

Ada County Mosquito Abatement District

2022 Annual Report

Desireé Keeney; Deputy Director

12/28/2021



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Mission Statement

The mission of Ada County Mosquito Abatement District is to control mosquitoes that are both a nuisance and potential vector of disease to Ada County residents using the best available data and sound science practices through Integrated Mosquito Management (IMM).

District History

Ada County's original Mosquito Abatement District was the Three-Mile Creek District established in 1974, which included 12 square miles from Cloverdale to Cole Roads, and Franklin to Columbia Roads. Several district annexations occurred over the next few decades, and in 2004, the Ada County Board of County Commissioners agreed to incorporate and operate what was then called the Southwest Ada County Mosquito Abatement District. Today, the district is known as Ada County Mosquito Abatement District (ACMAD), and it covers 406 square miles, with most of the district encompassing the major residential, rural, and urban areas.

ACMAD Management and Staff

Adam Schroeder, Director

Desireé Keeney, Deputy Director

Vacant, Division Coordinator

Diana Beahm, Administration Specialist II

Additional Staff: 4 fulltime field employees, and up to 16 seasonal employees; 1 fulltime GIS Analyst (shared with Weed and Pest departments); 4 fulltime administration staff (shared with Weed and Pest departments).

Training and Education

Training of staff and continuing education are primary objectives of ACMAD's program in efforts to use the best management practices available. Most of the staff training also contributes to certification and continuing education credits through the Idaho State Department of Agriculture (ISDA). This extensive training is necessary for ACMAD's full time and seasonal staff to carry a Professional Applicator's license in the State of Idaho. 5 full time staff and 2-10 seasonal staff were sent to education events, along with internal training for season staff, for over 6,100 hours of training and education in 2022.

2022 Seminar/Training	People Sent	Hours	Total Hours
NWMVCA Spring Meeting-Boise	7	12	84
AMCA Annual Meeting	2	40	80
IMVCA seminar-spring	14	6	84
IMVCA seminar - winter	9	12	108
DiSC Training- In house	5	8	40
Drone Pilot training and licensing	2	175	350
Larvicide Olympics	12	6	72
In house training (licensing testing, field, etc.)	[5-17]	5300+	5300+

Table 1. ACMAD training seminar attendance.

Memberships, Affiliations, & Grants

ACMAD is an active member of several professional vector control associations. These memberships help to improve the professional knowledge base by keeping ACMAD up to date on new abatement methods, best available science practices, and knowledge of potential legislation that will affect ACMAD operations and/or residents. ACMAD received no grants in 2022.

ACMAD is proudly affiliated with the following organizations:

- Idaho Mosquito and Vector Control Association (IMVCA)
- Northwest Mosquito and Vector Control Association (NWMVCA)
- American Mosquito Control Association (AMCA)

Integrated Mosquito Management

ACMAD follows an Integrated Mosquito Management (IMM) program that is designed to reduce disease-carrying mosquito populations while causing minimal adverse effects to people, wildlife, domestic animals, and the environment. An IMM program includes education and prevention, as well as cultural, physical, mechanical, biological, and chemical control. ACMAD recognizes that no single method will effectively manage all mosquito populations due to variations in the mosquito population abundance, species diversity, time of year, development habitats and environmental conditions. ACMAD considers all methods carefully. In addition to following IMM, ACMAD considers cost versus benefits analysis, efficacy, potential health effects, ecological impacts, and exposure to risk potential for vector-borne diseases when determining any management actions.

Public Education

Public Education is a primary objective of any IMM program. Through public education and outreach ACMAD works to better inform the residents of Ada County on the best forms of protection and control options against mosquitoes. Informed citizens can limit their interactions with mosquitoes, which reduces the potential spread of WNV and other vector-borne diseases.

Listed below are some examples of public education and outreach conducted in 2022:

- National Mosquito Awareness Week outreach at various public parks in Ada County - reaching a little over 100 unique visitors
- ACMAD web presence through the Online Mosquito Tracker, social media (over 22,200 unique accounts) and Ada County website
- Face to face interactions with field staff and the public when working daily during the mosquito season, especially during WNV positive outbreaks
- Televised news interviews
- Outreach at the Western Idaho Fair - over 800 visitors

History of WNV in Ada County

West Nile Virus (WNV) was first detected in Ada County in 2005, and in 2006, Idaho led the nation in human cases of WNV with over 1,000 reported cases resulting in 23 WNV-related deaths. ACMAD has collected mosquitoes infected with WNV nearly every year since then. Historically, ACMAD has observed cyclical trending of an average of every 3-4 years a peak in WNV activity and occurrence, with the worst season to date in 2021 observed in mosquito samples. WNV is an arthropod-borne flavivirus (arbovirus)

disease passed between birds and mosquitoes in a cyclical fashion. Mammals can also be infected with the disease but are considered “dead-end hosts” or “incidental hosts” of the virus and are unable to pass the disease any further. Mammals that contract the virus can become ill (Figure 1). On average, 80% of those infected with WNV do not show symptoms (known as asymptomatic) or show only mild symptoms. Approximately 20% of infected individuals experience short term and long-term effects of WNV. Some of the most reported symptoms are fevers, headaches, fatigue, and rashes. 1-5% of infected individuals develop severe neurological symptoms (such as encephalitis or meningitis), which may result in paralysis or death (Centers for Disease Control and Prevention, 2013). There is no treatment for WNV in humans at present.

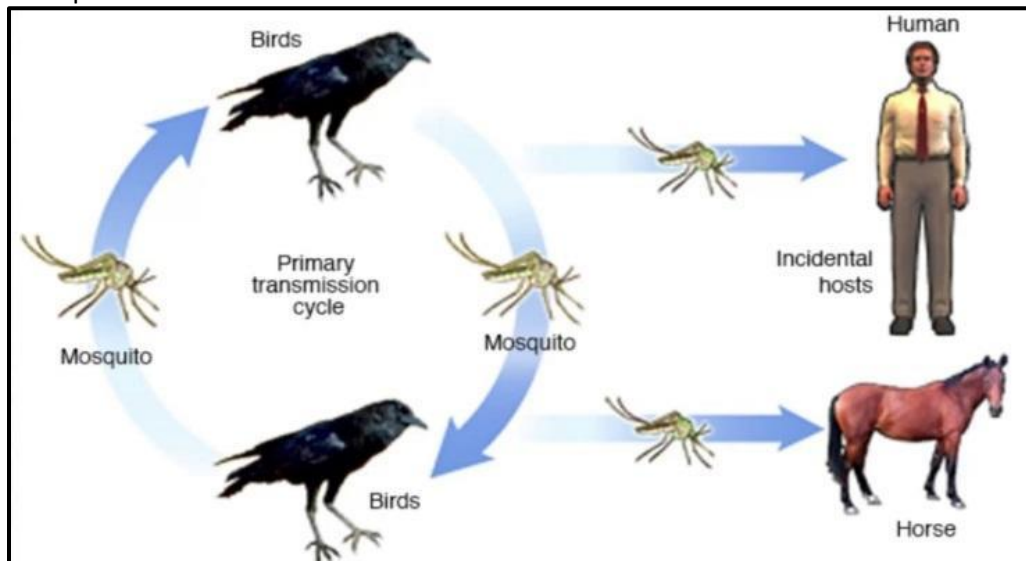


Figure 1. The transmission cycle of WNV, the most prevalent arbovirus in Ada County. Adapted from Mayo Foundation for Medical Education and Research.

As of October 20th, the Idaho Department of Health and Welfare (IDHW) reported 3 human cases of WNV in Idaho for the 2022 season (Idaho Department of Health & Welfare, 2022, see Appendix 6). As of December 13th, 2022, there were 1,007 ($n_{2021}=2,965$ for the year) cases of WNV, with 71 ($n_{2021}=191$) cases resulting in death nationwide in 2022 (Centers for Disease Control and Prevention, 2022).

Mosquito Surveillance Operations

Ada County mosquito surveillance operations began on May 8th, 2022, and continued through September 17th, 2022, for a total of 19 weeks (weeks 19-37, shown in Figure 2).¹ ACMAD used carbon dioxide (CO₂) baited Encephalitis-Virus-Surveillance (EVS) light traps that ran for an average of 10 hours a night with 3-4 lbs. of dry ice as an attractant. A total of 1,693 mosquito surveillance traps were placed during the 2022 season. In 2022, ACPAD trapped mosquitoes in 148 locations (out of 590 total trap locations) throughout Ada County. ACPAD surveyed 25 new locations based identified need or community requests.² Two surveillance crews placed an average of 85 mosquito traps on nightly deployments, a 24.1% decrease in weekly mosquito trapping as compared to the previous 3-year

¹ A list of all week numbers with corresponding dates can be found in Appendix 1.

² A map depicting all surveillance sites can be found in Appendix 2.

average. The trap failure rate was 1.48% (n = 24) in 2022, which was much lower than 2021's failure rate of 2.88% (n = 58).

