

A detailed, close-up photograph of a mosquito, focusing on its wings and the base of its abdomen. The wings are spread out, showing the intricate network of veins. The body is a golden-brown color, and the base of the abdomen is covered in a dense pattern of small, colorful, iridescent scales. The background is a soft, out-of-focus white.

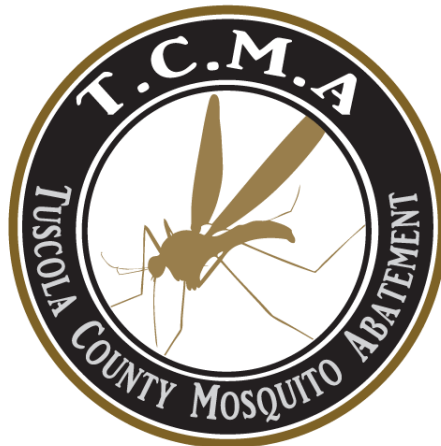
TUSCOLA COUNTY MOSQUITO ABATEMENT

2022 ANNUAL REPORT

2023 PROGRAM PLAN

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TCMA TIMELINE HIGHLIGHTS



ORGANIZATION

The Tuscola County Mosquito Abatement (TCMA) district was originally formed in 1997, after a millage proposal was passed by the citizens of Tuscola County. In August 2020, a six year renewal was passed with overwhelming support. Funding for the 2022 mosquito control season was collected during the winter of 2021 taxes, at a rate of 0.65 mills.

Tuscola County is currently one of four counties in Michigan with a formal comprehensive mosquito control program. TCMA is a county governmental agency, which serves to control nuisance and disease vectoring mosquitoes.

A Technical Advisory Committee (TAC), which is composed of some of Michigan's leading biologists, entomologists, conservationists, and scientists review TCMA's program every March.

Mosquito Abatement is based on Integrated Pest Management (IPM) practices. IPM is generally broken down into five categories or steps. These steps include:

- Identification of the pest
- Understanding the biology of the pest
- Monitoring the pest
- Developing sound goals to manage the pest
- Implementation of an IPM program

Biological surveillance, disease surveillance, product evaluations, field operations, and public education are included in this program.



STAFFING

Tuscola County Mosquito Abatement employed 19 seasonal positions and four full time staff in the 2022 season.

All TCMA technicians are required to have a MDA Certified Pesticide Applicators License (with a mosquito specific – 7F endorsement).

Newly hired staff, and those in need of re-certifying, are given study materials to review prior to testing. At this time, the Michigan Department of Agriculture has made all testing virtual through Metro Institute.

Once newly hired staff have passed all testing requirements, several days of training are provided to help technicians become familiar with equipment and operations.

Beginning with our annual spring treatment of flooded woodlots, all technicians will be working the day shift, 8:00am to 4:00 pm. When night time fogging begins, we split our crew and a night shift will be added from 5:00pm to 1:00am.

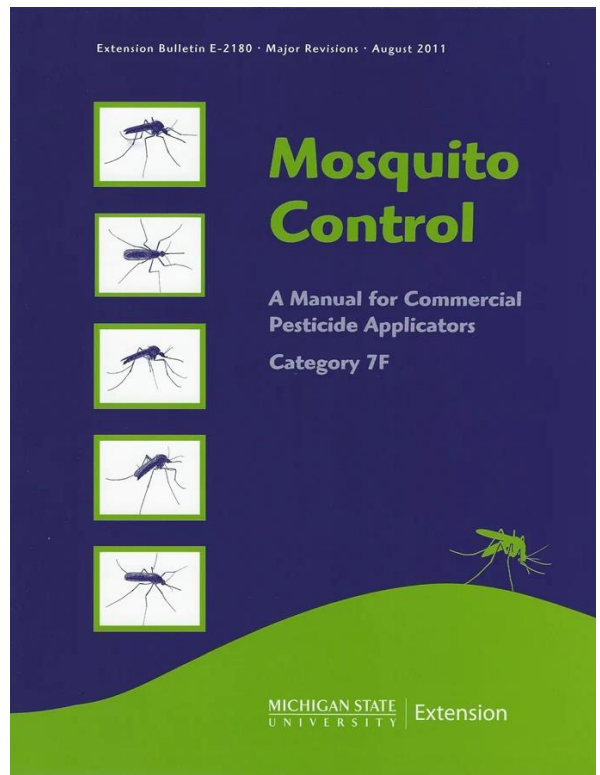
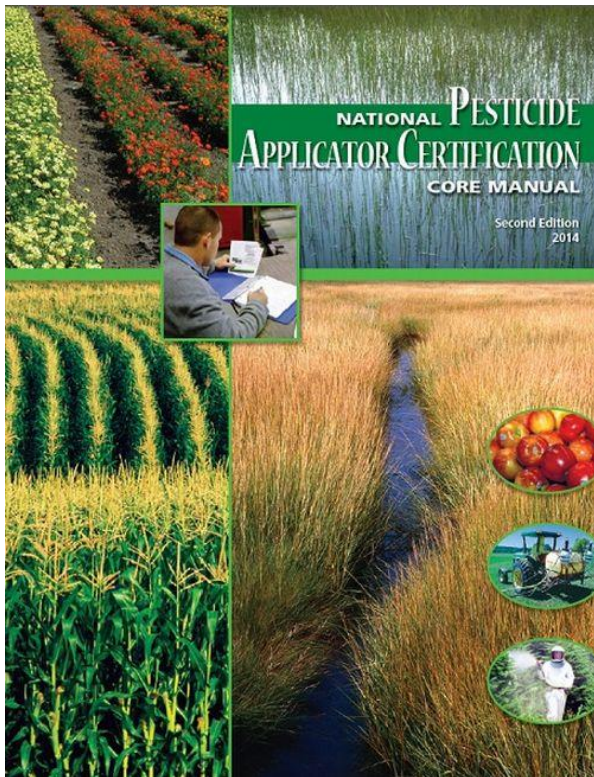


