

Photo by Angelica Menchaca

California leaf-nosed bat



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Townsend's big-eared bat



Hoary bat



Common vampire bat

# BAT DIVERSITY *in the* SONORAN DESERT

The Sonoran Desert Region, from southeastern California and Arizona to Baja California and Sonora, contains at least 48 species of bats—more than the total number of bat species in the entire United States. Almost all our bat species live in desert habitats, but some are exclusive inhabitants of the tropical areas of southern Sonora, and a few others typically inhabit boreal forests such as those on the sky islands. From south to north in the Sonoran

Desert the number of bat species declines—with the greatest number in southern Sonora, the smallest in Arizona. From east to west, the number only changes slightly, with some species replacing others as we move into Baja California. These bats come in various shapes, sizes, and behaviors, with lifestyles that reflect the rich biological diversity of the region itself.

There are bats that fly very high above the vegetation and others that fly close to the ground. Some bats

use rivers, streams, and washes as flyways, while others seek wide open spaces to search for their prey. There are bats with humongous ears, others with tiny ears. Some bats have a very long snout, and others a rostrum so short they look almost like monkeys. Some of our Sonoran Desert bats, like the mastiff bat or the Mexican free-tailed bat, have long, narrow wings that help them fly in the open at high speeds with relatively straight trajectories. Others, such as the little brown



Photo by Rodrigo Medellín

Ghost-faced bat



Photo by Rodrigo Medellín

Mexican free-tailed bat



Photo by Rodrigo Medellín

Baja California fish-eating bat



Photo by Rodrigo Medellín

Parnell's mustached bat

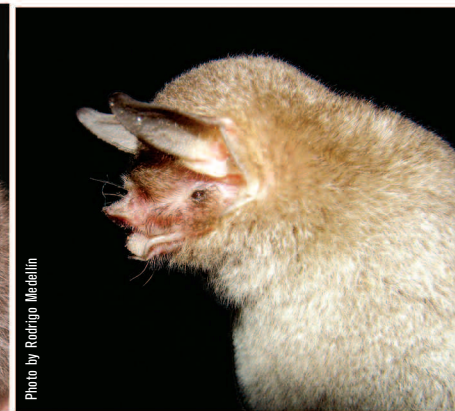


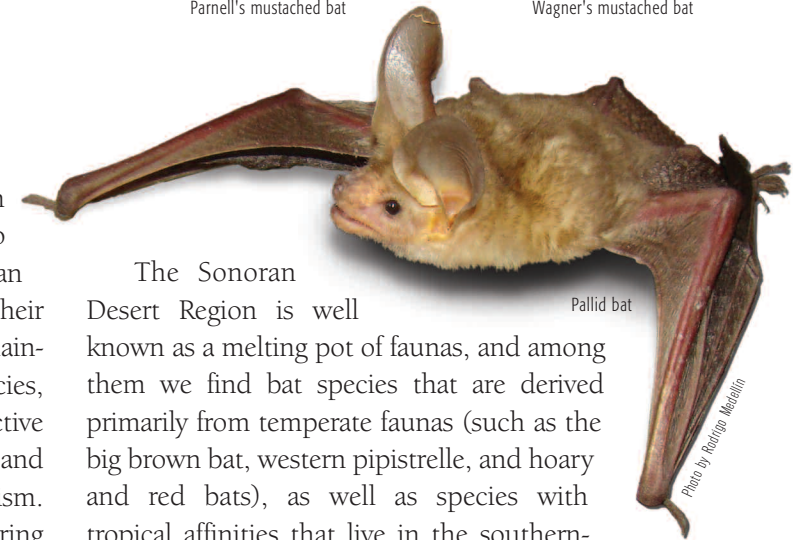
Photo by Rodrigo Medellín

Wagner's mustached bat

bat and the western pipistrelle, have shorter wings, which provide the amazing dexterity they demonstrate chasing moths and other prey in mid-air, following each swift twist and sudden turn. Still others, such as the pallid bat or the California leaf-nosed bat, have short, broad, powerful, and strong wings. This wing structure is ideal for the very slow flight they need to survey the ground or vegetation for prey. After landing on their prey and delivering several killing bites, they are able take off again carrying prey of up to 30 percent of their own weight.

In the Sonoran Desert a small group of species stay year-round, but most only take advantage of the plentiful resources the desert offers during the summer, migrating from central or southern Mexico to Sonora and Arizona. Although not yet verified, it is

thought that some hoary bats and red bats can migrate annually all the way from Canada to Mexico and back. Some of the year-round Sonoran Desert residents hibernate in winter, lowering their metabolism to one heartbeat per minute and maintaining a temperature of 35° to 40° F. Other species, such as the California leaf-nosed bat, remain active throughout the winter where climates are mild and insects are available to fuel their high metabolism. These bats depend on “hot caves” and mines during colder periods. Some migrating bats, like lesser long-nosed bats, also make use of hot caves, which have chambers with elevated ceilings that trap the heat and maintain the temperature range bats need for reproduction. Newborn babies of these species also gather together in large numbers to keep warm.



Pallid bat

Photo by Rodrigo Medellín

The Sonoran Desert Region is well known as a melting pot of faunas, and among them we find bat species that are derived primarily from temperate faunas (such as the big brown bat, western pipistrelle, and hoary and red bats), as well as species with tropical affinities that live in the southernmost skirts of the region (such as the hairy fig-eating bat, funnel-eared bat, Gray sac-winged bat, ghost-faced bat, and the mustached bat). Several species have evolved as unique endemics to the Sonoran Desert, including the fish-eating bat of the Sea of Cortez and the California leaf-nosed bat.





