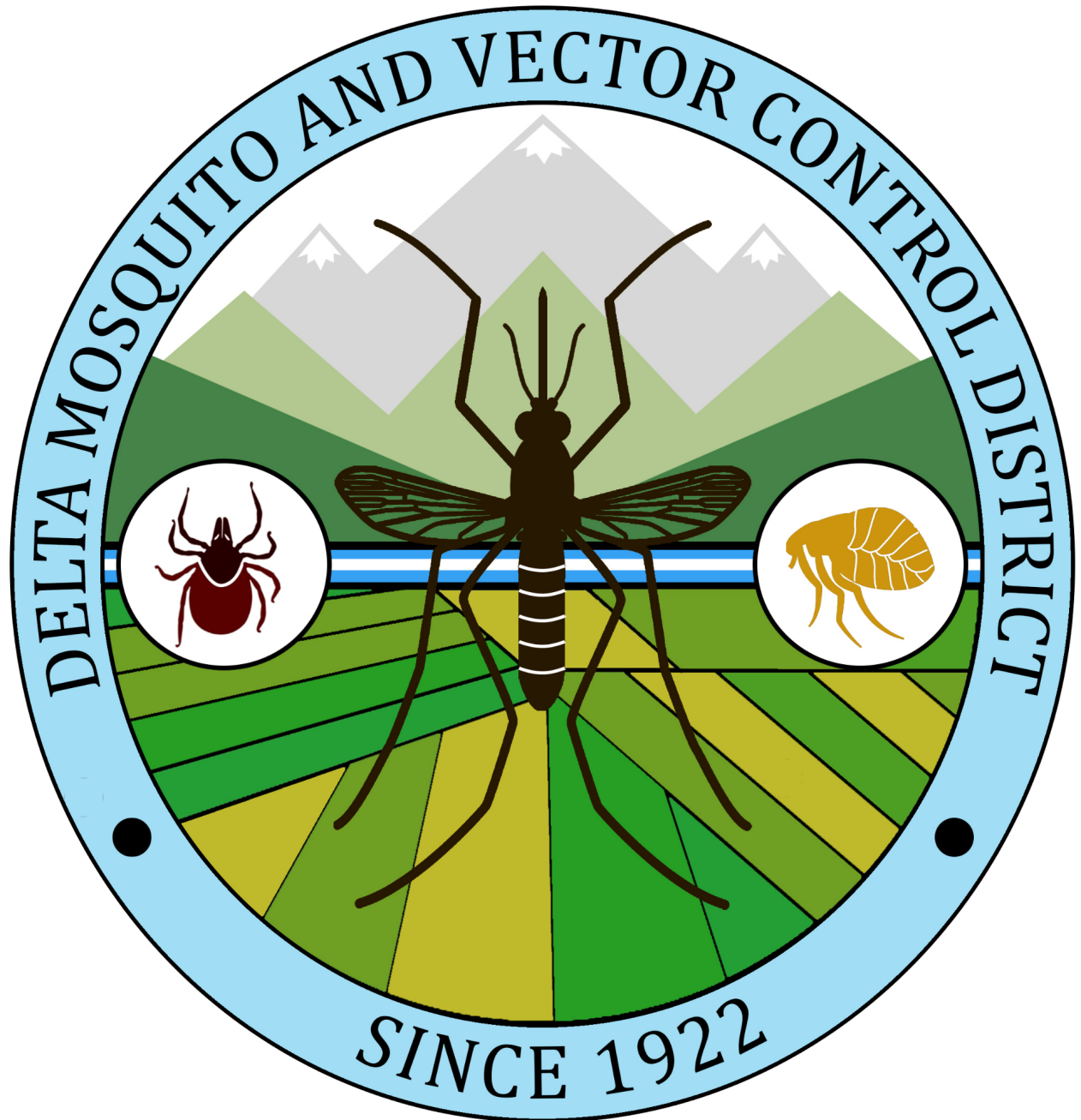


# 2021 DELTA MOSQUITO AND VECTOR CONTROL DISTRICT ANNUAL REPORT



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## 2021 AT A GLANCE

### Mosquito Abundance

Total Abundance: 154,143 mosquitoes collected

16 total mosquito species caught, the top 3 were:

76.0% *Culex quinquefasciatus* Say

10.7% *Aedes aegypti* (L.)

5.2% *Culex tarsalis*

### Dead Birds

Total Tested: 12

Of the 12 carcasses tested, 5 tested positive for West Nile virus.

### Control

Total Inspections: 45,699

3,856 Mosquitofish used to treat 161 sources.

554 Sources controlled with physical methods.

16,818 Chemical treatments were made.

### Service Requests

Total Service Requests: 907

313 Mosquito issues reported

198 Inspections requests

266 Potential mosquito-breeding sources reported

119 Mosquitofish requests

### Mosquito Samples Tested for Disease

Total Samples Tested: 3,052

278 samples tested positive for West Nile virus.

Four samples tested positive for St. Louis encephalitis virus.

*Mosquito samples may contain up to 50 mosquitoes.*

### Human Cases

Cases Reported: 4

Four human West Nile virus infections were reported within the District boundaries.

### Community Outreach & Education

Total Outreach Events: 15

Participants: 164

Radio Spots: 48

Newspaper Ads: 4

## ABOUT THE DISTRICT

The Delta Mosquito and Vector Control District (DMVCD) was established in 1922 to protect residents from malaria, a mosquito-borne disease that was common to the Central Valley then. The Visalia Women's Club played a key role in the formation of the District. Today, the District is responsible for control of mosquito vectors of West Nile virus (WNV), St. Louis encephalitis virus (SLEV), Western equine encephalitis virus (WEEV) Chikungunya, and Zika viruses. The District covers 712 square miles including the cities of Dinuba, Exeter, Farmersville, Visalia, and Woodlake, and the communities of Cutler, Orosi, Goshen, Ivanhoe, and Traver, all within Northern Tulare County.

### Our Vision

The DMVCD is the authority for vector control and vector-borne disease prevention in Northern Tulare County.

