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Plecotus townsendii.

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Plecotus townsendii Cooper, 1837

Townsend's Big-eared Bat

Plecotus townsendii Cooper, 1837:73, pl. 3, Fig. 6. Type locality "Columbia River." Restricted by Handley (1959) to Fort Vancouver, Clark Co., Washington.

CONTEXT AND CONTENT. Order Chiroptera, Family Vespertilionidae, Subfamily Vespertilioninae, Genus *Plecotus*, Subgenus *Corynorhinus*. The genus *Plecotus*, excluding *Idionycteris* (Williams et al., 1970), contains five living species: *P. townsendii*, *P. rafinesquii*, *P. mexicanus*, *P. austriacus*, and *P. auritus*. A key to the five species is included in Jones (1977). Five subspecies of *P. townsendii* are recognized (Handley, 1959):

P. t. australis (Handley, 1955*a*:147). Type locality 2 mi W Jacala, Hidalgo, Mexico.
P. t. ingens (Handley, 1955*a*:148). Type locality Hewlitt Cave, 12 mi W Fayetteville, Washington Co., Arkansas.
P. t. pallescens (Miller, 1897:52). Type locality Keam Canyon, Navajo Co., Arizona.
P. t. townsendii Cooper, 1837:73, see above.
P. t. virginianus (Handley, 1955*a*:148). Type locality Schoolhouse Cave, 4.4 mi NE Riverton, Pendleton Co., West Virginia.

DIAGNOSIS. This species is the most variable and progressive member of the genus *Plecotus* (Handley, 1959). Adults of *P. townsendii* can most easily be distinguished from *P. rafinesquii* by hair color. The bases of dorsal hairs in *P. townsendii* are slate or gray with tips varying in color from pale cinnamon brown to blackish brown. The bases of ventral hairs are slate, gray, or brownish, and brownish or buff at the tips. The color distinctions between the bases and tips of dorsal and ventral hairs in *P. townsendii* are not as sharply contrasted as in *P. rafinesquii* (Handley, 1959; Jones, 1977). By contrast with *P. mexicanus* and *P. rafinesquii* the first upper incisor is usually simple in *P. townsendii*, except in *P. t. ingens* where it is bifid. Compared with *P. mexicanus*, *P. townsendii* is lighter in color and shows more contrast between the bases and tips of dorsal hairs.

GENERAL CHARACTERS. Measurements in mm are: total length, 90 to 112; length of tail, 35 to 54; length of foot, 9 to 13; length of ear, 30 to 39; length of tragus, 11 to 17; length of forearm, 39.2 to 47.6; greatest length of skull, 15.3 to 17.2; depth of cranium, 5.4 to 6.1; breadth of cranium, 7.4 to 8.4, breadth of zygomata, 8.2 to 9.6; breadth of interorbital constriction, 3.2 to 4.0; breadth of palate, 5.4 to 6.5; length of palate, 5.6 to 6.6; length of maxillary toothrow, 4.8 to 5.6. Handley (1959) listed means and extremes for the five named subspecies. Adult mass ranges from 5 to 13 g, and females are heavier than males in fall and winter (Pearson et al., 1952; Williams and Findley, 1979). Females may average slightly larger than males (Whitlow and Hall, 1933). Significant differences in the forearm length were reported for males and females taken in New Mexico (Williams and Findley, 1979). The skull is illustrated in Fig. 1 and a flying bat is shown in Fig. 2. Photographs of *P. townsendii* are shown in Barbour and Davis (1969), Grinnell (1918), and Humphrey and Kunz (1976).

DISTRIBUTION. *Plecotus townsendii* occurs throughout much of western North America from British Columbia southward to the Isthmus of Tehuantepec, south and eastward to the Black Hills of South Dakota, across western Texas, eastward to the Edwards Plateau (Fig. 3). Isolated populations are known from gypsum caves of northeast Texas, Oklahoma, Kansas, and from limestone regions in Arkansas, Missouri, Oklahoma, Kentucky, Virginia, and West Virginia (Barbour and Davis, 1969; Handley, 1959; Villa, 1966). The present distribution of relictual populations probably reflects the influence of post-Pleistocene climates (Handley, 1959; Humphrey and Kunz, 1976). With the exception of populations in north-central Kansas (Humphrey and Kunz, 1976), local distributions are not well documented.

