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The Bats Of Wyoming

By

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ABSTRACT

We examined 1280 bats of 12 species submitted to the Wyoming State Veterinary Laboratory (WSVL) for rabies testing between 1981 and 1992. The most abundant species in the sample was *Myotis lucifugus*, followed by *Eptesicus fuscus*, *Lasionycteris noctivagans*, *M. ciliolabrum*, and *M. volans*. Using the WSVL sample and additional museum specimens, we summarized available records and knowledge for 17 species of bats in Wyoming. Records of the WSVL show that, between 1981 and 1992, 113 bats actually tested positive for rabies. We examined 45 of those rabies-positive bats; *E. fuscus* had the highest incidence (60%) in the sample, followed by *L. noctivagans* (11%) and *L. cinereus* (9%).

Key words: bats, Wyoming, distribution, seasonal occurrence, relative abundance, rabies

Although much has been written on mammals in Wyoming, especially large mammals, it is only recently that any real effort has been devoted to a better understanding of bats in that state. Still, no comprehensive summary of distribution and abundance exists for bats in Wyoming. Early reports on the state's mammals provided only fragmentary information. Cary (1917) listed eight species of bats as characteristic of the various life zones in the state and, not quite 50 years later, Long (1965) provided records for 11 species, many of these from surprisingly few localities. The most recent compilation of Wyoming mammals by Clark and Stromberg (1987) provides information on 16 species presumed to occur in the state. Although they provided considerable general natural history information on the species and mapped their distributions, they did not record lists of specimens examined and did not provide specific locality information. A more general overview of bats in the adjacent northern Great Plains is that of Jones et al. (1983), and specific information on mammals in the Black Hills of South Dakota and Wyoming is in Turner (1974).

Efforts are now underway in many states, including Wyoming, to obtain current information on status and trends of bat populations because there are widespread perceptions that bats as a group are declining in numbers (Bogan et al., 1996b). We believe that such efforts must be based on an understanding of distribution and abundance, and other aspects of bat biology (Fenton, 1997), that is as complete as practicable. We hope that this compilation will be useful in that regard.

In the early 1980s, the senior author was offered the opportunity to obtain for examination specimens of bats submitted to the Wyoming State Veterinary Laboratory (WSVL) that tested negative for rabies, much as Stromberg (1982) had done earlier. During the period from about 1981 through 1992 we were able to examine about 1300 specimens of bats submitted to WSVL for examination. Previous collections of bats in the state pale by comparison with this sample and, in a day and age when collecting of specimens requires increasing justification, the opportunity to examine such a sample is noteworthy. Our emphasis with this new information has been primarily to provide a better understanding of the distribution, seasonal occurrence, and relative abundance of bats in the state. We also were able to examine some bats that tested positive for rabies and we present that information. However, that dataset is incomplete, and we have been cautious in reporting those results.

MATERIALS AND METHODS

We obtained bat specimens that had been tested for rabies and found negative from the Wyoming State Veterinary Laboratory (WSVL) for the period from 1979 to 1992. The state of Wyoming, through WSVL, maintains an active wildlife rabies monitoring program in which veterinarians throughout the state send suspect animals to WSVL for fluorescent-antibody rabies testing. Between 1979 and 1992, WSVL received approximately 2000 bats for testing. We examined about 1300 of these bats, of which we saved more than 400 specimens of uncommon and difficult-to-identify species for examination of cleaned skulls. Other specimens, mostly of common and readily identifiable species, were discarded. Some specimens were not identifiable to either species or sex, and dates were missing for a few; this affects tabulated numbers. Specimens were deposited in the U. S. Geological Survey's Biological Survey Collection, Fort Collins (BS/FC), now in the Museum of Southwestern Biology, University of New Mexico. Additionally, at facilities of the WSVL, we examined 45 of 113 rabies-positive bats recovered between 1981-1989. For every bat, Dr. John Wiebel, WSVL, provided: locality of collection,

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date of collection, collector, receiving veterinarian, and a WSVL identification number. It is this attention to detail that makes this sample so valuable to those interested in bats in Wyoming.

Nearly all bats in our sample of WSVL bats were attributed to a town or city in Wyoming. Thus, in general, the locality information does not reflect natural habitats of these species, although some, such as *M. lucifugus* and *E. fuscus,* are common house bats in urban North America. Nonetheless, we believe that most of our records represent meaningful localities and provide an enhanced understanding of bats in the state. Most bats that we examined were in advanced stages of decomposition, a condition that we think makes it unlikely that those finding the bat would transport it any great distance. We have no information that suggests how far such a distance might be, but we did not find localities for any species that seemed greatly at odds with what is known of their habitat requirements.

In addition to the WSVL records, lists of specimens examined include 107 specimens collected between 1982 and 1993, as well as selected specimens in other regional museums (University of Wyoming, UWYO; University of Northern Colorado, UNC; and University of Colorado, CU). Specimens listed as examined are in the Biological Survey Collection of the Museum of Southwestern Biology unless otherwise noted. Specimens from WSVL listed as discarded were first examined and their identifications and other data were recorded. The senior author examined all specimens (saved, discarded, and in museums) and made all identifications. Distribution maps were plotted using both WSVL and previously reported localities. Localities underlined in lists of specimens examined were not mapped separately from the nearest non-underlined locality. Unless otherwise noted, additional records are those listed by Long (1965) and were mapped only if the locality was not otherwise represented in our database. Clark and Stromberg (1987) did not provide specific localities for their distribution maps, thus their records are not included in this report. We have chosen, for the most part, to present our data in the form of individual species accounts. Usage and order of scientific and vernacular names follow Jones et al. (1997) unless otherwise noted.

SPECIES ACCOUNTS

Myotis californicus (Audubon and Bachman)

The California myotis appears to be known certainly only from southwestern Wyoming, specifically in Sweetwater County; it is moderately common in adjacent parts of Colorado (Bogan, unpublished data). At the time of Long's (1965) work, the species was unknown from the state. Clark and Stromberg (1987) depicted the range of the species across much of western Wyoming on the basis of presumed specimens from northern Wyoming. We examined two pertinent specimens (BS/FC 10868, Big Horn Co.: Greybull; 10870, Park Co.: Powell, the latter reported by Stromberg, 1982) and believe that they represent the more common and widespread *M. ciliolabrum*. Worthington (1991), working in adjacent parts of Montana, found only *M. ciliolabrum*, further strengthening our belief that *M. californicus* does not occur in northern Wyoming. The subspecies occurring in southwestern Wyoming is *M. c. stephensi*, the race of the Great Basin and much of the arid Southwest (Bogan, 1975; Hall, 1981).

Myotis californicus differs from most other *Myotis* in Wyoming in having a keeled calcar, small ears, and pale, reddish-blonde coloration. From *M. volans* it differs in having a smaller hind foot, shorter forearm, and paler pelage. From *M. ciliolabrum* it differs in being paler in color and in lacking the distinct black mask of that species. Cranially, it differs from *M. ciliolabrum* in having a more delicate and globose braincase, smaller rostrum, and in having a distinct "forehead" to the cranium (Bogan, 1974). All but one of the nine WSVL specimens of this species examined were male and were found between the months of July and October. During the summer months, these bats typically inhabit crevices in a wide variety of situations, including rocks, cliffs, trees, and buildings (Barbour and Davis, 1969), where they form small colonies or roost solitarily. There were no winter records of this bat in Wyoming, but elsewhere they are known to hibernate in mines (Barbour and Davis, 1969) and in some areas they remain active throughout the winter (Krutzsch, 1954; O'Farrell et al., 1967). Principal food items are moths, flies, beetles, and bugs (Simpson, 1993).

Specimens Examined (8).—SWEETWATER CO.: Green River (6), Rock Springs (2) (Not mapped).

Discarded Specimen.—SWEETWATER CO.: Rock Springs (1).

Myotis ciliolabrum (Merriam)

The western small-footed myotis occurs statewide in Wyoming and is fourth in abundance in our sample from the WSVL (Fig 1). Previous investigators (Long, 1965; Clark and Stromberg, 1987) also agreed on the widespread distribution of this bat. This is typically a bat of yellow-pine and mixed coniferous forests and yet, interestingly, there appear to be no records from the mountainous part of western Wyoming (Lincoln and Teton counties and Yellowstone National Park). Records from the WSVL provide new county records for Sheridan, Platte, Albany, and Carbon counties. This species differs from other Wyoming myotis in much the same way as *M. californicus*, from which it differs as explained in that account. *M. ciliolabrum* has

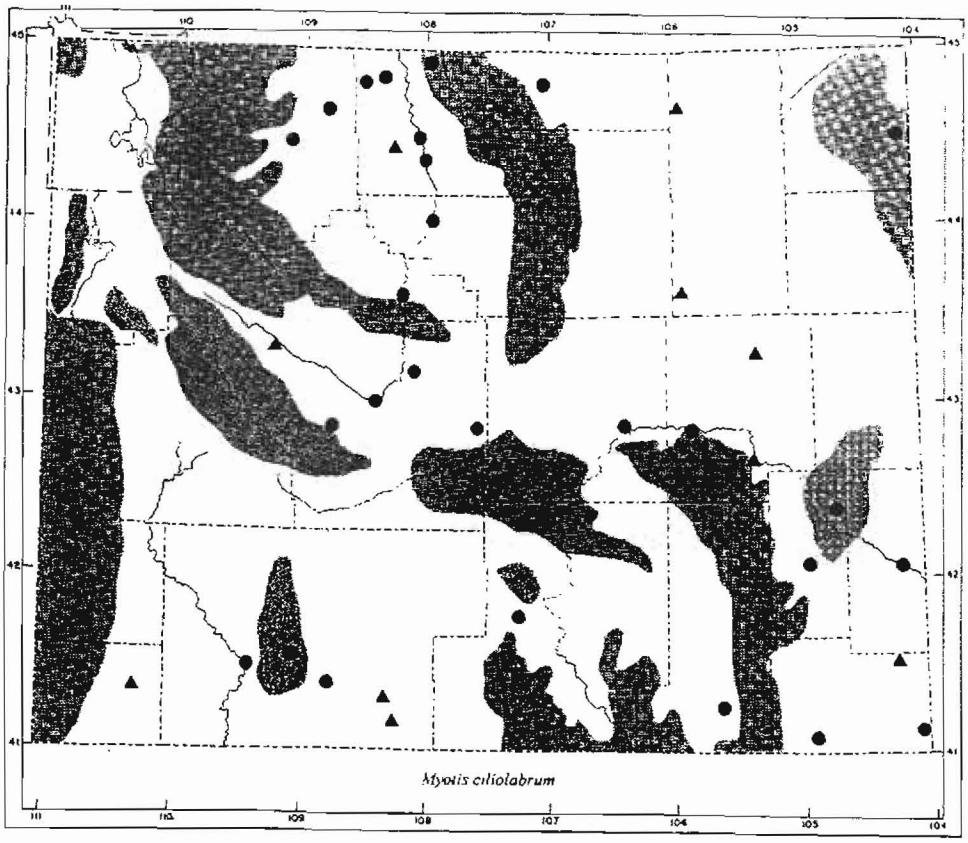

Fig. 1. Distribution map for *Myotis ciliolabrum* in Wyoming. Solid circles represent locality records of bats submitted to the Wyoming State Veterinary Laboratory (WSVL) for examination, or of bats captured in mist nets, for which a specimen was kept. Unless otherwise noted, all specimens listed as examined are housed in the Biological Surveys Collection in the Museum of Southwestern Biology. Open circles represent bats from the WSVL sample that were identified and discarded. Triangles represent previously published records of bat specimens for whieh there were no localities in the WSVL or mist-net samples. Multiple localities within the same area (approx. 10 km.) are represented by a single symbol and are underlined in the species accounts. Shaded areas represent highland areas above about 2,200 m. This map is modified from the Wyoming state map of the University of Kansas Museum of Natural History (1941 version).

been known by several names, among them *M. subulatus* and *M. leibii*. According to Glass and Baker (1965, 1968) the name *subulatus* applies to *M. yumanensis* (but see Hall [1981] for an alternative opinion). Van Zyll de Jong (1984) has demonstrated to our satisfaction that the eastern *M. leibii* represents a species distinct from western *M. ciliolabrum*. Specimens available to us suggest that most Wyoming specimens represent the race *M. c. melanorhinus* and that *M. c. ciliolabrum* occurs only in the eastern prairie portions of Wyoming. A study of geographic variation in this species would be of interest.