### Our Mission

The DMVCD is committed to protecting the public's health from vector-borne diseases and discomfort by delivering exceptional services which preserve and enhance the quality of life and desirability of the area to make northern Tulare County a safe place to live, work, and raise a family.

### Our Goals

1. Provide continual surveillance of mosquitoes to determine the threat of mosquito-borne disease transmission and annoyance levels.
2. Use safe, integrated vector management (IVM) methods to keep mosquito populations suppressed.
3. Promote cooperation and communication with property owners, residents, social and political groups, and governmental agencies.

### The Board of Trustees

As an independent special district, DMVCD serves its residents under the guidance of the Board of Trustees. The seven-member Board of Trustees consists of one resident from each of the incorporated cities in northern Tulare County and two representatives for the county-at-large.

Trustees are appointed by their respective City Council or the County Board of Supervisors to govern the District knowledgeably and effectively. Board members serve two or four-year terms according to the rules of their appointing body.

The regular Board meetings are held on the second Wednesday of each month at 1737 W. Houston Avenue in Visalia at 4:30 PM. The meetings are open to the public.

Board Member	Position	Representing
Greg Gomez	President	Farmersville
Belen Gomez	Secretary	Woodlake
Kevin Caskey	Trustee	County-at-large
Linda Guttierrez	Trustee	County-at-large
Larry Roberts	Trustee	Dinuba
Rosemary Hellwig	Trustee	Exeter
Michael Cavanagh	Trustee	Visalia

## District Personnel

### Administration

Dr. Mustapha Debboun, *General Manager*  
Mir Bear-Johnson, *Assistant Manager*  
Sheri Davis, *Administrative Assistant*  
Mary Ellen Gomez, *Administrative Analyst I*

### Public Relations

Erick Arriaga, *Community Education and Outreach Coordinator*

### Laboratory

Crystal Grippin, *Scientific Program Manager*  
Javier Valdivias, *Biologist*  
Mark Nakata, *Biologist*  
Andrea Troupin, *Biologist*

### Operations

Hector Cardenas, *Operations Program Manager*  
Paul Harlien, *Foreman*  
Rick Alvarez, *Supervisor of House Mosquito Program*  
Bryan Ruiz, *Vector Control Technician III*  
Bryan Ferguson, *Vector Control Technician III-Mechanic*  
Mario Sanchez, *Vector Control Technician III-Mechanic*

## 2021 Retirements

The District acknowledges the following individual for his dedication to serving District residents and wishes him the best during his retirement.

Employee	Position	Years of Service
Mark Dynge	System Administrator	16

## Professional Associations

Delta Mosquito and Vector Control District participates in various professional organizations that promote best practices in vector and vector-borne disease control, research, and management of special districts. The District is a member of Mosquito and Vector Control Association of California (MVCAC), American Mosquito Control Association (AMCA), Society for Vector Ecology (SOVE), Entomological Society of America (ESA), National Association of County and City Health Officials (NACCHO), California Special District Association (CSDA), and the Tulare County Health Emergency Coalition (TCHEC).

## Publications, Presentations, and Posters

Morphological variance of *Aedes aegypti* mosquito populations in Northern Tulare County. 2021. *AMCA and MVCAC*.

**Jesse Erandio**, Crystal Grippin, Mark Nakata, Javier Valdivias, Mir Bear-Johnson, Mustapha Debboun

Reducing *Aedes aegypti* production among residents with a history of continued production. 2021. *AMCA and MVCAC*.

**Crystal Grippin**, Javier Valdivia, Jesse Erandio, Mark Nakata, Mir Bear-Johnson, Mustapha Debboun

*Aedes aegypti* in 2020: Potential source preference. *AMCA and MVCAC*.

**Crystal Grippin**, Javier Valdivias, Jesse Erandio, Mark Nakata, Mir Bear-Johnson, Mustapha Debboun

Inside look at the \$1,000,000 mosquitofish rearing facility at Delta Mosquito and Vector Control District. 2021. *MVCAC*.

**Mark Nakata**, Crystal Grippin, Mir Bear-Johnson, Mustapha Debboun

“*Aedes Juice*” as an effective oviposition attractant for ovicups. 2021. *MVCAC*.

**Javier Valdivias**, Jesse Erandio, Crystal Grippin, Mark Nakata, Mir Bear-Johnson, Mustapha Debboun.

The WALs to the cemetery: Examining efficacy under field conditions. 2021. *MVCAC*.

**Crystal Grippin**, Javier Valdivias, Jesse Erandio, Paul Harlien, Tim Christian, Bryan Ruiz, Mir Bear-Johnson, Mustapha Debboun.

