

Integrated Mosquito and Vector
Management Program Plan

APPENDIX

O






VERTEBRATES OF PUBLIC HEALTH
SIGNIFICANCE IN CALIFORNIA



VERTEBRATES OF PUBLIC HEALTH IMPORTANCE IN CALIFORNIA



Instructions

- As you go through this power point you will be able to navigate through the slides using the buttons located at the bottom of the slides.
- You can use the home  button to return to the main chapter menu at anytime.
- Next you can use the arrow keys to move to the previous slide  or the next slide  in the presentation.
- If you need to return to the current chapter opening slide click on the .
- When a glossary term is necessary, you can click on the  to bring you to the glossary

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Introduction

Because of our physiologic similarities, the ecologic niches humans and other vertebrates often abut or overlap. This close association can lead to competition for resources and space, physical confrontation and transmission of disease.

When the potential hazard posed by another vertebrate species exceeds an acceptable threshold, some manner of abatement or control of that species becomes necessary. Generally, integrated programs combining avoidance, exclusion, deterrence, habitat modification, reduction and removal are the most effective.

The following presentation is intended to provide individuals seeking certification in Category D, The Vertebrates of Public Health Importance in California, the fundamental understanding of the biology and ecology of many vertebrate species of concern and the ethics by which they should be managed.