We found a nearly equal sex ratio in our sample, with both sexes being recovered between May and October. The greatest number of individuals were recovered during the months of August and September. Females were recovered more commonly during May through July (21 vs. 5), whereas males were more common in August and especially September (48 vs. 39). Maternity colonies have not been positively located in the state, but in South Dakota small groups of reproductive females have been found roosting in crevices at the base of sandstone cliffs (Bogan and Cryan, unpublished data) and in erosion crevices in the Badlands of South Dakota (Tuttle and Heaney, 1974). Priday and Luce (1996) located 39 wintering sites of *M. ciliolabrum*. Most were found in mines, although eight sites were located in caves and one was in a tunnel. Hibernating colonies averaged 3.8 bats (range 1 - 31) and were found mainly in the north-central and southwestern parts of the state.

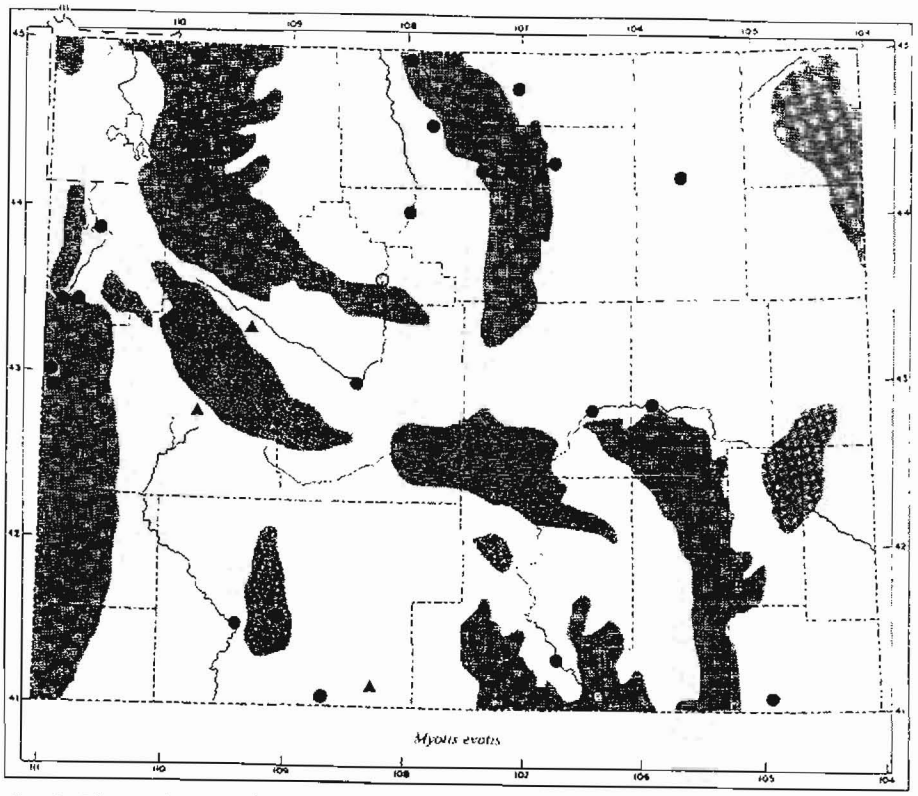

Fig. 2. Distribution map for *Myotis evotis* in Wyoming. Symbols and features are as in Fig. 1.

Specimens Examined (145).—ALBANY CO.: North Laramie (1 UWYO). BIG HORN CO.: Basin (2); Byron (3); Greybull (4); Little Mountain [19.3 km NE Lovell] (7), Lovell (18). CARBON CO.: Rawlins (1). CONVERSE CO.: Glenrock (1). CROOK CO.: Sand Creek (1). FREMONT CO.: Gas Hills (1); Lander (3); Riverton (1); Shoshoni (2). GOSHEN CO.: Torrington (3). HOT SPRINGS CO.: Thermopolis (18). LARAMIE CO.: Cheyenne (12); Pine Bluffs (5). NATRONA CO.: Casper (1). PARK CO.: Cody (1); Powell (7); unknown locality (1). PLATTE CO.:, Wheatland (1); Bat Cave, [near] Sunrise (7 UWYO). SHERIDAN CO.: Sheridan (1). SWEETWATER CO.: Green River (17); near Black Butte Coal Mine (1); Rock Springs (18). WASHAKIE CO.: Worland (7).

Discarded Specimens (4).—BIG HORN CO.: Basin (2); Lovell (1). SWEETWATER CO.: Green River (1).

Additional Records (17).—BIG HORN CO.: Otto (Miller and Allen, 1928) (2). CAMPBELL CO.: 3 mi. N, 7.5 mi. W Spotted Horse (2), NW side Middle Butte, 38 mi. S, 19 mi. W Gillette (1), *E side Middle Butte, 39 mi. S, 19 mi. W Gillette* (3). CONVERSE CO.: 12 mi. N, 7 mi. W Bill (1), 8 mi. S Douglas (1). FREMONT CO.: Bull Lake (1). LARAMIE CO.: Horse Creek, 6.5 mi. W Meriden (1). NATRONA CO.: Rattlesnake Mtns. (1). SWEETWATER CO.: Bitter Creek (Miller and Allen, 1928) (2); Kinney Ranch (Miller and Allen, 1928) (1). UINTA CO.: Ft. Bridger (Miller and Allen, 1928) (1).

Myotis evotis (H. Allen)

The WSVL samples of the long-eared myotis provide new county records for Sheridan, Hot Springs, Washakie, Johnson, Campbell, and Converse counties and confirm the essentially statewide distribution of this species (Fig. 2). This species was seventh in abundance in the WSVL sample. In much of the West, this species seems most common in coniferous forests although scattered records exist for lower-elevation shrub and woodland habitats. *M. evotis* is known from adjacent Montana (Worthington, 1991), South Dakota (Jones and Choate, 1978; Cryan and T. Mattson, unpublished data), and Colorado (Fitzgerald et al., 1994), but not Nebraska (Czaplewski et al., 1979). *M. evotis* can be distinguished from *M. thysanodes* by its longer (> 21 mm), glossy, black ears and the absence of a fringe on the trailing edge of the uropatagium. From *M. septentrionalis*, only known from eastern Wyoming, it differs in having black rather than brown ears and in not having a yellowish appearance to the pelage. Manning (1993) assigned Wyoming bats to

the race *M. e. chrysonotus*, the type of which comes from the Kinney Ranch in Sweetwater County.

Negus and Findley (1959) captured three individuals of this species over a waterhole in a sage-grass community north of Blacktail Butte; they found no day or night roosts of *M. evotis*. Priday and Luce (1996) found nine night roosts of this species in caves, mines, and rock shelters and one possible hibernaculum in a cave. In New Mexico, maternity roosts are known from rock crevices on or near the ground (Bogan et al., 1998). The sex ratio of long-eared myotis was nearly equal in WSVL samples. Males were recovered from June through October and females were found from May through September.

Specimens Examined (27).—BIG HORN CO.: Little Mountain (2); Paint Rock Creek (1); Shell (2). CAMPBELL CO.: Gillette (1). CARBON CO.: North Platte River, Corral Creek Campground (1). CONVERSE CO.: Glenrock (1). FREMONT CO.: Riverton (1). JOHNSON CO.: Buffalo (1). LARAMIE CO.: Cheyenne (4). LINCOLN CO.: Freedom (1); Thayne (1). NATRONA CO.: Casper (2). SHERIDAN CO.: Sheridan (1). SWEETWATER CO.: Green River (1); Rock Springs (1); Alkali Draw (1 UWYO). TETON CO.: Jackson (2); Wilson (1); 8 mi. S. Moran (1 UWYO). WASHAKIE CO.: Worland (1).

Discarded Specimens (5).—BIG HORN CO.: Shell (1). HOT SPRINGS CO.: Thermopolis (1). LINCOLN CO.: Afton (1). SHERIDAN CO.: Sheridan (1). TETON CO.: Jackson (1).

Additional Records (7).—CARBON CO.: Bottle Creek Picnic Ground, Sierra Madre Mtns. (2). FREMONT CO.: Buffalo Lake (Miller and Allen, 1928) (1). PARK CO.: 15 mi. S, 21 mi. W Cody (1). SUBLETTE CO.: 6 mi. N, 3 mi. E Pinedale (1). SWEETWATER CO.: Kinney Ranch (Miller and Allen, 1928) (1, holotype). WESTON CO.: 1.5 mi. E Buckhorn (1).

Myotis lucifugus (Le Conte)

The little brown myotis is statewide in distribution and was the most frequently encountered species in the WSVL sample (Fig. 3). We found new county records for Uinta, Hot Springs, Weston, Niobrara, and Goshen counties. In Wyoming, this species is most likely to be confused with *M. volans*, from which it differs in lacking a keeled calcar and extensive fur under the wing and in having shorter tibia and larger hind feet. From *M. yumanensis* it differs in having membranes and fur that are generally darker in color (fur dark brown with a brassy sheen as opposed to pale grayish-tan; membranes dark brown, not grayish-tan). From *Eptesicus fuscus* it differs in being smaller in overall size (forearm length 33-41 vs. 42-51) and it lacks the prominent rostral glands of *Eptesicus*. Young animals, however, can be difficult to identify with certainty. Presumably, bats of this species in Wyoming belong to the race *M. l. carissima*, although we have small series of specimens from Big Horn County that are distinctly paler in color. There is the possibility that more than one subspecies of *M. lucifugus* occurs in Wyoming.

Of the specimens recovered, females outnumbered males almost two to one, likely due to the common occurrence of maternity colonies in buildings. Both males and females were found from April through October, with the greatest number of both sexes recovered in July and August. Near Jackson Hole in June, Negus and Findley (1959) found large numbers of little brown bats in maternity colonies in Moran, in a chapel 1 mi. S Moran, and at the JO Ranch. Specimens taken by them (Negus and Findley, 1959) were predominantly from forested areas. Findley (1954) found pregnant females in late June at Jackson Hole. Priday and Luce (1996) found five hibernacula of this species, ranging in size from 1 to 28 bats, and four maternity colonies, numbering between 60 and more than 200 individuals. An additional maternity colony was located in an abandoned house during the summer of 1996 near Mule Creek Junction (B. Luce, personal communication). All hibernacula were located in caves, whereas three of the maternity colonies were found in buildings and one was in a cliff face.

Adams (1989, 1992a, 1992b, 1996, 1997) has added much to our knowledge of this species with his many studies of a large maternity population at Fort Laramie National Historic Site. More recently, Bogan and Geluso (unpublished data) initiated work on the roosting ecology of this species at Fort Laramie. Bogan and Geluso estimated that numbers of bats in maternity colonies in individual buildings ranged from 50 to several hundred. Maternity colonies were in buildings that had more stable temperatures compared to uninhabited buildings and bats tended to use small tight crevices in buildings as refugia.

