Marin/Sonoma Mosquito and Vector Control District

2020
Vector Surveillance Report

595 Helman Lane, Cotati, CA 94931

(707) 285—2200; *www.msmosquito.org*

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 both 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 direct critical vector control interventions to effectively and efficiently protect human health.

Since 2014, the District has conducted enhanced surveillance to detect invasive *Aedes* mosquito species. In addition to larval and adult surveillance for the invasive *Aedes aegypti* and *Aedes albopictus,* the District also investigates travel-related cases of chikungunya, dengue and Zika viruses. All traps set around cases are checked for the presence of *Aedes* adult mosquitoes. All *Culex* adult mosquitoes collected in these areas are tested for all three viruses, though there is no evidence that local *Culex* spp. can transmit these viruses. As of 2020, no invasive *Aedes* mosquitoes have been identified in Marin or Sonoma counties.

Increased invasive *Aedes* surveillance

During the 2019 season, the invasive species Aedes aegypti *was found closer to our district borders than ever before. In response, our laboratory increased surveillance for these mosquitoes, particularly in the eastern portion of Sonoma County. The District set out additional BG Sentinel traps, which are specifically designed to attract and catch these aggressive, day-biting mosquitoes. Weekly collections this season thankfully showed no evidence of this new species. However, our neighboring counties weren't quite as lucky. In 2020, this species was detected for the first time in Yolo, Sutter, Butte and Shasta counties. The District will continue to survey all areas where this species might be found, but we need your help! Call and let us know if you're being bitten by mosquitoes, and make sure to let us know if it's during the daytime!*

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 variabilis* (the 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 bacteria 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. To date, no human cases of *B. miyamotoi* have been reported in California, but the bacteria has been found in *I. pacificus* ticks throughout the state, including in Marin and Sonoma counties. *I. pacificus* also transmits the human pathogen *Anaplasma phagocytophilum*. In 2020, the District collaborated with state health to test a subset of ticks for this bacteria.

District staff checking for ticks

5 male and 4 female *Ixodes pacificus* on a flag

EXECUTIVE SUMMARY

Arbovirus Surveillance Program

In 2020, 43 mosquito pools from Marin and 345 pools from Sonoma were tested for WNv, SLEv, and WEEv. No virus was detected in any mosquito pools* in either county. A total of 14 dead birds were reported, of which 10 were viable for WNv testing. One (1) bird from San Rafael in Marin County tested positive for WNv.

In 2020, local health departments informed the District of two (2) travel-associated probable cases of arthropod-borne diseases in Marin County and nine (9) in Sonoma. All mosquito pools collected during disease follow-ups were tested for chikungunya, dengue and Zika viruses, as well as WNv, SLEv and WEEv. All pools tested negative for all viruses.

Mosquito pools by species

Marin County	
Species	**Number of Pools**
Culex erythrothorax	14
Culex pipiens	15
Culex stigmatosoma	5
Culex tarsalis	9
Culex thriambus	0
Total	**43**

Sonoma County	
Species	**Number of Pools**
Culex erythrothorax	145
Culex pipiens	44
Culex stigmatosoma	94
Culex tarsalis	61
Culex thriambus	1
Total	**345**

