ANNUAL REPORT
2021

SHASTA MOSQUITO AND VECTOR CONTROL DISTRICT

EST. 1919

MOSQUITO AND VECTOR CONTROL ASSOCIATION OF CALIFORNIA

Our Mission: "To protect the public's health from vector-borne disease and nuisance, through a comprehensive mosquito and vector control program focused on innovation, experience and efficiency."

FOREWORD

Residents of the Shasta Mosquito and Vector Control District,

On behalf of the Board of Trustees and staff of the District, we are pleased to present the 2021 Annual Report for the Shasta Mosquito and Vector Control District. As I began to write the foreword for the 2021 Annual Report, the first thought was the word déjà vu. The feeling that this foreword was going to sound a lot like the one from 2020. However, as I stopped and reflected further, it was clear that, although we met some of the same challenges experienced in the previous year, such as wildfires, COVID-19 response, and invasive *Aedes*, the lessons we learned from the year before built a resilience in our staff that truly carried us through another tough season. Instead, the best way to summarize the season in a few words is "over in the blink of an eye." This could be interpreted many ways, but for us, we were so busy and focused on providing effective public health mosquito control, the year flew by in a way that seemed almost unnatural. This is one of the many reasons we publish our annual report, to provide a snapshot of every season that we can share with our stakeholders and highlight the efforts of our staff.

This season, in addition to our continued focus on the health and safety of our staff and residents, we saw an unfortunate increase in both the locations we discovered invasive *Aedes* mosquitoes and in the sheer abundance of adults we collected in traps. Part of this increase is attributed to more comprehensive surveillance in infested areas, but still brings concerns regarding how widespread our invasive *Aedes* issues extend. With a season under our belt, we responded aggressively to all new and existing finds. We also stayed engaged in novel technologies and products that are being tested and operationally utilized to help with the control and eradication of these dangerous mosquitoes. The reality is that we will likely be working with these new mosquitos for at least the foreseeable future and finding new solutions will be essential to making progress toward eliminating them from Shasta County.

Finally, 2021 brought with it some big changes. As we close out the year, we say goodbye and thank you to our Assistant Manager, Guangye Hu PhD. Guangye worked for the District just shy of 10 years, and during that time, brought his years of expertise to Shasta County residents. Every employee that passes through our doors fulltime, parttime, or seasonal, leaves an impact on our community and helps to contribute to our mission: "To protect the public's health from vector-borne disease and nuisance, through a comprehensive mosquito and vector control program focused on innovation, experience and efficiency." Thank you to the staff, Board of Trustees, and the residents of Shasta County for the continued support.

Sincerely,

Peter Bonkrude
District Manager

Ann Morningstar
President

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John Albright
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Kendra Angel-Adkinson
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OPERATIONS STAFF

Guangye Hu, PhD
Assistant Manager
(Pictured on back cover)

Kelly Cleland
Mike Alexander
Field Supervisors

Al Shabazian
Brady Benton
Corey Boyer
Darrell Bible
Haley Bastien
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Robert Ault
Vector Technicians

ADMINISTRATIVE STAFF

Peter Bonkrude, MS
District Manager

Darcy Buckalew
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Jenna Ingebretsen
Administrative Analyst

DISTRICT HISTORY

Protecting public health since 1919

1919
Creation of Redding Mosquito Abatement District (MAD)

1950's
Annexation of Palo Cedro and Balls Ferry area (130 sq mi)

1970's
Merger of Anderson, Clear Creek and Cottonwood MAD to Shasta MAD

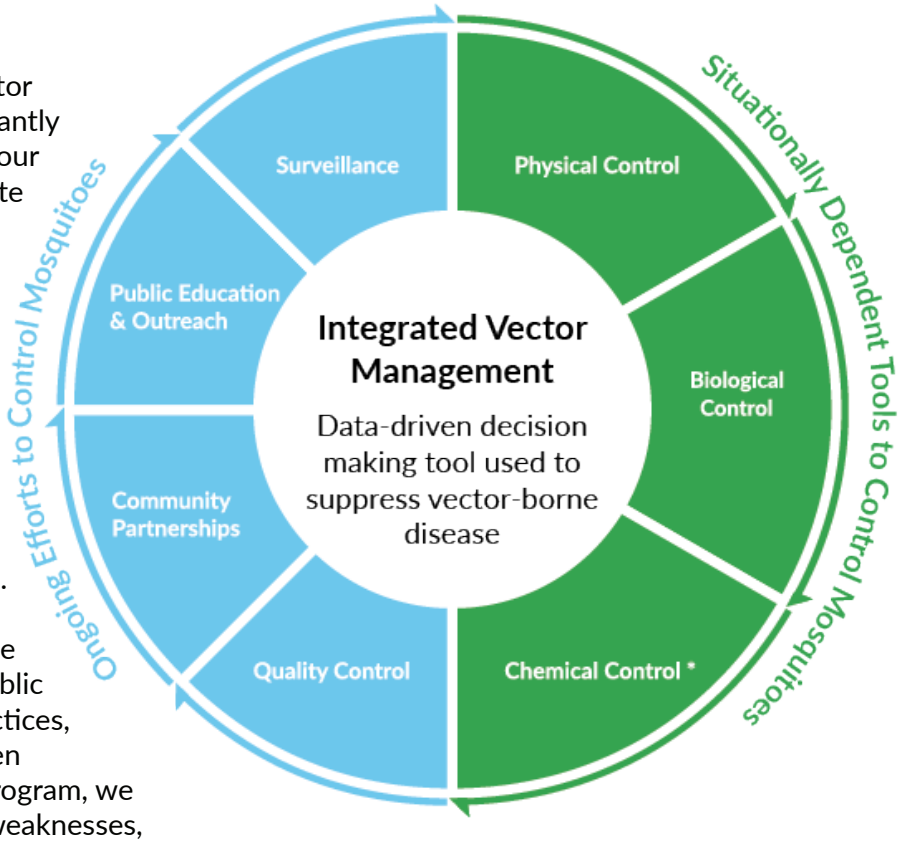
1990's
Annexation of Shasta Lake, Shasta, Centerville, Cloverdale, Happy Valley, Olinda, West Cottonwood, Mountain Gate, and Jones Valley (384 sq mi), creating the Shasta Mosquito & Vector Control District

2000
Annexation of Lakehead, Castella, French Gulch, Igo, Ono, Shingletown and Viola (1086 sq mi)

2019
Celebration of Shasta Mosquito & Vector Control District's 100 years protecting public health

INTEGRATED VECTOR MANAGEMENT

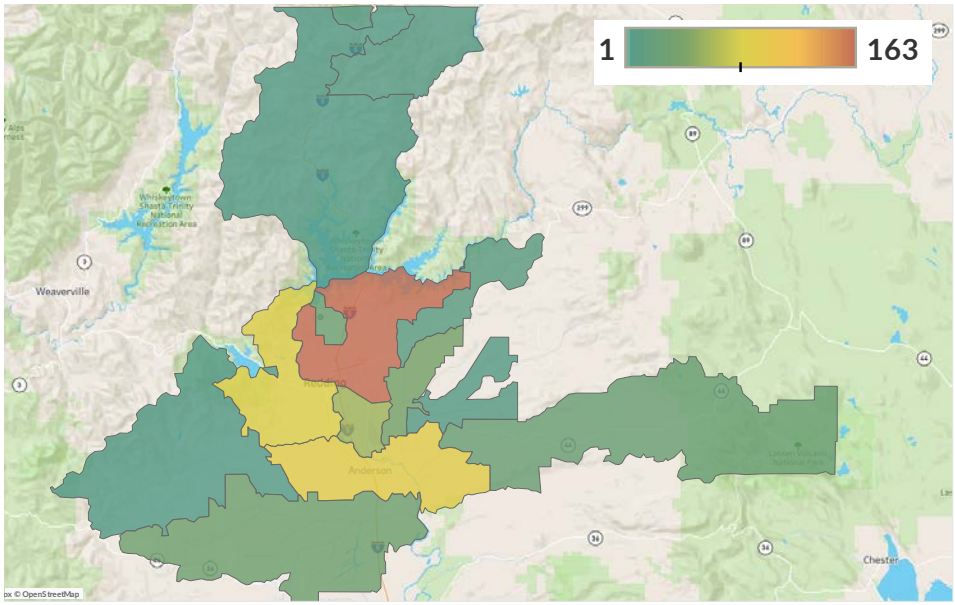
This Annual Report theme is "Integrated Vector Management (IVM) in Action." We are constantly applying IVM principles to every element of our work, but sometimes struggle to communicate IVM and its importance in a modern Vector Control Program. So, this year we'll not only define IVM, but we'll also show how it relates to our day-to-day operations. IVM is an evidence, data-driven decision-making tool used to suppress vector-borne diseases. IVM prioritizes surveillance as the start to any control decision. Our District employs both immature and adult mosquito surveillance, tracking species composition, mosquito abundance and disease prevalence. Throughout the Annual Report we'll be highlighting elements of IVM strategy that we utilize every day. These strategies include public education, physical control preventative practices, biological control, and chemical control. When implementing our surveillance and control program, we also continually evaluate our strengths and weaknesses, intervention costs and effectiveness to identify what combination in a given area is most appropriate for the current risk posed to the public health from mosquitoes and mosquito-borne diseases.



SERVICE REQUESTS

Providing responsive, professional, and impactful service to our residents is an essential piece of our mission as a public health agency. These interactions with the public often provide the first step to any surveillance effort. During these service requests, we are able to learn from the public and hear their issues, but also share information regarding personal protection and help prevent future mosquito issues. While the majority of our service requests come from residents experiencing high numbers of adult mosquitoes, we also respond to mosquitofish requests, neglected swimming pool reports and insect identification requests. These requests help focus our efforts and provide information that is essential to our IVM response. This year we received over 500 requests for service. On our website, the public can issue a service request any day, 24/7, gain information about our current mosquito conditions and response, and even find out where we are performing our adult mosquito control activities.