Specimens Examined (155).—ALBANY CO.: Laramie (2). BIG HORN CO.: *12 mi. E and 0.5 mi. S of Cowley* (23); Basin (6); ca. 8 mi. ENE of Lovell (2); Cowley (2); Greybull (4); Hwy. 14A at Five Springs (1); Little Spring, Little Mountain (1); *Lovell* (2). CAMPBELL CO.: Gillette (4). CARBON CO.: Rawlins (1); Shirley Basin (4). CONVERSE CO.: Douglas (2); Glenrock (1). CROOK CO.: 14 mi. N of Hulett (2); Sand Creek (2). FREMONT CO.: Boysen State Park, 11 mi. N Shoshone (3); Ethete (1); Lander (5); Riverton (1); Ft. Washakie (2). LARAMIE CO.: Cheyenne (17). LINCOLN CO.: Frontier (1). NATRONA CO.: Casper (8); *Casper Mountain* (1); Paradise Valley (1). NIOBRARA CO.: Lance Creek (1). PARK CO.: *3 mi. SW of Cody* (2); Cody (2); Powell (4). PLATTE CO.: Guernsey (1); Wheatland (1). SHERIDAN CO.: Beckton (1); Big Horn

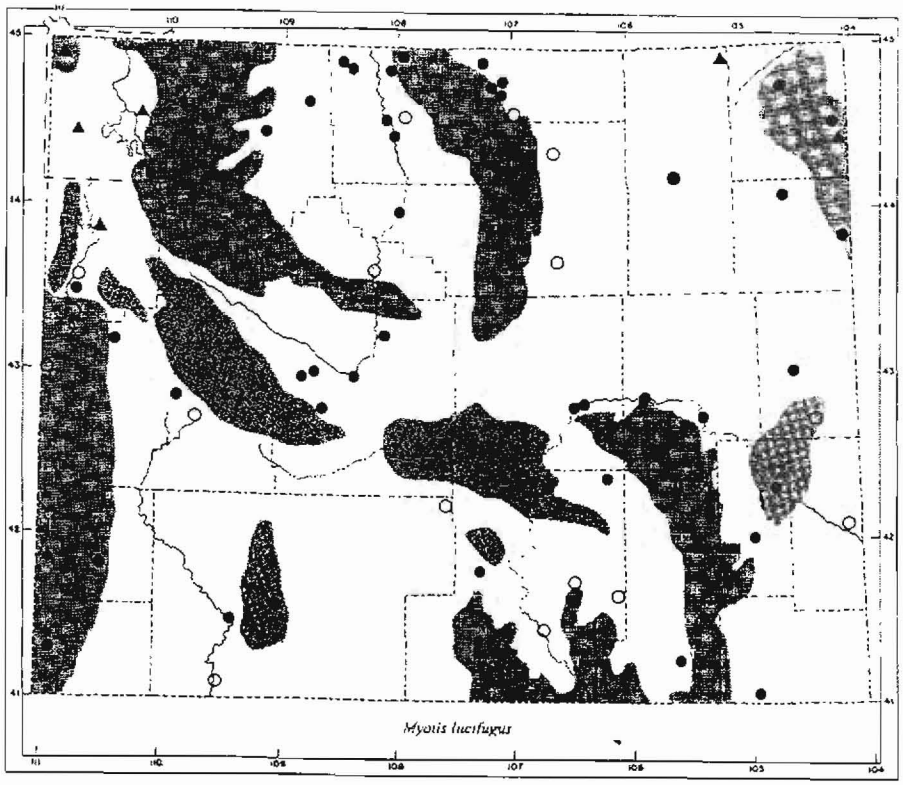

Fig. 3. Distribution map for *Myotis lucifugus* in Wyoming. Symbols and features as in Fig. 1.

(1); Ranchester (1); Sheridan (18). SUBLETTE CO.: Bondurant (1); Pinedale (2). SWEETWATER CO.: Green River (4); Rock Springs (2). TETON CO.: Jackson (6). UINTA CO.: Evanston (1). WASHAKIE CO.: Worland (5). WESTON CO.: Newcastle (2); Upton (1).

Discarded Specimens (235).—ALBANY CO.: Laramie (13). BIG HORN CO.: Basin (8); Cowley (1); Greybull (3); Lovell (6); Shell (1). CAMPBELL CO.: Gillette (1). CARBON CO.: Elk Mountain (2); McFadden (1); Rawlins (2); Saratoga (3). CONVERSE CO.: Douglas (2); Glenrock (3). CROOK CO.: Hulett (1). FREMONT CO.: Fort Washakie (4); *Hudson* (6); Lander (18); Riverton (4); unknown locality (1). GOSHEN CO.: Torrington (3). HOT SPRINGS CO.: Thermopolis (5). JOHNSON CO.: Buffalo (1); Kaycee (3). LARAMIE CO.: Cheyenne (56). LINCOLN CO.: Bedford (1); Freedom (3); Kemmerer (1); *Thayne* (1). NATRONA CO.: Casper (29); *Evansville* (2); unknown locality (1). NIOBRARA CO.: Lusk (2). PARK CO.: Cody (1); Powell (1). PLATTE CO.: Guernsey (2); Wheatland (2). SHERIDAN CO.: Sheridan (7); Story (1). SUBLETTE CO.: Boulder (1); Pinedale (1). SWEETWATER CO.: Bairoil (1); Flaming Gorge (1); Green River (4). TETON CO.: Jackson (11); Moose (2); Moran (1); Snake River (1); *Wilson* (2); unknown locality (1). UINTA CO.: Evanston. (5). WASHAKIE CO.: unknown localities (2).

Additional Records (44).—CAMPBELL CO.: Rocky Point (1). CROOK CO.: 15 mi. ENE Sundance (1); Sand Creek (2). LINCOLN CO.: 8 mi. N, 2 mi. E Sage (2). TETON CO.: *Leeks Lodge* (1); *4 mi. N, 4 mi. E Moran* (1); *Two Ocean Lake* (4); Moran (1); *Jackson Hole Wildlife Park* (1); *1 mi. S Moran* (6); *1 mi. S, 3.75 mi. E Moran* (2), *1 mi. S, 4 mi. E Moran* (2); Yellowstone National Park: Mammoth Hot Springs, 18, Lake Hotel (1 USNM); Geyser Basin (1) (Miller and Allen, 1928).

Myotis septentrionalis (Trouessart)

Long (1965) noted three specimens of this monotypic species (as *M. keenii*) for the state, all from 0.5 mi. E Buckhorn, 6100 ft, Weston County. Turner (1974), working in the Black Hills of South Dakota and Wyoming, noted these same three specimens. Subsequently, Clark and Stromberg (1987) depicted records for both Crook and Weston counties. We found no specimens of the northern myotis in the WSVL material and have been unable to find a specimen associated with the Crook County record. Priday and Luce (1996) reported finding two night roosts of this species, in a mine and a building, in Crook County. In our own work (Cryan, 1997; Bogan and Cryan, unpublished data) in the southern Black Hills of South Dakota, we found *M. septentrionalis* to be mod-

erately common. However, the species appears to be uncommon in northeastern Wyoming, and additional attempts should be made to determine the status of this species in this area. The northern myotis is known to form maternity colonies in dead trees (Cryan, 1997; Sasse, 1995) and occasionally buildings (Cope and Humphrey, 1972), and forms large hibernating colonies in other parts of its range (Jackson, 1961). Van Zyll de Jong (1979) clarified the relationships among *M. keenii*, *M. septentrionalis*, and *M. evotis*, determining that each was a reproductively isolated species.

Additional Record.—WESTON CO.: 0.5 mi. E Buckhorn (3) (not mapped).

Myotis thysanodes (Miller)

We are aware of fewer than 20 specimens of the fringed myotis from Wyoming, mostly from the eastern part of the state (Fig. 4). Long (1965) did not report *M. thysanodes* from the state, and Clark and Stromberg (1987) reported the species only from eastern Wyoming. Clark and Stromberg (1987) assigned Wyoming animals to *M. t. pahasapensis*, originally thought to be restricted to the Black Hills. This race was described by Jones and Genoways (1967a) from 10 of 11 known specimens, including two from Wyoming (Weston Co.: 1.5 mi. E Buckhorn; 6 mi. N Newcastle). Specimens from elsewhere in South Dakota as well as Nebraska also have been referred to *M. t. pahasapensis* (Jones and Choate, 1978; Czaplewski et al., 1979). Boyce (1980), however, referred a specimen from Laramie, Albany Co., Wyoming, to the western and Rocky Mountain race, *M. t. thysanodes*. There is some suggestion that *M. t. pahasapensis* might be more widespread on the High Plains. Jones et al. (1987) captured two bats in Crosby Co., Texas, and, although they assigned them to nominate *M. t. thysanodes*, they noted that the male exhibited characteristics in size and color that were reminiscent of *M. t. pahasapensis*. We have examined most of the pertinent material, including the specimen from Laramie, and are of the opinion that fringed myotis from east of the Continental Divide in Wyoming represent *M. t. pahasapensis*; bats to the west (Sweetwater County) represent nominate *M. t. thysanodes*. In adjacent Montana, *M. thysanodes* is known only from the southwestern part of the state (Hoffmann et al., 1969; Worthington, 1991).

The presence of a fringe on the trailing edge of the uropatagium distinguishes this species from other Wyoming bats. From close relatives, such as *M. evotis*, which occasionally may have a microscopic fringe of hairs, it differs in lacking large, glossy, black ears. The WSVL material contained only seven fringed myotis with a nearly equal sex ratio. Females were recovered between June and September, whereas males were found in September and October. Neither sex was recovered during

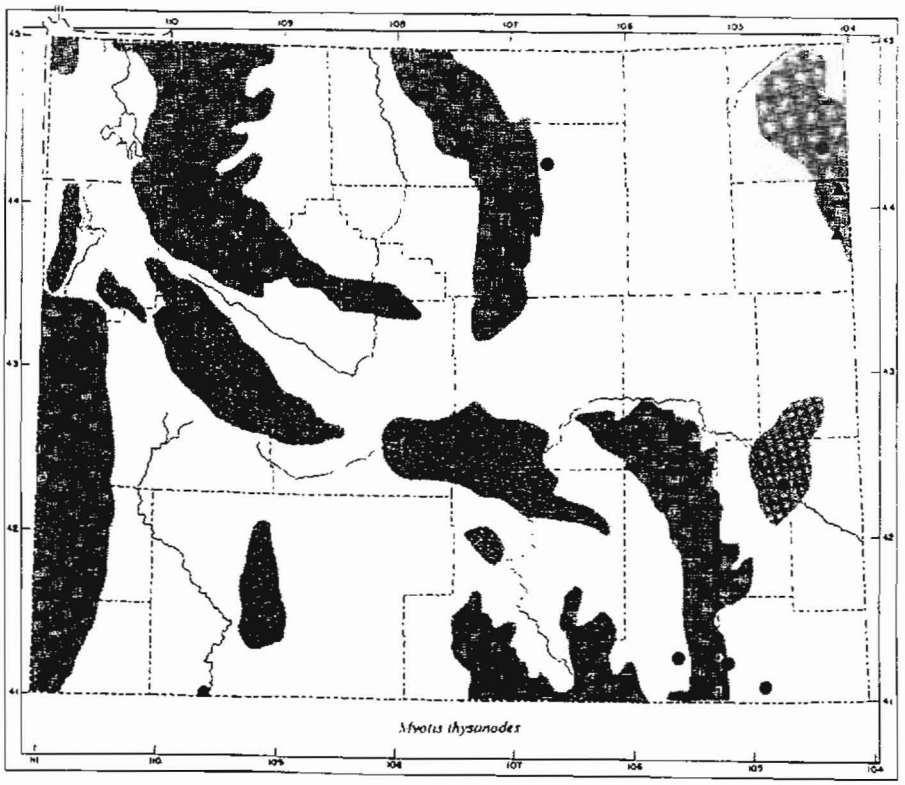

Fig. 4. Distribution map for *Myotis thysanodes* in Wyoming. Symbols and features are as in Fig. 1.

the month of August. Priday and Luce (1996) found 11 night roosts, one possible hibernaculum, and one known hibernaculum that contained three individuals in a cave in northwestern Goshen County. Maternity colonies have not been reported from Wyoming, but are known from buildings in the northern Black Hills (J. Tigner, personal communication) and trees and crevices in boulders and rock outcrops in the southern Black Hills (Cryan, 1997) of South Dakota.

Specimens Examined (13).—ALBANY CO.: Laramie (3); *UW Campus, Laramie* (1 UWYO). CROOK CO.: Sundance (1). JOHNSON CO.: Buffalo (1). LARAMIE CO.: Cheyenne (3); Table Mountain Cave, 5 mi. W Federal (1 CU). PLATTE CO.: cave near Sunrise (1 UWYO). SWEETWATER CO.: Henry's Fork 1 mi. E Manila, UT (1 UWYO); Rock Springs (1).

Discarded Specimen (1).—LARAMIE CO.: Cheyenne (1).

Additional Records (2).—WESTON CO.: *1.5 mi. E Buckhorn* (1) (Jones and Genoways, 1967a), 6 mi. N Newcastle (1) (holotype; Jones and Genoways, 1967a).