SAFETY & EDUCATION

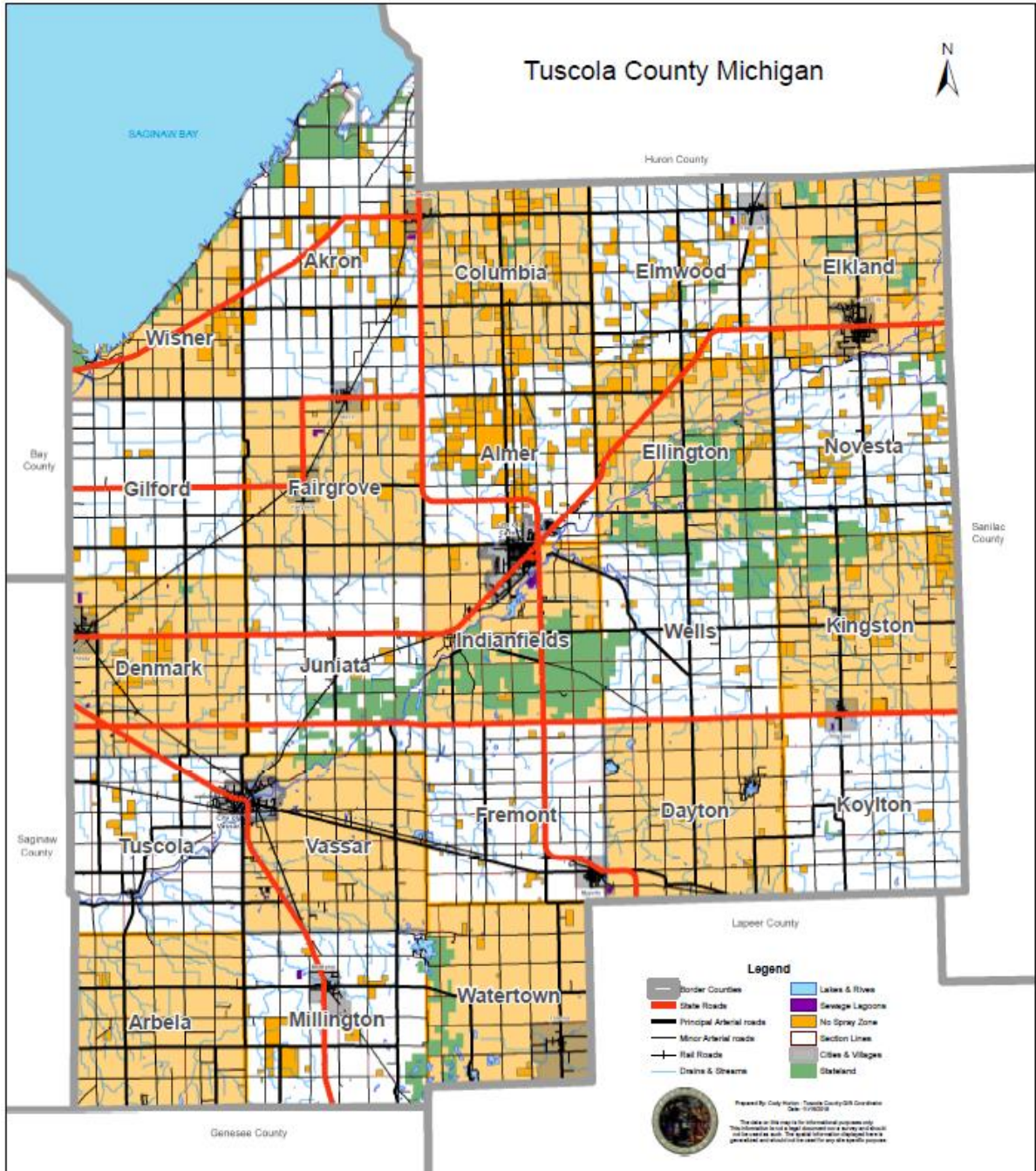
Michigan regulations require commercial applicators to pass two exams. One exam confirms practical knowledge of Core pesticide use and safety . The other exam is category specific to Mosquito Control-7F.

These exams require comprehension of pesticide label and labeling, safety and hazards, first aid, personal protective equipment use, and emergency response. Study manuals provide information about pesticides in the environment, pest identification and management, pesticide formulations, pesticide application equipment, application techniques, and laws and regulations.

All technicians employed at TCMA have successfully taken and passed both of these exams. This ensures all technicians are trained appropriately in knowledge and safety before going out into the field.



TUSCOLA COUNTY MAP



LONG DRIVEWAY PROGRAM

We realize that many homes in Tuscola County are set back from the county road and therefore, are subsequently shielded from the effect of the road-side adulticiding operations. If requested by the owner, their property will be reviewed to see if it meets the criteria. If the property does meet the established requirements, it will be placed on our Long Drive Program. The drive, at that time, will be marked with our long drive stake that has a reflective band at the top. These stakes are placed by our technicians. (We do ask the homeowners to remove them during the winter months to avoid possible damage from snow plows etc.). By placing these stakes at the end of the drives, our technicians are able to see the reflective band and treat the drive as required.

The criteria for a home to be placed on the Long Drive Program are:

- There must be a primary residence on the property and the front of the home must be 300 ft. or greater from the roadway.
- There must be an adequate turnaround for our trucks that does not require driving across any lawn areas.
- The drive must be passable with two-wheel drive vehicles.
- The drive must have significant vegetation that provides areas for mosquito harborage.

In 2022, we held our open enrollment for the long driveway program from March through April. Tuscola County currently has 562 residents enrolled in this program.



