Pallid Bat

(*Antrozous pallidus*)

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Legal Status
Federal: USFS: Sensitive; BLM: Sensitive
State: CDFG: Species of Special Concern (1993)

Global and State Conservation Status: G5S3; Global rank, G5 = Secure: Common; widespread and abundant; State rank, S3 = Vulnerable: Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation

Western Bat Working Group: High Priority

IUCN: Red list category: LR: lc (Lower risk: least concern)

Recovery Plan: None

Species Description and Life History

The pallid bat (*Antrozous pallidus*) is a member of the taxonomic Order Chiroptera and Family Vespertilionidae. It is currently the sole member of its genus. The generic name *Antrozous* may be translated as "living in caves" and the specific epithet *pallidus* means "pale". This species is a fairly large (15 – 27 g) bat with broad wings, large forward-facing ears, a blunt, pig-like snout, and pale fur. The pallid bat is not likely to be confused with any other species known to occur in Yolo County due to its distinctive coloration, muzzle, and large ear size. It is related in appearance to only one other bat with very large ears, the Townsend's big-eared bat (*Corynorhinus townsendii*), which is smaller overall with a small face and darker coloration.

The life history of the pallid bat centers on reproduction and meeting the energetic demands of a small insectivorous mammal. Its annual cycle includes an approximate 7 to 8 month period of peak activity in spring and summer when insects are most available and reproduction occurs. In April and May pregnant females gather in maternity colonies and males usually occur separately in bachelor groups. Maternity colonies may be relatively large; the largest known in northern California was several hundred (Tatarian pers. comm.). Females normally give birth to twin young in May or June and nurse them for 6 to 8 weeks. Juveniles are weaned when they have grown to adult size and are thus able to fly (O'Shea and Vaughan 1977). Beck and Rudd (1960) conducted a pioneering study of pallid bat maternity colonies in the Capay Valley, Yolo County. They found that young of the year are independent when they develop the skills necessary to hunt on the

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wing however adult females and young of both sexes remain together and are still reliant on the maternity roost site. Maternity colonies disperse into smaller groups by mid-October (Barbour and Davis 1969).

The pallid bat uses daily and seasonal periods of hibernation to conserve energy when it is inactive. In winter months when insect prey is less available this species extends hibernation over weeks or months. The pallid bat may also migrate locally to suitable hibernation sites. In the Sacramento Valley, bats may hibernate, migrate, or reside year-round and alternate between activity and hibernation depending on weather and insect availability. Johnston *et al.* (2006) found that male and female pallid bats roost together and are intermittently active throughout the winter along riparian corridors on the coast.

The longevity record for the pallid bat is 12 years in captivity (Brown pers. comm.); a record in nature is not available (Hermanson and O'Shea 1983). Potential predators of this species include hawks (Orr 1954), owls (O'Shea and Vaughan 1977), skunks, weasels, rats, snakes (Allen 1939), and cats. Hawks and owls may capture pallid bats as they emerge from the roost in the evening, and terrestrial predators may capture bats in the roost, especially juveniles.

Habitat Requirements and Ecology

The pallid bat occurs throughout the Central Valley in a variety of habitats including all types of woodland especially oak savanna, grassland, riparian areas and wetlands, orchards, vineyards, and cropland if appropriate roosting sites are available.

Roosting Ecology

The pallid bat roosts both during the day and at night, spending 60-80% of a 24-hour cycle in the roost environment (Vaughan and O'Shea 1976). During the day this species shelters inside crevices or cavities found in natural features such as trees, cliffs, caves and rocky outcrops, and in man-made features such as barns, bridges, mines and attics (Barbour and Davis 1969, Hermanson and O'Shea 1983, Pierson and Rainey 1998). Recent radio-tracking efforts in the west, including California, suggest that the pallid bat is far more dependent on tree roosts than was previously realized. This species has been located in tree cavities in oak, ponderosa pine, coast redwood, and giant Sequoia (Rainey *et al*. 1992, Cross and Clayton 1995, Pierson and Heady 1996 in Pierson and Rainey 1998). On Santa Cruz Island, however, radio-tagged animals selected rock crevices and buildings, despite abundant oak woodland (Brown *et al.* 1984 in Pierson and Rainey 1998). Pallid bats are also one of the species most predictably associated with bridges. They roost in expansion joints by day, and are commonly found night roosting in more open areas under the deck especially near abutments, particularly under concrete girder structures (Lewis 1994, Pierson *et al.* 1996 in Pierson and Rainey 1998, H. Johnson pers. obs.).).