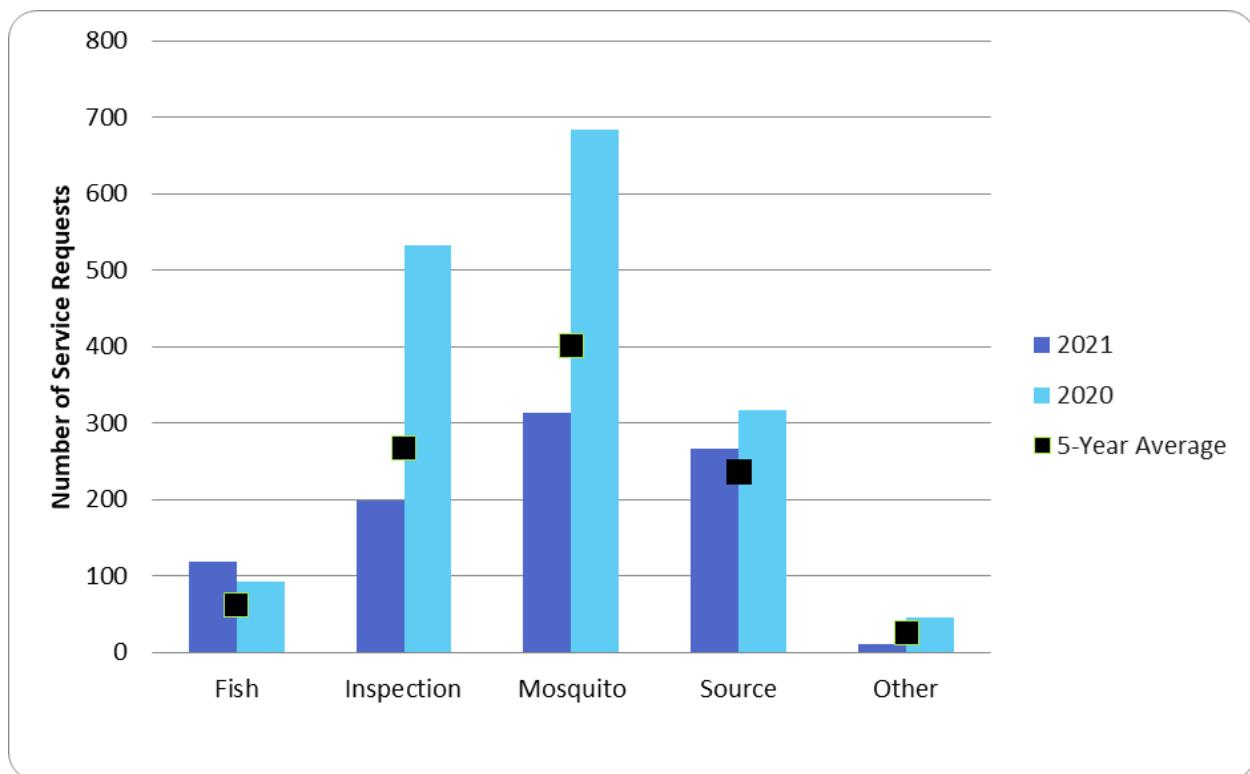
Stability of West Nile virus in lysis solution and its implication on One Health. *One Health Implement Res* 2021;2:56-65.

**Erandio JJC**, Debboun M.

## SERVICE REQUESTS

The District provides services directly to residents in addition to routine surveillance and control efforts. Services include inspecting properties for mosquito-breeding sources, mosquitofish for front and backyard water features, and investigating reports of increased mosquito activity or standing water.

There were 907 service requests in 2021. This was a 68% increase over the previous five-year average but a 46% decrease from 2020. Part of this decrease was due to increased resident understanding of the invasive *Aedes aegypti* mosquito. *Aedes aegypti* are aggressive, day-biting mosquitoes that prefer to lay their eggs in small, man-made containers, allowing them to thrive in common front and backyard environments. The number of mosquitofish requests has continued to be greater than the five-year average, indicating an increase in the awareness of their use as an important control method for front and backyard water features. The number of requests for inspections and reports of mosquitoes were both lower than the five-year average. (Figure 1)

