

OPOSSUMS

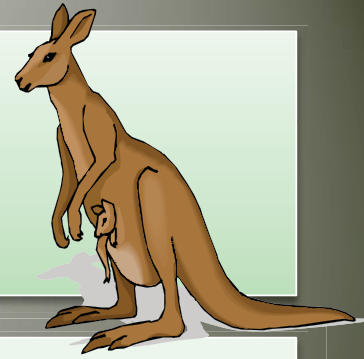
(CLASS MAMMALIA, SUPERORDER MARSUPIALIA)



Chapter 3



Introduction



- Marsupials are the pouched mammals. Based on the fossil record, it is hypothesized that marsupials originated in North America and spread to South America and eventually to Australia, via Antarctica. The opossums are sometimes called "living fossils" because they have remained virtually unchanged for 50 million years.



General Characteristics

- Taxonomy

- The Virginia opossum, *Didelphis virginiana* (Family: Didelphidae), is the only marsupial that lives in North America.



- Anatomy

- Opossums look almost rat-like, with a long narrow pointed snout and a white face, along with prominent grey to black guard hairs.
- You can easily see the difference from rodents and opossums by their large distinctive canine teeth and prehensile tail.
- Opossums are about the size of a domestic cat with a body 12-20in., tail 10-21in. and weighing 4-10lbs.
- Their prehensile tails are long with sparse hairs and prehensile (i.e., capable of grasping).
- Their hind feet also have a fifth prehensile toe, the tail is used for balance and stability while climbing.
- Males are usually larger than females and do not have a stomach pouch.





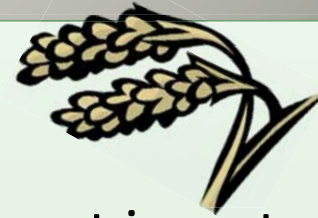
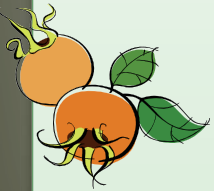
- Reproduction

- Opossums usually mate between January and July. They typically have 2 litters of 4-10 young per year. The young are born almost embryonic. About the size of a bumblebee, they crawl unaided to their mother's marsupium, or pouch, where they attach to a nipple. The young emerge from the pouch after approximately two months, then may stay with their mother for awhile longer, often riding on her back.



• Behavior

- Opossums are omnivorous and prefer to eat insects, snails, carrion, fruits (especially overripe), grains, mice, bird eggs, and small snakes. Compost piles, garbage cans, and pet food provide attractive meal opportunities for opossums. Opossums are solitary and nocturnal mammals. They usually move slowly and may exhibit an involuntary shock-like state when frightened ("playing possum"). If threatened, opossums will hiss or growl and bare their teeth, but are generally shy animals that prefer to avoid confrontation. An opossum that seems overly friendly, aggressive, or is active during the daytime is probably sick, possibly rabid, and should be avoided.
- Opossums have many predators including dogs, cats, owls, coyotes, and humans. The lifespan of an opossum in the wild generally does not exceed 2 years, but in captivity they may live up to 10 years.





- Distribution and habitat

- Opossums have an extensive range in North America.
- The opossum was introduced from the southeastern United States into California near San Jose in the early 1900s, and thereafter rapidly expanded its range to include the coast, from San Diego north to Oregon, and eastward to the Sacramento Valley and San Joaquin Valley.
- Opossums typically inhabit regions below 1000 meters elevation. Opossums thrive in many environments. The natural habitat of opossums is woodland areas near streams and rivers.
- Opossums also adapt well to agricultural areas and backyards of suburban neighborhoods. They will use hollow trees, woodpiles, rock piles, and abandoned underground burrows as dens. In a peridomestic setting, they will live under buildings and in attics.



Public Health Significance

- Opossums are a potential threat to human health through direct injury or as a reservoir of infectious disease.



Enteric
infections



Public Health Significance

- Bite wounds
 - Opossums are normally shy and will avoid contact with humans, but if they are aggravated either by being touched, picked up, or attacked by dogs or cats they may bite.
 - Bacterial infections can develop rapidly at the bite site. Wounds should be immediately cleaned with soap and water and medical attention sought.



