Ada County Mosquito Abatement District

2020 Annual Report

Desireé Keeney, Deputy Director

1/15/2020

Contents

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 (MAD) was the Three-Mile Creek District established in 1974, which included 12 square miles between Cloverdale and Cole Roads and Franklin and Columbia Roads. There were several district annexations made over the next few decades, and in 2004, 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 covers 406 mi^2, with the majority of the district covering major residential and urban areas.

ACMAD Management and Staff

Adam Schroeder, Director
Desireé Keeney, Deputy Director
Diana Beahm, Administration Specialist II
Additional Staff: five full-time field employees, and up to 16 seasonal employees; one full-time GIS Analyst (shared with Weed and Pest departments); four full-time administration staff (shared with Weed and Pest departments).

Training and Education

Continuing education and training are primary objectives of ACMAD's program in efforts to use the best management practices available. Most of the training also contributes to certification and continuing education credits through the Idaho State Department of Agriculture (ISDA). However, training was very limited in a professional setting due to the pandemic of COVID-19 in 2020. ACMAD was also impacted by a reduction of professional applicators licensed as field technicians in 2020 due to the pandemic. Typically, we have an average of over 300 hours in external training for staff, while in 2020 we only had about 87 hours for an external virtual training in the last quarter of the year.

Memberships, Affiliations, & Grants

ACMAD is an active member of several professional vector control associations. These memberships help to increase 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 is affiliated with the following organizations:

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

- American Mosquito Control Association (AMCA)

ACMAD received no grant funding from Idaho Department of Health and Welfare (IDHW) for the purpose of pursuing a mutual goal of mosquito control, surveillance, and disease transmission reduction due to a reduction of available ELC funds from the CDC, as in years past.

Integrated Mosquito Management

ACMAD follows an Integrated Mosquito Management (IMM) program which is designed to benefit, and to have minimal adverse effects on people, wildlife, domestic animals, and the environment. An IMM program includes education and prevention, cultural, physical and mechanical controls, biological control, and chemical control. We recognize that not all mosquito populations can be controlled using these methods, and there is no one way to use these practices due to variations in the mosquito population abundance, species diversity, time of year, development habitats and environmental conditions. ACMAD considers all controls carefully, using the previously mentioned techniques as well as cost versus benefits analysis, efficacy, potential health effects and ecological impacts, including exposure risk potential for vector-borne diseases.

Public Education

Public Education is a primary objective of any IMM program. Through public education and outreach, we can work to better inform the residents of Ada County about the best forms of protection and control options against mosquitoes, which may help to limit the interactions between mosquitoes and people, reducing the potential spread of WNV and other vector-borne diseases. Due to the current pandemic, many social and interactive education opportunities were cancelled, like the Western Idaho Fair, and we were limited to just social media outreach and website notifications.

Listed below are some examples of public education and outreach conducted in 2020:

- ACMAD web presence: Online Mosquito Tracker, social media, and Ada County website
- Children's coloring contest for National Mosquito Control Awareness Week
- Limited face-to-face interactions of field staff when working daily during the mosquito season, especially during WNV positive outbreaks.

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. Nearly every year since then, mosquitoes infected with WNV have been collected by ACMAD. 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; however, mammals can contract the virus and become ill (*Fig. 1*). On average, 80% of those infected with WNV may not show symptoms or show only mild symptoms. Some of the most commonly reported symptoms are fever, headaches and fatigue, and 1% of those who are infected develop severe neurological symptoms (such as encephalitis), which may result in paralysis or death (CDC, 2019).

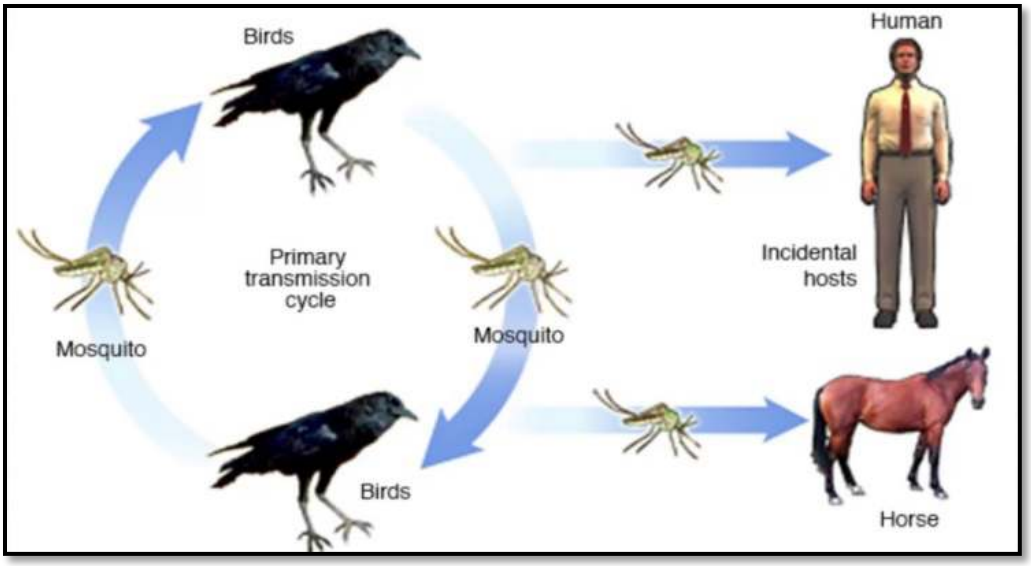


Figure 1. Shows the transmission cycle of WNV, the most prevalent arbovirus in Ada County. Adapted from Mayo Foundation for Medical Education and Research. (https://www.mayoclinic.org/diseases-conditions/west-nile-virus/multimedia/west-nile-virus-transmission-cycle/img-20006044).

The Idaho Health and Welfare Department reported that there were six human cases of WNV in Idaho as of November 27, 2020, with no cases resulting in death (IDHW, 2020). Nationwide, 2020 has seen 451 cases of WNV with 27 cases resulting in death (CDC, 2020). In Ada County, there were three reported human cases by IDHW, though two were considered imported, and ACMAD found one positive crow, which was the first time in-house and confirmed by the IBL along with positive mosquito pools, see below for more detailed information.

Mosquito Surveillance Operations

Ada County mosquito surveillance operations began April 26, 2020 and continued through September 19, 2020 for a total of 21 weeks (weeks 17-37) shown in *Fig. 2*.[1] The most commonly-used trap was carbon dioxide (CO_2)-baited EVS light traps, which, on average, ran for 10 hours a night, using between three and four pounds of dry ice as an attractant. ACMAD placed a total of 2,320 mosquito surveillance traps during the 2020 season. Historically, a cumulative of 514 trap locations have been used in Ada County; 120 locations were used for WNV surveillance during 2020.[2] Two crews were deployed nightly placing a 110 mosquito traps on per-weekly average, this was an increase in weekly mosquito trapping by 10% as compared to the previous three-year average. The trap failure rate was 4.87% (n=113) in 2020, which was lower than 2019's failure rate of 6.63% (n=149).

[1] A list of all week numbers with corresponding dates can be found in Appendix 1.1.

[2] A map with all surveillance sites can be found in Appendix 1.2.

