

Solano County Mosquito Abatement District

2018 ANNUAL REPORT

Prepared & Written by Solano County Mosquito Abatement District Biologist Waite Colbaugh

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Letter from the District Manager

On behalf of the Board of Trustees and the staff of the Solano County Mosquito Abatement District, it is my pleasure to present to you the 2018 Annual Report.

The Solano County Mosquito Abatement District (SCMAD) has a staff of nine employees and has experienced many changes in staff over the past few years due to retirements, the latest being technician Michael Gray with 36.5 years of service. Due to relocation, Biologist Waite Colbaugh will be leaving the District in January 2019.

Trustee Larry Petrie passed away in July 2018, serving on the Board of Trustees for 10 years with exemplary service and will be greatly missed. Trustee Glen Graves term shall expire February 2019 and he will not be seeking reappointment, thank you Glen for your service to the SCMAD and the residents of Solano County.

Virus Activity

West Nile virus has been detected in Solano County since 2004. West Nile virus is the Districts largest public health concern. The District experienced low West Nile virus (WNV) activity for 2018; no human cases, no dead birds, 3 mosquito samples and 7 sentinel chickens. WNV state totals for 2018 were 203 human cases, 501 positive dead birds, 1963 positive mosquito samples and 163 sentinel chickens.

Since 2011 California has detected in several counties (none in Solano County to date) both *Aedes aegypti* (yellow fever mosquitoes) and *Aedes albopictus* (Asian tiger mosquitoes). These mosquitoes are not native to California. These two mosquito species can only transmit Zika virus after it bites a person who has the virus in their blood. To date there has been no local mosquito-borne transmission of Zika virus in California. Thus far in California, Zika virus infections have been documented only in people who were infected while traveling to areas with ongoing Zika transmission, through sexual contact with an infected traveler or through maternal-fetal transmission during pregnancy.

The SCMAD Board of Trustees and staff are committed to suppressing both disease carrying mosquitoes and nuisance mosquitoes in Solano County with the most ecological friendly and cost effective methods available. In 2019, the District will be utilizing Unmanned Aerial Systems (drone) technology for mosquito surveillance activities and possibly pesticide treatments in the future.

I want to thank the SCMAD Trustees and Staff for their continued dedication to mosquito control and making Solano County a healthier place where its citizens and visitors can live, work and visit.

Respectfully,



Richard Snyder
District Manager

Independent Special District

The Solano County Mosquito Abatement District is an independent special district and is not a part of the Solano County governmental system. Rather, each city within the District's jurisdiction can appoint a trustee to represent their community on the Solano County Mosquito Abatement District's Board of Trustees; in addition to the Trustees that represent the municipalities, the county at large is also given a representative trustee position called the Trustee-at-Large.

Independent special districts are formed by residents and sanctioned by the State of California Government Code to provide local services.

2018 Board of Trustees

President: Joe Anderson (*Dixon*)
Vice President: James G. McPherson (*Rio Vista*)
Secretary: Glen Graves (*Suisun*)
Trustee: Charles Tonnesen (*Fairfield*)
Trustee: Mike White (*Benicia*)
Trustee: Ronald Schock (*Trustee-at-Large*)
Trustee: Robert C. Meador (*Vacaville*)
Trustee: Larry Petrie (*Vallejo*)

Solano County Mosquito Abatement District Staff

Administration

Manager: Richard Snyder
Administrative Assistant: Tami Wright

Biology/Laboratory

Biologist: Waite Colbaugh

Operations

Mosquito Control Technician Supervisor: Ian Caldwell

Mosquito Control Technicians:

Gary Dula
Damon Gray
Mike Gray
Mark McCauley
David Murrietta
Brian Slover

Mission Statement

The Solano County Mosquito Abatement District (SCMAD) is a special district responsible for mosquito abatement throughout the incorporated and unincorporated areas of Solano County, which covers 909 square miles.

Within this area, SCMAD contends with an extremely diverse range of aquatic habitats and temperature regimes. There are 21 species of mosquitoes known to be found within the SCMAD boundaries, 12 of which are important either as disease vectors (i.e., capable of transmitting disease) or pests.

The function of the SCMAD is to control all mosquitoes that may bring disease or harassment to humans and domestic animals. At the SCMAD, we accomplish this by evaluating and selecting the most effective and economical management techniques that result in the least possible damage to non-target organisms or to the environment.

SCMAD deploys a variety of preventive management techniques to control mosquitoes, including natural, physical, and chemical control measures. We also emphasize preventive measures, principally natural and physical control methods; however, chemical control is also integrated with other measures when necessary.

History of the SCMAD

The Solano County Mosquito Abatement District (SCMAD) was founded in 1930 in order to control the *Aedes* mosquitoes that were being produced in the 184 square mile Suisun Marsh. It was formed according to guidelines set forth by the Mosquito Abatement Act of 1915 and the California Health and Safety Code.

Because both the SCMAD and the mosquitoes within its boundaries have both evolved over the decades, the SCMAD now works diligently to contend with the 21 species of mosquitoes known to reside within the 909 square miles of Solano County throughout the year.

Working with the Public

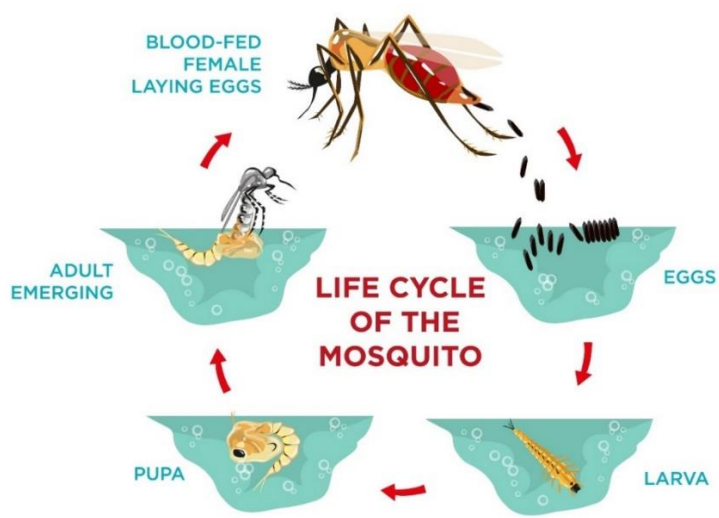
Solano Counties Mosquito Control Technicians work diligently to monitor and suppress mosquito populations within Solano Counties 910 mi² boundaries. However, it is nearly impossible to predict the mosquito patterns with a degree of certainty, because of this the SCMAD relies on information and service requests from the public. Information from the public allows the SCMAD to pinpoint mosquito breeding areas and assists us in allocating our resources to respond effectively and efficiently. In 2018 SCMAD's Mosquito Control Technicians responded to approximately 1293 service requests. During service requests SCMAD Technicians will conduct habitat evaluation and make treatment applications if necessary. **If you would like to make a service request you can do so by calling the SCMAD at (707) 437-1116 or by placing an online service request at <https://www.solanomosquito.com/contact>.**

Mosquito Biology & Development

In the 21 different species of mosquitoes that are known to occur in Solano County, each species has a specialized set of environmental preferences. While all of the all mosquitoes in Solano County share the same basic requirement for standing water to complete their life cycle, some species within the county can complete their lifecycle very quickly with only a small amount of water. Only a bottle cap full of water present for a period of 10 days is all that is required

to produce hundreds of offspring. This makes identifying and abating the breeding sources of these mosquitoes challenging.