Photo by Rodrigo Medellín



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Top: Bats have adapted to many habitats. These cute little bats from Costa Rica, Watson's fruit-eating bats (*Artibeus watsoni*), make tents out of large tropical leaves. Above: ASDM docents host a regular bat-emergence event at the bridge near Campbell and River Roads in Tucson. Cut out: Mexican free-tailed bats feed on moths and other soft-bodied insects.

## TIME TO EAT:

### Their Special Diets and What They Mean

The Sonoran Desert Region is home to many insectivorous bats, as well as nectar feeders and the unique fish-eating bat. In the more tropical habitats from

southern Sonora up to Alamos, a few fruit-eating species thrive, and one bat that feeds on blood, the common vampire bat, can be found.

It would be unfair, however, to simply lump all the bats that feed on insects and other arthropods in one category. Some species, such as the Mexican free-tailed bat, specialize in feeding on moths, flies, and other soft-bodied insects, taking them on the wing (while both are flying). One of the most visible bats in our region, the Mexican free-tailed bat roosts in large to huge numbers; one cave near Carbó, Sonora, contains over five million bats, and the bridge near Campbell and River Road in Tucson, Arizona, contains tens of thousands. Free-tails are “swarm feeders” that fly through large groups of insects. One million of these bats destroy *ten tons* of insects every night! This in itself is such a remarkable service to ecosystems and to humans that it is hard to imagine a world with no insect-eating bats. Other species, like the big brown bat, feed on beetles and other hard-bodied insects on the fly.

But there are others, such as the pallid bat and the California leaf-nosed bat, that specialize in capturing arthropod prey on the ground or vegetative surface, cueing in on sounds produced by the prey. A katydid grasshopper happily singing its summer song, a love

song designed to attract females, is also attracting sudden death in the form of a powerful bat that can land on the katydid, kill it with a couple of bites, and carry it off to its roost to savor a tasty meal. Or it could be a large centipede or a scorpion making almost imperceptible noises (certainly for us humans) while tiptoeing on the sand or under some leaf litter. These faintest of noises herald “mealtime” for these bats. If, on a hot summer night, you have occasion to observe life under a big light, you will see that the light attracts lots of flying insects that then fall to the ground, in turn attracting centipedes, scorpions, and large spiders. If you watch, you will undoubtedly see bats hawking the flying insects overhead. Closer to the ground, bats that eat terrestrial arthropods will pass through, selecting their next unsuspecting prey as if at a buffet dinner.

Other bat species feed primarily on nectar and pollen from several plant species— from columnar cacti like saguaro, cardon, and organ pipe, to agaves and morning glory trees. Most of these plant-loving bats are migratory. You may have noticed them visiting your hummingbird feeders, primarily in August (although some Mexican long-tongued bats remain in southern Arizona in the winter and also rely on hummingbird feeders during the colder months). These fascinating animals have an intimate connection with the desert plants: over many centuries the vast majority of the pollination of these columnar cacti and agaves has been carried out by bats. In other words, our familiar landscape with its striking,



enormous cacti, is the result of millions of years of connections between bats and plants.

The great majority of the nectar bats in our region are females bearing or suckling young, since the males remain behind in western Mexico. These females carry out migrations of more than a thousand miles as a bat flies, from west-central Mexico, around the coast of Jalisco near Puerto Vallarta and farther south, all the way up to Sonora and Arizona. It is hard to believe that this demanding trip is fueled only by nectar and pollen! And in their long migration, they provide important benefits to humans. Their pollination of agave is essential not only to the ecosystems, but to many humans too. Agaves are the source of many useful products—from natural ropes and string to syrups, to the larvae of a moth used as food in central Mexico, to tequila, mescal, and other beverages. Many millions of dollars are derived from the relationship between bats and agaves; in fact, tequila sales represent almost one billion dollars annually.

A few bat species in the southern end of the region feed on the fruits of tropical trees such as the native fig tree, dispersing its seeds and ensuring that the next generation of trees will be part of the tropical dry forest. One species endemic to the Sea of Cortez, the fish-eating bat, spends its entire lifetime on islands of the Gulf. It forages over the waves of the sea, never drinking fresh water. This remarkable bat is large,



Lesser long-nosed bats pollinate an agave. Right: Mexican free-tailed bats form tight clusters on the ceiling of a cave. Cut out: Shot of tequila with limes. Tequila is made from agave plants.

among the largest bats in our region, with a wingspan of about 17 inches and weighing almost an ounce. Its feet have elongated, flattened, recurved sharp claws, with which they hook fish and aquatic invertebrates from the ocean surface.

## SURVIVAL STRATEGIES

### Tailored to Place

Along with their great diversity in shapes and diets, bats have evolved wide-ranging survival strategies. All bat species in the Sonoran Desert use the sophisticated echolocation system for which they are renowned. Some rely on it to locate tiny insects in mid-air, others to navigate in and out of their roosts or to find their way through forest understory. Interestingly, preliminary evidence hints that even nectar bats, which have not generally been known for their use of echolocation, use it to find flowers. Some bats have color vision, some black-and-white vision. Where and how they roost depends on where they

evolved and the resources available to them—from cavities in trees and cacti to rock crevices, to bark, leaves, and manmade structures. Most bats have two types of roosts, one in which to rest during the day and the other in which to eat and digest food during the night's foraging activity. Bats hanging on your front porch wall during the night will usually be absent during the day.

## NOT JUST "A BAT"

With this brief overview, we hope to have passed on to you our enthusiasm and appreciation for the extraordinary diversity of bats in the Sonoran Desert Region, not only in the number of species, but also in their morphology, food habits, behaviors, and above all, the remarkable services they provide to ecosystems and to us. Next time you are out enjoying a splendid desert evening and see a bat chasing a moth, or see one visiting your hummingbird feeder, you might say quietly, "Thank you, friend." **S**