

A Morphological Key to the Bats of Montana

Identification of bats within our region is best accomplished by first determining if the species is within the genus *Myotis*. Non-*Myotis* bats have easily recognizable features and identification rarely requires detailed morphological analysis. The exception to this is the Big Brown Bat, which may initially appear similar to *Myotis* bats, albeit larger in size.

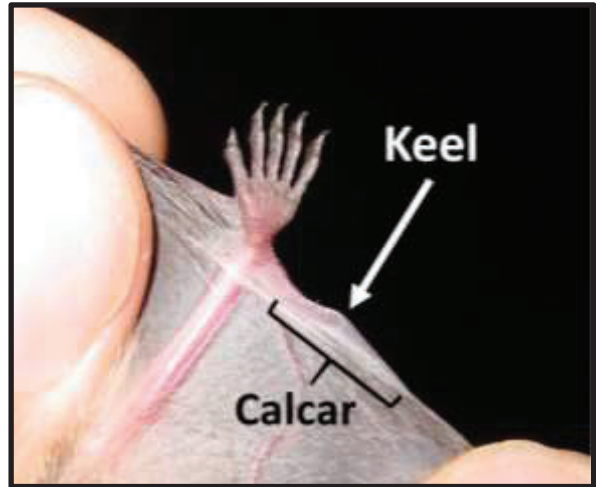
Separate *Myotis* Bats from non-*Myotis* species

- 1a. Mass does not exceed 10g, forearm often less than 41mm in length. **2. *Myotis* Bats**
- 1b. Mass exceeds 10g and forearm exceeds 41mm in length. **9. Non-*Myotis* Bats**

2. *Myotis* Bats

- 2a. Animal has distinct keel on calcar (Figure 15). **3. Keeled *Myotis***
- 2b. Keel indistinct or not present **5. Keel-less *Myotis***

Figure 13. Distinct keel on calcar between hind foot and tail. Note if not initially detected on one side, double check the other to ensure that the feature is not missed. © US Fish and Wildlife Service



3. Keeled *Myotis*: Three species of *Myotis* have a distinctly keeled calcar (Figure 15.) *M. volans* is easily separated from *M. californicus* and *M. ciliolabrum* based on its larger size (forearm greater than 36mm, mass greater than 6g). The latter species are small and easily confused and detailed examination of the pelage, muzzle, and tail are necessary for identification. Where range overlaps, genetic confirmation of species identity should be considered.

- 3a. Fur present on underside of wing extending to elbow (Figure 16). Usually dark chocolate in color. Forearm is at least 36mm in length. **Long-legged *Myotis* (*Myotis volans*)**
- 3b. Forearm less than 35mm and mass does not exceed 6g. **4**

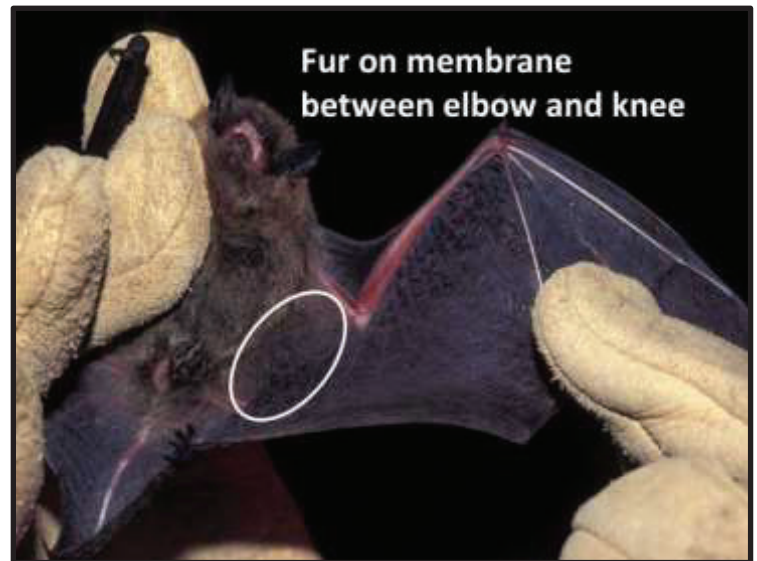


Figure 14. Location of diagnostic fur on underwing of Long-legged *Myotis* (*M. volans*). ©Kristi DuBois