The pallid bat is highly social and usually occurs in colonies of 12-100 individuals (Barbour and Davis 1969) that cluster to share body heat (Vaughan and O'Shea 1976). Appropriate roosting habitat that occurs in Yolo County includes bridges and buildings

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such as abandoned houses and barns (Beck and Rudd 1960), or other anthropogenic structures, hollows in riparian tree species (Johnston *et al.* 2006), oaks (Pierson *et al.* 2002), or various conifers (Johnston and Gworek 2006), and crevices in cliffs, caves, and rocky outcroppings. Pierson *et al.* (2002) radio-tracked nine females in different reproductive stages to roosts in a farmhouse attic, barn, several caves, and one male was suspected to be roosting in a hole in a eucalyptus tree. Reproductive females are the least flexible with respect to roost resources because of the energetic constraints that they are under.

Night roosts are usually separate from day roosts and are often structurally more open but warmer than ambient temperatures and protected from wind. Night roosts are commonly located under bridges and overhanging porches, and inside barns. When the same roost is used both day and night, the pallid bat may hang in exposed places at night rather than retreating into crevices as it would during the day. It is important to note that night roosts often contain characteristic insect prey remains that are unique to this species. Sites where pallid bats have consumed large insects are characterized by discarded prey remains such as heads, legs, and wing covers scattered amongst the fairly distinctive guano. Pallid bat guano is similar in size, shape, and texture to that of the big brown bat (*Eptesicus fuscus*) but collections of discarded arthropod prey remains are unique.

Foraging Ecology

The pallid bat is nocturnal and after sunset it emerges from the day roost to forage for insects. Water features are a vital habitat component because bats often drink immediately after emergence and water is an important source and concentration site for insects. Studies have shown that this species tends to forage for a few hours, night roost for a few hours, and then forage again before returning to the day roost (O'Shea and Vaughan 1977).

Pallid bats have been observed to feed on ground-dwelling arthropods such as crickets, grasshoppers, beetles, and scorpions, and vegetation-dwelling insects including cicadas, katydids, and moths (Hermanson and O'Shea 1983, Orr 1954). Foraging occurs in and among vegetation as well on the ground. Although many types of prey are found among debris, such as fallen branches under oak trees, it is not clear how much the pallid bat relies on arthropods found specifically in association with oak woodland and savanna. The percentage of potential foraging area and degree of productivity within the area surrounding a roost likely helps determine the carrying capacity for a given colony (Johnston and Stokes 2007). On the California coast, Pierson *et al.* (2002) found that pallid bats foraged in riparian and oak habitats. In Nevada, pallid bat foraging activity occurs in riparian, woodland, and agricultural habitats (Altenbach *et al.* 2002). One was captured on the ground in an apple orchard (Nelson 1918 in Orr 1954). In Solano County the pallid bat has been documented foraging in orchards (H. Johnson pers. obs.) and in Napa and Sonoma counties it has been documented foraging over vineyards (Tatarian pers. comm.). This species may follow linear habitat features such as foot paths and dirt roads lined by vegetation while hunting.

Radio-telemetry studies have documented a range of distances (.5 to 11 km) that pallid bats will travel from day roosts to foraging areas and night roosts. The desert subspecies of pallid bat may travel up to 11 km from roost sites in rock crevices to foraging areas (Brown *et al.* 1997) but studies have shown that they generally feed within 3-4 miles of their roost, and regularly occupy the same feeding area (Rainey and Pierson 1996, Brown pers. comm.). In western Nevada, Ball (1998) found that pallid bats foraged over agricultural fields 6.5 to 8.5 km away from their day roosts on a rocky hillside. In Oregon, night roosts (usually near foraging areas) were 0.5-1.5 km from the day roosts (Lewis 1994). In British Columbia, at the northern limit of their range, pallid bats regularly traveled .5 to 1 km or less to foraging areas, and roosted day and night in the same rock crevices (Rambaldini 2003). Tatarian (pers. comm.) tracked pallid bats foraging within 1 to 3 miles from their roosts in the Napa-Sonoma region. A radio-telemetry study conducted in the Bay Area in the fall documented pallid bats traveling to a night roost within .5 miles of the day roost. One individual in this study traveled a maximum of 2.5 miles from the day roost however it was unknown if foraging was taking place (Johnston pers. comm.).

Habitat requirements in Yolo County may include open, free water for drinking and foraging, undisturbed crevice and cavity day and night roost sites that provide thermal buffering, protection from predators, room for colonies to gather, and structurally diverse vegetation that support a diversity of insect prey for foraging habitat. If surveys reveal the presence of a reproductive population (e.g., pregnant or lactating females) then habitat is considered high quality.

