




# **Mosquito & Vector Control Program**

## **2015 Annual Report**

DEPARTMENT OF PUBLIC HEALTH  
DIVISION OF ENVIRONMENTAL HEALTH SERVICES





# **San Bernardino County Mosquito and Vector Control Program 2015 Annual Report**

**385 N. Arrowhead Ave. 2<sup>nd</sup> Floor  
San Bernardino, CA 92415  
1(800) 442-2283  
[www.sbcounty.gov/dph/dehs](http://www.sbcounty.gov/dph/dehs)**

Trudy Raymundo  
Director, Department of Public Health

Maxwell Ohikhuare, M.D.  
Health Officer

Corwin Porter  
Assistant Director, Department of Public Health

Josh Dugas  
Chief, Environmental Health Services

Jason Phillippe  
Program Manager, Environmental Health Services

Morena Garcia  
Mosquito & Vector Control Program Coordinator



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## **I. PROGRAM OVERVIEW**

The San Bernardino County Mosquito and Vector Control Program (MVCP), under the Division of Environmental Health Services, pursues its mission by providing quality and responsive services to County residents within its jurisdiction covering an area of 19,493 square miles. MVCP engages in water source surveillance and treatment to proactively control mosquito population and prevent breeding. MVCP responds to citizen requests for educational presentation as well as complaints/service requests for community control of vectors and nuisance pests such as mosquitoes, flies, rodents, and Africanized Honeybees. The MVCP monitors for the presence of vector-borne diseases, inspects poultry ranches, dairies, and riding academies for flies and other vector-related issues. The MVCP also provides direct abatement and control services in sanitary sewer systems, flood control channels and basins, public streets, and parks.

The California Legislature adopted the “Mosquito Abatement Act” in 1915. The law was later incorporated into the State Health and Safety Code, which authorized the creation, function and governance of Mosquito Abatement Districts in the State of California. This law was amended in 1939 and 1980 and then repealed and replaced by a new comprehensive Mosquito Abatement and Vector Control District Law in 2002.

The 1972 Saint Louis encephalitis outbreak in Los Angeles infected four people in San Bernardino County. This outbreak increased mosquito-borne disease awareness in the County and prompted the establishment of this vector control program in the Department of Public Health.

On November 24, 1986 the County Board of Supervisors adopted a County ordinance which granted authority for the creation of a Mosquito and Vector Control Program with the services provided to County residents in a wider area, enhancing the surveillance of vectors and vector-borne diseases.

The detection of Hantavirus in the County in the mid-1990s resulted in improved collaboration with local, state, and federal agencies; later, the arrival of Africanized Honeybees to the County in 1998 caused the program to focus efforts to mitigate this heightened concern of residents and visitors.

The arrival of West Nile virus (WNV) in the United States in the summer of 1999 required increased vigilance and an extensive outlay of resources nationwide. Once the disease was detected in the County in 2003, the focus of MVCP shifted to monitoring and controlling mosquito-borne diseases. This increase in services demanded additional resources to reduce the risk of WNV in the County.

In 2015, MVCP developed resources to establish abatement strategies for the Asian Tiger Mosquito (*Aedes albopictus*) and the Yellow Fever Mosquito (*Aedes aegypti*) in San Bernardino County. These newly introduced species are capable of transmitting diseases such as Zika, yellow fever and dengue fever.

Unlike most mosquitos that emerge and feed at dusk, the Asian Tiger mosquito is a daytime feeder. It is an aggressive biter and its feeding peaks in the early morning and late afternoon. The Yellow Fever Mosquito feeding also peaks in daytime but prefers biting indoors and primarily bites humans. Mosquito bites occurring during daytime hours should be reported immediately so MVCP can conduct surveillance activities to determine if either of the above mosquitos are present.

