ANNUAL 2019 REPORT 2019

The Centennial Edition





Protecting public health since 1919



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."

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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 2019 Annual Report for the Shasta Mosquito and Vector Control District. This year the District celebrated its hundredth year of protecting public health for the residents of the District, and to honor the milestone, we held an open house at the District. The open house was a great opportunity to showcase the District, our facilities and, most importantly, our staff. Our District staff are really the engine that propels this District forward and makes every year better than the one before it. Thank you to all the staff and Board that have been involved with the District over the last 100 years.

This year we experienced an average year for both mosquito production and disease activity. The timing was helpful, because we were challenged by a variety of other factors that made "normal" operation difficult. In 2019 we experienced snowstorms, flooding, extreme wind events and seemingly random power shutoffs. Through all these events we learned something new that made the next one easier to navigate. It has also led to staff reviewing emergency preparedness training, policies and collaboration with other government agencies.

Finally, the Board of Trustees and staff came together to update our District strategic plan. This is the third time in a decade that we have updated the plan and during that process have found value not only in the document and the direction it provides, but in the opportunity for everyone to engage and set the path for the District for the next few years. We identified some ambitious goals but know how important the future transitions we'll navigate will be to the District strength and growth. For more information about the District and our activities, please visit www.shastamosquito.org. As we close out 2019, we would like to thank the District staff, the Board of Trustees and our District residents for another successful year. We are ready to put the challenges of 2019 behind us, and prepare for whatever 2020 will bring our way.

Sincerely,

Peter Bonkrude

District Manager

Yay mover

Larry Mower

President

DISTRICT STAFF

Lab/Surveillance

John Albright Kendra Angel-Adkinson





Operations Guangye Hu

Kelly Cleland Mike Alexander Al Shabazian Brady Benton Corey Boyer Darrell Bible Haley Bastien Robert Ault

Administration

Peter Bonkrude Darcy Buckalew Jenna Ingebretsen





Seasonal Operations Avery Currier Debi Welton Garrett Hawkinson Jesse Bible Kristy Baumer Reid Sheeks Shelby Tucker

BOARD OF TRUSTEES



Larry Mower President City of Andersor



Benjamin Hanna Vice President Shasta County



Michael McNamara Secretary City of Redding



Vickie Marler Shasta County



Ann Morningstar City of Shasta Lake

100 YEARS PROTECTING PUBLIC HEALTH

Centennial Highlights

Happy Birthday Shasta Mosquito and Vector Control! Every year the District gets one year older, but one thing that never changes is the dedication by District staff to public health mosquito control. We are so proud to be a small part of the legacy that continues to prioritize service to our residents. For over a century this District has been a constant in the community, originally formed to combat malaria in 1919, but continuing to take on any new vectorborne challenge.

Early in 1917, the California Department of Public Health grew concerned with the growing malaria problem and its impact on rural agriculture. By 1919, 54.5 percent of the population in areas with irrigated pastures suffered from malaria. Based on this concern, the Anderson Mosquito Abatement District was created, unique because it was the first state launched mosquito control program.

After the implementation of mosquito control activities in the area it was noted by mosquito expert William B. Herms that the Anderson campaign was a model for future anti-mosquito work. "What Anderson has accomplished," Herms declared, "other California communities can accomplish, providing funds are available for fundamental work, the cost of which is beyond the means of the community to assume... Happy and grateful Anderson wants the state

to know of its victory, its prosperity, and its gratitude."

This led to the creation of mosquito districts across California, all with the goal of protecting Californians from the debilitating diseases that mosquitoes and other vectors can transmit. Since those early days, we have merged with other local mosquito districts officially becoming the Shasta Mosquito and Vector Control District in the 1990s and annexing most of the Shasta County area, currently providing public health mosquito control to over 1,100 square miles and approximately 130,000 residents.

Since our creation we have encountered malaria, St. Louis encephalitis, Western equine encephalomyelitis, West Nile virus, Lyme

disease, Bubonic plague, Sin Nombre or Hanta virus, the potential for Zika virus and new and emerging mosquitoes and diseases. Each new challenge provides the district with an opportunity to show the residents how important our services are and the continued commitment to follow our mission statement; "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 for championing the Shasta Mosquito and Vector Control District for the last 100 years; we wouldn't be here today without the residents and their continued support.





Centennial Open House - June 28th, 2019

Celebrating 100 years protecting public health!