Myotis volans (H. Allen)

The long-legged myotis is the fifth most common bat in Wyoming, as determined from our WSVL sample, and is statewide in distribution (Fig. 5). Specimens from the WSVL add new county records for Uinta, Sublette, Carbon, Platte, Goshen, Sheridan, and Johnson counties. It is one of three small-eared *Myotis* that have keeled calcars (the others are *M. californicus* and *M. ciliolabrum*), and it can be distinguished from *M. lucifugus* as noted in that account. All bats of this species from Wyoming are referable to *M. v. interior*. Bogan (1999) has suggested that nominate *M. v. volans* from Baja California may be specifically distinct from bats from elsewhere and currently assigned to that species. If so, then Wyoming bats would be called *M. longicrus interior*.

This species is common at higher elevations in the summer months but there were low-elevation records, such as those from Big Horn and Sheridan counties (approx. elevations 1142-1199 m), especially at cooler times of the year. Both sexes were represented in nearly equal numbers in the WSVL sample with females recovered from May through September and males found only from June through September. The greatest number of males were recovered in July and September and the greatest number of females in June and August. Negus and Findley (1959) found this species night-roosting in a cabin in lodgepole pine forest, and pregnant females were obtained in early July. Long-legged myotis are not known to form

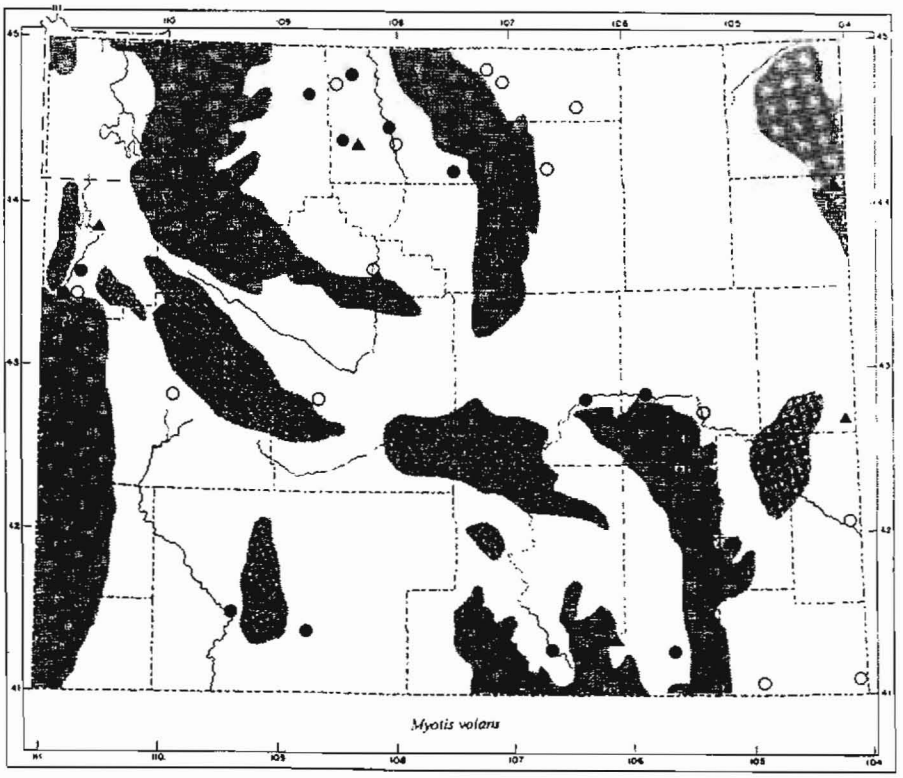

Fig. 5. Distribution map for *Myotis volans* in Wyoming. Symbols and features are as in Fig. 1.

maternity colonies in caves and mines, and extensive searches of such sites in Wyoming have revealed none (Priday and Luce, 1996). In the southern Black Hills, maternity colonies have been found in trees and rock crevices (Cryan, 1997). Findley (1954) found pregnant females in early July at Jackson Hole. Very little is known about the winter habits of this species, although small numbers hibernate in Jewel Cave, South Dakota (Choate and Anderson, 1997; Jones and Genoways, 1967b; personal observation).

Specimens Examined (36).—ALBANY CO.: Laramie (1); Squaw Peak[s, nr. Converse Co.] (1). BIG HORN CO.: 0.3 mi. E of Hyatt Ranch, Point [Paint?] Rock Creek (6); Burlington (1); Greybull (1); Lovell (3); Medicine Creek (not found) (2). CARBON CO.: 11 mi. E Riverside, waterhole near North Platte River (2). CONVERSE CO.: Glenrock (1). NATRONA CO.: Casper (6). PARK CO.: Kirwin, Golden Ridge Tunnel (not found) (2); Powell (2). SWEETWATER CO.: Green River (2); near Black Butte Mine (1); Rock Springs (3). TETON CO.: Moose (1); Wilson (1).

Discarded Specimens (68).—ALBANY CO.: Laramie (3). BIG HORN CO.: Basin (3); Byron (2); Lovell (4). CONVERSE CO.: unknown locality (1); Douglas (1); Glenrock (2). FREMONT CO.: Lander (4). GOSHEN CO.: Torrington (1). HOT SPRINGS CO.: Thermopolis (1). JOHNSON CO.: Buffalo (1). LARAMIE CO.: Cheyenne (2); Pine Bluffs (1). LINCOLN CO.: Diamondville (1). NATRONA CO.: Casper (9); unknown locality (1). PLATTE CO.: Guernsey (1). SHERIDAN CO.: Clearmont (1); Ranchester (1); Sheridan (2). SUBLETTE CO.: Pinedale (1). SWEETWATER CO.: Green River (6); Rock Springs (11). TETON CO.: Jackson (2); Moose (2); Wilson (3). UINTA CO.: Evanston (1).

Additional Records (14).—ALBANY CO.: Univ. Wyoming Sci. Camp (1). BIG HORN CO.: Otto (1) (Miller and Allen, 1928). FREMONT CO.: Lake Fork (1) (Miller and Allen, 1928). HOT SPRINGS CO.: 10 mi. S, 3 mi. E Thermopolis (1). LINCOLN CO.: Afton (1). NATRONA CO.: Rattlesnake Mtns. (1). NIOBRARA CO.: S-Bar Creek (1) (Quay, 1948); TETON CO.: Moran (1); *1 mi. S, 4 mi. E Moran* (1); *8 mi. S Moran* (3); *2 mi. N Blacktail Butte* (1). WESTON CO.: 0.5 mi. E Buckhorn (1).

Myotis yumanensis (H. Allen)

The Yuma myotis is not surely known from Wyoming. Long (1965) did not report it, but Clark and Stromberg (1987) attributed a single record from Sheridan County to *M. yumanensis*. This record is a specimen (BS/FC 10471; Sheridan Co.: Sheridan), and we have examined it, along with all large-footed, small-eared *Myotis* from northern Wyoming. Although the specimen has a fragmented skull, we believe it represents *M. lucifugus*. We are unaware of any specimens of *M. yumanensis* from elsewhere in Wyoming. We carefully scrutinized all the WSVL samples for the presence of this species and were unable to confirm its presence. Subsequent samples provided by Bob Luce of Wyoming Game and Fish Department and thought to contain *M. yumanensis* also proved to be *M. lucifugus*. Harris (1974) and Bogan et al. (1988) reported *M. yumanensis* from adjacent Uintah County, Utah, and Moffat Co., Colorado, respectively, where the species is moderately common. Jones and Genoways (1966) were among the first to refute distributional records of *M. yumanensis* in the northern Rocky Mountains and Great Plains, and we agree with them that the northern part of the range of this species is limited to the region west of the Continental Divide. Worthington (1991), working in the Pryor Mountains of Montana, did not find *M. yumanensis*, and Hoffmann et al. (1969) reported this species only from southwestern Montana. We suspect that, eventually, *M. y. yumanensis* will be shown to have a distribution in Wyoming much like that of *M. californicus*, in which it is restricted to the southwestern corner of the state, including Sweetwater County.

Lasiurus borealis (Müller)

The monotypic eastern red bat is uncommon in Wyoming, probably because it is at the western margin of its range (Fig. 6). Long (1965) reported a single occurrence, that from Laramie Peak, originally reported by Allen (1864). According to Long (1965), that specimen no longer can be found. Stromberg (1982) reported two specimens from earlier WSVL material, one a female with four embryos. We also examined a specimen from Thermopolis found by Bob Luce. In adjacent South Dakota, records of *L. borealis* are uncommon (Turner, 1974); since 1993 we have netted only three *L. borealis* (two males, one female) in extreme western South Dakota (Mattson, 1994; Bogan and Cryan, unpublished data). The development of riparian vegetation along prairie streams that now flow perennially rather than seasonally may be contributing to the apparent recent increase in records of this species. Eastern red bats are migratory (Jones et al., 1983) although we have no information on seasonal occurrence in the state. Baker et al. (1988) and Morales and Bickham (1995) have shown that eastern red bats are genetically separate from western red bats, now assigned to the species *L. blossevillii*.

Specimens Examined (3).—ALBANY CO.: Laramie (1). CARBON CO.: Rawlins (1). HOT SPRINGS CO.: Thermopolis (1, Bob Luce, WGFD).

Additional Record (1).—ALBANY CO.: Laramie Peak (Long, 1965).

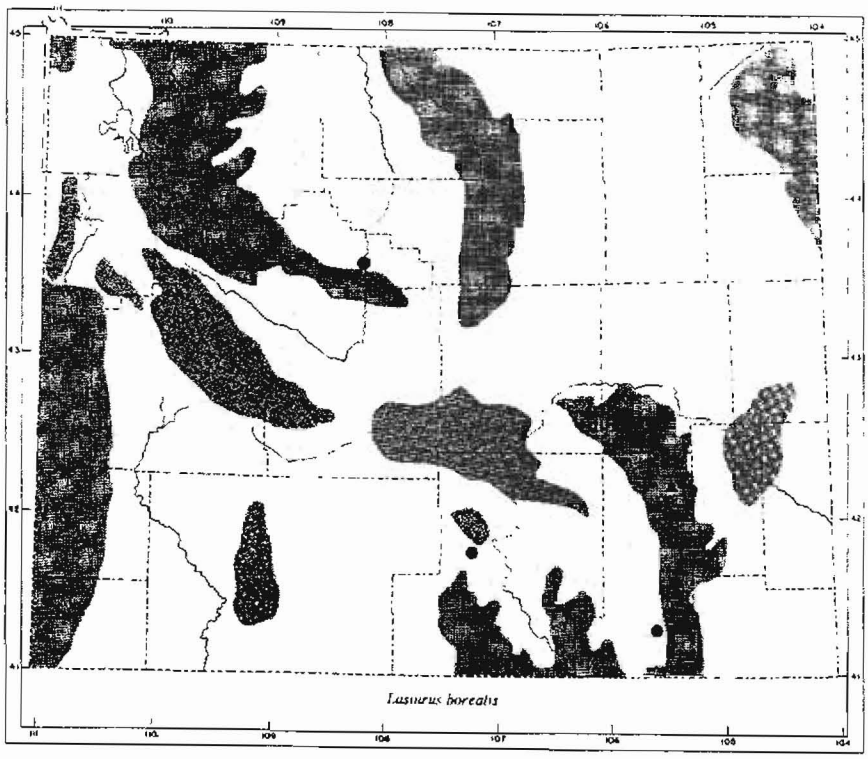

Fig. 6. Distribution map for *Lasiurus borealis* in Wyoming. Symbols and features are as in Fig. 1.

***Lasiurus cinereus* (Palisot de Beauvois)**

The hoary bat occurs virtually statewide in Wyoming (Fig. 7). We are aware of records from all counties except for Uinta, Sublette, Johnson, Carbon, Crook, Niobrara, and Goshen. Among records from the WSVL, this is the sixth most common bat. Findley and Jones (1964) discussed the seasonal occurrence of hoary bats in North America and noted that most females migrate north and spend the summer in the East, where they give birth and rear young. Males, in contrast, tend to be summer residents in much of the West, typically at higher elevations. Interestingly, nearly equal sex ratios were represented in the WSVL sample. Negus and Findley (1959) did not capture or record this species in Jackson Hole but noted a specimen from Leigh Lake, Grand Teton National Park. These bats tend to roost solitarily in trees and give birth to multiple young in June or early July (Bogan, 1972). In the WSVL samples, females were recovered from May through October and males from July through October. The absence of seasonally bimodal peaks of recovery suggests no detectable mortality associated with migratory movements through the state (e.g., Constantine, 1967). North American hoary bats are assigned to *L. c. cinereus* (Hall, 1981).