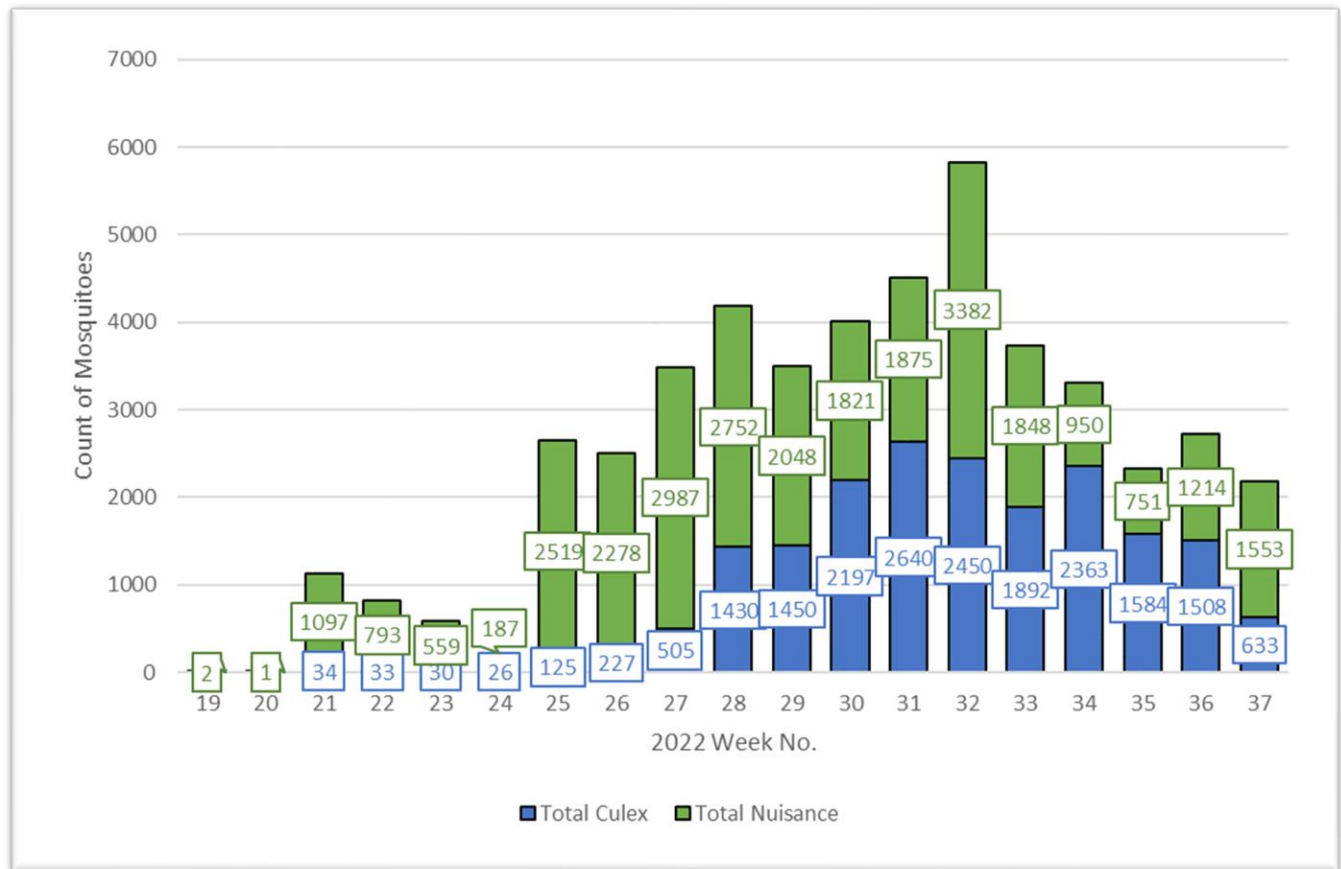


Figure 2. ACMAD's total mosquito sampling by week, with a distinction of important vector species (*Culex tarsalis* & *Culex pipiens*).

ACMAD collected 47,478 mosquitoes in the 2022 season (a 4.89% increase from the previous 3-year annual average of 45,155 mosquitoes trapped). As seen in Figure 2, WNV vector species, *Culex pipiens* (n = 12,388) and *Culex tarsalis* (n = 6,743) composed average of 40.3% mosquitoes trapped. In addition to monitoring the mosquito populations within Ada County, ACMAD tests all potential vector mosquitoes for WNV in-house with Rapid Analytic Measurement Platform (RAMP) testing; this allows for a same-day response to positive WNV pools and improves efficacy in controlling the potential spread of the disease.

Arbovirus Surveillance Operations in Ada County

ACMAD surveillance operations detect the prevalence and location of WNV in real time as the first step in protecting Ada County residents from the mosquito-borne disease. Upon collection of these traps, ACMAD separates mosquitoes by species. The mosquitoes identified as the WNV vector species found in Ada County, *Culex pipiens* and *Culex tarsalis*, are tested for WNV in a pool (1-50 individual *Culex spp.* of mosquitoes pooled together from a single site). In 2022, ACMAD detected 11 WNV-positive pools from

in 9 sites, a decrease of 90.7% in WNV-positive pools from 2021, despite a 5.42% increase in the overall mosquito population.³

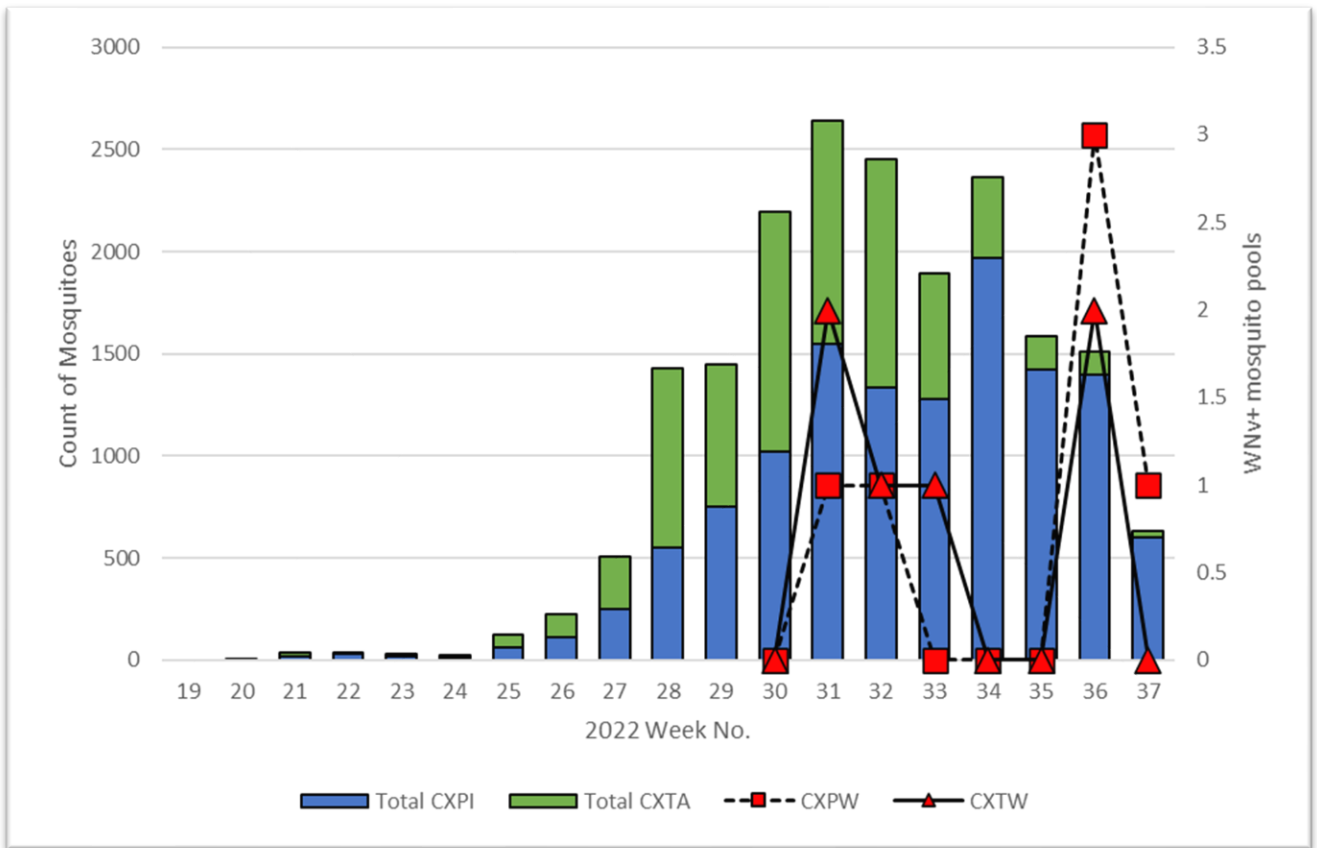


Figure 3. The above chart shows weekly *Culex pipiens* (CXPI) and *Culex tarsalis* (CXTA) collected samples and count of positive pools by each species (CXPW – *Culex pipiens* WNV+ ($n = 6$) and CXTW – *Culex tarsalis* WNV+ ($n = 6$)) for the 2022 season.

ACMAD analyzed a total of 1,430 RAMP tests in the 2022 season, with an average of 15 mosquitoes per pool. When necessary, Reverse Transcription Polymerase Chain Reaction (RT-PCR) testing for WNV was performed at the Idaho Bureau of Laboratories (IBL) on samples collected by ACMAD per the standard requirements and protocol designated by the IDHW for confirmation of disease presence. IBL confirmed the presence of WNV in 3 of the 27 samples that ACMAD sent in for confirmation. The first mosquito pool to test positive for WNV occurred on August 4th, 2022, during week 31 (1 week later than 2021).

Arboviral Risk Assessment

Ada County uses *Minimum Infection Rate* (MIR) and the CDC's *Vector Index Coefficient* (VIC) calculations to assess the risk of arbovirus transmission to the public and the WNV response matrix. ACMAD bases management decisions on these analyses, along with input from surveillance data and the IMM framework.

Note: MIR is expressed as the number of positive pools/1,000 mosquitoes. In 2018 Ada County began quantifying transmission risk using the CDC's VIC. This calculation is more in depth than previously used

³ A map depicting 2022 WNV+ locations can be found in Appendix 2.

risk coefficients and accounts for pool size, geospatial factors, and the presence of multiple vector species in an area (Centers for Disease Control and Prevention, 2013). VIC is expressed as the percent change that a mosquito in any given mosquito trap within a predetermined spatial zone will test positive for WNV. While VIC does not have a designated threshold for epidemic levels, it is an important indicator of arbovirus disease risk in Ada County, as there are two WNV vector species with different habitat and population behaviors.