13 L





INTEGRATED VECTOR MANAGEMENT

Operational response and disease surveillance have evolved dramatically over the last hundred years for the District. Modern mosquito and vector control districts like the Shasta Mosquito and Vector Control District (SMVCD), utilize Integrated Vector Management (IVM), a process that seeks to find the most effective and appropriate control strategy based on the information gathered by the District. about control, we need to first have as much information as possible. Without larval and adult mosquito surveillance we would be reducing our efficacy and efficiency, potentially putting the public at risk from a vector-borne disease.

IVM includes: the use of vector control methods based on the scientific knowledge of local vector ecology, surveillance data, pathogen transmission risk, quality control of methods and control products, applied research, collaboration among federal, state, and local public health agencies, vector control agencies, the research community and engagement with local communities and stakeholders. We cultivate these relationships to educate, gain support, leverage resources and change cultural practices.



SMVCD defines a vector as a living organism that can transmit diseases between humans, or from other animals to humans.

Many of these vectors are blood sucking insects and arthropods like mosquitoes, ticks, fleas, sandflies and triatomine bugs.

IVM is defined as a "sciencebased decision-making process that seeks to improve efficacy, fiscal responsibility and ecological soundness." Put another way, in order to make the best decision

SERVICE REQUESTS

As a public agency, our service to District residents is essential to protect people from vector-borne diseases. When we connect with the public, we get an opportunity to hear the concerns of our residents regarding mosquito and vector control and more importantly are able to share our knowledge and experience on how they can work with us to find the best solution to their problem. We pride ourselves on our quick response to requests, and we value the interaction. These requests cover a wide range of mosquito and vector related questions and issues including mosquitofish requests, mosquito complaints, neglected swimming pool reports, and general questions about insects and our services. We rely on these requests, not to direct control treatments, but to help guide District surveillance. This allows staff to focus on areas where potential mosquito problems are occurring. The public can issue a service request any time of the day, 24/7. Using our website, they can sign up for service, gain information about current mosquito conditions, and even find out where we are performing our adult mosquito control activities.

Service Requests by		
Community		
French Gulch	1	
Millville	3	
lgo & Ono	8	
Shasta	8	
Bella Vista	11	
Happy Valley	14	
I5 North	17	
Shingletown	30	
Cottonwood	44	
City of Shasta Lake	50	
Anderson	94	
Redding	495	
Grand Total	775	







IMMATURE **MOSQUITO CONTROL**

Shasta MVCD technicians spend much of their time inspecting the more than 16,000 potential mosquito breeding habitats throughout our District. Controlling mosquitoes in the water, while they are in their immature (larva and pupa) form, is the most efficient and effective form of control. In the water the mosquitoes are contained, concentrated and relatively easy to treat before they become biting adults. Once found,

CHEMICAL **MOSQUITO 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 and not other aquatic insects or other animals. These controls are categorized into the following categories: microbial products, insect growth regulators, surface oils, and toxins derived from bacteria. In 2019, staff made almost 4,000 treatments to water

PHYSICAL **MOSQUITO CONTROL**

Physical control is an important component of IVM. It reduces mosquito populations. The District staff conduct physical control by manipulating the physical environment the mosquitoes live in, such as source reduction, hand brushing in and around sources to enhance access to mosquito breeding sites, modifying sources to augment the impact of natural mosquito predators, herbiciding, and working with landowners to encourage prudent land and water use practices. Unlike the

District staff have several tools in the IVM tool chest to control these immature mosquitoes before they emerge: biological control, chemical control, and physical control. Following IVM, we choose the control tool or multiple tools, depending on the target species, time of year and habitat to have the most effective control. This vear our staff made almost 30.000 inspections to these sources for mosquitoes.

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.

Surface Oils	244
Methoprene	621
Microbials	944
Spinosad	2,177
Grand Total	3,986

previous years, the District was unable to use Cal-Fire Sugar Pine Conservative crews to physically remove brush and burn debris piles, since the fire crews were busy with enhanced fire prevention measures in California.

In 2019, our staff made the following physical control efforts:













BIOLOGICAL Mosquito control

Biological control is the use of other organisms that prey on, parasitize, compete with, or otherwise reduce mosquito populations. Finding natural enemies that feed on mosquito larvae and pupae in aquatic environments can play an important role in controlling mosquitoes. Biological control can be accomplished utilizing three broad categories: conservation, classical biological control, and augmentation. The District promotes conservation biological control by encouraging natural predators in habitats where they are established. By only choosing control products that will select for mosquitoes we can prevent reduction of other aquatic predators that help reduce mosquito populations. For augmentative control, the District continues to seek natural predators that can be released seasonally in large enough numbers to effect mosquito populations. Currently the most effective biological control category used is classical biological control, which takes a non-native species and introduces it to control a pest. Our District uses the mosquitofish, Gambusia affinis, which effectively preys on