Chapter 1

SNAKES AND LIZARDS



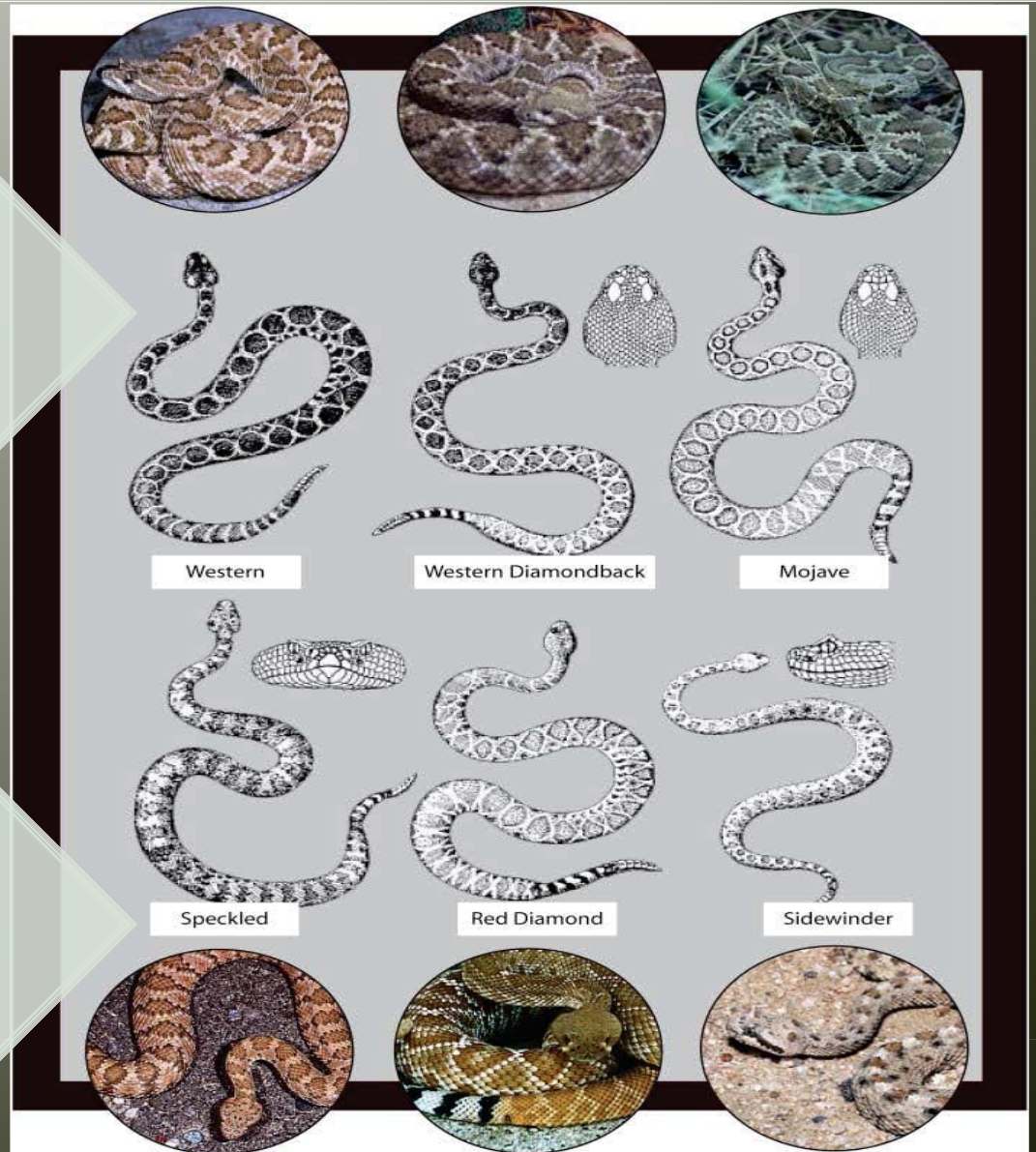
Rattlesnakes

Taxonomy

- Class Reptilia
- Family Viperidae (vipers)

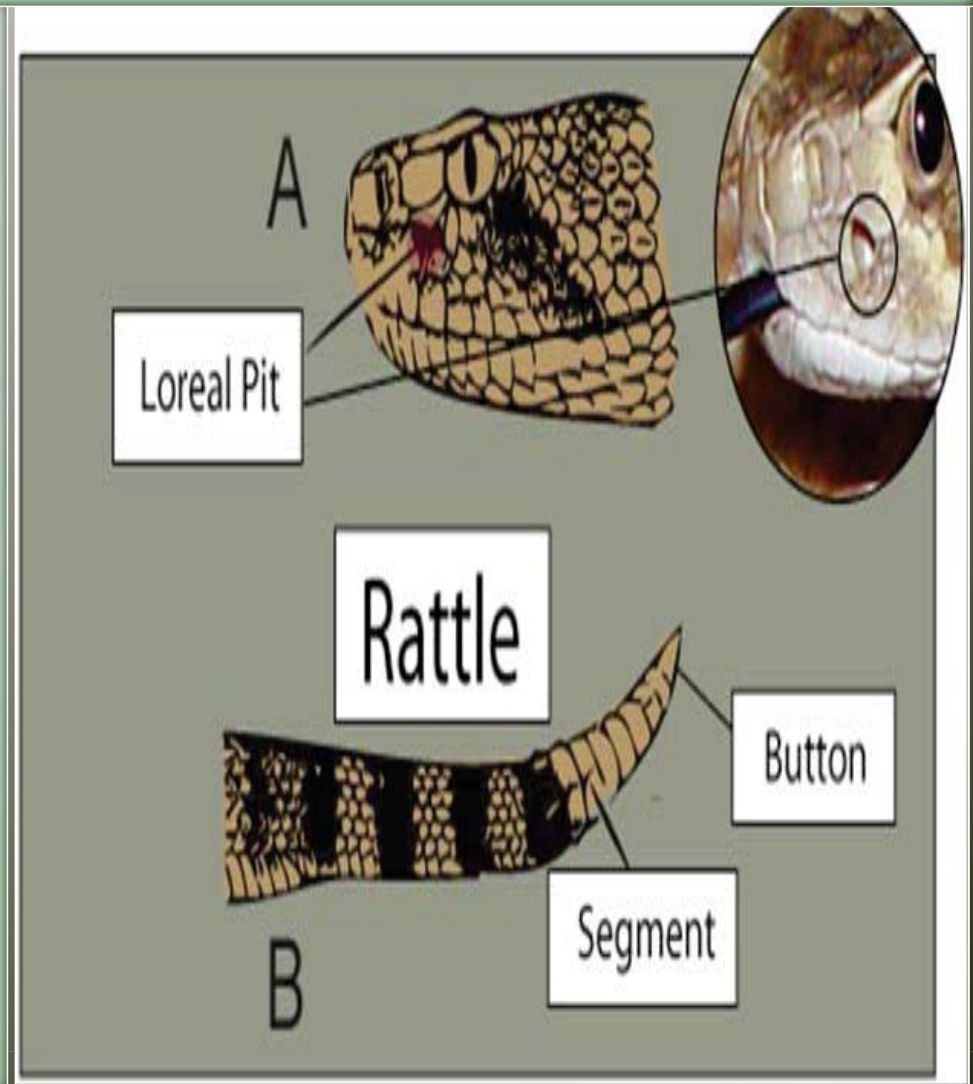
Anatomy

- Rattlesnakes are easily identified by their noticeably triangular head, a heat-sensing (infrared) loreal pit organ located between the eyes and nostrils, keeled scales, vertical pupils and their namesake rattles.