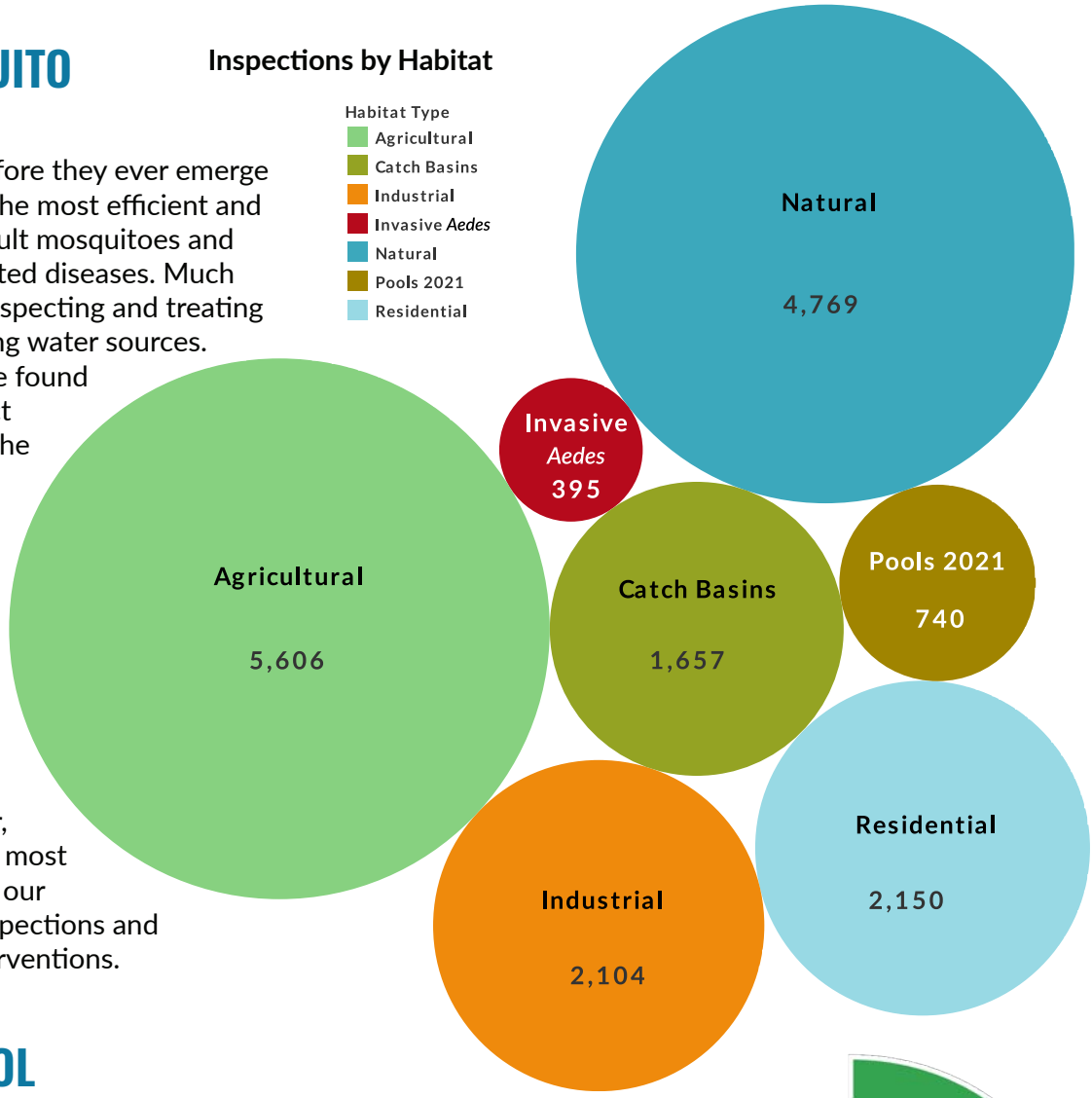
Service Requests by Zipcode



IMMATURE MOSQUITO CONTROL

Controlling mosquitoes before they ever emerge from the water sources is the most efficient and effective way to reduce adult mosquitoes and prevent mosquito transmitted diseases. Much of our staff time is spent inspecting and treating these, over 16,000, standing water sources. If immature mosquitoes are found in the water source, District staff have several tools in the IVM tool chest to control the mosquitoes before they emerge. These IVM control methods include: physical control, biological control, and chemical control. Following IVM, we choose the appropriate control tool or multiple tools, depending on the target species, time of year, and habitat, to achieve the most effective control. This year our staff made over 17,000 inspections and performed over 4,000 interventions.

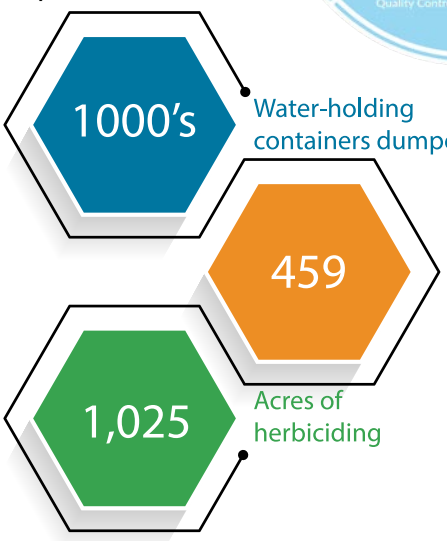
Inspections by Habitat

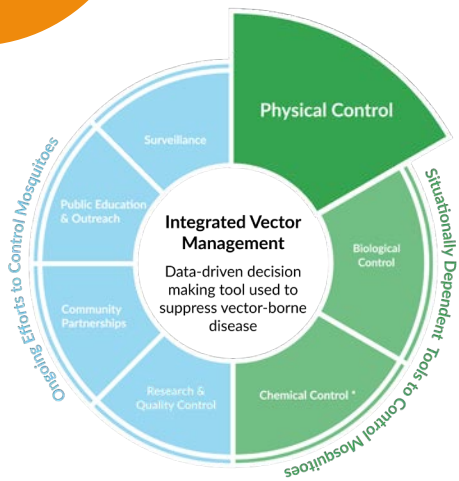


PHYSICAL CONTROL

Physical control means manipulating the habitats where immature mosquitoes live to eliminate or reduce further breeding. Physical control often is integrated with chemical and biological control in successful IVM programs. It is cost effective and has a long term effect on mosquito populations. With effective physical control, pesticide use is greatly reduced. Physical control activities range from practices including hand brushing, ditch cleaning, controlled burning of debris piles, and herbiciding, to simply dumping water containers or shutting off irrigation water runoff. These methods reduce larval mosquito sources and adult mosquito habitats and provide access to inspect and treat mosquito sources.

In 2021, our staff made the following physical control efforts:



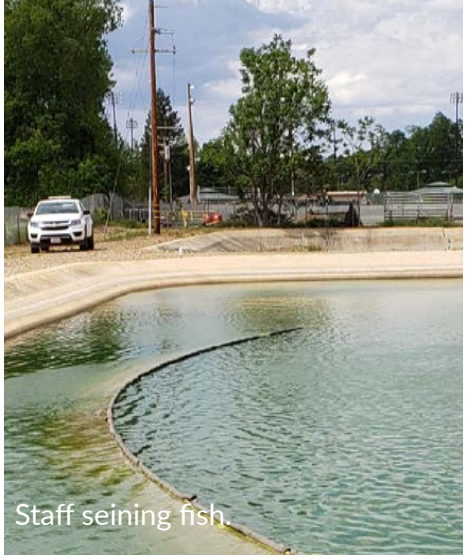


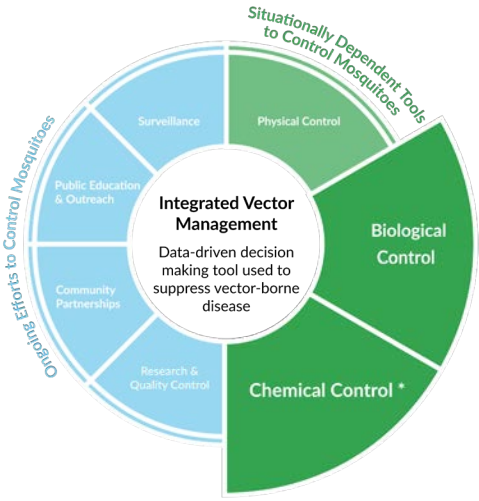
BIOLOGICAL CONTROL

Biological control or "biocontrol" is the use of natural enemies to suppress mosquito populations. It is an important component of Integrated Vector Management (IVM). Biocontrol is safe, environmentally friendly, sustainable, and helps to reduce prolonged use of pesticides. Our District has been mass producing mosquitofish, *Gambusia affinis*, and use it as a biocontrol agent to control mosquito populations successfully. One mosquitofish can consume hundreds of mosquito larvae and pupae each day when released in the confined water sources which breed mosquitoes. Mosquitofish adapt well to various environmental conditions, rapidly reproduce, and are an effective and sustainable tool to control mosquitoes.

In 2021, the district:

- Supplied 18.4 pounds of mosquitofish for field release.
- Released mosquitofish into over 800 mosquito sources, including bird baths, animal troughs, neglected swimming pools, water puddles, recreational ponds, etc.
- Treated a total of 375 acres of confined water bodies.
- Produced 23 pounds of mosquitofish from our indoor rearing facility.
- Responded to 228 service requests for mosquitofish from the public.


Staff seining fish.