Plecotus townsendii is common in the highland areas of western North America (Jones and Suttkus, 1972). Hoffmeister (1970) summarized the known locality records from Arizona and noted that this bat is a summer resident throughout the state, but in winter it is known only from south of the Mogollon Plateau. In New Mexico it was most commonly captured in evergreen forests during warm months, and least commonly taken in xeric shrub-grassland (Jones, 1965). In Kansas and Oklahoma Townsend's big-eared bat appears to be restricted to riparian communities and nearby gypsum caves in the mid-grass prairie (Humphrey and Kunz, 1976). Elsewhere it is uncommon in prairies and extreme desert habitat (Handley, 1959; Jones, 1965), although it is known from lower elevations of the arid plateau and desert ranges of north central Mexico and the arid valleys south of the transverse volcanic belt (Handley, 1959). Throughout much of its known range *P. townsendii* is common in mesic habitats, characterized by coniferous and deciduous forests (Dalquest, 1947; Jones, 1965). In California and Washington it is known from limestone caves, lava tubes, and man-made structures, located in coastal lowlands, cultivated valleys, and nearby hills covered with mixed vegetation (Dalquest, 1947, 1948; Graham, 1966; Pearson et al., 1952). Most of the limestone caves in California are too warm for successful hibernation (Graham, 1966), but in Utah these bats frequently hibernate in mines and caves (Twente, 1960). Altitudinal limits range from near sea level to well above 3,160 m (Pearson et al., 1952; Villa, 1966). Handley (1959) stated that *P. townsendii* has the largest geographic range and the greatest environmental tolerance of the three Recent species in North America.

FOSSIL RECORD. Fossils of four species of the subgenus *Corynorhinus* have been reported. Two species, *P. alleganiensis* (Gidley and Gazin, 1933) and *P. tetralophodon* (Handley, 1955*b*) are extinct. *P. townsendii* is known from two Pleistocene sites (Martin, 1972): the Papago Springs locality of Arizona (Skinner, 1942) and from the Dry Cave locality of New Mexico (Harris, 1970). *P. rafinesquii* is reported only from the Coleman IIA local fauna of Florida (Martin, 1979).

Specimens of *Plecotus* not identifiable to species have been reported from Bootlegger Sink, Pennsylvania (Guilday et al., 1966), Frankstown Cave, Pennsylvania (Guilday, 1961), Robinson Cave, Tennessee (Guilday et al., 1969), Clark's Cave, Virginia (Guilday et al., 1977), and Baker Bluff Cave, Tennessee (Guilday et al., 1978). Slaughter (1970) discussed the evolutionary trends of teeth in *Plecotus* and its relationship to other fossil bats.

FORM AND FUNCTION. Handley (1959) described and compared selected external, dental, and osteological characters of this and other members of the genus. Larsell and Dow (1935) characterized the ontogeny of the cerebellum in fetal bats from early stages until term. Morphology and histochemistry of the gut were treated by Forman (1972, 1974). The stomach is characteristic of an obligate insectivore, being generalized in gross morphology, symmetrical in shape, and having a simple fundic ceacum. Blood parameters, including erythrocyte diameter, hemoglobin concentration, hematocrit, and mean corpuscle hemoglobin concentration were determined by Sealander (1964). Adrenal weights were reported by Rudd and Beck (1969). The distinct pararhinal glands on the muzzle of *P. townsendii* include both sebaceous and sudoriferous components but apparently they are mostly sebaceous (Quay, 1970). The sperm of *P. townsendii* is distinct from that of other vespertilionids and it is larger than in *P. rafinesquii* (Forman, 1968). The baculum of *P. townsendii* is similar to that of *P. rafinesquii* (Krutzsch and Vaughan, 1955).