Rattlesnakes

- Rattlesnakes belong to the family Crotalidae, the pit vipers. These snakes have a specialized infrared sensory structure known as a loreal pit between the eye and nostril. Rattlesnakes use this organ to detect body heat of prey in close range.
- Rattlesnakes have an audible warning signal (the rattle) to ward off mammals and predators. Young rattlesnakes are born with only single rattle or button that cannot make sound.
- Rattle segments are dry, interconnected, hollow scales. A single segment is added each time the snake molts.



Rattlesnakes

Ecology

- All reptiles are “cold-blooded” vertebrates and are dependent upon environmental temperatures to regulate their mobility and physiological activities like feeding, digestion, and reproduction.
- Rattlesnakes are active during the warm months, and they will hibernate during the colder months. These patterns are dependent on the environment and can change with the climate.
- Shared underground hibernation dens with a southwestern sun exposure is favored. When rattlesnakes emerge from hibernation, they will begin searching for food during the day but as seasonal temperatures increase they will move towards more nocturnal activity.

Rattlesnakes

- Reproduction
 - Rattlesnakes are different than most reptiles, they produce live young, instead of laying eggs.
 - The number of young is dependent on environmental factors such as availability of prey. The numbers are also dependent on species, size and age of the female. The litters usually fall between 4-15 young that are born in the summer months.
 - Normally the females have one litter per year, but in colder environments it maybe one litter every two years.

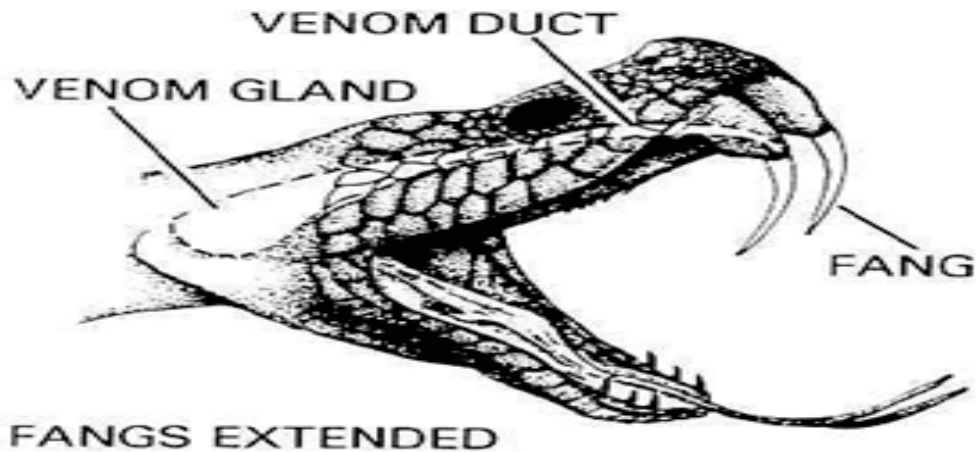


Public Health Significance

- Bacterial infections may result from contact with reptile fecal material, contaminated surfaces, or through bites. Individuals who are accidentally bitten when handling large lizards and non-poisonous snakes typically receive a tetanus shot and are given antibiotics.
- Transmission of *Salmonella* to humans has been documented for persons handling contaminated turtles, and other pet reptiles, like iguanas imported from outside California and sold locally in pet stores.
- An estimated 45,000 snake bites occur per year in North America, with 15-20 of these bites being fatal. Most often these fatal bites occur in the southern states where rattlesnakes are common.
- The victims of non-fatal bites frequently suffer debilitating or disfiguring side effects from bites because the venoms can produce massive amounts of tissue destruction and scars.



