

SAN JOAQUIN COUNTY  
**MOSQUITO  
& VECTOR  
CONTROL DISTRICT**



*Protection Through Prevention*

# MOSQUITOES AND MOSQUITO PREVENTION



- West Nile Virus
- Mosquito Life Cycle
- Mosquitoes of Concern
- Common Mosquito Sources
- Mosquitofish
- Canine Heartworm and Treehole Mosquitoes
- Insects that Resemble Mosquitoes

[www.sjmosquito.org](http://www.sjmosquito.org)

*Mosquitoes can transmit a variety of viruses and parasites to people and animals including West Nile virus, Western equine encephalomyelitis, St. Louis encephalitis, and other viruses, canine heartworm, and malaria.*

### ***Out for Blood***

Mosquitoes are small biting flies.

Both male and female mosquitoes feed on plant juices for food.

Only females bite to get blood from mammals, birds, amphibians, and reptiles using specialized mouthparts (proboscis).

Proteins in blood are needed to produce eggs.

Many mosquitoes lay their eggs in a raft form on still water, and others around the edges of containers or on damp soil.



### **MOSQUITOES & DISEASE**

Mosquitoes can be annoying, but they are most important as vectors (transmitters) of disease. Well over 50% of emerging threats to public health worldwide are diseases of animals transmitted to humans. Diseases once nearly eradicated are making a comeback in the United States and around the world.

Viruses that cause West Nile virus (WNV) and other encephalitides are normally found in birds, but also cause illness in people each year. Since introduced in 2004, many people have been sickened by WNV in San Joaquin County, as well as throughout California. Thankfully, most people bitten by an infected mosquito will not have symptoms. Approximately 20% will develop West Nile fever. Symptoms may include headache, fever, body aches, vomiting, nausea, swollen lymph glands and skin rash on the chest, stomach and back. A small percentage of this group will develop acute illness that invades the brain and/or nervous system leading to a more severe form of the disease typified by mental confusion, coma, paralysis, and in extreme cases, death.

There is no cure for WNV, but by following simple mosquito-proofing and bite prevention tips found in this brochure, you can reduce your risk and protect your family from mosquito-transmitted disease. For more information on mosquitoes and disease see our website at [www.sjmosquito.org](http://www.sjmosquito.org).

# Life Cycle of the Mosquito

The entire life cycle from egg to adult takes an average of five to seven (5-7) days for most species. In colder temperatures, this life cycle slows down.

## EGG

Adult female mosquitoes lay approximately 100-300 eggs either in clusters called rafts which float on the surface of the water, or singly on or at the water's edge. Larvae hatch from eggs within days after contact with water.



Egg raft actual size:  $\longleftarrow$  (1/8 inch)

## LARVA

Larvae are often found at the surface of the water where they breathe and feed. They live in a wide variety of water-filled sources including neglected swimming pools, ditches, storm drains, household containers, tree holes, ponds, horse troughs, and discarded tires. Larvae feed on algae and bacteria in the water and shed their skin four times as they grow over several days or weeks.



Larva actual size:  $\longleftarrow$  (1/16 inch)  
to  $\longrightarrow$  (3/8 inch)

Photo by M.J. Higgins

## PUPA

As pupae, mosquitoes transform in their cocoon-like shell. Pupae do not feed but must come to the water's surface to obtain oxygen. Once fully developed, the pupal skin splits and the adult mosquito emerges.



Pupa actual size:  $\longleftarrow$  (1/8 inch)

Photo by M.J. Higgins

## ADULT

Newly emerged adult mosquitoes rest on the surface of the water until they are strong enough to fly. After mating, female mosquitoes fly off in search of a blood meal necessary for developing eggs.

Female mosquitoes are attracted to heat, odors, and carbon dioxide given off by hosts such as humans, mammals, reptiles, and birds. Adult mosquitoes live an average of 1-3 weeks in the summer and 3-4 months overwintering.