Species Distribution and Population Trends

Central Valley occurrences include capture data from blue oak woodland in the Sutter Buttes, Sutter County (Johnson 2000) and pear orchards near Fairfield, Solano County (Johnson unpubl. data). Roost sites have been found in cropland near Woodland, Yolo County, and in grassland/riparian complexes near Red Bluff, Tehama County and near Griffith, Sutter County (H. Johnson unpubl. data). Pierson (2000) found pallid bats in riparian habitat in Merced County.

Records were obtained from pallid bat specimens submitted to the Yolo County Health Department (D. Constantine unpubl. data). Pre-1980 specimen localities (roughly 38 pallid bats) included Capay and Davis. Post-1980 localities (16 specimens) included Davis, Winters, Woodland, between Davis and Woodland, Guinda Dunnigan, Capay, and an unknown Yolo County locality. Recent surveys (2006) by H. Johnson have confirmed continued use of the historical roost site near Capay and revealed a new site south of Esparto.

Population Trends

Current population trends are unknown, however California bat biologists are documenting roost and habitat loss, and there are strong concerns that foothill oak woodland and rural landscapes where pallid bats are most abundant are highly impacted

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by urbanization. Bat biologists from the California Bat Working Group conducted a bat species status assessment workshop in Davis in 2007 as part of ongoing efforts to produce a California Bat Conservation Plan. The pallid bat was ranked in the top five species of conservation concern.

Generally, in order to assess the trend of the species, long-term monitoring of both habitat and roost sites conducted over multiple years is needed. Biologists recognize that "most efforts at monitoring bat populations involve use of indices that are uncalibrated in relation to population size, do not incorporate measures of variation or detectability, are discontinuous in time and space, and sometimes lack standard protocols" (O'Shea *et al.* 2003). Roost count indices are likely to be used to monitor pallid bat populations. The usefulness of indices may improve as standard protocols and measures of variation and detectability become available. Ball (2002) proposed that if land uses and bat habitat can be monitored simultaneously, patterns in the availability and condition of bat habitat will emerge to guide their management.

Threats to the Species and Other Conservation Issues

Threats to the pallid bat in the Yolo County area include mortality and/or loss of roosting habitat due to disturbance, vandalism, exclusion, extermination, pesticide use (Clark 1981), building demolition, bridge replacement and modification projects (Sidner 1997), and selective hardwood removal. Indirect threats to this species include loss of habitat to urban/industrial land-use conversions and hydrological alteration of watersheds and associated riparian habitat by surrounding developments and land uses (Hinman and Snow, eds. 2003). Some bat species can adapt to urban habitats but the pallid bat has only been found near the edges of urban areas or in outlying areas (Hinman and Snow, eds. 2003). Pierson and Rainey (1998) state the pallid bat will coexist with humans in rural settings, but appears to be intolerant of suburban and urban development.

In Napa County, pallid bats have declined significantly where oaks were cleared for vineyards (Pierson pers. comm.). Johnston and Stokes (2007) reported significant declines in populations of the pallid bat in Santa Clara and San Diego counties. In Santa Clara County the only 2 colonies known prior to 1948 have since been extirpated. Since 1992, 10 new maternity colony roosts have been located in Yolo County (D. Johnston, pers. comm.). However, since their discovery, 2 colonies of reproductive females have been destroyed, 1 colony was extirpated from a building during the maternity season, and 5 colonies are at risk because of the loss of foraging habitat (Johnston pers. comm.).

In Yolo County, the conversion and loss of oak savanna and riparian habitats has likely contributed to the loss of pallid bat populations. Expansion of urban development has also likely played a role in impacting this species in Yolo County. Although no conclusive evidence has been provided as to causes of population declines, human disturbance, logging practices, and the loss of savanna, grassland, and riparian habitats are suspect (Johnston and Stokes 2007).

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Significant data gaps exist in knowledge of the effects of habitat conversion of native habitat to vineyards, other agricultural practices, and urbanization. While there are data gaps, there is clear evidence that loss of oak woodland for agriculture, urbanization and firewood cutting is a significant problem (B. Hogan pers. comm.). Although this species is frequently excluded from buildings and bridges as a nuisance species, there is also a paucity of information on the effectiveness of relocation efforts or exclusion from roost sites. Data are also lacking for the effects of logging practices, and pesticide and heavy metal contamination. However, some impacts from firewood cutting and other timber operations are inferred from information on this species' significant dependence on tree roost sites.

The pallid bat often occurs at the periphery of agricultural and urbanized areas resulting in mostly undocumented impacts to populations.

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