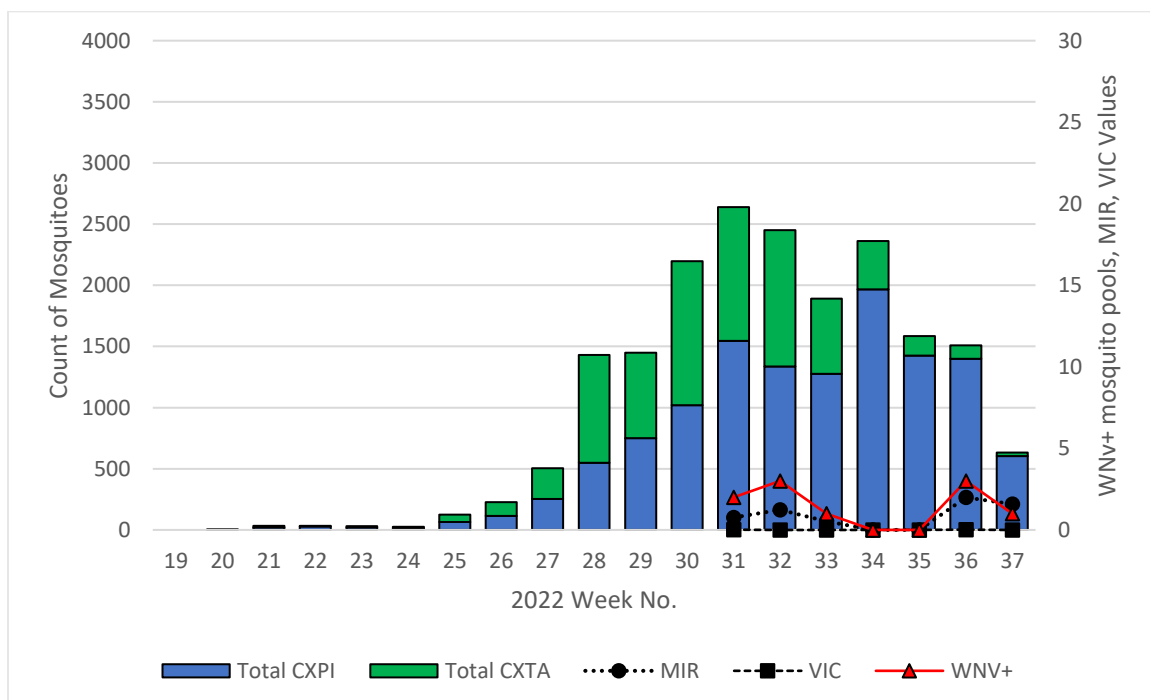
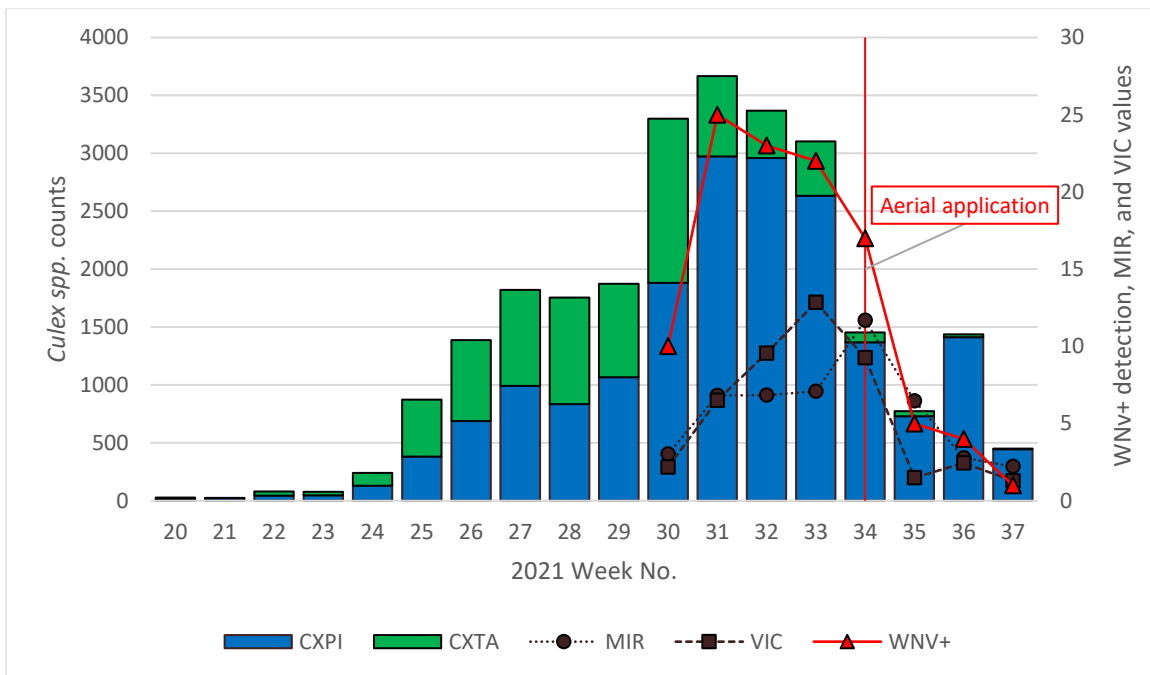


Figure 4. The minimum infection rate (MIR) and vector index coefficient (VIC) over time in 2022 (bottom graph) vs 2021 (top graph). These risk assessment coefficients help set thresholds for ground and/or aerial fogging and make best management decisions to reduce the spread of WNV.

Figure 4 displays the distinction between the two risk assessment strategies can be observed. In 2022, the maximum MIR (n=1.99) occurred during week 36, when 3 positive pools were detected from a total of 2,722 *Culex spp.* mosquitoes. The maximum VIC (n=1.61%) occurred during week 36 (in 2021 the VIC went to 12.85%) when 3 positive pools were detected from a total of 2,722 *Culex spp.* mosquitoes. VIC accounts for many factors missed by MIR assessments, including the average number of infected mosquitoes in each trap night in an area (Centers for Disease Control and Prevention, 2013). The distinction between risk assessment tools comes from the notion that the arbovirus patterns differ in *Culex pipiens* (*Cx. pipiens*) and *Culex tarsalis* (*Cx. tarsalis*). It is important for ACMAD to compare multiple risk assessment variables and monitor aberrations closely.

Species Composition Data

In 2022, ACMAD collected 47,748 mosquitoes during WNV surveillance: *Culex pipiens* (n = 12,388), *Aedes vexans* (n = 23,382), *Culex tarsalis* (n = 6,743), *Culiseta incidens* (n = 889), *Anopheles freeborni* (n = 1,879), *Aedes nigromaculis* (n = 409), *Culiseta inornata* (n = 1,674), *Aedes dorsalis* (n = 66), *Coquillettidia perturbans* (n = 110), *Aedes cinereus* (n = 98), *Aedes increpitus* (n = 74), *Aedes fitchii* (n = 2), *Culex minnesotae* (n = 34). In 2022, *Cx. pipiens* constituted 41% of sampled mosquitoes, a 26% decline in relative abundance. The *Ae. vexans* population increased from 33% composition in 2021 to 49% in 2022, and the *Cx. tarsalis* population decreased from 16% in 2021 to 14% in 2022.

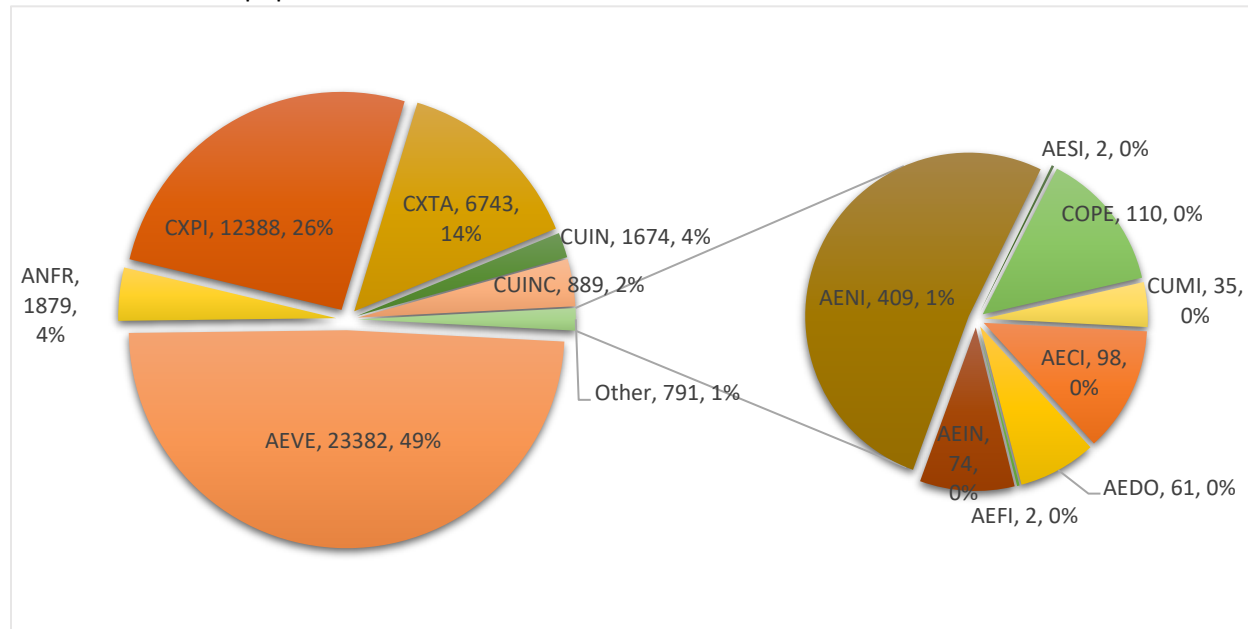


Figure 5. Species composition for mosquitoes sampled by surveillance traps.

Mosquito Surveillance & Climate Data

Precipitation in Ada County typically occurs outside of the mosquito development season, meaning most mosquito development sources are formed by watering for irrigation and landscaping. Figure 6 shows the total mosquito count and *Culex spp.* mosquitoes trapped by week number. *Culex spp.* activity peaks when nightly temperatures average 60-70+°F and slows down when nightly average temperatures reach

52-54 °F or less, which is consistent with known *Culex spp.* behavior. The average temperatures this year were warm for an Ada County summer.

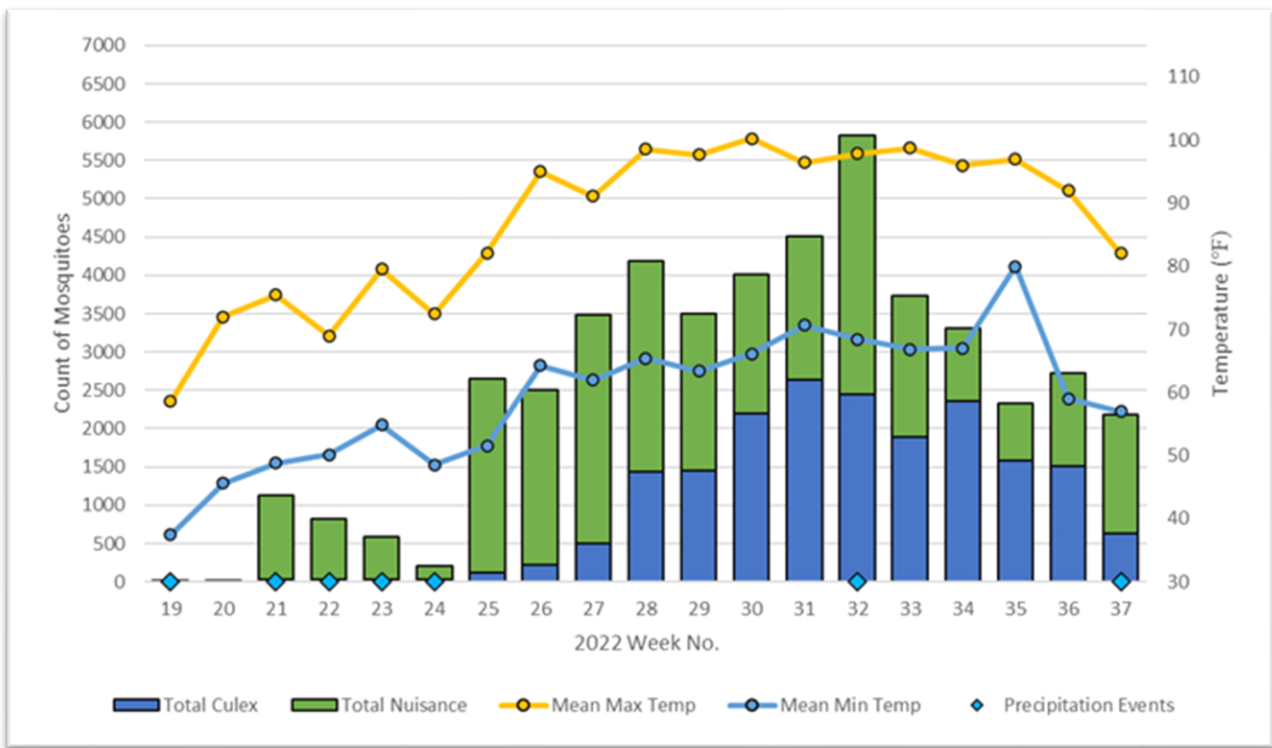


Figure 6. The correlation between mosquito population and climate.