Specimens Examined (13).—ALBANY CO.: Laramie, University of Wyoming (1 UWYO), Squaw Peak[s, nr. CONVERSE CO.] (1). FREMONT CO.: Shoshoni (1). HOT SPRINGS CO.: Thermopolis (1). LARAMIE CO.: Cheyenne (2). LINCOLN CO.: Kemmerer (1). NATRONA CO.: Casper (2). SWEETWATER CO.: Alkali Draw (1 UWYO); Rock Springs (1). TETON CO.: Death Canyon, Jackson Hole Wildlife Park (1 UWYO). WASHAKIE CO.: Worland (1).

Discarded Specimens (32).—ALBANY CO.: Laramie (1). BIG HORN CO.: Lovell (1). CAMPBELL CO.: Gillette (1). CONVERSE CO.: Glenrock (1). FREMONT CO.: Riverton (1). HOT SPRINGS CO.: Thermopolis (2). LARAMIE CO.: Cheyenne (8). NATRONA CO.: Casper (8). PARK CO.: Powell (1). PLATTE CO.: Guernsey (1). SHERIDAN CO.: Sheridan (3). SWEETWATER CO.: Green River (1); Rock Springs (1). WASHAKIE CO.: Worland (1). WESTON CO.: Newcastle (1).

Additional Records (3).—CAMPBELL CO.: 3 mi. N, 7.5 mi. W Spotted Horse (1); NW side of Middle Butte, 38 mi. S, 19 mi. W Gillette (1). TETON CO.: Leigh Lake, Grand Teton National Park (Negus and Findley, 1959) (1).

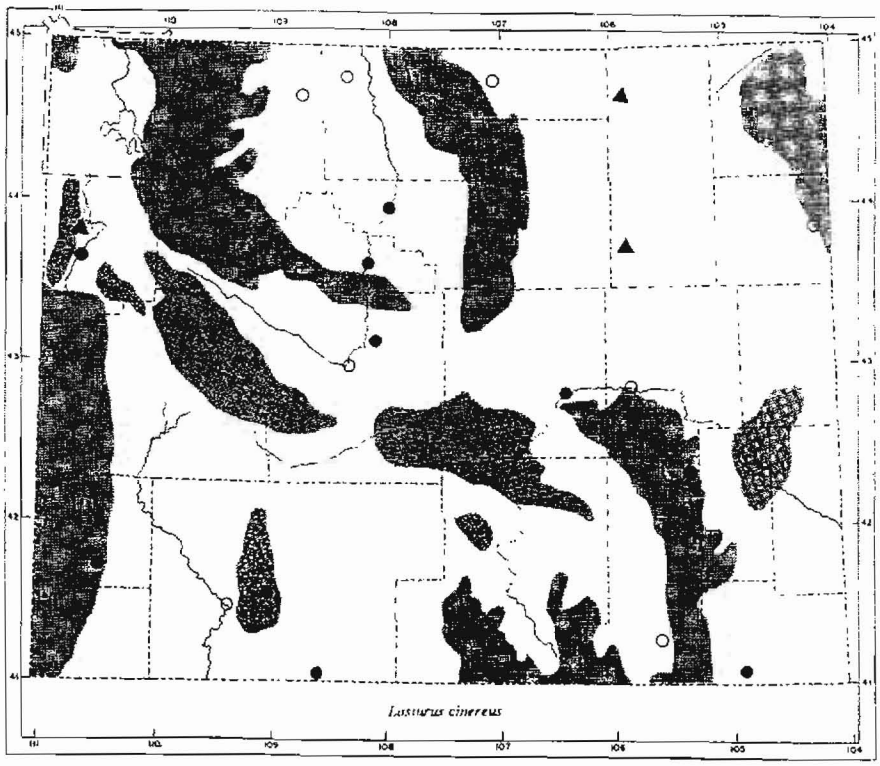

Fig. 7. Distribution map for *Lasiurus cinereus* in Wyoming. Symbols and features are as in Fig. 1.

Lasionycteris noctivagans **(Le Conte)**

The silver-haired bat is the third most commonly recovered species in the WSVL sample and is known statewide except for Campbell and Sublette counties (Fig. 8). In the Black Hills of South Dakota, females of this species form small colonies in cavities in ponderosa pines whereas males roost solitarily under the bark of pines (Mattson et al., 1996). In their work on mammals of Jackson Hole, Negus and Findley (1959) noted that they shot a silver-haired bat along the Gros Ventre River in a cottonwood-willow community on 11 August. The occurrence of this species in the WSVL records appears strongly tied to times of migratory flights, particularly in urban areas such as Cheyenne (Specimens examined; see also Clark and Stromberg, 1987). Among animals that could be identified to sex (about half), females represented 61% of the total number recovered and exhibited a strongly bimodal distribution in recovery date; 32% recovered from April through June, none in July, and 56% in September. Males likewise display a peak of recovery in September, but there were only two recoveries before August. The seasonal (bimodal) peaks in recovery dates in this species suggest mortality associated with spring and autumn movements through the state (e.g., Constantine, 1967), probably due to extreme periods of cold or inclement weather. There is the possibility that tree plantings in low-elevation urban areas provide "stopover" sites for this species during migration. In turn, bats are probably more likely to be recovered in such urban areas. The presumed migratory habits of this species are not well known; Kunz (1982) summarized evidence suggesting that, in the spring, the range shifts to the north and, in the autumn, to the south, with females moving farther than males. One silver-haired bat from Wyoming was recovered on 13 January from Cheyenne; this species may overwinter in parts of its range (Dorward et al., 1977; Izor, 1979; Perkins et al., 1990). Subspecies are not recognized in *L. noctivagans*.

Specimens Examined (43).—ALBANY CO.: Laramie (3). BIG HORN CO.: Greybull (1). CONVERSE CO.: Glenrock (1); Shawnee (1). CROOK CO.: Sundance (1). HOT SPRINGS CO.: Thermopolis (1). JOHNSON CO.: Kaycee (1). LARAMIE CO.: Burns (1); Cheyenne (22); Warren Air Force Base (3). NATRONA CO.: Casper (2). PARK CO.: 20 mi. WSW Meeteetsee (1 UWYO). SHERIDAN CO.: Dayton (1); Sheridan (1). SWEETWATER CO.: Rock Springs (2). TETON CO.: Wilson (1).

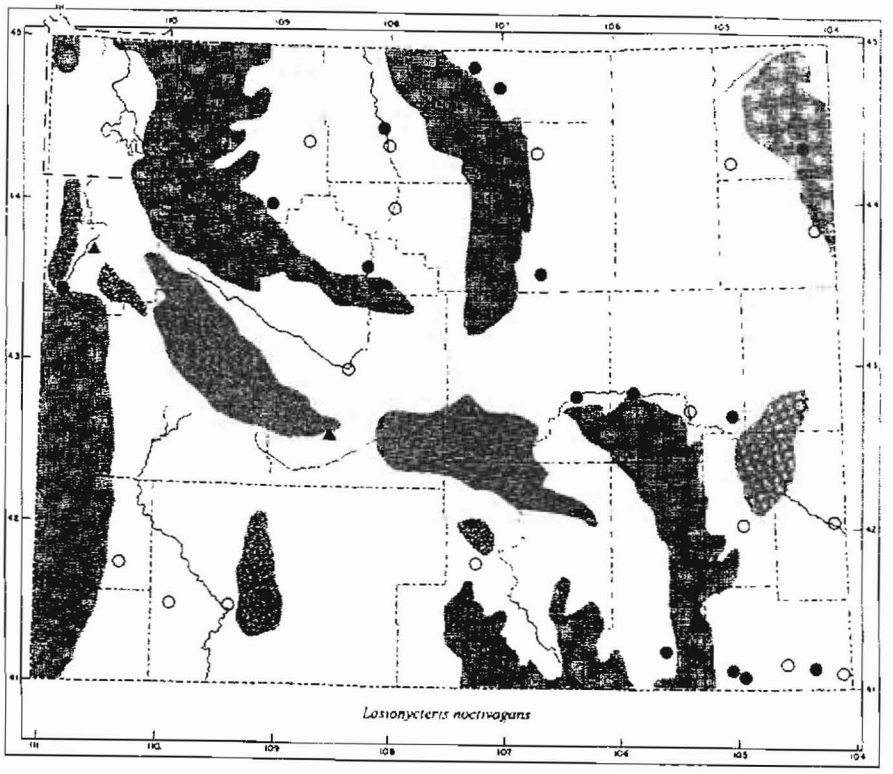

Fig. 8. Distribution map for *Lasionycteris noctivagans* in Wyoming. Symbols and features are as in Fig. 1.

Discarded Specimens (202).—ALBANY CO.: Laramie (10). BIG HORN CO.: Basin (3); Greybull (1). CARBON CO.: Rawlins (1). CONVERSE CO.: Douglas (1). CROOK CO.: Moorcroft (1). FREMONT CO.: Riverton (1). GOSHEN CO.: Torrington (1). HOT SPRINGS CO.: Thermopolis (3). JOHNSON CO.: Buffalo (1). LARAMIE CO.: Cheyenne (123); Hillsdale (1); Pine Bluffs (1). LINCOLN CO.: Opal (1). NATRONA CO.: Casper (16); unknown locality (1). NIOBRARA CO.: Lusk (1). PARK CO.: Powell (3); unknown locality (1). PLATTE CO.: Wheatland (2). SHERIDAN CO.: Sheridan (2). SWEETWATER CO.: Green River (8); Little America (1); Rock Springs (13).TETON CO.: Wilson (1). UINTA CO.: Evanston (2). WASHAKIE CO.: Worland (1). WESTON CO.: Newcastle (1).

Additional Records (3).—FREMONT CO.: South Pass City (1). NATRONA CO.: Split Rock (1). TETON CO.: Gros Ventre River (Negus and Findley, 1959) (1).

Pipistrellus subflavus (F. Cuvier)

The eastern pipistrelle, previously unknown from Wyoming, was first discovered in 1996 in a natural cave in northern Goshen County (Priday and Luce, in litt.; distribution in Wyoming not mapped). During a visit in February, one male was found and retained as a voucher specimen (Denver Museum of Natural History 8510); on a subsequent visit in March, two more individuals were found. All three bats were roosting solitarily and appeared to be hibernating. Other species found in the cave were *M. thysanodes* and *M. lucifugus*. The nearest published record of which we are aware is a specimen from Greeley, Colorado (Fitzgerald et al., 1994). Whether eastern pipistrelles have always been in Wyoming or whether they have followed riparian vegetation westward more recently is unknown. The subspecies in Wyoming is presumably *P. s. subflavus*.

We are aware of no records for the western pipistrelle, *P. hesperus*, in Wyoming, although it has been taken in small numbers in adjacent Moffat Co., Colorado (Bogan et al., 1988). We expect that further work in southwestern Wyoming will reveal the presence of this species.

Eptesicus fuscus (Schreber)

The big brown bat was the second-most abundant species in the WSVL samples, and records were from throughout the state (Fig. 9). Maternity colonies commonly are found in association with human habitations, although they also are known from a variety of other structures including rock crevices, caves, mines, and

trees (Barbour and Davis, 1969). Priday and Luce (1996) found eight small groups (n = 1-27) of hibernating *E. fuscus* in caves and mines in the southeastern and north-central regions of the state, as well as a maternity colony (n = 53) in a building in Big Horn County. The subspecies occurring in the state is *E. f. pallidus* (Hall, 1981; Burnett, 1983); Choate et al. (1986) demonstrated that size and color in this species do not vary concordantly. We note here that Koopman (1989, 1994; but not Koopman, 1993) suggested that North American bats of this species should be known by the name *E. serotinus*, rather than the more traditional *E. fuscus*. We further note that most authors (e.g., Jones et al., 1997) continue to use *E. fuscus* without acknowledging the alternative suggested by Koopman (1989, 1994).

Females were slightly more common than males among specimens identified to sex and exhibited a slightly greater temporal distribution in recovery than males (females, April through October; males, May through September). Both sexes exhibited a peak of maximum number recovered in August, which may be associated with juvenile mortality although our data do not establish that fact. There were records for single males in both January and February.