4a. Bare snout length 1.5 times distance between nostrils (Figure 17, left). Tail extends well beyond membrane (Figure 17, right). Pelage blond, dark ears and face give the appearance of a mask. **Western Small-footed Myotis (*M. ciliolabrum*)**

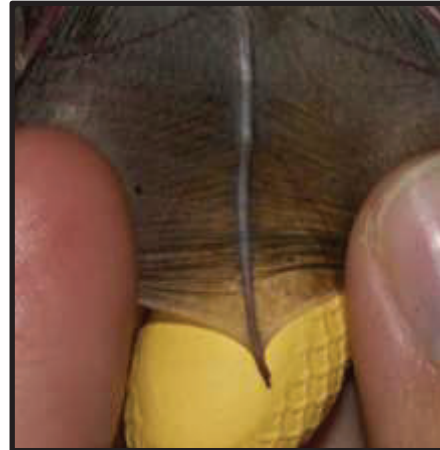
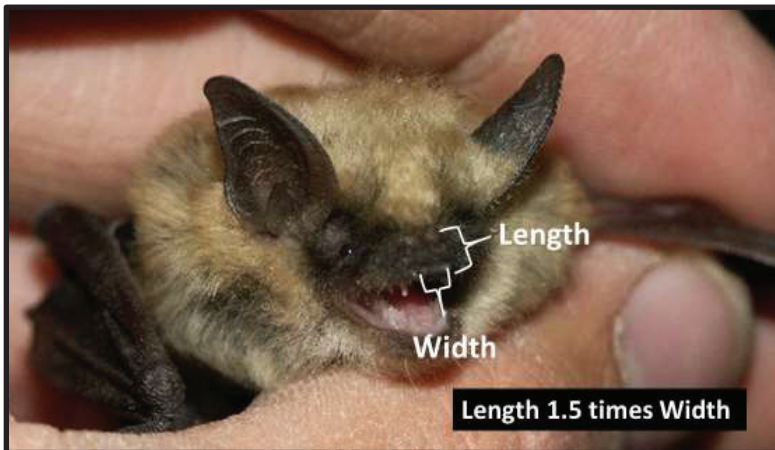


Figure 15 Definitive characteristics of the Western Small-footed Myotis (*M. ciliolabrum*) used to separate it from California Myotis (*M. californicus*). © Adam Messer

4b. Bare snout length same length as distance between nostrils (Figure 18, left). Tail barely extends beyond membrane (Figure 18, right). Known to be present in western Montana and mountainous areas in central and southern Montana east to the Pryor Mountains. **California Myotis (*M. californicus*)**

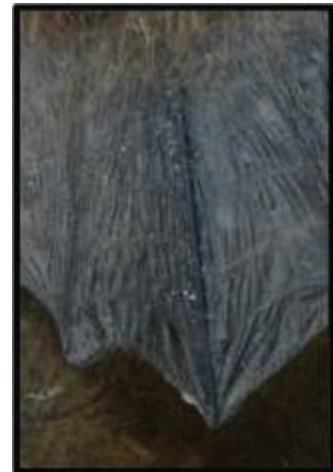
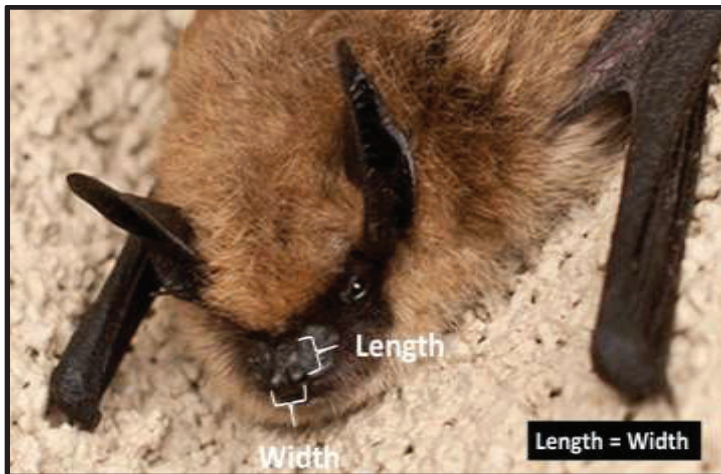


Figure 16. Definitive characteristic of the California Myotis (*M. californicus*) used to separate it from the Western Small-footed Myotis (*M. ciliolabrum*). ©Frank Carey, some rights reserved

5. Keel-less Myotis: This group is comprised of the easily-confused Long-eared Myotis species and the closely related *M. lucifugus/yumanensis* group.