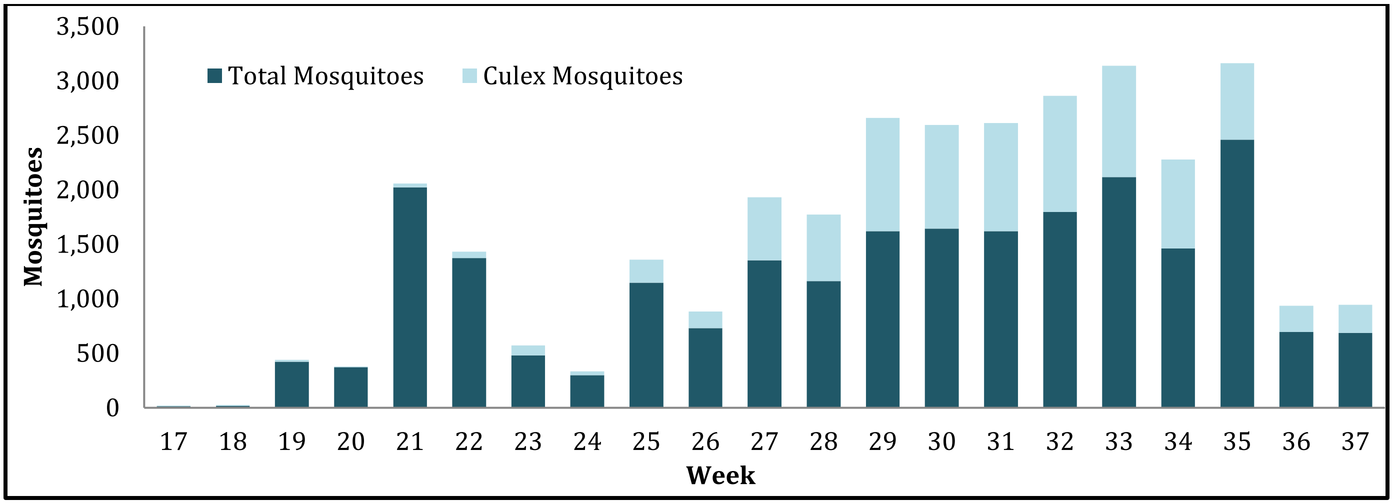


Figure 2. ACMAD's total mosquito sampling by week, with a distinction of important vector species (*Culex tarsalis & Culex pipiens*). Early season samples are primarily composed of nuisance (floodwater) mosquito species, with vector species abundance peaking in July-August.

During the 2020 season, ACMAD collected 23,491 mosquitoes. As seen in *Fig. 2,* WNV vector species, *Culex pipiens* (n=5,928) and *Culex tarsalis* (n=2,974) composed a yearly average of 37.9% mosquitoes trapped, this is a slight increase in vector species compared to 2019 (~7%). In addition to monitoring the mosquito populations within Ada County, ACMAD tests all potential vector mosquitoes for WNV in-house using Rapid Analytic Measurement Platform (RAMP) testing. This allows for a same-day response to positive WNV pools and increases efficacy in controlling the potential spread of the disease.

Arbovirus Surveillance Operations in Ada County

ACMAD uses adult mosquito surveillance as a tool to monitor and reduce the spread of WNV. Upon collection of these traps, mosquitoes were separated by species, and the important vector species (*Culex pipiens* and *Culex tarsalis*) were then tested for WNV in a pool (1-50 individual *Culex* species (spp.) of mosquitoes pooled together from a single site). In 2020, there were **11 WNV positive pools** detected in nine trap locations found in Ada County.[3] When compared with data from 2019, ACMAD saw a decrease of 56% in WNV positive pools, as well as a 64.97% decrease in overall mosquito population from 2019. Essentially, only *Culex pipiens* were found in positive pools in 2020 (one outlier was the first pool which had 28 CXPI and 2 CXTA). After the first positive pool, per internal protocols, ACMAD lab separates each species into separate pools for testing, and therefore can monitor the primary vectors independently for WNV potential spread within mosquito populations.

[3] A map depicting 2020 WNV+ locations can be found in Appendix 1.2.

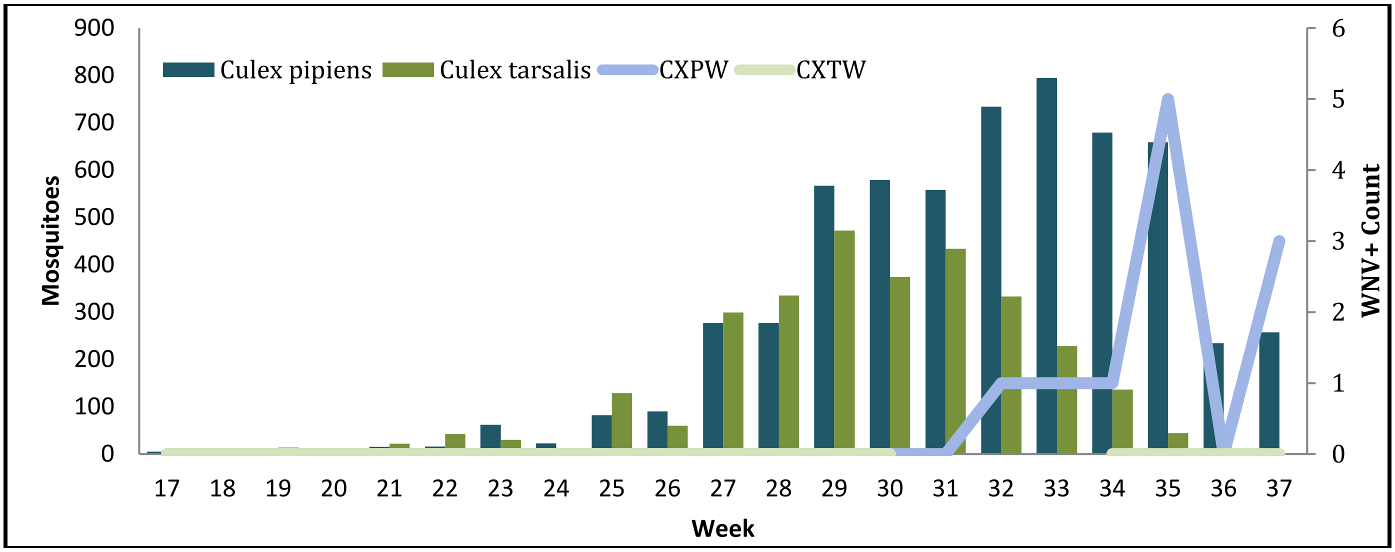


Figure 3. The above chart shows weekly *Culex pipiens* (CXPI) and *Culex tarsalis* (CXTA) collected samples and number of positive pools by each species (CXPW-*Culex pipiens* WNV+ and CXTW-*Culex tarsalis* WNV+ (n=0)) for the 2020 season.