All mosquitoes have a four-stage lifecycle (eggs, larvae, pupae, and adult.) Male mosquitoes feed primarily on nectar from flowers, the female mosquitoes require bloodmeals in order to produce viable eggs. It is during this egg production period that the humans and domestic animals in Solano County are bitten, which is not only a nuisance but for an unfortunate few, a means of disease transmission.

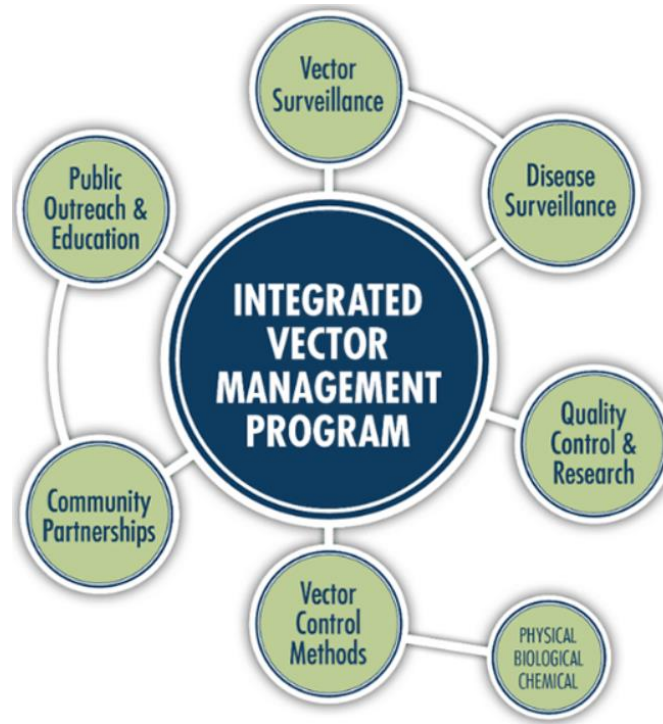


MOSQUITO ABATEMENT METHODS

It is the goal of the Solano County Mosquito Abatement District to cause a significant interruption the mosquito lifecycle whenever possible in order to reduce the overall mosquito population in Solano County. Keeping the mosquito population at low levels not only the reduces the nuisance to our community but also the likelihood of arboviruses, such the West Nile Virus, spreading to members of the public as well.

To achieve this goal the SCMAD utilizes an **Integrated Vector Management (IVM) Program**. IVM is a rational decision-making process for the optimal use of resources for vector control. The goal of IVM is to improve the efficacy, cost-effectiveness, ecological soundness and sustainability of disease-vector control. Additionally, when compared to traditional pest control methods, IVM is a more environmentally conscious method of mosquito control. The Solano County Mosquito Abatement District's IVM program integrates biological and disease surveillance information into selecting the appropriate abatement method.

The Vector Control Methods of IVM can be broken into 3 main method types: Physical Control, Biological Control, and Chemical Control. Each of these is explained, along with their role at the SCMAD, later in this report.



Physical Control

The most effective method of controlling mosquitoes is to drain or eliminate stagnant standing water where mosquitoes may breed; this method of physically manipulating mosquito breeding habitat is referred to as “Physical Control.” Physical controls utilized by the SCMAD can be broken into two different types: source elimination/reduction and source maintenance.

Source Elimination/Reduction

This type of physical control eliminates a larval habitat by modifying the landscape to allow for better drainage of precipitation or stopping a source of regular precipitation. Habitat modification or elimination can be as complex as adding drainage canals to a marsh or as simple as cleaning gutters, flushing dog water bowls frequently, or covering a pool/spa that is in disrepair.

Source Management

When a source of mosquitoes cannot be eliminated completely, source management is a practice that can reduce the population of mosquitoes. Source management often includes water management, vegetation management, as well as infrastructure maintenance, such as flood gate maintenance. This method of habitat reduction is often employed at duck clubs when lowlands are flooded to create a desirable duck habitat prior to duck hunting season. Source Management requires more labor hours to monitor for mosquito larvae and to apply a chemical treatment when necessary.

Physical control may not always be a practical method of mosquito abatement due to the practical limitations due to source size, logistical hurdles, or cost. For this reason, the SCMAD utilizes biological and chemical methods to reduce mosquitoes to complete their lifecycle and reproduce.

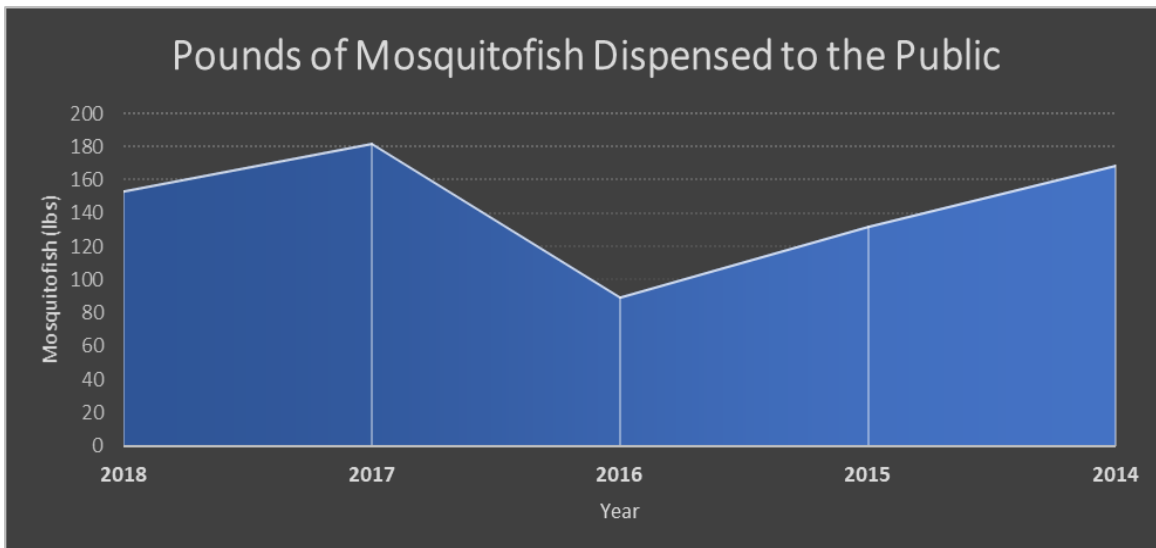
Biological Control Methods

When a waterbody does not drain regularly or is permanent but not suitable for physical control, such as source elimination, reduction, or maintenance, it may be selected as a candidate for biological control. Biological Control is when control of the mosquito population is accomplished by introducing/increasing the predator population in the mosquitoes' ecosystem.