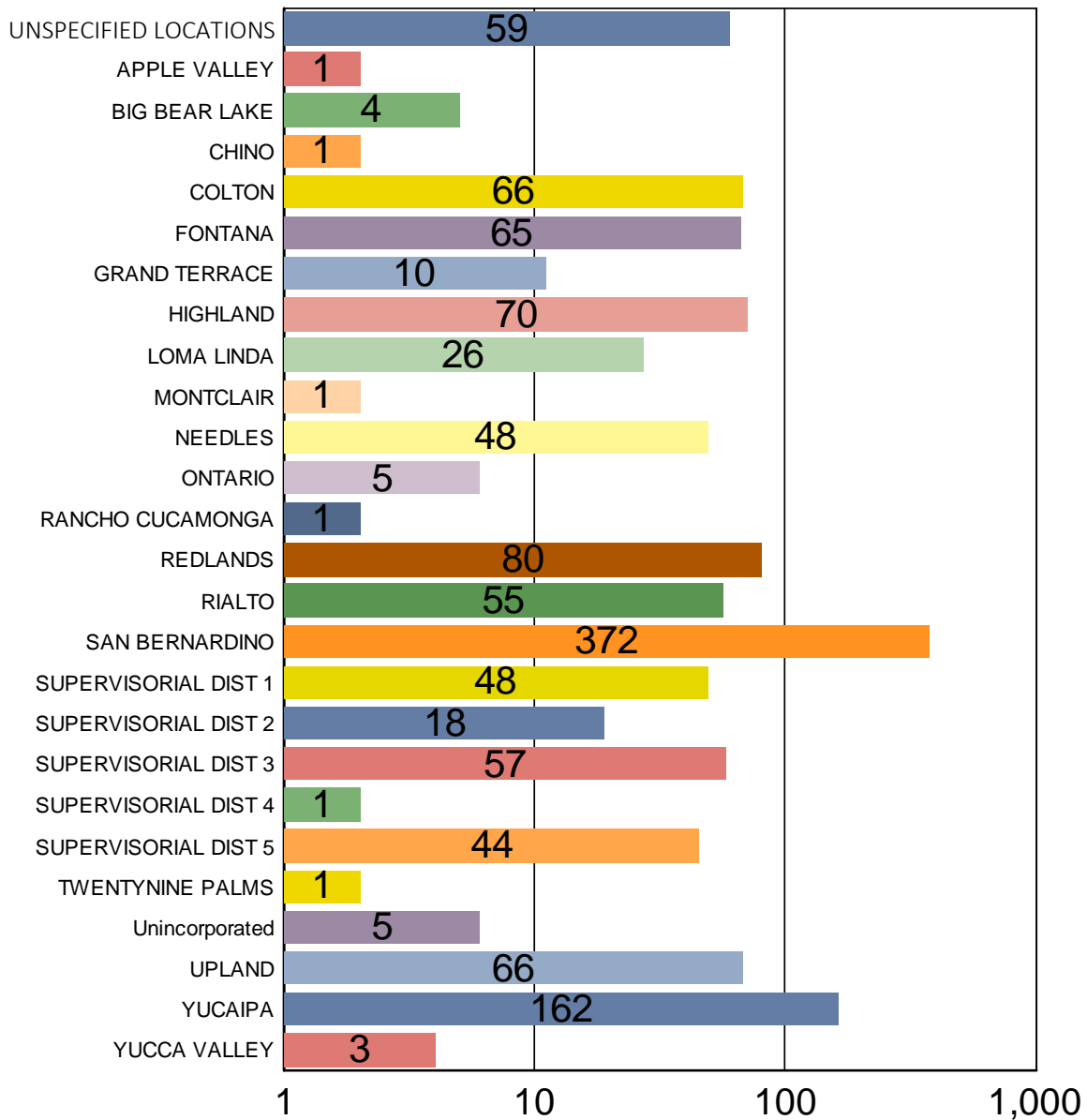


*Yellow Fever Mosquito (Aedes aegypti) (left) and Asian Tiger Mosquito (Aedes albopictus) (right)*

The following pages summarize operations, disease surveillance, and health education activities conducted by MVCP from January 1, 2015 through December 31, 2015. The report provides an overview of vector control activities and analyzes the level and distribution of MVCP services throughout the County.

## II. OPERATIONS

MVCP is currently staffed by a Supervising Environmental Health Specialist, an Environmental Health Specialist III, a Vector Control Technician II, 7 Vector Control Technician I, 5 seasonal field staff, an Office Assistant III and other support staff in the County Department of Public Health. Services provided to residents and visitors of San Bernardino County include responding to service requests/complaints relating to vector control issues within 24 to 48 hours, routine mosquito control, surveys that target vector species, and community education. In 2015, MVCP staff responded to 1,269 service requests and conducted approximately 10,278 water source inspections on 1,015 inventoried water sources to eliminate mosquito breeding.