Chagas' Disease

- **(American trypanosomiasis)** Chagas' disease is a febrile illness caused by a protozoal parasite, *Trypanosoma cruzi*, and transmitted by the bite of an infected kissing bug (cone-nosed bug, family Reduviidae).
- In South America, where Chagas' disease is endemic, members of the genus *Didelphis* are important reservoirs of *T. cruzi*. *T. cruzi* has been identified in approximately 15% of opossums in the southeastern United States.
- The role of opossums in the maintenance and transmission of *T. cruzi* to humans in North America is unclear.



Enteric infections

- Enteric bacteria such as *Salmonella* spp. are commonly found in the feces of many species of mammals and birds, including opossums.
- These bacteria and other enteric pathogens may be shed in feces and transmitted to humans by the fecal-oral route (e.g., via ingestion of pathogens in food or fomites contaminated with feces).
- Enteric infections are characterized by fever, malaise, and diarrhea. In the very young, the elderly, and persons with compromised immune systems, these infections may be severe or even fatal.



Murine Typhus (Flea-borne typhus, Endemic typhus fever)

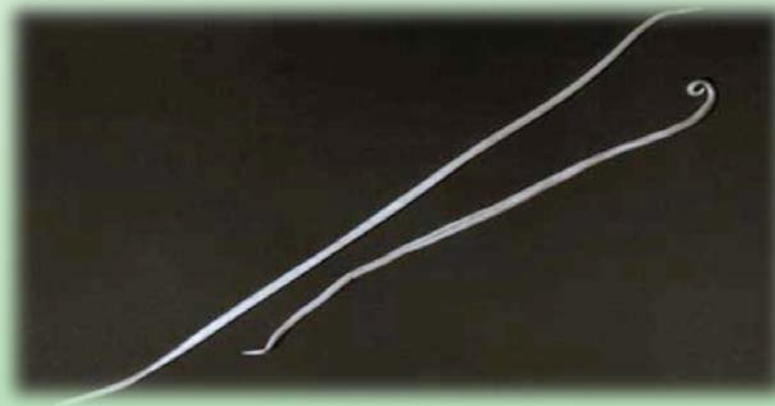
- Classic murine typhus occurs worldwide, most often as a rat-flea-rat cycle where humans represent an abnormal or "dead end" host. In suburban areas of the United States, especially southern California and south central Texas, the ecology of the disease has shifted to a peridomestic animal cycle involving opossums, cats, and their fleas. Seropositive opossums and cats have been found during human case-patient investigations in Los Angeles and Orange Counties. Infected opossums do not appear ill, to our knowledge.
- The cat flea (*Ctenocephalides felis*) is the suspected vector of murine typhus in southern California and opossums likely serve as reservoir hosts.
- Humans are at risk of bites by infected fleas which infest domestic animals and backyard wildlife.

Rabies

- Opossums are susceptible to skunk and bat strains of rabies, but represent less than 1% of animal rabies cases in California.
- A rabid opossum will generally exhibit unusual behavior such as daytime activity, aggression, weakness, and neurologic signs (circling, seizures, etc.).
- Potential exposure to a rabid opossum requires immediate medical attention.
- Dogs or cats that are bitten or scratched by an opossum should be placed in quarantine in accordance with local and state regulations. If available, the biting opossum should be tested for rabies at a public health laboratory.

Visceral and Ocular Larval Migrans

- Carnivores (dogs, raccoons) are the primary carriers of roundworms that cause larval migrans in humans. *Baylisascaris* spp. and other roundworms have occasionally been documented in opossums as well.



Management and Control

- Never pet or pick up opossums.
- If an injured or sick opossum is found, call animal control for assistance. Do not handle the animal yourself.
- Keep pets away from opossums.
- Eliminate or reduce opossum temptations such as food sources and den materials
 - Keep feed stores on farms and stables tightly covered.
 - Keep pet food and water covered at night or bring indoors
 - Tightly cover garbage cans, compost piles, and grain containers
 - Remove piles of rock, wood, vegetation, and lumber as these are all sources of shelter.
 - Block openings into houses and other building with strong wire mesh material.