At the SCMAD we breed and purchase live mosquitofish that are dispensed to the public free of charge for use on private properties in Solano County. Mosquitofish are commonly stocked in places like ornamental ponds, cattle troughs, stagnant swimming pools, and large fountains. The SCMAD staff will also stock the mosquitofish in other environments, including golf courses, country club ponds, water treatment facilities, and stock ponds, that do not have a population of predatory fish.

Mosquitofish are ideally suited for biological control because they are small (under 2.5 in length) and able to reproduce quickly. These fish have also been observed eating up to two times their body mass in mosquito larvae per day. Mosquitofish are also extremely resilient to harsh environmental conditions and can be successfully stocked where other aquatic predators might not survive. Stocking mosquitofish in a permanent water feature can mean months or even years of effective mosquito control.

The SCMAD Mosquitofish program has become very popular with the public. In 2018 the SCMAD staff went to farmers markets and other special events across the county to educate the public about mosquito control programs in Solano County. The SCMAD took this opportunity to distribute mosquitofish to the public while they were at the events. In 2018 the SCMAD distributed an estimated 154 lbs. of mosquitofish throughout Solano County providing long lasting, pesticide free mosquito abatement to an estimated 143 acres.



Chemical Control Methods

When physical and biological control methods are not viable options to reduce the mosquito population, the SCMAD can select a chemical control method to reduce the number of mosquitos to acceptable levels. The SCMAD works diligently to select and use all of our chemical pesticides in a manner that poses the lowest possible risk to both the public and the environment.

The chemical pesticides used by the Solano County Mosquito Abatement District can be classified into two different categories: larvicides and adulticides.

Larvicides

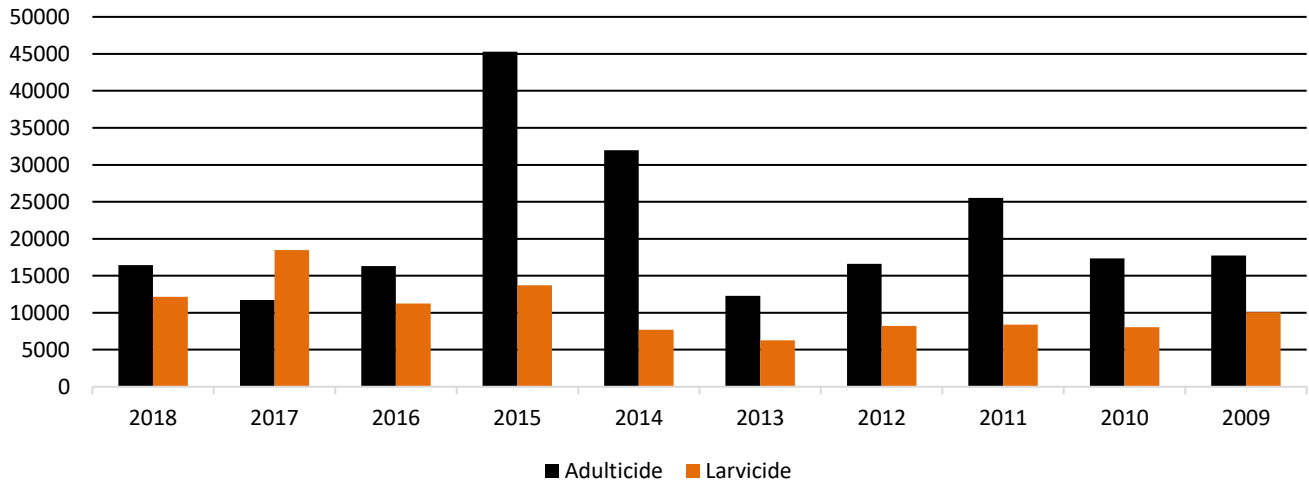
Larvicides are insecticides that target mosquitoes in the larval stage of their lifecycle. Larvicides are by far the most heavily used form of insecticide used by the SCMAD, although adulticide applications treated a greater area per application. Most larvicides used by the SCMAD contain the active ingredient Methoprene. Methoprene is frequently used as a public health pesticide because it poses a very low risk to residents and their animals, while at the same time reducing the amount of biting adult mosquitoes that emerge from an aquatic environment.

In 2018 the SCMAD deployed larvicides by ATV, hand, and even aircraft. Larvicides are important in controlling the mosquito populations that develop in the bayshore in late winter, spring and summer. The SCMAD also uses larvicides to control mosquito populations that develop in the fall when duck clubs are flooding prior to duck hunting season.

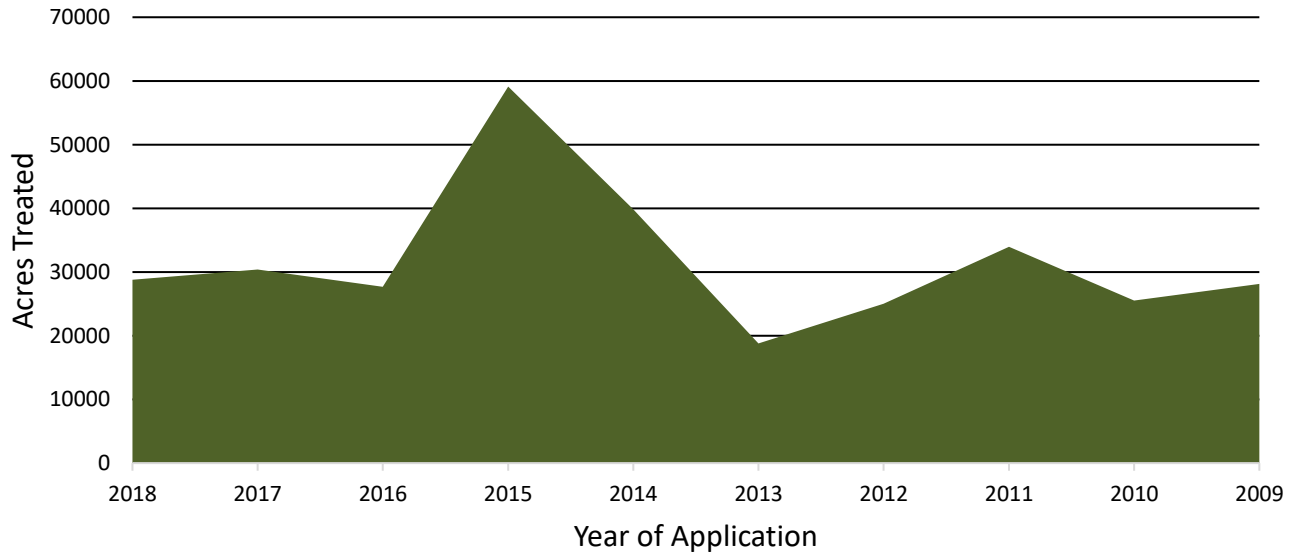
Adulticides

Adulticides are chemical pesticides that target mosquitoes in their adult life stage. Adulticides utilized by the SCMAD are effective in rapidly reducing the adult mosquito population in a specific area for a short period of time; however, if the mosquito habitat is not abated adulticide treatments will not provide long lasting results. Adulticides used by the Solano County Mosquito Abatement District are not target-specific and could affect the beneficial insect population. For this reason, the SCMAD generally only applies adulticides in/around areas that have known arbovirus activity to reduce the risk of arbovirus transmission. To date in Solano County adulticides are ONLY deployed by ground vehicles or using a hand applicator. The SCMAD has never applied adulticides using aircraft.