WNv detection 2004—2020

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**

*N/A indicates that testing was not conducted

West Nile Virus Dead Bird Hotline

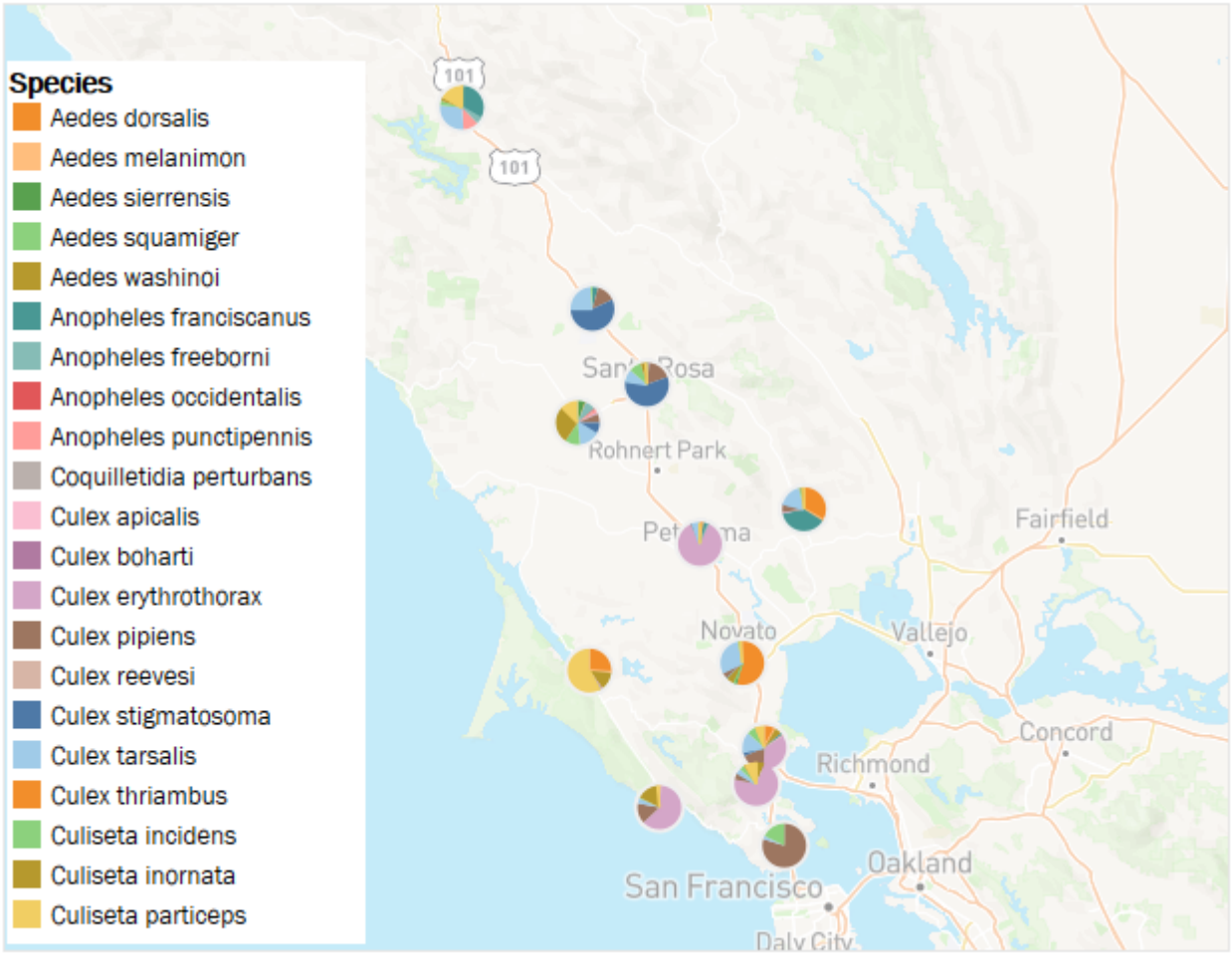
The California Department of Public Health runs a hotline that residents from any county in the state can call when they find a dead bird. If you find one, please let them know! When birds are the right species and in the right condition, the District can have them tested for WNv. Visit westnile.ca.gov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

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

ADULT MOSQUITO DISTRIBUTION

Arbovirus Surveillance Program

DID YOU KNOW: Even though most of our 23 species of mosquitoes are found throughout Marin and Sonoma counties, some are more prevalent in certain areas than others! Here we can see the number of adults of each species that were collected in certain cities in Marin and Sonoma counties in 2020. Notice any trends? You might see that *Culex erythrothorax* was quite abundant in Petaluma, whereas *Culex stigmatasoma* was the prevailing species in Santa Rosa during the 2020 season. Knowing this, we can target larval sources of these different species in different regions.



EXECUTIVE SUMMARY

Tick and Tick-Borne Disease Surveillance Program

In 2020, staff from the District sampled trails in state parks, regional parks, and the Marin Municipal Water District (MMWD) lands. A total of 20 sampling events occurred during the season, resulting in 1277 adult *Ixodes pacificus* and 58 *I. pacificus* nymphs being collected for testing. While lab staff were able to adapt to the changing regulations of 2020, surveillance was postponed from mid-March through May. This allowed the District and the parks time to develop appropriate COVID-19 site specific protection plans. Unfortunately this time period is also when nymphs of *I. pacificus* are most prevalent. For this reason, District staff did not collect as many nymphs in 2020 as have been collected in previous years. They are looking forward to increasing surveillance in the spring of 2021.