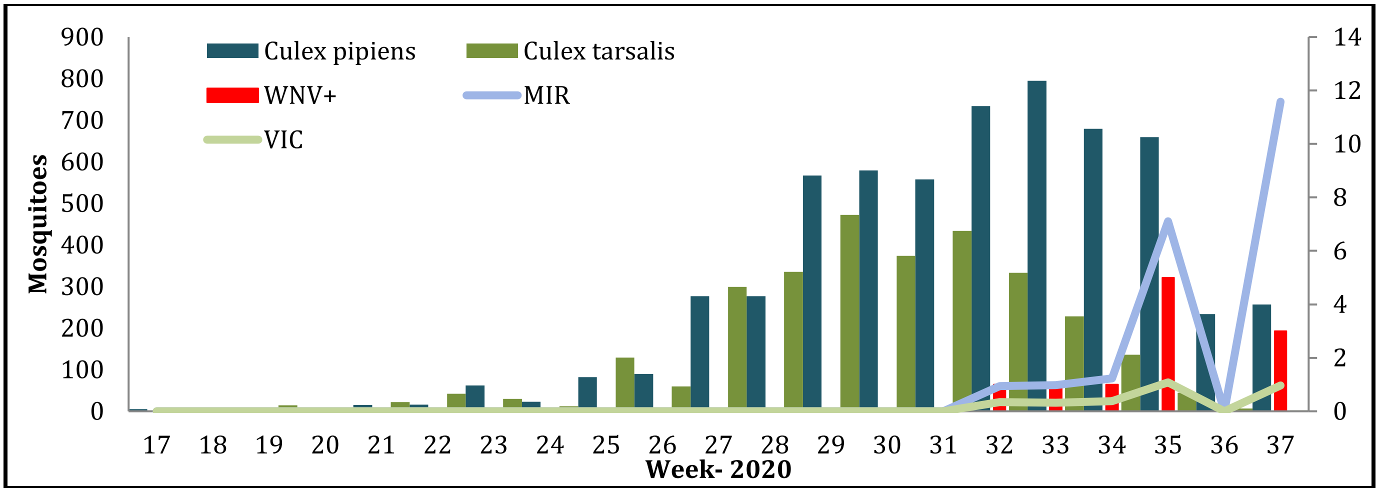
A total of 1,221 RAMP tests were analyzed during the 2020 season, which is an average of 7.32 mosquitoes per pool. When necessary, Reverse Transcription Polymerase Chain Reaction (RT-PCR) testing for WNV or St. Louis encephalitis (SLE) was performed at the Idaho Bureau of Laboratories (IBL) on samples collected by ACMAD per a standard protocol set forth by the IDHW for confirmation of disease presence within the RAMP samples. Six mosquito samples were sent to the IBL along with a crow sample; WNV RNA was confirmed in five samples as well as confirmation on the crow sample; SLE was not found in Ada County during the 2020 season. The first mosquito pool to test positive for WNV was on August 13th, 2020 during week 32 (*Fig. 3*) which was one week later than in 2019.

Arboviral Risk Assessment

Ada County uses both a *Minimum Infection Rate* (MIR) calculation to assess risk of arbovirus transmission to the public as a variable in the WNV response matrix in additional to other factors and CDC's *Vector Index Coefficient* (VIC). Ada County uses both assessments along with other qualitative and quantitative factors within the surveillance area and further IMM tools to assess potential risk of transmission and to make management decisions and respond quickly and accordingly.

Note: MIR is expressed as the number of positive pools/1000 mosquitoes. In 2018, Ada County began quantifying transmission risk using the CDC's Vector Index Coefficient (VIC). This calculation is more in depth than previously used risk coefficients and accounts for pool size, geospatial factors, as well as multiple vector species in an area (CDC, 2013). VIC is expressed as the percent chance that a mosquito in any given mosquito trapped 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 differing habitat and population behaviors.[4]

[4] CDC's *West Nile Virus in the United States: Guidelines for Surveillance, Prevention, and Control* describes the process of determining Vector Index Coefficient.



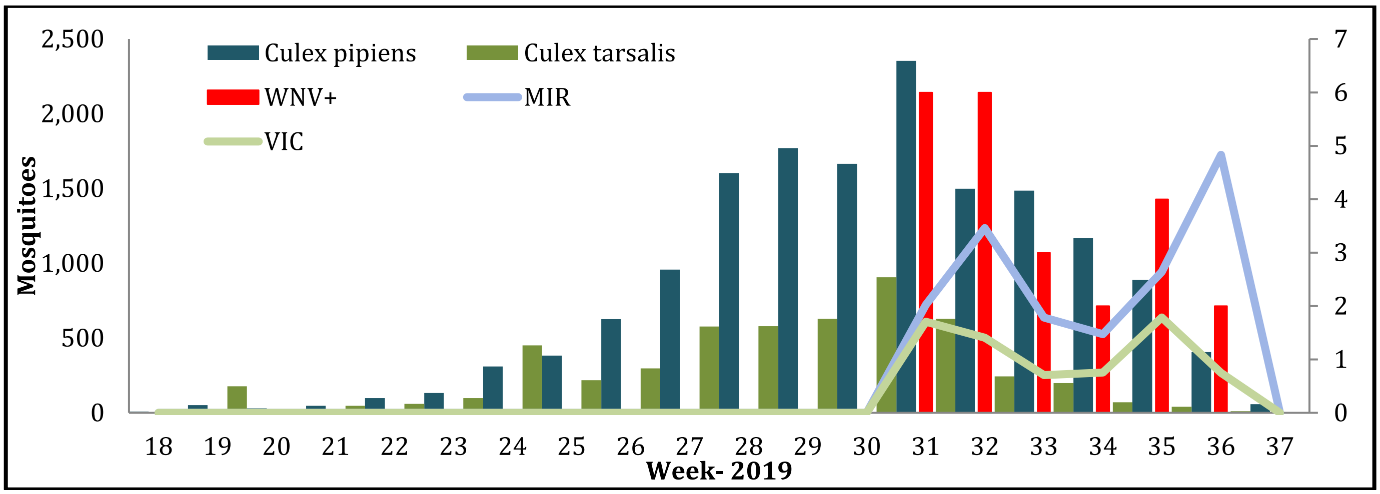


Figure 4. The minimum infection rate (MIR) and vector index coefficient (VIC) over time in 2020 (top graph) vs 2019 (bottom graph). These risk assessment coefficients help set thresholds for ground and/or aerial fogging and make best management decisions to reduce the spread of WNV.

In the comparison shown in *Fig. 4*, the distinction between these two risk assessment strategies can be observed. In 2020, the max MIR (11.6) was observed during week 37, when three positive pools were detected from a total of 259 *Culex spp.* mosquitoes. The maximum VIC (1.08%) was observed during week 35 when five positive pools were detected from a total of 703 *Culex spp.* mosquitoes. VIC accounts for many factors missed by MIR assessments, including the average number of infected vector species mosquitoes in each trap night in an area (CDC, 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).* Comparing the two graphs and vector species abundance over time along with WNV positive pool counts further demonstrates a difference when years of higher frequency of WNV positive pool counts and an increase in vector populations from 2019 and 2020. This information validates why ACMAD uses risk assessments along with historical data and mosquito abundance for IMM and WNV+ response needs.

Species Composition Data

In 2020, ACMAD collected 23,491 mosquitoes during WNV surveillance: *Aedes vexans* (n=12,293), *Culex pipiens* (n=5,928), *Culex tarsalis* (n=2,974), *Anopheles freeborni* (n=70), *Culiseta inornata* (n=258), *Aedes* *nigromaculis* (n=230), *Aedes dorsalis* (n=154), *Aedes cinereus (n=28), Culiseta incidens* (n=832), *Coquillettidia perturbans* (n=43), *Aedes increpitus* (n=2) and *Aedes sticticus* (n=2). In 2019, *Ae. vexans* constituted 64.87% of sampled mosquitoes; in 2020, *Ae. vexans* was reduced to 52.33% (*Fig. 5*) of the sampled population. *Cx. pipiens* made up 25% of all trapped mosquitoes in 2020 and *Cx. tarsalis* was only 13%. However, this season, ACMAD saw a significant increase in *Culiseta incidens*. As we normally trap a handful of this species per year, this season there were 832 mosquitoes trapped throughout the county in different locations, and some were captured almost every week. This species is known commonly as the 'cool weather mosquito' and is typically found to breed in coastal areas, and primarily west of the Rocky Mountains (North American Insects and Spiders website).