Solano County Acres Treated With Pesticide Adulticide vs Larvicide



Total Acres Treated with Pesticides by SCMAD



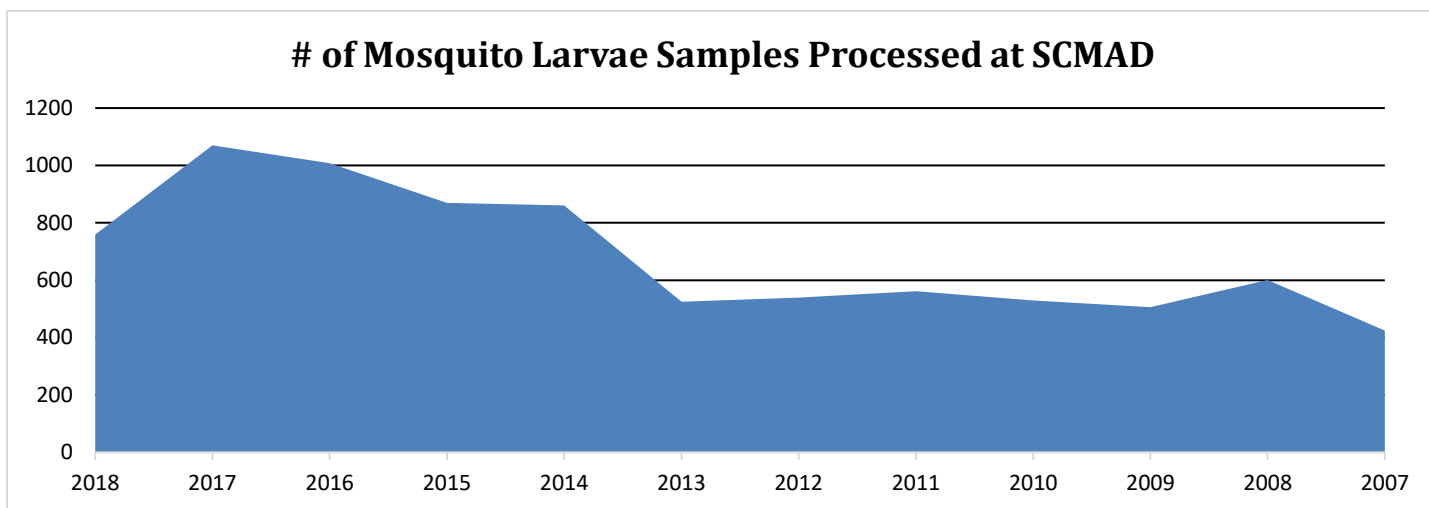
2018 MOSQUITO SURVEILLANCE

In 2018 the SCMAD used a variety of surveillance techniques to monitor and lower the mosquito population for both public nuisance and public health reasons. Mosquito surveillance yields a cornucopia of data that is useful for district staff. For example, the species and abundance of adult mosquitoes trapped in a specific time period could yield valuable information about where the mosquitoes are breeding, what flight range the mosquitoes have, and whether the public is at risk of disease transmission. While a larvae mosquito sampling could give us information about when

the next generation of mosquitoes might emerge, their potential population size if unabated, how far they could travel, whether the species known to vector disease, and if pesticides applied are effective.

Larval Surveillance

In an effort to identify mosquito breeding sources and plan abatement efforts, the SCMAD Technicians collect larval samples from aquatic habitats as a response to service requests or from known breeding sources. These samples are brought back to the SCMAD Laboratory where the macroinvertebrates are inspected and all mosquito larvae are identified to species. This population data allows the SCMAD to assess the upcoming risk to the public and the future adult mosquito population if unabated. Larval surveillance is crucial to not only achieving mosquito control before the mosquito population emerges as biting adults, but it also allows us to monitor our pesticides effectiveness. In 2018, the SCMAD Laboratory processed 759 mosquito larvae samples, which contained an estimated 60,000 mosquito larvae.



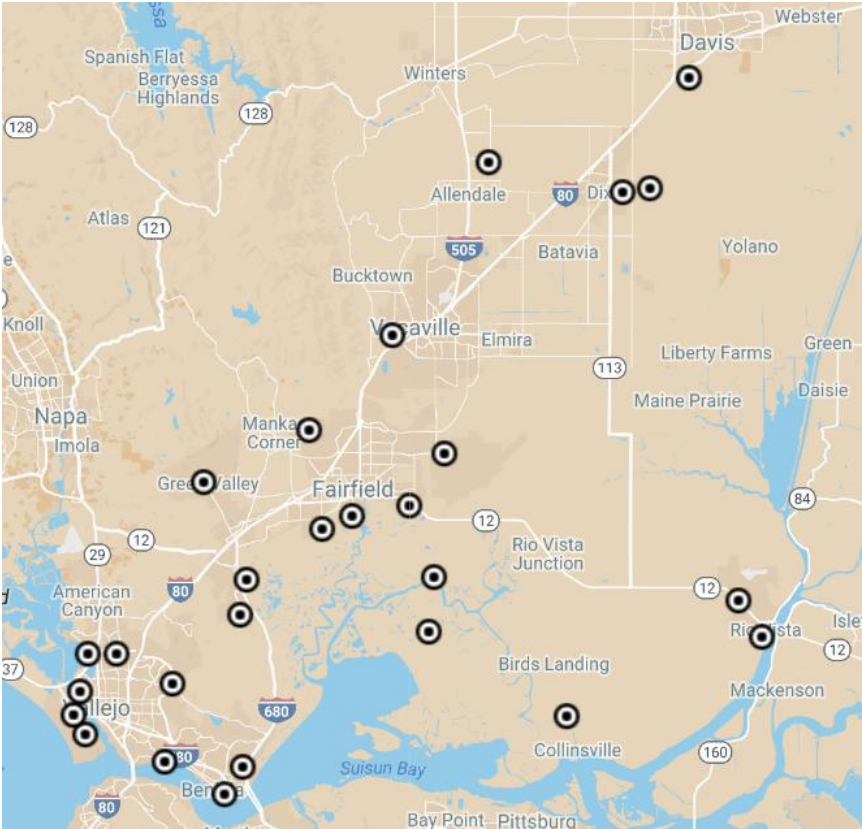
Larvicide Resistance Monitoring

Larvicides are an important component of the SCMAD’s abatement strategy in Solano County’s managed wetlands and marshes. Due to this, the SCMAD Biologist conducts larvicide resistance studies on habitats that have been recently treated. Data from these experiments are an important component in decisions made by the SCMAD staff when deciding types of insecticides to use or purchase, as well as what dose will be used in certain areas of the county.