CHEMICAL CONTROL

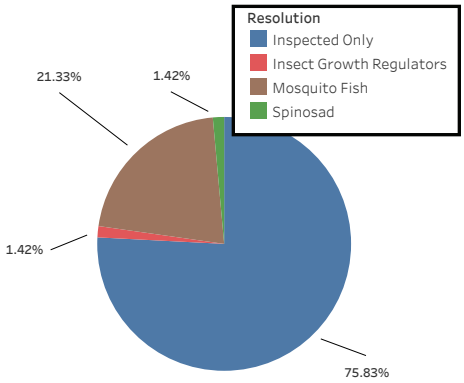
Chemical control of immature mosquitoes includes the use of products, called larvicides, that help reduce mosquito populations in the water before they emerge as adults. These larvicides are often very specific in targeting mosquitoes. These controls are categorized into the following categories: microbial products, insect growth regulators, surface oils, and natural toxins derived from bacteria. In 2021, staff made over 4,000 applications to water containing immature mosquitoes and used over 30 different products and formulations. Treatments can be for sources of less than a few ounces of water, up to multiple acres of mosquito producing habitat. Sources treated with chemical control products often need to be re-inspected regularly to ensure the product is still producing the level of control sufficient to prevent emerging adults.

SWIMMING POOL PROGRAM

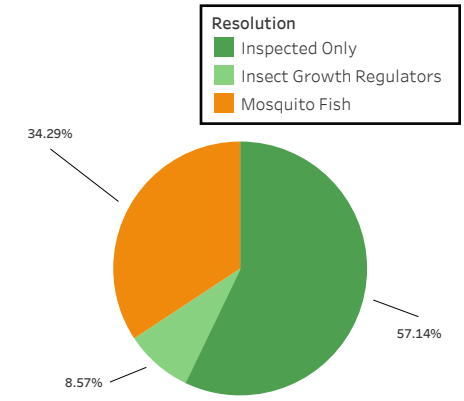
When a swimming pool is not maintained, the large volume of standing water in the pool is perfect for breeding mosquitoes, which can transmit life-threatening viruses such as Zika, dengue, and West Nile virus. Our District identifies neglected swimming pools by service requests from the public, inspection by our technicians, and aerial imaging. Each year, the staff inspects 100's of pools and treats those that have mosquito breeding potential. During the winter and early spring of 2021, the staff inspected 287 neglected swimming pools as follow-ups to fish releases and pesticide treatments conducted in the previous season. Of the pools inspected, 25% were found to need mosquito fish and/or chemical treatment.

During the summer, our District continued using a contracted aerial service provider to detect neglected swimming pools by aerial imagery. A total of 443 pools were identified and inspected by staff. Of the pools inspected, 86% were maintained and did not require treatment. Only 14% were found to be unmaintained with mosquito breeding potential and were treated with chemical control products and mosquito fish.

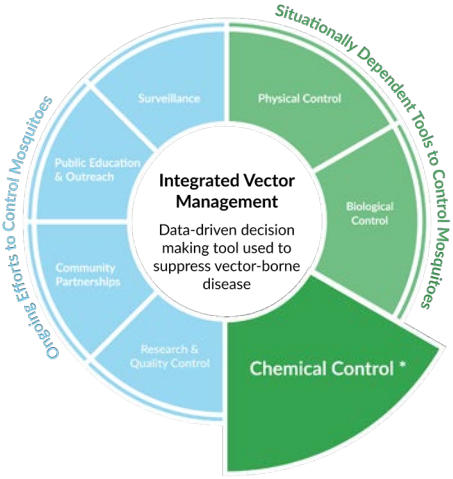
Winter Pool Resolutions



Summer Pool Resolutions



Immature Mosquito Control by Intervention Method



CATCH BASIN PROGRAM

Catch basins are sumps directly under storm drains, and are preferred habitats for mosquito larvae, especially for *Culex* species that have the potential to transmit West Nile virus. During the summer, the staff inspected more than 1,500 catch basins that were previously treated or in areas of special concern. Nearly half of the catch basins were found breeding mosquitoes and requiring treatment. Treatments primarily consisted of using a bacterial product providing up to 180-day residual control. Follow-up inspections and treatments were conducted in areas with special concerns throughout the season.


Staff applying larvicide to a catch basin.

CATCH BASIN 3D PRINTED BASKETS

During the 2021 season, the District deployed new 3d printed larvicide baskets, designed to float a particular product in the catch basin above settled mud and debris. Each basket printed as 1 piece in our 3d printer. Once closed with the product inside, the float disc was added to the top, and a binder ring and product label were added to lock it up. It was suspended by coated wire cable and attached at the top of the catch basin with a carabiner for basket retrieval and inspection.

We tried the baskets in catch basins that have a history of product failure (6 sites were identified), and of those, 3 had been cleaned out and were no longer viable trial sites for the baskets.


Basket application in a heavily organic catch basin.

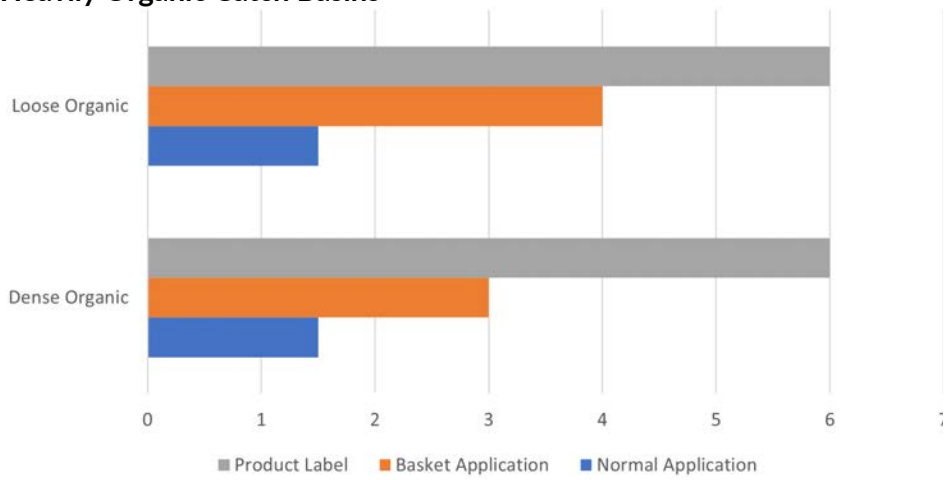

Basket loaded just before application.

In a heavily organic, dense catch basin, it appeared the product was not dispersing well enough to control larvae efficiently after about 3 months. In another less dense basin with slow, constant water flow, it provided effective control for about 4 months from May through the end of August, with no larvae at all. We reapplied another larvicide briquet into one of those baskets at that time because it had been reduced to the size of a nickel.

In normal applications at these same heavily organic catch basins, the larvicide failed after about 6 weeks.

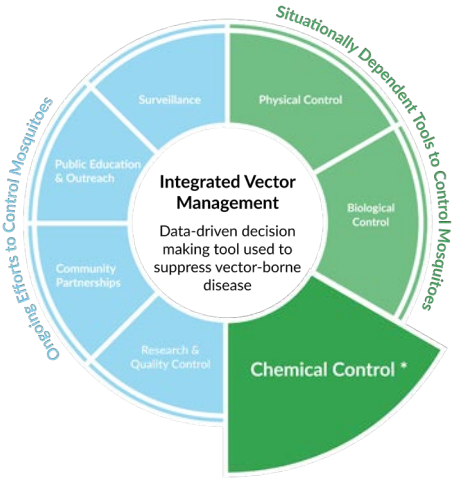

Product size after 4 months of control.

Months of Product Efficacy in Heavily Organic Catch Basins



ADULT MOSQUITO CHEMICAL CONTROL

Controlling adult mosquitoes is an integral component of a comprehensive IVM program. These applications can immediately reduce the number of biting mosquitoes in an area thereby lowering the risk of a mosquito-borne disease outbreak. This becomes essential when adult mosquito numbers become high enough to quickly transmit and spread diseases. Although adult mosquito control has its limitations, it is the only way to interrupt active mosquito disease transmission when it is occurring. These limitations mean the District must apply the adult mosquito control operations with several other IVM tools including an aggressive immature mosquito control program, increased community outreach for bite prevention, and as much mosquito source reduction as is feasible. No additional precautions are required for our residents during these