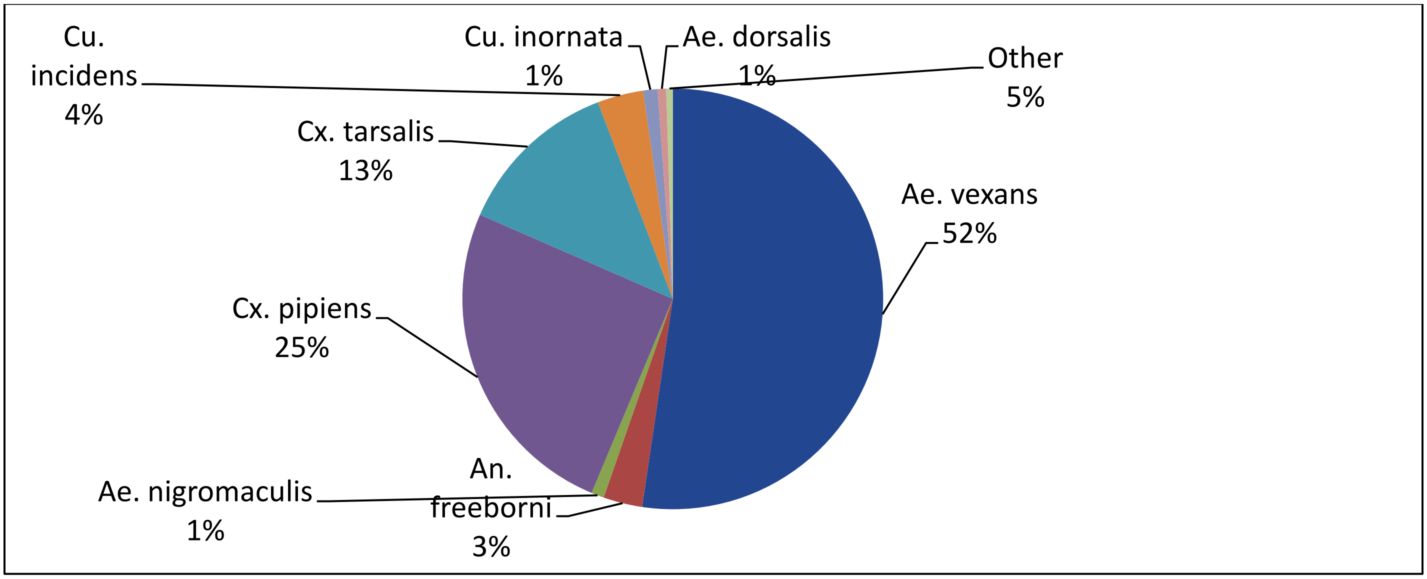


Figure 5. Species composition for mosquitoes sampled by internal surveillance traps, the remaining 5% (Other) is composed of *Culex erythothorax* (n=42), *Coquillettidia perturbans* (n=43), *Aedes increpitus (n=2) and Aedes sticticus* (n=2), *Aedes cinereus* (n=28).

Mosquito Surveillance & Climate Data

Typical precipitation for Ada County occurs mainly outside of the mosquito development season, meaning most development sources are caused by irrigation and landscaping. *Fig.6* shows the total mosquito count and the *Culex* mosquitoes trapped by week. *Culex* spp. activity peaks when nightly temperatures are averaging 60-70+°F, and then slows down when nightly average temperatures reach 52-54°F or less, which is consistent with known *Culex* spp. behavior. The average temperatures were typical (if not a little low) early on, but with a relatively wet spring, However, in weeks 23 and 24, the average temperatures fell close to 10°F from the previous week, which is not typical. Additionally, there was a significant decrease in mosquito population during these two weeks until the temperature spiked again in week 25. During week 25, after consistent rain events and a jump in temperature, there was a significant hatch-off of nuisance mosquitoes due to this weather pattern.

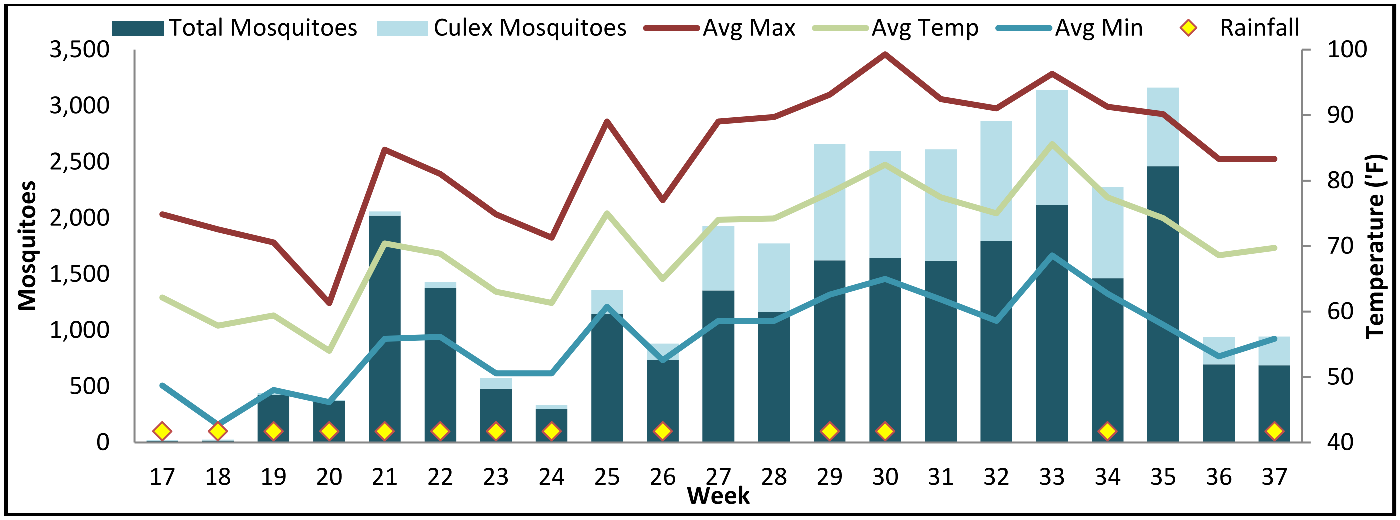


Figure 6. The correlation between mosquito population (left vertical axis) and climate (right vertical axis). The yellow diamonds represent the precipitation events to take place during the 2020 mosquito season.

Mosquito Larviciding Operations

The larvicide division had to adapt and change this year due to the COVID-19 pandemic; as there were only four returning seasonal larvicide field technicians. This resulted in the need to hire more new staff; training options were very limited, and many new technicians were not able to quickly obtain a professional applicator license through ISDA due to cancelled trainings, seminars and testing dates. At which time, the mosquito season had already began, and the new staff operated under supervision of existing licensed staff. The training options took longer and were more time consuming in virtual and one-on-one settings as opposed to group trainings; additionally, monitoring and supervision of staff was limited to reviewing electronic information and we couldn't provide as much hands-on training as we typically do. Due to the one-on-one training early in the season, limited professionally-licensed applicators, and COVID-19 safety protocols, every technician had to drive separate vehicles (instead of teams of two). This increased the mileage, fuel costs, and wear-and-tear on the trucks. Throughout the summer, the department operated short-staffed due to labor shortages reported by contractors, and due to COVID-19 shutdowns. Despite this lack of licensed staff, the mosquito larvicide crew pulled together and completed more inspections and treatments of standing mosquito development sources. We attribute this increase to an extended mosquito larvicide season compared to 2019.