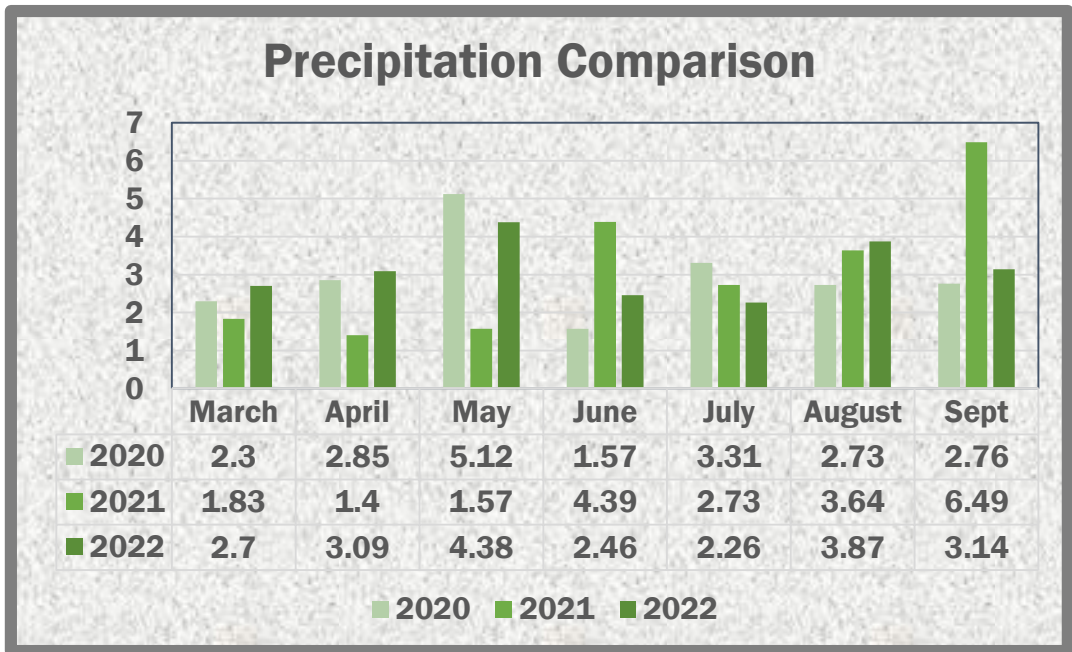
WEATHER DATA

Weather plays a very important role in determining our mosquito population.

Rain events that cause flooding or standing water create breeding areas that will result in a hatch of mosquitoes.

The 2022 season began relatively dry. On Monday April 4th, TCMA began treatments of flooded woodlots.

Overall, the county received 21.9 inches of rainfall this season, making it drier than last year. Monitoring the weather is a daily event due to the fact that all treatment techniques are weather dependent.



OPERATIONS

Mosquito Abatement strives to keep residents safe from mosquito-borne disease by reducing the mosquito population in our county.

This is done through various forms of treatment, typically beginning in late March, when we begin surveillance and treatment of the flooded woodlots with ground crews.

Once adult mosquitoes are present, usually in mid May, we introduce our second shift of technicians. They will begin to conduct routine roadside fogging and yard treatments for homeowners, when requested.

Early summer larviciding will include routine surveillance and treatment of ditches, catch basins, and sewage lagoons. Later in the season we will conduct surveillance and treat cross country ditches.

We maintain public use areas such as parks, campgrounds, trails, conservation clubs, golf courses, and schools on a weekly schedule during the season. This is to keep our citizens safe from disease carrying mosquitoes.

Residents may request yard treatments for special events such as weddings, parties, etc. We also provide treatment for the many festivals that occur throughout the county.



TREATMENT SITES

MATERIAL	TREATMENT SITE
BVA (Mosquito Larvicide Oil) (highly refined petroleum distillate)	Swamps, Flooded Woodlots, Flooded Fields
Kontrol 4-4 (permethrin)	Roadside fogging, Public Use Areas, Private Property
Four Star Briquets 90 Day (Bacillus sphaericus 6% Bacillus thuringiensis 1%)	Retention Pools
Mavrik (Tau-fluvalinate)	Select Private Property
Mosquito Dunks (Bacillus thuringiensis)	Small water hole, artificial containers
VectolexFG(Bacillus sphaericus)	Catch Basins
Suspend Polyzone (Deltamethrin)	Select Private Property
VectoBac G (Bacillus thuringiensis)	Flooded Woodlots, Artificial Containers, Tires, Ponds
VectoBac 12AS (Bacillus thuringiensis)	Roadside Ditches, Retention Ponds
VectoBac 12AS (Bacillus thuringiensis)	Lagoons

SPRING / SUMMER LARVICIDING

We begin in the early spring with the treatment of flooded woodlots.

This is done by our technicians, using hand held spreaders to deliver granular BTI or a backpack sprayer to deliver mosquito larvicide oil to the flooded areas.

We utilize a citizen tracking database, which allows us to keep a historical record of homeowners and locations throughout the county, with woodlots that may require treatment in the spring.

Biology staff and larviciding crews conducted routine surveillance and quality control on 2,067 flooded woodlot sites during the 2022 season, compared to 2,591 last season. In 2022 there was no delay in starting the season, so we were very pleased our crews were able to treat on schedule.

Tuscola County is home to nine sewage lagoons. Many of these areas have been known to be breeding sites. Each of these sites were checked routinely and treated throughout the 2022 season, using liquid BTI (VectoBac® 12 AS) and BTI (VectoBac® G). Catch Basins are treated 2-3 times throughout the season, depending on need, using VectoLex FG.

In addition, larviciding is also performed in the cross country ditches, flooded fields and artificial containers as needed using BTI (VectoBac® G).



ADULTICIDING

Tuscola County is made up of 23 townships. Each township is assigned a technician that will perform roadside fogging throughout the season.

Tuscola County currently has 817 “NO Spray” areas. These areas are organic farms or beekeepers, as well as residents who wish not to be treated. We utilize the FieldWatch site to help us stay current with new fields or beehives.

Assigning a technician to a specific township, allows them to become familiar with these special conditions. No Spray signage is checked at the beginning of every season to replace or post signs where needed.

Treatment route maps are updated routinely during the season, utilizing updates received from FieldWatch and our county citizens.

Kontrol 4-4 (Permethrin) is applied at 4.5oz. per minute, with truck mounted ULV units. Treatment is also conducted on a routine basis in all public use areas (parks, golf courses, schools, campgrounds, rail trails, gun clubs and archery clubs) using our Kawasaki Mule, equipped with a ULV unit. For treatment to be effective, temperatures must be above 50 degrees and winds below 10 miles per hour.

Citizens requesting treatment of their property are treated using a hand held thermal fogger or ULV backpack sprayer.