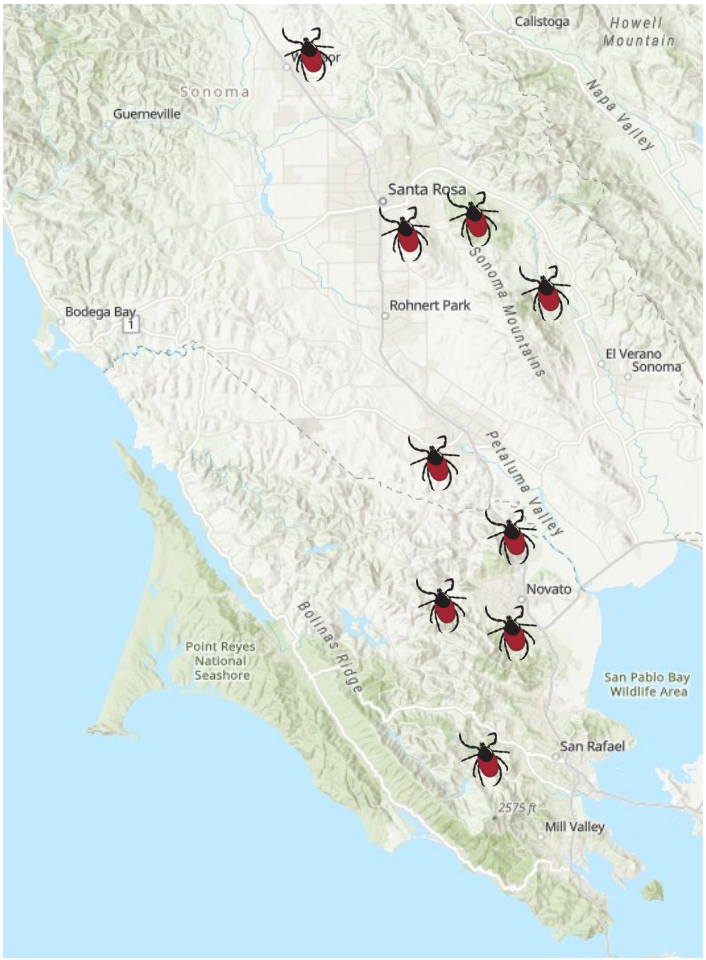
2020 Overview

Parks Sampled

10 pools of adult ticks and 2 nymphs from Marin County, and 5 pools of adult ticks from Sonoma County tested positive for *Borrelia burgdorferi* (pgs 7-8)

7 pools of adult ticks and 3 nymphs from Marin County, and 5 pools of adult ticks from Sonoma County tested positive for *Borrelia miyamotoi* (pgs 7-8)

44 pools of adults and 88 nymphs from Marin County collected in 2019 and 2020 were tested for *Anaplasma phagocytophilum*, in collaboration with the California Department of Public Health. 3 pools of adults and 2 nymphs tested positive for the bacteria



2020 ADULT TICK TESTING

Tick and Tick-Borne Disease Surveillance program

Of the 1277 adult *Ixodes pacificus* ticks tested in 2020, 15 pools tested positive for *Borrelia burgdorferi,* giving an overall minimum infection prevalence (MIP)* of 1.74% for Marin and Sonoma counties. The 10-year MIP for adult ticks in these counties is 1.92%.

Marin County parks and recreation areas had 10 *B. burgdorferi* positive pools out of 534 total adult ticks tested, for a MIP of 1.87%. The 10-year MIP for adult ticks in Marin County is 2.20%. Seven (7) adult tick pools tested positive for *Borrelia miyamotoi*, for a MIP 1.31%.

Sonoma County parks and recreation areas had five (5) *B. burgdorferi* positive pools out of 743 total adult ticks tested, for a MIP of 0.67%. The 10-year MIP for adult ticks in Sonoma County is 1.72%. Five (5) adult tick pools tested positive for *B. miyamotoi*, for a MIP of 0.67%.