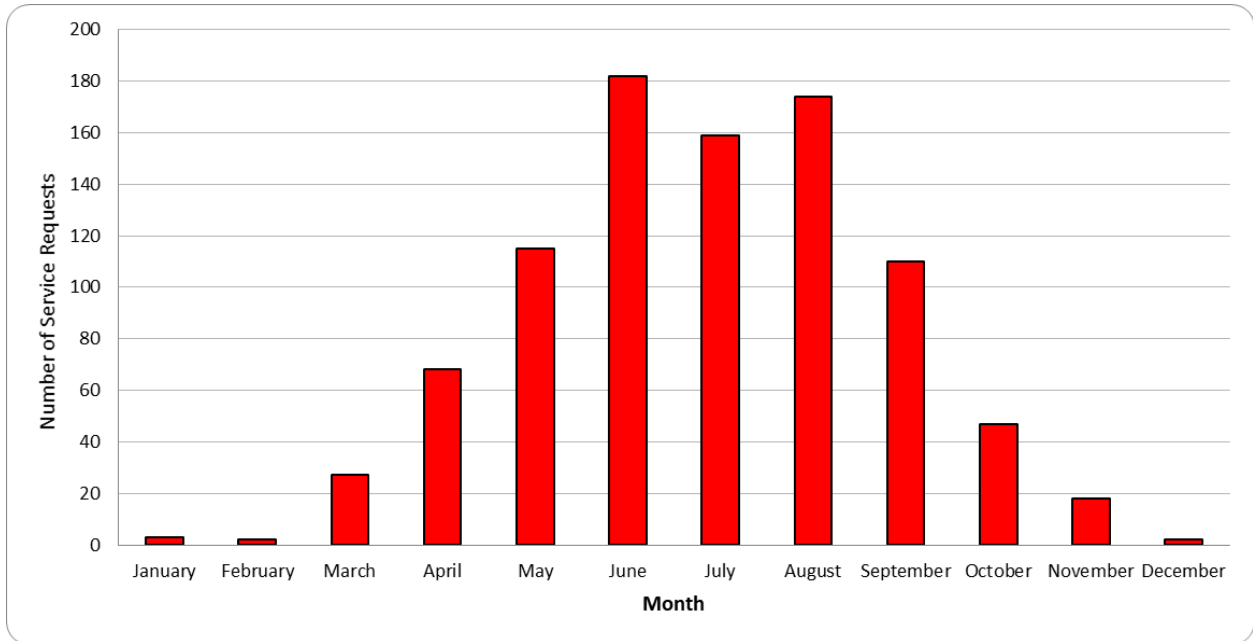


**Figure 1. Service requests by category in 2020 and 2021 compared to the five-year average.**

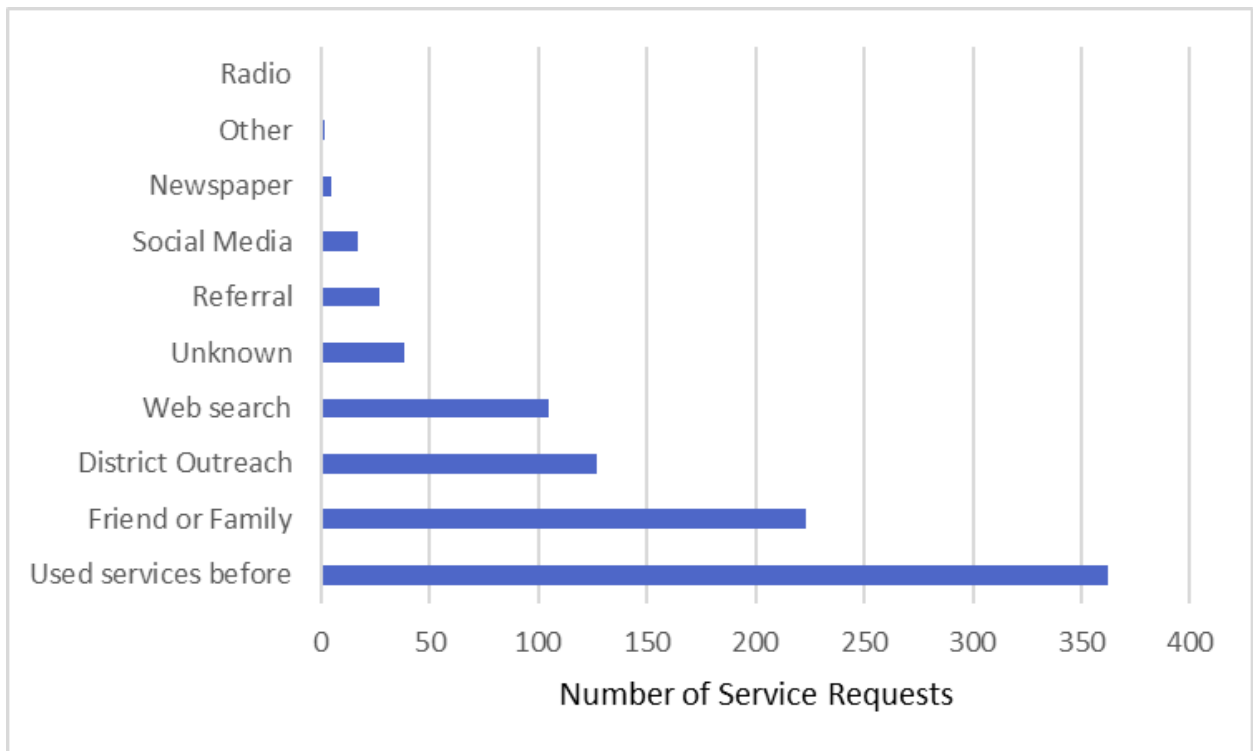
Although service requests were received every month, the majority were between June and August (Figure 2). This corresponds to the warmest summer temperatures of the year in the District. Warm weather increases mosquito abundance, leading to an increase in service requests during the hot summer months. The majority of households who requested services



had used District services before. This was closely followed by households who had heard about DMVCD through friends and family (Figure 3).



**Figure 2. Monthly service requests in 2021.**



**Figure 3. Individuals who requested services learned about DMVCD through a variety of ways.**

## INTEGRATED VECTOR MANAGEMENT (IVM)

The DMVCD uses evidence-based IVM principles to protect residents from vectors and vector-borne diseases. The IVM combines surveillance, control, and community outreach techniques to improve the effectiveness, ecological soundness, and sustainability of vector control programs.

### Surveillance

The District monitors vector abundance and arbovirus activity through a variety of adult mosquito traps and by testing mosquitoes and dead birds for WNV, SLEV, and WEEV. Human cases are also reported and investigated alongside the Tulare County Public Health Department.

Districtwide, the average number of female mosquitoes per trap night was 22.3 for the 2021 mosquito season. Female mosquitoes can transmit diseases of public health importance because they require a blood meal to lay eggs. During 6,928 collections, the District caught a total of 154,143 mosquitoes, of which 94.3% were female (Table 1). Of the 16 mosquito species represented, *Culex quinquefasciatus* contributed the most to total mosquito abundance at 76.0% followed by *Aedes aegypti* at 10.7% and *Culex tarsalis* at 5.2%.

**Table 1. Adult mosquito abundance by sex and species in 2021.**

SPECIES	FEMALES	MALES	TOTAL
<i>Culex quinquefasciatus</i>	114,879	2,193	117,072
<i>Aedes aegypti</i>	10,288	6,162	16,450
<i>Culex tarsalis</i>	7,847	244	8,091
<i>Culex stigmatosoma</i>	3,743	114	3,857
<i>Anopheles freeborni</i>	3,686	7	3,693
<i>Culex erythrothorax</i>	2,944	1	2,945
<i>Anopheles franciscanus</i>	1,349	1	1,350
<i>Culex thriambus</i>	199	1	200
<i>Aedes melanimon</i>	135	0	135
<i>Anopheles punctipennis</i>	132	0	132
<i>Culiseta particeps</i>	77	0	77
<i>Aedes vexans</i>	66	0	66
<i>Aedes nigromaculis</i>	42	0	42
<i>Culiseta inornata</i>	16	2	18
<i>Culiseta incidens</i>	11	0	00
<i>Aedes sierrensis</i>	3	1	4
<b>TOTAL</b>	<b>145,417</b>	<b>8,726</b>	<b>154,143</b>

Vector control technicians collected 720 larval samples. Of these, 384 were collected to identify the species present and 336 to monitor control efforts. *Culex stigmatosoma* was identified in 40.1% of mosquito samples followed by *Cx. tarsalis* at 21.9%, and *Cx. quinquefasciatus* at 19.8% (Table 2). None of the mosquito larvae collected to monitor control efforts showed resistance to the treatment.