mosquito larvae and pupae when released into mosquito breeding water bodies. Unfortunately, because they are not naturally found in our area, we are limited as to where they are appropriate to be used. This year, the District released mosquitofish to 913 confined water bodies. Mosquitofish can survive in various water qualities and reproduce quickly within short periods of time. Our indoor fish rearing facility provides mosquitofish for field releases, especially during the spring and the early summer. Residents can contact the District to request mosquitofish. Our technicians will bring fish to the site and release them in water sources, such as ponds, neglected swimming pools, and animal troughs. The mosquitofish are free to District residents.



A mosquitofish eating an adult mosquito from the surface of the water.





District staff checking a catch basin for mosquito activity.

CATCH BASINS

There are approximately 9,000 catch basins (also called storm drains) in our District. Some of the catch basins hold water and heavily breed mosquitoes. During the summer, the staff spent more than 600 manhours inspecting all the catch basins and treated 1.024 of them that held water. In the fall, staff conducted follow-up inspections of 2,430 catch basins that were either previously treated or in the areas of special concern, and treated 306 of them with products. For the catch basins in heavy-traffic areas, such as along highways, staff did inspections and treatments in the early morning (3-6 AM) for their and the public's safety. Staff also conducted surveillance on mosquitoes emerging from catch basins by setting EVS traps in them.



SWIMMING POOLS

Unmaintained or neglected swimming pools can breed mosquitoes that transmit West Nile virus. One swimming pool can produce thousands and thousands of mosquitoes during the season, increasing the risk to the neighborhood for mosquitoborne diseases. In 2019, staff made over 1,000 inspections to swimming pools that could be breeding mosquitoes. These pools are identified in several ways; by aerial imagery, concerned residents, or District technicians' inspection. Once a pool has been identified as having the potential to breed mosquitoes, technicians must perform an inspection to confirm the status and make the most effective control decision. We typically perform two large efforts to control neglected swimming pools. First, our "winter" pool program revisits pools that we have inspected and treated in previous years to update their status. Second, during our "summer" pool program the District will contract a service to fly over the District and identify potential neglected swimming pools with aerial imagery. In 2019, we made 490 treatments to neglected swimming pools. The treatment options for neglected swimming pools include utilizing a long residual product or utilizing mosquito fish. Both will control the mosquito production but do not change the appearance of the pool.



28.02%



ADULT Mosquito Control

Adult mosquito control, referred to as adulticiding, is the practice of controlling adult mosquitoes by applying chemical products. 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 reducing the risk of a mosquitoborne disease. This becomes essential when adult mosquito numbers become high enough to quickly transmit and spread diseases, or severely reduce the well-being of our residents. Although adult mosquito control has its limitations, it is the only way to interrupt active mosquito disease transmission when it is occurring. These limitations require the District to use this intervention along with several other tools; namely a robust immature mosquito control program and increasing our community engagement regarding

personal bite prevention. 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

Number of Applications

142

the same night or next day as the trap data is processed. This level of responsiveness ensures we can move fast enough to prevent human disease. This year, District staff completed 420 adulticiding routes and treated over 75,000 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 notification list.



140

130

120

110

100



August

September

RESEARCH & DEVELOPMENT

BIOGENTS TRAP COUNTER

The Biogents counter is an accessory device that remotely counts and delivers mosquito population data to a website accessible by any device with an internet connection. In 2019, this device was used to monitor mosquito population data before, during and after adulticide operations to get a better understanding of the application's effect.



Biogents trap set



CACHE VALLEY SURVEILLANCE

In 2013 the District received a report of an occurrence of Cache Valley virus in the Oak Run area. This virus is mosquito-borne and causes outbreaks of spontaneous termination and congenital malformations in sheep and cattle. It can cause encephalitis in humans in rare cases. In the last two years. the District conducted surveillance for mosquitoes utilizing EVS traps, resting units, and aspiration of adults seeking shelter in protected structures in the Oak run. Millville. and Palo Cedro areas. Thirty-two mosquito samples collected have been tested for the presence

of Cache Valley virus, but none showed positive. Field collection of mosquitoes has concluded, but more samples will be tested.



WALS PROJECT

The Wide Area Larvicide Spray (WALS) experiment examined the potential to apply larvicide to cryptic or otherwise inaccessible sources. Staff set out plastic cups in a wooded area as analogue for naturally occurring cryptic sources. Staff manipulated the cups' potential for pesticide exposure by placing them in varying locations such as under light vegetative cover. After applying product to the wooded area, the cups were evaluated by placing susceptible mosquito larvae in the cups and recording mortality. Despite unfavorable wind conditions, control was observed in a high percentage of cups in the treatment area.