ROADSIDE DITCH TREATMENT

TOWNSHIPS	MILES DRIVEN	GALLONS USED
AKRON	235	2.60
ALMER	188	1.90
ARBELA	177	1.40
COLUMBIA	204	2.35
DAYTON	172	1.25
DENMARK	151	1.05
ELKLAND	139	1.10
ELLINGTON	138	1.20
ELMWOOD	159	1.90
FAIRGROVE	178	1.37
FREMONT	172	1.60
GILFORD	179	0.85
INDIANFIELDS	132	1.70
JUNIATA	188	0.90
KINGSTON	108	1.40
KOYLTON	141	1.50
MILLINGTON	159	1.10
NOVESTA	186	2.45
TUSCOLA	156	1.00
VASSAR	147	1.10
WATERTOWN	132	0.50
WELLS	202	2.20
WISNER	103	1.00

ROADSIDE TRUCK FOGGING

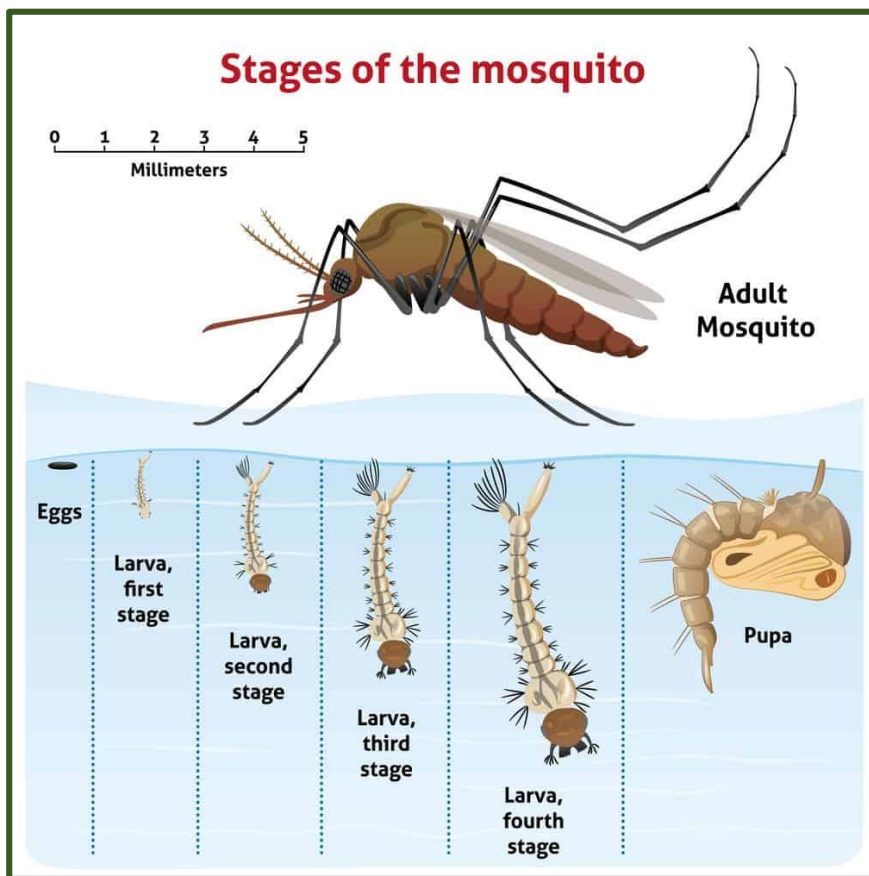
TOWNSHIP	MILES DRIVEN	GALLONS USED
AKRON	1304.00	206.78
ALMER	1009.00	161.05
ARBELA	1954.70	389.14
COLUMBIA	255.60	47.43
DAYTON	1568.10	227.30
DENMARK	921.70	130.54
ELKLAND	1133.50	209.47
ELLINGTON	927.40	175.80
ELMWOOD	979.60	128.20
FAIRGROVE	804.87	132.77
FREMONT	1046.90	195.94
GILFORD	653.40	94.64
INDIANFIELDS	2903.50	364.68
JUNIATA	1060.00	228.52
KINGSTON	1098.20	168.27
KOYLTON	1203.20	202.22
MILLINGTON1460	1460.80	399.56
NOVESTA	903.90	144.68
TUSCOLA	835.60	161.84
VASSAR	2575.50	415.24
WATERTOWN	896.10	164.04
WELLS	1168.80	182.38
WISNER	651.40	124.20

BIOLOGY

In order to develop a mosquito suppression strategy, a critical component in an Integrated Pest Management approach (IPM), the biology department conducts routine trapping. This trapping helps to monitor for mosquito population levels and disease. This Information, along with information provided by our residents, can be helpful in determining where we need to focus our efforts.

Our biology staff also monitors the effectiveness of our control materials. During our spring treatment of flooded woodlots, the technicians will dip the water routinely to determine where mosquito larvae can be found. Once the crew has treated said areas, our biology staff will return to those sites to confirm the application was effective.

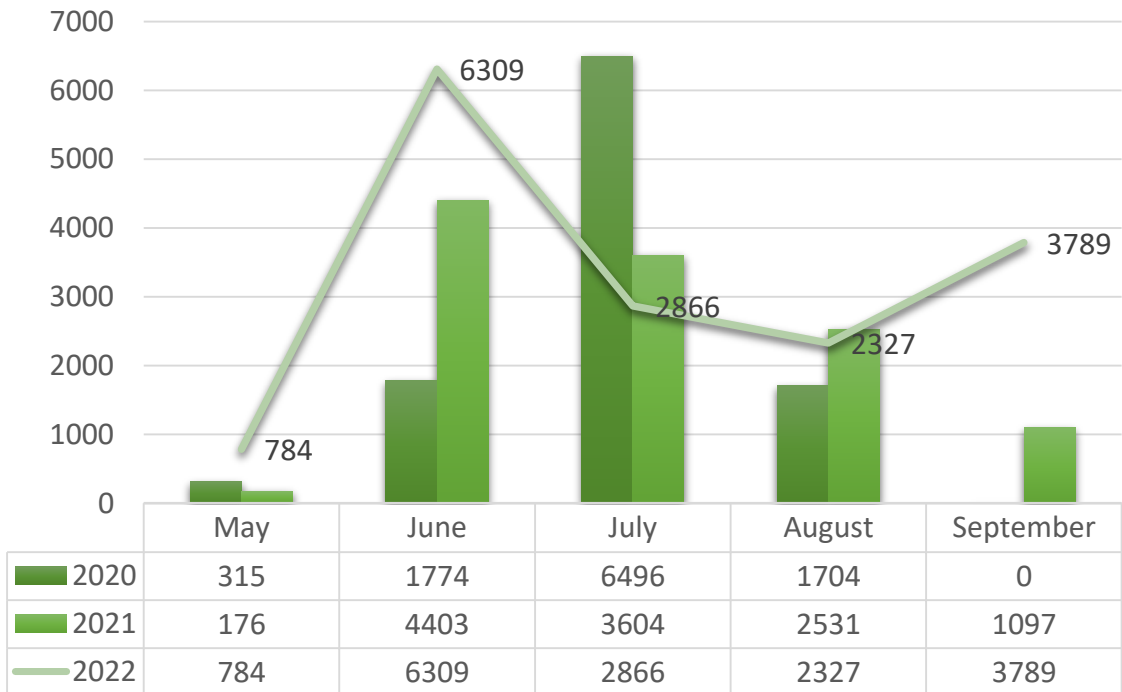
When monitoring the effectiveness of the adulticiding operations, traps are placed the night before an application, and then after. This will determine if the application was effective in suppressing mosquito populations.