5a. Ears 14mm or greater. When gently pressed forward, ear tips extend past the end of the muzzle. **6. Long-eared Myotis Species**

5b. Ears less than 14mm and do not extend beyond muzzle when pressed forward. **8. *M. lucifugus/ M. yumanensis***

6. Long-eared Myotis Species:

6a. Ear 14-16mm and when gently pressed forward, extends 3-5mm beyond end of muzzle. Tragus 8-10mm in length and tapers to narrow point (Figure 19). Membranes and pelage brown, rarely black. Area around eye between ear and mouth often sparsely haired with light brown/ pink skin. Known from forested areas along Yellowstone and Missouri rivers near the North Dakota Border. **Northern Myotis a.k.a Northern Long-eared Bat (*M. septentrionalis*).** Due to federal status and ease of confusion with similar species, genetic verification of species identity is strongly recommended.



Figure 17. A comparison of the profile of the Northern Myotis (*M. septentrionalis*, left panel) and Long-eared Myotis (*M. evotis*, right panel). Note the subtle difference in tragus shape. The tragus of the *M. septentrionalis* tapers to a narrow point while the tragus of *M. evotis* ends in a broad point. Photos © Mike McGrath USFW (left), Kristi DuBois (right)

6b. Not as above. Forearm greater than 37mm. **7**

- 7a.** Uropatagium may have sparse soft hair on margin, but this is only visible with close examination. Ear greater than 5mm beyond end of muzzle when gently pressed forward (total length 16-25mm). Tragus ends in a broad point. Forearm generally 40mm or less. **Long-eared Myotis (*M. evotis*)**
- 7b.** Uropatagium has bristle-like hairs on the margin apparent without detailed examination (Figure 20). Ears 14-18mm. Forearm generally 40mm or greater, but always greater than 38mm. **Fringed Myotis (*M. thysanodes*)**



Figure 18. Bristle like hairs on the uropatagium of *M. thysanodes*. Upon close examination, all *Myotis* bats have some hair on the margin of this membrane. *M. thysanodes* is the only *Myotis* species in this region to have stiff hairs that are easily seen. A general rule of thumb is that if you have to look hard for this attribute, the animal is most likely a *M. evotis*. © Adam Messer

- 8. *M. lucifugus* / *M. yumanensis*:** Species very similar in morphology and appearance. West of the Continental Divide, significant overlap exists with *M. yumanensis* and identification of individuals with intermediate morphological characteristics often requires use of acoustic equipment. For some individuals, genetic identification is the only means of accurately assessing species (see Figure 21).
- 8a.** Forearm length greater than 36.5mm is definitive. If forearm is shorter, a call sequence with a characteristic frequency of less than 44kHz is diagnostic. For individuals that do not meet these criteria, genetic identification is required (see Figure 21). Found across Montana. **Little Brown Myotis (*M. lucifugus*)**
- 8b.** Forearm length less than 36.5mm in length and a characteristic frequency of greater than 47kHz are definitive for this species. Genetic identification is required for all other individuals (see Figure 21). Currently known to be present along, and west of, the Continental Divide. **Yuma Myotis (*M. yumanensis*)**