Mosquito Larvicide Operations

ACMAD applies larvicides to known mosquito larval habitats to prevent the presence of biting adult mosquitoes. ACMAD internally maps persistent water sources for routine inspections and treatment. Suitable mosquito development sources range from natural features (i.e., ponds and marshes) to artificial objects like tires or pool covers. As Ada County grows in population, artificial mosquito development sources are becoming the more predominant source. ACMAD routinely checks known water sources for mosquito larvae and selects the most appropriate control method.

The ACMAD larvicide division also responds to public and internal service requests. Citizens of Ada County can request a larvicide technician to check their private or other public property. ACMAD uses these opportunities as an avenue for public education as well as providing mosquito abatement services. When internal surveillance meets specific thresholds, larvicide technicians are dispatched to the location to find and eliminate brooding sites. **In 2022, the larvicide division completed 458 public service requests and 146 internal service requests, which are slight decreases of 3% overall and 6% in internal service requests compared to last year.**⁴

⁴ A map depicting the distribution of larvicide service requests can be found in Appendix 3 and a chart depicting the distribution by city can be found in Appendix 5.

Larval Site Inspections and Treatment Summary

ACMAD mapped 3,770 new sites in 2022, bringing the total number of active sites to 51,102, an increase of from 2021 ($n_{2021}=44,691$). The larvicide division performed 102,580 inspections ($n_{2021}=99,536$), which is a 20% increase compared to last year. ACMAD made 59,795 ($n_{2021}=61,264$) larvicide applications, a 15% decrease from 2021. These applications covered 859 ($n_{2021}=921$) acres, a 6.7% decrease from 2021. Approximately 500 acres of this season's total acreage were treated with a UTV or backpack spreader.

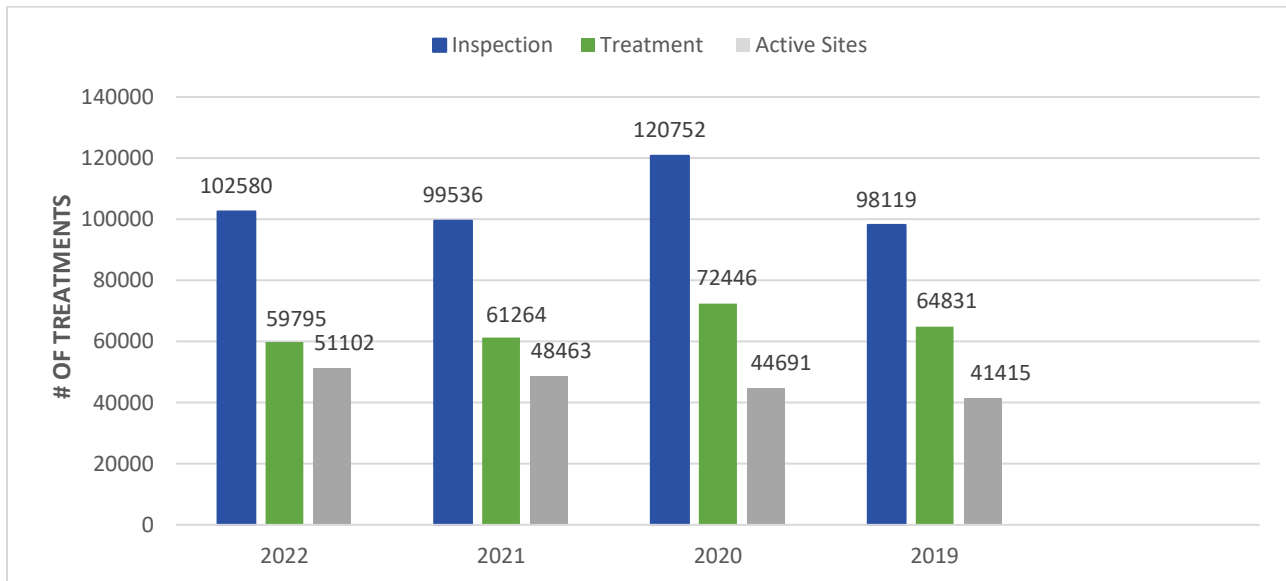


Figure 7. Annual Larvicide Division operations from 2019-2022.

After the mosquito season ended in October, full time staff mapped over 2,400 additional Drain Inlets (DIs) and storm drains in new construction areas and on new roads at the time of this report. Eighty-two percent of the active sites mapped by ACMAD are DIs, a favored oviposition habitat for *Cx. pipiens*, an important vector for WNV in Ada County. DIs are significantly increasing annually with the development of Ada County.

Larval Development Habitat Summary

There are many different larval habitats in Ada County, the most monitored and treated were pastures and DIs. These locations are favored oviposition habitats for *Ae. vexans* (pastures/floodwaters), *Cx. tarsalis*, and *Cx. pipiens* (stagnant water sources, like DI's and roadside water swales). As seen in Figure 8, 58.8% of acres treated in 2022 were pastures, and only 11.6% of acres treated were DIs. A total of 42,726 DIs were monitored in Ada County. Backyard sources in neighborhoods, however, are not typically included in this count or what is monitored by the mosquito control district due to restricted access unless a resident reached out to the district for help. These backyard sources often produce vector mosquitoes as well and are significant issues of concern in the district.

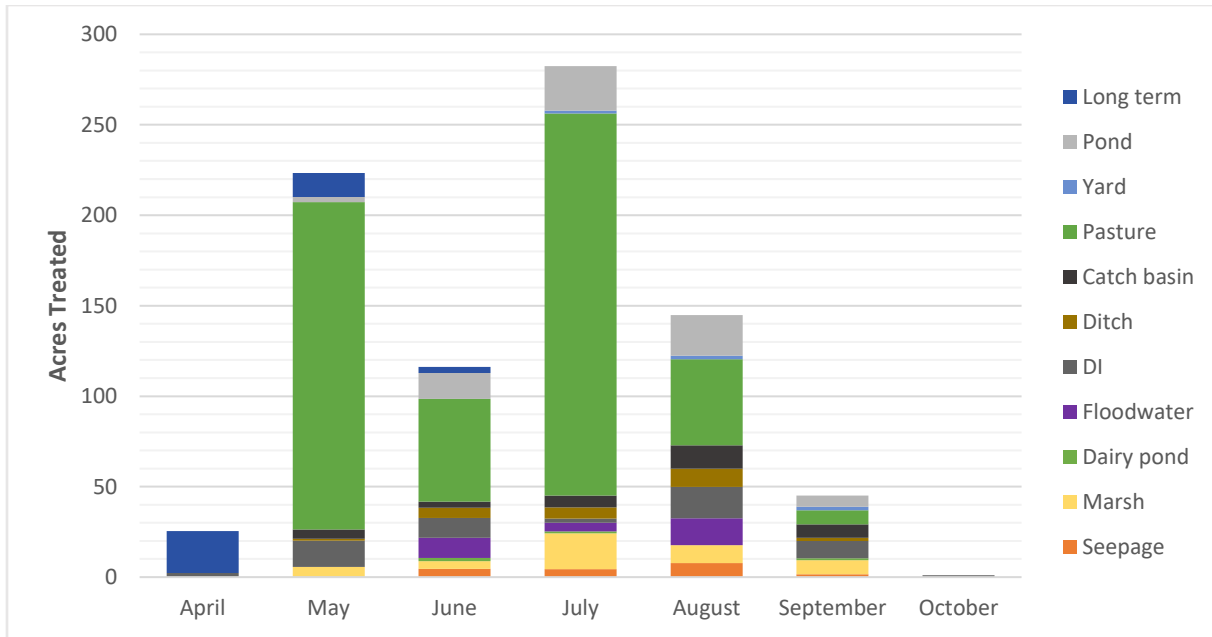


Figure 8. Acres treated by the ACMAD Larvicide division, sorted by site category.

Larvicide Product Summary

Historically, the vast majority of larvicide treatments use biological control methods. As seen in Figure 9, either a biological or mix of biological and biochemical control agents were used in 24% of the 859 acres treated in 2022. The predominant biological control ACMAD uses is a natural bacterium *Bacillus spp.* (*Bti.* or *Bs*). *Bacillus spp.* are soil-dwelling or aerobic spore-bearing bacteria which develop proteins toxic to insect larvae. Certain strains of *Bacillus spp.* are toxic to specific insect larvae, such as *Bacillus thuringiensis israelensis (Bti.)* which targets only mosquito and black fly larvae. *Bacillus spp.* do not leach into soil and are effectively non-toxic to humans, birds, fish, domestic pets, livestock, and other wildlife. ACMAD uses Spinosad, a natural bacterial byproduct, as an additional biological control agent. Biological

controls are an essential component of an IMM program. Some of these formulations used by ACMAD are Organic Materials Review Institute certified (organic).