NEW JERSEY LIGHT TRAPS

These traps are placed in fixed locations throughout the county year after year, supplying historical data on mosquito populations. They require a supply of electricity, which provides a light source to attract mosquitoes. Once mosquitoes have been attracted, a fan pulls them downward into a collection container, in this case, we use a mason jar. Inside said jar, a pesticide strip kills any bugs that have entered the trap. These traps are collected one to three times per week, depending on the amount of mosquito activity. Often times, we will base our suppression strategy off the information provided by the NJLT.

The mixed graph below shows the 2022 season's total monthly counts compared to that of 2020 and 2021. Looking at the line graph, which depicts 2022's monthly count totals, you can see that our seasonal counts started off much higher than that of years prior. This graph also indicates a spike of numbers earlier in the season that drops off into July and August. This means that, much like last season, our summer hatch came in June rather than July. Moving into September, you'll see our numbers spiked yet again. This indicates we had another hatch right before our season ended. However, this hatch was early on in the month so we were able to control these counts. The cooler weather then took care of any pests that were left; leaving our trap counts with no more than 10 mosquitoes per trap.



NEW JERSEY LIGHT TRAP YEARLY TOTALS

YEAR OF COLLECTIONS	Average High	Average Low
2022	79	51
SPECIES/LOCATION	TOTAL	
<i>Ae. canadensis</i>	2298	
<i>Ae. implicatus</i>	9	
<i>Ae. stim./fit.</i>	4	
<i>Ae. triseriatus</i>	217	
<i>Ae. trivittatus</i>	37	
<i>Ae. provocans</i>	33	
<i>Ae. japonicus</i>	16	
<i>Ae. cinereus</i>	0	
<i>Ae. vexans</i>	104	
<i>An. punctipennis</i>	427	
<i>An. quadrimaculatus</i>	1641	
<i>An. walkeri</i>	0	
<i>Cs. inornata</i>	0	
<i>Cs. minnesotae</i>	82	
<i>Cs. morsitans</i>	0	
<i>Cs. melanura</i>	9	
<i>Cx. pipiens</i>	1060	
<i>Cx. restuans</i>	110	
<i>Cx. tarsalis</i>	0	
<i>Cx. territans</i>	69	
<i>Cq. perturbans</i>	2847	
<i>Ps. ciliata</i>	2	
<i>Ur. sapphirina</i>	0	
<i>ps. Ferox</i>	2	
<i>Ae. sollicitans</i>	1	
	0	
Damaged	33	
Total Female	8968	
Total Male	7074	
YEARLY TOTAL: 16075		

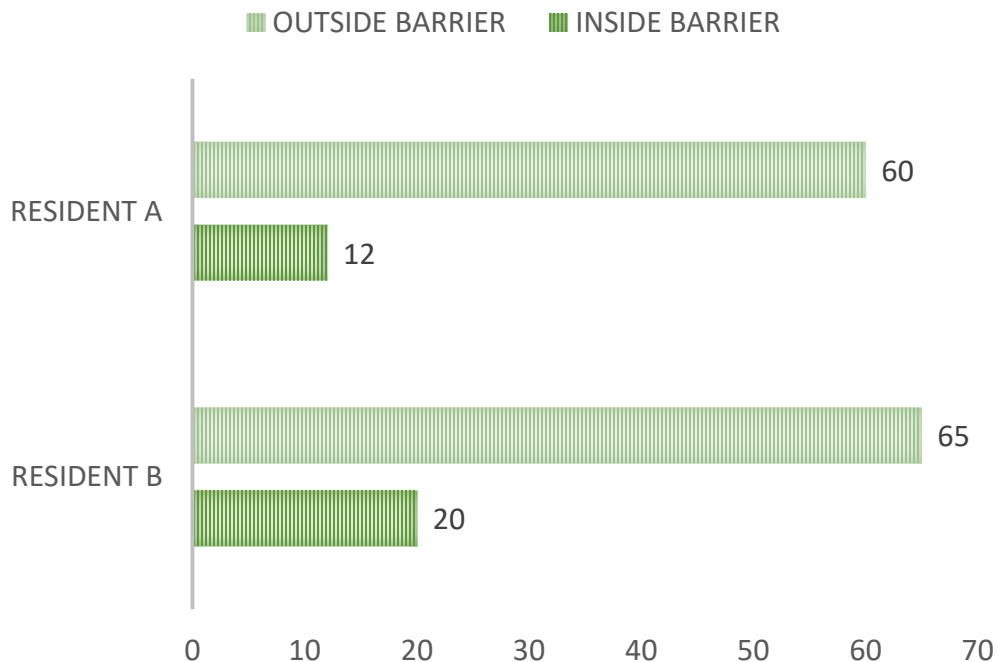
CDC TRAPS

Using a combination of light and CO₂, this smaller trap draws in mosquitoes that are searching for a blood meal. Once close enough to the light and the tube that connects the CO₂ tank to the trap, a fan pulls the mosquitoes down into a collection chamber.

We use CDC light traps to see just how effective our barrier treatments are. In order to make sure our treatment methods are still adequate, we place two CDC traps in the vicinity of a residents barrier treatment. One gets placed outside the barrier treatment and the other on the inside. Once we collect and count trapped mosquitoes, we are able to see if there is a significant difference between the two counts. If so, this means that our treatments were effective.

