2020

San Joaquin County Mosquito & Vector Control District

Annual Report

In Memoriam of Allan Richard Fetters 1936 - 2020

Mr. Allan Fetters served the residents of San Joaquin County Mosquito and Vector Control District for 20 years from 1991 to 2011, representing the city of Stockton. Allan was born in San Luis Obispo, California. He enjoyed a long career in agriculture, and was the owner of Ripon Farm Service for many years. His success in the business and fertilizer community was well regarded.

Mr. Fetters joined the District as a Trustee in January of 1991. He served as Board President in 1996 and 1997. As District Trustee, Mr. Fetters was instrumental in his support to secure funding for services through the District's Benefit Assessment, passed by San Joaquin County property owners in 2005. Mr. Fetter's dedication to the District, and genuine interest to the mission of protecting the public's health, was greatly appreciated.

Forward

On behalf of the Board of Trustees and staff of the San Joaquin County Mosquito and Vector Control District (District), I am pleased to submit the 2020 Operational and Fiscal Year Report. This report includes information on District administration and operations during the past year.

Financially, the District realized a 5.25% increase in revenues from that of 2019, primarily due to an increase in property taxes and an increase in property assessments due to commercial real estate development. In addition, the District receives revenue from the Mosquito, Vector, and Disease Control assessment approved by County landowners in 2005. This nominal charge generates a revenue stream that helps address vector-borne disease surveillance and operational control measures, community education and outreach activities, and most recently to address the arrival of invasive mosquito species.

Operationally, although we experienced a greater abundance of collected mosquitoes; for 2020, WNV activity decreased from that of 2019 regarding collected mosquitoes infected with the virus. The District recovered 262 WNV positive mosquito pools (50 mosquitoes / pool) compared to 288 positive pools in 2019. Subsequently, the number of confirmed human cases for San Joaquin County decreased to 1, as compared to 7 cases in 2019. In addition, we collected a group of mosquitoes from a rural area east of Lodi, that tested positive for St. Louis Encephalitis virus (SLE). This was the first find of SLE in the County, since a human case in 1973. The District emphasizes virus detection in local mosquito populations in the efforts to prevent the further spread of mosquito-borne diseases to the residents and visitors of San Joaquin County. These efforts were extremely important during this past year.

The District, for the second consecutive year, collected Invasive aedes mosquitoes in San Joaquin County. This aggressive biting mosquito, Aedes aegypti (the Yellow Fever mosquito), was collected in the same location as the District's initial find last year; the Brookside area of Stockton. The District has conducted surveillance activities using various methods to attract and trap these aggressive mosquito species for the past five years, with the first discovery transpiring last year in the same manner as experienced by other mosquito control districts in the State; via a service request. Based on these finds, the District implemented control procedures that included ground ULV treatments to reduce the adult populations, and conducted larviciding spray applications in an attempt to achieve immediate control and limit potential migration. Those efforts continued over the course of several weeks, with positive results. Although this mosquito is capable of transmitting several viruses that include dengue fever, chikungunya, Zika, and yellow fever, it currently is not implicated in the transmission of these viruses in California.

The District's surveillance and control measures were implemented using our integrated vector management (IVM) plan and the California Mosquito-Borne Disease Surveillance and Response Plan. These plans are used to detect and respond to West Nile virus activity. The District continues the use of specific trapping devices to collect Aedes aegypti in the Brookside area of Stockton, and additional trapping locations where we could anticipate future activity. These sites include the Port of Stockton, cemeteries, wholesale nurseries, and mobile home parks. In addition, our Lab continues to conduct diagnostic work to consistently test the effectiveness of mosquito control products.

Public education is an important element of our program. The District utilizes social media, website, local magazines, digital billboards, public outreach events; and most importantly, working with local school districts. Although limited due to COVID-19, the District has partnered with San Joaquin Office of Education to provide training for elementary school teachers on mosquito biology and prevention that can be used for both distance and in-class learning.

The District annually evaluates our response strategies to all annoyance mosquitoes and those species capable of spreading mosquito-borne diseases, while examining our revenue sources and budget expenditures to remain fiscally sound. The Board of Trustees and staff should be commended for their continued dedication and tireless work in providing a quality mosquito and vector control program for the residents and visitors of San Joaquin County.

Respectfully submitted,

Eddie Lucchesi

Eddie Lucchesi, Manager

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San Joaquin County Mosquito and Vector Control District is an independent special district. The District's operations are funded by San Joaquin County property taxes, a special tax, and a benefit assessment. The District is governed by an eleven member Board of Trustees, seven representing each incorporated city and four representing the County at large. The Board employs a manager who oversees program functions, hires and supervises staff. The staff consists of full and part-time employees to facilitate the daily district operations.

Mission Statement

Adopted by the Board of Trustees
On May 21, 1996

San Joaquin County Mosquito and Vector Control District provides comprehensive vector surveillance and control services to enhance the public health and quality of life for the residents and visitors of San Joaquin County. As a locally controlled independent agency, we seek to fulfill our mission through the following commitments:

- *To utilize the most advanced administrative and operational technology available;*
- *To provide stewardship for public funds by stressing efficiency in our operations;*
- *To encourage citizen participation in achieving our mission;*
- *To educate the public regarding the health implications of disease transmitting pests;*
- *To provide services consistent with an awareness and concern for environmental protection;*
- *And lastly, to provide and maintain a safe and effective public health pest management program.*

District History

In 1932, San Joaquin County health officials enlisted the aid of Civilian Conservation Corps to remove brush along streams to reduce mosquito producing stagnant water. In 1942, local citizens organized a petition signed by 3,800 residents to form a district. The Board of Supervisors formed the Northern San Joaquin County Mosquito Abatement District on January 22, 1945. A second district, the San Joaquin Mosquito Abatement District, was formed in 1955, for the remaining portion of the County. Due to the growing concern of encephalitis in the County, demands for mosquito control continued to increase. In 1980, by mutual consent of their governing bodies, the two independent districts combined to form San Joaquin County Mosquito Abatement District. The District expanded its mission to include another vector, ticks in 1992 & 1993. To reflect the newly adopted tasks, the District changed its name to San Joaquin County Mosquito & Vector Control District. To date, the District provides service to all of the residents and visitors of San Joaquin County covering 1,420 square miles.

(excerpt from original document)

Dated: January 22, 1945

BOARD OF SUPERVISORS OF THE COUNTY OF
SAN JOAQUIN -- STATE OF CALIFORNIA

By: (W.R. Ruggles) Chairman

Attest: R. E. Graham, County Clerk
By: (J. R. Plummer) Deputy Clerk

Said motion was seconded by Supervisor Stuckenbruck and duly carried

NORTHERN SAN JOAQUIN COUNTY MOSQUITO ABATEMENT DISTRICT, RESOLUTION FIXING BOUNDARIES

Supervisor Rimington moved that the following Resolution be passed and adopted, towit:

BEFORE THE BOARD OF SUPERVISORS OF THE COUNTY OF SAN JOAQUIN, STATE OF CALIFORNIA

RESOLUTION AND ORDER FOR THE INFORMATION OF THE
NORTHERN SAN JOAQUIN COUNTY MOSQUITO ABATEMENT DISTRICT

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This matter came on regularly for hearing before this Board on January 15, 1945, at the hour of 11:00 A.m., in the offices of the Board in Room 3 of the County Courthouse in the City of Stockton, County of San Joaquin, State of California, being the regular meeting place of said Board, and as authorized by Section 2216 of the Health and Safety Code, said hearing was adjourned to January 22, 1945 at the hour of 10:00 A.M., at the same place, and from the proceedings and evidence the Board finds:

That due and legal petitions are on file in the Office of this Board, which comply with the provisions of Chapter 5, Division 3 of the Health and Safety Code and from testimony and evidence introduced, it appears to this Board that the public necessity and welfare requires the formation of a mosquito abatement district; and this Board does declare and order that the territory within the boundaries hereinafter described and which are hereby fixed and determined, be organized as a mosquito abatement district to be known as the NORTHERN SAN JOAQUIN COUNTY MOSQUITO ABATEMENT DISTRICT.

This Board further finds and declares that certain objections and protests to the formation of said District and to the inclusion of certain territory therein were filed, and the same were duly and legally heard and considered and are hereby denied.

This Board further finds and declares that the territory hereinafter described includes the city of Lodi in said county, and there is on file in the office of this Board the duly authenticated Resolution of the said City for its inclusion in the District.

“Vector” Defined

According to the California State Health and Safety Code, Section 2002(K): “Vector” means any animal capable of producing discomfort or injury, including, but not limited to arthropods (mosquitoes, flies, fleas, lice, ticks, mites, etc.), small mammals (rabbits, rodents, etc.) and other vertebrates, but not including domestic animals.