Public Health Significance of Rattlesnakes



The venom injected by the fangs of most rattlesnakes are complex mix of proteins. Some of these proteins are enzymes that initiate the digestive process before the prey is swallowed. Other venom components may affect the nerves by reducing the ability of nerves to transmit impulses. The toxicity of rattlesnake venom can vary between species and among populations of the same species. Larger snakes have potential to inject greater quantity of venom. More venom = greater tissue destruction.

Venom toxicity (LD50 mg/kg) is rated by the quantity of venom required to kill 50% of a target animal (e.g., laboratory rat) population as a function of the animal's weight. Among California rattlesnakes, the venom of the Mojave rattlesnake (*Crotalus scutulatus*) is potentially more toxic than other species. Some studies have demonstrated an LD50 of only 0.21 mg/kg. The reason for this is because the venom may contain both hemotoxic and neurotoxic compounds that produce both blood and tissue degradation, as well as disruption of nerve function.



Outdoor Safety



Rattlesnakes do not strike as a consequence of instinctive aggressive behavior, but either as a defensive or hunting action. The best prevention against rattlesnake bite is to:

- Avoid contact.
- Wear protective clothing.
- Use common sense when in "rattlesnake country".

The following is a list of bite avoidance suggestions recommended by the Southwestern Herpetologists Society:

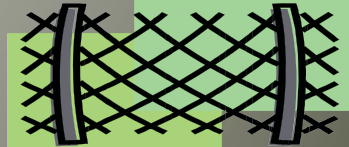
- Do not handle or provoke rattlesnakes and keep a safe distance once encountered.
- Watch where you place your feet; do not step "blindly" over rocks, logs and twigs.
- Watch where you place your hands; do not reach "blindly" over rocks and ledges, into crevices or animal burrows.
- Wear a sturdy pair of leather boots that extend above the ankle or don protective chaps in areas known to be heavily populated with rattlesnakes to prevent bites to feet, legs, and lower torso.



- If a snake bite occurs, the victim should be kept calm, covered with a warm blanket, and transported immediately to an emergency medical facility.
- Cutting and suctioning venom from the bite or applying tourniquets are not recommended due to a variety of complications that arise as a consequence of these radical first-aid procedures, including incipient bacterial infection.
- Administration of specific antivenin and support of life sustaining systems are the only appropriate and effective treatments for snake envenomation.
- If the biting snake was observed and its species can be identified, this information should be conveyed to the attending medical staff as it may provide information valuable toward the proper medical management of the patient. However, rattlesnake species identification is not necessary for proper treatment. Attempts to capture or kill the snake should never be attempted because these actions often result in additional bites.



Management & Control



Exclusion: The most effective means for homeowners to prevent rattlesnakes from occupying their properties is to construct a “snake-fence” around the yard or smaller areas where children and pets play. A rattlesnake fence is usually a one-meter high $\frac{1}{4}$ inch hardware cloth/mesh screening supported by conventional fence posts. The bottom edge of the screen should extend 10-15cm (4-6in) below the surface of the soil to make sure that rattlesnakes will not enter through gaps below the base of the fence. Additionally to the fences, residents should inspect their homes and garage for gaps (5mm or wider) in access doors, vents, and windows. All possible entry points should then be sealed, weather stripped, or screened with $\frac{1}{4}$ -inch hardware cloth.





Management & Control



Habitat Modification: Rattlesnakes in the wild use existing vegetation and other natural cover to hide from predators and to hunt for prey. Weeds, trash, lumber and wood piles as well as abandoned rodent burrows all can be used by rattlesnakes for shelter. Eliminating these areas can significantly reduce the attractiveness of a residence for snakes.



Trapping: In some areas in the United States, rattlesnakes are trapped at den sites during the time that they are entering or exiting the den for overwintering. Snake traps are designed to funnel the snakes to a central collecting location like a pitfall where a experienced handler can then remove them. This technique does not happen often in residential or rural areas because it is difficult to predict the snakes movement.

Public Awareness: The most important way to manage rattlesnakes is to inform the public about the proper steps and attitude to avoid interaction with rattlesnakes in their environment. When the proper clothing, property management, and taking suitable precautions traumatic rattlesnake encounters can be easily avoided.

Lizards

Class: Reptilia



Lizards in California are generally not a threat to public health.