**Table 2. Mosquito species identified in larval samples in 2021.**

SPECIES	SAMPLES	PERCENT of SAMPLES
<i>Culex stigmatosoma</i>	172	40.1
<i>Culex tarsalis</i>	94	21.9
<i>Culex quinquefasciatus</i>	85	19.8
<i>Aedes aegypti</i>	46	10.7
<i>Aedes nigromaculis</i>	19	4.4
<i>Culex thriambus</i>	4	0.9
<i>Aedes melanimon</i>	3	0.7
<i>Aedes vexans</i>	2	0.5
<i>Culex erythrothorax</i>	2	0.5
<i>Aedes sierrensis</i>	1	0.2
<i>Anopheles franciscanus</i>	1	0.2

Every mosquito sample contains 10 to 50 female mosquitoes of a single species that were caught in the same trap. The four *Culex* species tested are *Cx. quinquefasciatus*, *Cx. tarsalis*, *Cx. stigmatosoma*, and *Cx. erythrothorax*. A total of 3,052 mosquito samples composed of 115,839 individual mosquitoes were tested in 2021. While no samples were positive for WEEV, 278 tested positive for WNV (Figure 4) and four for SLEV (Figure 5).

In 2021, 46 dead birds were reported to the District. Of those, 12 were viable for disease testing. Dead bird carcasses are considered testable only if they have died within the past 48 hours, have no obvious physical trauma that led to death, and are of an accepted species for testing. Of the 12 birds tested, 5 were positive for WNV (Figure 6).

The Tulare County Public Health Department reported four human arbovirus infections to the District in 2021.

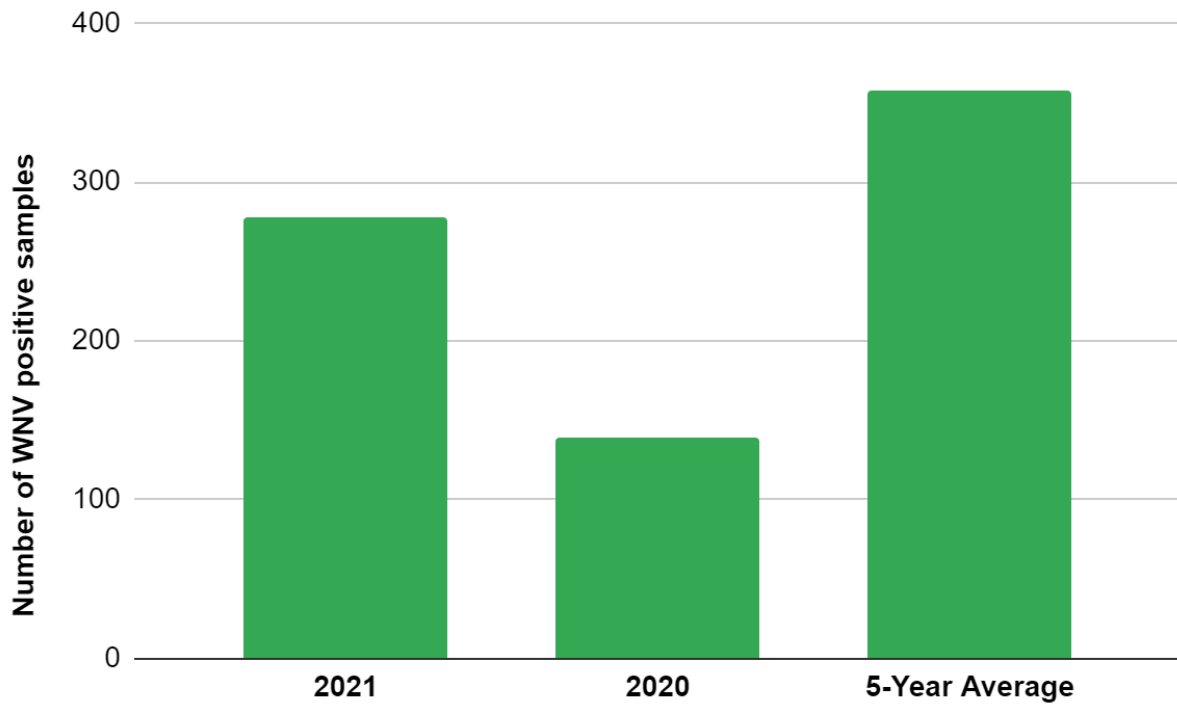


Figure 4. Mosquito samples positive for WNV, i.e., 2021, 2020, and 5-year average.

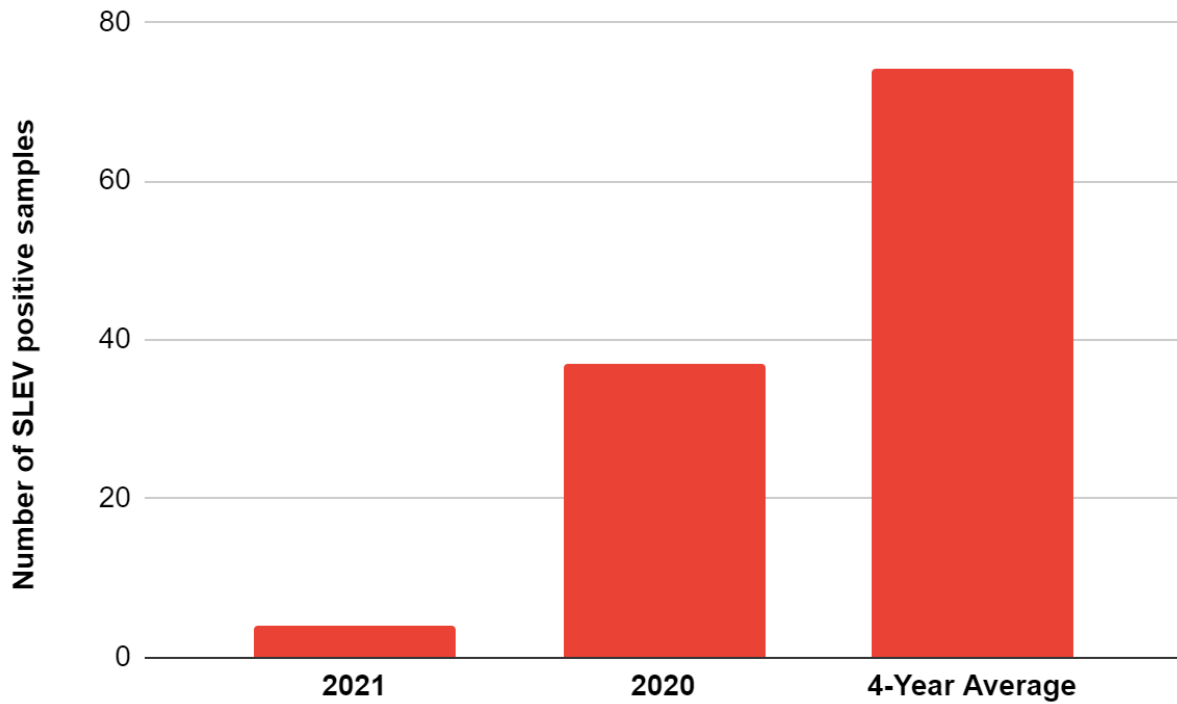


Figure 5. Mosquito samples positive for SLEV, i.e. 2021, 2020, and 4-year average.