Vectors can transmit infectious organisms that cause human and animal diseases. These diseases can be serious and sometimes fatal. Arthropods, particularly haematophagous insects, are the major group of vectors transmitting diseases (vector-pathogen) including encephalitis (mosquito-virus), malaria (mosquito-protozoan), typhus (flea/lice-bacterium), plague (flea-bacterium), dog heartworm (mosquito-roundworm), and Lyme disease (tick-bacterium). Encephalitis-causing viruses transmitted by arthropods are called arboviruses (Arthropod-borne viruses). The California Arbovirus Surveillance Program emphasizes forecasting and monitoring activity of St. Louis encephalitis (SLE), western equine encephalomyelitis (WEE), and West Nile virus (WNV). These viruses are maintained in the wild bird-mosquito cycles, and therefore are not dependent upon infections of humans or domestic animals for their persistence. Infections of humans and domestic animals by these viruses are transmitted by bites of infected mosquitoes that have fed on infected wild birds. WNV is currently of the most concern in San Joaquin County. It was first detected in San Joaquin County in 2004 and reached epidemic risk level for most of the years except the 2009 - 2011 period.

Aedes aegypti

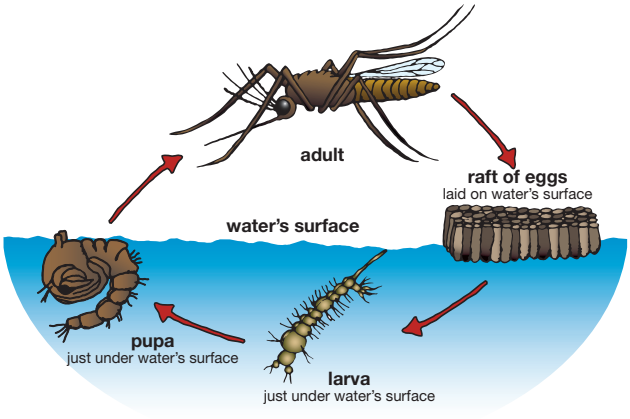
There are 18 mosquito species found in San Joaquin County. Three of them are of major public health concern; *Culex tarsalis,* is the principal vector of WEE, SLE and WNV, *Culex pipiens*, is the vector of WNV, and SLE, and *Anopheles freeborni*, the vector of malaria. In addition, the invasive mosquito Aedes aegypti was first discovered last year in our county and was found again in 2020. It is the major vector of Zika, dengue, yellow fever and chikungunya.

Mosquitoes of San Joaquin County

1. *Culex tarsalis*
   Western Encephalitis mosquito
2. *Culex pipiens*
   Northern House mosquito
3. *Culex stigmatosoma*
   Banded foul water mosquito
4. *Culex erythrothorax*
   Tule mosquito
5. *Anopheles freeborni*
   Western malaria mosquito
6. *Anopheles franciscanus*
   No common name
7. *Anopheles punctipennis*
   Woodland malaria mosquito
8. *Aedes aegypti*
   Yellow fever mosquito
9. *Aedes dorsalis*
   No common name
10. *Aedes melanimon*
    No common name
11. *Aedes nigromaculis*
    Irrigated pasture mosquito
12. *Aedes sierrensis*
    Western treehole mosquito
13. *Aedes vexans*
    Inland flood water mosquito
14. *Aedes washinoi*
    No common name
15. *Culiseta incidens*
    Cool-weather mosquito
16. *Culiseta inornata*
    Large winter mosquito
17. *Culiseta particeps*
    No common name
18. *Orthopodomyia signifera*
    No common name

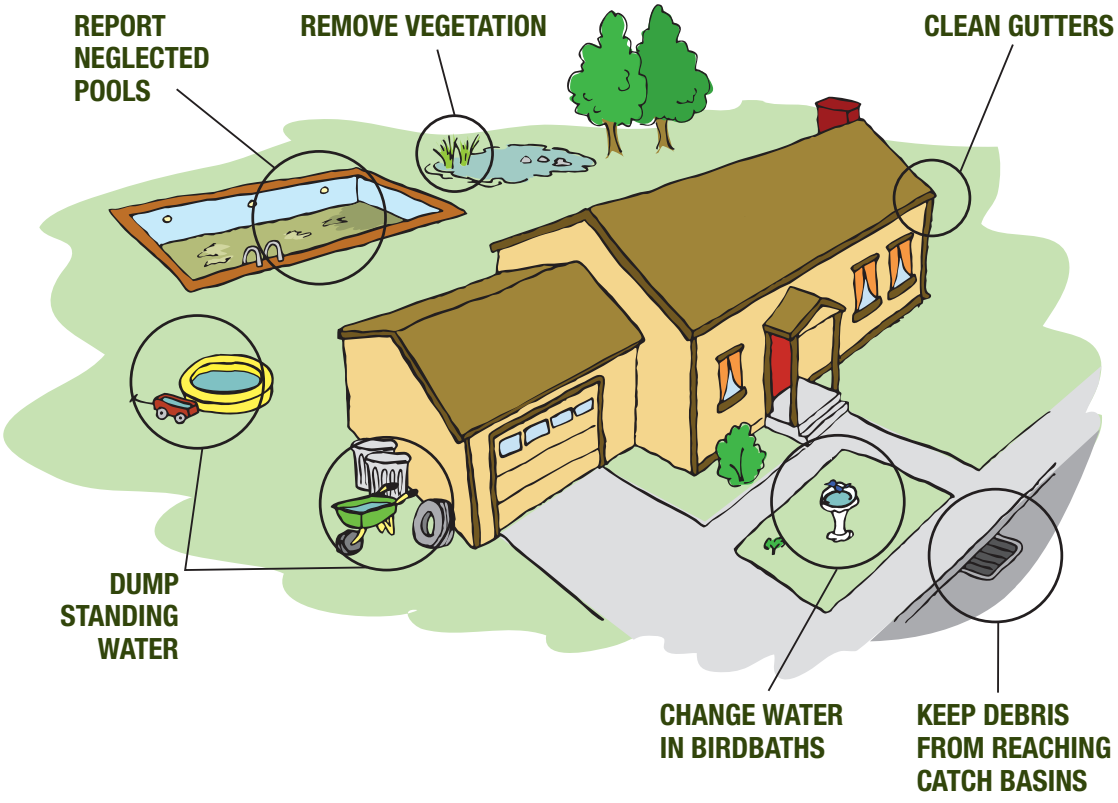
Mosquito Development

Mosquitoes complete a full metamorphosis: egg, larva, pupa, and adult. Critical to the mosquito's life cycle is water. Egg rafts of the genus Culex are laid on still or standing water. Each raft contains 100 - 300 eggs. The eggs hatch to larvae. The larvae grow through four stages called instars, shedding their outer skin as they grow to the next stage. Once the larvae reach the fourth instar, they then transform to pupae. The pupal stage is the equivalent of the cocoon, where the adult insect body develops.
Once development is complete, the pupae hatch off the water as adult mosquitoes. The adult female then needs to take a "blood meal" to provide necessary nutrients to her eggs. In warmer weather, mosquitoes complete a full metamorphosis, on average, in seven to ten days. Mosquito development around residential properties is the primary source for urban mosquitoes.



Other genera of mosquitoes vary in egg laying behavior. For instance, mosquitoes of the *Aedes*, *Anopheles* and *Psorophora* genera lay eggs singly in moist areas where flood water may come at a later date. These eggs can stay viable for years. *Culex* and *Culiseta* eggs are laid in rafts. For the *Anopheles*, each egg has two lateral air floats, which help them in floatation. For the invasive *Aedes* found in California, the eggs are glued to the sides of containers and hatch as containers are filled with water. This type of egg laying creates a particularly difficult situation in controlling this type of mosquito.

Find & Eliminate Mosquito Development Sources!

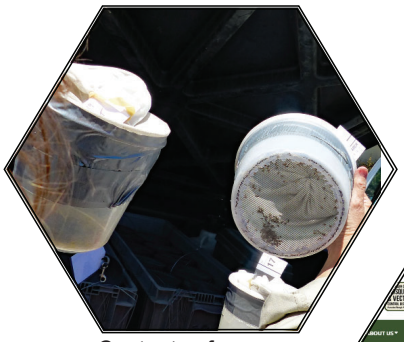


Integrated Pest Management

District operations are based on a concept that utilizes several different approaches to vector control. The concept is referred to as Integrated Pest Management (IPM). The District's definition of IPM is "a sustainable approach, or plan, 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." IPM can also be considered as a systematic approach to public health pest management, which combines a variety of surveillance and control practices. With regards to implementing a plan to control vectors, IPM can be defined as socially acceptable, environmentally responsible and economically practical protection of the public's health and well being. In the spirit of IPM, Integrated Mosquito Management (IMM), is a process that is directly related to the specific control of mosquitoes.