**Figure 1** Number of Service Requests Received by City in 2015 (n = 1,269)



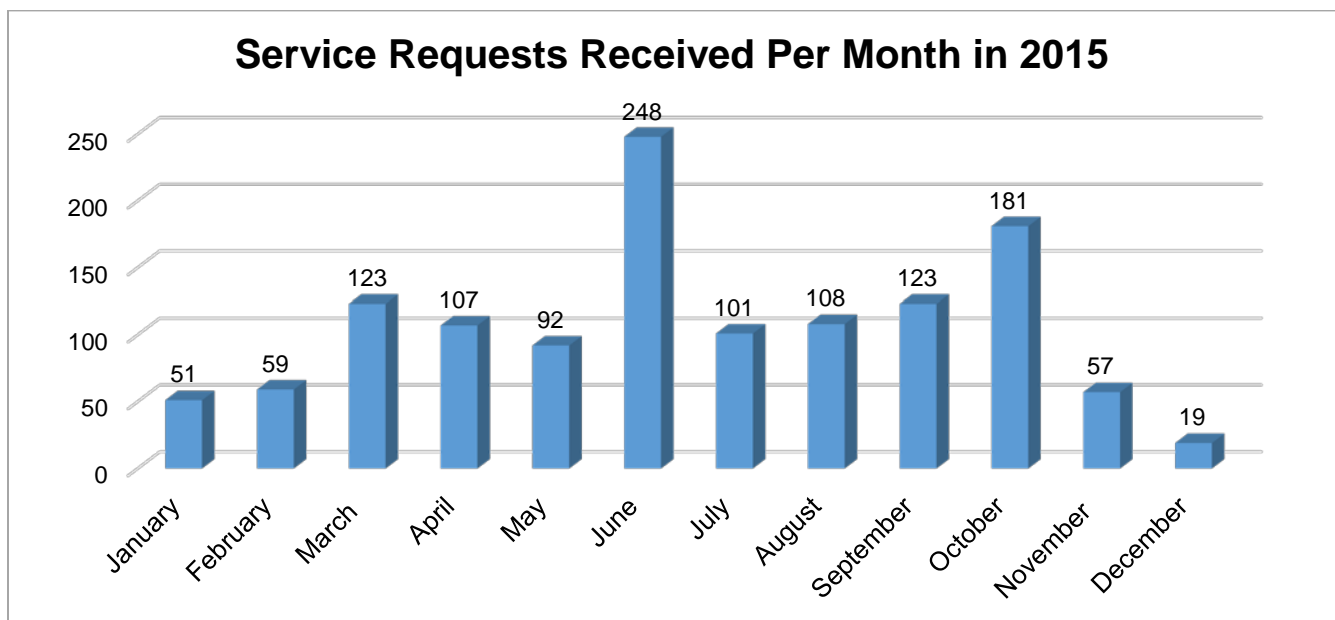
## Citizen Request for Service

MVCP responses to citizen requests vary from phone consultations, mailing educational and instructional literature, identifying specimens, inspecting premises, abating vector nuisances and enforcement of County Code. The following table (1) and figure (2) provides the number of service requests from previous years and monthly requests for 2015.