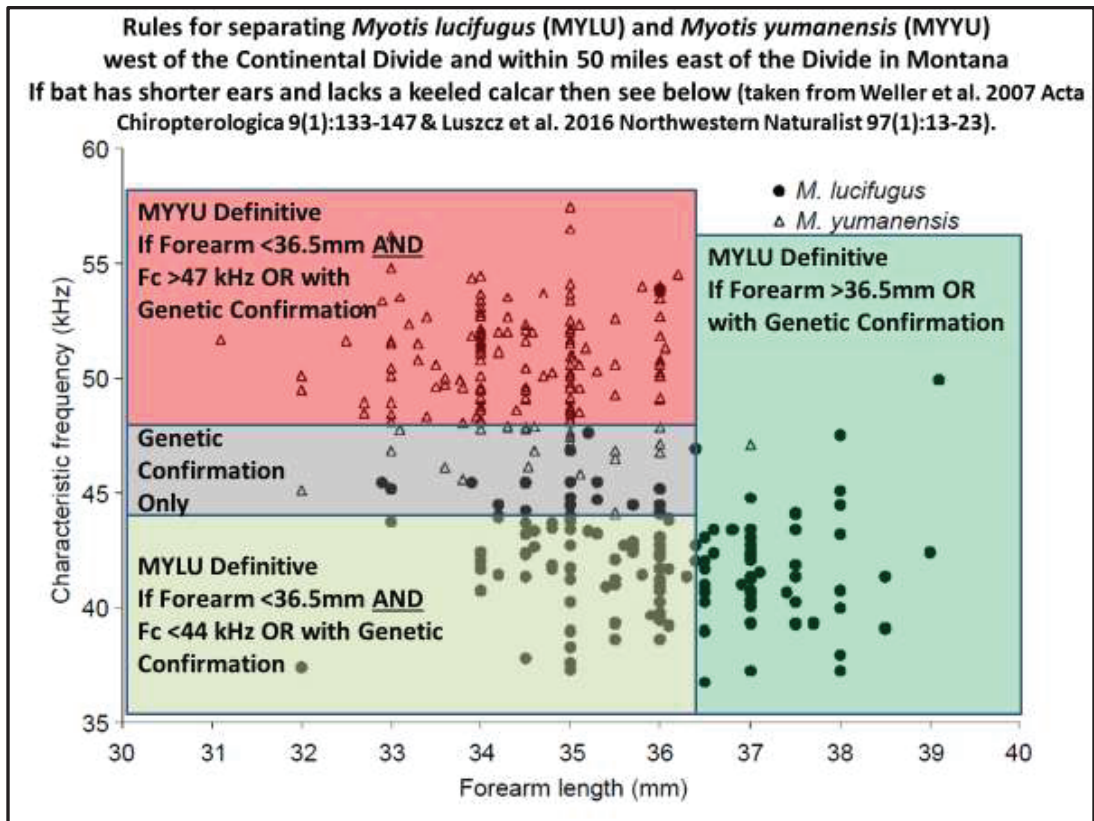


Figure 19. Rules for separation of Yuma Myotis (*M. yumanensis*) from Little Brown Myotis (*M. lucifugus*).

9. Non-Myotis Bats

9a. Ear length 20mm or greater. 10

9b. Ear length less than 20mm. 12

10a. Distinct black pelage with white spots (Figure 22). **Spotted Bat (*Euderma maculatum*)**

10b. Pelage uniform in color. 11

11a. Ears 30mm or greater and forearm less than 50mm. Pelage grey to dull brown. Distinct glands giving the rostrum a “lumped” appearance (Figure 23). **Townsend’s Big-eared Bat (*Corynorhinus townsendii*)**

11b. Ears less than 28mm, and forearm 55mm or greater. Light colored pelage. Nostrils distinctly pig-like in appearance (Figure 24). Captured in xeric forest or desert environments. **Pallid Bat (*Antrozous pallidus*)**



Figure 20. Spotted Bat (*Euderma maculatum*). ©Dick Dede, Jr.



Figure 21. Townsend’s Big-eared Bat (*Corynorhinus townsendii*) © Kristi DuBois



Figure 22. Pallid Bat (*Antrozous pallidus*). Note the shape of the nostrils and muzzle, which may help distinguish it from the Townsend’s Big-eared Bat (*Corynorhinus townsendii*). © Bryce Maxell

12a. Uropatagium well furred (Figure 25), pelage either dark with white tips or brick red. 13

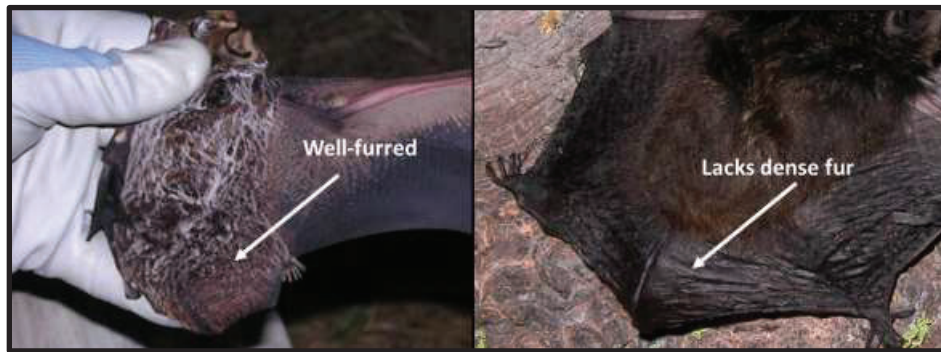


Figure 23. Levels of fur on the uropatagium. Left panel shows well-furred uropatagium while the right panel shows a uropatagium lacking fur. © Susan Lenard and Bryce Maxell (left), Kristi Dubois (right)

