

MAMMALIAN SPECIES 4:1-6

Brazilian free-tailed bat (*Tadarida brasiliensis*)

KATELYN ARMSTRONG

Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, Mississippi, 39762, USA

Abstract—*Tadarida brasiliensis* (I. Geoffroy, 1824) is a bat from the order Chiroptera commonly known as the Brazilian free-tailed bat; also referred to as the Mexican free-tailed bat. It is one of the most abundant bat species in the Western hemisphere and is found throughout the southern half of the North America, most of Central America and a portions of South America. It is listed as “lower risk, near threatened” by the International Union for the Conservation of Nature and Natural Resources 2000.

Published 5 December 2008 by the Department of Wildlife and Fisheries, Mississippi State University

Brazilian free-tailed bat

Tadarida brasiliensis (I. Geoffroy, 1824)

CONTEXT AND CONTENT.

Order Chiroptera, suborder Microchiroptera, family Molossidae (free-tailed bats), subfamily Molossinae. There are 9 subspecies currently recognized (Schwartz 1955): *T. b. brasiliensis* I Geoffroy, 1824; *T. b. antillarum* Miller, 1902; *T. b. bahamensis* Rhen, 1902; *T. b. constanzae* Shamel, 1931; *T. b. cynocephala* Le Conte,

1831; *T. b. intermedia* Shamel, 1931; *T. b. mexicana* Saussure 1860; *T. b. murina* Gray, 1827; *T. b. muscular* Gundlach, 1861

GENERAL CHARACTERS

Tadarida brasiliensis (Fig. 1) is a small bat with an average total length of 9.1 cm. Dorsally; it is brown to grayish in color with hairs uniformly colored. Ventral coloration is pale (Schwartz 2001). It is the only member of the genus *Tadarida* in North America to have prominent vertical wrinkles or grooves on its upper lip,



Fig. 1. *Tadarida brasiliensis* from the Ecological Society of America. Photograph by JS Altenbach.

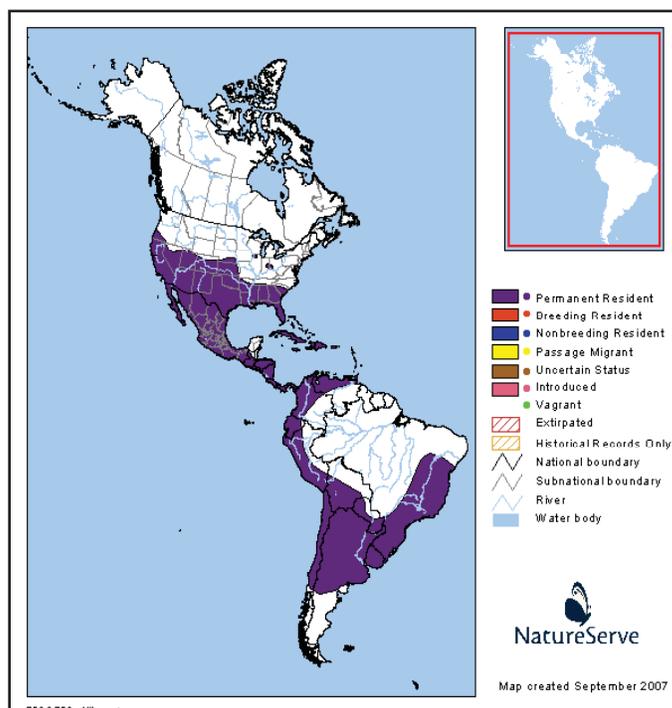


Fig. 2. Geographic distribution of *Tadarida brasiliensis*. (modified from InfoNatura: Animals and Ecosystems of Latin America [web application]. 2007.

