azteca</i>	Highland Fruit-eating Bat	rare	2, 6
<i>Dermanura phaeota</i>	Pygmy Fruit-eating Bat	uncommon	4, 5, 6
<i>Dermanura tolteca</i>	Toltec Fruit-eating Bat	abundant	1, 2, 3, 4, 5, 6
<i>Dermanura watsoni</i>	Thomas' Fruit-eating Bat	uncommon	2, 4, 6
<i>Centurio senex</i>	Wrinkle-faced Bat	rare	1, 2, 3

<i>Chiroderma salvini</i>	Salvin's White-lined Bat	rare	2
<i>Chiroderma villosum</i>	Shaggy-haired Bat	rare	2
<i>Ectophylla alba</i>	Caribbean White Bat	rare	6
<i>Enchisthenes hartii</i>	Velvety Fruit-eating Bat	rare	1, 2, 3, 4
<i>Platyrrhinus helleri</i>	Heller's Broad-nosed Bat	uncommon	1, 2, 5
<i>Platyrrhinus vittatus</i>	Greater Broad-nosed Bat	common	1, 2, 3, 4, 5, 6
<i>Sturnira hondurensis</i> ⁶	Highland Yellow-shouldered Bat	abundant	1, 2, 3, 4, 5, 6
<i>Sturnira mordax</i>	Talamancan Bat	uncommon	2, 3, 4, 5, 6
<i>Sturnira parvidens</i> ⁷	Little Yellow-shouldered Bat	uncommon	1, 2
<i>Vampyressa thyone</i>	Little Yellow-eared Bat	rare	2, 3, 5, 6
<i>Vampyrodes major</i>	Great Stripe-faced Bat	rare	2, 5
Desmodontinae	Vampire Bats		
<i>Desmodus rotundus</i>	Common Vampire Bat	uncommon	1, 2, 3, 5, 6
<i>Diphylla ecaudata</i>	Hairy-legged Vampire Bat	rare	2
Natalidae	Funnel-eared Bats		
<i>Natalus lanatus</i> ⁸	Highland Funnel-eared Bat	rare	2
Thyropteridae	Disk-winged Bats		
<i>Thyroptera tricolor</i>	Spix's Disk-winged Bat	common	2, 3, 4, 6
Vespertilionidae	Vespertilionid Bats		
<i>Bauerus dubiaquercus</i>	Doubtful Oak Bat	rare	2, 3, 5
<i>Dasypterus ega</i>	Southern Yellow Bat	common	2, 4, 6
<i>Dasypterus intermedius</i>	Northern Yellow Bat	rare	2, 6
<i>Eptesicus brasiliensis</i>	Brazilian brown Bat	common	2, 3, 4, 5, 6
<i>Eptesicus furinalis</i>	Argentine Brown Bat	uncommon	1, 6
<i>Eptesicus fuscus</i>	Big Brown Bat	uncommon	2, 3, 4

<i>Lasiurus castaneus</i>	Tacarcuna Bat	rare	4, 5
<i>Lasiurus frantzii</i>	Central American Red Bat	common	2, 3, 4, 5, 6
<i>Myotis albescens</i>	Silver-haired Myotis	uncommon	6
<i>Myotis elegans</i>	Elegant Myotis	uncommon	6
<i>Myotis nigricans</i>	Black Myotis	common	1, 2, 3, 4, 6
<i>Myotis oxyotus</i>	Montane Myotis	uncommon	2, 3, 4
<i>Myotis pilosatibialis</i> ⁹	Hairy-legged Myotis	abundant	1, 2, 3, 4, 5, 6
<i>Myotis riparius</i>	Riparian Myotis	uncommon	1, 2, 6
<i>Rhogeessa io</i> ¹⁰	Rainforest Yellow Bat	uncommon	6
Molossidae	Free-tailed Bats		
<i>Eumops auripendulus</i>	Shaw's Mastiff Bat	uncommon	1, 2, 4, 6
<i>Molossus molossus</i>	Little Mastiff Bat	common	1, 2, 6
<i>Molossus rufus</i>	Black Mastiff Bat	uncommon	1, 2, 5
<i>Molossus sinaloae</i>	Sinaloan Mastiff Bat	common	1, 2, 6
<i>Nyctinomops laticaudatus</i>	Broad-eared Bat	uncertain	2
<i>Promops centralis</i>	Big Crested Mastiff Bat	rare	2, 6
<i>Tadarida brasiliensis</i>	Brazilian Free-tailed Bat	uncommon	1, 2, 6