Since the need for mosquito control was recognized in the early twentieth century, increased knowledge of mosquito biology has driven the formulation of a variety of methodologies designed to successfully reduce both mosquito nuisance levels and mosquito-borne disease transmission. As the knowledge base from which these methodologies were derived have matured, the technologies are increasingly seen as mostly complimentary or synergistic in nature, providing optimal control as part of an overall strategy. IMM has been developed to encourage a balanced usage of cultural and insecticidal methodologies and habitat manipulations in order to minimize adverse environmental impacts. IMM is knowledge-based and surveillance-driven, and when properly practiced is specifically designed to accomplish the following:

1. Protect human, animal and environmental health.
2. Promote a rational use of pesticides.
3. Reduce environmental contamination to soil, ground water, surface water, pollinators, wildlife and endangered species.
4. Utilize natural biological controls to conserve and augment other control methods.
5. Use target specific pesticides to the extent possible.
6. Emphasize the proper timing of applications.
7. Minimize pesticide resistance problems.



Contents of a surveillance trap provides vital information about mosquito populations & disease.

Education and outreach includes the District's website and social media.

Physical control can be as simple as dumping out standing water.

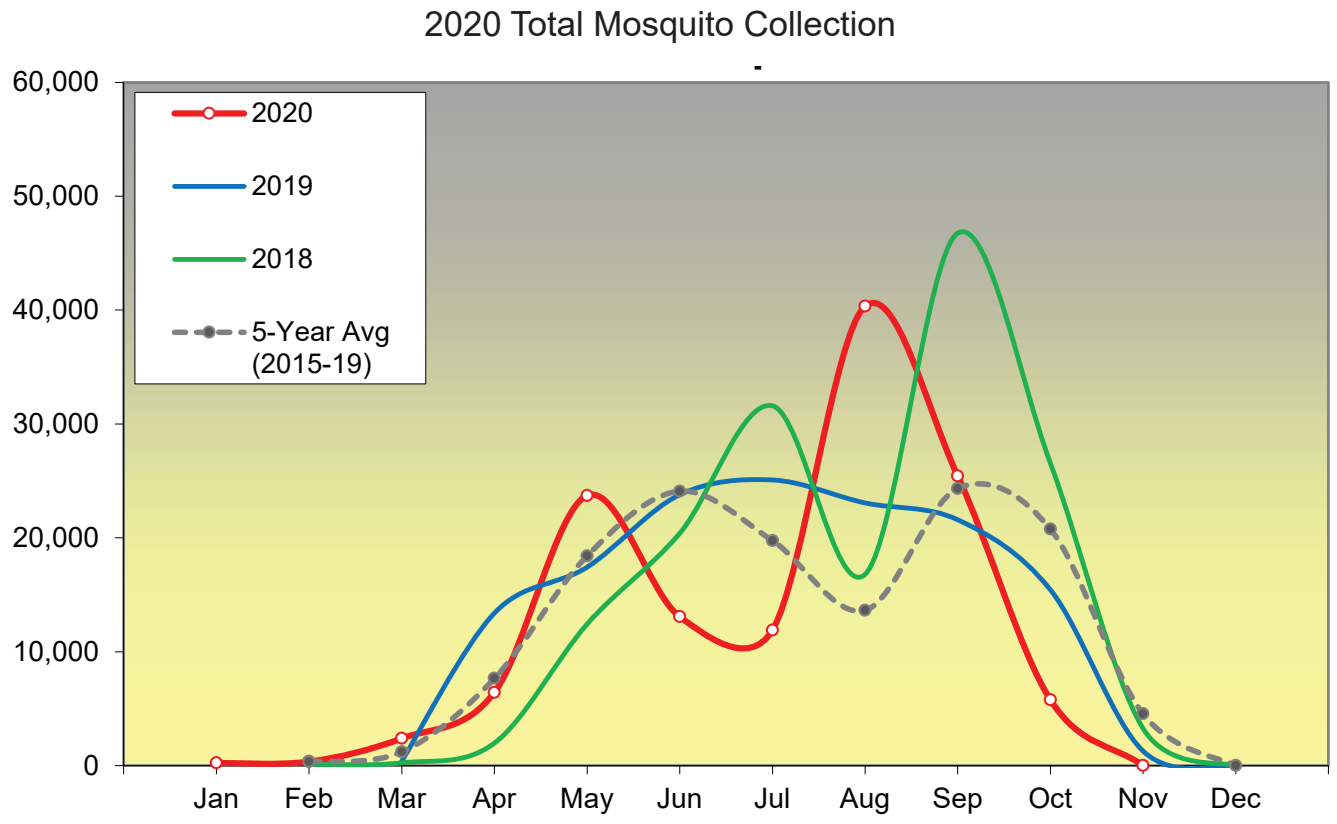
Mosquitofish are the primary biological control used by the District.

Chemical control includes treating immature mosquitoes in standing water.

Mosquito Population Surveillance

The District collects mosquitoes in various types of mechanical traps to target specific mosquito species that are vectors of encephalitis viruses. The trap types are referred to as Encephalitis Virus Surveillance (EVS) traps and gravid traps, which are used extensively throughout the District covering different types of mosquito breeding sources. Upon placement, the traps run for 24 hours prior to collection. Contents of the traps are analyzed each week. Each trap's contents indicate the population in a specific area along with information about the mosquito species distribution. The data is submitted to the California Vector Borne Disease Surveillance Gateway system for compilation with other vector control agency data. Following record high numbers of mosquito vectors collected in the period from 2017 to 2019, the mosquito count in 2020 was similar to 2019 and was ranked the fourth highest since the arrival of WNV in 2004.

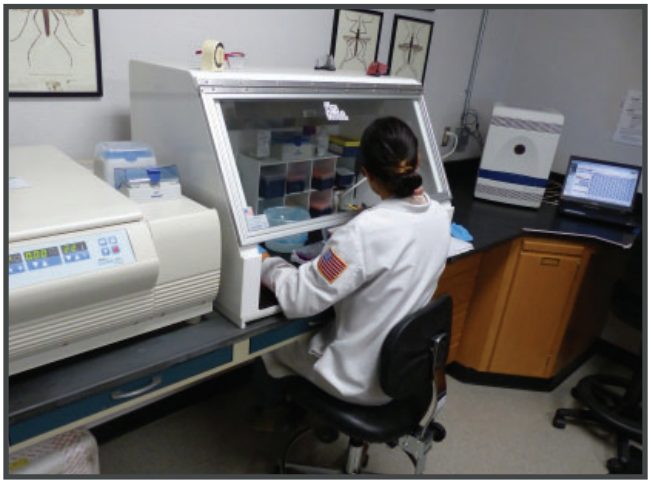
The data from surveillance is used in several important ways. First, the population counts help mosquito control technicians (MCT) find mosquito development sources. Sometimes these sources are new to the area and some are currently known to exist. Regardless, environmental conditions and land use change can result in unexpected mosquito development. Second, surveillance data provides information about mosquito species. This is useful information in determining what type of sources the mosquitoes may be developing in. For instance, Culex tarsalis are associated with fresh water low in organic matter, while Culex pipiens are associated with water high in organic matter. This information assists the MCT to find the source of development and take appropriate action. Third, mosquito population counts help determine areas where more aggressive treatment and surveillance are needed. Last, collected mosquitoes are separated and used to test for mosquito-borne disease. The results provide vital knowledge in suppressing mosquito populations and reducing the risk of disease to the public.