Photo by M.J. Higgins

## Adult Mosquitoes and Species of Concern

Adult mosquito control may become necessary if mosquito populations are high and disease transmission is occurring in specific areas. There is an approximate range of 3,000 – 3,500 species of mosquitoes worldwide. California is home to 53 different species, 17 of which are found in San Joaquin County. Those of greatest concern fall into one of four groups listed below.

### CULEX

Photo by M.J. Higgins



*Culex* are often brown or reddish and feed oriented horizontally.

The most prevalent mosquitoes in San Joaquin County, *Culex* thrive in natural and man-made sources of highly organic water including drainages, underground sumps, dirty or neglected swimming pools, and containers. Other *Culex* species thrive in cleaner water like animal water troughs and collected rain water. Most can mature from egg to biting adult in 5-7 days. Some species fly only short distances, but others may fly up to 10 miles in search of a blood meal and are active from dusk to dawn.

These mosquitoes feed primarily on birds, but also bite humans and are major vectors of West Nile virus, Western equine encephalomyelitis, and St. Louis encephalitis viruses.

### ANOPHELES



*Anopheles* feed head down at a characteristic 45-degree angle.

The most common *Anopheles* in northern California transmitted malaria among early settlers. While malaria is no longer endemic in California, local outbreaks can occur when infected travelers are fed upon by local mosquitoes.

*Anopheles* larvae are often found in rivers and canyon streams in algae mats and cattail stands.

Females are strong fliers and aggressive biters at dawn and dusk. *Anopheles* mosquitoes prefer to feed on humans and large mammals.

## ***AEDES***

Many *Aedes* inhabit flooded wetlands, irrigated pastures or breed in containers and tree holes. *Aedes* feed aggressively during the day and are significant vectors of dengue, chikungunya, and other viruses worldwide. In California, the treehole mosquito is responsible for transmitting canine heartworm and is often found in wooded areas where treehole cavities are common. Several invasive species of *Aedes* have been introduced into California and eventually may become established in San Joaquin County. If you notice day-biting mosquitoes, please report them promptly.



Photo courtesy of R. Berg,  
www.bugguide.net

Many *Aedes* have striking black and white banding.

## ***CULISETA***

These “cool-weather” mosquitoes are most common between fall and spring. Typically larger than *Culex* mosquitoes, *Culiseta* prefer to bite large mammals instead of humans. Larval habitats include both sunlit and shaded ponds, puddles, and artificial containers holding relatively clear water. These mosquitoes may be important in the maintenance cycle of canine heartworm.



Photo Courtesy of Kerry S. Matz,  
www.bugguide.net

*Culiseta* are larger and darker than other common species.

### **What can I do to avoid being bitten?**

- Apply a repellent that contains DEET, Picaridin, IR3535®, or Oil of Lemon Eucalyptus. Protection time varies on the type and percentage of active ingredient in these products. Make sure you follow label directions!
- Wear protective clothing, such as long-sleeved shirts and pants.
- Check and repair all screens and screen doors to keep mosquitoes out of your house.
- Minimize outdoor activities at dawn and dusk when mosquitoes are most active.

### ***Actual Size***

Mosquitoes are generally about 1/2” at full adult size.



# Fight the Bite! Protect Yourself

## A BIT ABOUT THE BITE!

That itchy bump you get after a bite is a reaction to the saliva a mosquito injects when it feeds. Viruses and other pathogens can also be transmitted through mosquito saliva.

## FIND SOURCES!

Look for anything that can hold water for more than a few days. Buckets, dirty/neglected swimming pools, tires, trash cans, and other containers should be drained and/or cleaned weekly.

## AVOID THEM!

Try to limit outdoor activity at dusk and dawn during peak mosquito season (spring through fall).