Various aspects of functional morphology of wings were treated by Farney and Fleharty (1969) and Vaughan (1970). Wing loading is similar for *P. townsendii* and *P. rafinesquii* (Farney

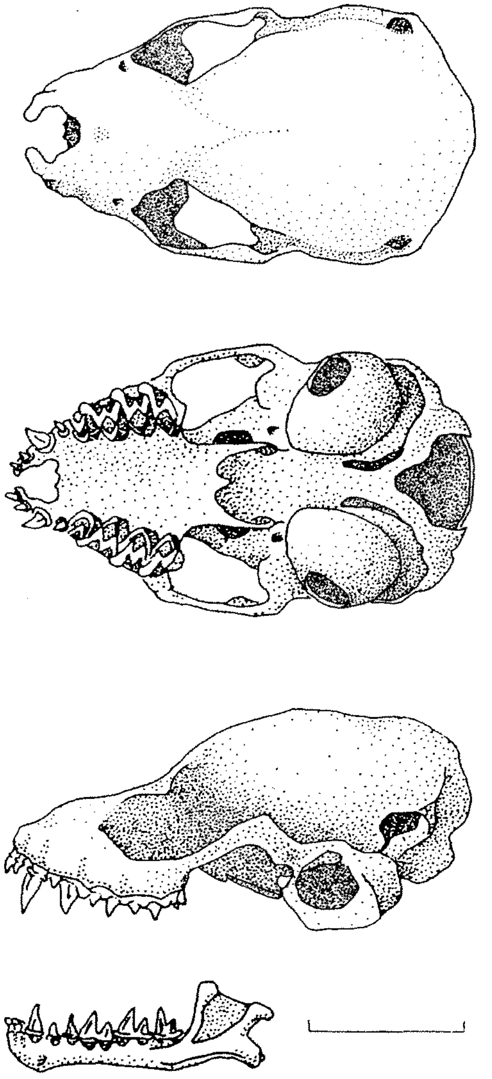

FIGURE 1. The skull of *Plecotus townsendii* (MCZ 42202), Museum of Comparative Zoology, Harvard University. Reference bar = 5 mm.

and Fleharty, 1969; Jones and Suttkus, 1971). These and other plecotine bats have relatively low wing loading and aspect ratios (Findley et al., 1972; Jones and Suttkus, 1971) which impart a greater lifting capacity (Davis and Cockrum, 1964), thus accounting for their high maneuverability, ability to fly at low speeds (Vaughan, 1970), and hovering flight (Norberg, 1976*a*, 1976*b*). Studier (1972) examined some physical properties of wings, including membrane thickness, strength, and elasticity, and compared them with those of other species. Flight speeds reported for *P. townsendii* ranged from 2.9 to 5.5 m/s (6.4 to 12.3 mph) when tested along straight-line courses (Hayward and Davis, 1964). Big-eared bats are capable of sustained, coordinated flight at greatly reduced body temperature (Hirshfeld and O'Farrell, 1976), which apparently reflects the uniform forced contraction of flight muscles over a wide range of ambient temperatures (Nelson et al., 1977).

A distinguishing feature of *P. townsendii*, as well as other plecotine bats, is the large size of the pinnae. In flight they are often directed forward in plane with the body (Dalquest, 1947; Handley, 1959), suggesting that they may provide some lift during flight. A thermoregulatory function of these highly vascularized structures has also been suggested (Humphrey and Kunz, 1976). More often it is stated that the function of the pinnae is of funneling sounds into the external auditory meatus (Henson, 1970).