Marin County

Park/Trail	Adults Tested	Pools Tested	*Borrelia burgdorferi s.l.*		*Borrelia miyamotoi*	
			Pos. Pools	MIP	Pos. Pools	MIP
Indian Tree OSP	**240**	**52**	**2**	**0.83%**	**2**	**0.83%**
Big Trees Trail	190	41	2	1.05%	2	1.05%
Fire Road	50	11	0	0.00%	0	0.00%
Indian Valley OSP	**112**	**26**	**1**	**0.89%**	**3**	**2.68%**
Pacheco Road	14	4	0	0.00%	0	0.00%
Susan Alexander Trail	8	2	0	0.00%	0	0.00%
Waterfall to Susan Alexander Trail	90	20	1	1.11%	3	3.33%
Marin Municipal Water District	**164**	**34**	**4**	**2.44%**	**0**	**0.00%**
Alex Forman Trail	164	34	4	2.44%	0	0.00%
Olompali State Park	**18**	**5**	**3**	**16.67%**	**2**	**11.11%**
Loop Trail	10	3	1	10.00%	2	20.00%
Miwok Trail	8	2	2	25.00%	0	0.00%
Overall	**534**	**117**	**10**	**1.87%**	**7**	**1.31%**

Sonoma County

Park/Trail	Adults Tested	Pools Tested	*Borrelia burgdorferi s.l.*		*Borrelia miyamotoi*	
			Pos. Pools	MIP	Pos. Pools	MIP
Annadel SP	**73**	**15**	**1**	**1.37%**	**2**	**2.74%**
Lawndale Trail	73	15	1	1.37%	2	2.74%
Foothill RP	**33**	**8**	**0**	**0.00%**	**0**	**0.00%**
Ravine Trail	15	4	0	0.00%	0	0.00%
Three Lakes Trail	8	2	0	0.00%	0	0.00%
Westside Trail	10	2	0	0.00%	0	0.00%
Helen Putnam RP	**158**	**35**	**1**	**0.63%**	**1**	**0.63%**
Filaree Trail	25	6	1	4.00%	0	0.00%
Filaree Trail/Pomo Trail	27	6	0	0.00%	1	3.70%
Pomo Trail	29	7	0	0.00%	0	0.00%
South Loop Trail	77	16	0	0.00%	0	0.00%
Jack London SP	**205**	**43**	**3**	**1.46%**	**2**	**0.98%**
Lake Rd/Lake Trail	88	19	1	1.14%	2	2.27%
Wolf House Ruins Trail	117	24	2	1.71%	0	0.00%
Taylor Mountain RP	**274**	**56**	**0**	**0.00%**	**0**	**0.00%**
Red Tail Trail	274	56	0	0.00%	0	0.00%
Overall	**743**	**157**	**5**	**0.67%**	**5**	**0.67%**

*MIP—Minimum Infection Prevalence = (number of positive tick pools/total ticks tested)*100; used when ticks are tested in pools up to 5

2020 NYMPHAL TICK TESTING

Tick and Tick-Borne Disease Surveillance Program

Due to COVID-19 regulations and county shelter in place orders in 2020, District staff suspended tick surveillance in both counties beginning in March. Upon completing required site-specific COVID-19 protection plans for each county, staff were able to resume tick surveillance in June. Unfortunately, the typical *Ixodes pacificus* nymph season is March through May in northern California. Therefore this season only 58 nymphs were collected in Marin County, and none were collected in Sonoma County. District staff are looking forward to increased surveillance in the spring of 2021.

Of the 58 nymphal *I. pacificus* ticks tested in 2020, two (2) tested positive for *Borrelia burgdorferi,* giving an overall infection prevalence (IP)* of 3.45% for Marin County. The 10-year MIP for nymphs in Marin County is 3.84%. Three (3) nymphs from Marin County tested positive for *Borrelia miyamotoi*, for an IP of 5.17%

The 10-year *B. burgdorferi* MIP for nymphs in Marin and Sonoma counties is 4.15%. The 10-year *B. burgdorferi* MIP for nymphs in Sonoma County is 4.43%^.