12b. Mass exceeds 10g for adults and forearm is over 42mm and often over 45mm. Uropatagium not furred. Superficially similar to *Myotis* in appearance, but larger. Muzzle is “dog-like” in appearance. Pelage color variable from light blond to dark brown (Figure 26). **Big Brown Bat (*Eptesicus fuscus*)**



Figure 24. Big Brown Bat (*Eptesicus fuscus*). ©Kristi DuBois

13a. Forearm at or less than 45mm. Mass 15g or less. Pelage may either be black (older individuals) or black with white/silver tips (younger individuals). Anterior edge of ear is light in color, contrasting with dark pelage and membranes (Figure 27). **Silver-haired Bat (*Lasionycteris noctivagans*)**

13b. Forearm greater than 45mm and pelage dark at base with grey/white tips. If forearm less than 45mm, pelage yellow to brick red in color. 14. ***Lasiurus* bats**



Figure 25. Silver-haired Bat (*Lasionycteris noctivagans*) © Kristi DuBois

14a. Pelage orange to red with dark wing membranes (Figure 28). Captured infrequently in forested areas or over water east of the Continental Divide. **Eastern Red Bat (*Lasiurus borealis*)**

14b. Forearm at or exceeds 50mm. Mass greater than 18g but often at or greater than 24g. Distinct white patches on wrists and elbows (Figure 15). **Hoary Bat (*Lasiurus***

***cinereus*)**



Figure 26. Eastern Red Bat (*Lasiurus borealis*). © Susan Lenard and Bryce Maxell



Figure 27. Hoary Bat (*Lasiurus cinereus*). Note white patches on wrist and elbows. ©Kristi Dubois

Measurements of Adult Bats from Montana, Northern Idaho, and Western South Dakota

The following tables and figures show the distribution of measurements, and age, sex, and status information collected from 3,222 bats representing 14 species captured between 1994 and 2016 across Montana, northern Idaho, and western South Dakota by biologists working with or for the Montana Natural Heritage Program, Montana Fish, Wildlife, and Parks, the U.S. Forest Service, and the Bureau of Land Management. We have compiled this information as a supplement to *A Morphological Key to the Bats of Montana*, to aid in identification of bats of the region, and allow comparisons of species' morphologies. In many of the data tables and figures, we have combined measurements from both male and female animals and do not account for physical condition such as pregnancy or sexual status in order to simplify display of information for use in species determinations.

Although common species such as the Little Brown Myotis (*Myotis lucifugus*) are well represented within these data summaries, other species have rarely been captured and have very few observations. Additionally, some measurements such as weight and forearm length have frequently been recorded, while others such as tragus length have been recorded less commonly. Due to the dearth of measurements for some species and features, we recommend that future studies record all measurements listed here. In particular tragus length should be measured on all Long-eared Myotis (*Myotis evotis*) captures, and thumb length should be recorded for all Western Small-footed Myotis (*Myotis ciliolabrum*) and California Myotis (*Myotis californicus*) captures.

Table 4. The number of adult individuals captured in Montana, Idaho or South Dakota used to determine the mean measurements and range for each feature. Note some species have been captured infrequently so these statistics may be biased due to low sample size.

Species*	4-letter Code*	Total	Weight	Forearm	Ear	Tragus	Thumb	Foot
<i>Antrozous pallidus</i>	ANPA	7	4	5	3	0	0	0
<i>Lasiurus cinereus</i>	LACI	230	192	205	68	31	42	38
<i>Euderma maculatum</i>	EUMA	0	0	0	0	0	0	0
<i>Eptesicus fuscus</i>	EPFU	379	307	324	128	60	77	76
<i>Corynorhinus townsendii</i>	COTO	29	27	26	12	0	0	0
<i>Lasiurus borealis</i>	LABO	7	6	7	3	3	3	3
<i>Lasionycteris noctivagans</i>	LANO	410	334	363	3	39	54	54
<i>Myotis volans</i>	MYVO	294	257	285	138	31	55	124
<i>Myotis ciliolabrum</i>	MYCI	125	109	117	50	22	42	52
<i>Myotis californicus</i>	MYCA	38	29	38	23	1	1	12
<i>Myotis septentrionalis</i>	MYSE	24	24	24	3	2	2	2
<i>Myotis evotis</i>	MYEV	483	425	456	316	57	81	92
<i>Myotis thysanodes</i>	MYTH	22	13	21	20	2	7	5
<i>Myotis lucifugus</i>	MYLU	889	773	818	293	117	132	136
<i>Myotis yumanensis</i>	MYYU	21	20	21	16	7	4	11

*Throughout this document 4-letter species codes are the first two letters of genus and species names.