In the chart below, you will see data we were able to record from two different residents' yard treatments during a single season. These totals provide proof that our treatments are very effective.

CDC TRAPPING TOTALS

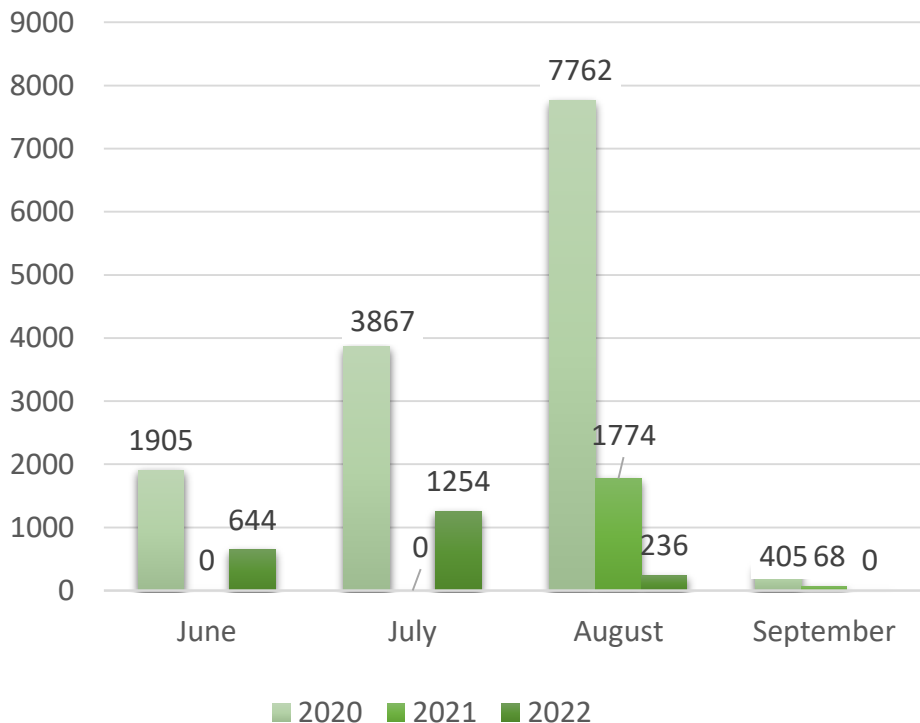


GRAVID TRAPS

Gravid Traps use highly organic water to lure in mosquitoes. These mosquitoes are typically females that have had a blood meal and are looking for a potential place to lay eggs. The mosquitoes collected from these types of traps are generally *Culex pipiens* and *Culex restuans*, that can transmit West Nile Virus. We use mosquitoes from these traps to test for disease.

The graph below compares the number of *Culex* mosquitoes trapped during the past three seasons. As shown in the graph, our counts were much higher in the beginning months than that of last season, but significantly lower than that of the 2020 season. We ended our 2022 season with 0 trap counts during September.

Gravid Trapping Data



BG-GAT TRAP

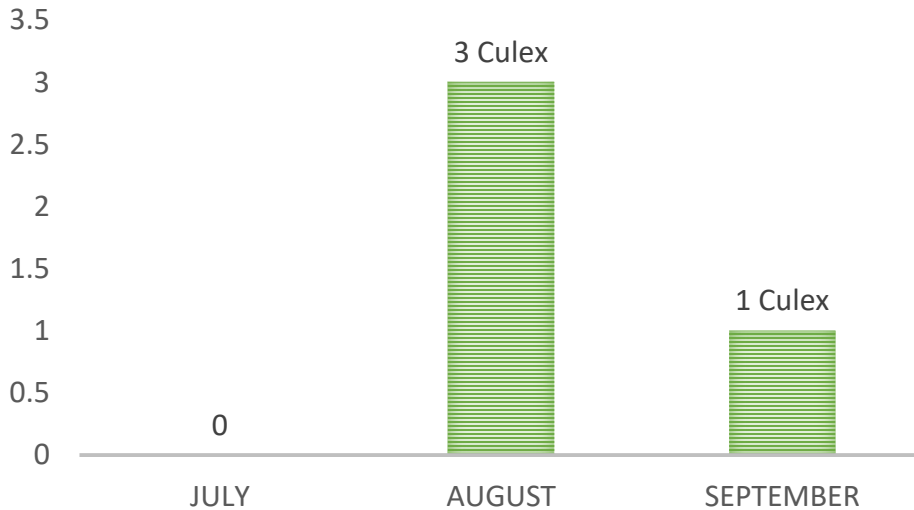
The GAT trap is primarily used to trap for specific mosquitoes, such as the Asian tiger (*Aedes albopictus*) and yellow fever mosquitoes (*Aedes aegypti*). Like the Gravid trap, this trap also draws in already fed female mosquitoes that are looking for a suitable place to lay eggs. A solution of water and highly organic matter is placed in the bottom of the bucket to lure these mosquitoes in. Once in the reep, the mosquitoes are collected on a sticky surface.

Due to very low volume of typical mosquito collections, we check and collect these traps about once a month.

We have had no past data recorded to compare collections, but as of this year we were able to collect a few different mosquitoes. None of which were either *Aedes aegypti* or *Aedes albopictus*.

The chart below shows you our collections from our single BG-GAT trap for the 2022 season.