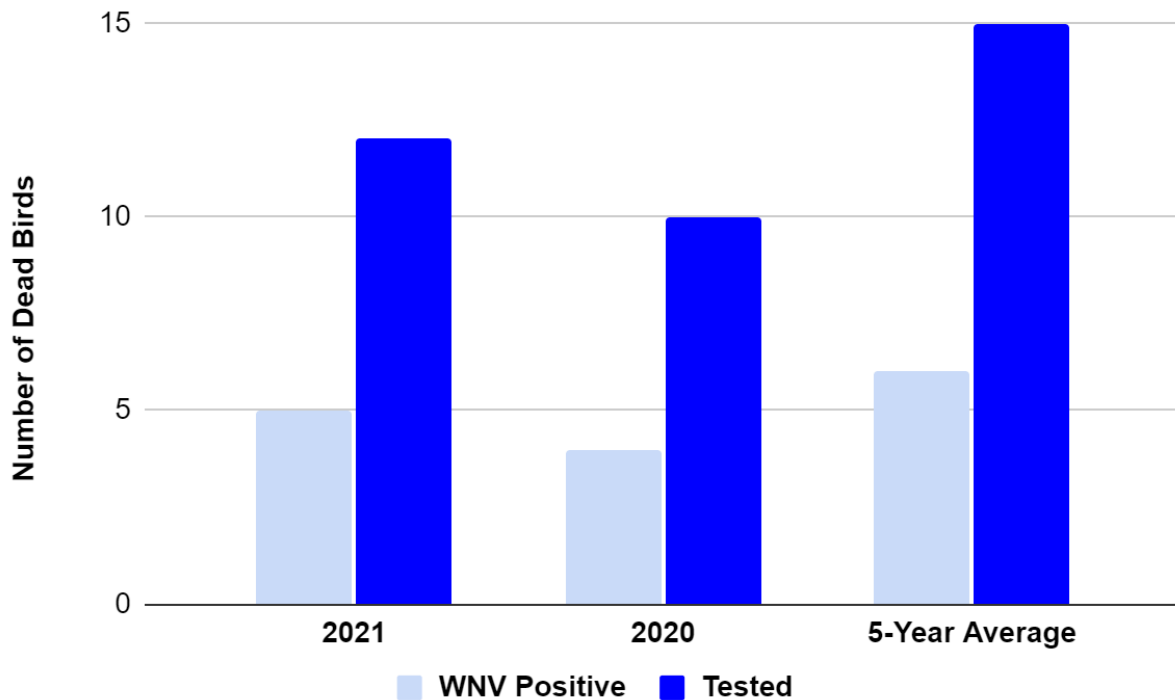


Figure 6. Number of dead birds tested and positive for WNV, i.e. 2021, 2020, and 5-year average.

## Control

Delta Mosquito and Vector Control District's mosquito control program is prevention focused, relying on the early identification and control of larval mosquito sources to reduce the biting adult mosquito populations. Physical, biological, and chemical control methods are used to control larval sources, allowing for mosquito-specific control. The vast majority of the District's mosquito control program consists of larval-based control. Mosquito larviciding is both efficient and cost effective. Larval based control eliminates mosquito larvae before they develop into mosquitoes that are capable of transmitting mosquito-borne diseases to humans. Larval based products used to control mosquito larvae are target specific, i.e., they have minimal to no effects on non-target organisms. However, when adult mosquito populations become a threat to public health and transmit diseases such as WNV, the District takes measures to control adult mosquitoes by conducting adult mosquito treatments to break the disease cycle in the population and continue with surveillance and larval based control.

The 2021 season implemented the integration of the "Aedes Program" and the "House Mosquito Program" to the new "Urban Mosquito Program". The Urban Mosquito Program main focus is to reduce the mosquito populations of both native and invasive

species of mosquitoes in urban locations throughout the District's jurisdiction. Surveillance trapping efforts allow operations to make scientific based decisions on the use of resources to reduce arbovirus disease risk and high mosquito population. In addition, operations have added the use of "Wide Area Larviciding" techniques completing 7 applications covering a residential area of 63.5 acres per treatment to reduce invasive mosquito populations.

In 2021, technicians controlled 3,113 (13.11%) mosquito-breeding sources out of 23,741 known or historical mosquito sources inspections (Table 2). Catch basins were treated monthly during the high mosquito season (Table 2) In accordance with IVM principles, a variety of control methods were used to control mosquito-breeding sources and prevent insecticide resistance in mosquitoes (Table 3).

**Table 2. Total sources and treatments of catch basins and historical sources in the District in 2021.**

SOURCE TYPE	TOTAL SOURCES	TREATED	INSPECTIONS
Catch Basins	13,037	59,166	59,166
Historical Sources	2,465	3,113	23,741

Mosquitofish, *Gambusia affinis*, are a large component of maintaining permanent water sources such as ponds and troughs. In 2021, the District's Alburn Fish Hatchery produced 9,544 mosquitofish. Of these, 3,856 were used to treat 161 mosquito-breeding sites in 2021 (Table 3). Free mosquitofish are available to residents by request.