Specimens Examined (65).—BIG HORN CO.: 12 mi. E and 0.5 mi. S of Cowley (1); Basin (1); Greybull (7); Little Spring, Little Mountain (5); Lovell (4); Paint Rock (1). CONVERSE CO.: Douglas, State Fair Grounds (1). LARAMIE CO.: Cheyenne (26). NATRONA CO.: Casper (1). PARK CO.: Powell (1). PLATTE CO.: Wheatland (1). SHERIDAN CO.: Beckton (1); Sheridan (1). SWEETWATER CO.: Green River (1); Rock Springs (7); unknown locality (1). UINTA CO.: Evanston (1). WASHAKIE CO.: Worland (3).

Discarded Specimens (269).—ALBANY CO.: Laramie (1). BIG HORN CO.: Basin (19); Burlington (4); Cowley (1); Greybull (2); Lovell (9); Frannie (1). CONVERSE CO.: Glenrock (7). FREMONT CO.: Ethete (2); Fort Washakie (1); Hudson (3); Lander (12); Riverton (8). GOSHEN CO.: Fort Laramie (1); Torrington (3). HOT SPRINGS CO.: Thermopolis (14). JOHNSON CO.: Buffalo (2). LARAMIE CO.: Cheyenne (47); Hillsdale (1); Pine Bluffs (3); Warren Air Force Base (1). LINCOLN CO.: Freedom (1). NATRONA CO.: Casper (22). NIOBRARA CO.: Lusk (1). PARK CO.: Meeteetsee (1); Powell (9). PLATTE CO.: Wheatland (1). SHERIDAN CO.: Big Horn (1); Sheridan (25). SWEETWATER CO.: Green River (12); Rock Springs (26); Thayer Junction (1). TETON CO.: Jackson (2); Triangle X Ranch (1). WASHAKIE CO.: Worland (20). WESTON CO.: Newcastle (4).

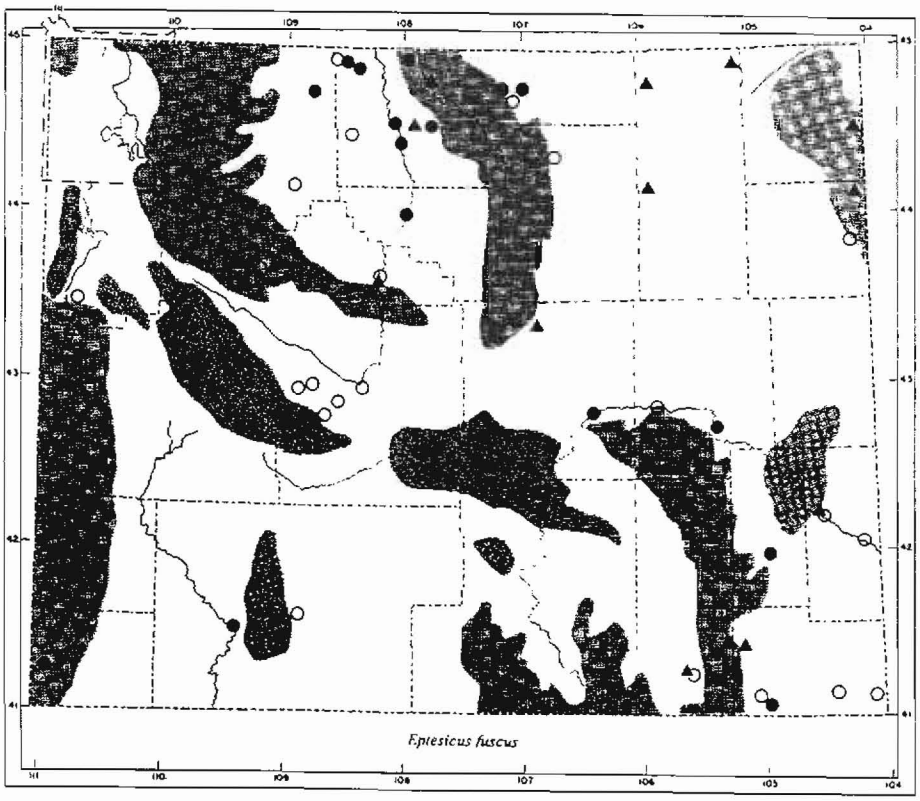

Fig. 9. Distribution map for *Eptesicus fuscus* in Wyoming. Symbols and features are as in Fig. 1.

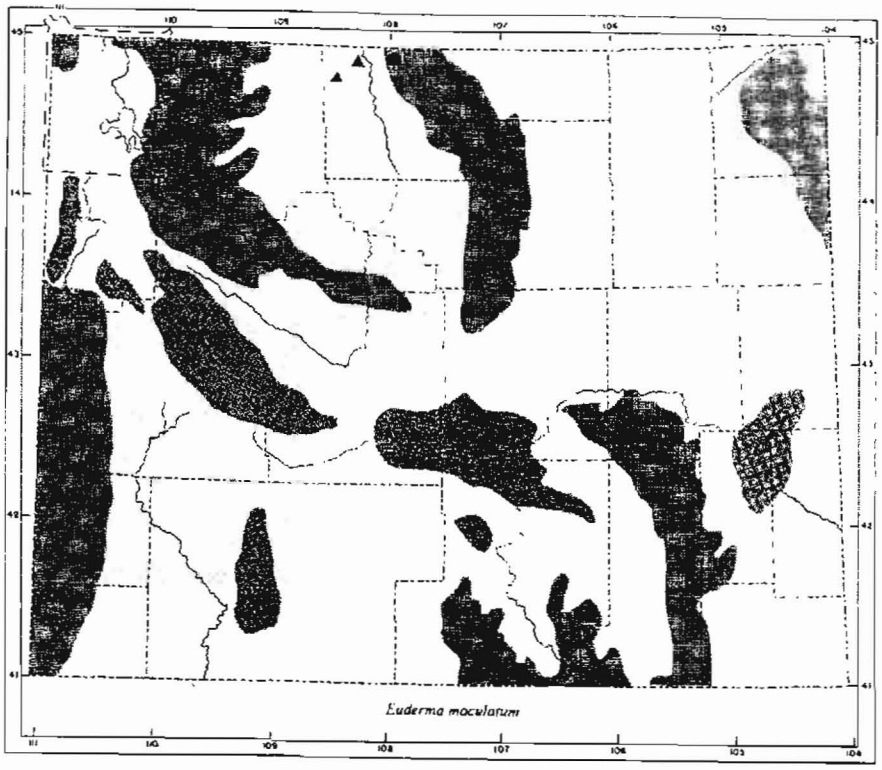

Fig. 10. Distribution map for *Euderma maculatum* in Wyoming. Symbols and features are as in Fig. 1.

Additional Records (31).—ALBANY CO.: Laramie (1). BIG HORN CO.: Shell Creek, 1mi. NW Shell (2). CAMPBELL CO.: 0.5 mi. S Rocky Point (9); 3 mi. N, 7.5 mi. W Spotted Horse (2); NW side Middle Butte, 38 mi. S, 19 mi. W Gillette (1). CROOK CO.: Sand Creek (1). GOSHEN CO.: Fort Laramie (1). HOT SPRINGS CO.: 9 mi. S, 2 mi. E Thermopolis (1). LARAMIE CO.: Horse Creek, 6.5 mi. W Meriden (8). NATRONA CO.: 27 mi. N, 1 mi. E Powder River (1). SHERIDAN CO.: 38 mi. E Lovell (3). WESTON CO.: 1.5 mi. E Buckhorn (1).

Euderma maculatum (J. A. Allen)

For many years, the spotted bat was thought to be absent or uncommon in the state. The first record was that of an individual captured in a warehouse in Byron (Mickey, 1961). Subsequently, a live bat was photographed at the headquarters of the Bighorn Canyon National Recreation Area near Lovell (Clark and Stromberg, 1987). In 1990, one of us (MAB) helped capture two spotted bats in mist nets on Little Mountain plateau, about 19.3 km northeast of Lovell. That this species would occur statewide in suitable habitat is suggested by the captures of multiple individuals to the south in adjacent Moffat County, Colorado (Bogan, personal observation; Fig. 10). Indeed, Priday and Luce (1999) heard audible calls of this species (30 occasions) and captured three individuals at 10 different locations, mostly in northern Wyoming; one call was heard in Sweetwater County. These bats are known to roost in cracks and crevices in high cliffs throughout their range in a wide variety of habitats (Easterla, 1970; Watkins, 1977; Leonard and Fenton, 1983). Their perceived rarity in mistnet samples may be due to their propensity to forage for long periods well above the ground (e.g., up to 15 m, Wai-Ping and Fenton, 1989). Winter habits are unknown although there are multiple records from southwestern Utah in January and February (Ruffner et al., 1979). Best (1988) found considerable geographic variation in *Euderma* but did not delineate subspecies. There were no spotted bats among our samples from the WSVL; rabies-positive individuals have been reported from elsewhere, however (Constantine, 1979).

Specimens Examined (2).—BIG HORN CO.: Little Spring, Little Mountain (2).

Additional Records (2).—BIG HORN CO.: Byron, 4020ft. (1 UWYO), Big Horn Canyon National Recreation Area headquarters (photograph; Clark and Stromberg, 1987).

***Corynorhinus townsendii* (Cooper)**

Townsend's big-eared bat likely occurs statewide (Fig. 11). The WSVL material contained specimen records for Yellowstone National Park and Albany, Big Horn, Converse, Crook, Platte, Hot Springs, and Sweetwater counties. Priday and Luce (1996) found three maternity roosts, 37 hibernacula, and 47 "summer" roosts at 66 different sites, all of which were caves, mines, or rock shelters. The species also is known to use buildings as maternity roosts (Cryan, 1997). Counties of roost occurrence included Albany, Big Horn, Carbon, Converse, Fremont, Goshen, Hot Springs, Johnson, Park, Platte, Sheridan, and Washakie (Priday and Luce, 1996). Most *C. townsendii* observed by Priday and Luce were solitary individuals or small groups; maternity colonies ranged from 27 to 200 bats. Although we are unaware of any data on population trends for this species in Wyoming, it is a species of concern here, as elsewhere in the West. Individual *C. townsendii* often roost in relatively exposed locations and seem to be very susceptible to disturbance; great care should be taken in or near such colonies (see, for example, Humphrey and Kunz, 1976). Numbers of hibernating bats found by Priday and Luce (1996) generally were small, and the largest colony numbered only 49. The largest hibernating colony near Wyoming of which we are aware is in Jewel Cave, South Dakota; recent winter censuses there have estimated around 800 wintering *Corynorhinus* in the cave (Cryan, personal observation; M. Curtin, in litt.). In the Badlands of South Dakota, small numbers of this species seem to be fairly common in summer (Bogan et al., 1996a).

Several recent studies (e.g., Frost and Timm, 1992; Tumlison and Douglas, 1992) have suggested the name *Corynorhinus*, formerly used as a subgenus for North American *Plecotus*, should be elevated once again to generic status, and we follow this usage here. Anthony and Kitchen (1976) found Wyoming individuals of this species to be very similar chromosomally to populations studied from Arizona, New Mexico, and Utah, all of which are assigned to *C. t. pallescens*. Only two individuals (both female) of this species were in the WSVL material we examined, and one of those tested positive for rabies. The infected bat was found in October and the non-infected bat in September.

Specimens Examined (13).—ALBANY CO.: 10 mi. E top of Laramie Peak, Shaw Canyon on Cottonwood Creek (1 UWYO). CONVERSE CO.: Carenther's Cave, 17 mi. SW Douglas (1 UWYO); 18 mi. SW Douglas (1 UWYO); *8 mi. S Douglas* (1 UWYO). PLATTE CO.: Guernsey (1 UWYO); *2 mi. E Guernsey* (5 UWYO); *10 mi. N Guernsey* (1 UWYO); *Sunrise* (1 UWYO); Wheatland (1 UWYO). SWEETWATER CO.: Rock Springs (1).

Discarded Specimen (1).—HOT SPRINGS CO.: Thermopolis (1).

Additional Records (19).—BIG HORN CO.: 25 mi. NE Greybull (1) (Handley, 1959). CROOK CO.: Sand Creek (10). PLATTE CO.: 25 mi. NW Wheatland (2); Yellowstone National Park: Mammoth Hot Spring (6).