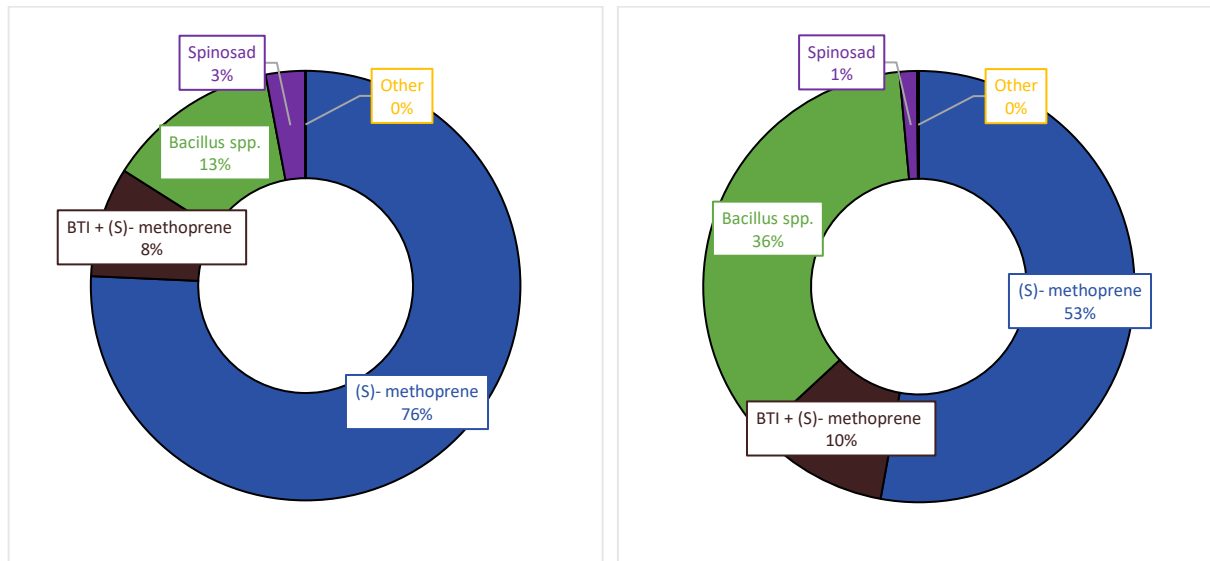


Figure 9. Comparison of active ingredients present in larvicide applications for 2022 (left) and 2021(right).

ACMAD also uses (S)-Methoprene to control mosquito larvae. (S)-Methoprene is an insect growth regulator, which is considered a biochemical pesticide. Instead of a chemical poison, (S)-Methoprene controls pests through interference of the life cycle and prevents the larvae and pupae from reaching maturity. (S)-Methoprene has no adverse effect on fish, waterfowl, mammals, or beneficial insects according to the Environmental Protection Agency (EPA) registered and approved label. Typically, (S)-Methoprene has long-term residual activity which helps reduce labor costs and increase in mosquito inspection efficiencies and larval source reduction. (S)-Methoprene usage increased by 23% this season due to a stronger reliance on long term residual products ranging from 42-150 days and lower staff capacity at 80% in 2022.

Mosquito Adulticiding Control and Operations

The final line of defense against arboviral diseases and nuisance adult mosquitoes is Ultra Low Volume (ULV) application of adulticide insecticides. ACMAD uses ULV foggers mounted on pick-up trucks, that are driven throughout the county after dusk, releasing an EPA-approved pesticide at designated locations to control flying adult mosquitoes. ULV foggers release micron-sized droplets of insecticides, which are lethal to flying mosquitoes by contact but are not lethal to larger beneficial insects such as dragonflies, butterflies, or moths (Scheier III & Peterson, 2010). ACMAD also takes a proactive approach to avoid water bodies with fish and known honeybee hive locations when applying adulticide chemical, and limits ULV applications to after dusk when bees have returned to their hive and are not actively flying or foraging on plants.

The 2022 adulticide season started on June 9th, 2022 (week 23) and ended on September 27, 2022 (week 39). Traditionally, the adulticide division conducts its nightly operations with 3 technicians using truck mounted ULV foggers. An estimated total of 42,768 (n₂₀₂₁=71,008) acres (industry standard of 300 ft swath width and dependent on wind speed and direction) or approximately 1,214 lane miles were treated during 2022.

Adulticiding Treatment Summary

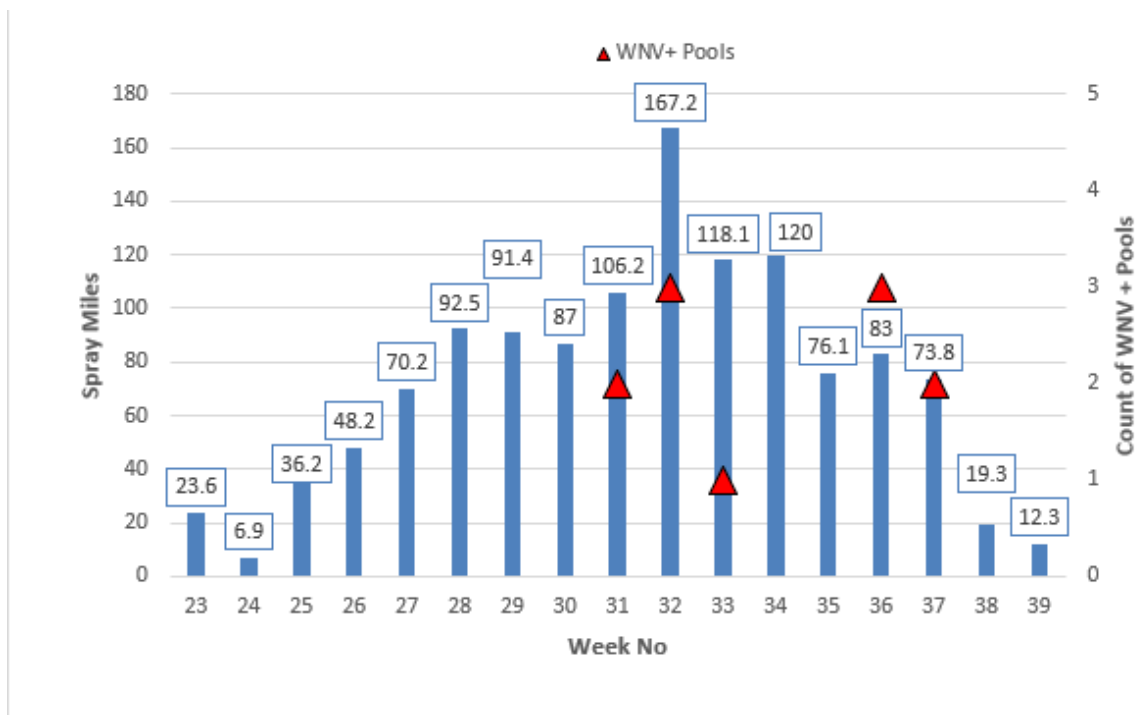
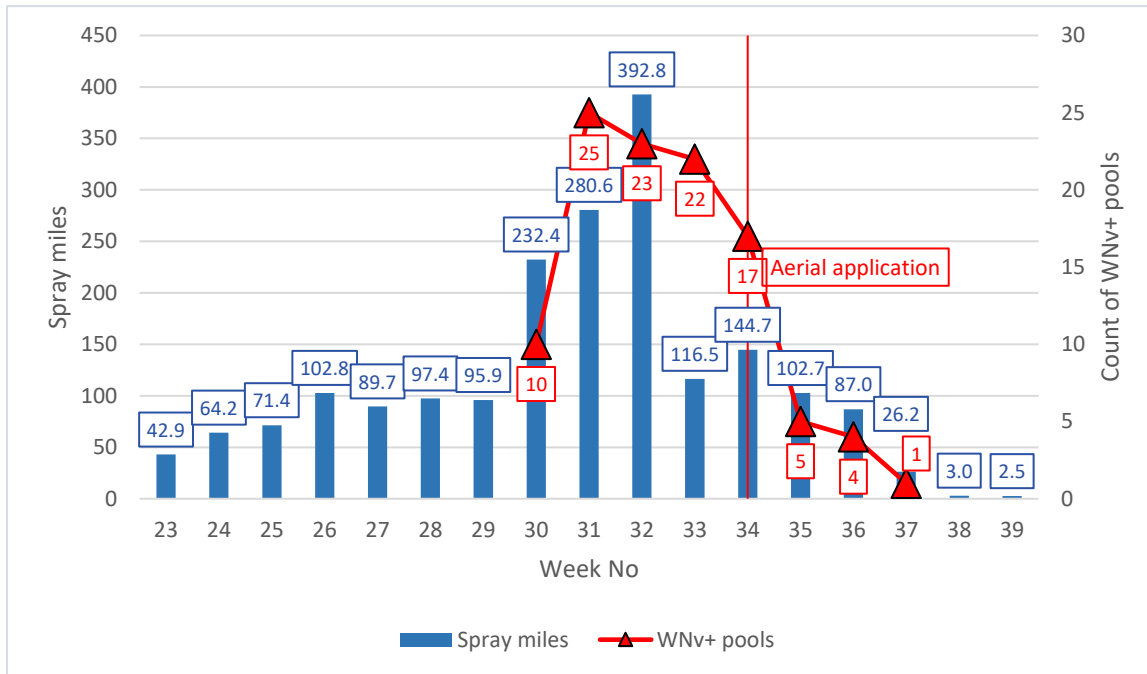


Figure 10. Weekly spray miles for 2022 with WNV+ pools (bottom) compared to 2021 (top). A total of 466 gals of insecticide was used in 2022.

ULV truck applications are based on public requests, WNV response, and mosquito population thresholds as determined by the surveillance division and lab results. If a surveillance site traps more

than 5 vector mosquitoes or more than 25 nuisance mosquitoes, and if the action threshold has been met, an adulticide applicator is dispatched to the location within 48 hours. If the surveillance team discovers WNV, the adulticide team is dispatched within 12 hours and a ULV application is made to all accessible roads within 1 mi² of the positive location. Figure 10 displays the positive correlation of spray miles within the same week of positive pools. The spray radius is determined by *Culex spp.* mosquitoes' average travel radius of up to a mile from their hatch location, however, mosquito behavior is dependent on species and blood source availability which is one of many dynamic variables in mosquito control response.