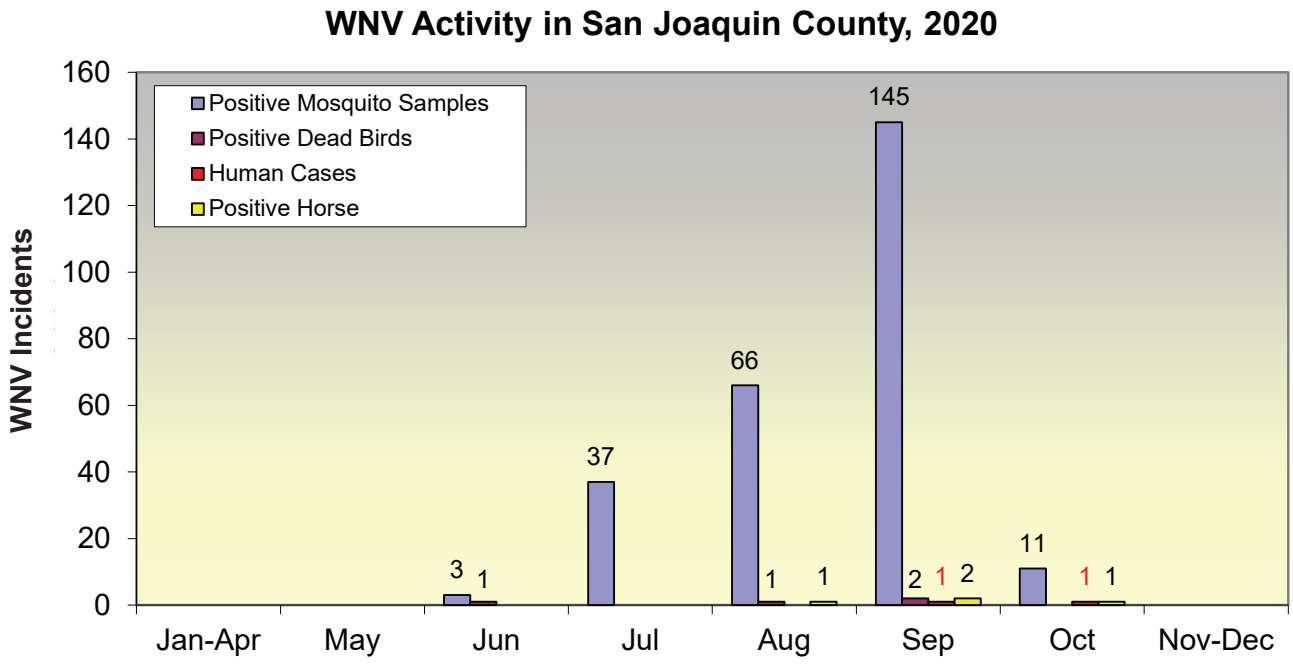
Mosquito-Borne Disease Surveillance

In combination with mosquito population surveillance, early detection of mosquito-borne diseases is critical to developing a proactive and effective control and prevention response. The District uses several surveillance methods to test for the presence of encephalitis viruses and other pathogens. These methods include testing wild dead birds and groups of mosquitoes for the presence of pathogens within their bodies using quantitative RT-PCR. For many years, mosquitoes and dead birds have been the earliest indicators of WNV activity in San Joaquin County. The District calculates and uses vector abundance*, WNV Minimum Infection Rate (MIR)*, average daily weather temperature, the number of WNV positive dead birds and human cases as the main parameters to evaluate overall transmission risk.

In San Joaquin County, West Nile virus was first detected in 2004 with three human cases, followed by intensive amplification and transmission resulting in 36 human cases and 19 horse cases in 2005. WNV activity subsequently went through a pattern of 1-2 years of average or below average activity followed by 2-3 years of moderately high activity. This pattern generally agrees with what has been observed nationally, although regional variations exist and outbreaks occurred intermittently in the nation.



Testing for West Nile virus at the District's laboratory.



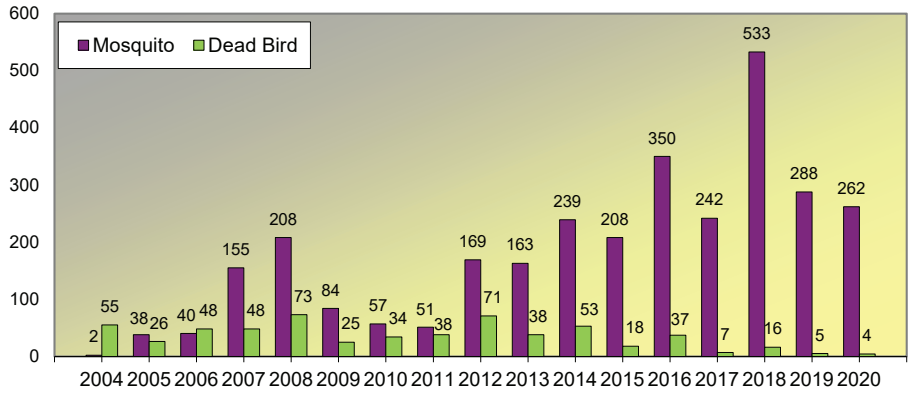
*: Vector abundance: the number of mosquitoes caught per trap per night . WNV Minimum Infection Rate (MIR): the number of infected mosquitoes per 1,000 mosquitoes.

Mosquito-Borne Disease Surveillance

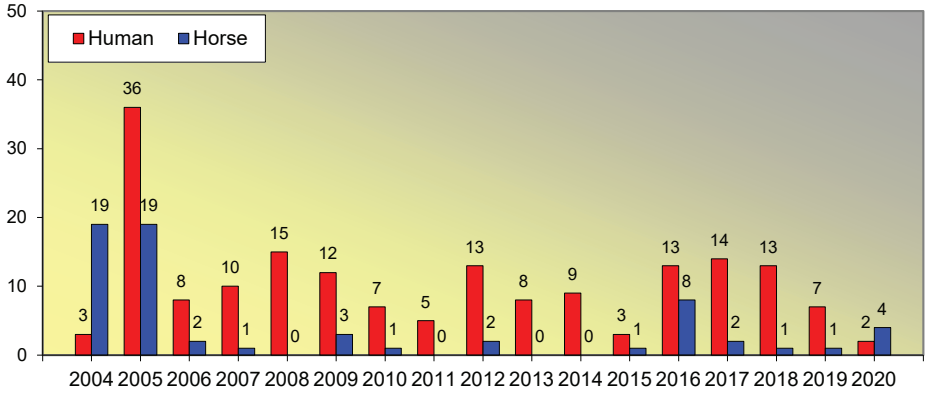
The overall WNV transmission risk for 2020 in San Joaquin County reached and stayed at epidemic planning level from late August to September. Specifically, WNV activity in 2020 followed a similar spatial pattern to 2019 except that the activity peaked in early September compared to mid-August in 2019. The number of WNV positive mosquito samples was above average. In addition to the four equine cases reported in our county, there was one WNV human case and one SLE human case reported. The number of human cases in 2020 may not reflect the actual transmission events due to the potential effect of COVID-19 on WNV diagnostic testing and human exposure to mosquito bites. The SLE human case was the first reported case in San Joaquin County since 1973. SLE was first identified in 1933 during an epidemic outbreak in St. Louis, Missouri. In California, a statewide arbovirus surveillance program was established in 1953 and mosquito testing started in 1969. Mosquito testing data showed that SLE activity in California was mostly occurred before the 1990s. SLE disappeared in 2003 for 12 years and was detected again in southern California in 2015.

From 2004 to 2020, a total of 35,131 mosquito pools of nine mosquito species were tested by VecTestTM, RAMP® and/or RT-qPCR for WNV and SLE. There were 3,096 positive mosquito samples (8.74%) that were of species *Cx. tarsalis* (1,743), *Cx. pipiens* (1,329), *Cx. erythrothorax* (20) and *Ae. vexans* (4). In 2020, The District tested 2,757 mosquito samples, of which 260 were positive for WNV. In comparison, 288 out of 2,688 mosquito samples tested positive for WNV in 2019. In 2020, two mosquito samples also tested positive for SLE. These two SLE positive samples also represent the first SLE positive mosquito samples in San Joaquin County since 1973.