Larval Site Inspections and Treatment Summary

ACMAD mapped 3,276 new larvicide sites in 2020, for a total of 44,691 sites monitored throughout the season (March through October). After the mosquito season ended in October, full-time staff also mapped additional Drain Inlets (DIs) and storm drains in new construction areas and on new roads, bringing the total active sites to 45,592. Of the total sites mapped in 2020, 78% are DIs, which are a favored oviposition habitat for *Cx. pipiens,* an important vector for WNV, and are significantly increasing annually with new development in Ada County. The larvicide crew made 125,397 site inspections this year, which was a 26.3% increase since 2019. This led to 72,433 treatments, 11.8% more than 2019. That is an average of 3,918 inspections and 2,264 treatments per week (*Fig. 7*). The larvicide crew completed 531 public service requests in 2020, which is a 36.7% decrease from 2019 operations. The larvicide crews treated a total of 931 acres by ground applications, which is an increase of 5.7% from 2019 season.

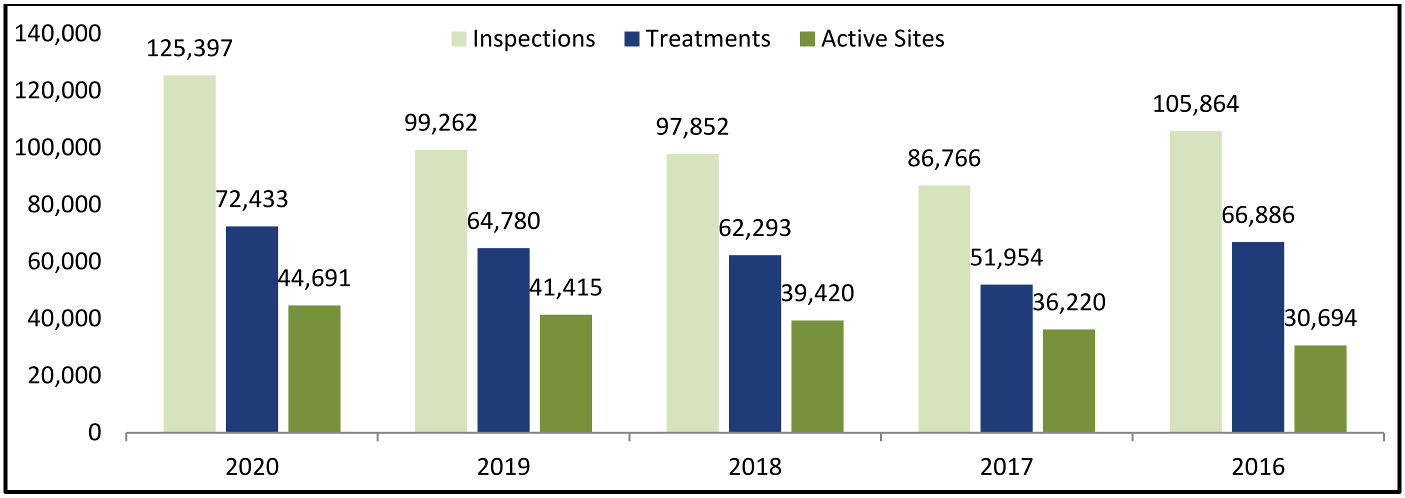


Figure 7. Larvicide operation from 2016-2020; since 2017, ACMAD has seen an increase in treatments, sites, and inspections annually.

Larval Development Habitat Summary

There are many different larval habitats in Ada County, the most commonly-monitored and treated were pastures and DIs. These locations are favored oviposition habitats for *Ae. vexans, Cx. tarsalis* and *Cx. pipiens* respectively. As seen in *Fig. 8*, 55.3% of acres treated in 2020 were pastures, and only 17.2% of acres treated were DIs. A total of 35,669 DIs were monitored in Ada County, making up 77.6% of ACMAD's known larval development sites. The acreage difference is relative to the size of the site, so while more pasture acreage was treated for mosquito larvae, DIs were monitored more, and the prime habitat of the main WNV vector, *Cx. pipiens* in Ada County.

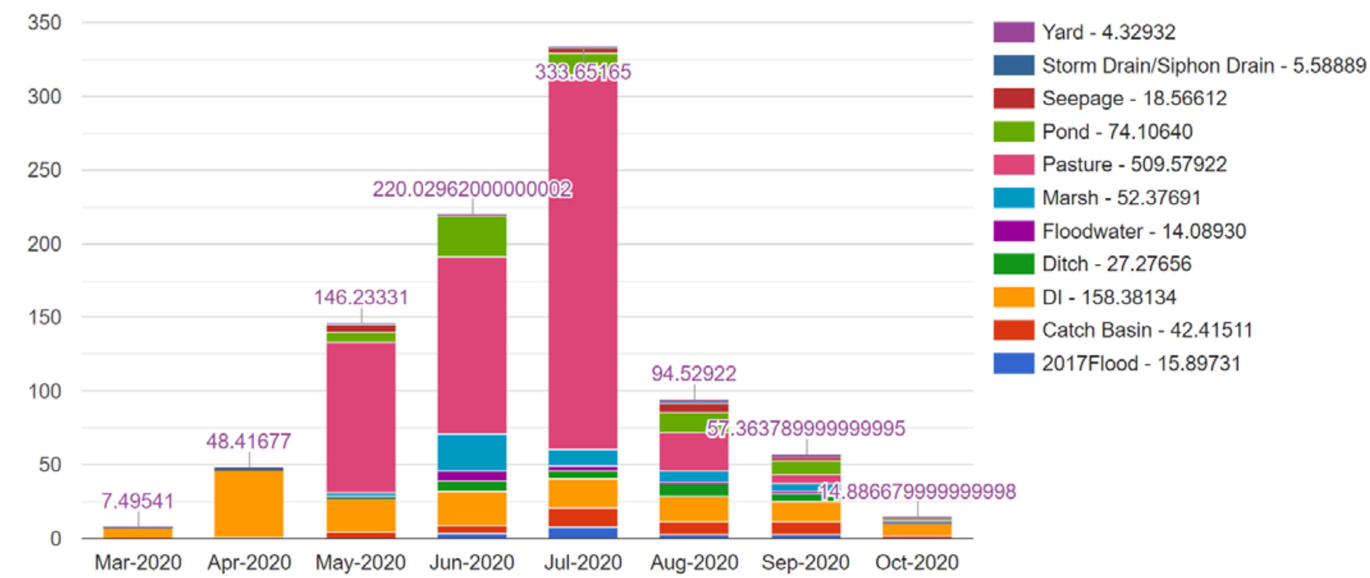


Figure 8. Acres treated by the ACMAD larvicide team, sorted by site category. *Note: only categories with a monthly total >1 acre is displayed.*