Bats

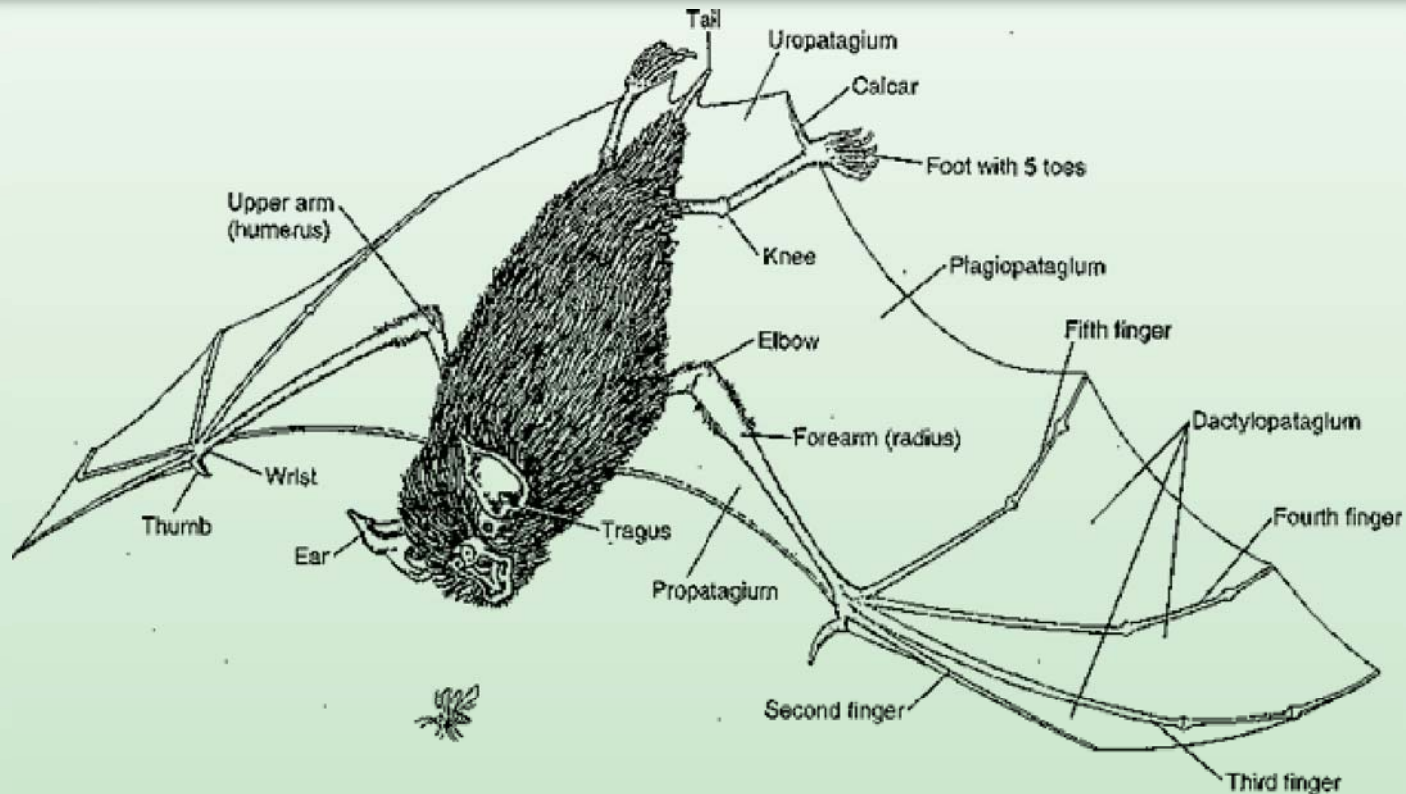
(Class Mammalia, Order Chiroptera)



Chapter 4



INTRODUCTION/CHARACTERISTICS



Bats, like humans and other mammals, are warm-blooded and have fur or hair. They give birth to live young, feeding them with milk from mammary glands. Bats are the only mammals that are able to fly, and their wings make any of the >900 species in the world instantly recognizable.

