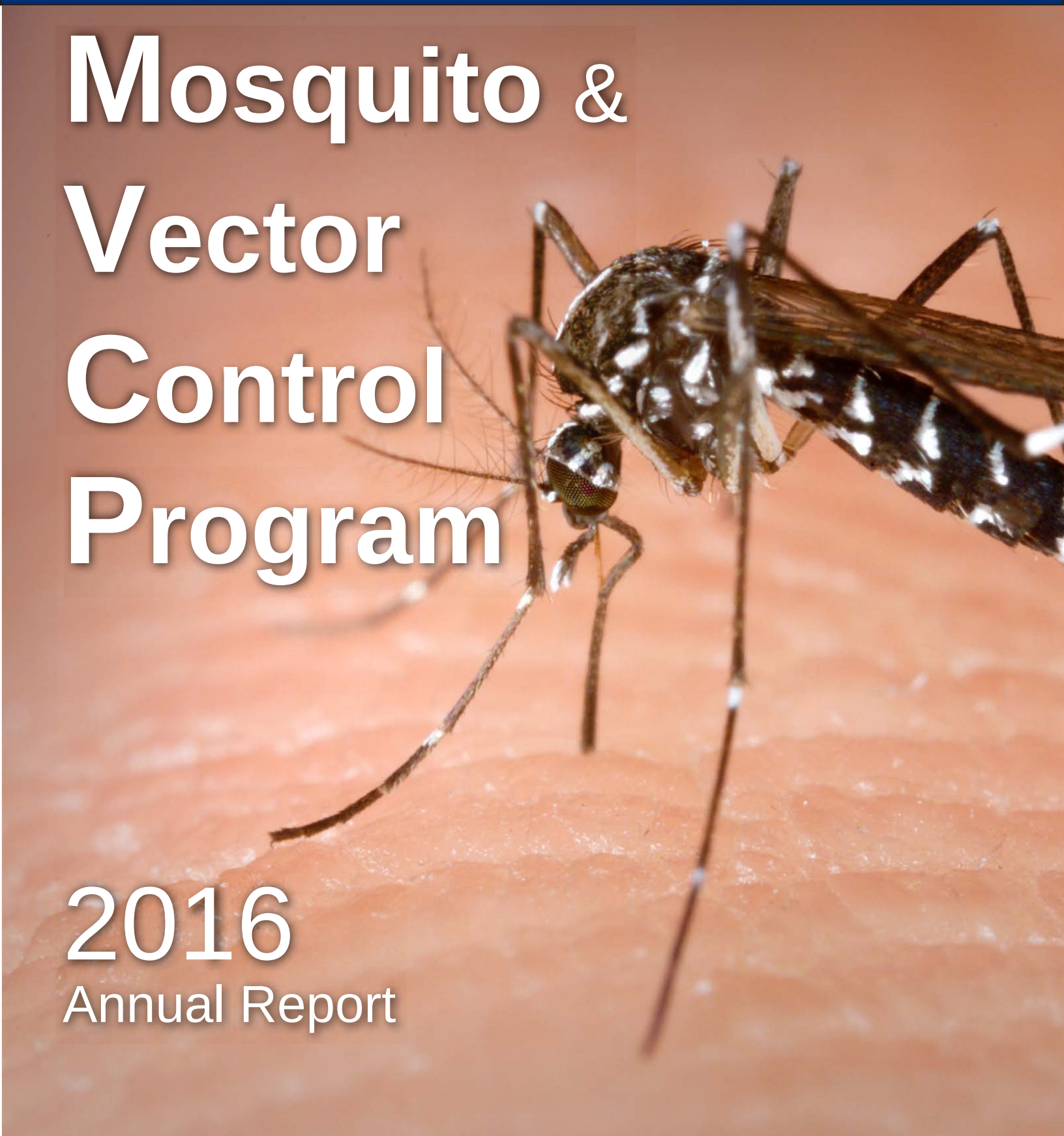
SAN BERNARDINO COUNTY

Public Health
Environmental Health Services

Mosquito & Vector Control Program



2016
Annual Report


Lake Gregory

San Bernardino County Mosquito and Vector Control Program 2016 Annual Report

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Aedes albopictus adult

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 populations 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 This law was amended in 1939 and 1980 and then repealed and replaced by a new comprehensive Mosquito Abatement and Vector Control District Law in 2002.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 increased collaboration with local, state, and federal agencies; later, the arrival of Africanized Honeybees to the County in 1998 increased activities and efforts to mitigate this heightened concern of residents and visitors.