The western fence lizard and the southern alligator lizard are lizards of public health interest because they play a role as secondary hosts of immature *Ixodes* ticks which transmit the bacterial agent of Lyme Disease in California.



California Lizards of Public Health Importance

Description: The gila monster (9-14 in.) is the only venomous lizard in North America. This species is easily identified and unmistakable due to its heavy body, large head, swollen tail, beaded appearance with blotches of red, orange, and pink with brown to black contrasting blotches.



Significance: Little to none. The venom of the gila monster is moderately toxic. Unlike rattlesnakes, the venom is not injected into the prey by fangs, but expelled into the mouth from glands in the lower jaw, from which it flows down the grooves in the teeth and enters the victim when the lizard bites down with a chewing motion.

Range: Extremely rare in California. Historically found in the extreme eastern Mojave Desert of San Bernardino County in the Clark, Kingstone, and Piute Mountains. Once collected from the Providence Mountains and at Imperial Dam along the Colorado Desert.





Western fence lizard (*Sceloporus occidentalis*)

Southern alligator lizard (*Elgaria multicarinata*)



Description: The western fence lizard is one of the most common lizards in California. Measuring 5-18cm, 2-7in. in length. It is also known as the “blue belly” or “fence swift”. The females also have the blue but it is not as bold, or even absent. The females also have dark crescent bars across the back.

Range: The fence lizard is found throughout most of California with the exception of the deserts where it is replaced other *Sceloporus* species.

Habitat: This common lizard resides in a variety of habitats from grasslands, chaparral, sagebrush desert, woodlands, coniferous forest, and farmland.

Significance: This lizard may play an important role as an alternative host to tick species that are known vectors of Lyme disease in California.

Description: A short-legged, heavy bodied lizard with a large triangular head measuring up to 50cm, 20 in. in length. Back is brown to reddish with checked black and white. The distinguishing characteristics for the alligator lizard is its long prehensile tail and large triangular head.

Range: Southern Washington to central Baja California.

Habitat: Occurs in most non-desert habitats; prefers area where there is shade and water. They have adapted to urban life and are found in backyards and vacant lots.

Significance: Just as the western fence lizard the alligator lizard may play an important role as an alternative host to tick species known as vectors for Lyme disease. Alligator lizards are not easily intimidated by humans and can inflict a vigorous and painful bite.

Chapter 2



Introduction

- From the view of public health, birds pose little direct threat to humans when compared with other vertebrates; however, it is important to be aware of the potential health and safety risks that contact with birds could pose.
- The class of Aves has nearly 10,000 species.
- Birds can also be organized into six groups based on their physical features, habitat, and lifestyles.
- In California there are more than 600 wild bird species.