- **Taxonomy**

- Class *Mammalia*
- Order *Chiroptera*
- (3 families – 23 species in California)

- Bats comprise the order of mammals called *Chiroptera*, a name derived from Greek meaning "hand wing."
- Bats are subdivided into two major groups or suborders, the *Megachiroptera* (megabats) and the *Microchiroptera* (microbats).
- Megabats do not rely on echolocation, they have large bodies and eyes, eat primarily fruit, and are limited in their distribution to the Old World tropics.
- In contrast, microbats rely on echolocation for foraging and maneuvering, have small bodies and eyes, eat primarily insects, and are widely distributed throughout the world.

- Forty-two species of bats are found in the United States, all microbats. In California, there are 23 species within 3 families. Bats are the only mammals that fly, consequently many of their unique features relate to flight. (The wing is formed from skin stretched between the arm, wrist, and finger bones. Although the skin on the wings is very thin and appears delicate, it is fairly resistant to tears or punctures.
- Bats exhibit a great range of body sizes, from the tiny hog-nosed or bumble bee bat of Thailand (2 g) to the fruit-eating flying foxes (1,600 g) which have a wing-span of 2 m. However, most bats are relatively small, weighing 10-100 g. The western pipistrelle is the smallest bat in California and one of the smallest mammals at 2-6 g. The largest bat in California, the western mastiff bat, weighs 45-73 g (1.5-2.5 oz) and has a wing-span of 53-57 cm (21-23 in).



- Roosting Behavior

- Bats are active and feed at night. During the day, bats roost in dark, sheltered places such as caves, mine tunnels, rock crevices, hollow trees, under loose tree bark, in trees and understory vegetation, in buildings, under bridges, and in other protected places. Some species roost alone, while others form colonies that vary from a few to millions of individuals. Roosts can be subdivided into day and night roosts, hibernation roosts, summer roosts, nursery roosts, feeding roosts, and transient or resting roosts. The roosting habits of bats are adaptations that reflect the interrelationships of social structure, diet, flight behavior, predation risks, and reproduction of each species.

- Feeding Habits

- Flight has allowed bats to occupy many feeding niches. Most species of bats eat insects, often taking insects in flight, but occasionally from plants or from the ground. All bats in California are insectivorous with the exception of the Mexican long-tongued bat which feeds primarily on fruit, pollen, and nectar.

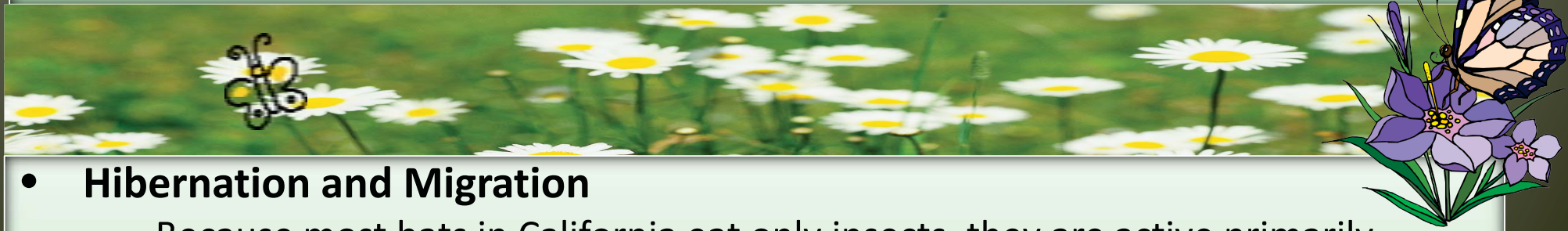
- Navigation (Echolocation and Feeding Behavior)

- In order to find prey items and to maneuver within their environment, most bats echolocate. Bats emit high-frequency sound impulses and discern information about objects in their path from rebounding echoes. Many of the structural characteristics of bats, including their varying shapes and sizes of ears and their occasionally bizarre facial features, relate to echolocation. Many aspects of echolocation are specific to each species and relate to foraging for food.