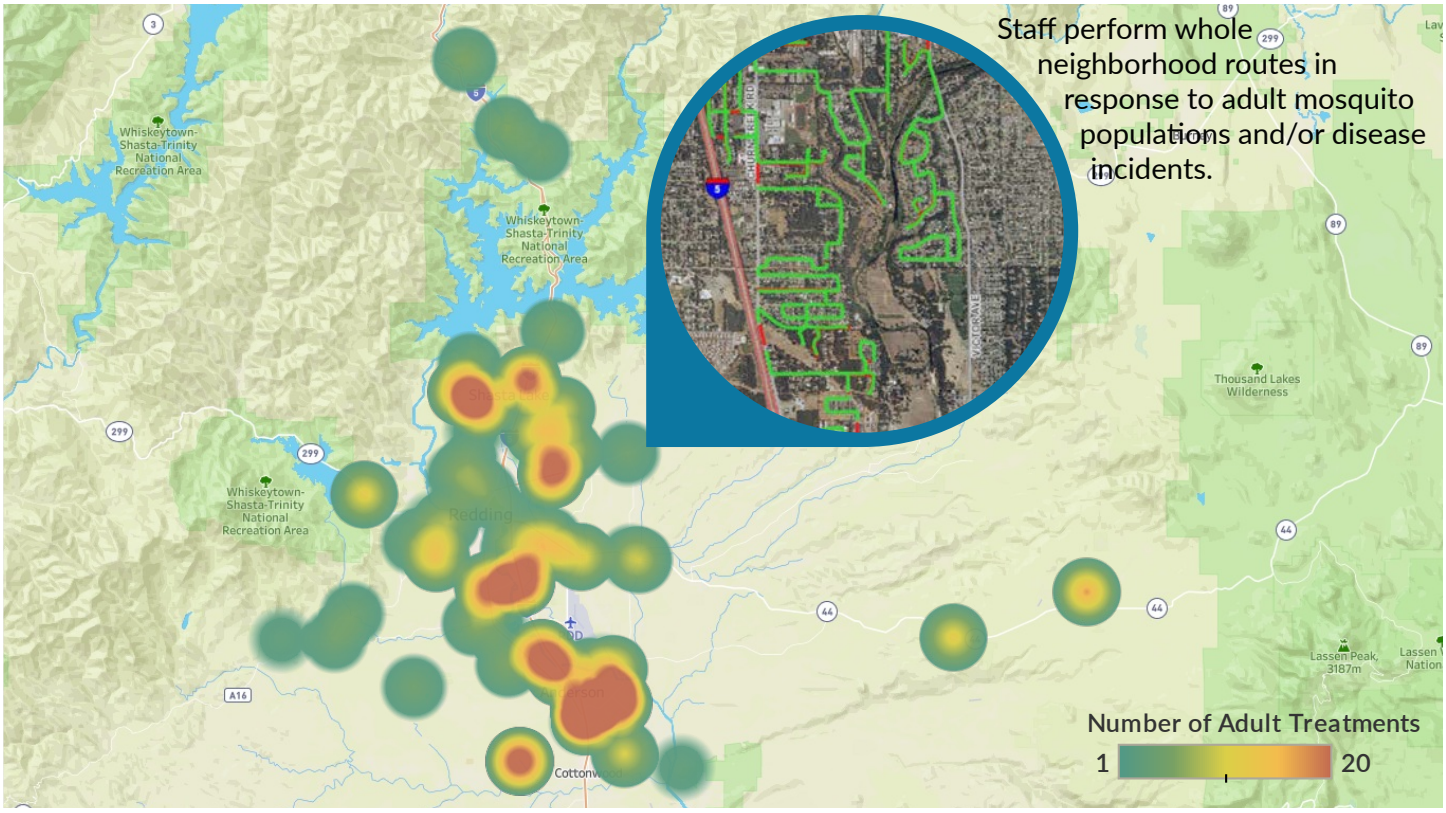


applications because of the low application rates, typically less than 3 ounces per acre. Additionally, the size of the droplet, the time of the application (dusk/dawn), and the knowledge of critical habitats mitigate any non-target impacts. Our applications are made dynamically, in response to our adult mosquito surveillance. This could mean applications are made the same night or next day, as the trap data is processed. This level of responsiveness ensures we can move fast enough to prevent


Staff performing an adult mosquito control ATV route.

human disease. This year, District staff completed 344 adult mosquito control routes and treated over 65,000 acres. Residents can visit our website: www.shastamosquito.org to review where and when our adult mosquito applications will be conducted, or to subscribe to our spray notifications via email or text message.

Adult Mosquito Control Routes



MOSQUITO SURVEILLANCE

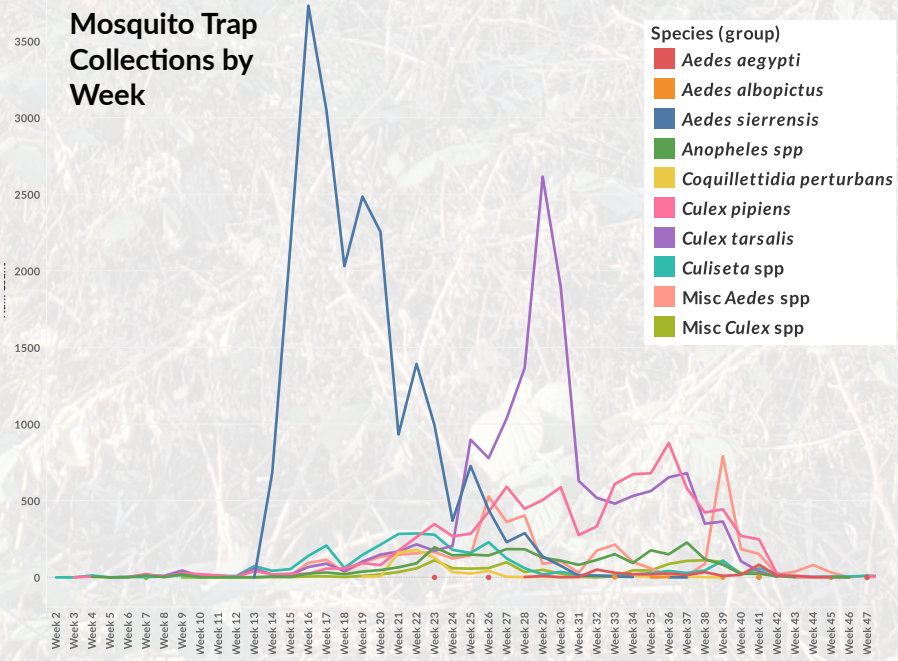
Mosquito surveillance is a fundamental element of integrated vector management and guides control decisions. Staff use a variety of traps to collect adult mosquitoes which provides data on the total population and disease presence in the environment.

Vector ecology staff identify every mosquito captured to sex and species to gain insight into the abundance and composition of the mosquito population throughout the district. Each collection is a snapshot of the mosquito population, and together the collections show how the population changes over time.

As shown in the graph below, the western tree hole mosquito, *Aedes sierrensis*, emerges rapidly. Their population peaks and recedes within a few weeks of emergence between about March and June. . Mid to late summer is marked by the increase of *Culex* spp. which are vectors of West Nile virus. Similarly, invasive *Aedes* spp. mosquito populations increase during this time and can be found well into fall in certain areas of the District.

Larval Mosquito Surveillance

Mosquito larvae are confined to standing water sources and are limited to water sources that are suitable to their development. Different mosquito species can tolerate different ranges of environmental factors, such as temperature and pollution levels. A thorough knowledge of habitat preferences, coupled with historical data of larval abundance, allows staff to monitor larvae in known and suspected sources.



One of our mosquito traps set in the field.

TICK SURVEILLANCE

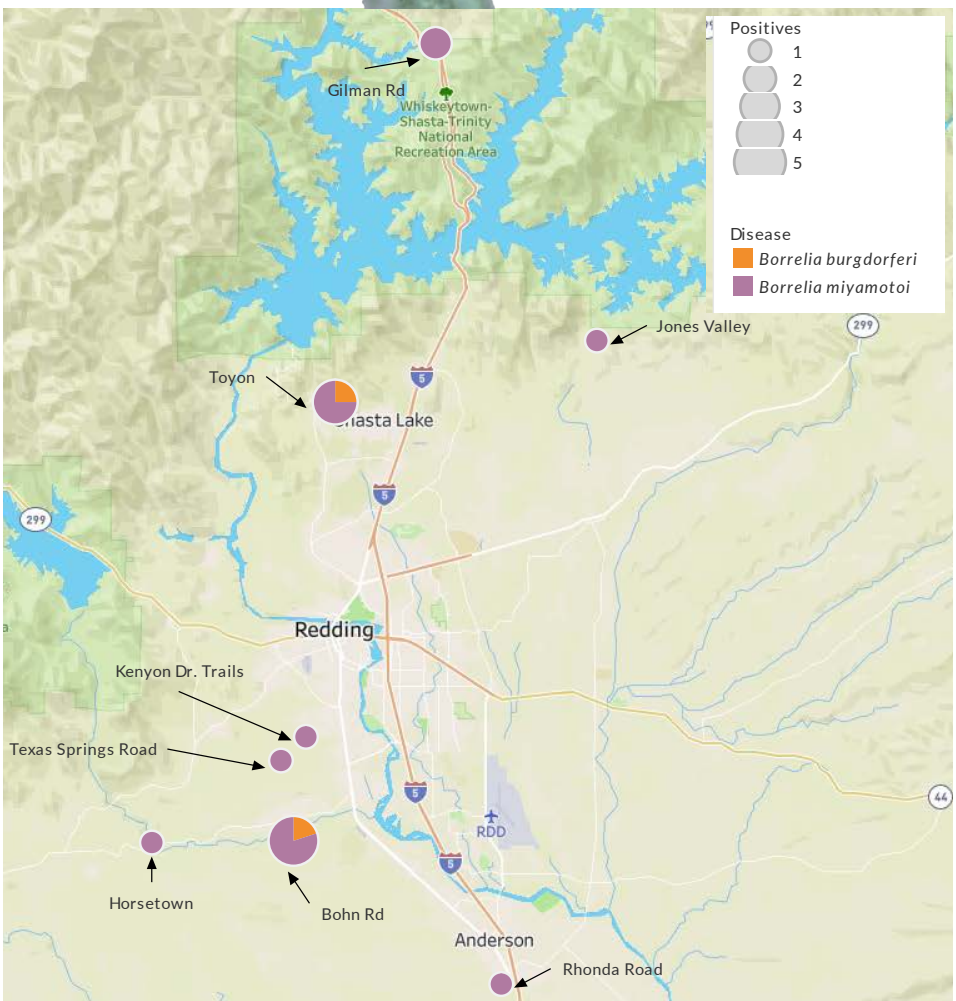
In the 2020 – 2021 season, ticks were collected at 23 surveillance areas where tick habitat coincided with the risk of human exposure. Surveys were conducted on a weekly basis between November 2, 2020 and February 24, 2021 by dragging a cloth "flag" through tick habitat and inspecting trailside plants for questing ticks. Questing ticks wait at the tips of vegetation with their front legs outstretched along areas where large animals traverse, attempting to latch onto host animals as they pass by.

District personnel collected mostly three types of adult ticks within the district: two types of *Dermacentor spp*. ticks and *Ixodes pacificus*. *Ixodes pacificus*, the western black-legged deer tick, which can spread the bacteria that causes Lyme disease, is predominant from November into February. In February and March, *Dermacentor spp*. ticks, which are more heat tolerant, begin to increase as a proportion of adult tick populations within the District. *Dermacentor spp*. ticks are frequently encountered by District personnel in moist riparian areas with dense, low vegetation well into the summer. These ticks are a lower human disease concern in Shasta County.

Overall tick populations averaged 20.2% below the 10-year average, but 28% above 2019 –2020 seasonal levels throughout the collection season.