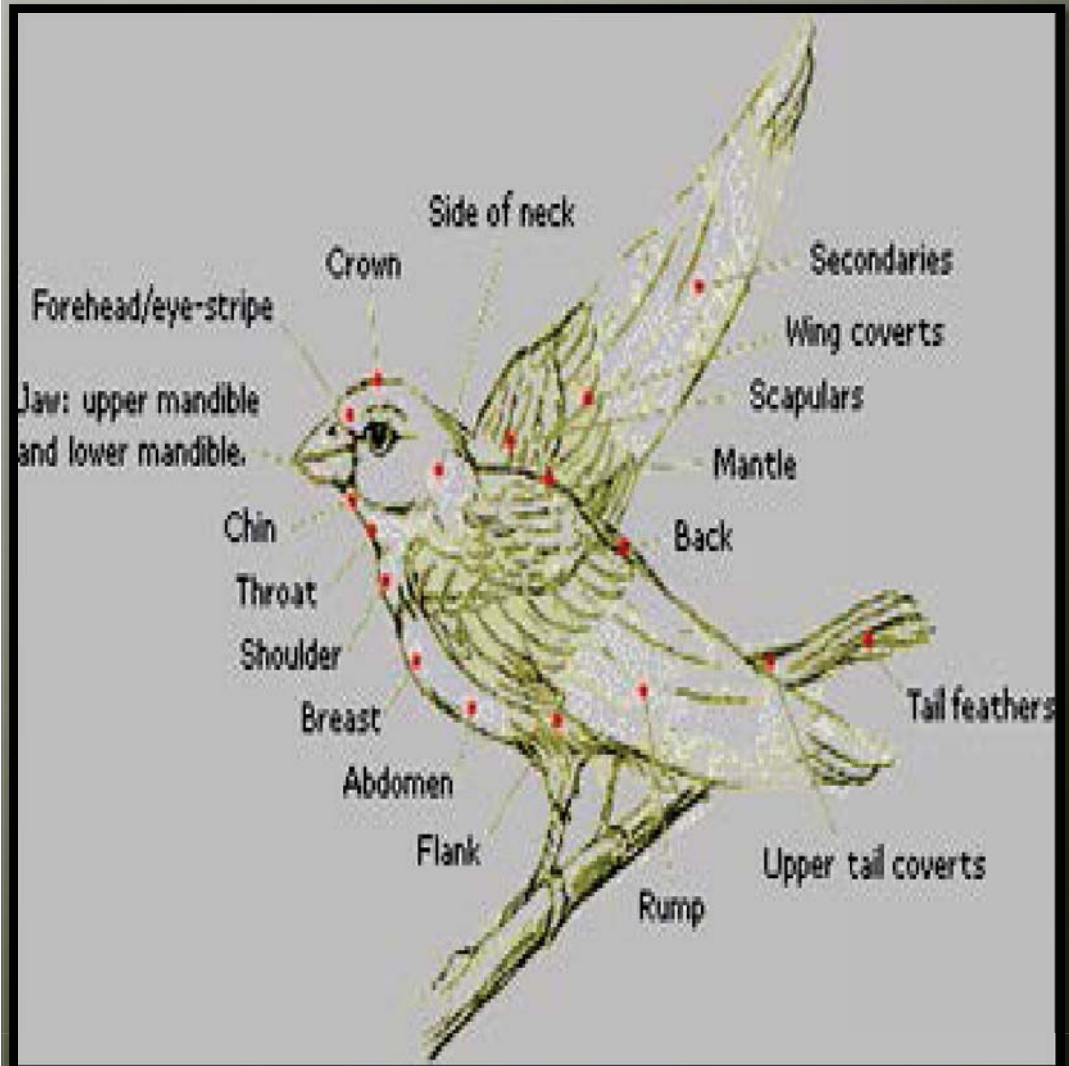


Characteristics

- The six groups that birds can be categorized into are:
 - Perching birds: sparrows, crows, finches, swallows, blackbirds.
 - Birds of prey: hawks, falcons, vultures, owls.
 - Running birds: quail, turkeys, pheasants, grouse.
 - Wading birds: herons, storks, spoonbills, ibises.
 - Aquatic birds: ducks, geese, swans, gulls, pelicans.
 - Other land birds: pigeons, hummingbirds, woodpeckers.

Anatomy

1. Epidermal covering of feathers and leg scales.
2. Skeleton fully ossified with air cavities and beak with no teeth.
3. Paired limbs with the forelimbs usually adapted for flying and posterior pair adapted for perching, walking, or swimming.
4. Internal fertilization with large-yolked, hard shell eggs.
5. Homeothermic (warm-blooded).
6. Four-chambered heart.
7. Respiration by slightly expansible lungs with thin air sacs.



California Birds of Public Health Importance

American Crow (*Corvus brachyrhynchos*)



- Range: Common throughout California.
- Habitat: Developed and undeveloped areas, agricultural land, forests and parks. May nest or roost in urban areas.
- Biology: Nest between February and May. Lay 3-9 eggs; incubation is approximately 18 days.
- Crows flock after fledglings leave the nest. Crows congregate in large communal roosts at night.
- Significance: Important sentinel species for surveillance of West Nile virus in North America.
- Legal Status: Classified as migratory non-game birds and may be taken only by property owners or tenants to avoid health hazard or nuisance.

California Birds of Public Health Importance

House finch

(Carpodacus mexicanus)



- Range: Common throughout California. Most abundant in valleys and foothills.
- Habitat: Woods, deserts, farmlands, suburban and urban areas.
- Biology: Nest in nearly any sheltered area between March and July. Lay 2-6 eggs which hatch in 13-14 days. Broods of young and adult birds band together during the summer. Feed primarily on seeds, buds, and berries.
- Significance: Important reservoir of mosquito-transmitted encephalitis viruses.
- Legal Status: Classified as a migratory nongame bird by Federal Regulations. A U.S. Fish and Wildlife Service permit must be obtained before control measures can be implemented.