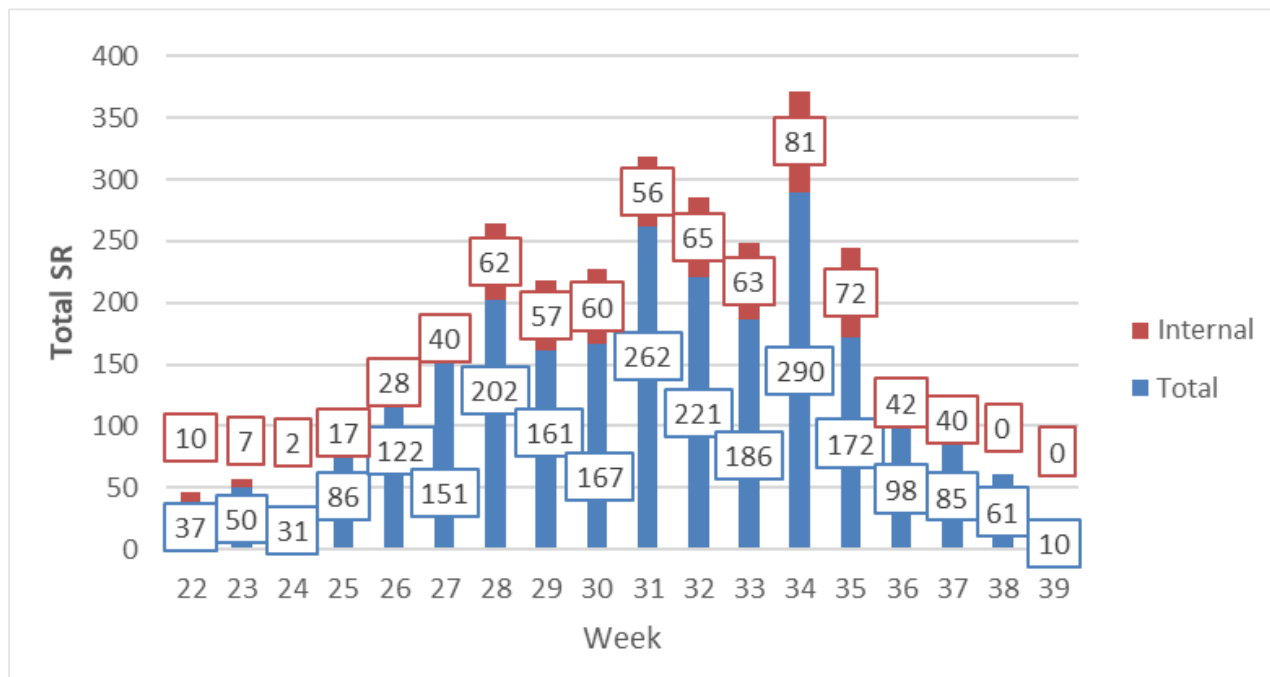


Figure 11. Comparison of public and internal adulticide service requests by week.

As seen in Figure 11, the adulticide team responded to 2,395 service requests; 681 (n₂₀₂₁= 920) requests prompted by internal action thresholds, and 1,714 service requests from Ada County residents throughout the 2022 season.⁵ This is a decrease of 26% service requests for internal surveillance compared to 2021. Figure 12 shows the comparison in service requests over time; figure 13 shows the distribution of service requests by city (resident mailing address code).

⁵ A map depicting the distribution of larvicide service requests can be found in Appendix 4 and a map depicting the distribution by city can be found in Appendix 5.

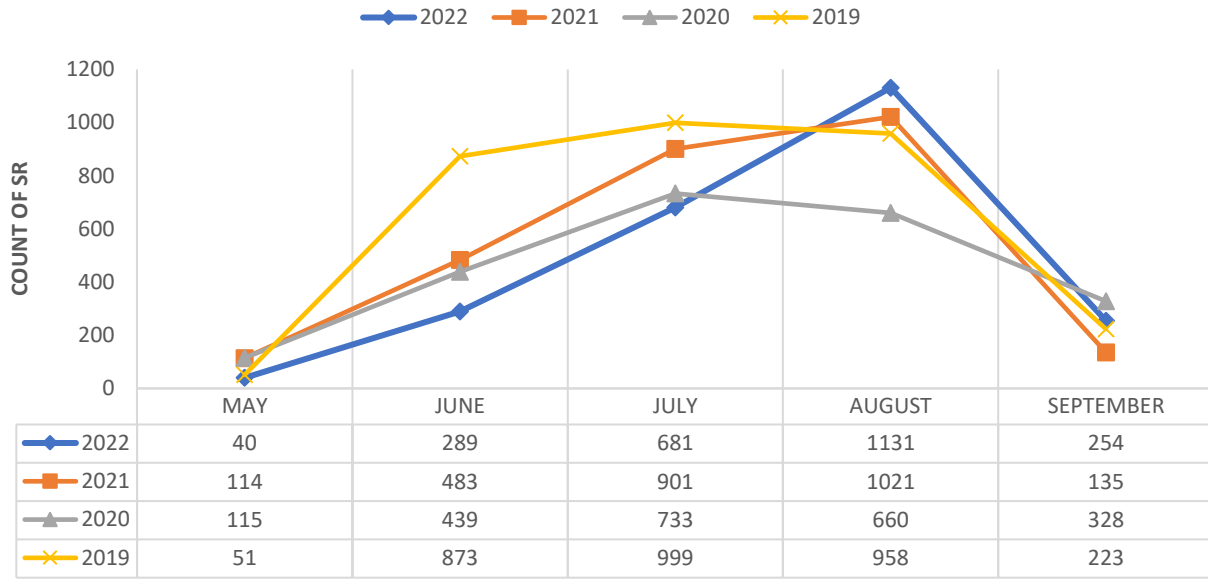


Figure 12. Comparison of service requests per month over the last 4 seasons (2019-2022).

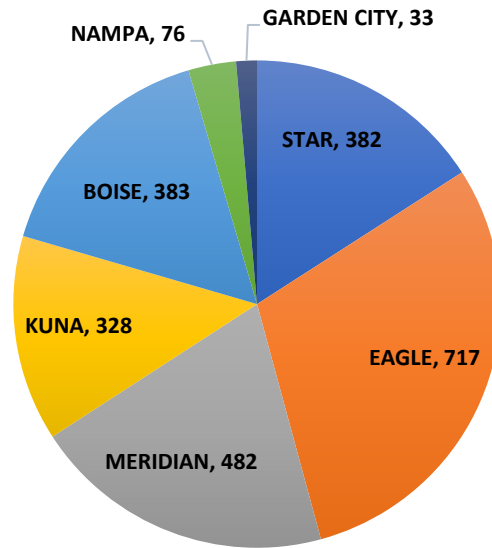


Figure 13. Service requests by city in 2022.

Aerial Application

There was no aerial application in 2022 for WNV, or vector and/or nuisance population abundance.

Projects and Field Trials

In contrast to previous years, ACMAD did not participate in any field trials this season.

Drone Project and Implementation

ACMAD began the planning stages for a new drone application within the larvicide division in 2022. The process is taking longer than first expected due to limited staffing and funding resources. In 2022, the final project proposal was approved and launched, with the first phase (planning) at 80% complete. One of the larvicide crew leads will be leading the program as part of their duties. The larvicide crew lead and one of ACMAD's full time staff studied and received drone pilots' licenses and ISDA Professional Aerial Applicator licenses. At the end of 2022 fiscal year, the mosquito abatement department was able to purchase the drone with funds from budget savings, and the project is about 40% complete at the time of the report.

New designation of areas and new crew lead

In 2022, ACMAD promoted a full-time technician to a crew lead. This change was implemented to help split the county into smaller management areas for crew leads and seasonal staff. The mosquito district was divided into 2 general areas (West and East districts), and within those areas, there were the existing predefined zones that a technician or team of technicians worked daily to monitor and find mosquito sources to abate. This structural change was implemented to help organize the larvicide division into smaller teams and allow for the crew leads to manage them more effectively. The overall goal of this change was to be more efficient, more thorough with training, provide on-going assistance and instruction for the seasonal staff, and to improve the management of the designated areas. The West and East teams worked on a 10-hour Schedule for 4 days per week, which was noted to improve seasonal staff attendance by the crew leads. Data to assess these changes in the department structure are preliminary and will continue to be evaluated in the next season for the review of this development.

Pesticide Resistance Testing

Pesticide resistance testing is a necessary step to evaluate whether the most effective insecticides are being used to combat adult flying mosquitoes. Typically, insecticide resistance is monitored at different locations in Ada County and these locations are tested for resistance to the technical-grade active ingredient Permethrin or other a.i.'s using the CDC Bottle Bioassay protocols. However, due to staffing limitations and vacancies, there were no bioassay's completed in 2022.

Discussion and Conclusion

Overall, 2022 was a lighter season for ACMAD's mosquito control and abatement practices which was expected after the record-breaking year of WNV detection in mosquito pools in 2021. Mosquito abundance in surveillance sites were typical, while service requests from the public were closer to normal (with considerable fewer requests from the lab). Adulticide applications were also significantly reduced in 2022, and no aerial application was needed this season as ACMAD ground operations effectively controlled mosquito populations.

The larvicide division was split from one crew lead overseeing 8-14 people to 2 crew leads overseeing 5-8 people in the East and West districts in 2022. Ideal coverage would be 2 people per area on each side with 5 areas on each side. The intention of this split was to reduce stress on one supervisor with staffing, coverage, and training. Also, this would help improve productivity and allow for more hands-on support with a full-time supervisor of new seasonal staff and on-going training.

The seasonal staff that were hired and retained in 2022 did a great job in following up with service requests, lab identification, disease testing and abating mosquitoes more effectively with the new support of their supervisors. The crew leads noticed less absences or time off requests and more hours were worked this season in addition to the full staff and the 4:10 schedule.

ACMAD lost the Mosquito Division Coordinator (FTE) in July to another position within the county, which required the Deputy Director to assist in the lab, coordinate activities, and supervise the surveillance division for the remainder of the season.

Surveillance summary

In 2022, the mosquito surveillance division trapped 47,748 mosquitoes, 40.3% were *Culex* species, which is closer to a normal season than in 2021. After the extremely high prevalence of WNV in 2021, the 2022 season was expected to be a low WNV year based on historical cycling data, and it followed that pattern with an 89% decrease in WNV mosquito positive pools (n=11). At the beginning of the season, the lab was fully staffed for positions and the surveillance crews stayed for the entire season. This helped relieve stress and staff coverage. However, due to the absence of the lab technician full-time position in 2022 (this was lost at the beginning of the fiscal year), and the loss of the Division Coordinator, the Deputy Director had to fulfill this role and the duties of the of the FTE lab technician. Halfway into the season, ACMAD was able to bring in an intern from BSU that assisted with the busiest period of the season for 3 days of the week. In 2023, the lab technician will be rehired as an FTE and the mosquito Division Coordinator position will be filled.

Larvicide summary

The larvicide division monitored over 51,100 sites with over 102,500 inspections resulting in over 59,700 treatments. The treatment count and acres decreased in 2022 from 2021, likely due to a more normal mosquito season, as well as the increased application of long-term residual products. The increase in (S)-Methoprene applications allowed for fewer return visits to over 18,000 sites, which reduced the total number of treatments at these sites. Instead of 4 to 5 visits to a site, 1 visit would suffice for the season. This transition of product selection from short term treatment windows using *Bti.* and *Bs.* along with short-term 30-day products was significantly decreased this year and should be noted; this is primarily due to staffing concerns and the increase in amount of mosquito sources annually. The teams completed more inspections, but the increase in inspections is due to an increase in the mapped and monitored sites. Overall, these numbers have continuously increased over the last 5 years, even with limited staffing and resources beginning in 2020.

The seasonal staffing capacity was improved to about 80% for the first 2 months of 2022. However, in the last 2 months of the season (August and Sept.) ACMAD lost 4 applicators that returned to school with the start of the school year. Students are great resources, but ACMAD also needs staff to finish the season. Moving into 2023, ACMAD will still strive to have 2 person crews in each area, then students (if applicable) will work along someone that is a returner or will finish out the season to help alleviate the stress of losing a worker mid-season if ACMAD can fill all positions to 100% capacity.