**Table 1** Number of Service Request Received per Year

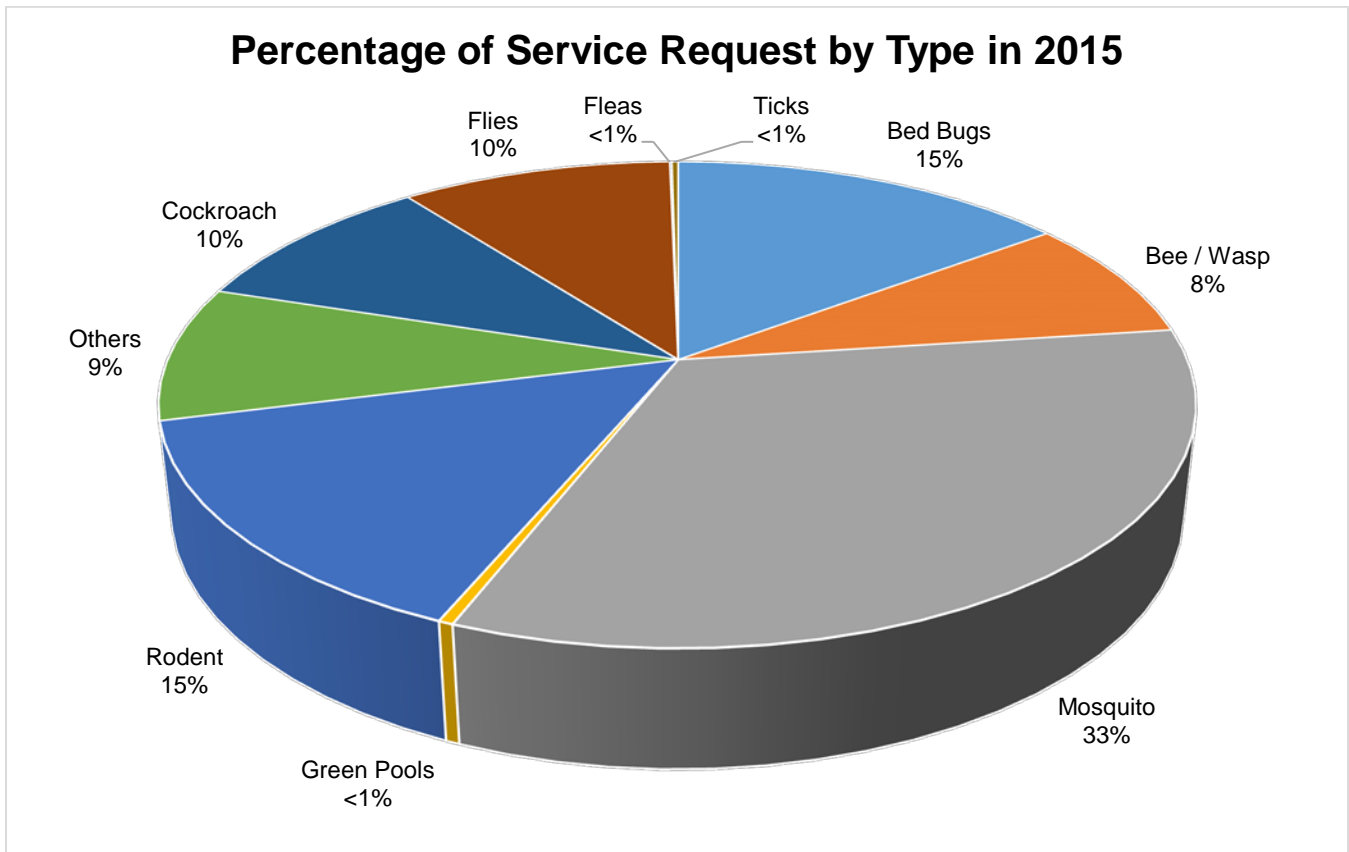
### Service Requests Received Per Year

Year	Requests Received
2011	1,642
2012	1,417
2013	1,219
2014	1,177
2015	1,269



**Figure 2** Number of Service Requests Received Per Month in 2015 (n = 1,269)

Of the service requests addressed by MVCP in 2015 (Figure 3), the highest number was for mosquitoes (419), followed by bed bugs (188), and rodents (186). Green pools are an ongoing concern for MVCP as they can be a major source of mosquito breeding. To address this concern, MVCP is consistently working with the San Bernardino County Sheriff's Department Aviation Division to identify unmaintained swimming pools with possible mosquito breeding. Of the 419 mosquito service requests received, 248 were related to green pools. Each was inspected and treated with larvacide to control breeding. Six of these pools were drained by Vector Control staff to eliminate mosquito breeding.



**Figure 3** Number of Service Requests Received by Type in 2015 (n = 1,269)

Bed bug service requests are continuing to increase in numbers and are being seen in a variety of facilities such as motels, hotels, camps, health care facilities, apartments, and single family residences. Bed bugs:

- Live in mattresses, linens, headboards, walls, flooring, and other furniture
- Usually feed at night
- Do not transmit disease
- Should be controlled by a licensed pest control operator

Enforcement actions are sometimes necessary to gain compliance. Compliance methods include Notices of Violation, Courtesy Notices to Abate, Office Hearings, and Billable Inspections. In 2015 there were 372 Notice of Violations reported and 438 Courtesy Notice to Abate issued.

## Sanitary Sewer Inspections

Sanitary sewer systems are a network of underground ducts which may provide a habitat, and may serve as breeding grounds for cockroaches and rats. Whenever a complaint is received for possible issues, MVCP conducts surveys to determine course of action. The ultimate goal is to reduce the number of roaches and rodents in sewer systems so humans are not negatively affected. Each survey may cover a specific local target area or a broad area of a city.



## Vector Inspections in County Flood Control System

Under a written contract between the MVCP and the San Bernardino County Department of Public Works Flood Control District, MVCP inspects and treats for mosquitoes and other vectors and nuisance pests breeding at flood control channels and basins. MVCP works with the County Flood Control District to identify basins and channels that require debris and vegetation removal to prevent breeding.

MVCP staff conducted 3,329 inspections and spent 1,652 direct work hours inspecting and conducting surveillance for mosquitoes and breeding sources in flood control facilities. Physical abatement, biological controls and larvicides were used in the flood control channels and catch basins.