- **Reproduction, Litter Size, and Longevity**

- Some bat species breed in the spring while others breed in the fall and delay fertilization until spring. In either case, birth coincides with the emergence of insects in the spring.
- While many small mammals have several large litters each breeding season, most bats produce only a single litter per year, with typically only one, or less frequently two, young per litter.
- Bats have much longer life spans than is typical for small mammals, sometimes exceeding 30 years. Prolonged life spans may be a function of reduced metabolic rates on the bases of daily torpor, seasonal hibernation, or both.



- **Hibernation and Migration**

- Because most bats in California eat only insects, they are active primarily during the warmer months when insect populations are more abundant and active. In the winter, bats either migrate south to a warmer climate or hibernate in a protected location. The migration patterns and the seasonal distribution of many bats are unknown. In California, some migration patterns may be limited to changes of elevation.



• Distribution

- Bats are the most widely distributed group of terrestrial mammals. Representatives inhabit every continent except Antarctica. While as many as 90% of species reside in tropical regions, bats are also abundant in temperate regions during the summer. Bats also utilize a wide variety of ecosystems. In the US they are abundant in both forests and deserts, and range from sea level to 15,000 feet elevation.
- Twelve of the 23 species in California are found throughout California, with the exception of the south- eastern deserts and the San Joaquin Valley. Seven species inhabit principally southern California, especially the southeastern desert regions. The remaining four species have limited or separate distributions which do not fit the other two basic patterns.

Ecological and Economic Value

- Bats play an important beneficial role as the major consumers of night-flying insects, as pollinators of plants, and in the dispersal of seeds of fruits. Bats consume staggering quantities of insects every night. Mosquitoes comprise a high percentage of some bats' diets; individuals may consume as many as 1,000 mosquitoes per hour. Bats serve as pollinators and seed dispersal agents for hundreds, and probably thousands, of species of plants.
- A few of the better known economically valuable crop plants which rely on bats for survival are bananas, avocados, dates, figs, mangoes, cashews, and agave (tequila). Bats often account for as much as 95% of tropical forest regrowth by dispersal of seeds from consumed fruit.



Public Health Significance

- Bats are known to transmit to humans only two diseases in California.
 - Rabies
 - Histoplasmosis



Rabies

- Rabies is a viral infection of the central nervous system that is almost always fatal.
- Bats and striped skunks have replaced the dog as the primary maintenance species of rabies in California. Bats are generally not aggressive and will bite only in self-defense. There are no records of house dwelling bats transmitting rabies through the air, feces, or urine. Humans are rarely attacked or bitten by bats except when handled.



Rabies

- Bats are susceptible to rabies, but only a small proportion of a population is infected. They seldom become aggressive when infected, but rather generally become paralyzed and die within a few days of onset.
- Rabid bats can be found anywhere in California; rabies has been detected in bats from all 58 counties and from below sea level to over 3000 m elevation in the Sierra Nevada mountains.
- Bats found on the ground, active during the day, in a place where bats are not normally seen (for example, in a swimming pool, caught by a cat or dog, etc.), or unable to fly are more likely to be rabid.
- Persons bitten by a bat, or who experience contact with bat saliva, should wash the affected area thoroughly with soap and water and seek immediate medical attention. Whenever possible, the bat should be retained and sent to the local county public health laboratory for rabies testing. Although most people recognize when they have been bitten by a bat, bite marks from bats' small teeth may not always be evident. Therefore, persons awakening to find a bat in their room should seek medical attention and have the bat tested. The bat should be removed by animal control.



Histoplasmosis

- Histoplasmosis, infection with the fungus *Histoplasma capsulatum*, most commonly manifests as a flu-like respiratory disease. If infection becomes circulated, symptoms can be severe and occasionally fatal. Histoplasmosis can be contracted by breathing dust stirred up from areas where bat or bird (especially pigeon) droppings accumulate. Buildings, attics, caves, and other enclosed areas where bats congregate can present a particular risk. Persons working in these areas should always use a properly fitted respirator capable of filtering particles as small as two microns in diameter. Histoplasmosis occurs most commonly in the Midwestern U.S., and infrequently in California.