Mosquito development sources increased in many areas that are not accessible (i.e., residents are creating development sources in their own backyards). All locations that ACMAD can access during day-to-day operations, like roadside drainages, catch basins, and DIs, are mapped, monitored, and treated, if necessary. Unfortunately, ACMAD is not able to monitor mosquito breeding habitat created by backyard

water use and will need to develop and implement a plan to improve education and outreach that informs the public to remove these mosquito development sources consistent with IMM practices.

Finally, the drone program planning phases began in 2022. However, due to timing, resource constraints, and funding, ACMAD was not able to purchase the drone until the middle of the fiscal year. ACMAD has completed about 40% of this project at the time of this report. ACMAD hopes to have the program up and running by the end of the 2023 season. This project will be monitored and reviewed for the efficacy of the program with the goal to reduce staff time and treatment days, which will improve the operational flexibility and capacity to concentrate on other problem areas of concern within the county. This project will focus on sites that have large acreages of treatments that historically had to be walked by multiple staff carrying a backpack spreader or treated by UTV application. These sites are usually fields, pastures, and areas along the Boise River that are difficult to reach. This will also reduce hazardous risk for staff.

Adulticide summary

The total number of service requests (n=2,395) in the adulticide division decreased 10% from 2021 to 2022, as well as a decrease (40%) in acres treated (n=42,768) due to a more typical mosquito abundance season and low WNV positive year. The adulticide team was able to complete all service requests in a timely manner and implemented the use of new foggers with few issues in 2022. At the end of 2022 fiscal year, the adulticide division was able to purchase flow rate controllers to connect to the ULV foggers for implementation in 2023. The flow rate controllers will help the ULV foggers to treat more acres in the short time window of an evening application to best control the targeted mosquito species of *Ae. vexans* and *Cx. Spp.* The new Airmars were also tested and implemented this season on the adulticide vehicles (an upgrade from previous versions) that monitor the climate data and truck speed for the GIS locations at the time of application. The active ingredient of the product used in 2022 was permethrin for the entire season, which was diluted to the mid-label rates of 6.8 – 9.5 fl.oz./min. at 13 mph (rate dependent on the brand name of the product) from June 9th, 2022, through September 26th, 2022, covering a total of 1,214 lane miles.

Conclusion summary

As expected, the 2022 season was a much more normal mosquito season following the “hot” WNV positive season of 2021 in mosquito pools. While still feeling the effects of COVID-19 with staffing shortages and challenges, ACMAD worked hard to prevent and eliminate WNV positive mosquito populations and keep mosquito abundance numbers low through Integrated Mosquito Management practices. No adverse incidents were confirmed, documented, or reported to the ACMAD or other regulatory agencies in 2022. However, there were some minor issues with a small handful of private citizens understanding what the mosquito abatement district is and does. ACMAD will continue to develop its education and outreach program to help increase the awareness of the mosquito control district and what an individual can do in their own property to help mitigate and control mosquitoes.

ACMAD Goals

Goals for 2022

- I) Improve upon mid-season training for all seasonal staff to ensure *Best Management Practices* are followed
 - a) *Completed*- A split in the county from East and West and hiring another crew lead for the larvicide division allowed for the crew leads to follow-up, assist, and train seasonal staff while in the field independently more routinely, preliminary data still pending for on-going analysis to continue in 2023.
- II) Conduct Adulticide efficacy field trial and operational analysis.
 - a) *Not completed*- this is due to a loss of the Mosquito Division Coordinator, however more flexible sites were added and monitored in 2022 by the lab under the Deputy Director in response to adulticide night applications and product efficacy.
- III) Strengthen public education on land management practices with the help of our Public Information Officer.
 - a) *Completed & In Progress*- The ACMAD PIO went to 2-3 different parks during National Mosquito Awareness week and some of the mosquito staff helped with education time at the Western Idaho State Fair.
- IV) Increase public education and outreach to continue to adapt and improve our IMM
 - a) *In Progress* - This season there was an increase in documented public education and remediation points of # and # respectively and will continue in future seasons (in the past this was done but not documented well); Education Points = 197 and Remediation Points = 58.

Goals for 2023

- I) Review current larvicide division staffing structure and best management practices; implement adaptations as necessary and directed by management.
- II) Improve upon mid-season training for all seasonal staff to ensure *Best Management Practices* are followed, implement, and use field training assessment forms and report to the mosquito team.
- III) Complete Resistance Monitoring.
- IV) Strengthen public education on land management practices with the help of our Public Information Officer and increase and document public education and outreach to continue to adapt and improve IMM practices.
- V) Implement drone for applications to 50% of large application pasture treatments, approximately 250 acres or more.

Works Cited

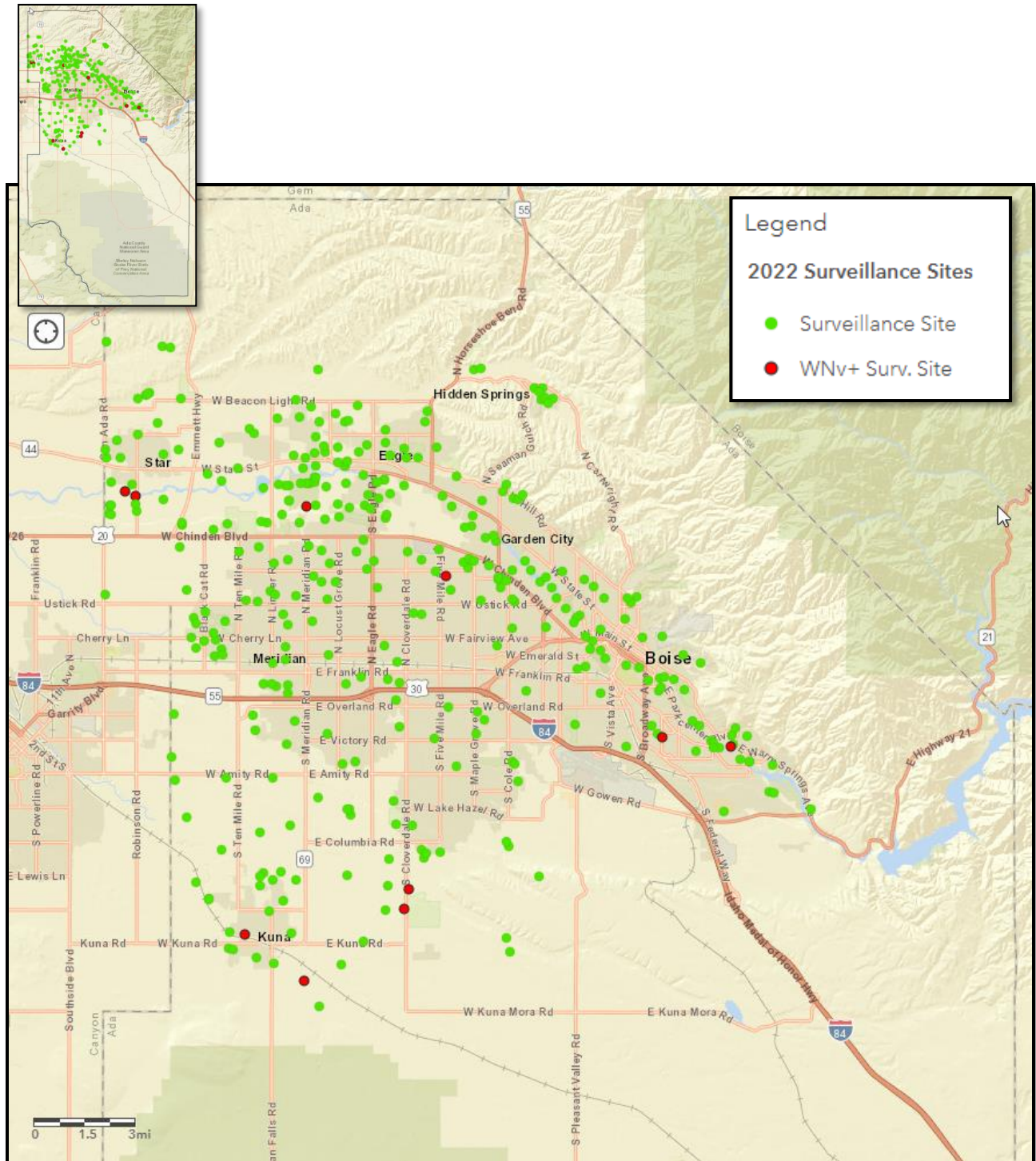
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Appendices

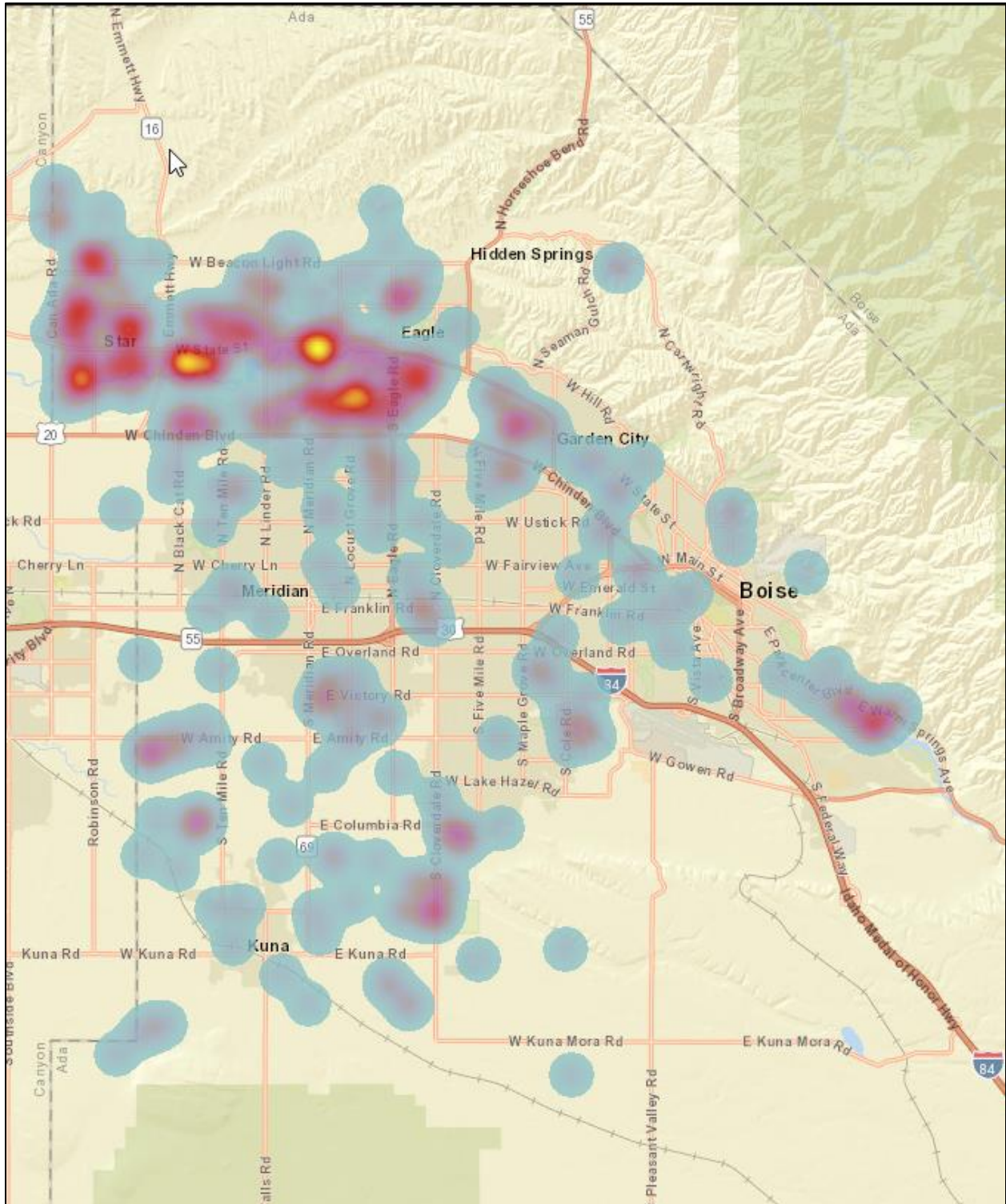
Appendix 1. Week number by start and end dates; divisions start and end weeks, and WNV positive pool weeks.