## Integrated Vector Management Services

In 2015, MVCP used several strategies to control mosquitoes and other vectors and nuisance pests. These strategies include physical, biological and chemical control, in addition to active surveillance and trapping. Pesticide use is the last option if physical abatement, such as using a shovel or biological controls, are not effective.

Mosquito fish (*Gambusia affinis*) are the primary biological abatement method for controlling mosquito larvae in decorative ponds and other water sources on private property. MVCP places the fish in breeding sources whenever it is practical. Free mosquito fish are available to San Bernardino County residents to place in their personal ponds or water sources.



*Mosquito Fish (Gambusia affinis)*

When physical and biological abatement cannot be used, chemical abatement methods are utilized. Chemicals that MVCP use typically have less toxicity than table salt or caffeine and are targeted towards specific vectors. MVCP used several types of chemicals for the abatement of vectors and nuisance pests. A total of 314 routine inspections were performed at various water sources where pesticides were utilized to mitigate public health threats or nuisance conditions.

MVCP introduced a midge (*chronomidae*) control program in 2008. Midge look like mosquitoes but lack piercing mouthparts and do not bite or take blood meals. They have aquatic larvae and are more common around bodies of water. Midges do not transmit human disease but in rare cases, may cause asthmatic reactions in some people with chronic exposure to large numbers. Although they are not a disease vector, in sufficient numbers they affect quality of life for residents and visitors.



*Midge Fly*



*Housefly (Musca domestica)*

Nuisance flies are insects that are an annoyance and can spread diseases to people and domestic animals by biting or physical deposition of pathogens. The immature (larval) stages of flies are found in a range of habitats, including water and semi-aquatic sites. Fly larvae found in decaying organic matter are sometimes called maggots. The close association of many of these insects with dead animals, feces, or garbage and their attraction to humans and animals allows flies to potentially pick up and spread a variety of bacteria and parasites that may cause disease.



In order to control adult fly populations a combination of environmental modification and pesticide treatment was used in 2015 on and near dairies, poultry ranches and other fly breeding sources.

Active surveillance was an additional tool for monitoring and controlling vectors. Trapping techniques were used to monitor for and/or control mosquitoes, ticks, cockroaches, rats, mice, and other nuisance pests within the County.

### III. DISEASE SURVEILLANCE

MVCP maintains a proactive surveillance and monitoring program to determine the abundance of vector populations and the prevalence of diseases they transmit, focusing mainly on mosquito-borne viruses, rodent-borne and tick-borne diseases. In 2015, MVCP also made a concerted effort to monitor midge fly populations due to their increasing numbers in specific areas of the County. Surveillance efforts in 2015 are summarized below.

#### Mosquito Surveillance Program

MVCP disease surveillance program monitors adult mosquito populations throughout the County using New Jersey Light Traps (NJLT), carbon dioxide (CO<sub>2</sub>) – baited traps, and gravid traps. The NJLT uses a light source to attract both male and female mosquitoes. The CO<sub>2</sub>-baited traps use *carbon dioxide* to attract host-seeking female mosquitoes, while gravid traps use a hay infusion as an attractant for ovipositing (egg-laying) females. Combinations of these trapping methods are continually being used across the County to provide an accurate representation of mosquito activity throughout the year. Higher mosquito counts and the presence of WNV in mosquitoes, sentinel chicken flocks, and dead birds are factors used to determine the risk of infection to humans and animals.



New Jersey Light Trap (NJLT)

The abundance of adult mosquito species was monitored weekly using NJLTs throughout the County. Eighteen NJLTs in 2015 were stationed in rural, suburban, and urban habitats of the valley, mountain, and desert regions of the County. All mosquito counts were reported to the California Department of Public Health on a weekly basis. Table 2 provides a representation of traps per San Bernardino County Region sites:

**Table 2 Mosquito Traps by Region**

Region	Cities
Valley	Bloomington, GrandTerrace, Mentone, Redlands, Yucaipa, Upland and San Bernardino
Mountain	Big Bear Lake, Lake Arrowhead and Silverwood Lake
Desert	Needles, Parker Dam, Hesperia, Mojave Narrows Regional Park

In 2015, a total of 1,282 mosquito surveillances were performed, from which 13,876 mosquitoes were collected. Of the 569 mosquito pools (a pool is a group of mosquitos trapped in a common area) tested, 18 pools were positive for WNV, indicating a low prevalence of the virus in mosquito populations.