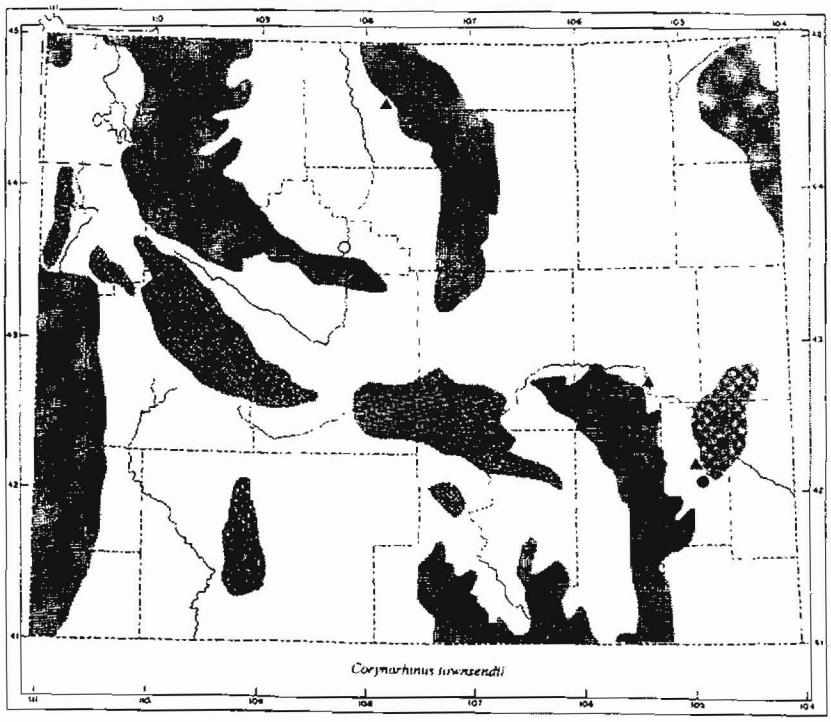

Fig. 11. Distribution map for *Corynorhinus townsendii* in Wyoming. Symbols and features are as in Fig. 1.

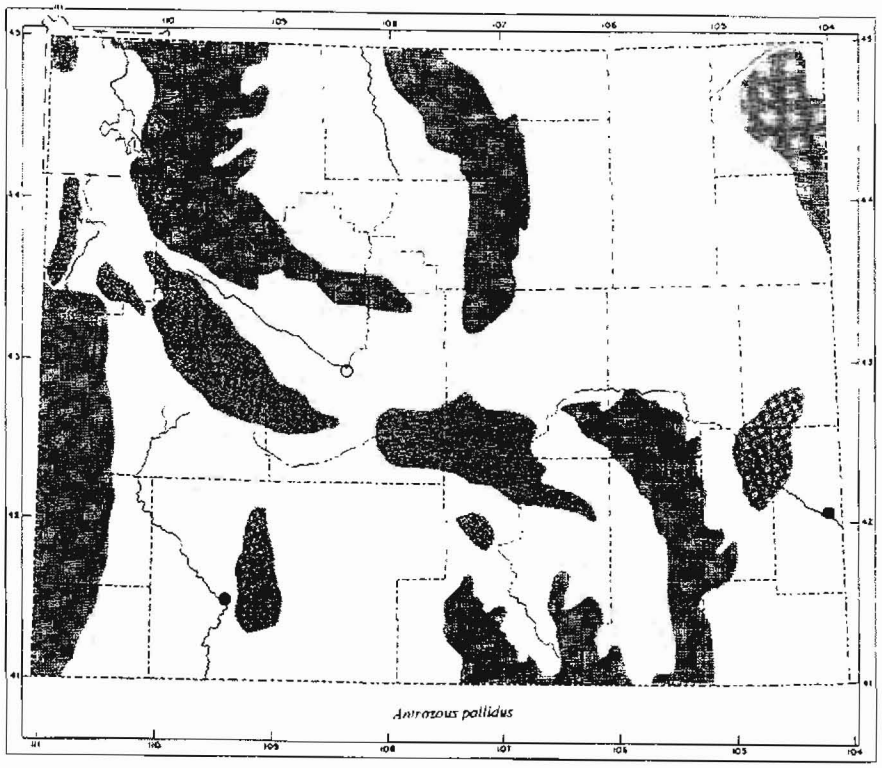

Fig. 12. Distribution map for *Antrozous pallidus* in Wyoming. Symbols and features are as in Fig. 1.

***Antrozous pallidus* (Le Conte)**

This large and unique bat has an interesting distribution in Wyoming (Fig. 12). That the pallid bat should occur in Sweetwater County is not surprising, as they are known to occur in adjacent Moffat County, Colorado (Bogan et al., 1988). However, the presence of a small colony in Torrington, Goshen County (Stromberg, 1982; Clark and Stromberg, 1987), is surprising as there are no other records from the northern High Plains. We suspect that the species is either more widespread than presumed or occurs as isolated populations in Wyoming. Interestingly, Worthington (1991) reported pallid bats from the Pryor Mountains in south-central Montana. These bats are known to feed on ground-dwelling arthropods and usually roost colonially, often in shallow caves or rock shelters; females typically give birth to twins (Manning et al., 1987). Populations in Wyoming presumably belong to *A. p. pallidus*, although the Torrington animals should be compared with the Great Plains subspecies *A. p. bunkeri*. In the WSVL sample, females were taken from July through September, peaking in August; they outnumbered males, which were found in equal numbers during July and August.

Specimens Examined (13).—GOSHEN CO.: Torrington (4). SWEETWATER CO.: Green River (2); Rock Springs (7).

Discarded Specimens (2).—FREMONT CO.: Riverton (1). SWEETWATER CO.: Green River (1).

Additional Specimen (1).—HOT SPRINGS CO.: unknown locality (Bob Luce, in litt.; not mapped).

***Tadarida brasillensis* (I. Geof. St.-Hilaire)**

Were it not for the samples forwarded to the WSVL and subsequently identified by knowledgable biologists, the Brazilian free-tailed bat would be unreported from Wyoming (Fig. 13). The first known record was reported by Stromberg (1982) in earlier material from WSVL. That individual came from F. E. Warren Air Force Base in Cheyenne. Subsequently, two females were recovered from Big Horn and Sublette counties. The records reported here are the northernmost known for *T. brasiliensis* (Hall, 1981) in the Rocky Mountains and High Plains. The records may be attributed to wandering individuals, or they may represent still-undiscovered colonies in the state. Females of this species typically roost in large colonies in caves or mines (as at Carlsbad Caverns, New Mexico), whereas males may occur in smaller colonies or as solitary individuals.

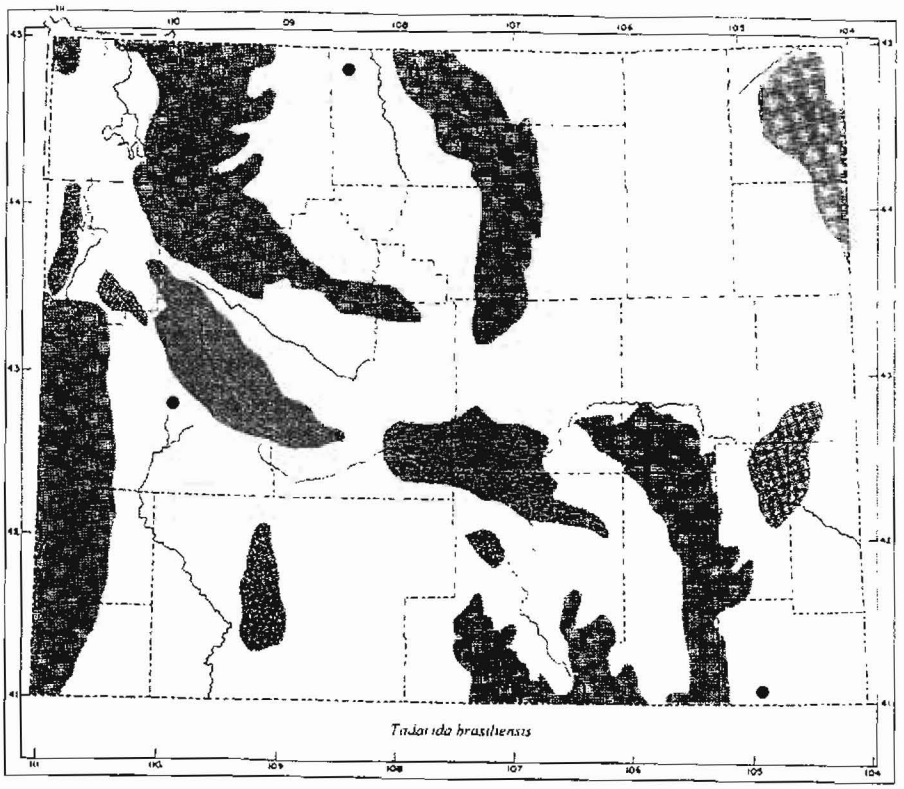

Fig. 13. Distribution map for *Tadarida brasiliensis* in Wyoming. Symbols and features are as in Fig. 1.

The nearest large colony known to us is in an abandoned mine in the Sangre de Cristo Mountains, above the San Luis Valley of Colorado (Armstrong et al., 1994). Of the two females found in June and August and submitted to WSVL for examination, neither tested positive for rabies. The subspecies in Wyoming is *T. b. mexicana*.

Specimens Examined (3).—BIG HORN CO.: Cowley (1). LARAMIE CO.: Cheyenne (1). SUBLETTE CO.: Pinedale (1).

Nyctinomops macrotis (Gray)

The first record for this monotypic species in Wyoming is a male from West Gros Ventre Butte. There are scattered and widespread records of the big free-tailed bat from the western United States; the nearest published record is that from Grand Junction, Colorado (Hall, 1981). Breeding colonies are known from northern New Mexico (Constantine, 1961; Bogan et al., unpublished data) and southeastern Utah (Bogan, unpublished data). So far as known, these bats roost in cracks and crevices in high cliffs. There were no records of this species among bats submitted for analysis to the WSVL.

Specimen Examined.—TETON CO.: West Gros Ventre Butte, 6168 ft, 1 mi. N, 3 mi. W Jackson (1) (not mapped)

RESULTS AND DISCUSSION

Geographic Distribution.—Known changes in the species richness of bats in Wyoming since Clark and Stromberg (1987) include the deletion of one species--*M. yumanensis,* for which no definitive proof of occurrence exists at present—and the addition of two species—*P. subflavus* in eastern Wyoming and *N. macrotis* in the Northwest. This brings the known bat fauna to a total of 17 species. We suspect that *M. yumanensis* and *P. hesperus* eventually will be found in southwestern Wyoming, making a total of 19 species for the state.

Bat species are not uniformly distributed in Wyoming. Two species (*M. californicus* and *A. pallidus*) have distributions that are mostly restricted to the southwestern corner of the state, and two more species (*M. yumanensis* and *P. hesperus*) may yet be found in the southwestern corner of Wyoming. All four of these species are relatively common farther south, for example in Moffat County, Colorado, and Uintah Co., Utah, and represent species that are wide-ranging in the western United States. There is one intriguing record of *A. pallidus* from

southeastern Wyoming (Torrington) that deserves further study. The only record for *N. macrotis* is from northwestern Wyoming at a site that seems suitable although more information is needed on the occurrence of this species. Several other species (*M. septentrionalis*, *M. thysanodes*, *L. borealis*, and *P. subflavus*) are limited primarily or exclusively to the eastern part of the state, and except for *M. thysanodes*, are species of eastern affinities. We suspect that additional work will result in captures of the fringed myotis statewide (e.g., Priday and Luce, 1996). The remaining 10 species appear, on the basis of specimens or other evidence, to be essentially statewide in distribution These 10 represent species with nearly continent-wide distributions (*M. lucifugus, L. cinereus*, *L. noctivagans*, *E. fuscus*, *C. townsendii*, and *T. brasiliensis*) or species with western affinities (*M. ciliolabrum*, *M. evotis*, *M. volans*, *E. maculatum*).