Table 5. Definitive features and measurements for Montana Bat species. The 5th to 95th quantiles are shown for each measurement with the mean in parentheses. See sample sizes in table above and box and whisker plots below for each measurement; * indicates too few measurements to display.

Species	Keeled Calcar	Forearm (mm)	Weight (g)	Ear (mm)	Tragus (mm)	Thumb (mm)	Foot (mm)	Other Key Identifying Features
Larger easily identified bats								
LANO	N	39.5-43.5 (41.4)	9-14.5 (11.7)	9.6-14 (11.7)	3-6 (3.7)	4.7-7.3 (6)	5-9 (7.2)	Black pelage with more silver highlights in younger animals. Light color at base of small rounded black ears.
EPFU	Y	43.4-49 (46.1)	14-24.7 (18.8)	11-15 (13.1)	3-8 (5.2)	6-9 (7.4)	7-11 (9)	Doglike muzzle. Pelage light blond to dark brown.
LACI	Y	50.7-56.1 (53.2)	20.1-31.1 (25.4)	10.7-15 (12.9)	4-8 (6.1)	9-12 (10.9)	7-12 (9.6)	Grizzled dorsal fur contrasting with yellowish collar and white elbow patches. Small rounded ears.
LABO	Y	39.3-43 (41.2)	11.2-20.5 (16.2)	*	*	*	*	Reddish color with dark wing membranes. Small rounded ears, resembles small red LACI.
ANPA	N	55.4-59.8 (57.4)	20.2-22.8 (21.2)	*	*	*	*	Doglike muzzle with forward facing pig like nostrils having horseshoe shaped ridge. Large ears, pale in color, musky odor.
COTO	N	42.8-46.9 (44.4)	8.9-14 (10.8)	30.1-33.9 (31.8)	*	*	*	Very large ears joined on forehead. Two prominent lumps on nose.
EUMA	N	*	*	*	*	*	*	Large ears, distinct black pelage with 3 white patches.
Myotis Species: use calcar keel, forearm length, and then other key features listed. Bold lines are used to group morphologically similar species								
MYVO	Y	36.8-40.8 (38.9)	6.5-9.3 (7.9)	9-12.9 (10.9)	3-7 (4.8)	5-7 (6.2)	6-9 (7.3)	Fur on underside of wing extending to elbow. Usually dark chocolate in color.
MYCI	Y	30.1-33.9 (32.1)	4-5.7 (4.7)	10-13 (11.4)	3-6 (4.7)	4-6 (4.8)	5-8 (6)	Bare snout length 1.5 times distance between nostrils. Tail extends well beyond membrane. Light color with contrasting black mask.
MYCA	Y	31.9-34.5 (33.3)	4.3-6 (5.1)	9-13 (11.3)	*	*	5-6.8 (6)	Bare snout length same length as distance between nostrils. Tail barely extends beyond membrane.
MYSE	N	33.1-37.4 (35.0)	7-9 (8)	14-17 (15.7)	6-10 (8.3)	6.3-8.5 (7.25)	7-9 (8)	Ear 14-17mm in total length extends <5mm beyond tip of nose. Tragus long and slender. If caught collect guano or tissue sample for genetic verification.
MYEV	N	36.7-40.5 (38.6)	5.5-8.5 (6.7)	16-20 (18)	6.5-11 (8.8)	6-9 (7.2)	6.5-10 (8.2)	Ear >16mm extends beyond tip of nose > 5mm. Ear length variable. Fine hair may be present on edge of tail membrane, but is NOT a conspicuous fringe.
MYTH	N	38.8-43.6 (40.9)	6.1-10 (7.9)	14-19 (16.2)	*	5-7 (6.2)	7.2-10.7 (8.8)	Conspicuous fringe of stiff hairs extending from edge of tail membrane.
MYLU	N	35.1-39 (37)	5.5-10 (7.2)	10-13 (11.6)	4-7 (5.5)	5-8 (6.1)	6.5-10 (8.4)	Forearm > 36.5mm or forearm <36.5 <u>AND</u> characteristic frequency <44 kHz separates from MYU, otherwise genetic confirmation needed.
MYU	N	34.5-36.8 (35.6)	5.8-8 (6.5)	9.7-13.2 (11.5)	3.2-6 (4.6)	*	6.3-9.5 (8.3)	Forearm <36.5mm <u>AND</u> characteristic frequency >47 kHz separates from MYLU, otherwise genetic confirmation needed.

