# ALLEN'S BIG-EARED BAT (*IDIONYCTERIS PHYLLOTIS*) DOCUMENTED IN COLORADO BASED ON RECORDINGS OF ITS DISTINCTIVE ECHOLOCATION CALL

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ABSTRACT—Allen's big-eared bat (*Idionycteris phyllotis*) inhabits much of the southwestern USA, but has not been documented in Colorado. We recorded echolocation calls consistent with *I. phyllotis* near La Sal Creek, Montrose County, Colorado. Based on characteristics of echolocation calls and flight behavior, we conclude that the echolocation calls described here were emitted by *I. phyllotis* and that they represent the first documentation of this species in Colorado.

RESUMEN—El murciélago-mula de Allen (*Idionycteris phyllotis*) habita gran parte del sudoeste de USA, pero no ha sido documentado en el estado de Colorado. Grabamos las señales de ecolocación consistentes con *I. phyllotis* cerca de La Sal Creek, condado de Montrose, en Colorado. Basados en características de las señales de ecolocación y el comportamiento de vuelo, concluimos que las señales de ecolocación descritas aquí fueron emitidas por *I. phyllotis* y que representan el primer registro de esta especie en el estado de Colorado.

Allen's big-eared bat (*Idionycteris phyllotis*) is the only species in North America known to emit long, constant frequency-frequency modulated echolocation calls (Simmons and O'Farrell, 1977; Simmons and Stein, 1980). Characteristics of these long calls include a long (duration 20–200 ms) constant frequency (CF) component that occurs at ca. 27 kHz and a frequency modulated (FM) component at the end of the call that sweeps from ca. 24 to 12 kHz. On 18 August 2006, echolocation calls consistent with *I. phyllotis* were recorded along an unimproved road next to La Sal Creek, Montrose County, Colorado (elevation 1,715 m) with a Pettersson Ultrasound Detector D240× (Pettersson Elektronik AB, Uppsala, Sweden) and analyzed using SonoBat™ 2.5.6 software for analysis of bat calls (DNDesign, Arcata, California). The location was characterized by riparian habitat in a narrow canyon within a piñon-juniper dominated landscape. Eleven sequences of calls were recorded from one or more bats during 0009–0220 h. The bat or bats emitted audible long-CF/FM calls while foraging within a riparian canopy using slow, maneuverable flight.

Echolocation calls recorded at La Sal Creek consisted of CF and FM sounds. Many calls exhibited long-CF components that closely match calls of *I. phyllotis* described by Simmons and O'Farrell (1977) and Simmons and Stein (1980), and calls recorded in central New Mexico (Museum of Southwestern Biology, Acoustic Call Library, http://www.msb.unm.edu/mammals/batcall/html/speciesaccounts.html) and elsewhere in the southwestern USA (W. Gannon, pers. comm.). For example, one call that was recorded had duration of 88 ms and mean CF component of 26 kHz followed by a short FM component that swept from 29 to 13 kHz (Fig. 1). Short-CF/FM calls and calls with only an FM component also were recorded, and were consistent with calls of *I. phyllotis* described by Simmons and O'Farrell (1977). The FM component of all calls was similar regardless of presence or length of the CF component. Some calls exhibited a slight to strong trill pattern in the CF component. Lewis (2006) suggests that a trill >20 kHz definitively differentiates *I. phyllotis* from other species, such as the spotted bat (*Euderma maculatum*). Spectrographs we recorded at La Sal Creek

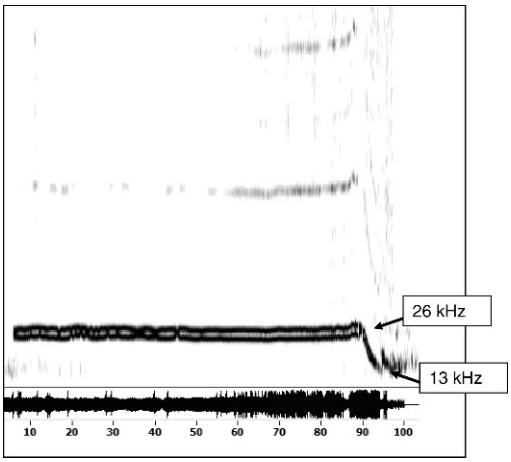


FIG. 1—An 88-ms call made by a foraging bat at 0015 h on 18 August 2006 at La Sal Creek, Montrose County, Colorado. The constant-frequency component of the call was at 26 kHz followed by a frequency-modulated component that swept from 29 to 13 kHz.

were shown to other biologists with experience recording and identifying echolocation calls of this species (C. Corben, L. Lewis, T. Snow, and J. Szewczak), all of whom identified the species as *I. phyllotis*.

