
Marin/Sonoma

Mosquito and Vector Control

District



2025

Vector Surveillance Report

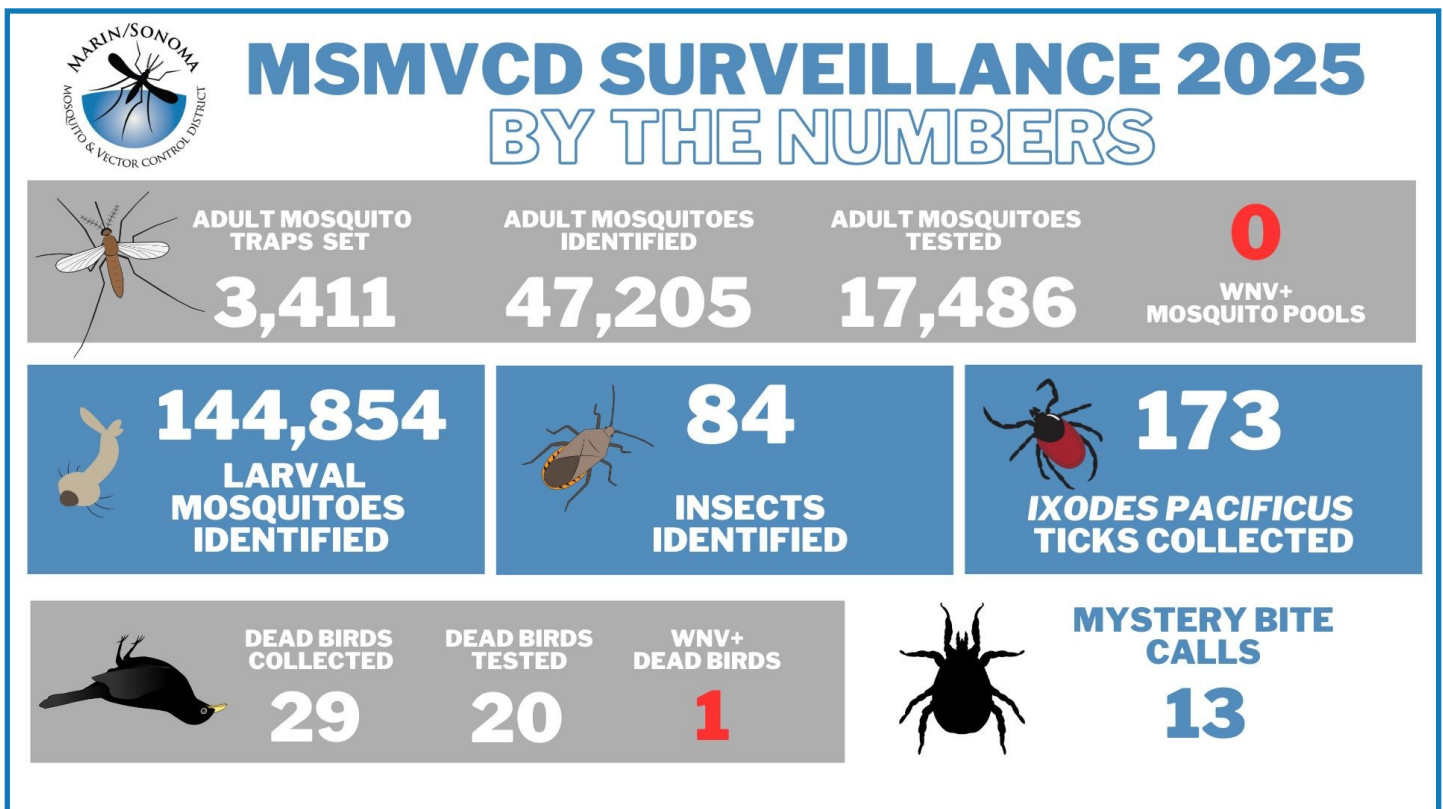
595 Helman Lane, Cotati, CA 94931

(707) 285 - 2200 | www.ms mosquito.org

Laboratory Program Overview

Programs and Activities

The laboratory at the Marin/Sonoma Mosquito and Vector Control District (the District) contributes to the District’s mission of protecting the health and welfare of the communities it serves in many ways. This includes monitoring the species distribution and abundance of vectors and vector-borne diseases, evaluating the efficacy of mosquito control materials and equipment, and providing support for operations staff in surveillance and control. On a regular basis, laboratory staff are busy working on a number of projects and activities. Operations staff bring in larval samples daily for the laboratory to identify, helping the District to know where and when different species are active, and when it is time to institute source reduction and/or treat sources with a larvicide. Members of the public also submit photos and specimens of insects for laboratory staff to identify. This year the District processed 84 submissions. In addition, laboratory staff work closely with the District’s Rodent Control Specialist on unique cases involving mystery biting incidents, with particular attention to the tropical rat mite, as they can cause a significant issue for the public. The infographic below shows the extensive work completed by the laboratory in 2025.