## BLOCK 'EM OUT!

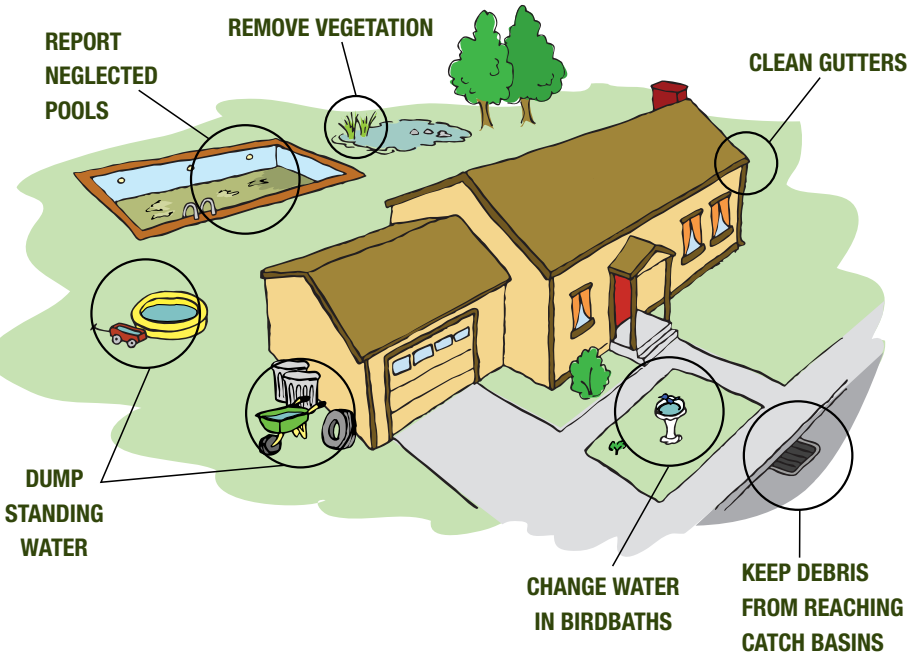
Make sure windows and doors have tight fitting, intact screens. This will help keep other unwanted critters out too!

## USE MOSQUITOFISH!

These small, hardy fish can eat hundreds of mosquito larvae a day in a backyard pond or other man made source of water. Call us, we provide them at no charge to our residents.

## WEAR REPELLENTS!

Wear long sleeves and pants and use repellents when outdoors. Remember to read the labels and carefully follow instructions on all insect repellents.



## Common Residential Mosquito Sources

Residential yards are often the #1 source of mosquito production in a community. Anything that can hold a half inch of water for more than five days can be a source of mosquitoes. This includes puddles in lawns and gardens, flower pot saucers, neglected swimming pools and spas, bird baths, clogged rain gutters, and more. Maintain, manage, or eliminate all types of standing water regularly.

*Use this home & garden checklist to help make your activities around your home safer & more enjoyable.*

- Trash bins:** Keep lids shut tightly and remove water that accumulates inside. Drill several drain holes in the bottoms.
- Boats:** Check and remove water weekly from boat covers.
- Fountains and bird baths:** Clean or hose out weekly.
- Rain gutters:** Keep clear of leaves and other debris.
- Potted plant saucers:** Don't over water. Flush out saucers with a hose or drill holes in the bottom to allow for better drainage.
- Tires:** Drill holes in tire swings. Recycle used tires or store in a covered area.
- Water bowls for pets:** Rinse and fill with fresh water 1 to 2 times a week.
- Water troughs:** Stock with free mosquitofish from the District.
- Leaky hoses:** Replace damaged hoses and fix leaky faucets and pipes.
- Low areas:** Do not over water lawns or gardens.
- Ponds:** Stock ornamental ponds with mosquitofish. Keep ponds clear and free of excess vegetation.
- Neglected swimming pools and spas:** Maintain even when not in use. Remove standing water on top of covers. Report neglected pools or spas by contacting the District.
- Containers:** Store containers upside down, cover or place in a sheltered area.
- Rain barrels:** Cover tightly with a fine mesh screen.
- Chain link fence:** Cover hollow chain link fence posts with caps.
- Drains:** Make sure that drains are not clogged by debris and flow freely.
- Flat roofs:** Water may puddle on flat roofs during the rainy season. Inspect weekly and remove any standing water.
- Lighting:** Check garden lights and eliminate water from tops of fixtures and from inside floodlights.
- Sculptures:** Check for water that may collect in lawn ornaments. Drain or flush out weekly.
- Screens:** Install and maintain tight fitting window and door screens.
- Rot hole in trees:** Be aware that water can collect in treeholes, crotches and dead tree stumps. Check with an arborist for best way to manage water or fill cavities.
- Water under home:** Use a sump pump to remove water.
- Septic tanks:** Screen vent pipes with a fine mesh screen. Cover exposed tanks or manhole lids with plastic or a similar material and secure in place. Place several inches or more of dirt or sand over the top of the area.
- Wheelbarrows:** Remove water that collects inside or store upside down.