Between October of 2020 and March of 2021, the District submitted a total of 318 samples of 3 - 5 *Ixodes pacificus* ticks each (1429 total ticks) from 19 different locations spread throughout the District. In total, 14 samples from 8 different locations were found to be positive for *Borrelia miyamotoi*, a bacterium known to cause a relapsing fever disease in humans. Two of those locations also had samples positive for *Borrelia burgdorferi*, the causative agent for Lyme Disease. The minimum infection rate for all tested ticks was 9.8 ticks per 1,000 for *Borrelia miyamotoi* and 1.4 per 1,000 for *Borrelia burgdorferi*.

Tick Testing Results by Flagging Location 2020-2021



Staff flagging for ticks.

CAGE TRIALS

Cage trials are used to assess whether adult mosquito control products applied by the District are effective when applied under field conditions. Local mosquitoes are placed in cages made of cardboard and tulle and placed in a grid pattern in the field alongside cages of known susceptible mosquitoes.

Truck-mounted ultra-low volume (ULV) application equipment is driven upwind of the test area to make an application to the grid using products applied at normal label rates. Mortality of the wild-type mosquitoes is then compared to the susceptible mosquitoes to check for any signs of lowered product efficacy.

On August 8, the District ran 3 cage trials using a pyrethroid product, an organophosphate, and a natural pyrethrum product. Despite unfavorable wind speeds and direction, good efficacy was observed for runs where conditions allowed the products to reach the cages.

Cage Trials - Percent Mortality by Active Ingredient
08/05/2021

Permethrin

	7		8		9	
	CQ1	Wild	CQ1	Wild	CQ1	Wild
300ft	100%	100%	100%	100%	100%	15%
4	100%	100%	100%	100%	100%	100%
6						
100ft	100%	100%	100%	100%	100%	100%
	1		2		3	

TRUCK ROUTE

Malathion

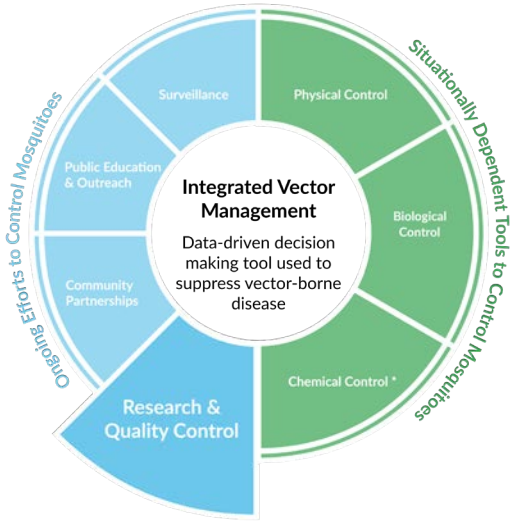
	7		8		9	
	CQ1	Wild	CQ1	Wild	CQ1	Wild
300ft	100%	85%	0%	5%	0%	0%
4	100%	95%	100%	64%	11%	0%
6						
100ft	100%	100%	100%	85%	100%	6%
	1		2		3	

TRUCK ROUTE

Pyrethrum

	7		8		9	
	CQ1	Wild	CQ1	Wild	CQ1	Wild
300ft	100%	26%	5%	0%	6%	0%
4	100%	30%	100%	16%	0%	5%
6						
100ft	100%	73%	100%	32%	100%	39%
	1		2		3	

TRUCK ROUTE

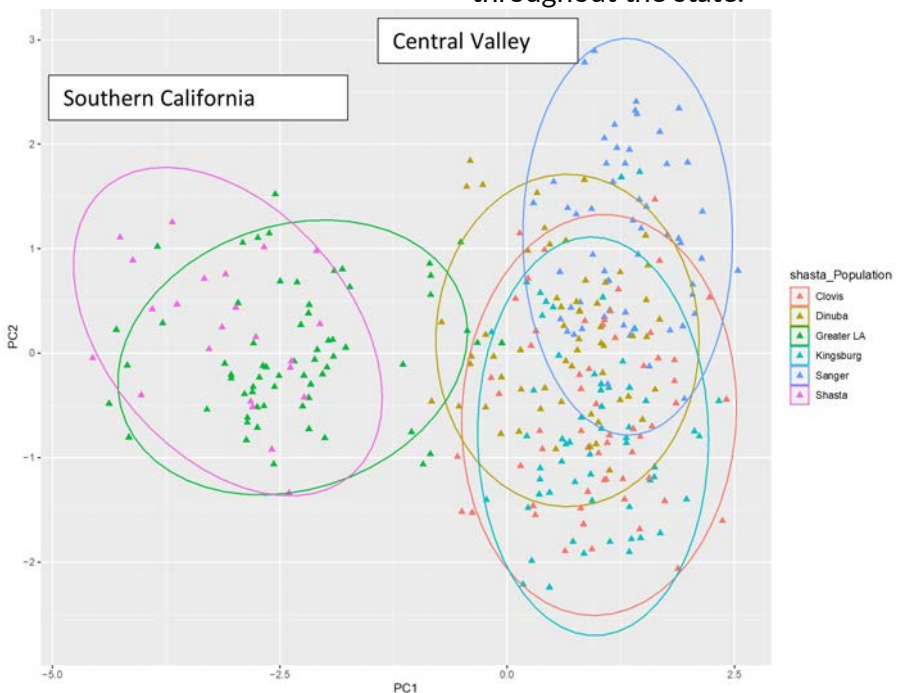


In 2021, a total of 82 samples of the invasive mosquito *Aedes aegypti* from 4 geographical areas of infestation were submitted to UC Davis for genetic characterization. We also submitted samples totaling 145 local *Culex tarsalis* mosquitoes to Pennsylvania State University for researchers studying the genetics of that species throughout its range in the US.

Some results of genetic testing of *Aedes aegypti* mosquitoes submitted to UC Davis for genetic analysis in 2020 were received by the District in early 2021. The results showed that our *Aedes aegypti* were closely related to mosquitoes from the greater Los Angeles area. Also, our mosquitoes had fewer of some genetic markers associated with pesticide resistance than other *Aedes aegypti* collected throughout the state.

COLLABORATION

Knowledge about the origins, evolution and pesticide resistance characteristics of local and imported mosquito types can be gained through modern genetic analysis techniques. The District does not currently have the expertise or equipment to conduct such sophisticated research but can easily provide locally acquired mosquito specimens to various university researchers conducting such research.

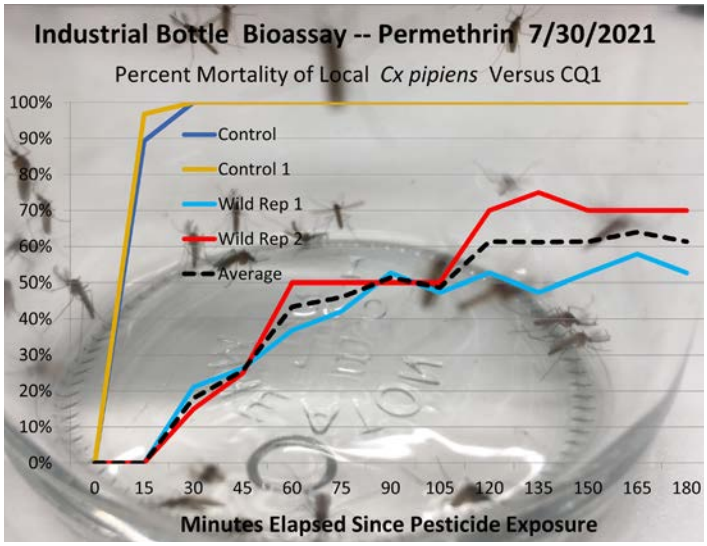


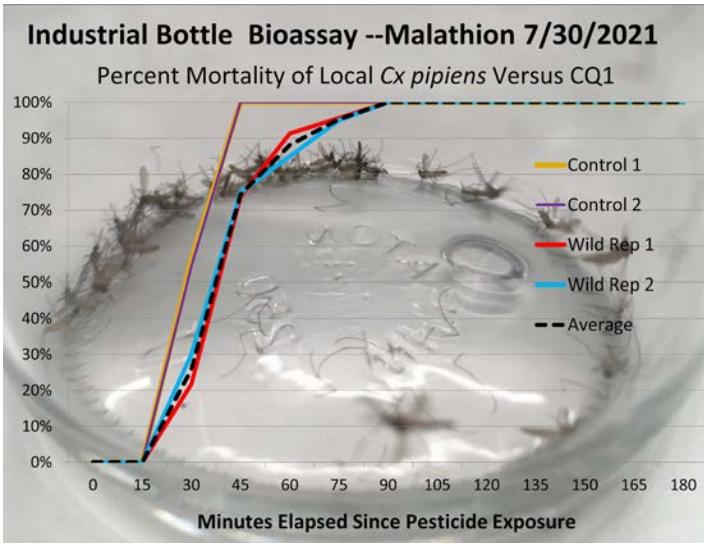
BOTTLE BIOASSAYS

Bottle bioassays use tiny amounts of pesticide active ingredients coating the inside of bottles to check for early signs of pesticide tolerance in local mosquito types. Wild mosquitoes are placed in treated bottles alongside bottles with known susceptible lab-reared mosquitoes. The time that it takes for the wild mosquitoes to die is compared to the susceptible mosquitoes and using standard times provided by the CDC, who also provides materials for the bottle bioassays.

In 2021, the District ran bioassays on three occasions in June, July and September, respectively to monitor for changes in susceptibility to mosquito control products throughout the season. Samples of *Culex pipiens* mosquitoes from three locations were tested using the active ingredients permethrin, deltamethrin, pyrethrum and malathion. As in years past, some tolerance to pyrethroid ingredients was observed, which did not seem to affect the results of cage trials that were conducted in August.