Marin County

Park/Trail	Nymphs Tested	*Borrelia burgdorferi s.l.*		*Borrelia miyamotoi*	
		Pos. Pools	IP	Pos. Pools	IP
Indian Tree OSP	**2**	**0**	**0.00%**	**0**	**0.00%**
Big Trees Trail	2	0	0.00%	0	0.00%
Indian Valley OSP	**1**	**0**	0.00%	0	0.00%
Waterfall to Susan Alexander Trail	1	0	0.00%	0	0.00%
Marin Municipal Water District	**55**	**2**	**3.64%**	**3**	**5.45%**
Alex Forman Trail	55	2	3.64%	3	5.45%
Overall	**58**	**2**	**3.45%**	**3**	**5.17%**

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

^2010 - 2019 10-year MIP is used here because no nymphs were collected in Sonoma County in 2020

Additional Tick Testing in 2020

In addition to the laboratory testing that the District conducted to identify Borrelia burgdorferi *and* Borrelia miyamotoi*, staff collaborated with the California Department of Public Health, Vector-borne Disease Section (VBDS) to test a subset of samples for* Anaplasma phagocytophilum. *This bacteria causes a febrile disease called anaplasmosis. Cases of this disease are diagnosed annually in California, and sporadically in Marin and Sonoma counties. VBDS staff tested 54 nymphs and 18 pools of 87 adult* Ixodes pacificus *ticks collected by the District in 2020. District staff also provided 34 nymphs and 26 pools of 130 adult ticks collected in 2019 for analysis. Overall 2 nymphs and 3 pools of adult ticks tested positive for* A. phagocytophilum*, with one pool of adults also testing positive for* Borrelia burgdorferi.

Q&A WITH THE SCIENTIFIC PROGRAMS MANAGER

Tick and Tick-Borne Disease Surveillance Program

Meet Dr. Kelly Liebman, Scientific Programs Manager at the District! Kelly has been studying and working with vector-borne diseases for more than 15 years. With an educational and professional background in public health and entomology, she joined the District in April 2018 after working as a biologist with the California Department of Public Health, Vector-borne Disease Section. While out and about in the counties, Kelly and our lab staff are commonly asked a number of interesting questions about what we do and why we do it. Here are the answers to some of those questions.

Q: What are you doing with that white flag? Surrendering?
A: As part of our tick surveillance program, we go out onto public trails and monitor ticks. To do this, we drag a white cloth along the trail for about 15 steps, then check it for ticks. The flannel fabric mimics animal hide (or human skin/clothes!), so ticks that are looking for a host will grab onto the cloth. The white color makes it easier for us to spot the tiny ticks.

Q: I have seen so many ticks this year! Is it a big tick year?
A: This is a question that we get every year. Unfortunately we don't have any data to be able to say if there are more ticks out one year compared to another. It's important to remember that there is variability on each trail from year to year. You may see a ton of ticks one year, and then virtually none the next! This unpredictability is why we emphasize the use of personal protective measures to avoid tick bites, even in areas you think might not have ticks.

Q: How do you protect yourself when you're out looking for ticks?
A: We follow the same suggestions that we recommend for the public. This includes using an EPA-registered repellent, wearing light-colored clothing with long sleeves/pants, and treating clothes and boots with permethrin. While we are at the park, we do our best to stay on the trails, though this can be tricky for us these days since we do like to move out of the way to keep 6 feet apart from other visitors. Because of this we do periodic tick checks while we are collecting. When we return to the office, we change our clothes and check for ticks. For more information on preventing tick bites, please see our website at www.msmosquito.org/tick-bite-prevention.

Q: Do all ticks carry the same diseases?
A: Not all ticks carry the same diseases. Here in Marin and Sonoma counties, the most prevalent pathogens are carried by the western black-legged tick, *Ixodes pacificus*.

Q: How has COVID-19 impacted the tick surveillance program?
A: A number of changes were implemented this past year to make sure that our staff was safely able to conduct our surveillance. One of the biggest changes is that we now tend to do tick surveillance independently. In previous years, you could regularly find at least two lab staff on a trail at once. Now we try to do different parks/trails, and when that's not possible we follow our new COVID-19 protocols, which include staying 6 feet apart and wearing masks. During the initial shelter in place order, we refrained from tick surveillance, as the counties and the District worked to develop a COVID-19 safety plan.

Have a question we didn't answer? Give us a call! (707) 285 - 2200

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 treating clothes/personal outdoor equipment with an acaricide containing permethrin.
- 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 the tick 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 it in a sealed bag/container, wrapping it tightly in tape, or flushing it down the toilet.
- If redness or pain develops at the tick bite site, consult your physician.

For more information about our services and programs:
Marin/Sonoma Mosquito and Vector Control District
595 Helman Lane, Cotati, CA 94931
(707) 285 - 2200 *www.msmosquito.org*