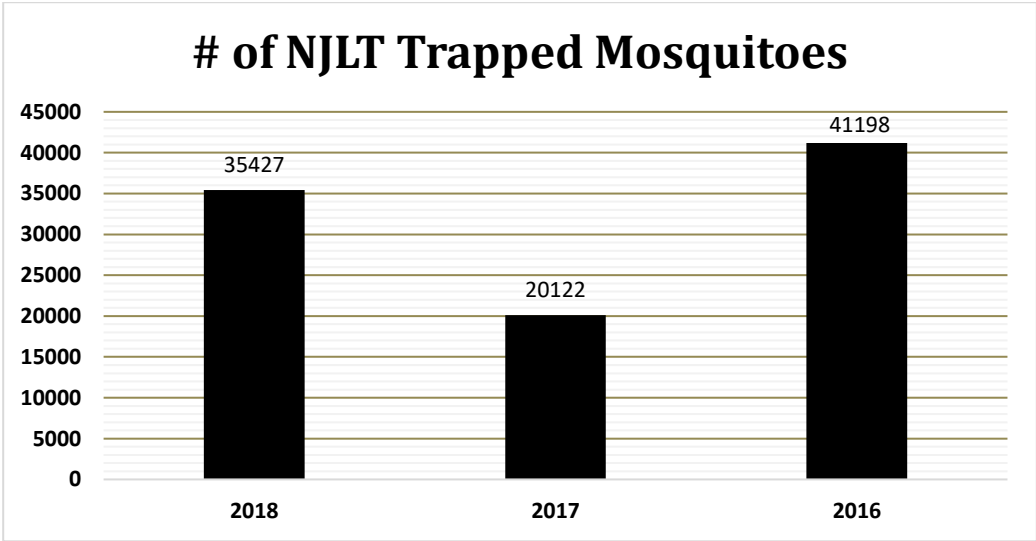
New Jersey Light Traps

The SCMAD uses New Jersey Light Traps as semi-permanent monitoring stations for mosquito surveillance. The SCMAD deploys these traps for roughly 9 months a year throughout the county by partnering with the local land owners. New Jersey Light Traps use light to attract mosquitoes at night, then trap and kill them. These traps are very effective in providing the SCMAD staff with mosquito diversity and long-term comparable population data used for resource allocation decisions. The trap numbers and locations are roughly the same year to year, which allows the SCMAD to use the data from previous years to compare and identify trends and patterns.

2018 Locations of NJLT Surveillance Sites



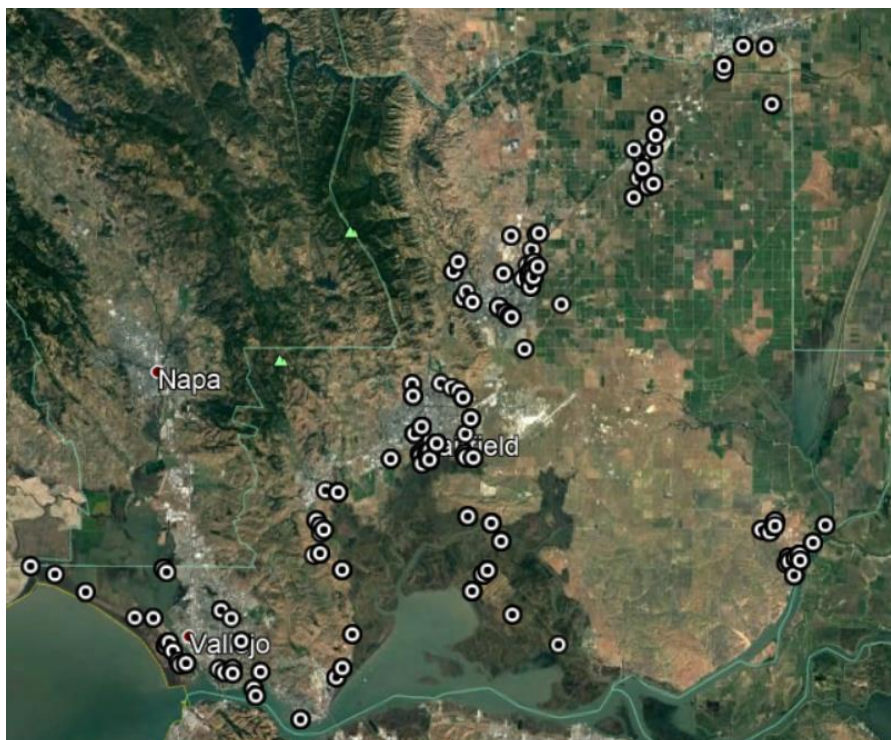
of NJLT Trapped Mosquitoes



CO₂ Mosquito Trapping

CO₂ mosquito traps emit carbon dioxide to attract adult mosquitoes, and these traps yield a very high catch rate. However, due to battery and bait limitations, they can only be deployed for less than 24 hours. The mosquitoes that are trapped in CO₂ traps yield the same population information as New Jersey Light Traps, but with the added benefit of keeping the mosquitoes alive and viable for arbovirus testing. Between May and October 2018, 329 CO₂ mosquito traps were baited and deployed, capturing over 12,000 mosquitoes for disease testing.