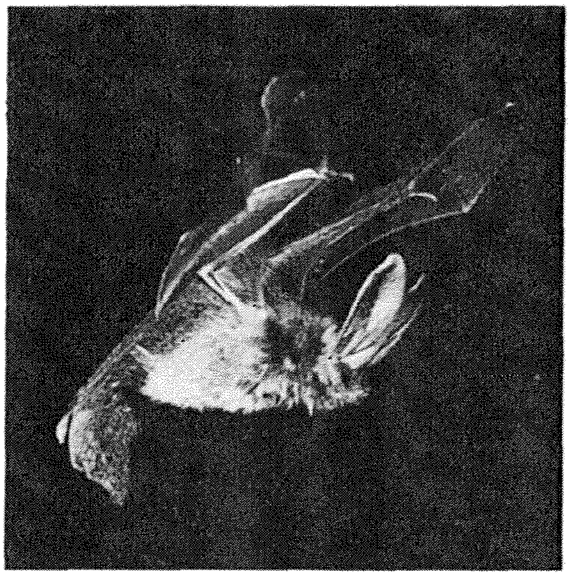

FIGURE 2. Photograph of a flying *Plecotus townsendii*. Photograph provided by J. Scott Altenbach, University of New Mexico.

Echolocation and audition in *P. townsendii* have been studied extensively in the laboratory (Griffin, 1958; Griffin et al., 1963; Grinnell, 1963*a*, 1963*b*, 1963*c*, 1963*d*; Grinnell and Grinnell, 1965). The auditory system is adept at discriminating echolocation signals from background noise (Griffin et al., 1963), which may facilitate the detection of insects on vegetation and other surfaces. *P. townsendii* emits echolocation pulses during the search and cruise phases at repetition rates from 10 to 20/s at frequencies from 90 to 20 kHz. The production of low intensity sounds (40 to 50 db lower than *Myotis lucifugus*) emitted by *P. townsendii* appears to be a coadaptation coinciding with large pinnae (Grinnell, 1963). Griffin (1958) noted that this big-eared bat is able to emit echolocation pulses through its nose almost as effectively as through its mouth.

Townsend's big-eared bats have two regions of low auditory sensitivity, one near the range of the fundamental frequency and the other near the second harmonic. Auditory sensitivity below the fundamental frequency and the second harmonic may help to reduce the effect of ambient noise and help explain their exceptional ability to detect and avoid obstacles (Griffin, 1958; Griffin et al., 1963), including mist nets (Ross, 1967). The high degree of directional sensitivity in *P. townsendii* occurs at 50 kHz, at angles 15 to 30° ipsilateral to the ear (Griffin et al., 1963). The sharp tuning of neurons to particular frequencies (Grinnell, 1963*b*) may account for the tremendous resistence of these big-eared bats to jamming (Griffin et al., 1963; Grinnell, 1963*b*). The apparent importance of the external ear in echolocation is the creation of highly complicated patterns of directional sensitivity which can be changed by slight changes in ear position (Griffin et al., 1963). Angular sensitivity is greatest at high frequencies (Grinnell and Grinnell, 1965).

ONTOGENY AND REPRODUCTION. Reproduction, growth, and development of *P. townsendii* were treated by Pearson et al. (1952), and the following account is based mostly on their detailed study in California. The reproductive pattern is characterized by a short proestrus in late summer. Estrus and subsequent copulation begin in autumn and the peak of copulations occurs from November through February, although some females apparently mate before arriving at hibernacula. Young females are reproductively active and mate in their first autumn. Spermatozoa are stored in the reproductive tracts of females until spring, when ovulation, fertilization, and gestation occur. Ovulation may occur either before or after females leave hibernation. Development of a single embryo takes place in the right uterine horn. The length of gestation varies from 56 to 100 days, depending on spring temperatures and the varying amounts of torpor experienced by different individuals. Parturition occurs in late spring and early summer, followed by an anestrous period. This pattern of reproduction should be similar in other areas where hibernation occurs, but the timing of events no doubt differs geographically. Deviations from such a reproductive pattern may be found in non-hibernating populations occurring in the tropics and subtropics (Myers, 1977).

In adult males, spermatogenesis occurs during the summer, reaching maximum activity in September. By late September and early October, the testes of adults begin to atrophy, coinciding with the appearance of sperm in the enlarging epididymides. The accessory glands reach full size in late October. Copulation is preceded by a ritualized precopulatory behavior characterized by the production of audible vocalizations, followed by head nuzzling which may be directed at either torpid or active individuals. Young males fail to reach sexual maturity in their first autumn.