## Immature Mosquitoes

Eliminating sources of standing water removes habitat where mosquitoes lay their eggs. Immature stages must have water to survive. Overturning buckets and other containers will prevent mosquitoes from maturing into biting adults. In areas where water cannot be removed, mosquitoes can be managed using biological or chemical control.



To help mosquitofish adjust to a new home, place the container of fish directly into the pond for 10-15 minutes before release.

Mosquitofish are opportunistic feeders; they will eat just about anything, but to sustain them a small amount of fish flake food is beneficial. In colder winter months it helps to feed fish several times a week. Crushed fish flake food is best.

### Mosquitofish-Biological Control

Mosquitofish (*Gambusia affinis*) are small, surface feeding fish used throughout the world to control mosquito larvae. They are well adapted to artificial ponds and are available for delivery or pickup, free of charge to residents within San Joaquin County. They are available for use in artificial containers like water troughs, backyard ponds, fountains and neglected swimming pools, and should not be released into natural water areas.

Mosquitofish may not be compatible with koi as mosquitofish tend to nibble on fins and tails. Game fish such as bass, bluegill and trout feed on mosquitofish.

### Chemical Control

Chemical control for mosquito larvae is called larviciding. The safest and most commonly used products are derived from natural sources. Bacteria, insect juvenile growth hormones and surface films all help to eliminate mosquitoes in their aquatic stage.

## BACKYARD REMEDIES FACT OR FICTION?

- Many electronic devices claim to repel mosquitoes with high frequency sounds that mimic their natural predators; however there is no scientific support for these claims.
- Bug 'zappers', even those using mosquito attractants, are not effective against mosquitoes.
- Citronella candles/oil lamps may provide benefit over a limited area but should not be relied upon to protect users from bites.
- Mosquito traps will attract and capture a percentage of the mosquitoes however they are expensive to purchase and maintain. They work best when placed at the periphery of large properties in areas where mosquito numbers are high.



# Mosquitoes Can Make Your Pets Sick Too!

Canine (Dog) Heartworm Disease is a serious and sometimes fatal condition in dogs caused by the roundworm *Dirofilaria immitis* that lives within the dog's heart and lungs. Heartworm affects coyotes, foxes, dogs, and rarely cats, and is transmitted by mosquitoes, particularly the Western treehole mosquito (*Aedes sierrensis*).

## BIOLOGY

Adult heartworms are 6 -12 inches long and can reduce blood flow to the point that the heart, lungs, liver, and kidneys of canines are damaged. Symptoms are usually not apparent until after damage has been done. Advanced symptoms of heartworm include: rapid tiring, panting, chronic soft dry cough, listlessness, and weight loss.

Mosquitoes become infected and can transmit heartworm after feeding on an infected dog, fox, or coyote. Humans cannot develop heartworm even if bitten by an infected mosquito.

## PREVENTION

It is usually impossible for mosquito control agencies to eliminate treehole mosquitoes from a problem area because of the difficulty in locating and accessing breeding sources. Immature treehole mosquitoes develop in the water that collects in rot holes of mature trees, old tires, cans, buckets, and other containers. Treehole mosquitoes are most common in heavily wooded areas including neighborhoods.

Homeowners should examine trees and tree stumps on their property for rot holes, cavities, and crotches that can hold water. If holes are found, consult an arborist to determine the best way to correct the problem. Holes may be filled with sand or water absorbing gel polymers (polyacrylamide). Eliminate other breeding sources by emptying, turning upside down, or throwing away containers that hold water.



Used with permission from UC Davis

Dog heart with heavy worm infestation.

### **Pet Prevention**

Pet owners should consult with their veterinarian about testing and preventative medications for dogs, especially those that frequently spend time outdoors.