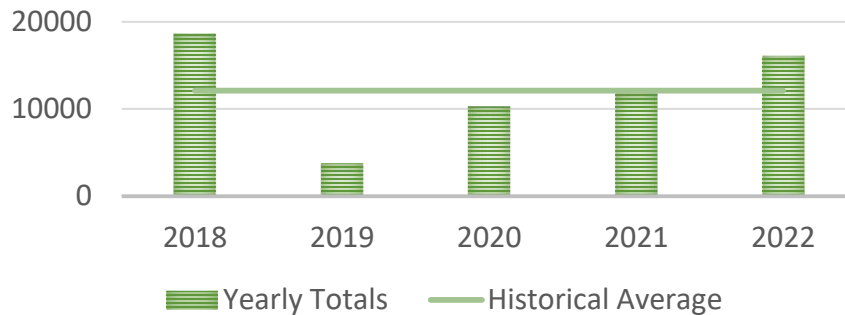
BG-GAT DATA



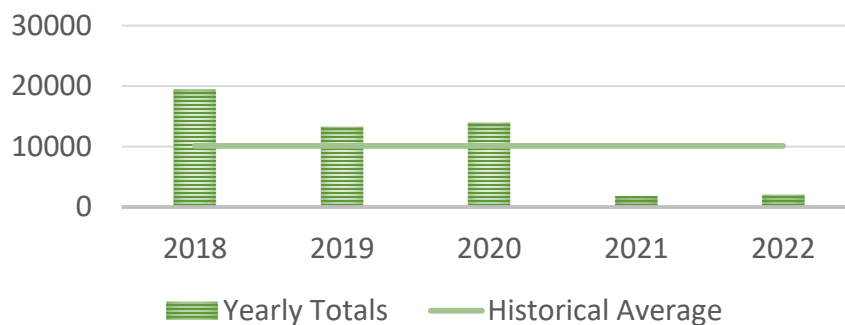
HISTORICAL TRAPPING DATA

In the two graphs shown below, you can see TCMA's Gravid trap and NJLT data compared to data collected in years prior.

HISTORICAL NJLT DATA (FEMALE MOSQUITOES)



HISTORICAL GRAVID DATA (FEMALE MOSQUITOES)



DISEASE SURVEILLANCE

The mosquitoes captured in all forms of traps, are sorted and identified. Those species, which are more likely to be involved in disease transmission, are selected for testing. These tests are used to check for the presence of West Nile Virus (WNV), St. Louis Encephalitis (SLE), Jamestown Canyon Virus (JCV) and Eastern Equine Encephalitis (EEE).

This year TCMA sent our mosquito pools to Michigan Department of Health and Human Services (MDHHS). We were able to send a total of 29 pools before MDHHS informed us that they were behind on testing. However, of the pools that were submitted, none came back positive for any diseases. We then proceeded to use our in-house testing kit to conduct disease surveillance on the rest of our collected specimen. You can find our charted in-house testing results for mosquito pools that were unable to be sent to MDHHS during the 2022 season on the next page.

The lab also conducts in house testing on dead birds that have been turned in by our county residents using the same VecTOR Test Kit. This season, we had no in house testing on found birds and all of our testing on mosquitoes came back with negative results.



IN-HOUSE TESTING RESULTS

WNV, EEE, SLE		
In House Vector Testing Results 2022		
DATE	ITEM	NOTES
07/26/2022	Culex	Sugar Ponds- negative
07/26/2022	Culex	Kingston- negative
07/27/2022	Culex	Mayville- negative
08/02/2022	Culex	Mayville- negative
08/02/2022	Culex	Sugar Ponds- negative
08/03/2022	Culex	Millington- negative
08/03/2022	Culex	Woodvalley- negative
08/03/2022	Culex	Vassar WTP- negative
08/23/2022	Culex	Reese- negative
08/23/2022	Culex	Richville- negative
08/24/2022	Culex	Woodvalley- negative
08/24/2022	Culex	Vassar WTP- negative

EASTERN EQUINE ENCEPHALITIS

Eastern equine encephalitis (EEE) is a virus known to be transmitted between birds and mosquitoes. In some cases, even horses and humans can be susceptible to this disease.

EEE is maintained in a cycle between *Culiseta melanura* mosquitoes and avian hosts. This particular kind of mosquito is found in freshwater hardwood swamps and is not considered to be bothersome to humans, due to the fact that it almost exclusively feeds on birds. However, if a “bridge” mosquito, such as some *Aedes*, *Coquillettidia*, and *Culex* species, were to contract the virus through an infected bird, then it is likely that a horse or human can therefore obtain the disease if bitten by said infected mosquito.

However, once a human or horse has contracted EEE neither one, nor the other, can infect another mammal. Like WNV, both human and horse are considered “dead-end” hosts.

As you can see in the image below, no cases of EEE were detected in Tuscola County during the 2022 season.

2022 EEE Cases in Michigan



Arbovirus* Activity, Including West Nile Virus and Eastern Equine Encephalitis: Weekly Summary, Michigan 2022

*Arboviruses are viruses transmitted by mosquitoes or other insects

Updated: December 9, 2022

89 

Mosquito pools testing positive for arbovirus virus infection

19 

Animals testing positive for West Nile virus infection

3 

Horses testing positive for Eastern Equine encephalitis

13 

Human cases of West Nile virus or other arboviruses reported

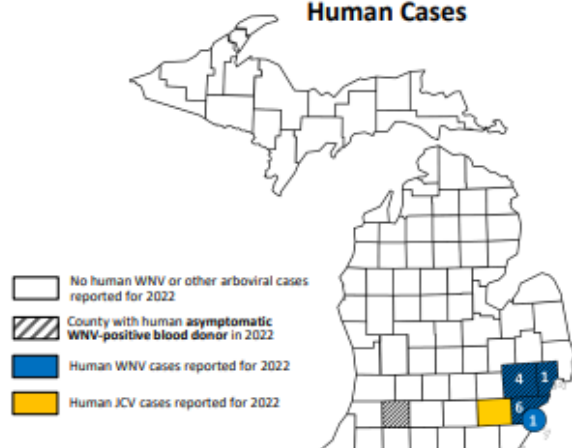
2022 Michigan Arbovirus Surveillance

Jamestown Canyon Virus Positive Mosquito Pools	12
West Nile Virus Positive Mosquito Pools	77
LaCrosse Encephalitis Virus Positive Mosquito pools	1
Total Number of Mosquito Pools Tested	4,584
Total Number of Mosquitoes Tested	67,752
Animal WNV cases	19
Animal EEE cases	4
Human WNV cases	12
Human JCV cases	1
Human asymptomatic WNV-positive blood donors	3