CAGE **TRIALS**

Monitoring the efficacy of our techniques and control products is essential to ensuring a high level of public health mosquito control. One of the tools we utilize to test our products are called caged mosquito bioassays. These bioassays place "wild" mosquitoes, those reared from native populations, in cages and compared against our lab reared mosquitoes that we know are susceptible to the products we use in the field regularly. We then apply our products during field conditions at different distances over a grid pattern and assess the results. This trial was a huge effort requiring almost 4,000 mosquitoes, 180 cages and our entire staff

to complete. Unfortunately, the one element that is hard to control is the wind, and constantly shifting winds made several of our applications provide unusable data. We plan to repeat these trials on a regular basis to assess any changes



% MORTALITY BY DISTANCE (PERMETHRIN)



Lab Reared Wild Type

BOTTLE BIOASSAYS

The District tests local adult mosquitoes for pesticide resistance by placing them in bottles with tiny, precisely measured amounts of test active ingredients and observing their rate of mortality compared to lab-reared susceptible mosquitoes. In 2019, two pesticides were tested on mosquitoes from two different locations in July and September. The amount of tolerance to mosquito control products detected in local mosquitoes is similar to observations made in previous years.



in our mosquito populations or new product evaluations. Caged mosquito bioassays, in conjunction with several other tests can provide our staff with insights into any potential resistance in our local mosquito population.



LARVICIDE **EFFICACY**

In 2018, staff tested a larvicide for its residual effect on mosquito larvae. The slow release product is an insect juvenile hormone analogue of mosquitoes that prevents the emergence of adult mosquitoes. Results from the testing can help staff schedule reinspection and treatment of the sources based on the

50

residual effect in varying water quality and source types.

Larvicide Efficacy Results in Days



VECTOR SURVEILLANCE



SMVCD staff assisting CDPH with rodent surviellance.

RODENT SURVEILLANCE

District personnel assisted California Department of Public Health personnel in a project to capture rodents and test them for rodent borne diseases at a campground in Viola. Blood samples from 25 deer mice were submitted and tested for the presence of Hantavirus. All except 1 sample tested negative.



TICK SURVEILLANCE

District personnel collected ticks on a weekly basis from October 2018 through March 2019 at 22 locations throughout the District. Tick populations were below the previous year and five-year averages for that same time of the year.

During the 2018-2019 tick season, 347 samples totaling 1588 *Ixodes pacificus* ticks were submitted for testing, looking for the presence of *Borrelia burgdorferi* (Lyme Disease) and *Borrelia miyamotoi*, a bacterium that can cause a relapsing fever in humans.



2.59% TICK SAMPLES TESTED POSITIVE FOR TICK-BORNE DISEASES



November 2018 - March 2019



110 MOSQUITO SURVEILLANCE

The District used up to 7 New Jersey-style light traps and 64 CO2-baited traps

- spread throughout the
 District on a weekly basis to
 monitor adult mosquitoes
 throughout the District
- all year long. With the exception of an early season
 spike in the population of
- Aedes sierrensis, the western treehole mosquito, the
- ⁵⁰ populations of local adult mosquitoes were near or below normal seasonal
- levels throughout 2019.

Apr 7

May 5

Jun 2

Jun 30

Week of Collection Date [2019]

Jul 28

Aug 25

Sep 22

Oct 20

Nov 17

Dec 15

Jan 12

Mar 10

30

20

10

0

Jan 13

Feb 10

Grouped Species Culex pipiens Culex tarsalis Aedes sierrensis Aedes spp. Anopheles spp. Culex spp. Culiseta spp.

LOCAL DISEASE SURVEILLANCE

Mosquito population data and disease indicators are two guiding factors for vector control. Mosquito samples, sentinel chicken blood samples and dead bird saliva samples are all collected by District staff to monitor disease transmission. Additionally, the District receives limited data on mosquito-borne illness when humans or horses are infected. A positive sample from any of these sources prompts swift response from the District.

West Nile virus (WNV) was detected in 3 mosquito samples, one sentinel chicken, and one dead bird. This very low level of detection is an unusual but welcome reprieve. It is important to remain vigilant against mosquito-borne disease as a single unusual year is no indication of future disease incidence.