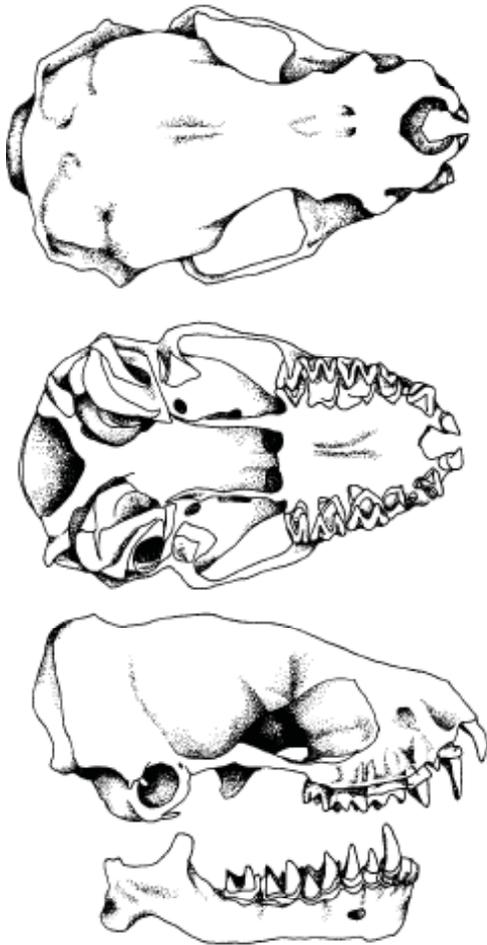


Fig. 3. Dorsal, ventral, and lateral views of the mandible and cranium of a male *Tadarida brasiliensis* (Taken from Wilkins 1989 Mammalian species account of *Tadarida brasiliensis*)

and a z-shaped upper third molar (Hall 1981). Three species of *Tadarida* occur in the United States and of them; *T. brasiliensis* is the smallest (Barbour and Davis 1969). The distal half of the tail is free from the uropatagium, hence the name free-tailed. Ears are fairly large and rounded and they project slightly forward and beyond the muzzle (Lowery 1974).

DISTRIBUTION

Tadarida brasiliensis is one of the most abundant species of bat in the Western hemisphere. It occurs throughout southern North America, Central America, and large areas of South America (Fig. 2; Zubaid et al. 2006).

FORM AND FUNCTION

Dental formula is I 1/2, c 1/1, p 2/2, m 3/3, 30 total, or i 1/3, c 1/1, p 2/2, m 3/3, 32 total (Schwartz 2001). The pelvic skeleton is sexually dimorphic. The wings are long and narrow, allowing for high-speed flight compared to other species. The mouth is enlarged which aids in gathering insects more efficiently (Wilkins 1989).

ONTOGENY AND REPRODUCTION

Gestation is between 77 and 100 days (Feldhamer et al. 2003). The young are hairless and have smooth slightly pigmented skin, although there is some hair near the toes and thumbs. Body length is about two-thirds that of the adult, and they reach adult size in about 2 months (Pagels and Jones 1974). Young are weaned at 6 weeks and can begin to fly at around 5 weeks (Schwartz 2001), although some are capable of straight-line flight in as little as 35 days. All the deciduous teeth are erupted at birth (2/3 I, 1/1 C), and the permanent incisors and canines come in just before the permanent (Pagels and Jones 1974).

Females reach sexual maturity as early as one year, while males reach sexual maturity at 2 years of age (Kunz et al. 1995).

Tadarida brasiliensis species produces 1 pup usually, but on occasion can have twins (Feldhamer et al. 2003). Young are precocial and are left in nursery colonies while mothers forage at night. Breeding happens in early spring, from mid February to March with young born in early June (Feldhamer et al. 2003). Parturition happens while the mother is hanging upside down. It takes about 90 seconds for the baby to pass through the birth canal and the baby will hang from the umbilical cord until it can climb up and nurse (Wilkins 1989).

ECOLOGY

Population characteristics.—The sex ratio is generally 1:1 at birth (Wilkins 1989). Some caves in Texas, including Carlsbad Caverns and a few others, can have up to 20 million bats in one colony. The females will migrate a little earlier than the males.

Space use.—In this species, populations around the central southern U.S will migrate in late February to March from Mexico to Texas, Arizona, New Mexico, and Oklahoma, where they roost in caves and give birth. Along with caves, these bats will roost in caves, old mines, buildings that are not disturbed, bridges, old wells, and hollow trees (Feldhamer et al. 2003). Then in late August and September, they will migrate with their young back to Mexico and Central America (Schwartz 2001). The populations that live on the east and west coasts do not migrate.

Diet.—*Tadarida brasiliensis* is an opportunistic and generalist insectivore (Kunz et al. 1995; Whitaker and Rodriguez-Duran 1999). They forage from dusk until dawn and may cover an area of over 400 km² (Lee and McCracken 2005). *T. brasiliensis* primarily eats Coleopterans (beetles) and Lepidopterans (moths), although, under certain conditions when there are other orders of insects that are more abundant, *T. brasiliensis* will eat whatever is available at the time (McWilliams 2005). Other orders of insects that are consumed are as follows: Diptera (true flies), Hymenoptera (wasps and bees), Hemiptera (stinkbugs), Homoptera (cicadas, leafhoppers), Neuroptera (lacewings), and Odonata (dragon flies, damselflies) (Whitaker and Rodriguez-Duran 1999), all insects that fly.