Primates**Primates**

Atelidae	Howler and Spider Monkeys		
<i>Alouatta palliata</i>	Mantled Howler Monkey	common	1, 2, 3, 4, 5, 6
<i>Ateles geoffroyi</i>	Black-handed Spider Monkey	uncommon	2, 3, 4, 5, 6
Cebidae	Capuchin Monkeys		
<i>Cebus capucinus</i> ¹¹	White-faced Capuchin	common	1, 2, 3, 4, 5

Cingulata	Armadillos		
Dasypodidae	Armadillos		
<i>Cabassous centralis</i>	Northern Naked-tailed Armadillo	rare	2, 3, 4, 6
<i>Dasyus novemcinctus</i>	Nine-banded Armadillo	abundant	1, 2, 3, 4, 5, 6
Pilosa	Anteaters and Sloths		
Bradypodidae	Three-toed Sloths		
<i>Bradypus variegatus</i>	Brown-throated Three-toed Sloth	rare	1
Megalonychidae	Two-toed Sloths		
<i>Choloepus hoffmanni</i>	Hoffmann's Two-toed Sloth	common	1, 2, 3, 4, 5, 6
Cylopedidae	Silky Anteater		
<i>Cyclopes didactylus</i>	Silky Anteater	uncertain	2, 6
Myrmecophagidae	Anteaters		
<i>Myrmecophaga tridactyla</i>	Giant Anteater	originally here, but now extirpated	1
<i>Tamandua mexicana</i>	Northern Tamandua	uncommon	1, 2, 3, 5, 6
Lagomorpha	Rabbits		
Leporidae	Rabbits and Hares		
<i>Sylvilagus floridanus</i>	Cottontail Rabbit	uncommon	1, 2, 3
<i>Sylvilagus gabbi</i> ¹²	Forest Rabbit	rare	2, 3
Rodentia	Rodents		
Geomyidae	Pocket Gophers		
<i>Orthogeomys cherriei</i>	Cherrie's Pocket Gopher	common	2, 3, 6
Sciuridae	Squirrels		

<i>Microsciurus alfari</i>	Alfaro's Pygmy Squirrel	common	2, 3, 4, 5, 6
<i>Sciurus granatensis</i>	Neotropical Red Squirrel	common	1, 2, 3, 4, 5, 6
<i>Sciurus variegatoides</i>	Variiegated Squirrel	abundant	1, 2, 3, 6
Heteromyidae	Pocket Mice		
<i>Heteromys desmarestianus</i>	Desmarest's Spiny Pocket Mouse	common	5, 6
<i>Heteromys nubicolens</i> ¹³	Cloud-dwelling Spiny Pocket Mouse	common	1, 2, 3, 4
Cricetidae	Long-tailed Rats and Mice		
<i>Handleyomys alfaro</i>	Alfaro's Rice Rat	uncommon	2, 3, 5
<i>Melanomys chrysomelas</i> ¹⁴	Dusky Rice Rat	uncommon	5, 6
<i>Nephelomys devius</i> ¹⁵	Tome's Rice Rat	common	2, 3, 4, 5
<i>Nyctomys sumichrasti</i>	Sumichrast's Vesper Rat	uncommon	1, 2, 3, 5, 6
<i>Oligoryzomys fulvescens</i>	Pygmy Rice Mouse	rare	2, 3, 5
<i>Oligoryzomys vegetus</i>	Pygmy Rice Mouse	rare	2, 3, 4
<i>Otodylomys phyllotis</i>	Big-eared Climbing Rat	rare	1, 2
<i>Peromyscus nudipes</i> ¹⁶	Naked-footed Mouse	abundant	1, 2, 3, 4, 5
<i>Reithrodontomys brevirostris</i>	Chiriquí Harvest Mouse	common	1, 2, 3, 4, 5, 6
<i>Reithrodontomys creper</i>	Chiriquí Harvest Mouse	uncommon	4
<i>Reithrodontomys sp.</i> ¹⁷	Harvest Mouse	rare	4
<i>Rheomys raptor</i>	Goldman's Water Mouse	rare	3, 4, 5
<i>Scotinomys teguina</i>	Alston's Brown Mouse	common	2, 3, 4, 5, 6
<i>Sigmodon hirsutus</i>	Southern Cotton Rat	common	1, 2
<i>Transandinomys bolivar</i> ¹⁸	Long-whiskered Rice Rat	rare	6
<i>Tanyuromys aphrastus</i> ¹⁹	Long-tailed Montane Rat	rare	4, 5
<i>Tylomys watsoni</i>	Watson's Climbing Rat	common	2, 3, 4, 5, 6