Laboratory Program Overview

Arbovirus Surveillance Program

The Marin/Sonoma Mosquito and Vector Control District (the District) maintains a multifaceted surveillance program for arboviruses, including West Nile virus (WNV), St. Louis encephalitis virus (SLEV), and western equine encephalitis virus (WEEV). The District utilizes active and passive surveillance techniques to detect and quantify the density of mosquito populations and the intensity of virus transmission in the region. This information is then used to predict areas of elevated disease risk and inform critical vector control interventions to effectively and efficiently protect human health. In 2025, the District re-introduced in house testing for these viruses.

Since 2014, the District has conducted enhanced invasive mosquito surveillance efforts. The invasive species *Aedes aegypti* and *Aedes albopictus* have expanded their range throughout California, reaching closer to our county borders every year. These mosquitoes are aggressive daytime biters, and can make it virtually impossible to enjoy outdoor activities. They can also transmit diseases that our native mosquitoes cannot, making them a potential threat to public health. Neither species has been found in Marin or Sonoma counties, but we need your help! Call if you're being bitten by any mosquitoes, and make sure to let us know if it's during the daytime!

Advancing our 3D-Printed Trap Series

Each year, the District deploys more than 300 gravid traps to monitor adult mosquito populations. These traps use nutrient-rich water to attract mosquitoes that are looking to lay eggs. They play a critical role in detecting West Nile virus (WNV) activity and have accounted for over half of all WNV-positive mosquito samples identified by the District. During the 2025 mosquito season, the District designed and tested a new, in-house 3D-printed version of this trap. The Furey 3000 Gravid Trap performed comparably to commercially available traps while costing significantly less to produce. Along with the previously developed Furey 3000 CO₂ Trap, this new tool highlights the District's commitment to innovation and the use of practical, cost-effective solutions to enhance mosquito surveillance and protect public health.



Laboratory Program Overview

Tick and Tick-Borne Disease

Surveillance Program

Throughout the year, District laboratory staff collect ticks of different species and life stages from trails in state, regional, and local parks and recreation areas around Marin and Sonoma counties. Ticks are collected by dragging a one meter square flannel flag on the ground and in the vegetation along trails. Collected specimens are identified and separated by species, sex, and life stages to be tested for pathogens when appropriate. The three main species collected by the District are *Dermacentor occidentalis* (the Pacific Coast tick), *Dermacentor similis* (the Western American dog tick), and *Ixodes pacificus* (the western black-legged tick).

Ixodes pacificus is the common tick species in the area that can transmit *Borrelia burgdorferi*, the bacterium that causes Lyme disease. Adults and nymphs of this species are tested for this pathogen, as well as *Borrelia miyamotoi*, which is a bacteria that causes a relapsing fever-type illness. This bacteria has been found in *I. pacificus* throughout the state, including in Marin and Sonoma counties. In 2022, California’s first human case of disease linked to *B. miyamotoi* was identified in Marin County. *I. pacificus* also transmits the human pathogen *Anaplasma phagocytophilum*.



Staff conducting tick surveillance in Sonoma County

Tick species of Marin and Sonoma counties



Dermacentor occidentalis
Pacific Coast tick



Dermacentor similis
Western American dog tick



Ixodes pacificus
Western black-legged tick



Arbovirus Surveillance

Arbovirus Surveillance Program

In 2025, 120 mosquito pools* from Marin County and 622 pools from Sonoma County were tested for WNV, SLEv, and WEEv. WNV was not detected in any mosquito pools tested in either county in 2025.

A total of 29 dead birds were collected, of which 20 were suitable for WNV testing. One bird from Sonoma County tested positive for WNV in 2025.

This year, the District re-introduced in-house testing of mosquito pools utilizing a multiplex real-time polymerase chain reaction (PCR) assay. 197 of the 742 pools tested were done by District laboratory staff.

*Female mosquitoes of the same species collected in the same trap are pooled by species (up to 50 per tube) to be tested for the presence of WNV, SLEv, and WEEv.