2018 CO₂ TRAP SITE LOCATIONS

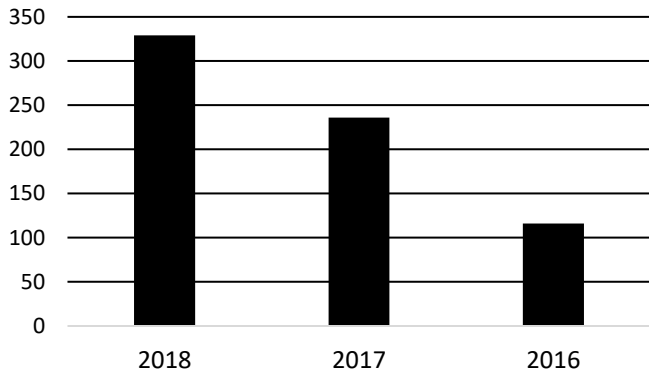


ARBOVIRUS SURVEILLANCE

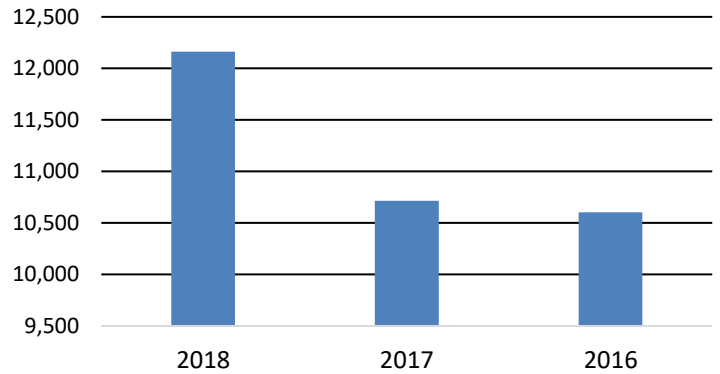
Mosquito Population Testing

A robust mosquito sampling program is very important in order to identify areas where arboviruses are active and to prevent human transmission. In early 2017 the decision was made by the District Biologist to expand the CO₂ trapping program to obtain more accurate precise disease surveillance program data. In 2018, 329 CO₂ traps were deployed, an 183% increase since 2016. In those traps, 12,162 mosquitoes were sampled, identified in the SCMD laboratory, and then taken to UC Davis to be tested for arboviruses. The purpose of this testing is to identify areas within Solano County where the human population was at risk of contracting arboviruses, such as the West Nile Virus. Of the mosquitoes tested, 3 sites were found where the mosquito population was confirmed to host the West Nile Virus. These sites were identified between the months of August and September when the WNV is most commonly active in Solano County. When these areas were identified, Mosquito Control Technicians responded by conducting a habitat assessment and developing and implementing an effective abatement strategy to quickly lower the mosquito population in these areas. Solano County Public Health and the Municipalities City Manager were also notified of the positive results.

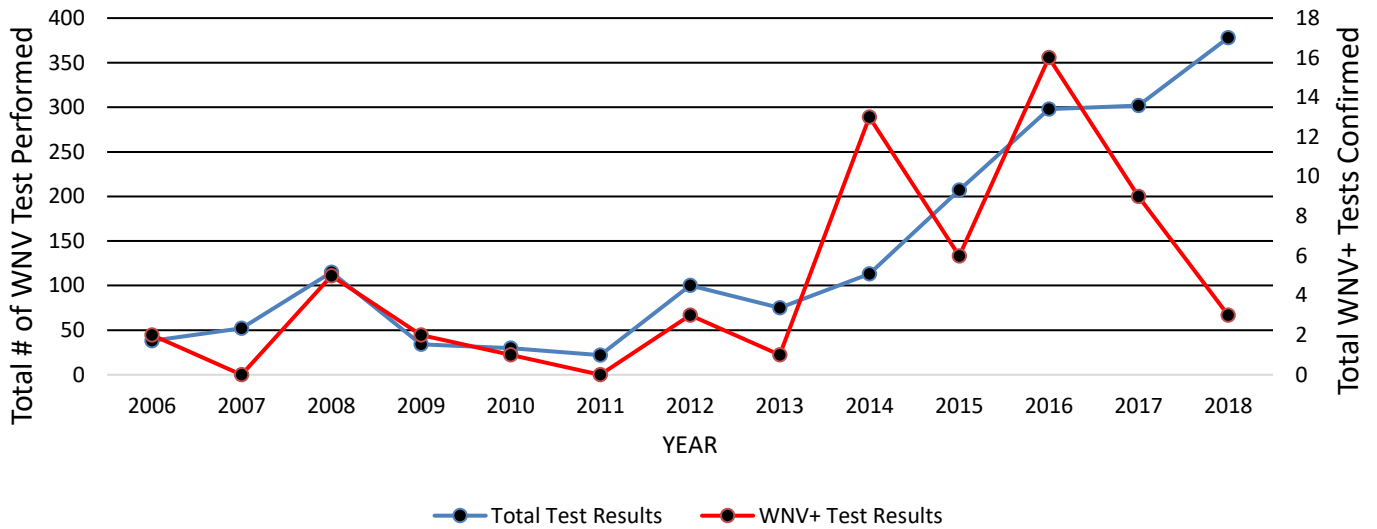
Number of CO2 Traps Deployed By SCMA D Biologist



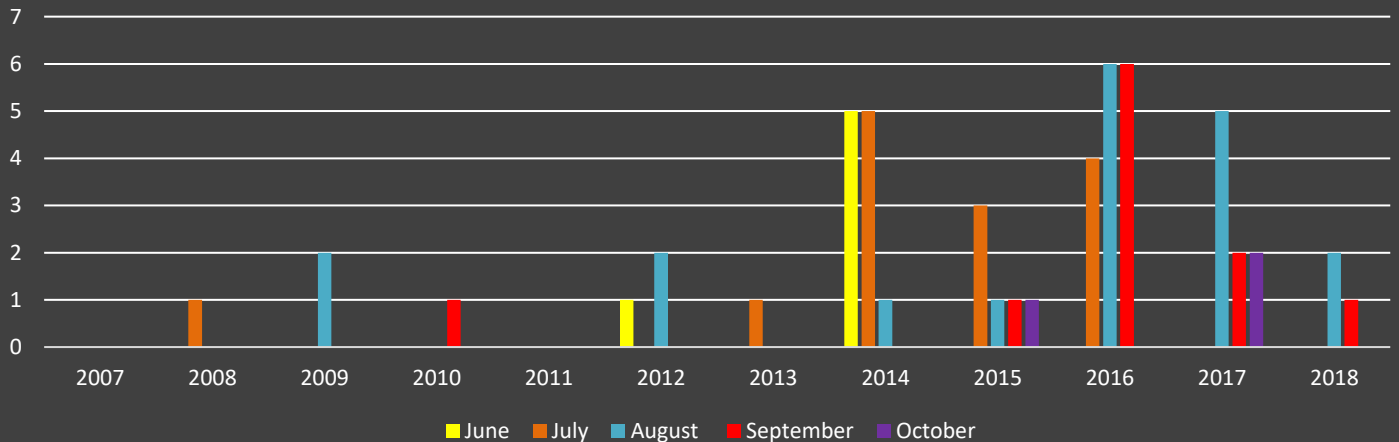
Number Of Mosquitoes Tested for Arboviruses