Photo courtesy of R. Berg, www.bugguide.net

*Aedes sierrensis* aka the "Treehole Mosquito".

## Insects That Resemble Mosquitoes

The Northern California Valley is home to numerous insects that closely resemble mosquitoes. Many of these insects emerge in large numbers during the early spring, alarming the public. The following are insects that are often mistaken for mosquitoes.

Photo ©entomart



Midge

### Actual Size

Midges are generally about 3/8" at full adult size.



## MIDGES

Midges are small, grayish colored flies similar in size to mosquitoes. Most species do not bite or pose a health risk, but can be a serious nuisance, particularly in communities adjacent to large aquatic habitats. They have a body (abdomen) that is longer than their wings. Immature midges live in damp or submerged soils and are often an important source of food for aquatic predators. Adult midges are short-lived and weak flyers. During peak emergence, massive swarms may appear like clouds of smoke from afar, and when at rest, can cover houses, cars, and other structures.

Photo ©entomart



Crane Fly

### Actual Size

Crane Flies can be from 1" to 3" depending on species.



## CRANE FLIES

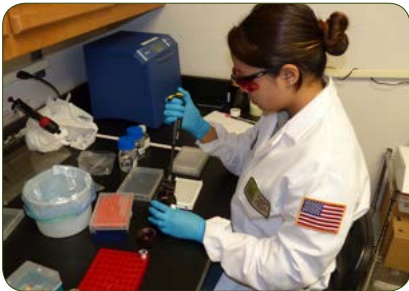
Often called "mosquito hawks," harmless crane flies are much larger than mosquitoes and cannot bite or transmit any diseases to people. Crane flies are tan, brown or reddish in color with long legs and slender bodies reaching 1 to 3 inches in length. The larvae live in moist soil, muddy water, or decomposing material.

These non-biting insects are short-lived and do not constitute a health problem but can be annoying when found inside homes or in large numbers. If they get indoors, they should be released back outside since crane flies are an important seasonal food source for birds.

# What We Do To Control Mosquitoes

The District uses a knowledge-based and surveillance-driven approach to controlling mosquitoes. Mosquito control starts with surveillance of mosquito activity. Mosquito samples are collected, counted and tested for mosquito-borne disease.

The results help in concentrating mosquito control activities. These activities include biological, physical, educational, chemical, and legal control methods.



Surveillance and testing.



Treatment of mosquito sources.



Local aviation preparing for larva control.



Outreach presentation.



Mosquitofish harvesting.



Physically preventing mosquito sources.

# San Joaquin County Mosquito & Vector Control District

*Protection Through Prevention since 1945*

San Joaquin County Mosquito and Vector Control District is an independent special district governed by a board of trustees.

The District covers over 1,400 square miles including seven cities and all unincorporated areas. District operations are based on a concept that utilizes several different approaches to vector control. The District uses state-of-the-art, environmentally sound techniques as a sustainable approach to managing public health pests and vectors, by combining biological, chemical, legal, natural and physical control tactics in a way that minimizes economic, health and environmental risks.

San Joaquin County Mosquito and Vector Control District continues to protect public health through preventive techniques, as well as providing surveillance for potentially new invasive mosquitoes and exotic diseases they may carry.

Front cover photo by Jim Gathany

## SERVICES PROVIDED

for **San Joaquin County Residents** (cities and rural areas)

### Mosquitoes

Inspection  
& Control

### Mosquitofish

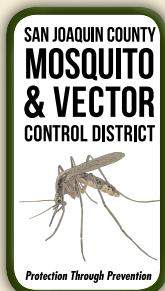
For Residential  
& Agricultural Sites

### Ticks

Inspection, Identification  
& Education

### Public Education

Literature, Presentations,  
Website, News & Spray Alerts



209.982.4675

1.800.300.4675

7759 S. Airport Way  
Stockton, CA 95206

### District Hours

Monday-Friday  
7a.m. to 3:30p.m.

[www.sjmosquito.org](http://www.sjmosquito.org)

Visit our website for  
more information