Additionally, autocidal gravid ovitraps (AGO) traps that contain a grass hay/water infusion to attract gravid female mosquitoes to lay eggs are placed at strategic locations that are likely to have attractive water sources for these mosquitoes. These locations include, but are not limited to, nurseries, cemeteries and mobile home parks, which may have numerous potted plants and other small containers that hold water. Residential areas that are known to have been infected with disease from *Aedes* mosquitoes are also monitored.



AGO Trap

AGO traps are checked each week by field staff and the glue paper utilized to collect the mosquitoes are replaced. The glue paper from each trap is returned to the disease surveillance lab and inspected for presence of *Aedes* mosquitoes by lab assistants/technicians. AGO traps have been placed in 14 locations that are likely to be an introduction hotspot within MVCP's jurisdiction.

Female mosquitoes detect the scent of humans and other animals to find a blood meal that is needed to produce eggs. BioGents Sentinel (BG) traps use chemical attractants that mimic this scent. BG traps are placed in the same type of locations as the AGO traps. The traps are placed at various locations each week and collected on the third day after placement. BG traps are currently placed in 24 locations in the San Bernardino Valley. Any mosquitoes collected are identified by species, and counted in the MVCP lab.

When *Aedes* mosquitoes or viral indicators are detected, the efforts are enhanced. Results of weekly rotation *Aedes* surveillance are reported to California Vectorborne Disease Surveillance Gateway and tested for Zika and other viruses. Table (3) below, shows trap types, the number of mosquitoes caught, and the number of traps testing positive for WNV.

	NJLT	AGO	CO2
<b>Number of Mosquitoes</b>	1,219	391	12,266
<b>Number of Pools Submitted for Testing</b>	N/A	13	553
<b>Number of Pools Tested Positive for WNV</b>	N/A	0	18

**Table 3** Total number of mosquitoes collected, mosquito pools submitted for testing, and the number of pools that tested positive for WNV in 2015

### Day-Biting Mosquito Surveillance Program

MVCP established a Day-Biting Mosquito Surveillance Program in 2015, in anticipation of the invasive *Aedes* mosquitoes to the County. Specialized traps were placed in target areas to determine the presence and abundance of these day-biting mosquitoes. The trapping allows MVCP to monitor changes in mosquito populations and collect mosquitoes for disease testing.

At the beginning of the 2015 mosquito season, the MVCP identified a total of 3 *Aedes aegypti* (the Yellow Fever mosquito) collected in traps located in Upland and Colton.



## Sentinel Chicken Flock Samples

Nine sentinel chicken flocks, each containing 8 chickens, were placed in various areas to monitor arbovirus activity within the County. Arboviruses are viruses that are transmitted between susceptible vertebrate hosts by blood-feeding arthropods, such as mosquitos. Although chickens can become infected with arboviruses, they are not negatively affected and do not show symptoms.

Samples were taken from all the sentinel flocks once every two weeks and sent to the State laboratory for viral testing. Of the 72 chickens tested in 2015, 39 chickens were infected with WNV throughout the season.

Positive chickens with WNV were confirmed in the cities or areas of Redlands, Colton, Fontana, Needles, Upland , Rialto, and San Bernardino.