Disease and parasites.—There are many different ectoparasites that can occur on this species. A few of the more common ones found are ticks and specifically the mite *Chiroptonyssus robustus* (Feldhamer et al. 2003). A few endoparasites include the nematode *Sueratum cancellatum* and the chigger *Microtombicula merrihewi*, found in the nasal cavity (Wilkins 1989). Rabies is a rhabdovirus that can affect any mammal species, although there are a very small number of bats that actually contract it annually. Some other viruses that can be carried by *Tadarida brasiliensis* include SLE (Saint Louis encephalitis), also eastern equine encephalitis, western equine encephalitis, and Japanese B encephalitis (Constantine 1970).

Interspecific interactions.—Predators of *Tadarida brasiliensis* include various raptors, Great horned owl (*Bubo virginianus*), Barn owl (*Tyto alba*), raccoons (*Pryocyon lotor*), striped skunks (*Mephitis mephitis*), opossums (*Diadelphus virginiana*), and several species of snakes (Feldhamer et al. 2003).

Miscellaneous.—Age can be estimated by tooth wear, banding and recovery, and mass of the eye lens (Wilkins 1989).

BEHAVIOR

Grouping behavior.—Females form nursery colonies to leave their pups in while foraging.

Communication.—Bats produce a high frequency sound known as echolocation which is used for orientation, locating prey, and communication. Echolocation and the other vocalizations of *Tadarida brasiliensis* can reach a minimum frequency of 20—25 kHz, which is audible to humans since maximum human hearing is 20 kHz (Feldhamer, 2003).

Tadarida brasiliensis produces both foraging and communicative sound. Buzzing sounds are emitted while foraging and when stationary as a means of communication (Schwarz et al., 2007). The echolocation calls used vary with situation. When flying in a group, *Tadarida brasiliensis* uses a wider range of frequencies than when flying alone (Ratcliffe et al. 2004). There is also a mating call emitted by males during active copulation, although if the female is passive and does not struggle, then no call is emitted (French and Lolar 1998 in Keeley, 2004).

Miscellaneous behaviors.—*Tadarida brasiliensis* does not hibernate, although migratory populations in the United States may enter torpor for short periods.

CONSERVATION

The species is considered “lower risk, near threatened” on the IUCN *Red List of Threatened Species* (International Union for the Conservation of Nature and Natural Resources 2008). It is extirpated from the Turks and

Caicos Islands. *Tadarida brasiliensis* has a great impact on agriculture in the United States. They consume many insects considered crop pests, especially corn earworm (*Helicoverpa zea*) and fall armyworm (*Spodoptera exigua*) moths (McCracken and Lee, 2005). However, in doing so, there is an increased risk of pesticide contamination and accumulation. Bats in Texas consume an annual estimated 6,000—8,000 metric tons of insects (Schmidly, 1991). Organochlorine pesticides are fat-soluble and can accumulate in stored body fat as a result of the large quantities of insects consumed. When the fat is metabolized, such as during migration, exposure to the organochlorines increases and can be lethal (Bennett and Theis, 2007). Pesticides may also be passed from adult to young during lactation (McCracken, 1986).

