

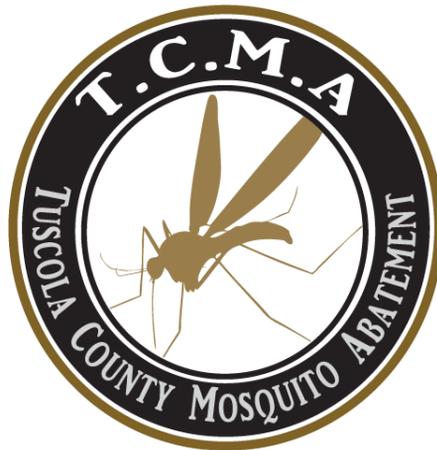
TUSCOLA COUNTY MOSQUITO ABATEMENT



2021 ANNUAL REPORT
2022 PROGRAM PLAN

CONTENTS

2.	Contents	18.	Biology
3.	Tuscola County/TAC	19.	New Jersey Light Trap
4.	TCMA Staff	20.	NJLT Totals
5.	Report Highlights	21.	CDC Traps
6.	Organization	22.	Gravid Traps
7.	Staffing	23.	Historical Trapping Data
8.	Safety	24.	Disease Surveillance
9.	County Map	25.	Eastern Equine Encephalitis
10.	Long Driveway Program	26.	Jamestown Canyon Virus
11.	Weather Data	27.	MDHHS Summary
12.	Operations	28.	Garage News
13.	Treatment Sites	29.	Memberships
14.	Larviciding	30.	2022 Program Plan
15.	Adulticiding		
16.	Ditch Treatment		
17.	Roadside Fogging		



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County Board of Commissioners

Thomas Bardwell, District 2

Kim Vaughan, District 3

Doug DuRussell, District 4

Dan Grimshaw, District 5

County Administration

Clayette Zechmeister, County Controller/Administrator

2021 Mid-Michigan Mosquito Control

Technical Advisory Committee

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Fred Yanoski, Midland County Health Department