The arrival of the Aedes aegypti mosquito introduced West Nile virus (WNV) to the United States, and 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.

With the arrival of the Aedes mosquitoes in California and San Bernardino County, the San Bernardino MVCP has enhanced the surveillance and abatement methods for the Asian Tiger Mosquito (Aedes albopictus) and the Yellow Fever Mosquito (Aedes aegypti).

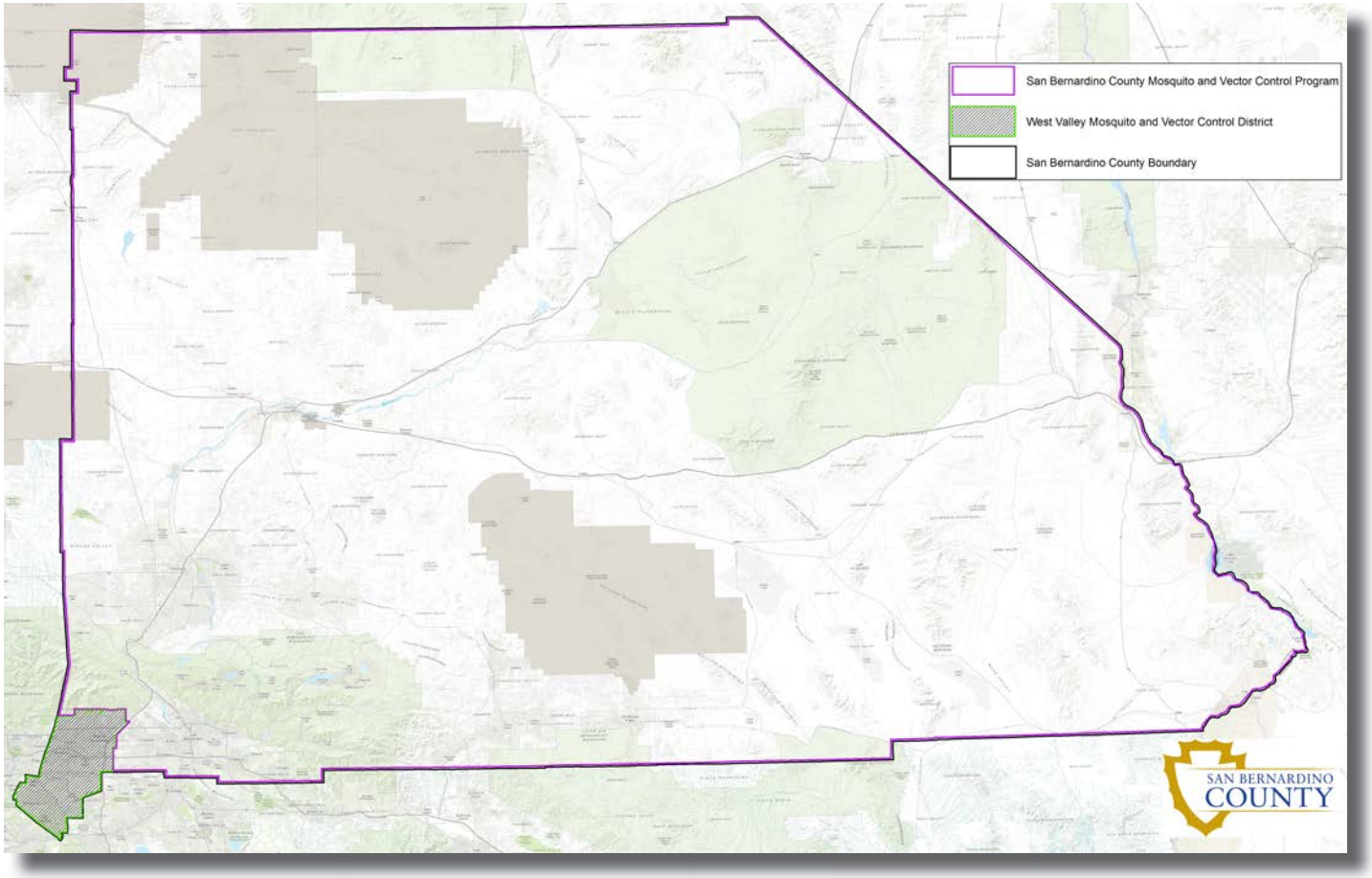
Unlike most mosquitoes that emerge and feed at dusk, the Asian Tiger Mosquito is a daytime feeder. It is an aggressive biter and its feeding peaks in the early morning and late afternoon.