*Leghorn Chicken (Gallus gallus)*

## Dead Bird Surveillance Program



*American Crow (Corvus brachyrhynchos)*

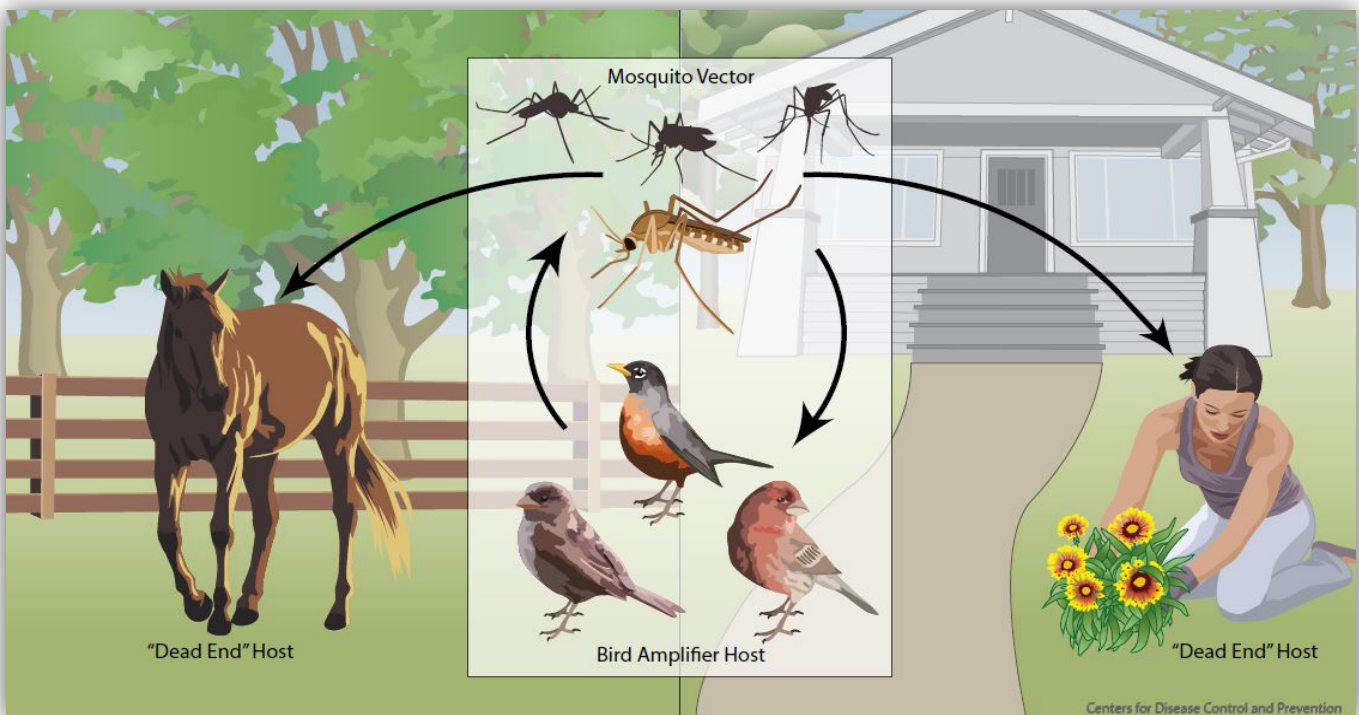
The dead bird surveillance program started in 2000 to enhance WNV detection capabilities. MVCP responds to dead bird reports related to birds from the family Corvidae, sometimes called Corvids. Corvids are reservoirs for WNV. Crows and Ravens, which belong to the family, die quickly after becoming infected with WNV, which gives an early warning that WNV is present in an area. In 2015, MVCP responded to a total of 40 dead bird reports, where 20 tested positive for WNV. Positive dead birds were collected from the cities or areas of Fontana, San Bernardino, Yucaipa, Colton, Redlands, Upland, and Bloomington.

Individuals are encouraged to report dead birds immediately by calling **1(877)WNV-BIRD** (877-968-2473) staff will then retrieve the bird for testing.



## Human Cases of West Nile Virus

Most people who become infected with WNV will not show any symptoms but that does not mean that an illness will not develop. According to the Center for Disease Control and Prevention (CDC), 1 in 5 people infected with WNV will show signs of West Nile Fever (non-neuroinvasive) and about 1 in 150 people infected with WNV will develop neuroinvasive symptoms, which affect the brain, spinal cord and nervous system. These symptoms include high fever, muscle weakness, vision loss, paralysis, coma, encephalitis, even death. In 2015, there were a total of 53 WNV human cases, with 47 cases being neuroinvasive (encephalitis), 7 non-neuroinvasive (West Nile Fever), 6 asymptomatic, and 3 fatalities. Human cases and the prevalence of WNV in the County increased in 2015 from 22 cases reported in 2014. The following is a depiction of a mosquito vector and its possible hosts.



*West Nile Virus (WNV) Transmission Cycle*

## West Nile Virus in Equine (Horse) Population



WNV infections are a serious threat to horses. Horses are very sensitive to the virus and have a high mortality rate if they are infected. The most commonly described symptom of an infected horse is lack of coordination and stumbling. In 2015, WNV was not detected in any horses in the County. This is partially attributed to successful WNV vaccination efforts in the County.

## Plague Surveillance

Plague is caused by *Yersinia pestis*, a bacteria that can be transmitted to humans through the bites of infected fleas. Plague is endemic in the mountains and foothills of San Bernardino County, and is commonly transmitted by infected fleas found on ground squirrels and other rodents.

MVCP carried out routine surveys in the mountain, foothill, and valley areas of the County to detect and monitor for plague and the fleas that carry it. In 2015, 17 plague surveys were conducted, trapping a total of 60 rodents. None of the rodents tested positive for plague and no human cases were identified in 2015.



California Ground Squirrel (*Otospermophilus beecheyi*)

## Hantavirus Surveillance

Hantavirus ardiopulmonary syndrome, or HCPS, is a rare but often fatal disease of the lungs. Although there are many types of hantavirus, Sin Nombre virus (SNV) is the specific hantavirus that causes HCPS in the western United States. In California, the deer mouse, *Peromyscus maniculatus*, is the most common species known to carry SNV.