Positive Mosquito Samples and Dead Birds, 2004 - 2020

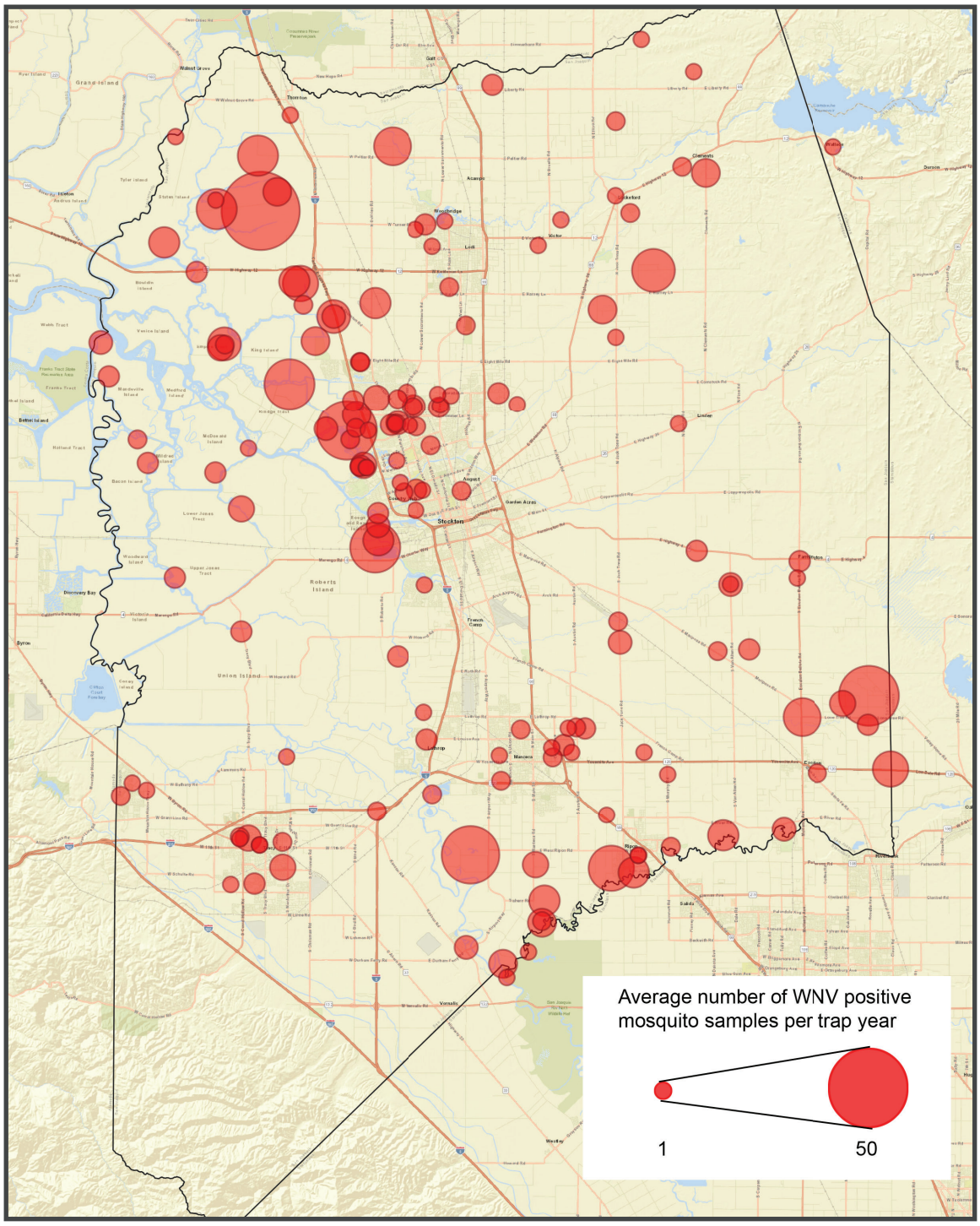


Human and Equine Cases, 2004 - 2020



The District received dead bird reports from residents through the statewide WNV hotline (1-877-968-2473). The reports are used by the California Department of Public Health to create statewide risk maps. These maps assist the District in targeting areas for additional mosquito control efforts. From 2004 to 2020, the District received 16,179 dead bird reports and tested 1,516 birds, resulting in 584 positive birds. Approximately 75% of the positive birds are corvids (crows, ravens, jays, magpies) and the rest are mostly passerine birds (sparrows, finches, robins). In 2020, the District received 157 dead bird reports. The District tested 38 of them and 4 tested positive for WNV infections.

Geographic Distribution of WNV Activity in Mosquitoes San Joaquin County 2004 - 2020

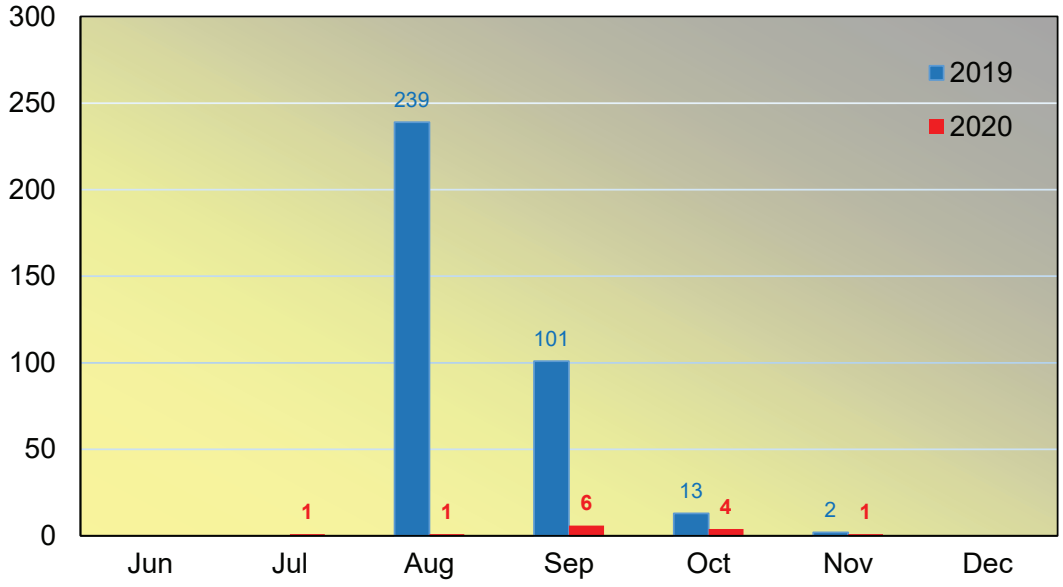


Geographic mapping indicated that hot zones of WNV activity in mosquitoes are located in the Delta area, north portion of City Stockton, and the riparian areas along the Stanislaus River. The District will continue to employ robust and sensitive methods to monitor WNV activity in dead birds and mosquitoes.

The Invasive Mosquito *Aedes aegypti*, the Yellow Fever Mosquito

The yellow fever mosquito, *Aedes aegypti*, was first found in California in Madera County and Fresno County in 2013. It spread as far north as Merced County and as far south as San Diego County through 2018. In the summer of 2019, *Aedes aegypti* was discovered in San Joaquin County in a neighborhood west of I-5 and south of March Lane in the city of Stockton. It was found again in 2020 in the same locations. The surveillance data showed that *Aedes aegypti* did not spread further beyond the 2019 distribution range of a 1,000-foot radius with the index house as the center, which is the initial discovery location in 2019. In addition, the population was suppressed to a very low level. There were only 13 adults collected this year compared to 355 adults collected in 2019. There was not more than one adult caught per trap and no more than two adults caught per week. The *Aedes* Response Plan proves to be very effective. The District will continue to implement and improve the plan to suppress the *Aedes aegypti* populations for a potential eradication.

Collection of Invasive *Aedes aegypti* Adults, 2020 vs 2019



Trap Locations of Invasive Aedes Detection, 2020

Ticks & Tick Borne Disease

The most common ticks found in San Joaquin County are: the American dog tick, *Dermacentor variabilis*; the Pacific Coast tick, *Dermacentor occidentalis*; and the Brown dog tick, *Rhipicephalus sanguineus*. The Pacific Coast tick is one of the most widely distributed ticks in California. Occasionally, the Western black-legged tick, *Ixodes pacificus* is also found in San Joaquin County.

Ixodes pacificus
Western Black-legged Tick

The District conducts surveillance for ticks in parks and river areas of SJC that are known habitats. Surveillance for adult ticks is typically performed during the months of November through April when ticks are most abundant. *Ixodes pacificus* is the primary species targeted during surveillance due to its ability to carry Lyme disease.

Surveillance typically is conducted along waterways, riparian areas, and foothill areas used by the public for recreational activities. Ticks may be submitted by local veterinary hospitals and the general public for identification.

This year there were no tick specimens collected from the field. The District received one *Dermacentor variabilis* and one *Dermacentor occidentalis* specimen from San Joaquin County residents for species identification.