Larvicide Product Summary

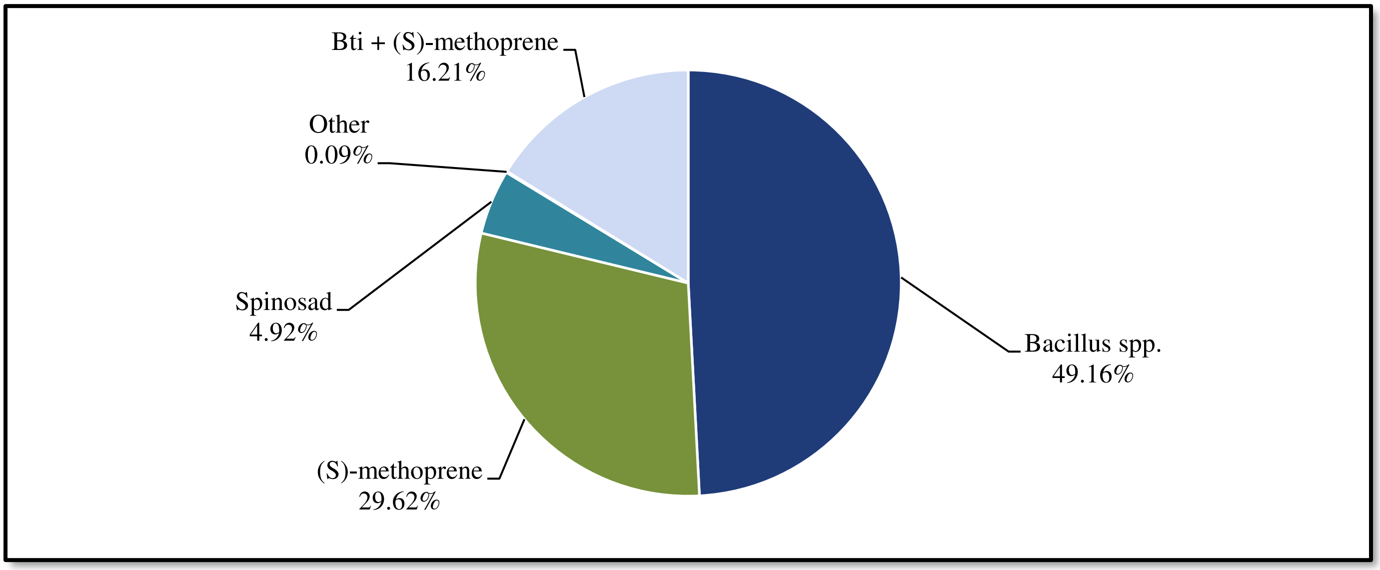


Figure 9. An example of the active ingredients present in larvicide products used by ACMAD 2019.

Historically, as seen in *Fig. 9*, of the 931 acres treated in 2020 by the larvicide team, the vast majority are treated with biological control agents that are natural bacterium such as *Bacillus* species (*Bti*. and *Bs*.) or Spinosad. *Bacillus* species are soil-dwelling or aerobic spore-bearing bacteria which develop proteins toxic to insect larvae. Certain strains of *Bacillus* are toxic to specific insect larvae, such as *Bacillus thuringiensis israelensis (Bti)* which targets only mosquito and black fly larvae. *Bacillus* species do not leach into soil and are effectively non-toxic to humans, birds, fish, domestic pets, livestock, and other wildlife. Biological controls are an essential concept of IMM and are considered biological organisms used to control mosquito populations within Ada County. Many of these formulations used by ACMAD are OMRI certified (organic).

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 its EPA-registered label. Typically, (S)-Methoprene has long-term residual activity which helps reduce labor costs and increase in mosquito inspection efficiencies and larval source reduction.

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 to pickup trucks, which are then driven throughout the county, after dusk, and an EPA-approved insecticide is released at designated locations to control flying adult mosquitoes. ULV foggers release micron-sized droplets of insecticides, which are lethal to flying mosquitoes but are not lethal to larger beneficial insects such as dragonflies, butterflies, or moths (Johnson 2010, Schleier and Peterson 2013, and Schleier and Peterson 2010). ACMAD also takes a proactive approach to avoid water bodies with fish, and known honey bee hive locations when applying adulticide chemicals. We also limit ULV applications to after dusk when bees have returned to their hive and are not actively flying or foraging on plants. An estimated total of 52,671 acres (this number is with a rounded buffer on the GIS lines and completely dependent on wind direction and the industry standard 300 ft. rounded edge buffer) were treated during 2020. In 2020, there were no aerial insecticide applications in Ada County.

Adulticide Treatment Summary

ULV applications are based on public requests, WNV response, and mosquito population thresholds, as determined by surveillance. If a surveillance site traps more than five vector mosquitoes, or 25+ nuisance mosquitoes, and the action threshold has been met, an adulticide applicator is dispatched to the location within 48 hours. If WNV is found by the surveillance team, the adulticide team is dispatched within 12 hours and a ULV application is made to all accessible roads within one square mile of the positive location which can also be seen through the positive correlation of spray miles within the same week of positive pools (see Fig. 10). This is because *Culex* mosquitoes are not normally known to travel over a mile from their hatch location, but mosquito behavior can be dependent on species and blood source availability.

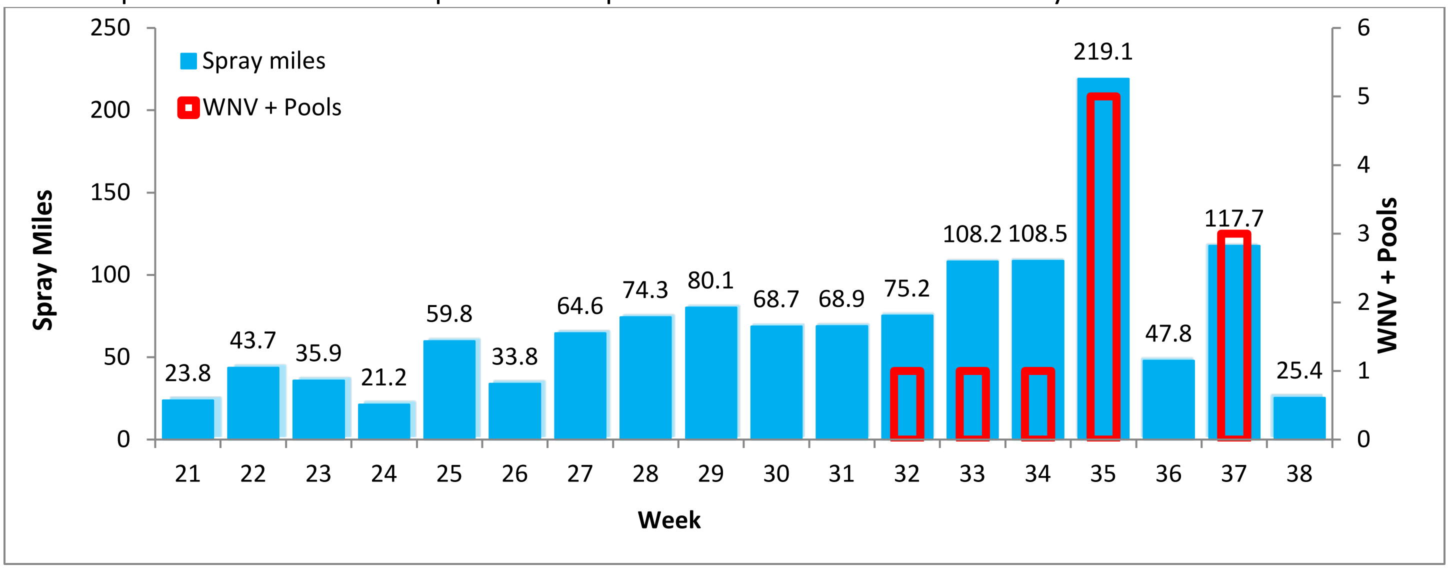


Figure 10. Weekly spray miles for 2020 with WNV+ pools. There is a correlation between the number of WNV+ pools, which result in a 1 mi.^{2} application, and the total weekly spray miles; a total of 468 gals of insecticide was used in 2020.