Five species in Wyoming are presumed to be migratory: *L. borealis*, *L. cinereus*, *L. noctivagans*, *T. brasiliensis*, and *N. macrotis*. *L. borealis* is known to be migratory (Jones et al., 1983), although the precise wintering grounds of Wyoming bats are unknown. Presumably, they are in the southern and southeastern parts of the United States. Findley and Jones (1964) documented migratory patterns in *L. cinereus*, and our data show occurrence of this species only from May through October. Recoveries of hoary bats peak in July (n = 13) and August (11), with smaller numbers of both sexes recovered through October. Only females were recovered in May and June; otherwise, sex ratios were about equal in animals in which sex could be determined. Thus, both species appear to be resident throughout summer in the state and may be more prone to recovery in summer, but they seem to exhibit no mortality that is tied to migratory flights (e.g., Constantine, 1967). *L. noctivagans* is migratory (Jones et al., 1983), and recoveries appear to track movements through the state with greater numbers recovered in spring (April-May, n = 26) and especially in fall (September-November, 172, or 73% of total recoveries). Such a pattern suggests mortality tied to migration (Constantine, 1967), perhaps due to inclement weather. The other presumed migratory species in Wyoming are both molossids (*T. brasiliensis* and *N. macrotis*), but too little information is available on them to comment further. All other species in Wyoming likely are resident throughout the year with animals moving only short distances from summer to winter quarters. For example, Priday and Luce (1996) have documented the occurrence of seven species in hibernacula: *M. ciliolabrum*, *M. evotis*, *M. lucifugus*, *M. thysanodes*, *E. fuscus*, *P. subflavus*, and *C. townsendii*.

Table 1. *Numbers of bats submitted by year to Wyoming State Veterinary Laboratory and made available for this study.*

Species	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	TOTAL
M. californicus	0	0	0	0	2	0	3	0	1	0	2	0	1	0	9
M. ciliolabrum	1	0	8	19	9	1	5	0	8	9	26	8	20	25	139
M. evotis	0	0	2	1	3	0	5	0	3	3	6	3	1	2	29
M. lucifugus	2	0	13	37	39	3	59	0	37	49	59	9	15	43	365
M. thysanodes	0	0	0	0	0	0	0	0	2	1	1	0	2	1	7
M. volans	0	8	4	8	19	4	12	0	7	15	9	5	3	12	106
L. cinereus	0	0	3	1	4	1	11	0	2	9	7	0	4	0	42
L. noctivagans	0	0	8	21	23	34	39	1	22	27	28	0	9	23	235
E. fuscus	0	0	28	20	10	6	26	0	49	52	63	7	32	35	328
C. townsendii	0	0	0	0	0	0	1	0	1	0	0	0	0	0	2
A. pallidus	0	0	5	2	0	0	2	0	3	3	0	0	0	0	15
T. brasiliensis	0	0	1	0	0	0	1	0	0	1	0	0	0	0	3
TOTAL	3	8	72	109	109	49	164	1	135	169	201	32	87	141	1280

Relative Abundance.—The most common bat species in the WSVL sample are *M. lucifugus*, *E. fuscus*, *L. noctivagans*, *M. ciliolabrum*, and *M. volans* (Table 1). The first two of these species are known to roost in buildings and a high frequency of occurrence in WSVL samples might be predicted. Recoveries of *L. noctivagans* are strongly skewed by fall samples from Cheyenne and other towns where these bats may be using trees in urban areas as roosts. However, the other two species, although known to use buildings occasionally, probably are more prone to use natural structures (e.g., trees, rocks, cliffs) as roosting sites and their abundance in the sample suggests to us that they are relatively common in the state. Seven species of bats in the state were recovered less commonly (n = 2 - 42 individuals), and five species (*M. septentrionalis*, *L. borealis*, *P. subflavus*, *E. maculatum*, and *N. macrotis*) were not found in the WSVL samples. Of 936 animals for which we could determine sex, 544 (58%) were female (*cf.* Kurta and Matson, 1980).

We examined the relationship between concentrations of people and numbers of bats recovered, by county, and found a statistically significant correlation (Fig. 14; $r = 0.79$, $p < 0.01$), suggesting that the more populous the county the more likely the possibility that bats would be recovered.

The most populous county (Laramie; 73,142) led the state in recoveries (339) in our sample, followed by Natrona (61,226; 112 bats). Only two counties fell outside the general cloud of points: Sweetwater County (38,823; 173 bats) in the southwestern part of the state and Big Horn County (10,525; 194 bats) in the northcentral part. Both these counties accounted for many more recoveries than would be predicted based on population size alone. Reasons for this are unknown, but there is the possibility that bats are more common in these counties because there is more available habitat (*sensu* Humphrey, 1975). Alternatively, residents of these counties may be more inclined to recover and submit bats, residents may be outside to a greater extent, or human population flow through the area may be greater (e.g., tourism).

There also was a relationship between number of bats recovered per county and the numbers of species recovered in the county ($r = 0.69$, $p < 0.01$), suggesting that the greater the number of individual bats recovered, the greater the number of species within that sample. Within the WSVL sample, Sweetwater County led the state in species richness (11 species), followed by Laramie and Big Horn (9), Fremont and Hot Springs (8), and Natrona, Sheridan, and Converse (7 each). Again, we suspect that factors other than just population size are contributing to the observed relationship. For example, Humphrey (1975) showed a relationship between degree of physical structure in the environment, a possible index of availability of roosting sites, and bat species richness.

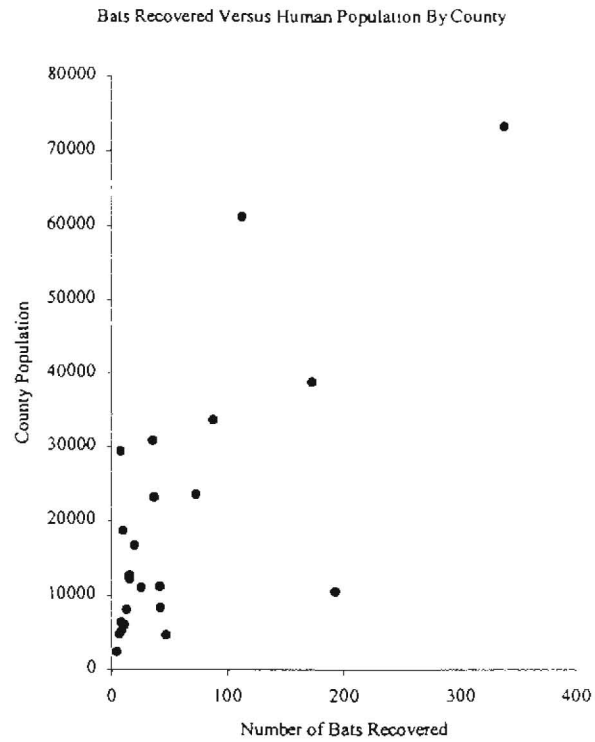

Fig. 14. Numbers of bats recovered and submitted to Wyoming State Veterinary Laboratory as a function of human population size in counties in Wyoming. Population size taken from the Rand McNally Road Atlas for 1995 (Skokie, Illinois).

Rabies Incidence.—We were able to examine the records of the WSVL for the years 1981 through 1989, years that included all but 270 bats of the total that we examined. During those years, WSVL received 18 to 295 bats per year ($\bar{x} = 194$) and tested a total of 1746 bats for rabies (of which we examined about 1021). Data were missing for the second half of 1981 and the first half of 1982. Out of 1746 bats submitted for examination, 113 tested positive for rabies (mean = 6.5%; range 3.5% - 10.8%/yr, Table 2). The mean overall infection rate of bats submitted to the WSVL is lower than previously reported rates in California, Arizona, New Mexico, Colorado, and Kansas (Armstrong et al., 1994; Birney and Rising, 1967; Constantine, 1967).

We examined 45 of the 113 rabies-positive bats (the others having been destroyed) found between 1981 and 1989. Nine of the 17 bat species known to inhabit Wyoming were included in the sample. No conclusions can be drawn about overall rates of infection in individual species as we did not examine all rabies-positive bats nor did we examine all bats submitted during this time period.

Nonetheless, within this particular sample of 45, some species exhibited greater rates of infection: *E. fuscus*, 27 (60% of total); *L. noctivagans*, 5 (11%); *L. cinereus*, 4 (9%); *M. ciliolabrum*, 3 (6%); *M. lucifugus*, 2 (4%); four other species (*M. californicus*, *M. evotis*, *A. pallidus*, and *C. townsendii*) were each represented by one positive specimen each (2%). These data demonstrate that, for this sample, *M. lucifugus* and *E. fuscus*, the two most common species in Wyoming (and recovered in almost equal numbers in our sample; *cf.* Armstrong et al., 1994) and also the most likely to reside in buildings, had very different incidences of rabies infection. Rabies-positive individuals of all species of bats known from Wyoming appear to have been reported (Constantine, 1979, 1988), although we could not determine if this was unequivocally true for *M. septentrionalis*, whose taxonomy recently was revised.

Table 2. *Total bats received by Wyoming State Veteterinary Laboratory from 1981 to 1989 and numbers of individuals testing positive for rabies (WSVL files).*

Year	Total Bats Received	Number Positive	Percent Positive
1981	18	1	5.5
1982	225	17	7.5
1983	175	10	5.7
1984	290	18	6.8
1985	185	6	3.5
1986	295	16	5.4
1987	185	10	5.4
1988	169	13	7.7
1989	204	22	10.8
	1746	113	Mean = 6.5

Rabies-positive bats were recovered only from June through October, which also are the months of greatest numbers of bats submitted for examination. Constantine (1967) found that the observed rate of infection was highest during the summer months, although most infected bats were recovered during autumn. *E. fuscus* had the greatest incidence (27) of positive individuals, and from 1981 to 1989, there were six occurrences in which multiple, rabies-infected *E. fuscus* were collected within the same area during the same year. During June of 1988, two males and one female were taken in Worland; during August and October of 1988, two females were taken in Thermopolis; during September and October of 1989, two males and one female were taken in Sheridan (a male and a female were found at same location); in July of 1989, two females were taken in Basin; and in June and July of 1989, two males were taken in Lovell.

Rabies-positive recoveries of *L. noctivagans* included one male in August and one male and three females in September. A higher incidence of rabies-positive *L. noctivagans* has been observed in August and September (Constantine, 1967; Dorward et al., 1977). Hunt and Bhatnagar (1997) noted that the variant of rabies virus associated with *L. noctivagans* was identified as the major source of human cases acquired within the United States since 1980. Of the four *L. cinereus* that tested positive for rabies, three were female and one was male. All rabies-positive hoary bats were recovered in September and October. The greatest number of rabies-infected bats collected within a year at the same locality was four: two female *L. noctivagans* and two female *L. cinereus* collected in Casper during September and October of 1989.

A slightly higher number of females than males (26:18, 59%) tested positive in the sample we examined. Constantine (1967) reported equal rates of infection between male and female bats over the summer months in the southwestern United States. Constantine (1967) sampled clinically normal bats and found rabies infection rates no greater than 1% in most resident (i.e., nonmigratory) species such as *Myotis*, although the rate was 1.6 to 2.5% in *Eptesicus*. Additional sampling of *E. fuscus* has shown an even higher prevalence of 1.6 to 4.1% (Brass, 1994). Rates in migratory species (such as *Lasiurus* and *Lasionycteris*) averaged between 2 to 3% and the stress of migration may increase the susceptibility of these bats to disease (Constantine, 1967; Burnett, 1989). Yancey et al. (1997) sampled 171 free-flying bats of 12 species (including eight species known from Wyoming) for rabies in Texas and found all were negative for rabies; they computed that the percentage of rabid bats in the population they were sampling from was very low (0% to 1.74%, $p \leq 0.05$).

CONCLUSIONS

Presently available data support the existence of 17 species of bats in Wyoming and we believe that additional work in southwestern Wyoming will eventually add two more species to the known bat fauna of the state. Several species appear to have restricted ranges in the state and we encourage others to investigate the distribution, seasonal occurrence, population status, and trends in roosting colonies of bats in Wyoming. Files of WSVL and our examination of 45 rabies-positive bats suggest that the incidence of rabies in bats in Wyoming is consistent with previously published reports.

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Finally, the senior author, who is fond of saying "If it weren't for Gene Fleharty I wouldn't be where I am today," wants to acknowledge the veracity of that statement but note that, although Dr. Fleharty was responsible for focusing my interests on mammals and providing an academic foundation that has served me remarkably well, he is not responsible for any of my weaknesses, at least one of which the editor of this volume has tolerated with amazing patience. And for that too, I am thankful.

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