Dermacentor variabilis
American Dog Tick

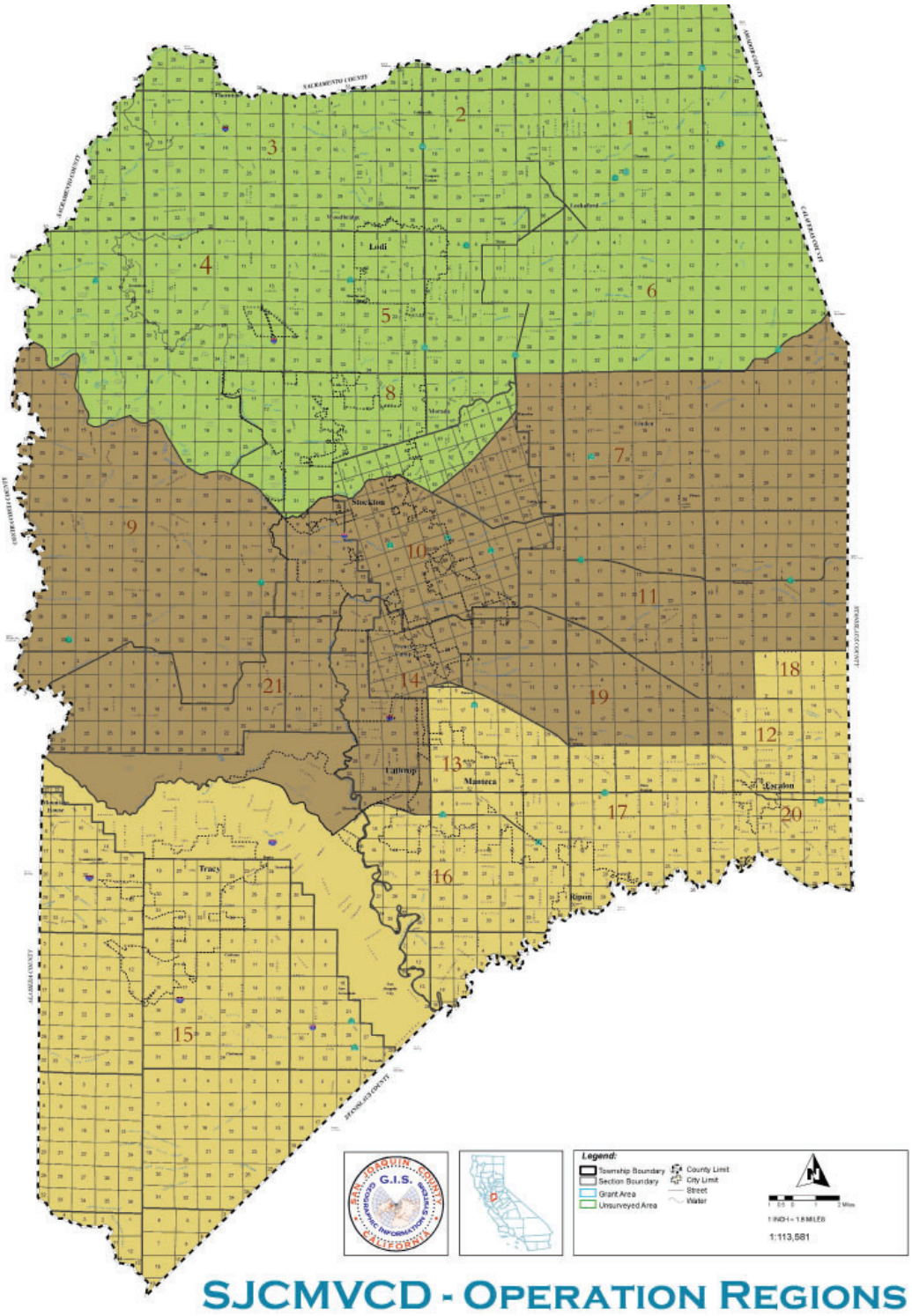
Rhipicephalus sanguineus
Brown Dog Tick

Dermacentor occidentalis
Pacific Coast Tick*

Lyme disease is a bacterial infection. The bacteria that causes Lyme disease is *Borrelia burgdorferi* and is transmitted primarily by the Western black-legged tick. Prompt removal of the tick will reduce risk of disease transmission. Early symptoms of Lyme disease may include head and muscle aches, sore throat, nausea, fever, stiff neck or fatigue. About 70-80% of those infected develop a rash (Erthema migrans or EM) at the bite site, which sometimes resembles a "bull's eye." The EM rash may appear on any area of the body within 3 to 30 days after a tick bite. Later symptoms may involve numbness or tingling of the limbs, joint swelling and pain, memory loss, and/or mood swings.

* Credit:"Pacific Coast Tick (Dermacentor occidentlis)" by jkirkhart35 is licensed under CC BY 2.0

Operational Zone Map



The District is divided into three operational regions under the direction of a regional supervisor. The North region (green) has seven operational zones. The Central region (brown) has six operational zones, and the South region (yellow) has six operational zones. Each zone is staffed with a state certified mosquito control technician. There are a total of 115 mosquito source types categorized by agricultural, natural, residential, and industrial/ commercial sources. Examples include: field crops, animal waste ponds, irrigation ditches, natural drains, tree holes, containers, septic tanks, ornamental ponds, roadside ditches, railroad borrow pits, tires, storm water retention ponds, and catch basins.

Public Outreach

The District's public outreach informs and educates the public of all mosquito-related issues pertinent to San Joaquin County. These issues range from mosquito development and control methods to the risk of mosquito-borne diseases and invasive mosquito species. To communicate timely and accurate information, we utilize news releases, spray alerts, annual reports, website posting, social media, paid newspaper ads, radio, and magazine ads, as well as school and community group presentations. This year, the District celebrated 75 years of protecting public health. Our primary message was, "Mosquito Prevention Is Everyone's Responsibility."

The following are the most notable outreach activities the District performed during 2020:

The District's website was posted with news releases, as well as spray alerts for adult mosquito spraying. Throughout the year, the District interviewed with local newspapers, KCRA 3, ABC 10, CBS 13, and Univision 19. We were interviewed and filmed by Soundings Magazine. Sounding Magazine is an online local interest publication here in Northern California. During the year, six news releases and 53 spray alerts were sent. The website had 86,071 total visitors for the entire year, which averages 235.8 visitors per day.

This year was the second full year the District utilized Facebook. During the year, we posted 37 times. Of those posts, there were 101,586 people reached, with 11,185 engagements. The highest ranking post was on June 4th regarding the first find of WNV, reaching 49,724 people. Two different social media campaigns were run by Mayaco Marketing and the Lodi News Sentinel. Mayaco ran Facebook ads for all three Districts. The District's San Joaquin County run was 1,124,155 impressions with 292,225 unique reach. The Lodi News Sentinel social media campaign ran during August with 54,290 impressions and 105 click-throughs. This campaign targeted homeowners along the I-5 corridor in Stockton using geo-marketing. We targeted the messaging to invasive *Aedes* education and control. Lodi Sentinel also ran digital ads on the newspaper's website with 111,139 impressions and 140 click-throughs.

Large-scale radio campaigns aim to increase awareness of mosquito development, mosquito-borne disease, and invasive mosquito species. The District contracted with local radio stations to run 30-second ads on KATM 103.3, KWIN 97.7, KSJN 102.3, KQOD 100.1, RIVR 105.5, KJOY 99.3, and KSTN 105.9. Also included in the purchase were two Hispanic stations KMIX 100.9, and KTSE 97.1, which ran 60-second ads. Partnering with East Side and Turlock Mosquito Abatement Districts, 2,651 commercials ran throughout the summer.

Additional outreach activities include:

- Hwy 99 digital billboard ads ran from mid-April through the end of September. Ads ran on both sides of the billboard, every eight seconds per minute, 24 hours per day for a total of 239,000 ads.
- San Joaquin Magazine ran half-page color ads in March, April, June, July, August, September, and October with an additional ad in the Home Magazine in August.
- Third grade students participating in two Ag Venture programs: 69 presentations with 1,717 students and parents in attendance.
- Fifth and sixth grade elementary presentations: 8 presentations with 15 classes in attendance.
- Presentations were provided to the Central Valley Association of Realtors, Lodi Rotary, and the San Joaquin County Office of Education.
- During the District's twelfth annual mosquitofish giveaway, 166 people received fish. All seven cities in San Joaquin County were visited.
- The SJC Master Gardeners distributed *Aedes aegypti* information throughout California as part of an effort by the MVCAC PR committee.

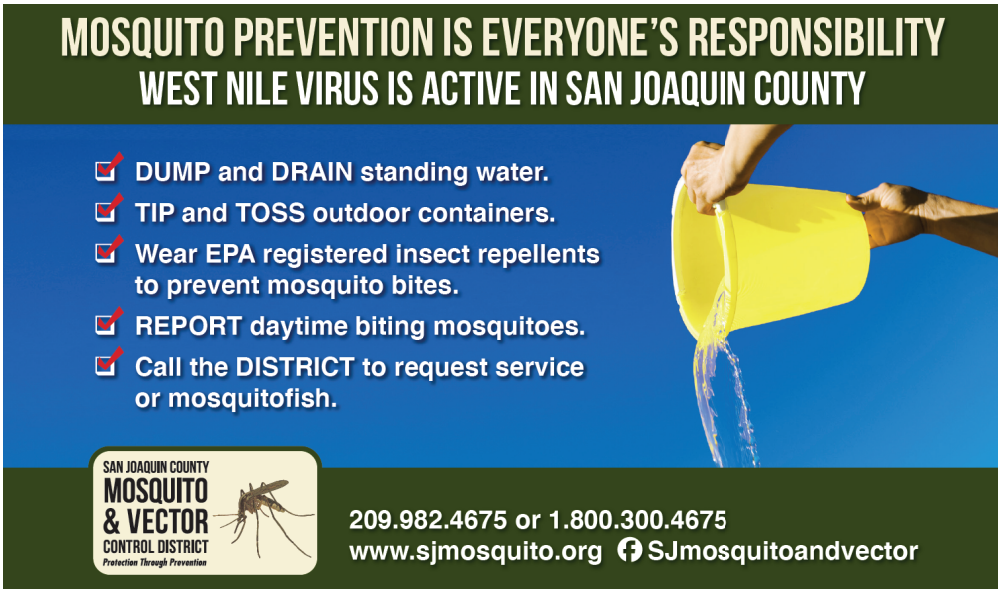
Physical Control

The term physical control refers to making an environmental or physical change to a mosquito-breeding source by physical or mechanical means. Physical control is also known as "source reduction". Ultimately, physically changing the mosquito-breeding source can make the site less suitable for mosquito production.