The Yellow Fever Mosquito with its feeding peaking in daytime prefers biting indoors and primarily bites humans.

MISSION STATEMENT

"The mission of the San Bernardino County Mosquito and Vector Control Program (MVCP) is to protect health and enhance the quality of life of County residents through the suppression of mosquito and other vector transmitted diseases, and the reduction of annoyance levels caused by mosquitoes and other pests of public health importance."

MVCP BOUNDARIES



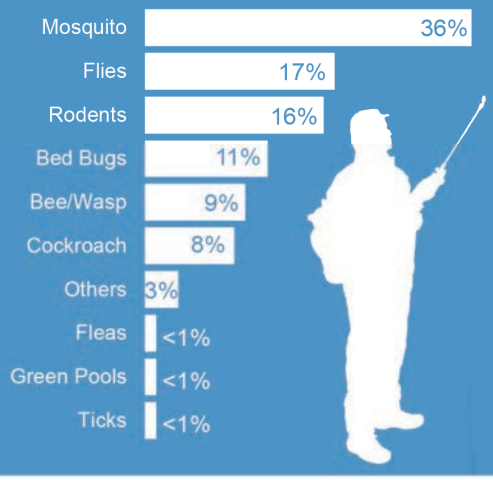
MOSQUITO AND VECTOR CONTROL AT-A-GLANCE

OPERATIONS

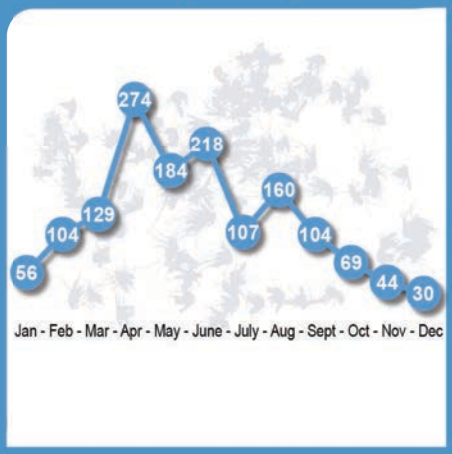
Responded to 1,479 service requests
Conducted 5,616 water source inspections