Bottle bioassays can provide some early indications of the presence and potential mechanisms of pesticide tolerance, depending on the type of active ingredients tested. Ideally signs of tolerance can be detected before resistance affects the efficacy of treatments in the field. To adequately assess whether resistance is affecting the efficacy of adult mosquito control efforts, actual mosquito control products must also be tested under field conditions, using other methods such as cage trials.



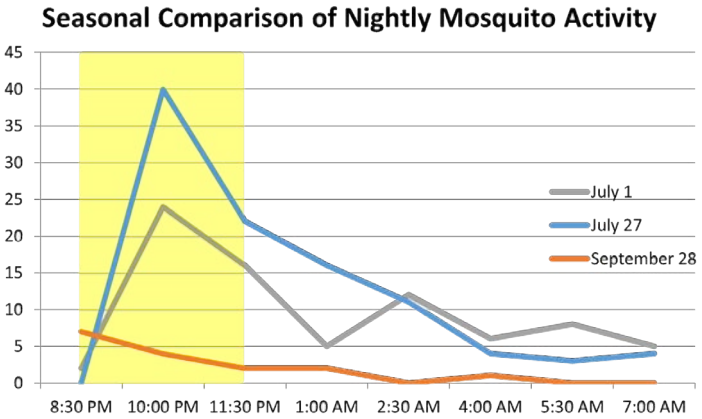


ROTATOR TRAP

A rotator trap uses 8 collection jars mounted on a timed "carrousel" to take adult mosquito samples from the environment at preset time intervals over a time range, such as sunset to sunrise, to determine changes in mosquito activity levels over time. Such knowledge enables the District to time adult mosquito control treatments to the times of peak adult mosquito activity, thereby increasing the efficacy of mosquito control efforts.

A rotator trap was set on six occasions in 2021 at a total of five locations. Four trappings were done in early to mid-summer to characterize mosquito activity at the seasonal time of peak temperatures and peak mosquito activity. The trap was set on two more occasions in early fall to see in what ways adult mosquito activity changed under conditions with lower daily temperatures.

This limited data indicates that in high temperature conditions there is a lag while nighttime temperatures cool before mosquitoes become active in the environment. Conversely, when the weather is colder, mosquitoes seem to have their peak activity close to dusk and retreat from the environment through the night as temperatures drop. All data shows higher mosquito activity between dusk and midnight than in the predawn hours.

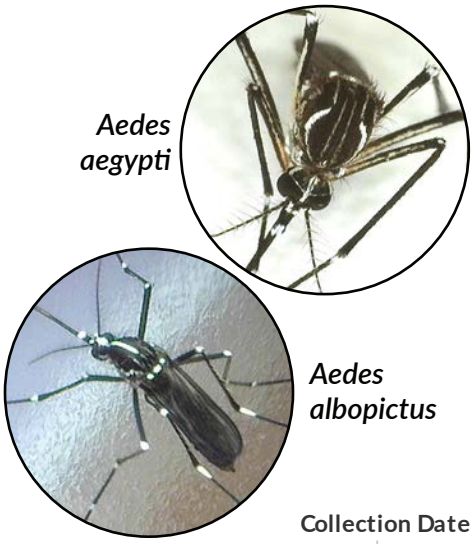


INVASIVE AEDES

Unfortunately, as mentioned in the foreword, 2021 saw the continued increase in number and geographic scope for our invasive *Aedes* infestation. These invasive *Aedes*, *Aedes aegypti* and *Aedes albopictus*, are a worry for several reasons. The most concerning is the ability of these two mosquitoes to transmit diseases that we currently do not have in Shasta County, including Zika, dengue, yellow fever and chikungunya. We continued to respond aggressively to existing and new immature and adult finds.

With each new location, we begin our intervention by conducting door-to-door inspections of the surrounding properties. We provide public education to residents about the species and potential sources. We also increase our surveillance, trapping adult mosquitoes and surveying for larval mosquitoes. This triggers the deployment of our autodissemination ovitraps, the application of larval control products through our wide area larviciding (WALS) technology, and in most instances, adult mosquito control to reduce the actively flying adults.

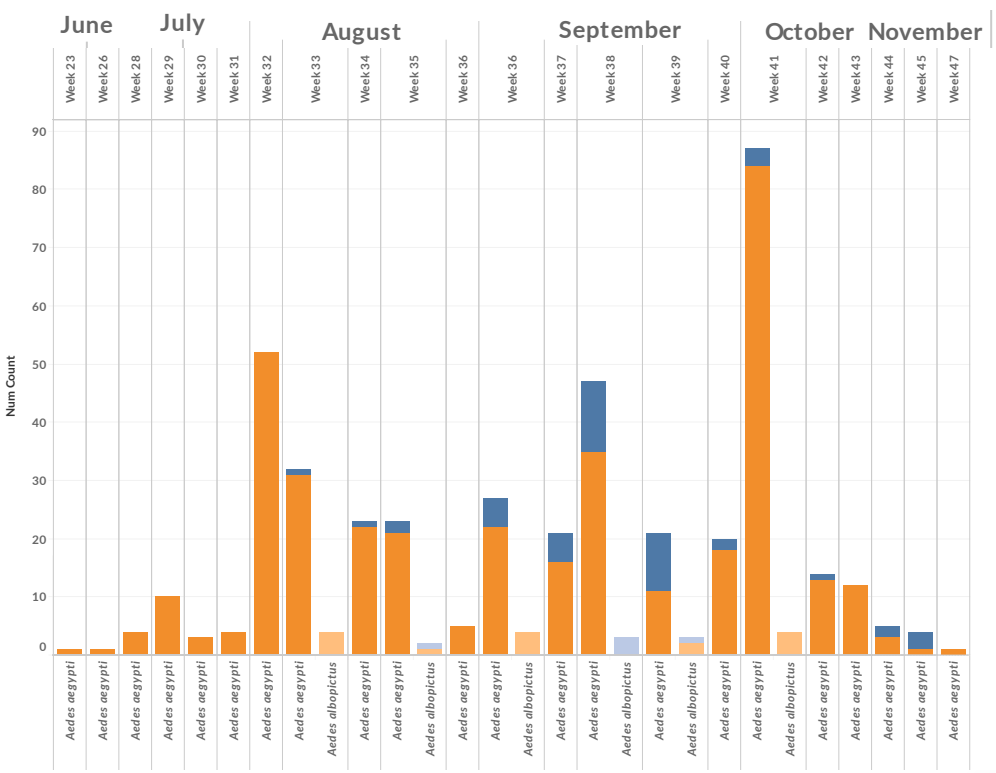
As we continue to identify more locations, the potential for eradication becomes lower; however, we will continue to work toward dramatically reducing their numbers and tracking any potential local transmission of the novel diseases they transmit to ensure the chance for local transmission remains low. New control options are quickly moving to the market, like sterile insect techniques (SIT), that could provide additional exciting tools to add to our toolbox when dealing with these challenging mosquitoes.

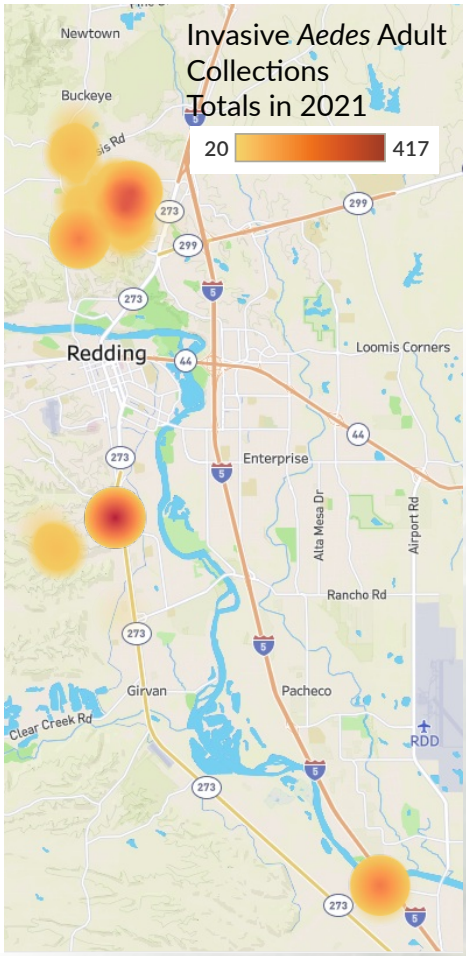


Aedes aegypti

Aedes albopictus

***Aedes aegypti* sources.**





TRAPS FOR INVASIVE AEDES

Even before the first invasive mosquito species was confirmed within District boundaries in August 2020, vector ecology staff had used several specific traps to monitor for the introduction of non-native mosquitoes. In 2021, the Biogents gravid *Aedes* trap (BG GAT) was the most commonly used trap that specifically targets the invasive *Aedes aegypti* mosquitoes. BG GATs were cumulatively operated for more than 3600 trap nights across 40 different locations.

TREATMENT FOR INVASIVE AEDES

In2Care

One of the newer technologies the District is employing in areas of known invasive *Aedes* is the deployment of the In2Care trap. These traps utilize two methods to help reduce the populations of both *Aedes aegypti* and *Aedes albopictus*. After the pregnant female mosquito is attracted to the trap they enter the trap and come into contact with two mosquito control products; the first will eliminate the female mosquito after a few days and the other will be transported to any additional water sources the female encounters after leaving the trap, providing additional control to those immature mosquitoes.

Staff placing an In2Care trap.

Wide Area Larviciding (WALS)

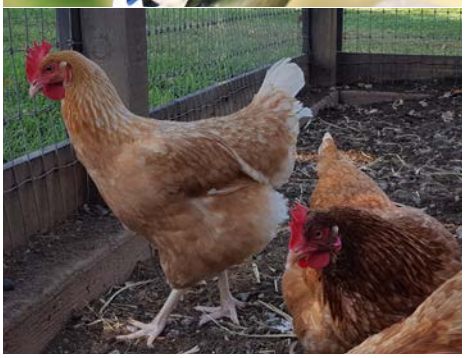
Due to the cryptic nature of the invasive *Aedes* mosquitoes, identifying and treating all the breeding sources is almost impossible. Therefore, the district utilizes a specialty mist blower that sends our BTi product in tiny droplets up, over and around homes, foliage, and any other obstacle with the hope that the product will come in contact with any exposed water sources in residential backyards. Although our use of this technology is fairly new, it was tested and shown effective during Zika outbreaks in Florida during the 2016 response.