Landowners and land managers have a responsibility to minimize mosquito production on their lands and play a key role in reducing mosquito populations throughout the District. The implementation of mosquito prevention Best Management Practices (BMPs) can reduce or eliminate the ability of aquatic sites to produce mosquitoes. BMPs are defined as actions landowners can take to reduce or eliminate mosquito production from water sources on their property in an environmentally and fiscally responsible manner, and to reduce the potential for transmission of disease from mosquitoes to humans.

In 2012, the California Department of Public Health and the Mosquito and Vector Control Association of California updated a manual of BMPs titled "BEST MANAGEMENT PRACTICES FOR MOSQUITO CONTROL IN CALIFORNIA" (http://www.westnile.ca.gov/resources.php), which has been adopted by the District and is used as the standard set of recommendations for property owners to reduce or eliminate mosquito breeding sources on their property.

Each mosquito breeding source and property is unique, and the BMPs listed in the manual referenced above, will apply to some properties, but not others. After evaluating their property, the District works with the landowner to implement applicable BMPs to reduce or prevent future mosquito breeding as well as to manage existing mosquitoes at that site.



Physical control can be as simple as dumping out a bucket of water and tossing out contaners that can potential hold water.

Mosquito Control Best Management Practices At-A-Glance:

- Eliminate artificial mosquito sources.
- Ensure man-made temporary sources of surface water drain within four days (96 hours) to prevent development of adult mosquitoes.
- Control plant growth in ponds, ditches, and shallow wetlands.
- Design facilities and water conveyance and/or holding structures to minimize the potential for producing mosquitoes.

Biological Control

Biological mosquito control is one of the mainstays in protecting the public from mosquitoes and the transmission of mosquito-borne diseases. Biological mosquito control agents include a wide variety of pathogens, parasites and predators. The primary biological control agent used by the District is *Gambusia affinis*, the mosquitofish.

Mosquitofish are small live-bearing minnows closely related to the common guppy. These fish are a vivacious consumer of mosquito larvae and pupae and can survive in varying water temperatures. Because mosquitofish are surface feeders, they are extremely efficient mosquito predators. A single mosquitofish has been said to consume upwards of 80-100 mosquito larvae per day. They are capable of quickly populating a source if conditions are favorable. The fish are placed in a variety of permanent and semi-permanent fresh water habitats such as neglected swimming pools, water troughs, rice fields, and wetlands.

Harvesting Mosquitofish From Hatchery Pond

The District's White Slough Fish Rearing Facility is located at the City of Lodi's White Slough Water Pollution Control Facility. The facility consists of thirteen rearing ponds and five above ground tanks. The ponds are capable of rearing 3,500 - 4,000 pounds of fish per year.

Mosquitofish Production In Pounds Per Ponds 1-13

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13
1st Harvest	301.8	325.2	208.1	239.1	248.9	313.8	224.8	192.6	241.3	75.6	156	124.7	342.9
2nd Harvest	264.6	0.0	291.5	0.0	155.2	0.0	0.0	251.9	236.5	0.0	0.0	0.0	0.0
Total	566.4	325.2	499.6	239.1	404.1	313.8	224.8	444.5	477.8	75.6	156	124.7	342.9

Mosquitofish Planting Sites / Pounds Planted

	Fish Origination Site	Island & Duck Club Flooding	Wildlife & Ecological Reserves	Sewers, Retention & Private Ponds	Rice Fields	Service Requests: Fish Ponds, Swim Pools, Water troughs	Miscellaneous (Drains, Canals, Ditches & River Seepage)
2019	White Slough	1124.4	541.8	0.0	1309.6	111.9	91.7
	Wild Fish	0.0	0.0	0.0	0.0	0.0	0.0
2020	White Slough	707.6	510.5	34.5	2072.2	162.5	6.0
	Wild Fish	0.0	0.0	0.0	0.0	0.0	0.0
5 Yr. Avg. 2015-2019	White Slough	928.6	476.5	89.4	963.0	284.1	83.4
	Wild Fish	0.0	0.0	1.3	0.0	42.9	3.9

Chemical Control

Larvicides may be applied to water in which larvae or pupae are developing. Pastures, septic tanks, irrigation ditches, animal waste ponds, creeks, sloughs, catch basins, treeholes, and roadside ditches are examples of areas the District's technicians regularly inspect and treat to reduce mosquito populations.

Adulticides may be applied as space sprays, mists, or fogs to kill adult mosquitoes and as a residual insecticide on surfaces likely to be contacted by adult mosquitoes.

Herbicides are used to reduce mosquito habitat and provide better access for larvicide treatment, and biological control.

The chart below shows larviciding and adulticiding for 2020 with a comparison to a five year average. For acres treated with herbicide, see the table below the graph.

Larviciding urns in a local cemetary

Larvicide & Adulticide Applications In Acres Treated

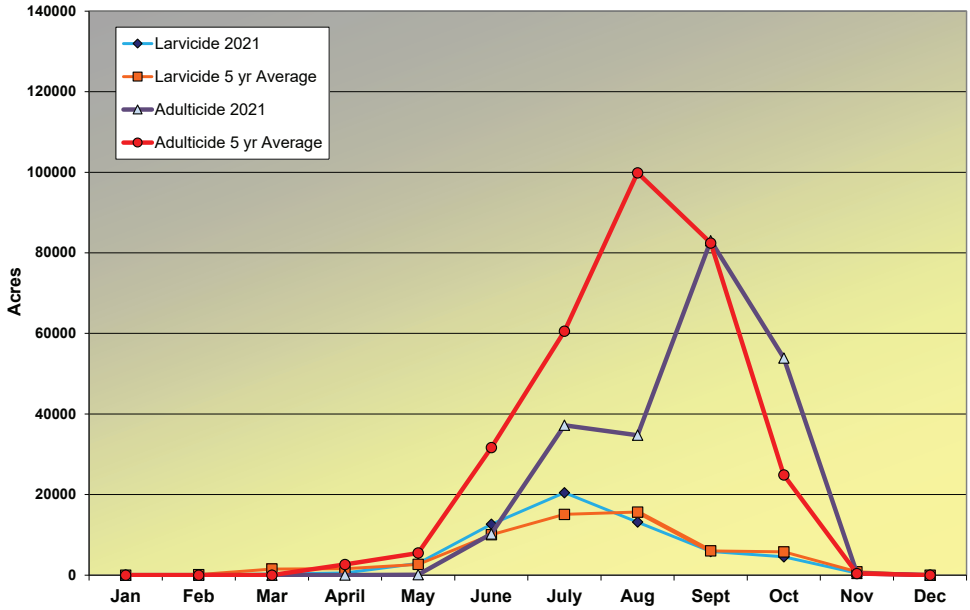


Table is in acres treated	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Larvicide 2020	2	19	258	558	2924	12647	20470	13169	5861	4555	9	3
Larvicide 5 yr. avg.	25	133	434	1054	2603	9800	16600	16476	6439	4168	915	16
Adulticide 2020	0	0	1	18	102	10240	37210	34744	83007	53899	448	0
Adulticide 5 yr. avg.	0	3	8	1455	6181	24690	65232	75313	60077	20869	414	1
Herbicide 2020	83	20	137	13	77	97	108	47	22	13	89	26
Herbicide 5 yr. avg.	26	137	13	76	109	62	132	129	31	36	15	36