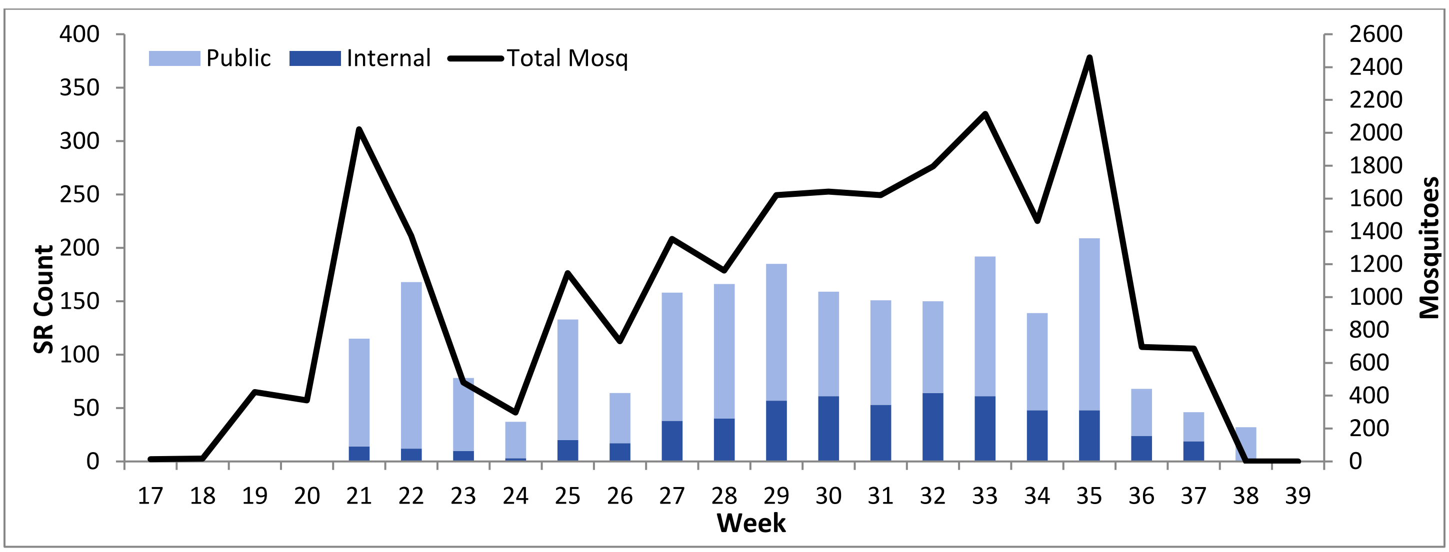


Figure 11. Comparison of public and internal adulticide service requests (SR) with total mosquito population sampled by week.

ADA COUNTY MOSQUITO ABATEMENT DISTRICT

As seen in *Fig. 11*, the adulticide team responded to 2,275 service requests[5]; 589 prompted by internal action thresholds, and 1,686 requests from Ada County residents throughout the 2020 season. This was a significant decrease by the public and internal service requests generated from surveillance trap sampling results by 36.4% from 2019. All public mosquito complaints were followed up with a ULV application, and many verified with surveillance traps.

Projects and Field Trials

Back-check Project

During the 2020 season, ACMAD worked on the Commercial DI Back Check project and was intended to provide data on long term briquet efficacy in a real-world scenario. Per the pesticide label, some of these products have control ranges from 150-180 days. In previous seasons, field technicians would often place these products in commercial DIs or drains in industrial areas where washout was not likely to occur, and the product was unlikely to be removed by professional drain companies. Field technicians would consider the site to be treated for the season and would not perform follow-up inspections (which is necessary with other products). This would allow the field technicians to save time and resources and divert those efforts to finding new mosquito development sites, or helping other technicians with assigned projects/areas.

ACMAD monitored the efficacy of Natular XRT (Spinosad), Fourstar 180-day briquets (Bti/Bs), and Altosid XR Briquets (Methoprene), ACMAD also added Sumilarv (pyriproxyfen) as a field trial product only with observation of efficacy (dependent on concentration at time of application). All data below is preliminary and final analysis and results of this project will be documented in a separate project report at a later time.

Beginning June 8th, 2020, the mosquito laboratory technician inspected 183 commercial DIs located in Boise or Meridian. There were 45 sites assigned to each treatment plan, split between multiple properties. Weekly for 17 weeks, the technician inspected each of these locations and dipped for larvae with an average of three dips if wet, and would mark if flowing or dry, if the product was visible or had high organic matter. Those with instar four or pupae (dependent on product treated with at the beginning of the year) were sampled and taken back to the lab for adult emergence results.

Long Term residual products-

There were 2425 inspections with very few larvae/pupae samples taken back to the lab adult emergence analysis. Data analysis is still be performed at the time of this report.

Sumilarv field assessment-

Sumilarv was tested as a field trial product to determine length of control using one, two, and three water soluble packets per the label as application rates in “dead-end” storm drains that did not lead to a natural body of water. At the time of this report, the data was still being reviewed and analyzed so the following information is preliminary; however, of the 49 sites sampled, there were 542 inspections and 13 samples were collected with pupae, of which, two had adult emergence. These pupae sampled

[5] A map of adulticide service request frequency can be found in Appendix 1.3.

locations were also noted as consistently seeing frequency of larvae/pupae, while the other sites monitored no larvae/pupae were observed during the trial.

Pesticide Resistance Testing

Pesticide resistance testing is a necessary step to evaluate that the most effective insecticides are being used to combat adult flying mosquitoes. Using the CDC Bottle Bioassay protocols, insecticide resistance was monitored at two different locations in Ada County. These locations were tested for resistance to the technical-grade active ingredients Permethrin, ACMAD's primary active ingredient adulticide. The two testing locations were chosen by the frequency and density of historical applications of insecticide containing the active ingredient, by public and private sector applicators throughout the years.

Permethrin-

Samples were collected from surveillance trap locations in Eagle and Star in June and July (mid-mosquito season). The first round of testing was conducted on June 16th, from field-collected mosquito samples. The mosquitoes were tested for resistance to Permethrin (mosquitoes trapped were held for 12-24 hrs. and fed). During the June 16th Permethrin testing, *Aedes vexans and Culex tarsalis* (n_{Eagle}=48 and n_{Star}=10) mosquitoes were exposed to 15.0 µg Permethrin, and had a 100.00% mortality rate at the diagnostic time. This mortality rate indicates the mosquitoes are highly susceptible to Permethrin at the time of testing. Mosquitoes were also tested on July 14th, mid-season for Permethrin resistance. Using mosquitoes sampled from Star and Eagle, *Aedes vexans* and *Culex tarsalis* and *Culex pipiens* (n_{Star}=40 and n_{Eagle}=32) displayed a 97.43% mortality rate at the diagnostic time which indicates a high susceptibility.

Conclusion

There were many challenges in 2020 that inhibited standard operating procedures with hiring and training. ACMAD responded by employing temporary adaptions for field technicians this spring and into summer. There were direct increases in budget costs that were unplanned for in 2020, which included things like masks, safety supplies, fuel usage, maintenance and repair on vehicles, and time spent training new staff one-on-one. Opportunity costs were endured due to enhanced safety protocols related to COVID-19. With all this, ACMAD personnel stepped-up to complete work loads and stay on top of mosquito monitoring and treatment throughout the season. Due to several factors, ACMAD continued to experience personnel turnover (both seasonal and full-time) which continued to put more stress and workloads on existing staff, and reducing secondary task production.