Reported 344 Notice of Violations
Issued 421 Courtesy Notice to Abate

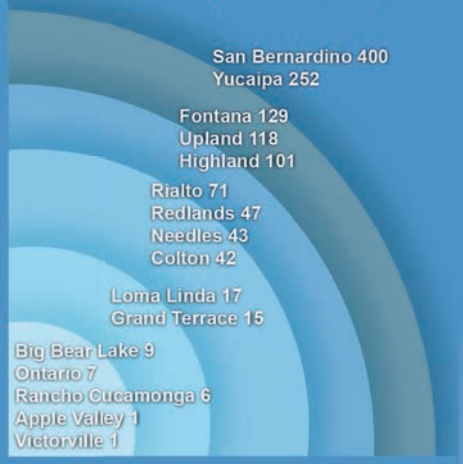
Service Requests by Pests



Service Requests per Month



Service Requests by City



DISEASE SURVEILLANCE

6 mosquito clusters tested positive for West Nile Virus

25 chickens were infected with West Nile Virus

3 dead birds tested positive for West Nile Virus

No horses tested positive for West Nile Virus

No rodents tested positive for the plague or Sin Nombre Virus

1 tick tested positive for Lyme disease

HEALTH EDUCATION

Events

MVCP participated at 8 vector control events and 23 general program events

Over 1,050 people attended MVCP presentations

Over 2,500 people at health/career fairs received educational materials

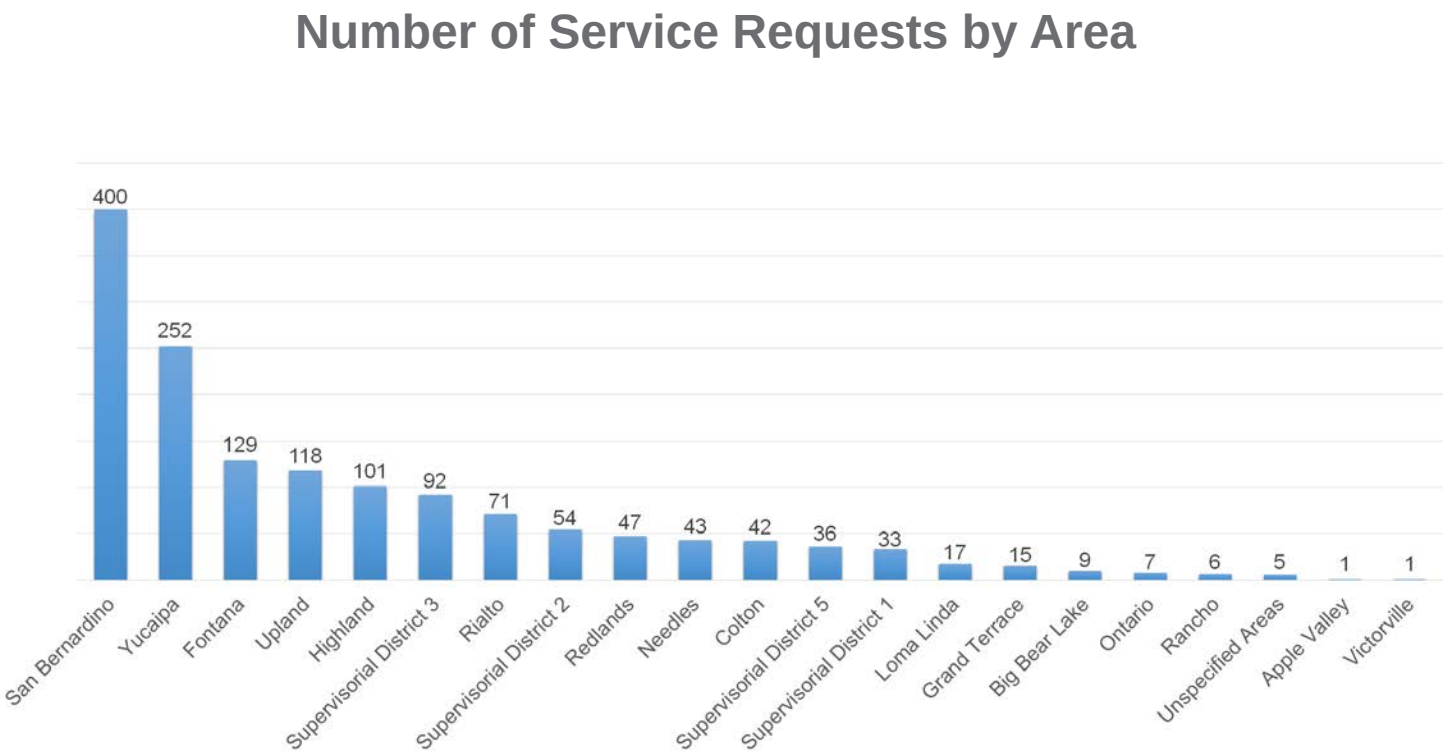
OPERATIONS

MVCP is currently staffed with a Program Coordinator, Environmental Health Specialist III, Vector Control Technician II, 7 Vector Control Technician I, 7 seasonal field staff, 1 Office Assistant III, and other support staff throughout the Department of Public Health. Services provided to residents and visitors of San Bernardino County include:

- Vector Surveys
- Vector Surveys
- Facility Inspections
- Water Source Reduction
- Mosquito Abatement
- Mosquito Service Requests
- Bee/Wasp Service Requests
- Rodent Service Requests
- Other calls to include the control of cockroaches, spiders, bedbugs, etc.

Service Requests

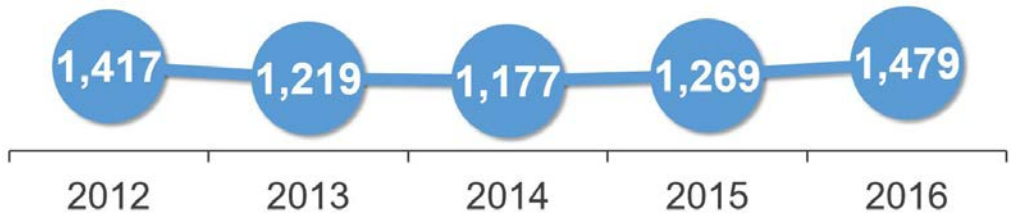
In 2016, MVCP staff responded to 1,479 service requests and conducted approximately 5,616 water source inspections on 1,005 inventoried water sources to eliminate mosquito breeding. The image below illustrates the number of service requests received by city in 2016.



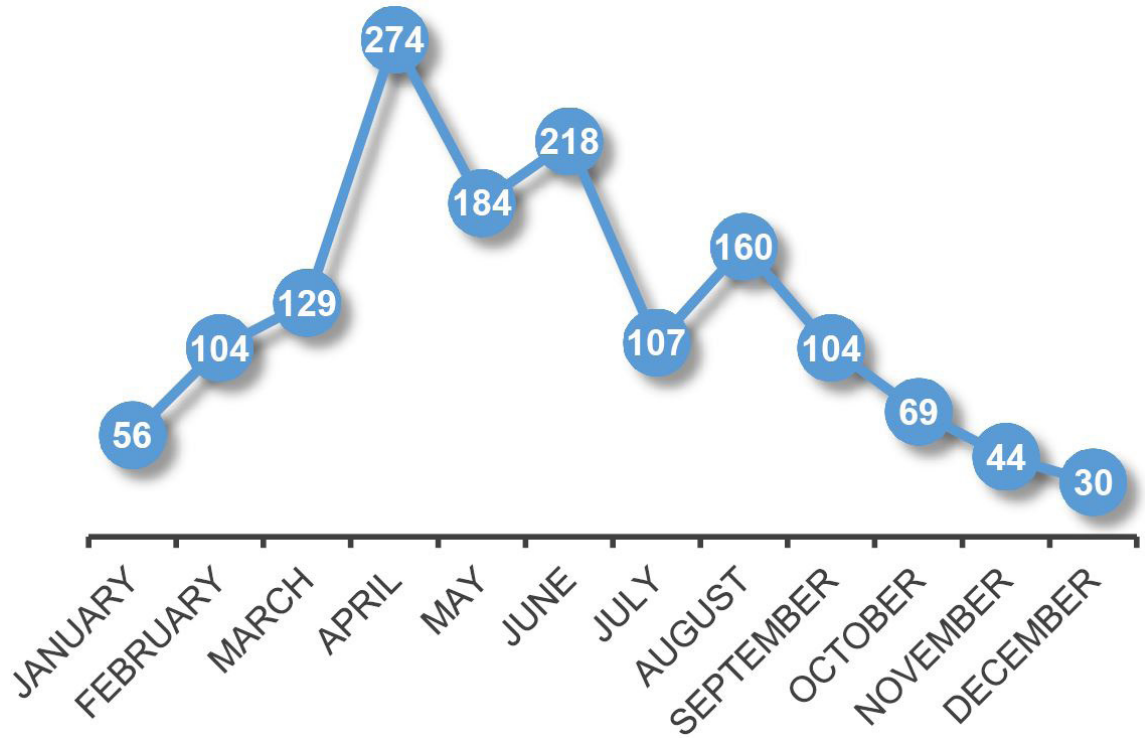
Citizen Requests for Service

MVCP responses to citizen requests include phone consultations, mailing educational and instructional literature, identifying specimens, inspecting premises, abating vector nuisances, and enforcement of County Code. The graphs below provide the program's annual and monthly service requests.