There was no clear relationship between the timing of parturition and latitude in California, but on the average adult females gave birth earlier than yearling females. Young are born over a 3 to 5 week period beginning in late May in California, but in the state of Washington, the first births are in the second week of July (Scheffer, 1930). Births begin in June and young are flying shortly after mid-July in southwest Texas (Easterla, 1973).

As in other bats, baby *P. townsendii* are large at birth, weighing nearly 25% of their mother's post-partum mass. Newborn bats are naked and their large ears lie over their unopened eyes for the first few days. Within a few hours after birth they can produce audible "chirps" which may play an important role in mother-infant recognition. At the age of 1 week young bats are capable of producing adult-like audible "squawks." Young bats grow rapidly, nearly reaching adult forearm size in one month. They are capable of flight at 2.5 to 3 weeks and are fully weaned by 6 weeks.

ECOLOGY AND BEHAVIOR. In spring and summer, females form maternity colonies in warm parts of caves, mines, and buildings (Dalquest, 1948; Humphrey and Kunz, 1976; Pearson et al., 1952; Scheffer, 1930; Turner, 1974; Twente, 1955). During the maternity period males are solitary (Barbour and Davis, 1969; Humphrey and Kunz, 1976; Pearson et al., 1952). Maternity colonies comprise one or more small clusters and seldom exceed 100 adults (Humphrey and Kunz, 1965; Pearson et al., 1952; Turner, 1974), yet there are reports of larger colonies (Scheffer, 1930; Villa, 1966). Females usually remain alert and active in maternity roosts, but at times when roost temperatures are low these bats may become torpid. When at rest the ears lie back along the neck or coil slightly (Barbour and Davis, 1969), but they are held erect when bats become alert. Townsend's big-eared bats regularly hang pendant from the ceiling with one or both feet (Dalquest, 1947), and as noted by Pearson et al. (1952), they typically prefer dark places, although others have observed them roosting in or near dimly lighted areas (Barbour and Davis, 1969; Graham, 1966; Twente, 1955). Maternity colonies breakup in August, although there appears to be no clear indication whether adults or young are the first to leave (Pearson et al., 1952).

In winter, most big-eared bats roost singly although some form clusters ranging from a few up to several dozen individuals (Humphrey and Kunz, 1976; Twenty, 1955). Rippy and Harvey (1965) found approximately 420 hibernating in a single cluster in Kentucky. The age and sex of individuals hibernating in small clusters appears to be random (Humphrey and Kunz, 1976; Martin and Hawks, 1972), but large clusters more often comprise nearly equal numbers of both sexes (Humphrey and Kunz, 1976; Rippy and Harvey, 1965). In the eastern United States *P. townsendii* has been taken in the same hibernacula with *P. rafinesquii* (Rippy and Harvey, 1965). In the west, *Eptesicus fuscus*, *M. velifer* (Twente, 1955), *M. leibii*, and *M. californicus* (Pearson et al., 1952) are known to use the same hibernacula.

During hibernation *P. townsendii* assumes postures that appear to buffer it from environmental extremes, yet these postures afford sensitivity to climatic changes and disturbance. The ears are held erect or coiled like a rams horn (Barbour and Davis, 1969; Dalquest, 1947; Humphrey and Kunz, 1976; Pearson et al., 1952). Solitary bats often hang pendant by one or both feet with wings wrapped around the body and interlocked ventrally. The long pelage is erected to afford maximum insulation (Twente, 1955). In contrast, the wings of clustered bats are usually folded tightly against the body and the ears may or may not be coiled (Humphrey and Kunz, 1976; Pearson et al., 1952; Twente, 1955). Occasionally these bats cling to the substrate with their thumbs as well as their feet (Martin and Hawks, 1972; Whitlow and Hall, 1933).