California Birds of Public Health Importance

House sparrow

(*Passer domesticus*)



- Range: Common throughout California.
- Habitat: Developed and agricultural areas.
- Biology: Nest building begins in February. Lay 2-7 eggs.
- in up to three broods per year. Eggs hatch in 10-14 days. Young birds and adults flock together in late summer. Feeds primarily on grain, human discards in urban areas.
- Significance: Reservoir for pathogens of veterinary and human medical importance, including western equine encephalomyelitis virus and diverse fungal and protozoal parasites.
- Legal Status: Classified under California Fish & Game Code as a nongame bird which may be taken at any time.



California Birds of Public Health Importance

Canada goose

(*Branta canadensis*)



- Range: Migratory. Summer breeding grounds in Canada and Alaska, but geese of the Pacific flyway overwinter in California and other western states.
- Habitat: Can be found near any body of water, be it natural or man-made (e.g., city park pond).
- Biology: Feed on grasses, grains, and seeds along the water's edge. Form life-long breeding pairs. Lay 3-7 eggs which take 25-30 days to hatch.
- Significance: While goose feces can contain pathogens capable of causing disease in humans, the risk of infectious disease to humans through contact with goose feces is considered quite low. Accumulated fecal material from large flocks can deface public areas (e.g., golf courses) and create hazard of injury on walkways. Because of their large size (up to 24 lb) and aggressive disposition when defending a nest, Canada geese present a risk of biting injury, especially to small children.
- Legal Status: Protected by state and federal law (Migratory Bird Treaty Act). A permit must be obtained from the U.S. Fish and Wildlife Service before geese may be taken.



California Birds of Public Health Importance

Rock dove, aka. city pigeon

(*Columba livia*)



- Range: Widely distributed within and around developed areas of California.
- Habitat: Cities, suburbs, and farmland.
- Biology: Use shelters and ledges, commonly on man-made structures, for nesting sites. Lay 1-2 eggs which hatch in 16-19 days. Five or more broods are raised each year. Feed mostly on seeds and grains. In cities, may subsist on foods intentionally or inadvertently offered by humans.
- Significance: Host for several pathogens of veterinary and medical importance, including *Toxoplasma* and *Salmonella*. Pigeon feces can deface buildings, automobiles, walkways, and public art. Pigeon feces also provide an ideal medium for growth of *Histoplasma* and *cryptococcus* fungi, both of which can cause respiratory illness in humans. Their nests can interfere with drain pipes and awnings.
- Legal Status: Rock doves are not protected by federal or state law.

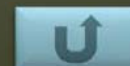


Public Health Significance

Avian Influenza (bird flu). Influenza is caused by RNA viruses that come in many varieties and are constantly evolving. Pathogenicity and transmissibility to different species is determined principally by the virus's hemagglutinin (H1-H16) and neuraminidase (N1-N9) type. Whereas most species are susceptible to only a few virus types, birds can carry and transmit virtually all influenza viruses. Avian influenza viruses are further classified as either High Path or Low Path, based on their mortality amongst birds.

Most avian influenza viruses cause no or mild symptoms in humans. However, when avian influenza viruses mix with other influenza viruses, e.g., in swine, viruses can swap genetic material and change their pathogenicity and ease of transmission to other species.

Introduction of novel avian influenza viruses from their reservoir in wild waterfowl to domestic poultry can cause significant mortality as well as restrictions on movement and marketing of birds.



Public Health Significance

Psittacosis (parrot fever, ornithosis). *Chlamydophila psittaci* is a bacterium transmitted from birds to humans that affects primarily the respiratory system. *C. psittaci* has been isolated from approximately 120 bird species and is most commonly identified in psittacine birds, especially cockatiels and parakeets.

Approximately 75% of cases result from individuals exposed to caged pet birds, the majority of whom are bird fanciers or pet shop employees. However, transmission has also been documented from wild birds, including doves, pigeons, raptors, and shore birds. The infection is acquired by inhaling dried secretions (including feces) from infected birds. The incubation period is 6-19 days. The clinical features in humans include fever, chills, headache, muscle aches, and a dry cough. The infection usually resolves with appropriate antibiotic therapy, but rarely heart, liver, and neurologic complications may occur and fatal cases have been reported.