**Table 3. Operational data for control efforts in 2021.**

<b>PHYSICAL CONTROL OPERATIONS</b>	<b>2021</b>	<b>2020</b>
Number of sources	**	554
<b>MOSQUITOFISH OPERATIONS</b>		
Number of sites stocked	161	184
Number of fish used	3,856	3,214
<b>ADULTICIDE OPERATIONS</b>		
Number of operations	12	5
Pyronyl 525 (oz)	4,859	2,961.1
<b>SURFACE AGENTS</b>		
Agnique Liquid (oz)	424.8	666.5
BVA2 larvicide (gallons)	5,867.5	4,492.8
<b>BIORATIONAL LARVICIDES</b>		
<b><i>Bacillus thuringiensis israelensis (Bti)</i></b>		
VectoBac 12AS (oz)	30454.45	140,974
VectoBac G (lb)	40	41
VectoBac GR (lb)	0	40
VectoBac WDG (lb)	74	88
<b><i>Bacillus sphaericus (Bs)</i></b>		
VectoLex Granules (lb)	15	45
VectoLex WSP (each)	351	1,512
<b><i>Bti and Bs</i></b>		
FourStar 180 (each)	99	7
<b>Spinosad</b>		
Natular 2EC (oz)	926.85	853
Natular DT (each)	0	237
Natular G30 (lb)	18.25	31.9
Natular XRT(each)	46	0
<b>Insect growth regulator (methoprene)</b>		
Altosid Briquets (each)	147	164
Altosid Liquid (oz)	488.14	1,148
Altosid Pellets WSP (each)	57,726	69,572
Altosid Sand Mix (lb)	618.58	695.5
Altosid XRG (lb)	498.33	482
MetaLarv XRP (each)	1,394	00

\*\* Data for 2021 was not quantifiable due to the implementation of a new data record system Fieldseeker.

## Community Education and Outreach

The goal of community education and outreach is to increase resident participation in preventing nuisance biting and vector-borne diseases by educating residents to reduce mosquito-breeding water sources and use the appropriate personal protective measures to reduce mosquito bites.

In 2021, the District staff had a booth at the Baseball Rawhide Ballpark, Kaweah Farmer's Market, and provided presentations to the Visalia Public Cemetery Board, Visalia Breakfast Lions Club, Visalia City, and Woodlake City Councils. In total, 164 adults and children were reached. Staff also participated in an Instagram interview with San Gabriel Mosquito and Vector Control District.

The District website, [www.deltamvcd.org](http://www.deltamvcd.org), was updated and relaunched in early 2020. The new website increased information for residents on vector control, prevention, and what the District does. In addition to Frequently Asked Questions and downloaded brochures in both English and Spanish, residents are able to find reliable, relevant information that is updated weekly on mosquito trapping, and disease testing.

Radio advertising began earlier in the season in May and ended in August. Similar to previous years, messaging focused on reducing mosquito-breeding sources and bite prevention. In total, 48 thirty-second radio spots in English were aired on one local radio station. Additionally, 4 print advertisements were placed in The Good Life, a local newspaper whose senior audience is at high risk of neuroinvasive WNV infections. Finally, District trucks had magnets with prevention messages placed on their tail gates (Figure 7). Through routine staff activities, the truck magnets provide access to key prevention messages across the District including rural areas where traditional media may not reach.

### PREVENT THE BITE DAY & NIGHT!



**TIP**

standing water weekly



**TOSS**

unused containers



**REPEL**

with EPA-registered insect repellents

**Figure 7. Rural areas across the District received key prevention messages with banner style truck magnets placed on District vehicles.**



Delta Mosquito and Vector Control District distributed 13,600 newspaper insert leaflets by N&R Publications through the Visalia Times-Delta, Mid-Valley Times, Foothills Sun Gazette, and Tulare County Farm Bureau (Figure 8). The leaflet teaches residents about basic mosquito biology, mosquito-bite prevention, and identification of common front and backyard mosquito-breeding sources. These insert leaflets were distributed through local newspapers.