Loss of body mass during hibernation may account for over half of the autumn body mass in *P. townsendii*, with the greatest loss occuring in the first months of winter (Humphrey and Kunz, 1976). Big-eared bats appear to arouse frequently and either change position within a hibernaculum or move among nearby caves and mines, thereby contributing to loss of fat reserves. There is only circumstantial evidence that big-eared bats feed during winter. Their relatively high winter activity also may account for the observed discrepancy of sex ratios reported in different geographic regions (Humphrey and Kunz, 1976; Pearson et al., 1952; Rippy and Harvey, 1965; Turner, 1974), although sex differences in survivorship and sampling bias should not be discounted.

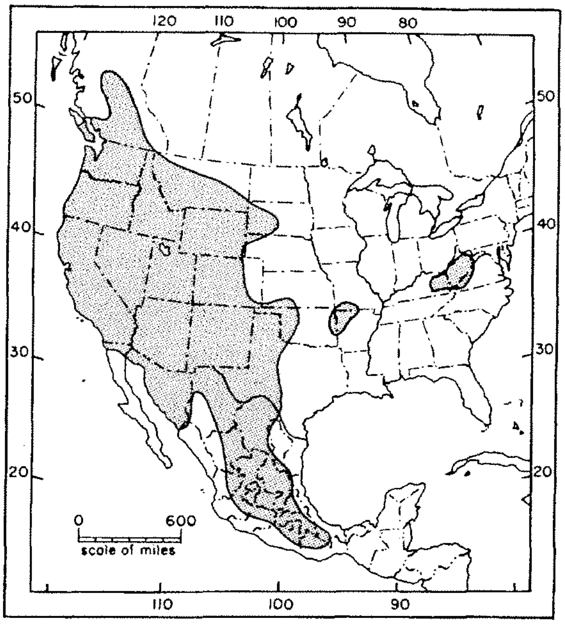

FIGURE 3. The distribution of *Plecotus townsendii* (modified after Hall, 1981).

Townsend's big-eared bats prefer relatively cold places for hibernation, often near entrances and in well-ventilated parts of caves and mines (Barbour and Davis, 1969; Dalquest, 1947; Humphrey and Kunz, 1976; Martin and Hawks, 1972; Pearson et al., 1952; Twente, 1955). In winter they often move deeper into the thermally more stable parts of caves if temperatures near entrances become too extreme, but they are rarely encountered in warm chambers (Humphrey and Kunz, 1976; Martin and Hawks, 1972; Pearson et al., 1952; Twente, 1955, 1960). In central California, solitary males and small groups of females are known to hibernate in buildings (Pearson et al., 1952).

Torpid bats have body temperatures that are highly correlated with ambient air temperature and the temperature of the substrate on which they roost (Humphrey and Kunz, 1976). Body temperatures of hibernating big-eared bats in Kansas ranged from 1 to 12°C. In California, Pearson et al. (1952) noted that females tended to roost in colder places than males, although no evidence of this behavior was found in Oklahoma and Kansas (Humphrey and Kunz, 1976). Periodic arousals may be spontaneous or stimulated by sudden changes in air temperature or humidity resulting from moving weather fronts (Humphrey and Kunz, 1976; Twente, 1955). Twente (1955) reported that the rate of arousal from hibernation in *P. townsendii* was 0.6°C/min, and that the flight was possible at body temperatures of 28 to 30°C. Similar observations were reported by Hughes (1968), who noted that the time from onset of arousal to flight was 20 to 30 min.

Natality rates are comparable throughout the species range, varying from 90 to 100% (Fenton, 1969; Hall, 1946; Humphrey and Kunz, 1976; Pearson et al., 1952; Turner and Jones, 1968). Pre-weaning post-natal mortality was 5% in South Dakota (Turner and Jones, 1968) and 4% in Kansas and Oklahoma (Humphrey and Kunz, 1976). Pearson et al. (1952) estimated survival rates of females by recording the number of yearling and adult females that returned to maternity colonies each year. The number returning in a 3-year period ranged from 70 to 80% for adults and 38 to 40% for yearlings. Of the yearlings that survived the first year, 75% returned as 2-year-olds and 80% of these returned as

3-year-olds. Judging from the percentage of young bats observed in hibernation, Pearson et al. (1952) postulated that most mortality in the first year occurred before bats entered hibernation. Based on recoveries of banded bats in California, Paradiso and Greenhall (1967) calculated the maximum longevity for this species to be 16 years, 5 months.