Public Health Significance

Dermatitis. Mites (e.g., *Ornithonyssus* spp.) that infest wild and domestic birds can occasionally infest and bite humans, causing pruritic (itchy) rashes. Persons who handle wild birds or their nests are at potential risk of infestation. Avian mites can be controlled by treating the birds and wearing protective clothing and or spraying clothing with insect repellents prior to entering infested areas.

Hypersensitivity pneumonitis. Some persons may experience an allergic reaction to bird antigens present in dander. Exposure may cause respiratory inflammation when the antigens are inhaled. Sensitive persons can protect themselves by wearing respiratory protection and by working in well-ventilated areas.

Gastroenteritis. A variety of disease agents that cause diarrhea and vomiting, such as *Salmonella* and *Campylobacter*, may be present in bird feces. People can get these diseases by ingesting the bacteria present as surface fecal contamination on undercooked meat or poultry. People can also become infected by handling infected birds or bird feces and then contaminating food items or other surfaces by touching them without first washing their hands.



Public Health Significance

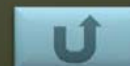
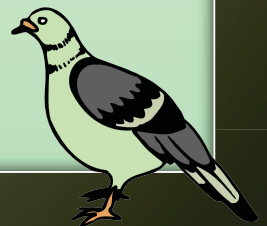
Arboviral encephalitides. Birds can serve as reservoir hosts for several of the viruses associated with mosquito-borne viral encephalitis.

In California, house finches and house sparrows are the most important reservoirs for western equine encephalomyelitis virus (WEE) and St. Louis encephalitis virus (SLE). These species are important to arbovirus transmission because they a) are abundant, b) live in close association with many human communities, c) have a relatively high proportion of infected birds, and d) maintain a persistently high viremia. Birds remain generally unaffected by infection, but mortality can be significant with the more virulent (e.g., eastern equine encephalomyelitis) or exotic (e.g., West Nile) arboviruses.

Public Health Significance

Fungal infections. Bird feces can serve as an ideal environment for the growth of a number of fungi that can cause severe disease in some humans. Growth of certain fungi, normally present in the soil, may be promoted in the presence of bird fecal matter.

In California, *Cryptococcus neoformans* is often isolated from pigeon feces. Individuals can become infected following inhalation of aerosolized dust or soil that is contaminated with pigeon feces. Only a small percentage of exposed persons develops respiratory illness; however, the risk of severe illness is increased for immunosuppressed individuals. Precautionary measures include controlling urban pigeon populations, avoiding highly contaminated areas, working in well-ventilated areas, wetting down contaminated areas prior to entry to minimize aerosolization, and the use of respiratory protection.

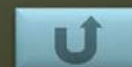


Management and Control



- Waste management

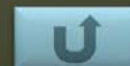
- Management and control of bird populations and their waste products can be difficult, but efforts should be taken especially around areas where susceptible people are like hospitals and nursing homes.
- Cleanup should take place at times when risks to passersby are at the lowest. Barricades should be placed to deter pedestrians.
- If cleanup is taking place on a roof, close all air ducts into the building before beginning to clean.
- Persons conducting cleanup should wear appropriate clothing, eye, and respiratory protection.
- Bird droppings pose the biggest risk of infection when they are dried and able to get stirred up into the air where they can be inhaled. Before cleanup begins dropping should be saturated with a low-pressure fine mist of disinfectant solution (e.g., diluted bleach).



Management and Control

- Bird control

- Control actions depend on the species involved, the habitat, and the level of infestation. Bird control is rarely achieved with a single product or treatment so a combination of habitat modification, use of repellents and removal of problem birds should offer adequate control.



Management and Control

- Habitat modification

- Birds are attracted to areas where food, water, and shelter (for nesting and roosting) are available to them. Eliminating or restricting access to these resources will help to limit the number of birds in the area.
- Typical food sources are fruit, nuts, seeds and insects. netting can be draped over producing plants to keep birds away.
- Removing unneeded water sources will help limit bird numbers.
- Repellents use both audio and visual techniques. Effective with some bird species like the European starlings, but ineffective with other species such as the rock dove. Statues made to look like predators like owls or raptures have been shown to scare some birds away.