Parasites

- Like all mammals, bats may harbor ectoparasites such as fleas, ticks, mites, and other parasites, including bat flies and a specific bed bug. In most cases, these parasites are host-specific to bats and usually only confined to a specific bat species.



Management and Control

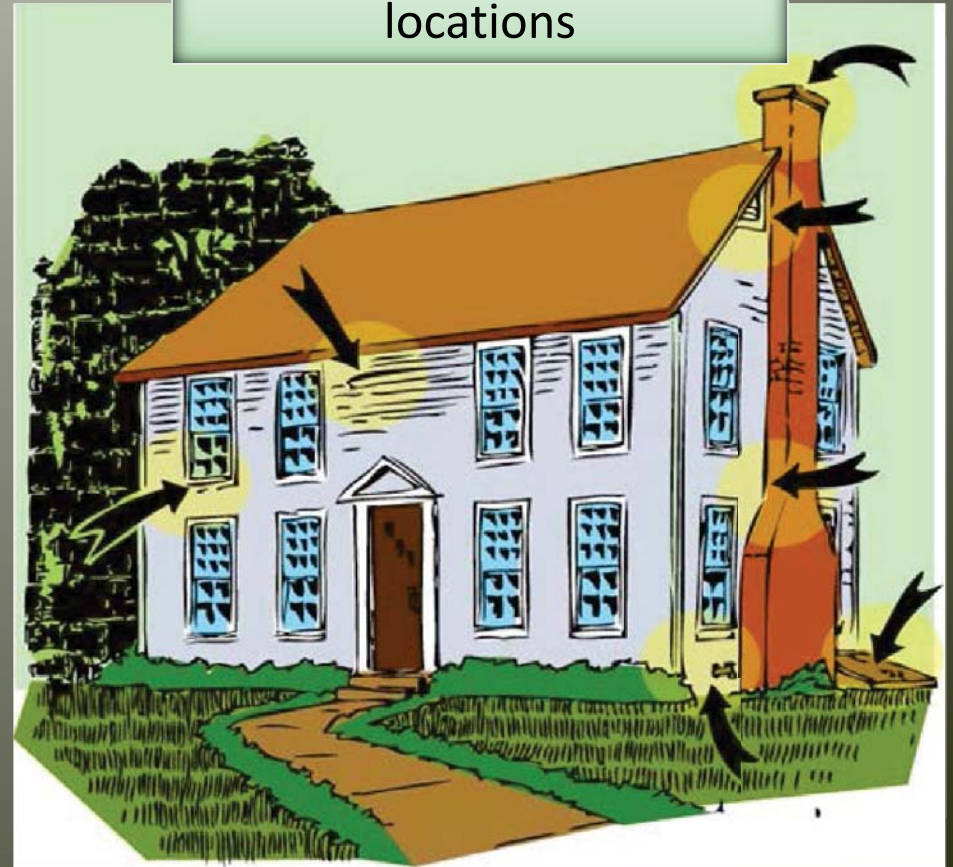
- In the U.S., six bat species are federally listed as Endangered. In California, eight species and three sub-species of bats have experienced declining populations and are designated Species of Special Concern by the Department of Fish and Wildlife.
- When called upon to take care of "bat problems" the person should be knowledgeable in the special care and restrictions required when working with these species.