The estimate of crude density of one bat per ha on a 46.6 km^2 tract in Oklahoma is approximately 3 to 4 times greater than that reported for populations in California (Humphrey and Kunz, 1976; Pearson et al., 1952). Assuming comparable local densities, Humphrey and Kunz (1976) extrapolated this estimate to the entire southern plains region and predicted a maximum population size of approximately 14,000 individuals. The above estimate of crude density would no doubt be adjusted upward if the foraging habitat for *P. townsendii* was better known.

Plecotus townsendii appears to be a relatively sedentary species (Barbour and Davis, 1969; Humphrey and Kunz, 1976; Pearson et al., 1952). No long distance migrations have been reported. The longest movement recorded in California was of a male who traveled 32.2 km (20 mi) (Pearson et al., 1952). Movements of three individuals from maternity roosts to hibernacula averaged 11.6 km (3.1 to 39.7 km) (Humphrey and Kunz, 1976). Barbour and Davis (1969) recorded movements of 64.4 km (40 mi) in Kentucky and West Virginia. This species exhibits a high degree of site attachment, returning year after year to the same maternity roost (Pearson et al., 1952). Winter activity may be accompanied by short movements among nearby hibernacula (Humphrey and Kunz, 1976).

Although there are several reports of early nightly emergence times (Barbour and Davis, 1969), *P. townsendii* generally appears to be a late flyer (Cockrum and Cross, 1964; Dalquest, 1947; Jones, 1965; Pearson et al., 1952; Ross, 1967; Twente, 1955). This bat reaches its peak of flight activity later than other species in Arizona (Cockrum and Cross, 1964). Late-evening departures are usually preceded by light sampling behavior (Pearson et al., 1952; Twente, 1955).

Townsend's big-eared bats feed principally on small moths (microlepidopterans), averaging 6 mm in length (range 3 to 10 mm), but they may take other insects, including representatives of Neuroptera, Coleoptera, Diptera, and Hymenoptera (Hamilton, 1943; Ross, 1967; Whitaker et al., 1977). Howell (1920) noted that *P. townsendii* captured insects from leaves and other places. Bell (pers. comm.) noted that big-eared bats fed mostly in the air along forested edges and suggested that they should not be regarded as foliage gleaners. After an initial feeding bout, big-eared bats use night roosts which are often shared with other species (Dalquest, 1947; Pearson et al., 1952). That these bats usually do not return to their daytime retreat until shortly before sunrise (Pearson et al., 1952) suggests that a second feeding bout occurs following the night roosting period, as has been reported for several other vespertilionid bats. Twente (1955) noted that *P. townsendii* in Kansas seeks night roosts in warm caves.

Endoparasites include two nematodes (Specian and Ubelaker, 1976; Tromba and Smith, 1952), a cestode (Rausch, 1975), and a trypanosome (Mitchell, 1956). One of the nematodes (*Seuratum cancellatum*) was found in the body cavity (Specian and Ubelaker, 1976), although the other nematode and the cestode were in the gut. Rabies virus was isolated from less than 1% of asymptomatic bats taken in New Mexico (Constantine, 1967).

The winged bat fly (*Trichobius corynorhini*; Streblidae) is the most common and conspicuous ectoparasite on *P. townsendii* (Beck, 1969; Dalquest, 1947; Jameson, 1959; Krutzsch, 1955; Kunz, 1976; Ross, 1960, 1961; Smith, 1934; Turner, 1974; Whitaker and Easterla, 1975*a*; Wilson, 1946). This bat fly commonly occurs on the membranes of its host during the roosting period, but usually departs before the host takes flight (Kunz, 1976). The average number of bat flies present on a host appears to be dependent on host density (Beck, 1969; Kunz 1976). In Kansas, female *P. townsendii* were infested with the highest numbers and frequencies of infestation of bat flies in early winter. Numbers of flies and frequencies of infestation differed for solitary and clustered males, but not for females. Winter levels of infestation were positively correlated with host density (Kunz, 1976).