Week number	Start date	End date	Larvicide wks.	Surveillance wks.	Adulticide wks.
12	March 20, 2022	March 26, 2022			
13	March 27, 2022	April 2, 2022			
14	April 3, 2022	April 9, 2022			
15	April 10, 2022	April 16, 2022			
16	April 17, 2022	April 23, 2022			
17	April 24, 2022	April 30, 2022			
18	May 1, 2022	May 7, 2022			
19	May 8, 2022	May 14, 2022			
20	May 15, 2022	May 21, 2022			
21	May 22, 2022	May 28, 2022			
22	May 29, 2022	June 4, 2022			
23	June 5, 2022	June 11, 2022			
24	June 12, 2022	June 18, 2022			
25	June 19, 2022	June 25, 2022			
26	June 26, 2022	July 2, 2022			
27	July 3, 2022	July 9, 2022			
28	July 10, 2022	July 16, 2022			
29	July 17, 2022	July 23, 2022			
30	July 24, 2022	July 30, 2022			
31	July 31, 2022	August 6, 2022			
32	August 7, 2022	August 13, 2022			
33	August 14, 2022	August 20, 2022			
34	August 21, 2022	August 27, 2022			
35	August 28, 2022	September 3, 2022			
36	September 4, 2022	September 10, 2022			
37	September 11, 2022	September 17, 2022			
38	September 18, 2022	September 24, 2022			
39	September 25, 2022	October 1, 2022			
40	October 2, 2022	October 8, 2022			
41	October 9, 2022	October 15, 2022			
42	October 16, 2022	October 22, 2022			
43	October 23, 2022	October 29, 2022			

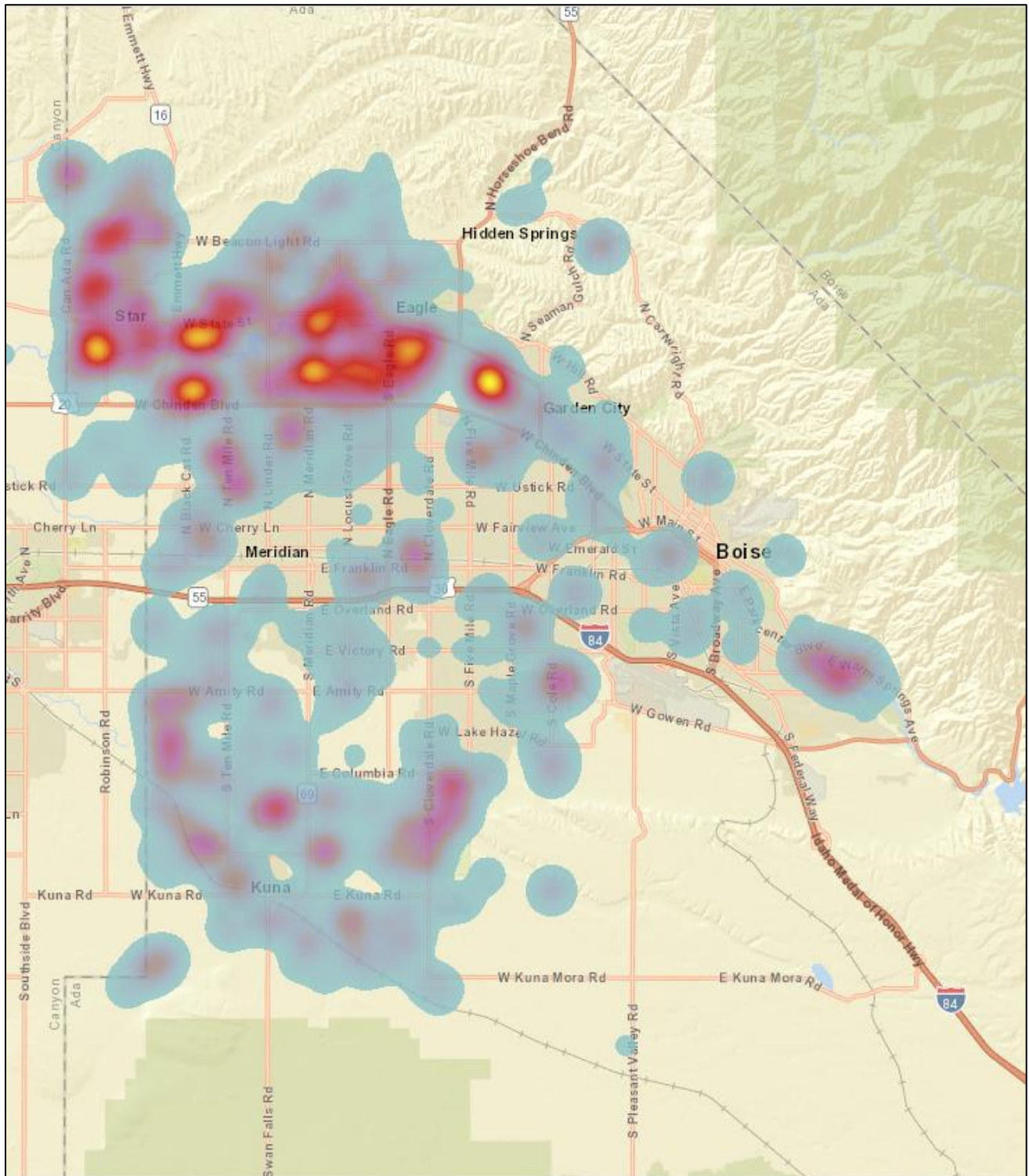
Appendix 2. Distribution of surveillance sites and WNV+ detection in those locations in 2022.



Appendix 3. Distribution of Larvicide service requests in 2022.



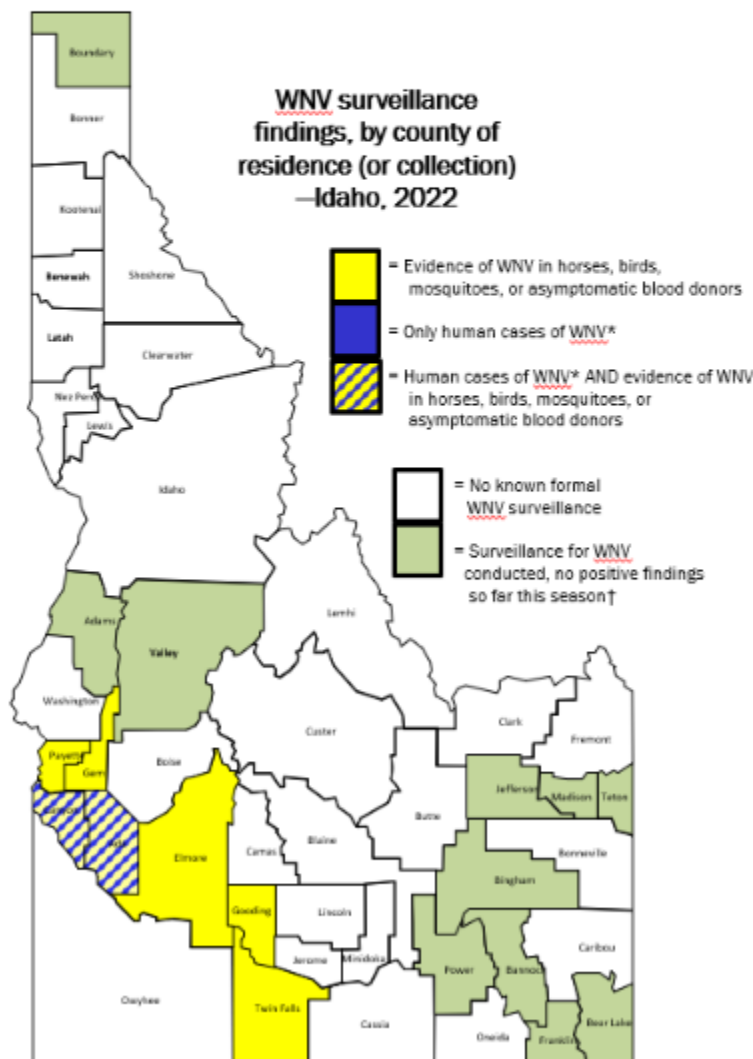
Appendix 4. Distribution of Adulticide service requests in 2022.



Appendix 5. Idaho Health and Welfare Data for Idaho, as of October 20th, 2022.

2022 WEST NILE VIRUS (WNV) SURVEILLANCE SUMMARY*

- Total reported people with symptomatic WNV infection: **3**
- Deaths related to WNV infection: **0**
- Presumptive-positive viremic blood donors: **0**
- Total reported WNV-positive horses/other mammals: **3**
- Total reported WNV-positive birds: **0**
- Counties reporting WNV-positive mosquitoes: **6**
- Counties reporting positive WNV surveillance findings, all types: **7**



* symptomatic cases
 † county-specific surveillance activities may not be county-wide.