The weather helped field technicians and contributed to a delayed mosquito population abundance in early spring. This allowed technicians to discover and treat breeding sites before large nuisance hatches could occur. There was no flooding of the Boise River this season which also helped reduce mosquito abundance along the river corridor - which is typically seen early in the spring, and results in high adult mosquito populations and adulticide public service requests.

With less mosquitoes, and no river flooding, field technicians were able to treat and monitor more sites and vector source production areas. This helped contribute to less WNV positive locations within sampled areas (n=11 pools) in Ada County in 2020 than in previous years. ACMAD saw less (65%) overall nuisance and vector mosquitoes due to the lower-than average temperatures and weekly precipitation (weeks 17 through 24).

Likely because of this, ACMAD observed an unusual increase in *Culiseta incidens* of eight times as many as compared to 2019 throughout the county.

Due to reduced mosquito populations, increased larvicide acres treated and monitored, and less WNV positive pools, there was also a direct reduction in adulticide operations in acres (23% less) treated as well as lab-produced and publicly-requested service requests (36.4% less).

While standard operations were impacted by the COVID-19 pandemic, public health emergency protocols and significant societal stresses to personnel and residents; the weather was mild and the mosquito population was low resulting in ACMAD having an overall fairly successful year with an "easier" mosquito season to maintain, monitor and treat despite exogenous setbacks.

ACMAD Goals

Goals for 2020…

I. Improve upon mid-season training for all seasonal staff to ensure *Best Management Practices* are followed
   a. More one on one training was conducted throughout the season out of necessity, but for most of the year, it was remote (via phone) and distant due to the COVID-19 restrictions and hindered the ability to complete a full in-depth mid-season training
II. Conduct Adulticide efficacy field trial and operations analysis
   a. This project was cancelled for 2020 due to loss of support staff mid-season and COVID-19 restrictions
III. Strengthen public education on land management practices with the help of our Public Information Officer
   a. This goal was limited to only a few social media informational outreach actions, all in person activities and education events were cancelled due to the COVID-19 restrictions

Goals for 2021…

I. Improve upon mid-season training for all seasonal staff to ensure *Best Management Practices* are followed
II. Conduct Adulticide efficacy field trial and operations analysis, we hope to have this project enacted again in 2021 after the pandemic of 2020
III. Strengthen public education on land management practices with the help of our Public Information Officer

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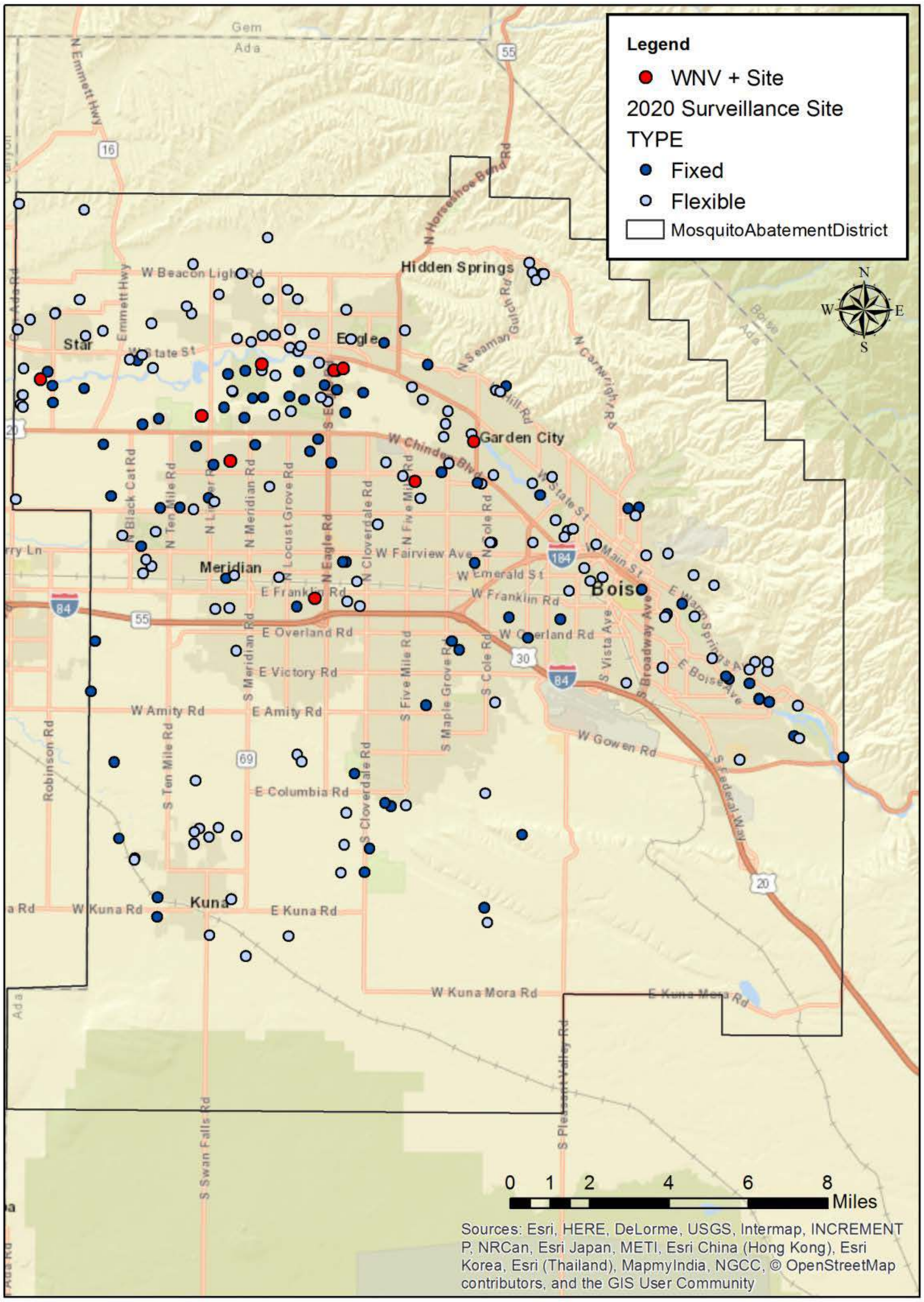
Appendices

Appendix 1.1

Week	Start Date	End Date
17	April 26, 2020	May 2, 2020
18	May 3, 2020	May 9, 2020
19	May 10, 2020	May 16, 2020
20	May 17, 2020	May 23, 2020
21	May 24, 2020	May 30, 2020
22	May 31, 2020	June 6, 2020
23	June 7, 2020	June 13, 2020
24	June 14, 2020	June 20, 2020
25	June 21, 2020	June 27, 2020
26	June 28, 2020	July 4, 2020
27	July 5, 2020	July 11, 2020
28	July 12, 2020	July 18, 2020
29	July 19, 2020	July 25, 2020
30	July 26, 2020	August 1, 2020
31	August 2, 2020	August 8, 2020
32	August 9, 2020	August 15, 2020
33	August 16, 2020	August 22, 2020
34	August 23, 2020	August 29, 2020
35	August 30, 2020	September 5, 2020
36	September 6, 2020	September 12, 2020
37	September 13, 2020	September 19, 2020
38	September 20, 2020	September 27, 2020

Appendix 1.2

2020 Mosquito surveillance locations and WNV positive pools in sampled adult mosquito populations



ADA COUNTY MOSQUITO ABATEMENT DISTRICT

Appendix 1.3

Frequency of Adulticide Service Requests 2020