Erethizontidae	Porcupines		
<i>Coendou mexicanus</i>	Prehensile-tailed Porcupine	common	1, 2, 3, 4, 5, 6
Cuniculidae	Pacas		
<i>Cuniculus paca</i>	Paca	uncommon	1, 2, 3, 4, 5, 6
Dasyproctidae	Agoutis		
<i>Dasyprocta punctata</i>	Agouti	common	1, 2, 3, 4, 5, 6
Carnivora	Carnivores		
Canidae	Coyotes, Foxes, and Dogs		
<i>Canis latrans</i>	Coyote	uncommon	1, 2
<i>Urocyon cinereoargenteus</i>	Gray Fox	common	1, 2, 3, 5
Mephitidae	Skunks		
<i>Conepatus semistriatus</i>	Striped Hog-nosed Skunk	uncommon	1, 2, 3, 4, 6
<i>Spilogale angustifrons</i>	Southern Spotted Skunk	rare	2
Mustelidae	Weasels and Otters		
<i>Eira barbara</i>	Tayra	common	1, 2, 3, 4, 5
<i>Galictis vittata</i>	Grison	rare	2, 3, 5, 6
<i>Lontra longicaudis</i>	Southern River Otter	rare	1, 2, 3, 4, 5, 6
<i>Mustela frenata</i>	Long-tailed Weasel	uncommon	1, 2, 3, 4, 5, 6
Procyonidae	Raccoons and allies		
<i>Bassaricyon gabbii</i>	Olingo	common	1, 2, 3, 5, 6
<i>Bassariscus sumichrasti</i>	Central American Cacomistle	uncertain	3
<i>Nasua narica</i>	White-nosed Coati	abundant	1, 2, 3, 4, 5, 6
<i>Potos flavus</i>	Kinkajou	common	1, 2, 3, 4, 5, 6
<i>Procyon lotor</i>	Raccoon	common	1, 2, 3, 5, 6

Felidae	Cats		
<i>Leopardus pardalis</i>	Ocelot	uncommon	1, 2, 3, 4, 5, 6
<i>Leopardus tigrinus</i>	Little Spotted Cat	uncertain	1, 3, 4, 6
<i>Leopardus wiedii</i>	Margay	uncommon	2, 3, 4, 5, 6
<i>Panthera onca</i>	Jaguar	rare	3, 4, 5, 6
<i>Puma concolor</i>	Puma, Mountain Lion, Cougar	uncommon	1, 2, 3, 4, 5, 6
<i>Puma yagouaroundi</i>	Jaguarundi	uncommon	1, 2, 3, 4, 5, 6
Artiodactyla	Deer and Peccaries		
Tayassuidae	Peccaries		
<i>Tayassu pecari</i>	White-lipped Peccary	originally widespread, but now extirpated	
<i>Pecari tajacu</i>	Collared Peccary	common	2, 3, 4, 5, 6
Cervidae	Deer		
<i>Mazama temama</i> ²⁰	Central American Brocket Deer	uncommon	1, 2, 3, 4, 5, 6
<i>Odocoileus virginianus</i>	White-tailed Deer	uncommon	1, 2
Perissodactyla	Tapirs and Horses		
Tapiridae	Tapirs		
<i>Tapirus bairdii</i>	Baird's Tapir	uncommon	3, 4, 5, 6
Species introduced into the area by humans			
<i>Mus musculus</i>	House Mouse	common	1, 2, 6
<i>Rattus rattus</i>	Black, Roof Rat	uncommon	1, 2, 6