Total WNV Mosquito Tests VS WNV+ Test Results

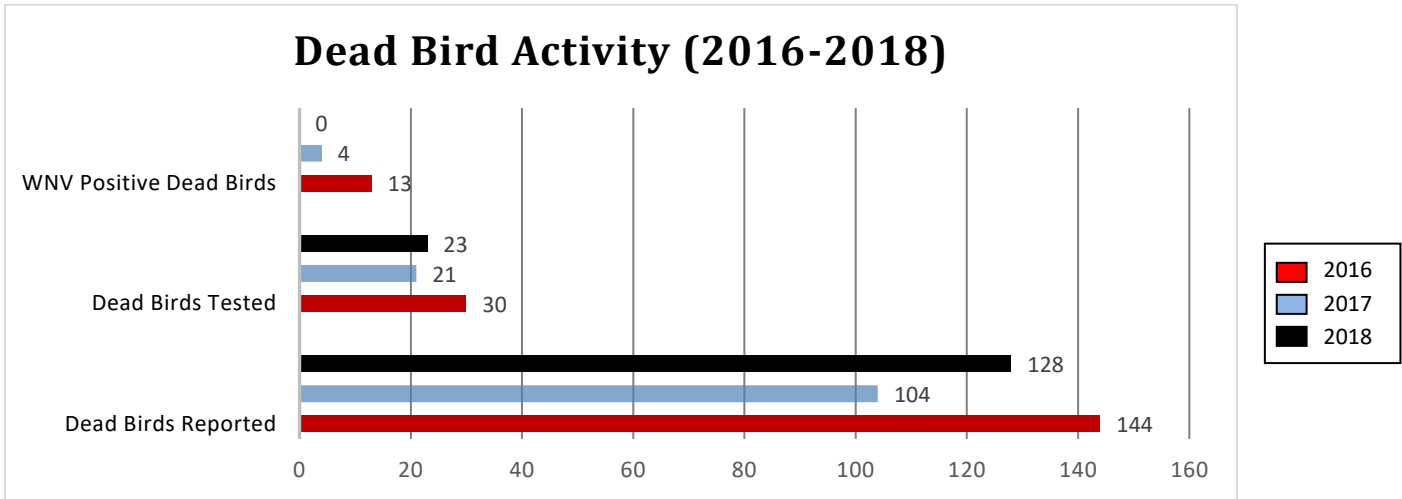


of WNV Positive Mosquito Samples by Month 2007-2018



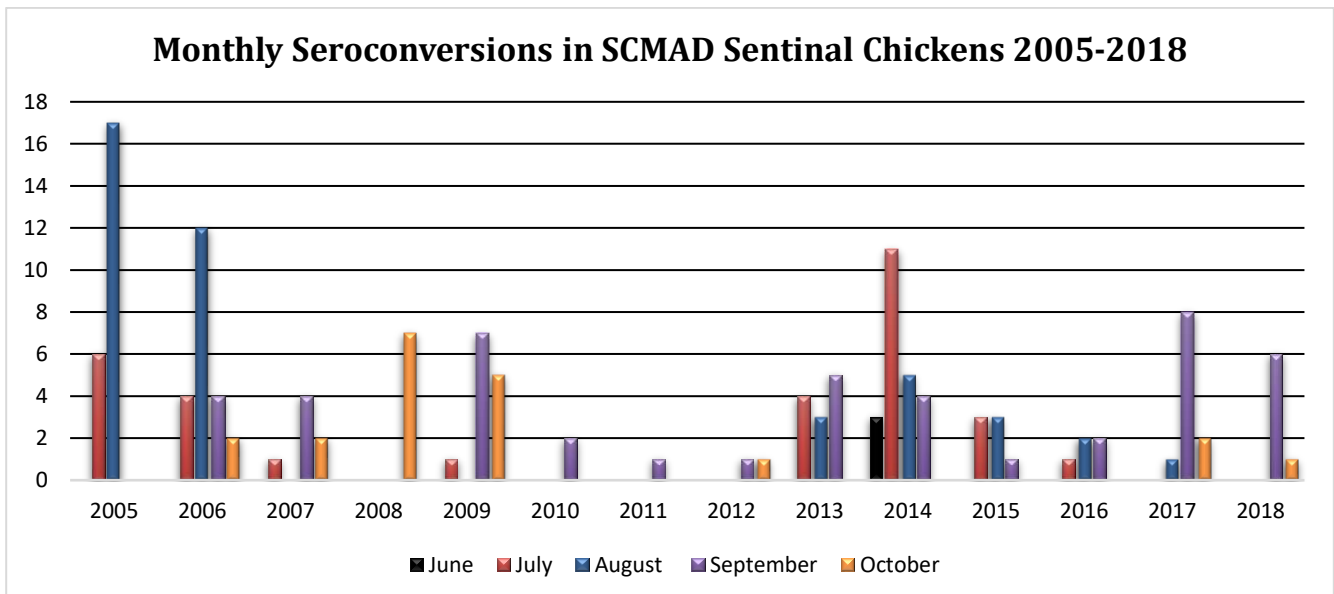
Dead Bird Testing

The Solano County Mosquito Abatement District works with the California Department of Health and University of California Davis to collect and test dead birds within Solano County for arboviruses. The dead birds were reported by calling 1 (877) 968-2473 or reporting them online at http://westnile.ca.gov/report_wnv.php. This year 128 dead birds were reported, 23 dead birds were collected and tested, and no birds tested positive for WNV.



Sentinel Chicken Flocks

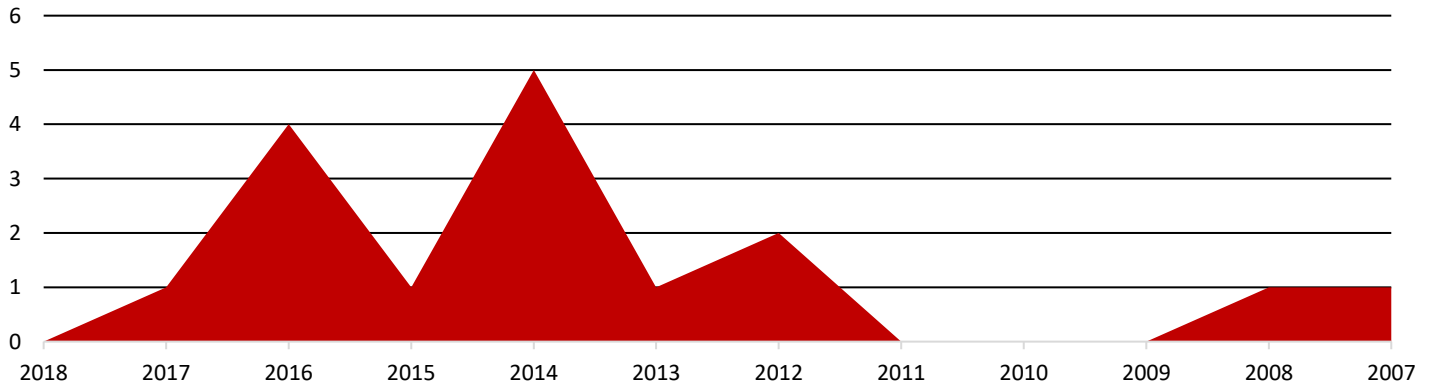
In 2018, the District operated 3 sentinel chicken flocks with a total of 36 chickens between the months of April and November. Blood samples were taken from the chickens biweekly and were tested for the presence of arboviruses. Chickens were used because if chickens become infected with the West Nile Virus, the virus cannot pass on to future hosts. Out of the 502 samples taken, 30 test results were positive confirming that 7 chickens from all 3 of the flocks were infected by the WNV. This information was used to identify areas where the virus was present and to develop/implement abatement strategies.



Human Arbovirus Case Response

It is our goal at the SCMAD to identify areas where arboviruses are present and reduce the risk of transmission to the human occupants of Solano County before they occur, however, that is not always feasible. In the event of a human infection, the occurrence is reported to the Solano County Mosquito Abatement District by the Solano County Public Health Department (SCPHD). All information that is supplied the SCMAD is provided in a manner that is compliant with all HIPAA regulations and guidelines. When possible the SCMAD will collaborate with the SCPHD to determine the likelihood of the disease transmission occurring in Solano County by conducting trapping and habitat surveys. Mosquito abatements are conducted in areas where arboviruses are suspected in order to rapidly reduce the risk to the public. Any areas where arbovirus abatements occur are then monitored for 14 to 21 days to ensure a low risk to the public. In 2018 there were no confirmed human cases of arbovirus infections within Solano County. This was the first time Solano County did not have a positive human case since 2011.