*Idionycteris phyllotis* inhabits much of the southwestern USA (Czaplewski, 1983), but the species has not been documented in Colorado (Armstrong et al., 1994; Adams, 2003). Czaplewski (1983) included extreme southwestern Colorado in the geographical distribution map of *I. phyllotis*, and Armstrong et al. (1994), Fitzgerald et al. (1994), and Adams (2003) also speculated that this species likely resides in southwestern Colorado. Nevertheless, the nearest records for this species are from Canyonlands National Park, Utah (Armstrong, 1974), 74 km WSW La Sal Creek and from 8 km N Blanding, Utah (Black, 1970), 85 km SSW La Sal Creek. However, *I. phyllotis* has been observed traveling long distances during nightly foraging bouts (Brown and Berry, 2004), so dispersal into southwestern Colorado would not be surprising. This species has been associated with a variety of habitats, including ponderosa pine forests, piñon-juniper woodlands, lowland riparian areas, and desert shrublands (Commissaris, 1961; Findley and Jones, 1961; Hayward and Johnson, 1961; Cockrum and Musgrove, 1964; Black, 1970; Armstrong, 1974; Poché, 1975; Hoffmeister, 1986; Cockrum et al., 1996; Foster et al., 1997; Mollhagen and Bogan, 1997; Rabe et al., 1998; Brown and Berry, 2004). Vegetation formations and landscape features in southwestern Colorado are contiguous with those in southeastern Utah. There is no major obstacle that would impede dispersal of *I. phyllotis* from southeastern Utah where the species is known to reside, and elsewhere on the Colorado Plateau, into areas of southwestern Colorado.

Given that this is the only species in North America known to use long-CF/FM calls with the characteristics described above, and that the flight behavior and calls recorded at La Sal Creek are consistent with *I. phyllotis* observed elsewhere in the southwestern USA, we conclude that the echolocation calls described here were emitted by *I. phyllotis*. These calls represent the first documentation of this species from Colorado.

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## LITERATURE CITED

ADAMS, R. A. 2003. Bats of the Rocky Mountain West: natural history, ecology, and conservation. University Press of Colorado, Boulder.

ARMSTRONG, D. M. 1974. Second record of the Mexican big-eared bat in Utah. Southwestern Naturalist 19: 114–115.

ARMSTRONG, D. M., R. A. ADAMS, AND J. FREEMAN. 1994. Distribution and ecology of bats of Colorado. University of Colorado Museum, Natural History Inventory of Colorado 15:1–83.

BLACK, H. L. 1970. Occurrence of the Mexican big-eared bat in Utah. Journal of Mammalogy 51:190.

BROWN, P. E., AND R. D. BERRY. 2004. Foraging habitat and home range of Allen's big-eared bat (*Idionycteris phyllotis*) in the Arizona desert as determined by radio-telemetry. Bat Research News 45:207–208.

COCKRUM, E. L., AND B. F. MUSGROVE. 1964. Additional records of the Mexican big-eared bat, *Plecotus phyllotis* (Allen), from Arizona. Journal of Mammalogy 45:472–474.

COCKRUM, E. L., B. MUSGROVE, AND Y. PETRYSZYN. 1996. Bats of Mohave County, Arizona: populations and

movements. Occasional Papers, Museum of Texas Tech University 157:1–71.

Commissaris, L. R. 1961. The Mexican long-eared bat in Arizona. Journal of Mammalogy 42:61–65.

Czaplewski, N. J. 1983. *Idionycteris phyllotis*. Mammalian Species 208:1–4.

Findley, J. S., and C. Jones. 1961. A new United States record of the Mexican long-eared bat. Journal of Mammalogy 42:97.

Fitzgerald, J. P., C. A. Meaney, and D. M. Armstrong. 1994. Mammals of Colorado. Denver Museum of Natural History and University Press of Colorado, Niwot.

Foster, D. A., L. Grignon, E. Hammer, and B. Warren. 1997. Inventory of bats in high plateau forests of central and southern Utah. Pages 63–72 in Proceedings of the third biennial conference of research on the Colorado Plateau (C. van Riper, III and E. T. Deshler, editors). National Park Service Transactions and Proceedings Series NPS/NRNAU/NRTP-97/12:1–256.

Hayward, B. J., and R. Johnson. 1961. Notes on *Plecotus phyllotis* from Arizona. Journal of Mammalogy 42:402.

Hoffmeister, D. F. 1986. Mammals of Arizona. University of Arizona Press, Tucson.

Lewis, L. 2006. Allen's lappet-eared bat (*Idionycteris phyllotis*): surveys in the Gila Wilderness. United States Fish and Wildlife Service, Ecological Services Field Office, Albuquerque, New Mexico.

Mollhagen, T. R., and M. A. Bogan. 1997. Bats of the Henry Mountains region in southeastern Utah. Occasional Papers, Museum of Texas Tech University 170:1–13.

Poché, R. M. 1975. New record of the bat *Plecotus phyllotis* from Utah. Great Basin Naturalist 35:452.

Rabe, M. J., T. E. Morrell, H. Green, J. C. DeVos, Jr., and C. R. Miller. 1998. Characteristics of ponderosa pine snag roosts used by reproductive bats in northern Arizona. Journal of Wildlife Management 62:612–621.

Simmons, J. A., and M. J. O'Farrell. 1977. Echolocation by the long-eared bat, *Plecotus phyllotis*. Journal of Comparative Physiology A: Neuroethology, Sensory, Neural, and Behavioral Physiology 122:201–214.

Simmons, J. A., and R. A. Stein. 1980. Acoustic imaging in bat sonar: echolocation signals and the evolution of echolocation. Journal of Comparative Physiology A: Neuroethology, Sensory, Neural, and Behavioral Physiology 135:61–84.

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