County	Species	# of Pools
Marin	<i>Culex erythrothorax</i>	68
	<i>Culex pipiens</i>	17
	<i>Culex stigmatosoma</i>	22
	<i>Culex tarsalis</i>	13
Sonoma	<i>Culex erythrothorax</i>	199
	<i>Culex pipiens</i>	110
	<i>Culex stigmatosoma</i>	220
	<i>Culex tarsalis</i>	111

WNV detection 2004 - 2025				
Year	Humans	Dead Birds	Mosquito Pools*	Sentinel Chickens
2004	0	72	1	0
2005	1	92	0	0
2006	1	29	5	0
2007	1	23	1	0
2008	0	12	2	0
2009	0	N/A	0	0
2010	0	N/A	0	0
2011	0	N/A	2	0
2012	0	28	3	1
2013	2	46	5	3
2014	0	43	12	3
2015	1	14	12	0
2016	0	13	2	N/A
2017	0	6	1	N/A
2018	0	0	1	N/A
2019	0	0	0	N/A
2020	0	1	0	N/A
2021	0	1	2	N/A
2022	0	1	0	N/A
2023	1	18	6	N/A
2024	0	0	0	N/A
2025	0	1	0	N/A

N/A indicates that testing was not conducted

West Nile Virus Dead Bird Hotline

The California Department of Public Health runs a hotline that residents from any county in the state can call when they find a dead bird. If you find one, please let them know! When birds are the right species in the right conditions, the District can have them tested for WNV. Visit westnile.ca.gov for more info.



Executive Summary

Tick and Tick-Borne Disease

Surveillance Program

In 2025, staff from the District visited seven parks in 12 sampling events, resulting in 70 *Ixodes pacificus* adults and 103 *I. pacificus* nymphs collected for testing. A multiplex real-time polymerase chain reaction (PCR) assay was used to test these ticks for two bacteria: *Borrelia burgdorferi* (the causative agent of Lyme disease) and *Borrelia miyamotoi* (a related bacterium that can cause a relapsing fever-type illness). Nymphal ticks were tested individually, while adult ticks were pooled by collection date, location, and sex. A maximum of five ticks were placed in each pool. In previous years, nymphal ticks were tested in pools as well. Therefore overall infection prevalences for both counties are presented below as Minimum Infection Prevalence (MIP).

Minimum Infection Prevalence (MIP) = (number of positive tick pools/total ticks tested)*100

Ixodes pacificus testing for *Borrelia burgdorferi*: 2008 - 2025

County	Total Adults Tested	Minimum Infection Prevalence	Total Nymphs Tested	Minimum Infection Prevalence
Marin	7,971	2.10%	2,723	4.08%
Sonoma	9,558	1.54%	2,677	4.07%
Overall	17,529	1.79%	5,400	4.07%

Ixodes pacificus testing for *Borrelia miyamotoi*: 2016 - 2025

County	Total Adults Tested	Minimum Infection Prevalence	Total Nymphs Tested	Minimum Infection Prevalence
Marin	2,968	1.28%	1,113	1.35%
Sonoma	3,230	0.71%	834	1.08%
Overall	6,199	0.98%	1,947	1.23%

2025 Overview

Marin County: Four nymphs tested positive for *Borrelia burgdorferi*. Five nymphs tested positive for *Borrelia miyamotoi*.

Sonoma County: Two pools of adults tested positive for *Borrelia burgdorferi*. No ticks tested positive for *Borrelia miyamotoi*.

Visit our website at www.msosquito.org/tick-surveillance for detailed information about cumulative tick collections at specific parks.



2025 Adult Tick Testing

Tick and Tick-Borne Disease

Surveillance Program

County	Park/Trail	Adults Tested (Pools)	<i>Borrelia burgdorferi</i>		<i>Borrelia miyamotoi</i>	
			(+) Pools	MIP	(+) Pools	MIP
Marin	Angel Island State Park	6 (2)	0	0.00%	0	0.00%
	N. Ridge Trail*	6 (2)	0	0.00%	0	0.00%
	Gary Giacomini Open Space Preserve	2 (2)	0	0.00%	0	0.00%
	Willis Evans Trail	2 (2)	0	0.00%	0	0.00%
	Indian Tree Open Space Preserve	8 (2)	0	0.00%	0	0.00%
	Big Trees Trail	8 (2)	0	0.00%	0	0.00%
	Marin Municipal Water District	1 (1)	0	0.00%	0	0.00%
	Shadyside Trail	1 (1)	0	0.00%	0	0.00%
	Roy's Redwoods Open Space Preserve	1 (1)	0	0.00%	0	0.00%
	Forest Trail*	0	N/A	N/A	N/A	N/A
	Loop Trail	1 (1)	0	0.00%	0	0.00%
	Total	18 (8)	0	0.00%	0	0.00%
Sonoma	North Sonoma Regional Park	27 (7)	2	7.41%	0	0.00%
	Umbrella Tree Trail	27 (7)	2	7.41%	0	0.00%
	Shiloh Ranch Regional Park	2 (1)	0	0.00%	0	0.00%
	Big Leaf Trail	2 (1)	0	0.00%	0	0.00%
	Sonoma Valley Regional Park	2 (1)	0	0.00%	0	0.00%
	Valley of the Moon Trail	2 (1)	0	0.00%	0	0.00%
	Spring Lake Regional Park	10 (2)	0	0.00%	0	0.00%
	Nature Trail	10 (2)	0	0.00%	0	0.00%
	Taylor Mountain Regional Park	11 (3)	0	0.00%	0	0.00%
	Red Tail Trail	11 (3)	0	0.00%	0	0.00%
Total	52 (14)	2	3.85%	0	0.00%	