Staff performing a WALS treatment via backpack applicator.

Staff performing a WALS treatment via a truck mounted applicator.

LOCAL DISEASE SURVEILLANCE

The District uses several methods to monitor the presence and incidence of mosquito-borne viruses in the environment which may cause disease in humans. These methods include testing dead birds, sentinel chicken blood collections, and mosquito samples for evidence of West Nile virus (WNV), Saint Louis encephalitis virus (SLEV), and western equine encephalomyelitis virus (WEEV), mosquito-borne diseases that have all historically been found in California. Additionally, limited information is reported to the District when horses or humans become infected with a mosquito-borne disease. A positive result from any of these indicators prompts swift response to disrupt the transmission cycle.



Mosquito Samples

Mosquitoes are collected in groups of 12-50 and then sampled for the presence of viruses that can cause illness in humans. In 2021, 635 samples were submitted for testing. Of these, 28 samples were positive for West Nile virus from 18 different locations. A total of 16,631 individual mosquitoes were tested.

Dead Bird Reports

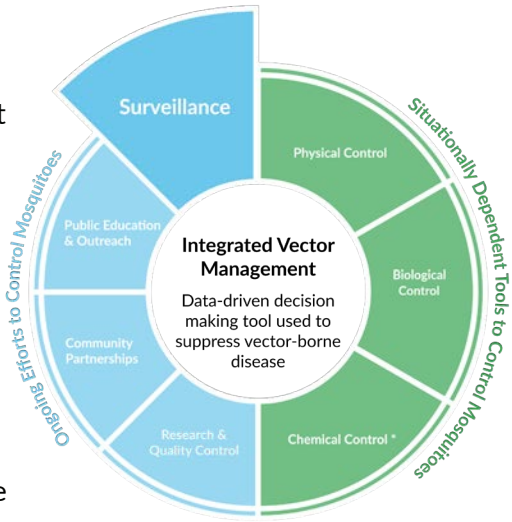
A single, yellow-billed magpie reported to the District in September was the only wild bird collected that was suitable for West Nile virus (WNV) testing in 2021. It was negative for WNV. The last wild bird found positive for WNV within the District was a scrub jay from north Redding collected in 2019.

Humans & Horses

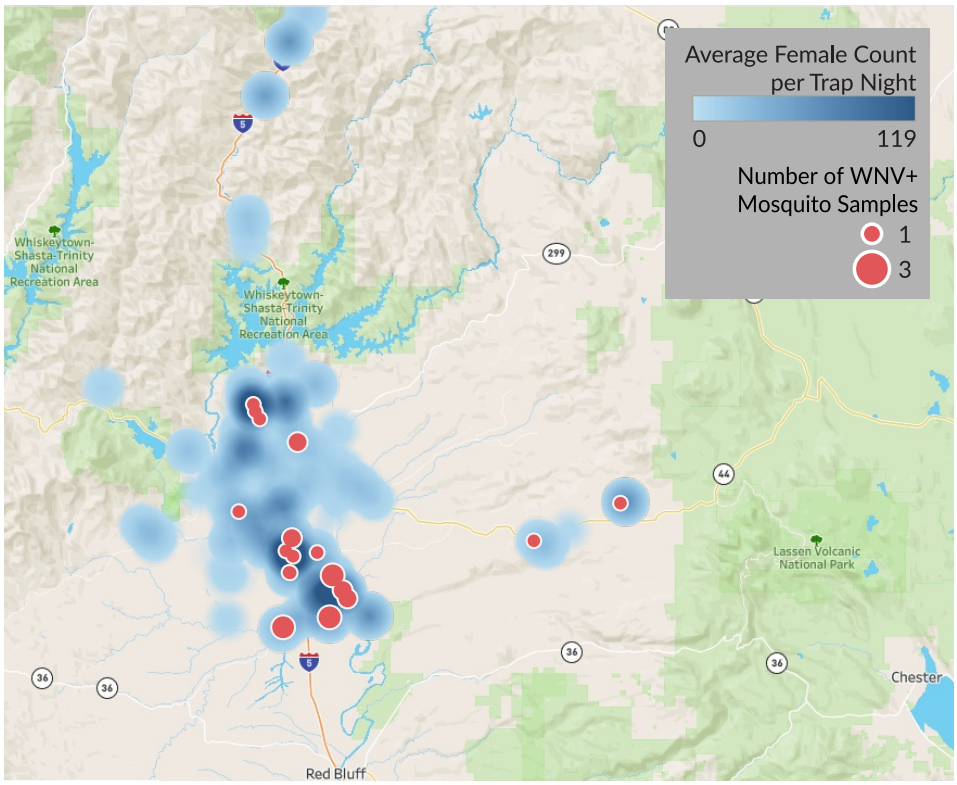
Three human cases of WNV were reported within Shasta County in 2021. Two of those were within the District, including one fatality. The additional case was reported from outside the District boundaries. There were no reported cases of WNV in horses.

Sentinel Chicken Seroconversion

Chickens are used to monitor for virus transmission at fixed locations and time periods. A positive test result indicates more precisely where and when virus transmission has occurred. Three sentinel chickens were infected with WNV in 2021. The first was discovered during mid-July, while the second and third returned positive results in early October and were from the same flock.



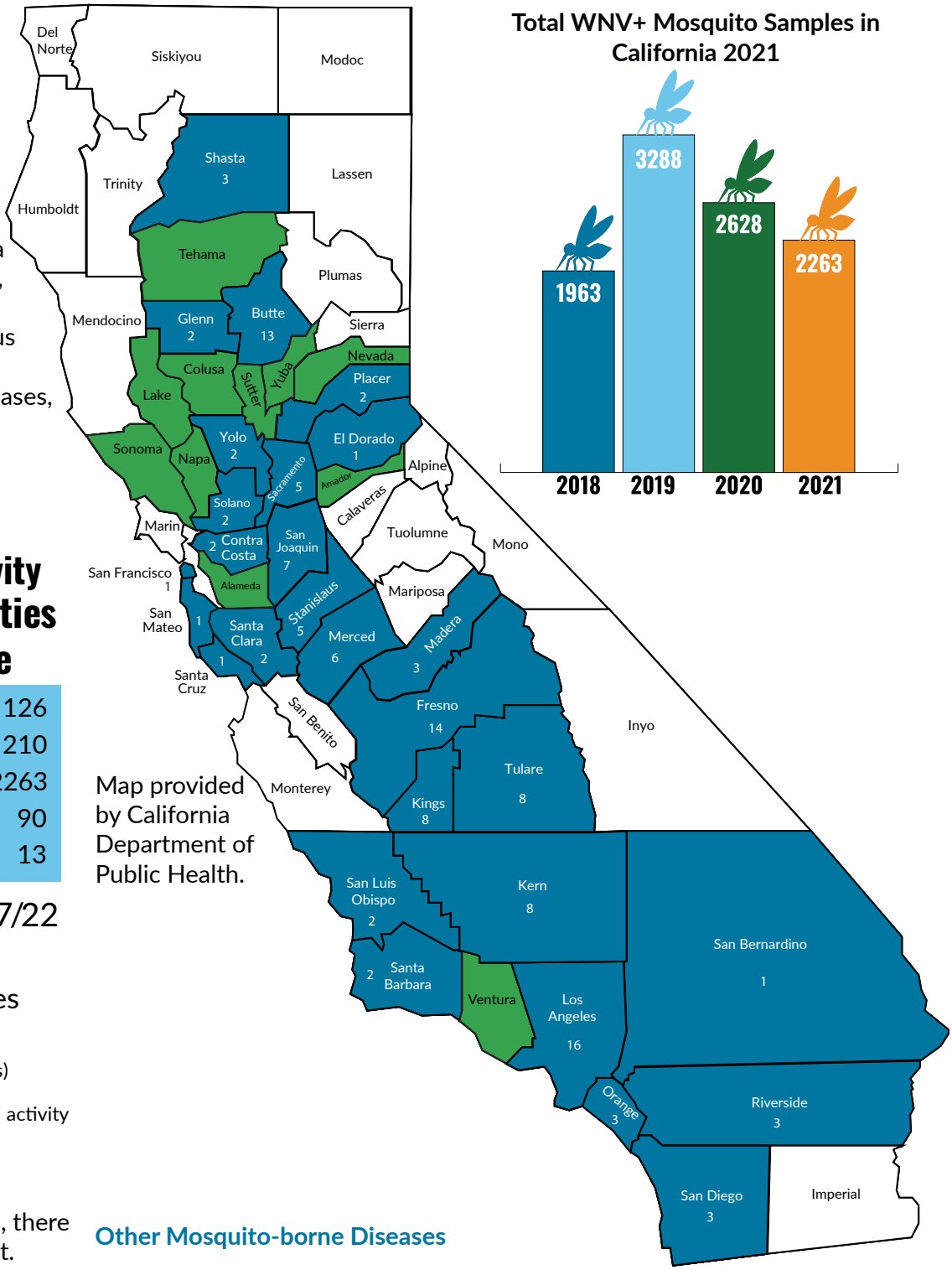
Average Female Mosquitoes Trapped per Night vs WNV+ Mosquito Samples



STATE-WIDE DISEASE SURVEILLANCE

West Nile virus

Most mosquito districts throughout California utilize a statewide database to collect, store and analyze vector population and West Nile virus data. In 2021, all disease indicators, as well as human cases, declined within the state compared to 2020 and the five-year average.



Map provided by California Department of Public Health.