Number of Service Requests per Year



Number of Service Requests per Month in 2016

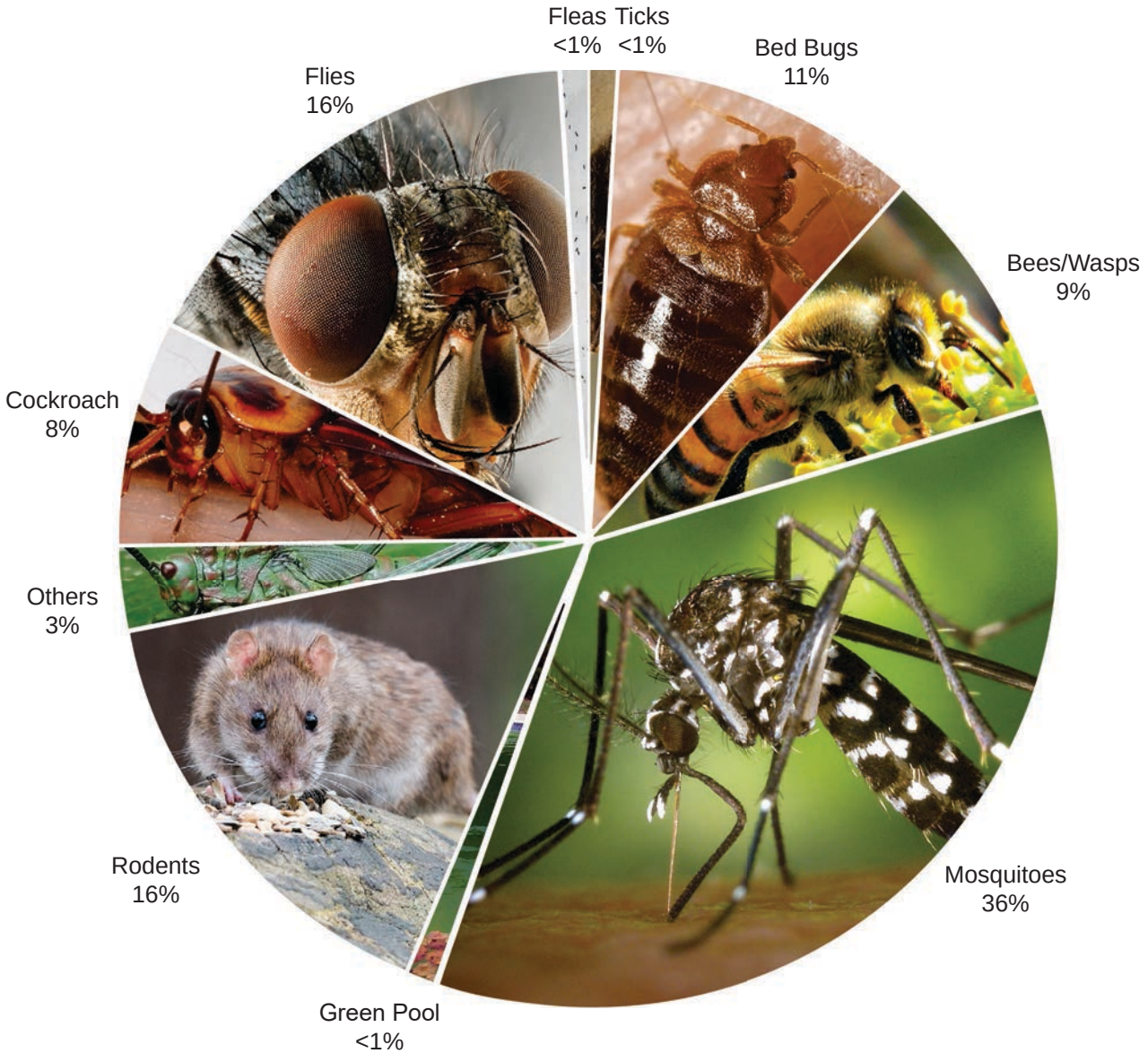


Enforcement actions are sometimes necessary to gain compliance. Compliance methods include Notices of Violation, Courtesy Notices to Abate, office hearings, and billable inspections. In 2016 there were 344 Notice of Violations reported and 421 Courtesy Notice to Abate issued.

Of the service requests addressed by MVCP in 2016, the highest number was for mosquitoes (534), followed by flies (251), and rodents (242). Green pools are an ongoing concern for MVCP as they can be a major source of mosquito breeding. 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 represented 11% of all service requests received.

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 534 mosquito service requests received, 319 were related to green pools. Each pool was inspected and treated to control breeding and eight of these pools were drained by Vector Control staff. The image below provides the distribution of service requests received by MVCP.

Percentage of Service Requests by Pest



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, other vectors and nuisance pests breeding at flood control channels and basins. Additionally, MVCP and the Flood Control District work to identify basins and channels that require debris and vegetation removal to prevent breeding.

MVCP spent 916 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 flood control channels and catch basins.

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 in teams of two to ensure safety and accuracy. 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.

Sewer entry point

Potential vector breeding source in flood channel

Integrated Vector Management Services

In 2016, 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 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 where other methods of control are not practical. Free mosquito fish are available to San Bernardino County residents to place in their personal ponds or water sources.

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 5,616 routine inspections were performed at various water sources where pesticides were utilized.

Mosquito Fish (Gambusia affinis) eating a mosquito larva

CO2 Mosquito Trap

Fly Abatement

Flies on a worldwide scale are responsible for transmitting and causing millions of vector-borne disease deaths and morbidity in humans. Flies of public health importance are found in virtually every habitat from the high arctic tundra to equatorial rain forests.