MOSQUITO SAMPLES

Adult mosquito collection via trapping is an integral part of both population and disease surveillance. Sorting mosquitoes by species and sex generates population data which guides control decisions. After sorting, some species are sampled for the presence of viruses. These sample results, like population data, also aid District staff to make informed decisions regarding mosquito control.



District-wide WNV+ Indicators 2019



District-wide Positive WNV Indicators 2014-2019

	2014	2015	2016	2017	2018	2019
Human Cases	2	2	1	1	1	0
Horses	1	2	1	0	1	0
Dead Birds	6	15	3	2	5	1
Mosquito Samples	33	48	12	0	8	3
Sentinel Chickens	11	18	3	4	4	1
Total Indicators	53	81	20	7	19	5

DEAD BIRD REPORTS

Crows, jays and magpies all belong to the Corvid family. These birds are especially susceptible to West Nile virus and infection is often fatal. When discovered, the public reports dead birds which District staff then retrieve and sample for WNV. Only one dead bird reported to the District was appropriate for virus testing and was subsequently confirmed to be WNV positive.



SENTINEL CHICKENS

Sentinel chickens were one of the first virus surviellance tools used by mosquito districts. They are still used to detect virus transmission and are an important part of surveillance. Staff routinely sample each chicken's blood to test for antibodies to mosquitoborne viruses. A positive result indicates when and where virus transmission occurred, and staff respond with appropriate control measures. In 2019, one sentinel chicken was infected with WNV.





Aedes Aegypti DETECTION BY COUNTY 2013-2019

Year of first detection

INVASIVE MOSQUITOES, AKA #INVAEDES

The detection of Aedes aegypti in

ongoing efforts against the spread

the neighboring cities of Citrus



OUTREACH & PUBLIC EDUCATION

As a key part of the District's integrated vector management approach, there is no substitute for public awareness about mosquito-borne diseases and the importance of mosquito prevention and avoidance by the public. Therefore, the District's outreach and public education efforts have continued to increase, with this year's program being no exception. To improve awareness, the District has added a Facebook page to better reach our community on a digital level, and continued to grow the PSA reach into local radio, TV, and YouTube pre-roll media. The District has also increased the number of booth events and speaking engagements with community service groups, schools, and other agencies. As this was our Centennial Celebration, we were able to partner with KIXE, our local PBS station, to add additional commercials, and bring our Open House event to another level with more family friendly activities and additional character visits. The event itself was a success, and the District was able to share its mission through many activities and guided tours.

Public Education At A Glance

25,824 Social Media Impressions 9,920 Youtube PSA Impressions 4 Classroom Presentations 10 Public Presentations 22,087 Website Visits 19 Community Events 189 Radio PSA Spots 4 Radio Interviews 99 TV PSA Spots



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 2018-2019 (June 30, 2019)		
Assets		
Cash and cash equivalents	\$ 3,038,888	
Due from other governments	\$ 14,998	
Inventories	\$ 64,626	
Non-depreciable capital assets	\$ 51,273	
Depreciable capital assets, net	\$ 973,712	
TOTAL ASSETS	\$ 4,143,497	
Liabilities		
Accounts payable	\$ 40,395	
Net pension liability	\$ 2,246,364	
Compensated Absences	\$ 169,725	
TOTAL LIABILITIES	\$ 2.456.484	

The District continues to run smoothly and independently from the county. We remain fiscally conservative and utilize a transparent approach. This year we saw implementation of a new payroll system as well as a successful filing of a clean annual audit.

Additionally, staff members and Board of Trustee members worked on creating a new strategic plan for the District. The 2019-2022 Strategic Plan was adopted in November. Staff is currently working on various department assignments and projects as well as Capital Improvements. This was a successful experience and will support planning for the future growth of the district.

2018-2019 REVENUES				
Property Taxes	\$ 1,309,621	47.39%		
Assessments	\$ 1,366,568	49.45%		
Interest & Miscellaneous	\$ 87,408	3.16%		
TOTAL REVENUE	\$ 2,763,597	100%		
2018-2019 EXPENDITURES				
Salaries and Benefits	\$ 1,934,594	71.82%		
Service and Supplies	\$ 727,746	27.02%		
Utility Expense	\$ 31,290	1.16%		
TOTAL EVDENIDITURES	¢ 2 759 172	100%		

In Memoriam

100

10.00

1.00

1.00



Larry Mower Board Member

It is with deep sadness that we say goodbye to long-time Board Member (2008-2020) from the City of Anderson, Larry Mower. Mr. Mower dedicated himself to the District and we will always be thankful for his service and contribution.

"The true meaning of life is to plant trees and create shade where you do not necessarily expect to sit." - Nelson Henderson

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