West Nile Virus Activity in California Counties 2021 Year-to-date

Human cases	126
Dead birds	210
Mosquito samples	2263
Sentinel chickens	90
Horses	13

Updated 2/07/22

28 counties with human cases

Counties with West Nile virus activity (no human cases)

Counties with West Nile virus activity (number of human cases)

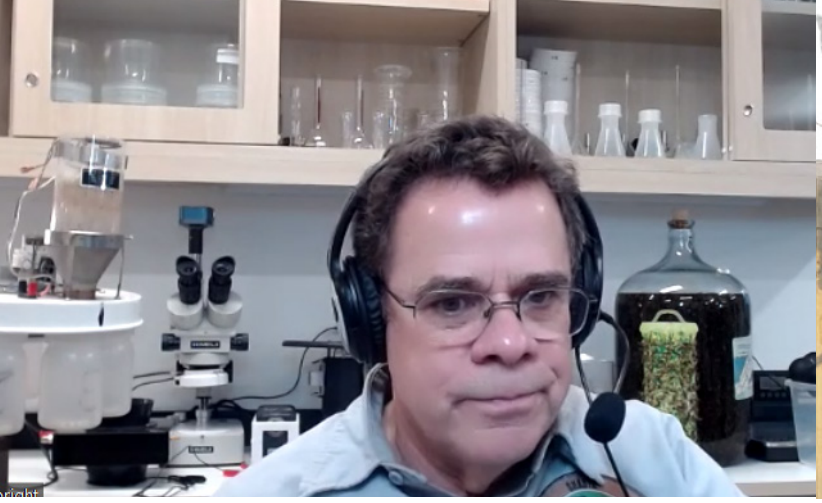
Total WNV+ Mosquito Samples in California 2021

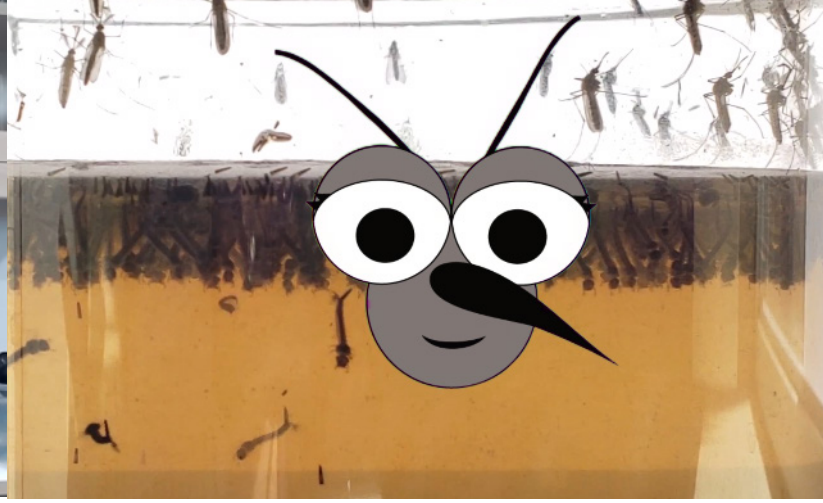
St. Louis encephalitis virus

In contrast to West Nile virus, there were far fewer incidence of St. Louis encephalitis virus (SLEV) in mosquito samples. Human cases remain low and comparable to the number diagnosed in 2020. SLEV was detected in 2015 after several years without any detection of the virus whatsoever. Since its reemergence, it has been isolated at very low levels in mosquitoes, sentinel chicken blood samples, and very rarely as the causative agent of human illness.

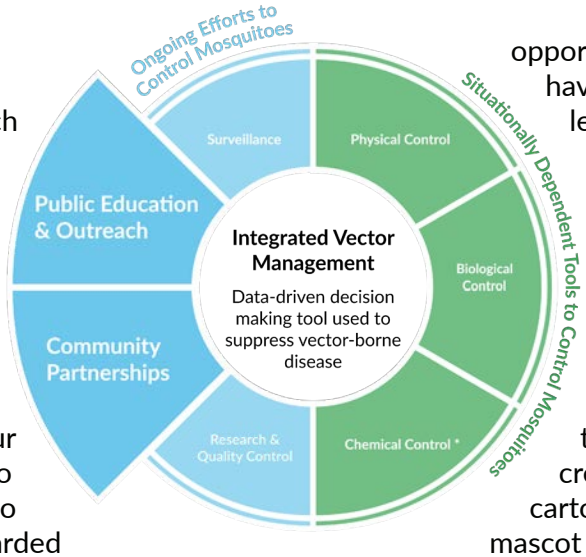
Other Mosquito-borne Diseases

Some mosquito-borne illnesses that have been historically recorded in California, such as western equine encephalomyelitis virus (WEEV) and malaria, are reported and monitored by the California Department of Public Health (CDPH). Other emerging vector-borne viruses, such as dengue, Zika, chikungunya and yellow fever, which could present new public health threats, are also tracked by CPDH. Although there are occasional human cases of some of these diseases detected in international travelers, no evidence of any of these diseases being spread locally by mosquitoes was detected in California in 2021.





OUTREACH



As a key pillar in the District's Integrated Vector Management approach, the District's Outreach and Public Education efforts have continued to develop, and this year is no exception. To improve awareness, we continue to maintain and update our device-responsive District website and social media platforms, to reach our community on a digital level. Our seasonally designated local radio and television PSAs continued to roll this year, and we also onboarded geo-targeted streaming services to air our video PSAs via Roku, Amazon Fire TV, Samsung TV, and other streaming services. This new media service allowed us to reach over 62,000 impressions with an average view completion rate of over 95%, improving our reach within our District at a minimal cost.

In addition to digital outreach, we also participated in a limited number of outdoor community events, providing informational booths manned by our District staff, where we distributed a wide variety of educational materials. These events also provide opportunities for our constituents to have one-on-one conversations and learn about our District programs. Some community events, such as the STEM Career Fairs, pivoted to a virtual format, in which we produced 2 STEM Career themed videos in-house and participated in 4 Live Q & A chats via Zoom and Google Meet. In the production of these videos and virtual chats, we created a Missy Keeto animated cartoon, allowing our District mosquito mascot to speak with students, even during live virtual events.

Acknowledging the increase in clinic foot traffic, our District partnered with Shasta County Public Health to provide activity books and educational brochures to our local clinics. Similarly, we also provided educational materials to our Shasta County Agricultural Department of Weights and Measures for lobby information, as well as distribution to their state association to encourage communication with their local mosquito control agencies.

DISTRICT HEADQUARTERS

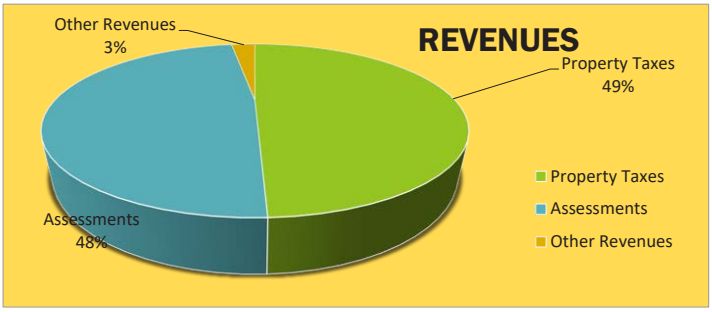
FINANCIAL REPORT

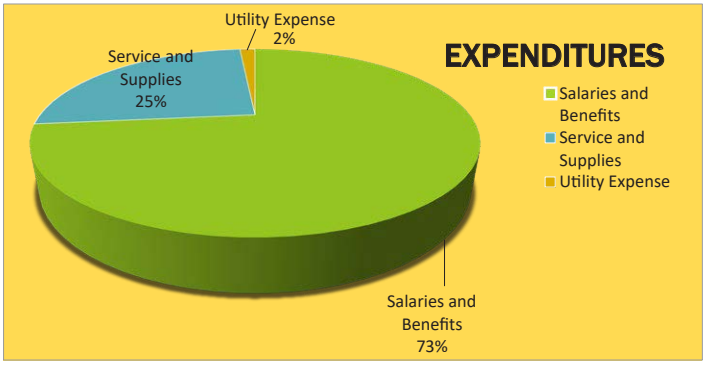
The Shasta Mosquito and Vector Control District depends on property tax revenues and benefit assessments to fund its operations. The District's objective is to be fiscally responsible in accordance with Generally Accepted Accounting Principles (GAAP), Governmental Accounting, Auditing and Financial Reporting (GAAFR) as well as State Controller reporting guidelines.

Statement of Financial Position: FY 2020-2021 (June 30, 2021)	
Assets	
Cash and cash equivalents	$3,837,712
Due from other governments	5,354
Inventories	100,323
Non-depreciable capital assets	51,273
Depreciable capital assets, net	987,201
TOTAL ASSETS	**4,981,863**
Liabilities	
Note payable	$146,546
Net pension liability	2,400,000
OPEB	297,067
Compensated Absences	**121,185**
TOTAL LIABILITIES	**2,964,798**

During the year, the District successfully transitioned to a cloud-based system to give the flexibility of working remotely, without impeding business practices. The District has and continues to be committed to the responsible management of public funds in efforts to reduce the risk of disease transmission and nuisance to members of the public within our district boundaries. We continue to utilize a transparent approach in our finances as well as all aspects of District operations. We continue to have successful filings of clean annual audits.

2020-2021 REVENUES		
Property Taxes	1,522,619	49.33%
Assessments	1,485,645	48.14%
Interest & Miscellaneous	78,025	2.53%
TOTAL REVENUE	**3,086,289**	**100%**
2020-2021 EXPENDITURES		
Salaries and Benefits	2,038,663	73.37%
Service and Supplies	699,471	25.17%
Utility Expense	40,613	1.46%
TOTAL EXPENDITURES	**2,778,747**	**100%**





Honoring your decade of service and dedication to our team and our community. Happy retirement!

19200 Latona Road, Anderson, CA 96007
P: 530-365-3768 F: 530-365-0305
www.shastamosquito.org