A wingless bat fly (Nycteribiidae) has been reported from *P. townsendii* in western North America (Dalquest, 1947; Krutzsch, 1955; Stiles and Nolan, 1931; Whitaker and Easterla, 1975*b*), but apparently it is uncommon elsewhere. Dalquest (1947) noted that nycteribiids were the most common ectoparasite on big-eared bats in California, with numbers ranging up to 5 per bat. Three species of macronyssid mites (Jameson, 1959; Krutzsch, 1955; Radovsky, 1967; Reisen et al., 1976), representatives of two families of ticks (Bradshaw and Ross, 1961; Jameson, 1959; Reisen et al., 1976; Whitaker and Easterla, 1975*b*), a chigger, and a sarcoptid mite (Turner, 1974) are known from *P. townsendii*. No spinturnicid mites (Rudnick, 1960) or bat bugs (Usinger, 1966) have been reported.

GENETICS. *Plecotus townsendii* has a karyotype indistinguishable from that of *P. rafinesquii* (Baker and Mascarello, 1969; Baker and Patton, 1967; Williams et al., 1970), both having a diploid number of 32 and a fundamental number of 50. Autosomes consist of 10 metacentric and submetacentric pairs and 5 acrocentric pairs. The X and Y chromosomes are acrocentric. G-band karyotypes for both sexes were reported by Anthony and Kitchin (1976). The X chromosomes from specimens taken in Wyoming (Anthony and Kitchin, 1976) are larger than those reported from specimens taken in Arizona (Baker and Mascarello, 1969) and New Mexico (Williams et al., 1970). Anthony and Kitchin (1976) suggested that this variation reflects the amount of constitutive heterochromatin in different populations. Bickham (1979) discussed the evolutionary relationships between *P. townsendii* and other vespertilionids based on karyotypes.

REMARKS. Prior to Handley's (1959) revision of North American plecotine bats, there was considerable confusion in the use of the appropriate binomen for this taxon. Subsequent to Handley's revision some authors used *P. rafinesquii* in referring to *P. townsendii*, but this misuse was later corrected (Griffin et al., 1963).

The generic name *Plecotus* is derived from the Greek *pleko* and the Latin word *otus*, which reflect the large, twisted ears. The species name refers to the naturalist Charles H. Townsend. Vernacular names applied to this bat include Townsend's big-eared bat, western long-nosed bat, and western lump-nosed bat. The name most frequently used is Townsend's big-eared bat (Jones et al., 1979).

The isolated populations, *P. townsendii virginianus*, in Kentucky, Virginia, and West Virginia (Barbour and Davis, 1969; Harvey, 1975), and *P. townsendii ingens*, in the Ozark Highlands of Missouri, Oklahoma, and Arkansas (Harvey, 1975, 1980; Harvey et al., 1979), are threatened and may be in danger of extinction. The vulnerability of these and perhaps other populations is high because of their susceptibility to disturbance (Barbour and Davis, 1969; Graham, 1966; Humphrey and Kunz, 1976). Like many other bats, loss of habitat, vandalism, and increased visitation by humans to maternity roosts and hibernacula (Harvey, 1975; Humphrey and Kunz, 1976) have no doubt been factors in reported declines. Big-eared bats appear to be especially subject to injury from wing-banding (Humphrey and Kunz, 1976). Pearson et al. (1952) postulated that the availability of man-made structures may have led to an increase in numbers of *P. townsendii* in parts of western United States in the recent past.

We are grateful to Gary P. Bell, Michael J. Harvey, and Everett M. Grigsby for commenting on an earlier draft of this paper. We also thank Sophie W. Webb for preparing Fig. 1, J. Scott Altenbach who provided us with the photograph of a flying bat (Fig. 2), and E. Raymond Hall who made available a copy of the distribution map for *P. townsendii* from the second edition of "The Mammals of North America," which we modified in the preparation of Fig. 3.

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