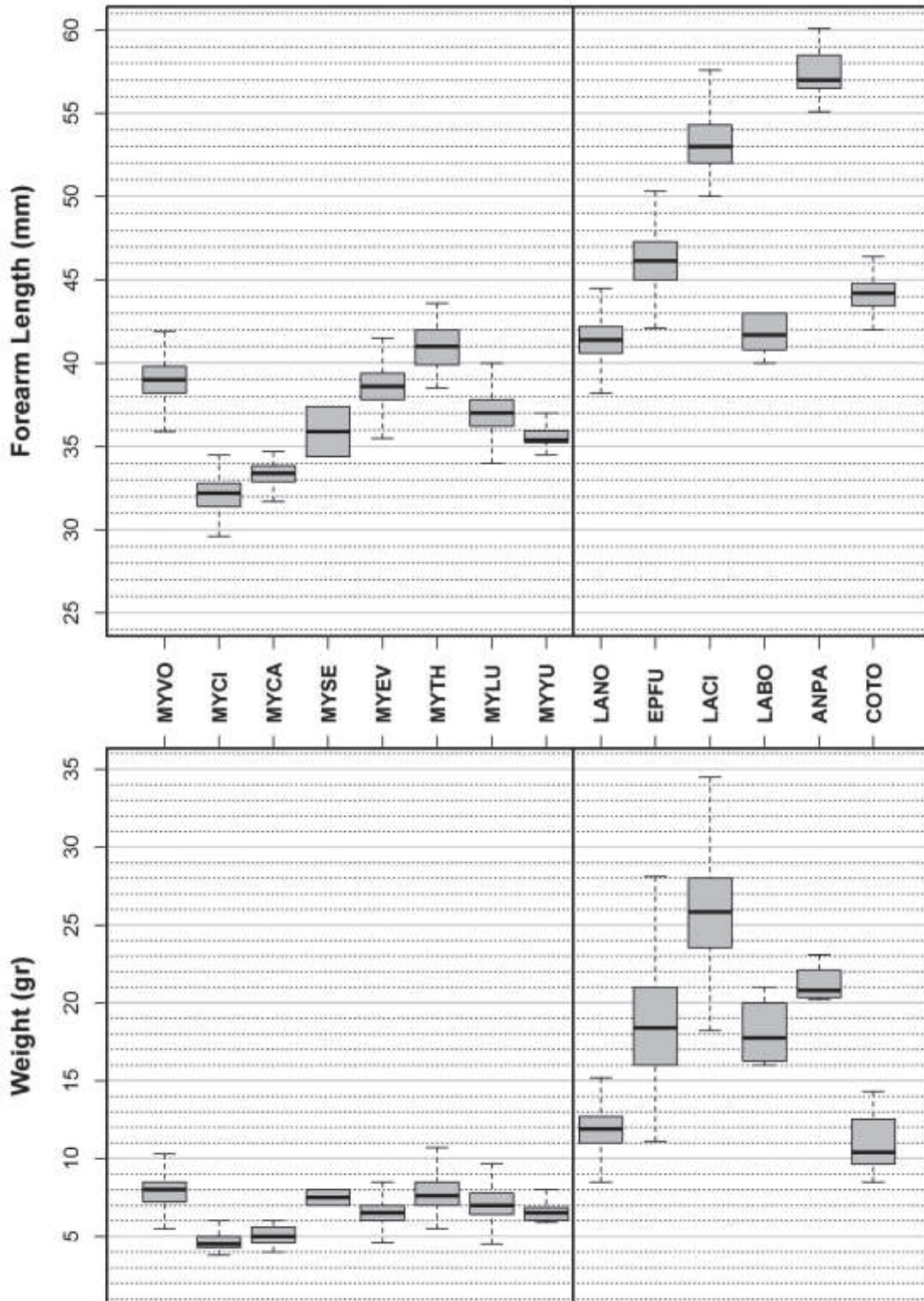


Figure 28. A comparison of the distribution of measurements for forearm length and weight of bats found in Montana. Note that the corresponding species names can be found in Table 4.