Generally, nuisance flies are more common in spring, summer, and fall but many are active during the winter months. Due to California's range of latitudes, habitats and elevations, the occurrence of nuisance flies varies by region.

Nuisance flies are insects that are annoying and can spread diseases to people and domestic animals by biting or carrying pathogens. All nuisance flies are members of the Insect Order "Diptera" (meaning "two-wings"). The adults can be identified by having only one pair of wings, however these fly species may be quite diverse in appearance. Nuisance flies are found throughout California and cause a variety of problems. The immature (larval) stages of these 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 these insects with dead animals, feces, or garbage and their attraction to humans, animals, and food allows flies to spread a variety of bacteria and parasites that may cause disease. Some nuisance flies reproduce rapidly and become annoying simply because of their sheer numbers, but do not pose a risk to humans. In 2016, Yucca Valley had the highest number of nuisance fly complaints.

House fly (Musca domestica)

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 2016, MVCP hired additional seasonal staff to conduct extensive disease and surveillance monitoring for Aedes mosquitoes. Additional traps were placed in areas of concern and preexisting traps were relocated to hotspot cities such as Colton to monitor additional water sources. Surveillance efforts in 2016 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 (CO2) – baited traps, and gravid traps. The NJLT uses a light source to attract both male and female mosquitoes. The CO2-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.

The abundance of adult mosquito species was monitored weekly using NJLTs throughout the County. Twenty NJLTs in 2016 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.

In 2016, a total of 1,342 mosquito surveys were performed, during which 23,598 mosquitoes were collected. Of the 830 mosquito clusters, 6 clusters tested positive for WNV, indicating a low prevalence of the virus in mosquito populations. The California Department of Public Health (CDPH) provided 9 additional BioGents Sentinel (BG) traps to be placed in Colton where the invasive Aedes mosquitoes were detected in 2016.