Hantavirus surveillance consists of rodent trapping and testing for antibodies against SNV at various sites within the County. 17 surveys were conducted in 2015 to determine the prevalence of the virus. Of the 54 rodents trapped, none tested positive for SNV.



Deer Mouse (*Peromyscus maniculatus*)

## Tick Surveillance



Western Black Legged Tick (*Ixodes pacificus*)

The Western black-legged tick, *Ixodes pacificus*, can transmit the spirochete *Borrelia burgdorferi* which is responsible for causing Lyme disease in humans. Wild rodents and other mammals are likely reservoirs of these pathogens. This tick is distributed in the Western Pacific region of the United States. Larvae and nymphs feed on birds, lizards and small rodents, while adult ticks feed on deer and other mammals.

The tick surveillance program primarily involves the collection of host-seeking ticks for tick-borne infections, especially Lyme disease. 90 tick surveys were conducted in 2015 that yielded 644 ticks. Results found 1 tick tested positive for Lyme disease.



## IV. HEALTH EDUCATION

Community outreach and health education benefit the residents and visitors of the County by disseminating vector control information and educational material directly to the public. In 2015, health education efforts by MVCP included telephone and personal visits, distribution of flyers and brochures, lectures, presentations and participation at local health fairs. Presentations were also provided in public forums to businesses and community organizations. Radio and television interviews were conducted, and press releases were distributed to the media when incidents of public health significance occurred.

In 2015, MVCP conducted block surveys, making direct contact with residences and leaving MVCP information at the residences where direct contact could not be made. MVCP also took part in 7 educational events including 1 vector control event, and 6 general program events which covered all DEHS programs. These events included presentations, health/career fairs, and the distribution of written educational material to the public. Over 200 people attended presentations, which included K-8 school children, students from local colleges and universities, senior center staff and members, and the general public at various city chambers of commerce. Over 400 people at health/career fairs were provided with written educational material and inquired about the program and its services.



For more information about the Health Education Program or to schedule a presentation, please contact MVCP at **1(800)44-ABATE** or visit the website at [www.sbcounty.gov/dph/dehs](http://www.sbcounty.gov/dph/dehs).

## V. AWARDS

Each year, the National Association of Counties (NACo) recognizes counties that have developed and implemented innovative and cost-efficient programs to better serve their citizens. The County of San Bernardino, Department of Public Health Division of Environmental Health Services (DEHS) received the prestigious 2015 NACo Achievement Award for their Electronic Pesticide Use Reporting Program.



MVCP looked toward technology to develop an innovative and unique way of logging all of its pesticide use in an electronic database. The development of the Electronic Pesticide Use Reporting Program has enabled staff to input information in a seamless manner into an electronic database. These advancements have also enabled the quick and easy reporting of pesticide use to outside agencies (such as the Department of Agriculture), and have saved hundreds of man hours. This time-saving program has allowed staff to focus on MVCP's true purpose, which is protecting the health and safety of all San Bernardino County residents and visitors from vector borne diseases

## VI. ACKNOWLEDGMENTS

- ❖ San Bernardino County Mosquito and Vector Control Program Staff
- ❖ Cities of Big Bear Lake, Colton, Fontana, Grand Terrace, Highland, Loma Linda, Needles, Redlands, Rialto, San Bernardino, Upland, and Yucaipa
- ❖ San Bernardino County Departments of Agriculture, Public Health, and Transportation/Flood Control
- ❖ Mosquito and Vector Control Association of California (MVCAC)
- ❖ California Department of Public Health Vector-Borne Disease Section
- ❖ Viral and Rickettsial Disease Laboratory, California Department of Health Services
- ❖ California Department of Fish and Wildlife
- ❖ California Department of Food and Agriculture
- ❖ California Department of Parks and Recreation
- ❖ School of Veterinary Medicine and Center for Vector-Borne Disease Research, Department of Entomology and the Davis Arbovirus Research Unit at University of California – Davis
- ❖ Bureau of Land Management
- ❖ United States Forest Service

**For Information about the San Bernardino County Mosquito and Vector Control Program  
Please contact us at:**

**385 N. Arrowhead Ave. 2<sup>nd</sup> Floor | San Bernardino, CA 92415 | (800) 422-2283**

**Visit us at [www.sbcounty.gov/dph/dehs](http://www.sbcounty.gov/dph/dehs)**