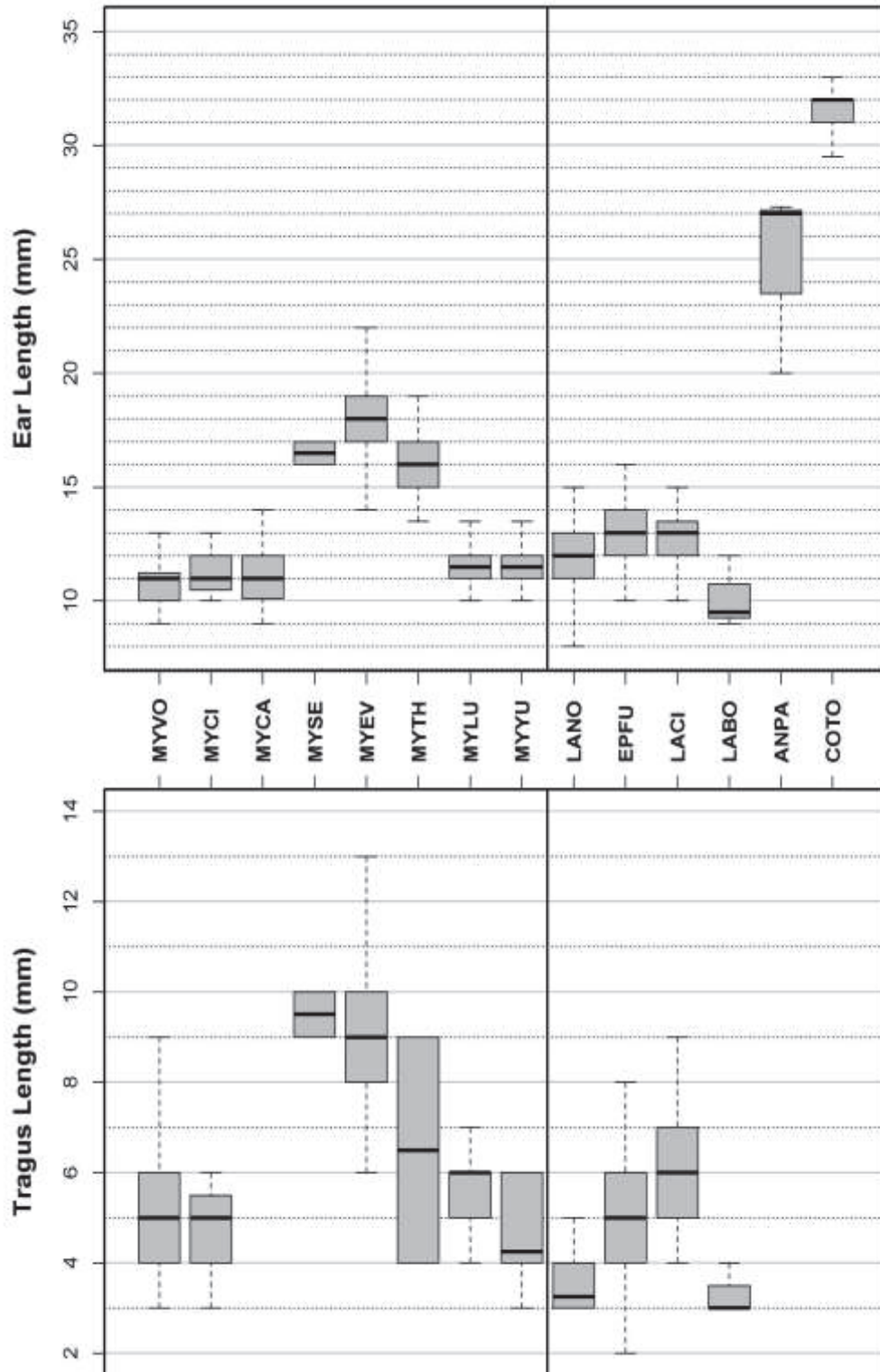


Figure 29. A comparison of the distribution of measurements of ear and tragus lengths for bats found in Montana. Note that the corresponding species names can be found in Table 4