Mosquito Trap Locations by City

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. AGO traps are checked weekly 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. AGO traps have been placed in 11 locations that are likely to be an introduction point within MVCP's jurisdiction.

Female mosquitoes detect the scent of humans and other animals to find a blood meal which is needed to produce eggs. BioGents Sentinel (BG) traps use chemical attractants mimicking 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 5 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, efforts are enhanced to reduce risk of disease transmission. Results of the weekly Aedes mosquito surveillance are reported to California Vector Borne Disease Surveillance and tested for Zika and other viruses.

Day-Biting Mosquito Surveillance Program

In 2016, the MVCP's Day-Biting Mosquito Surveillance Program focused on the invasive Aedes aegypti mosquitoes in 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. In addition to placing specialized traps for invasive Aedes mosquitoes, additional staff were assigned to conduct block surveys in Colton. Block surveys were conducted throughout summer months as disease and surveillance traps showed results in these communities. Each team consisted of two employees who conducted over 100 front and backyard inspections looking for specific water sources which could influence Aedes mosquito breeding. The purpose of block surveys in the community is to conduct effective education, community awareness, and outreach education of the Aedes mosquito to residents of the community.

At the end of the 2016 mosquito season MVCP identified a total of 68 Aedes aegypti (Yellow Fever mosquito) which were collected in traps located in Upland and Colton.

Yellow Fever Mosquito (Aedes aegypti)

Sentinel Chicken Flock Samples

Ten sentinel chicken flocks 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 mosquitoes. 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 biweekly and sent to the State laboratory for viral testing. Of the 80 chickens tested in 2016, 25 chickens tested positive for WNV. Positive chickens with WNV were confirmed in the cities of Needles, Colton, Yucaipa, Fontana, Upland, Mojave, Rialto, and San Bernardino.

Dead Bird Surveillance Program

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. This gives MVCP an early warning that WNV is present in an area. In 2016, MVCP responded to a total of 12 dead bird reports, where 3 tested positive for WNV. Positive dead birds were all collected from the city of San Bernardino.

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

Leghorn Chicken (Gallus gallus)

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 infected. The most commonly described symptom of an infected horse is lack of coordination and stumbling. In 2016, 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 performed routine surveys in the mountain, foothill, and valley areas of the County to detect and monitor for plague. In 2016, of the plague surveys conducted and rodents trapped for testing, none of the rodents tested positive for plague and no human cases were identified.

Hantavirus Surveillance

Hantavirus cardiopulmonary syndrome, or HCPS, is a rare but often fatal disease of the lungs. Although there are several 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. Surveys were conducted in 2016 to determine the prevalence of the virus. Of the rodents trapped, none tested positive for SNV.

Golden Mantled Ground Squirrel (Callospermophilus lateralis)

Tick Surveillance

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. Of the surveys conducted and ticks submitted for testing by MVCP in 2016, results found 1 tick tested positive for Lyme disease.

Deer Tick (Ixodes scapularis)

HEALTH EDUCATION

Community outreach and health education benefit the residents and visitors of the County by disseminating vector control information and educational materials. In 2016, health education efforts by MVCP included telephone calls, distribution of flyers/brochures, lectures, and presentations at local health fairs. Presentations were also provided in public forums to businesses and community organizations. Radio and television interviews were conducted, as well as press releases distributed to the media when incidents of public health significance occurred.

In 2016, MVCP conducted block surveys, making direct contact with residences and leaving MVCP information at the residences when direct contact could not be made. MVCP also held 8 vector control events, focusing specifically on MVCP issues, and 23 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 1,050 people attended presentations, which included K-8 school children, students from local colleges and universities, senior centers, and the general public at various community events. Over 2,500 people at health/career fairs were provided with written educational material and inquired about the MVCP and its services.

Fontana Health Fair, September 2016

Death Valley National Park

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, 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

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