Human Cases of West Nile Virus in Solano County



PUBLIC OUTREACH

Public Events

In 2018, the Solano County Mosquito Abatement District conducted presentations and attended several public events to meet and interact with members of the public. We estimate that we engaged with an estimated 4,432 people. Below is a list of events and presentations that were conducted by SCMAD staff. Presentations are conducted free of charge to the public upon request. To schedule an appointment, please call the Solano County Mosquito.

1. **Fairfield Earth day (April 21):** 1000 people
2. **City of Vacaville, Celebrate Seniors (May 16):** 500 people
3. **Benicia Farmers Market**
(June 14): 400 people
(July 12): 400 people
(August 9): 400 people
4. **Fairfield Tomato Festival (August 18-19):** 1200 people
5. **Vacaville Kids day (October 20):** 300 people
6. **Crescent Elementary (October 24):** 192 people
7. **Rio Vista Rotary Club (September 31):** 40 people

Advertising

In 2018, the Solano County Mosquito Abatement District launched its new website, as well as several advertising campaigns. In order to educate and conduct outreach to the public bus ads were created and ran on busses in Fairfield, Suisun, and Vacaville. In addition to bus ads newspaper ads were printed in the Vallejo Times Herald, Daily Republic, Vacaville Reporter, and the Dixon Independent Voice newspapers. The District also aired radio advertisements and radio commercials on KUIC's local radio station and website. It is our hope that 2018's advertising campaign will yield positive long-term results, and allow us to interact with more residents of Solano County.

FINANCE

The District Manager, the Board of Trustees and the District's Administrative Assistant manages the budgeting, accounting, and record keeping. The finances are also audited annually by a certified third-party public accountant (Fechter & Company). The SCMAAD is committed to the ethical and fiscally responsible management of public funds in its efforts to reduce the risk of disease transmission and nuisance to members of the public in Solano County.

Statement of Financial Position: Fiscal Year 2017-2018

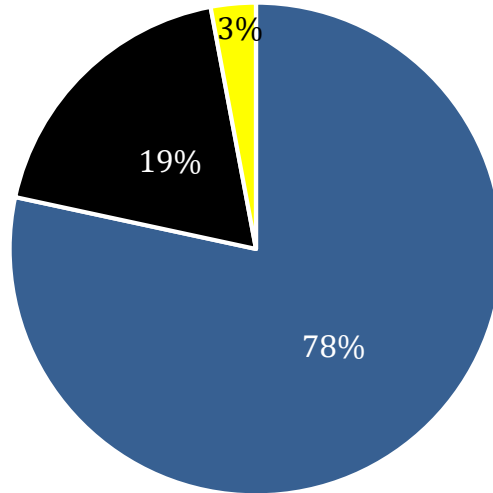
Revenue

Property Taxes	\$2,162,586
Other Tax Revenue	\$515,026
Use of Money and Property	\$81,496
Miscellaneous	\$3.00
Total Revenues	\$2,759,111

Expenditures/Expenses

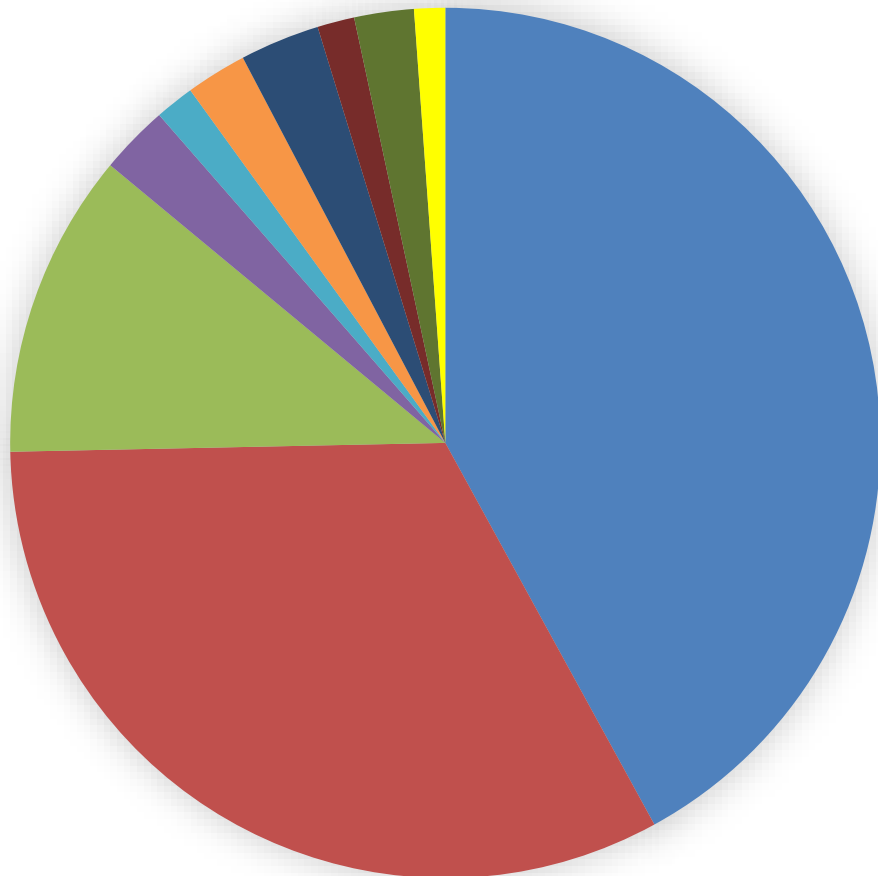
Salaries and Wages	\$941,108
Employee Benefits	\$731,269
Pesticides	\$160,741
Aircraft Services	\$93,171
Insurance	\$57,484
Structure & Grounds Maintenance	\$25,131
Property Tax Administration	\$32,572
Motor Vehicles/Equipment Maintenance	\$26,912
Gas & Oil	\$22,650
Materials & Supplies	\$28,131
Office Supplies	\$13,044
Professional Services	\$50,678
Memberships	\$11,772
Publishing & Advertising	\$23,778
Conference	\$9,670
Communications	\$7,096
Continuing Education	\$3,667
Travel	\$635
Total Expenditures	\$2,336,282

2017-2018 Fiscal Year SCMAD Revenue



■ Property Taxes ■ Other Tax Revenue ■ Use of Money and Property

SCMAD 2018 Expenditures/Expenses



- Salaries and Wages
- Employee Benefits
- Pesticides
- Insurance
- Property Tax Administration
- Professional Services
- Property Maintenance & Supplies
- Advertising & Communications
- Motor Vehicles
- Staff Development