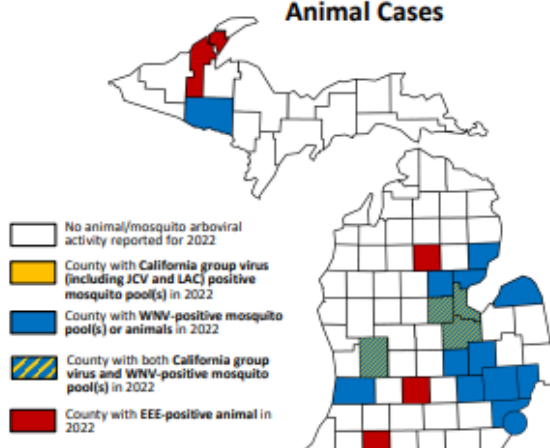
Highlights

- Three horses from Eaton, Roscommon and St. Joseph counties, and one bird from Houghton County have died from Eastern Equine encephalitis (EEE).
- One Detroit resident, one Macomb County resident, four Oakland County residents and six Wayne County residents have been sickened with West Nile Virus (WNV). One Washtenaw County resident has contracted Jamestown Canyon Virus. Four asymptomatic blood donors from Kalamazoo, Macomb, Oakland, and Wayne counties have also tested positive for WNV.
- One horse from Livingston County, eighteen birds from Allegan, Bay, Iron, Macomb, Saginaw, Shiawassee, and Wayne counties, and 77 mosquito pools from Arenac, Bay, Genesee, Gladwin, Huron, Iosco, Kent, Macomb, Midland, Oakland, Saginaw, and Wayne counties have tested positive for WNV.
- One mosquito pool from Saginaw County has tested positive for LaCrosse (LAC) encephalitis virus, and twelve mosquito pools from Bay, Kent, Midland, and Saginaw counties have tested positive for Jamestown Canyon virus (JCV).

Human Cases



Animal Cases



For more information

www.michigan.gov/westnile

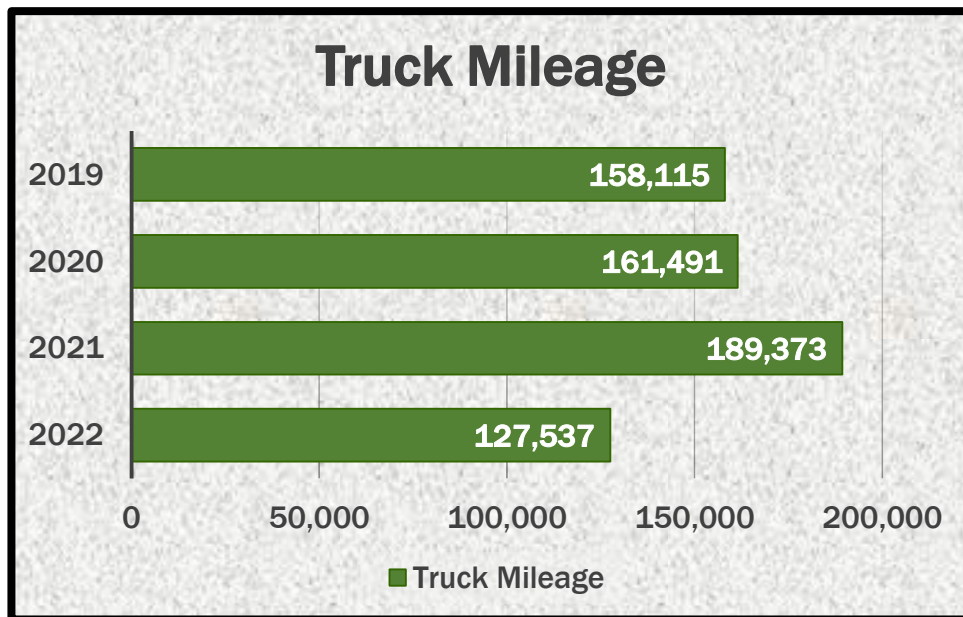


GARAGE NEWS

Pat Dennis has had a very busy season. There were five transmissions that needed work this year. He had five trucks that needed brake repair and replaced several tires. The Kawasaki Mule needed the driveline repaired. He replaced two Briggs & Stratton starters and one FMI pump and did over ninety engine oil changes between trucks and ULV foggers. He flushed 4 power steering systems and did multiple truck and small engine tune ups including numerous bulb replacements. Once again proving how much of an asset he has been to our operations-Pat has incorporated GPS units to allow road fogging trucks to be approximately 40% more effective on average which covers more territory and uses less vehicles and personnel.

Tuscola County Mosquito Abatement's twenty-one truck fleet, added 127,537 miles this season.

All truck mounted ULV's are set to deliver 4.5 ounces of Kontrol 4-4 per minute, compared to the 5 ounces used in the past. The droplet sizes produced by each ULV are measured and calibrated utilizing the Army Insecticide Measuring System (AIMS), following the label recommendations. The droplets are set to be delivered in a range that helps ensure safety and efficiency.



MEMBERSHIPS

TCMA staff are required to obtain and maintain licensing through the Michigan Department of Agriculture (MDA) as certified pesticide applicators, in both the Core Category and 7F (Mosquito Control).

To assist our technicians and ensure proper training, a review day was held on April 5th for those testing or re-certifying.

In order to stay informed of current developments, the permanent staff of TCMA are also encouraged to attend conferences, classes and seminars relating to mosquito biology and control. TCMA's Technical Advisory Committee (TAC) also provides new insight and important data in the areas of Biological Environmental Sciences.

The permanent staff of TCMA also maintains memberships and are active in the Michigan Mosquito Control Association (MMCA) and The American Mosquito Control Association (AMCA).

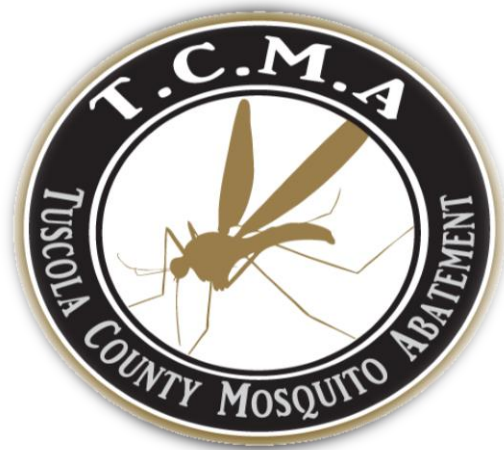
Last year the annual MMCA Convention was held virtually. At this time, the Convention is being planned as an in-person meeting in February.



2023 PROGRAM PLANS

- 2 New Technicians
- 1 New Truck
- 1 New ULV Truck Fogging Unit
- Trial of Vectobac DT
- Trial of Essentria IC-3





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