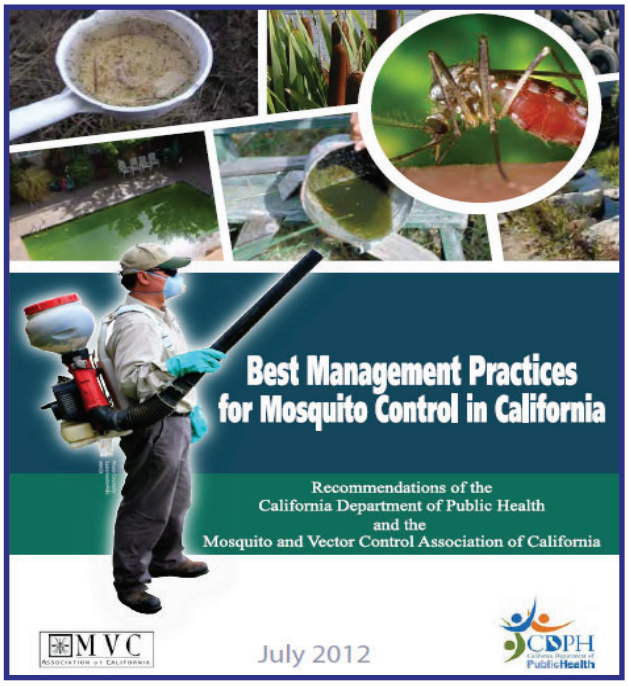
Legal Abatement

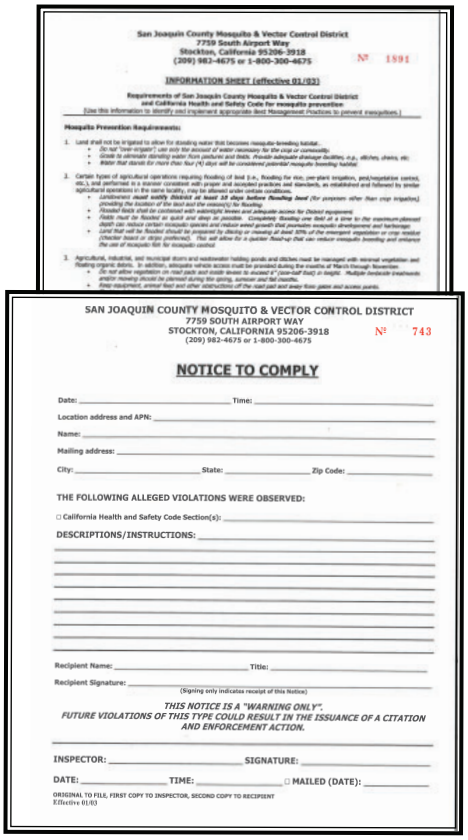
The District incorporates local, state and federal statues to regulate excessive mosquito breeding on private and public lands. Using provisions of the California Health and Safety Code, the District can legally require property owners to reduce or eliminate mosquito breeding when it becomes a public nuisance.

Abatement of mosquitoes generally follows a three step process; whereby, the owner of mosquito-producing land is: 1) contacted and requested to take steps to prevent the occurrence of mosquito development and provided an "Information Sheet"; 2) if corrections do not take place, a "Notice to Comply" is issued; 3) if the condition persists, and the problem is not corrected, the District can initiate legal abatement proceedings per §2060 of the California Health and Safety Code. Fines of $1,000 per day can be levied for non-compliance once a legal abatement hearing has taken place and the property owner refuses to comply.

During the year, seventeen information sheets were provided to property owners explaining how to reduce mosquito development on their property.

Year	Information Sheet	Notice to Comply	Citation	Warrants
2020	17	1	0	0
2019	47	1	0	13





San Joaquin County Mosquito & Vector Control District
7759 South Airport Way
Stockton, California 95206-3918
(209) 982-4675 or 1-800-300-4675

INFORMATION SHEET (effective 01/03)

SAN JOAQUIN COUNTY MOSQUITO & VECTOR CONTROL DISTRICT
7759 SOUTH AIRPORT WAY
STOCKTON, CALIFORNIA 95206-3918
(209) 982-4675 or 1-800-300-4675

NOTICE TO COMPLY

THE FOLLOWING ALLEGED VIOLATIONS WERE OBSERVED:

DESCRIPTIONS/INSTRUCTIONS:

THIS NOTICE IS A "WARNING ONLY".
FUTURE VIOLATIONS OF THIS TYPE COULD RESULT IN THE ISSUANCE OF A CITATION AND ENFORCEMENT ACTION.

District's "Information Sheet" and "Notice to Comply"

The District provided mosquito prevention Best Management Practices (BMPs) handouts for the reduction of mosquitoes to residential, agricultural, commercial, and industrial property owners. The above handout is available from the District: Best Management Practices for Mosquito Control in California - 2012. The BMPs are often handed out upon request, during routine inspections, presentations, and public events.

Request for Service

The general public is encouraged to contact the District to request service. These requests generally are either to report a mosquito-related problem, request mosquitofish, inquire about information on ticks, insect/vector identification, or to request a property inspection. There is no charge for these services. San Joaquin County residents can call the District at (209) 982-4675 or 1-800-300-4675 or request service at the District's website **www.sjmosquito.org**. The District usually is able to respond within 24 to 48 hours. During the year the District responded to 1,803 service requests.

	Mosquitoes		Ticks		Insect Identification		Fish		Property Inspection (Pools)	
	2020	2019	**2020**	2019	**2020**	2019	**2020**	2019	**2020**	2019
January	**16**	15	**0**	0	0	0	**18**	15	28	37
February	**32**	11	**0**	4	0	0	**25**	12	39	24
March	**16**	61	**0**	3	0	0	**18**	108	43	85
April	**136**	369	**0**	0	0	0	**56**	73	53	66
May	**113**	160	**1**	2	3	2	**50**	59	35	103
June	**134**	357	**0**	2	4	0	**228**	140	30	45
July	**108**	125	**0**	0	0	1	**26**	73	32	18
August	**149**	196	**1**	0	1	2	**21**	19	17	20
September	**134**	83	**0**	0	2	0	**24**	11	12	16
October	**136**	63	**0**	0	0	0	**14**	5	17	15
November	**9**	4	**0**	0	1	0	**3**	8	4	9
December	**3**	9	**0**	0	0	0	**1**	4	10	10
Total	**986**	**1453**	**2**	**11**	**11**	**5**	**484**	**527**	**320**	**448**

Through the District's website, users can access "Request for Service" for mosquitio problems, and to request mosquitofish. In addition, people can also report daytime biting mosquitoes, neglected swim pools, and dead bird.

Financial

SAN JOAQUIN COUNTY MOSQUITO AND VECTOR CONTROL DISTRICT

Statement of Revenues, Expenditures and Changes in Fund Balance - Governmental Funds

For the year ended June 30, 2020

	General fund
Revenues	
Property taxes	$ 5,795,316
Property assessments	3,194,184
Investment income	296,748
Property tax relief	114,446
Reimbursements and rebates	114,280
Other revenues	4,843
Grant revenue	745
Total revenues	9,520,562
Expenditures	
Operating	
Salaries and benefits	4,849,903
Services and supplies	2,661,790
Capital outlay	709,536
Total expenditures	8,221,229
Excess of revenues over expenditures	1,299,333
Other financing sources (uses)	
Proceeds from sale of capitol assets	4,180
Total financing sources (uses)	4,180
Net Change in fund balances	1,303,513
Fund balances, beginning of year	16,572,718
Fund balance, end of year	$ 17,876,231

The accompanying notes are an integral part of this financial statement.

Excerpt from page 15 of the Financial Statements And Independent Auditor's Report 2020. Find the full report at www.sjmosquito.org

District Staff

Years of Service as of December 31, 2020

Management & Administrative Staff

Ed Lucchesi - Manager, 35 yrs.
John Fritz - Assistant Manager, 8 yrs.
Aaron Devencenzi - Public Information Officer, 26 yrs.
Emily Nicholas - Administrative Assistant, 18 yrs.
Jamie Tuggle - Secretary, 6 yrs.

Laboratory Staff

Shaoming Huang, Ph.D- Entomologist, 11 yrs.
Sumiko De La Vega - Assistant Entomologist, 7 yrs.
Mary Iverson - Lab Technician I, 22 yrs.
Andrew Provencio - Vector Ecologist, 2 yrs.

Fishery Staff

John Vignolo - Fish Hatchery Manager, 30 yrs.
Eric Martinez - Fish Hatchery Technician, 1 yr.

Mechanic Staff

John Moniz - Mechanic II, 11 yrs.
Michael Miller - Mechanic I, 6 yrs.

Seasonal Staff

George Lucas - Utility

Field Staff - Northern Region

Keith Nienhuis - Mosquito Control Supervisor, 32 yrs.
Chris Heirs - Mosquito Control Technitian II (MCT II) 13 yrs.
Janine Durham - MCT I, 15 yrs.
Sterling Thomas - MCT I, 6 yrs.
Adam Coles - MCT I, 5 yrs.
Roy Pfeifer - MCT I, 22 yrs.
Juilan Ramos - MCT I, 6 yrs.
Norm Hopkins - MCT I, 16 yrs.

Field Staff - Central Region

Deanna Hopkins - Mosquito Control Supervisor, 20 yrs.
Joseph Sarale - MCT II, 13 yrs.
Dennis Keith - MCT I, 35 yrs.
Michael Corrales Jr. - MCT I, 13 yrs.
Carlos Ramero - MCT I, 2 yrs.
Steve Duke - MCT I, 14 yrs.
Josh Diaz - MCT I, 3 yrs.

Field Staff - Southern Region

Morgan Bennett - Mosquito Control Supervisor, 12 yrs.
Martin Jucutan - MCTII, 7 yrs.
Loni Wilkins - MCT I, 2 yrs.
Harold Carpenter - MCT I, 4 yrs.
Richard Domench - MCT I, 6 yrs.
Byron Vanoy - MCT I, 1 yr.
Juan Jimenez - MCT I, 2 yrs.

SAN JOAQUIN COUNTY
MOSQUITO
& VECTOR
CONTROL DISTRICT

Protection Through Prevention

7759 S. Airport Way
Stockton, CA 95206

209.982.4675 or
1.800.300.4675

www.sjmosquito.org