Minimum Infection Prevalence (MIP) = (number of positive tick pools/total ticks tested)*100

* indicates site/trail not previously sampled



2025 Nymphal Tick Testing

Tick and Tick-Borne Disease

Surveillance Program

County	Park/Trail	Nymphs Tested	<i>Borrelia burgdorferi</i>		<i>Borrelia miyamotoi</i>	
			(+) Pools	IP	(+) Pools	IP
Marin	Angel Island State Park	0	N/A	N/A	N/A	N/A
	N. Ridge Trail*	0	N/A	N/A	N/A	N/A
	Gary Giacomini Open Space Preserve	0	N/A	N/A	N/A	N/A
	Willis Evans Trail	0	N/A	N/A	N/A	N/A
	Indian Tree Open Space Preserve	70	3	4.29%	3	4.29%
	Big Trees Trail	70	3	4.29%	3	4.29%
	Marin Municipal Water District	9	0	0.00%	0	0.00%
	Shadyside Trail	9	0	0.00%	0	0.00%
	Roy's Redwoods Open Space Preserve	22	1	4.55%	2	9.99%
	Forest Trail*	9	0	0.00%	0	0.00%
	Loop Trail	13	1	7.69%	2	15.38%
	Total	101	4	3.96%	5	4.95%
Sonoma	North Sonoma Regional Park	0	N/A	N/A	N/A	N/A
	Umbrella Tree Trail	N/A	N/A	N/A	N/A	N/A
	Shiloh Ranch Regional Park	N/A	N/A	N/A	N/A	N/A
	Big Leaf Trail	N/A	N/A	N/A	N/A	N/A
	Sonoma Valley Regional Park	N/A	N/A	N/A	N/A	N/A
	Valley of the Moon Trail	N/A	N/A	N/A	N/A	N/A
	Spring Lake Regional Park	2	0	0.00%	0	0.00%
	Nature Trail	2	0	0.00%	0	0.00%
	Taylor Mountain Regional Park	N/A	N/A	N/A	N/A	N/A
	Red Tail Trail	N	N/A	N/A	N/A	N/A
Total	2	0	0.00%	0	0.00%	

Infection Prevalence (IP) = (number of positive ticks/total ticks tested)*100

* indicates site/trail not previously sampled



Tick Safety Tips

Tick and Tick-Borne Disease

Surveillance Program

Before entering tick habitat, take the following precautions

- Consider applying an effective tick repellent to exposed skin that has one of the following EPA-registered active ingredients: DEET, picaridin, IR3535, oil of lemon eucalyptus (OLE), or para-menthane-diol (PMD).
- Consider pretreating clothing/personal outdoor equipment with a product labeled for tick protection, such as permethrin.
- It is important to read repellent and permethrin product labels carefully before applying.
- Wear light-colored clothing (making it easier to spot ticks).
- Wear long pants, long sleeves, and long socks whenever possible. This makes it more difficult for ticks to get to your skin.

While in tick habitat

- Stay on trails. Adult ticks are typically more abundant on uphill sides of trails.
- Avoid contact with nymphal habitats, including leaf litter, downed logs, and tree trunks.
- Periodically check people and animals for ticks.

After exiting tick habitat

- Check people and animals for ticks, promptly removing any that might be on clothing or skin.
- Tumble dry clothes in a dryer on high heat for 10 minutes to kill ticks.
- Shower after coming indoors and carefully check for ticks.
- Properly remove any attached ticks immediately.

How to properly remove a tick

- Ideally, use tweezers to grasp the head of the tick as close to the skin as possible.
- Pull upward with steady, even pressure. DO NOT twist or jerk the tick; this can cause the mouthparts to break off and remain in the skin. If this happens, remove the mouthparts with tweezers. If you are unable to remove the mouthparts easily with clean tweezers, leave it alone and let the skin heal.
- After removing the tick, thoroughly clean the bite area and your hands with rubbing alcohol or soap and water.
- Never crush a tick with your fingers. Dispose of a live tick by putting it in alcohol, placing in a sealed bag/container, wrapping it tightly in tape, or flushing it down the toilet.
- If redness or pain develops at the tick site, consult your physician.