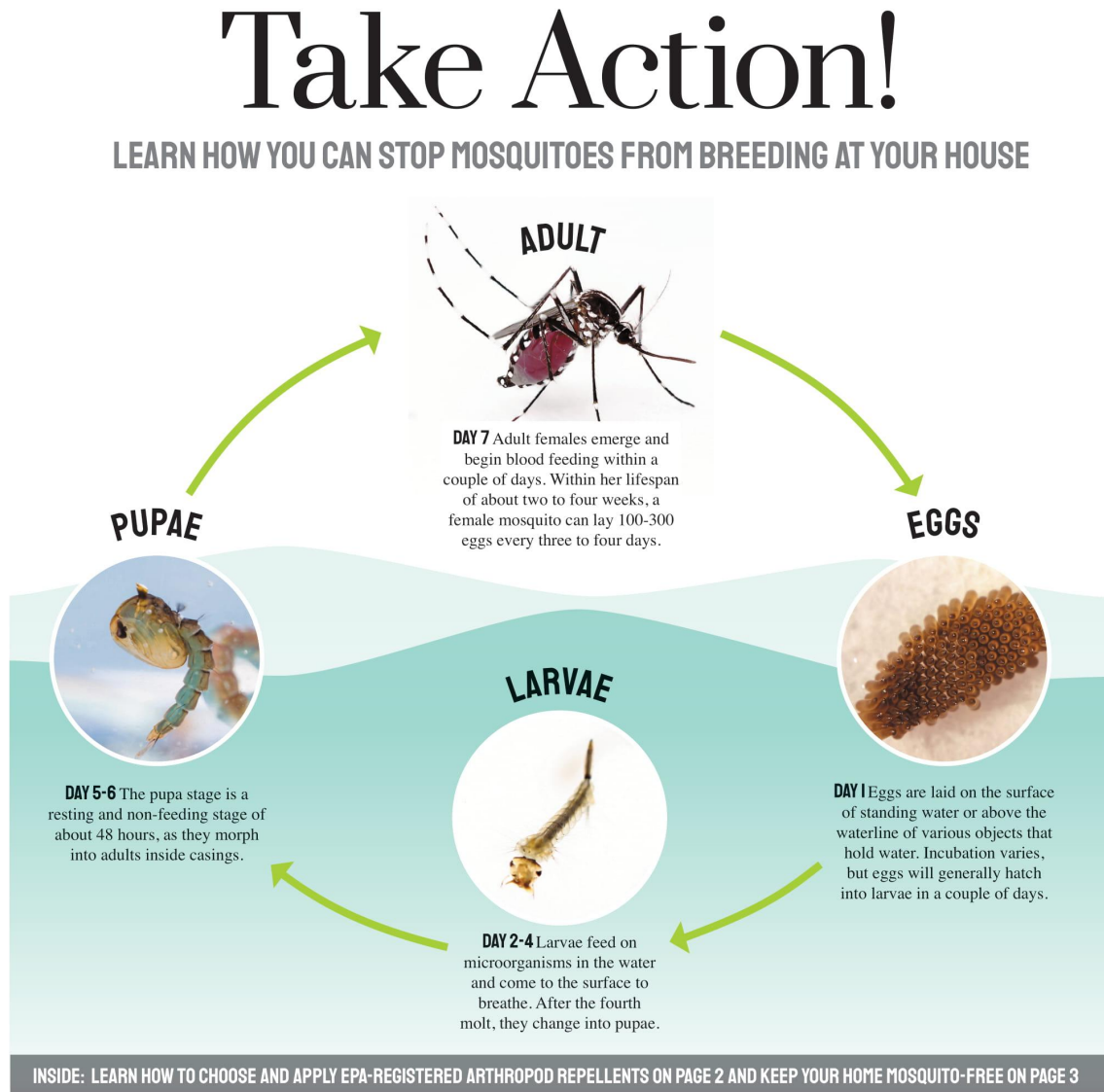


Figure 8. An insert leaflet that was distributed to District residents through local newspapers.

# Financial Reports

## Budgetary Comparison Schedule General Fund

Fiscal Year ended June 30, 2021

	Budgeted Amounts			Variance with
	Original	Final	Actual	Final Budget
<b>REVENUES</b>				
Property Taxes:				
Current secured	\$ 2,349,145	\$ 2,349,145	\$ 2,453,469,	\$ 104,324
Current unsecured	135,116	135,116	146,449	11,333
Prior secured	47,655	47,655	60,401	12,746
Prior unsecured	1,818	1,818	1,622	(196)
State homeowner's property				
tax relief	18,644	18,644	18,375	(269)
Pass through income	334,988	334,988	466,940	131,952
Interest income	79,586	79,586	63,561	(16,025)
Charges for current services	6,953	6,953	12,352	5,399
Other governmental income	-	-	941	941
Assessments	-	-	17,663	17,663
Other income	-	-	30,652	30,652
Total Revenues	<u>2,973,905</u>	<u>2,973,905</u>	<u>3,272,425</u>	<u>298,520</u>
<b>EXPENDITURES</b>				
Current:				
Salaries and employee benefits	2,609,588	2,609,588	2,347,927	261,661
Services and supplies	737,195	737,195	702,118	35,077
Debt service	113,819	113,819	113,819	-
Capital outlay	133,801	133,801	697,992	(564,191)
Total expenditures	<u>3,594,403</u>	<u>3,594,403</u>	<u>3,861,856</u>	<u>(267,453)</u>
Excess (deficiency) of revenues				
over (under) expenditures	<u>(620,498)</u>	<u>(620,498)</u>	<u>(589,431)</u>	<u>31,067</u>
Net change in fund balance	<u>\$ (620,498)</u>	<u>\$ (620,498)</u>	<u>(589,431)</u>	<u>\$ 31,067</u>
Fund balance, July 1, 2020			<u>4,904,934</u>	
Fund balance, June 30, 2021			<u>\$ 4,315,503</u>	

## Governmental Fund Balance Sheet

	General Fund	Adjustments	Statement of Net Position
<b>ASSETS</b>			
Cash and cash equivalents	\$ 4,370,716	-	\$ 4,370,716
Accounts receivable	1,223	-	1,223
Capital assets, net of accumulated depreciation	-	3,985,214	3,985,214
Other post employment benefits asset	-	55,507	55,507
<b>Total Assets</b>	<b>4,371,939</b>	<b>4,040,721</b>	<b>8,412,660</b>
<b>DEFERRED OUTFLOWS OF RESOURCES</b>			
Pension deferrals	-	560,4341	560,4341
Other post employment benefits deferrals	-	28,003	28,003
<b>Total deferred outflows of resources</b>	<b>-</b>	<b>588,437</b>	<b>588,437</b>
<b>LIABILITIES</b>			
Accounts payable	30,387	-	30,387
Accrued expenses	11,344	-	11,344
Payroll liabilities	14,705	-	14,705
Accrued interest	-	31,614	31,614
Due in one year:	-		
Compensated absences	-	70,397	70,397
Lease payable	-	92,145	92,145
Due in more than one year	-		
Compensated absences	-	46,932	46,932
Lease payable	-	838,264	838,264
Net pension liability	-	2,152,355	2,152,355
<b>Total Liabilities</b>	<b>56,436</b>	<b>3,231,355</b>	<b>3,231,355</b>
<b>DEFERRED INFLOWS OF RESOURCES</b>			
Pension deferrals	-	119,294	119,294
Other post employment benefits deferrals	-	157,069	157,069
<b>Total deferred inflows of resources</b>	<b>-</b>	<b>276,363</b>	<b>276,363</b>
<b>FUND BALANCE/NET POSITION</b>			
Fund balance:			
Unassigned	4,315,503	(4,315,503)	-
<b>Total fund balance</b>	<b>4,315,503</b>	<b>(4,315,503)</b>	<b>-</b>
Net position:			
Net investment in capital assets	-	3,054,805	3,054,805
Unrestricted	-	2,381,786	2,381,786
<b>Total fund balance/net position</b>	<b>4,315,503</b>	<b>1,121,088</b>	<b>5,436,591</b>