¹ Abundance categories: abundant = often observed and/or captured in appropriate habitats; common = frequently observed in appropriate habitats; uncommon = only occasionally observed in appropriate habitats; rare = very few records for Monteverde; extirpated = previously known from the area, but no longer in the region due to overhunting and habitat destruction; uncertain = of unknown abundance.

- ² Life Zone: These correspond to the 6 Holdridge life zones in Monteverde area. Brief descriptions and elevational ranges of each zone are found in Table 1 below.
- ³ A species new to science described by N. Woodman and R. M. Timm.
- ⁴ Name recently changed from *P. parnellii*.
- ⁵ Name recently changed from *C. brevicauda*.
- ⁶ Name recently changed from *S. liliium*.
- ⁷ Name recently changed from *S. ludovici*.
- ⁸ Recently recorded from Costa Rica for the first time.
- ⁹ Name recently changed from *M. keaysi*.
- ¹⁰ This genus is currently being revised and the authors state that this is probably an undescribed species. For now we provisionally use the name *R. io* to provide consistency with the published literature.
- ¹¹ Some anthropologist suggest the name for the Central American capuchins should be *C. imitator*.
- ¹² Name recently changed from *S. brasiliensis*.
- ¹³ A species recently described from Monteverde by Anderson and Timm (2006).
- ¹⁴ The correct name for the species of *Melanomys* at Monteverde may be *M. chrysomelas*. It is likely that at least two species of *Melanomys* occur in Costa Rica.
- ¹⁵ Name recently changed from *Oryzomys albigularis*.
- ¹⁶ Bradley et al. (2016) suggested that the *Peromyscus* at Monteverde should be considered as conspecific with those of Nicaragua and as such *P. nicaraguae*. Reed treats all *Peromyscus* in Costa Rica, Nicaragua, and adjacent countries as belonging to the widespread species *P. mexicanus*. We suspect that eventually two or perhaps three species of *Peromyscus* will ultimately be recognized in Costa Rica and continue to treat the species at Monteverde as *P. nudipes* until the systematic relationships among these species are better understood.
- ¹⁷ A new species being described by R. M. Timm and M Soley.
- ¹⁸ Name recently changed from *Oryzomys bolivaris*.
- ¹⁹ Name recently changed from *Oryzomys aphaerastus*.
- ²⁰ Name recently changed from *Mazama americana*.

Table 2. Characteristics of the Holdridge life zones in the Monteverde area and Life Zone code numbers associated with mammal distributions. Life zones are arranged in sequence along a transect across the mountains from the Pacific to the Atlantic slope.

Life Zone	Elevation (m)	Annual Rainfall (range in mm)	Dry Season Duration (months)	Canopy Height (m)	Life Zone
Premontane Moist Forest	700–1300	2000–2500	5.5	ca. 25	1
Premontane Wet Forest	1300–1500	2500–3500	5	30–40	2
Lower Montane Wet Forest	1500–1650	3000–5000	3	25–35	3
Lower Montane Rain Forest	1650–1850	5000–8000	2	20–30	4
Premontane Rain Forest	700–1600	4000–7000	1	30–40	5
Tropical Wet Forest	500–700	3500–4500	1	30–50	6

Modified from Haber (2000).

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