Removal

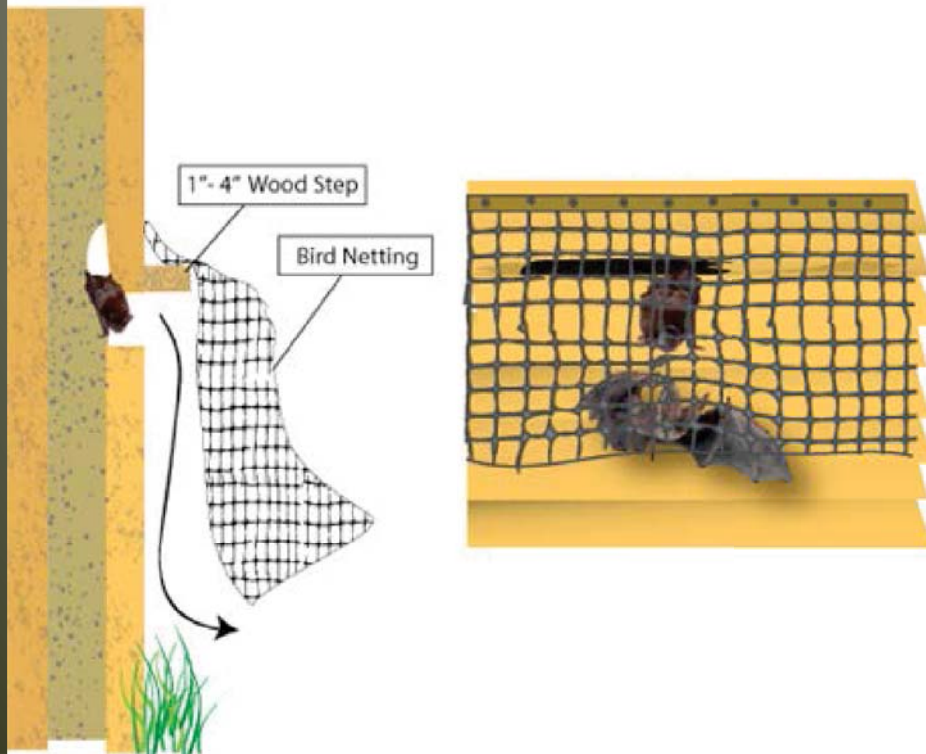
- Bats are reclusive by nature and will attempt to avoid human contact, and more likely will seek to escape an encounter.
- If found roosting in the daytime or during winter months, bats will most likely be torpid (asleep) or hibernating. Torpid bats have a much lower body temperature and metabolic rate, and may not awaken immediately.

Possible bat entry locations



Exclusion

Exclusion Technique



Exclusion technique for bats. Bird netting properly suspended over entry locations, allows emerging bats to crawl under and out, but returning bats are unable to find their way back under.

- Bats that suddenly appear in houses or other buildings have usually entered through rather predictable routes, the most obvious of which are an open door or window. Other common routes are unguarded chimneys, loose window or door screens, or uncovered air vents.
- A piece of $\frac{1}{4}$ - or $\frac{1}{2}$ -inch mesh hardware cloth over the top of the chimney or air vent or a tighter fitting screen should eliminate most accesses. Any hole or opening more than $\frac{1}{2}$ by 1 inch should be closed or sealed, especially those leading to the attic or outer walls. Small holes and cracks can be sealed with silicone caulking, and larger openings with a foam sealant, or even duct tape.
- Unlike rodents, bats do not chew holes or electrical wiring. Large numbers of bats living in an attic or wall space can become a nuisance resulting from their odor, noise, or both.



Exclusion

- Exclusion is best to do during late fall or winter when the bats have migrated or changed their roosting location.
- If there are no young non-flying bats, then a simple exclusion technique is the use of ½ inch polypropylene bird netting to block bat entry to structures. See the hardware cloth slide for proper use.
- Harmless repellents, such as ultrasound devices have never been proven to be effective, despite the seeming sensitivity of bat's acute hearing.
- Although advocated as a repellent in the past, naphthalene (moth balls) has proven ineffective and potentially toxic to humans.





Safety Precautions



- Bats of all sizes will bite in self-defense, but rarely attack people without provocation. By not handling bats, you avoid the risk of being bitten and possibly contracting rabies.
- If you must handle a bat, wear thick gloves, wrap the bat in a heavy towel, or capture and retain the bat in a net or other container. If you are bitten or handle a sick or dead bat with your bare hands, wash your hands thoroughly with soap and water and see a physician immediately.
- Do not discard the bat. It should be retained for possible rabies testing.
- It is illegal and dangerous to keep bats as pets.
- Wear a respirator while working in a confined area that contains bat droppings.
- Persons who have frequent contact with bats or other potentially rabid animals should consider receiving pre-exposure rabies vaccination.
- Poisons and chemicals are illegal and ineffective against bats, and potentially hazardous to humans.
- The only safe, permanent solution is exclusion.