LITERATURE CITED

- Barbour, R. W., and W. H. Davis. 1969. Bats of America. Univ. Press Kentucky, Lexington 286 pp.
- Bennet, B. S., and Monte L. T. 2007. Organochlorine pesticide residues in guano of Brazilian free-tailed bats, *Tadarida brasiliensis* Saint-Hilaire, from East Texas. Bulletin of Environmental Contamination and Toxicology 78:191—194.
- Chiroptera Specialist Group 1996. *Tadarida brasiliensis*. In: IUCN 2007. 2007 IUCN Red List of Threatened Species <www.iucnredlist.org>. Downloaded on 27 September 2008.
- Constantine, D. G. 1970. Bats in relation to the health, welfare, and economy of man. Pp. 319—449 in Biology of bats (W. A. Wimsatt, ed.). Academic Press, New York 2:1--477
- Gunnell, G. F. and Nancy B. S. 2005. Fossil evidence and the origin of bats. Journal of Mammalogy 12:June
- Hall, E. R. 1981. The mammals of North America. 2nd ed. John Wiley and Sons, New York 1:1—600
- Feldhamer, G. A., Thompson, B. C., and Chapman, J. A. 2003. Wild Mammals of North America: Biology, Management, and Conservation. Published by JHU Press.
- French, B. and A Lollar. 1998. Observations on the reproductive behavior of captive *Tadarida brasiliensis mexicana* (Chiroptera: Molossidae). Southwestern Naturalist 43:484—490.
- InfoNatura: Animals and Ecosystems of Latin America [web application]. 2007. Version 5.0. Arlington, Virginia (USA): NatureServe. Available: <http://www.natureserve.org/infonatura>. (Accessed: September 27, 2008).
- IUCN Red List of Endangered Species, 2008
- Keelley, A. T. H., and B. W. Keeley. 2004. The mating system of *Tadarida brasiliensis* (Chiroptera: Molossidae) in large highway bridge colony. Journal of Mammalogy 85:113—119.
- Kunz, T. H., J. O. Whitaker, Jr., and M. D. Wadanoli. 1995. Dietary energetics of the insectivorous Mexican free-tailed bat (*Tadarida brasiliensis*) during pregnancy and lactation. Oecologia 101: 407—415.

ACKNOWLEDGMENTS

I thank Dr. J. Belant for his support and assistance throughout this project, as well as my fellow peers who served as editors. I wish to also thank the staff of the Mitchell Memorial Library and the College of Forest Resources at Mississippi State University for assistance in gaining access to valuable information and materials.

- Lee Y., and G. F. McCracken 2005. Dietary variation of Brazilian free-tailed bats links to migratory populations of pest insects. *Journal of Mammalogy* 86:67—76.
- Lowery, G. H., Jr. 1974. *The mammals of Louisiana and its adjacent waters*. Louisiana State Univ. Press, Baton Rouge 565pp.
- McCracken G. F. 1986. Why are we losing our Mexican free-tailed bats? *Bats* 3:1—2.
- McWilliams, L. A. 2005. Variation in diet of the Mexican free-tailed bat (*Tadarida brasiliensis mexicana*). *Journal of Mammalogy* 86:599—605.
- Pagels, J. F. and C. Jones. 1974. Growth and development of the free-tailed bat, *Tadarida brasiliensis cynocephala* (Le Conte). *Southwestern Naturalist* 19:267—276.
- Ratcliffe, J. M., Hofstede, H. M., Avila-Flores, R., Fenton, M. Brock., McCracken, G. F., Biscardi, S., Blasko, J., Gillam, E., Orprecio, J., and G. Spanjer. 2004. Conspecifics influence call design in the Brazilian free-tailed bat, *Tadarida brasiliensis*. *Zoology* 82:966—971.
- Schmidly, D. J. 1991. *The bats of Texas*. Texas A&M Univ Press, College Station.
- Schwartz, C., Jedidiah, T., Keller, H., Vanzant, M., Ezell, S., and M. Smotherman. 2007. The tiny difference between foraging and communication buzzes uttered by the Mexican free-tailed bat, *Tadarida brasiliensis*. *Journal of Comparative Physiology A: Neurology, Sensory, Neural, and Behavioral Physiology* 193.
- Schwartz, C. W., and E. R. Schwartz. Jerry J. Conley (contributor). *The Wild Mammals of Missouri*. Missouri Dept. of Conservation University of Missouri Press 2001. 102—105.
- Whitaker, John O., Jr., and A. Rodríguez-Duran. 1999. Seasonal variation in the diet of the Mexican free-tailed bats, *Tadarida brasiliensis antillarum* (Miller) from a colony in Puerto Rico. *Caribbean Journal of Science* 35:23—28.
- Wilkins, K. T. Mammalian Species No. 331 *Tadarida brasiliensis*. 1989. *The American Society of Mammalogists* 1—10.
- Wilson, Don E., and D. M. Reeder (ed.). 2005. *Mammal Species of the World. A Taxonomic and Geographic Reference* (3rd ed.), Johns Hopkins University Press.
- Zubaid, A., McCracken, G. F., and T. H. Kunz. *Functional and Evolutionary Ecology of Bats*. Published by Oxford University Press US, 2006

Contributing editor of this account was Clinton Smith.