Roger Garner, Midland County

Emily Dinh, Michigan Department of Health and Human Services

Joe Sova, Midland County Drain Commission

Kent Singer, Tuscola County Health Department

Kim Vaughan, Tuscola County Commissioner

Joseph Rivet, Bay County Drain Commissioner

Fred Yanoski, Midland County Health Department

Jerry Somalski, Bay Landscaping

John Hebert, Bay County

Tom Putt, Bay County

Consultants

Richard Merritt, Ph.D Michigan State University

Edward Walker, Ph.D Michigan State University

Kevin Kern, Michigan Department of Agriculture and Rural Development

Darrin McCullough, Michigan Department of Environment, Great Lakes and Energy

TCMA STAFF 2021

DIRECTOR

Larry Zapfe

BIOLOGIST

Shyann Green

ADMINISTRATIVE ASSISTANT

Laura Hill

EQUIPMENT TECHNICIAN

Pat Dennis

SEASONAL OFFICE STAFF/UTILITY

Bonnie Fackler

Jean Smith

FOREMAN / ASSISTANT FOREMAN

Mike Sherman

Joe Benjamin

Dennis Haley

SEASONAL TECHNICIANS

John Adamczyk

Jack Clark

Kevin Gainforth

Mark Howard

Richard Letts

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Ron Turner

Caleb Weisenburger

Rodney Speirs

Kirk Bauer

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Connor Langenburg

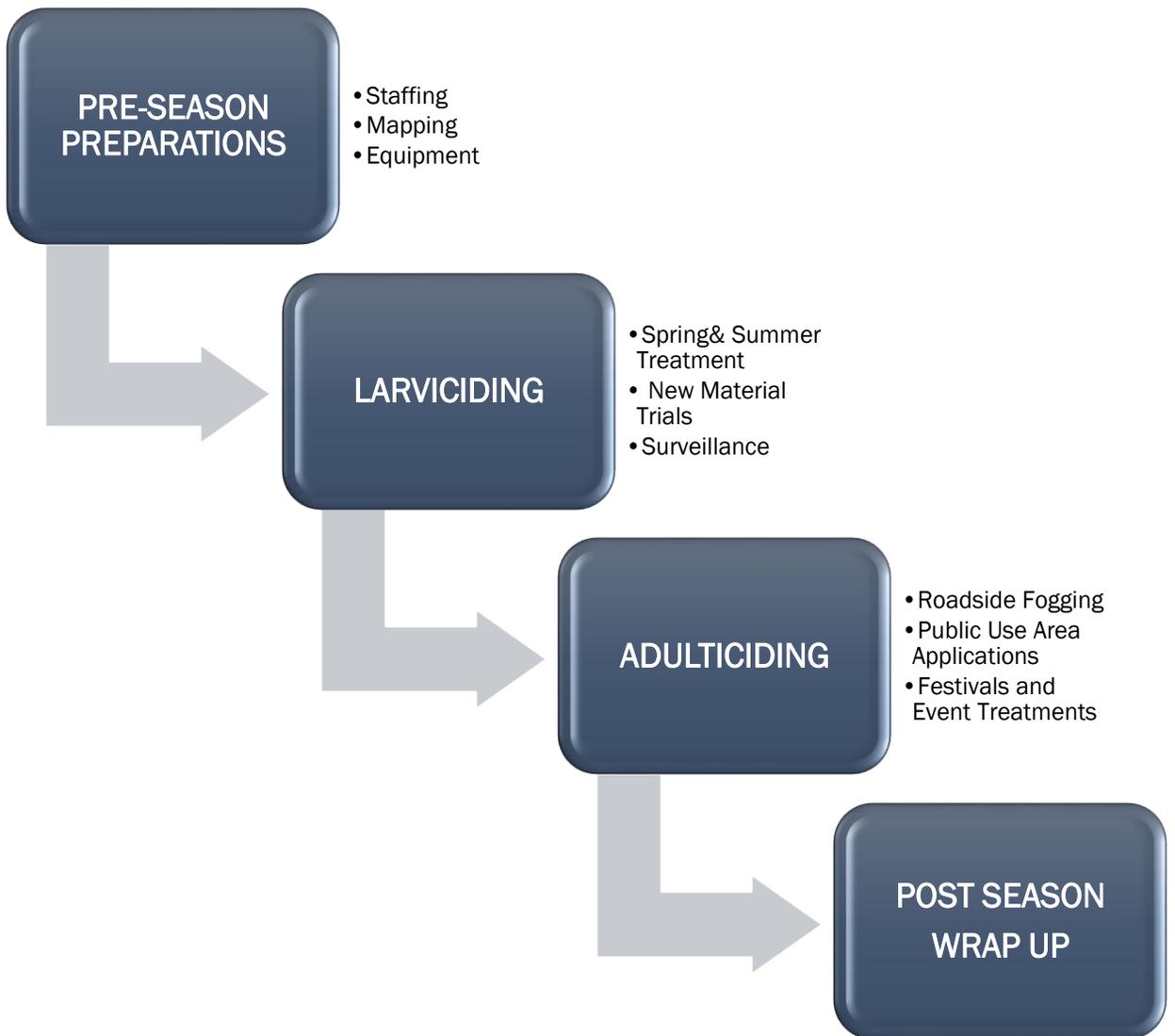
Rich Myers

Mike Ryan

Amos Perkins

Mike Emry

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 2021 mosquito control season was collected during the winter of 2020 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 23 seasonal positions and four full time staff in the 2021 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, due to Covid-19, the State of Michigan 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.



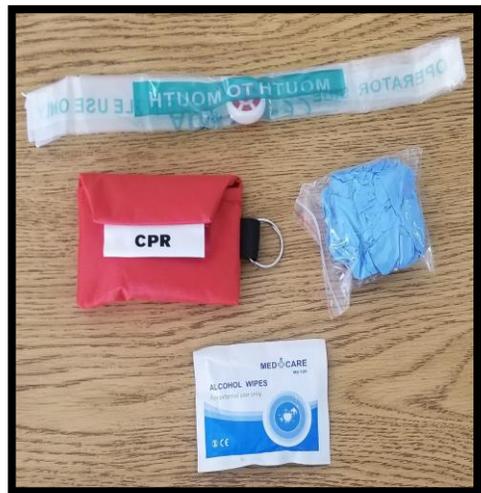
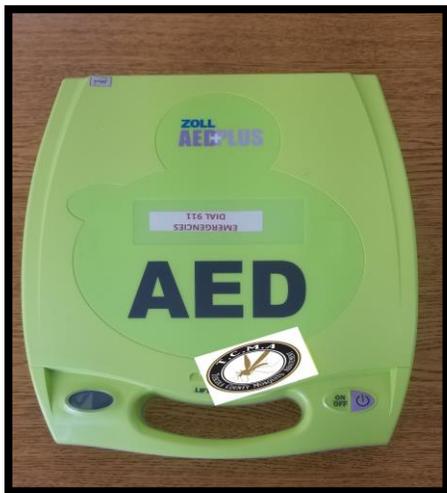
SAFETY

Tuscola County Mosquito Abatement is lucky to have a diverse group of team members. Assistant Foreman Dennis Haley, a former Law Enforcement Officer and First Aid Instructor, spoke with our Director and stated an interest in the necessity of an AED Machine at TCMA.

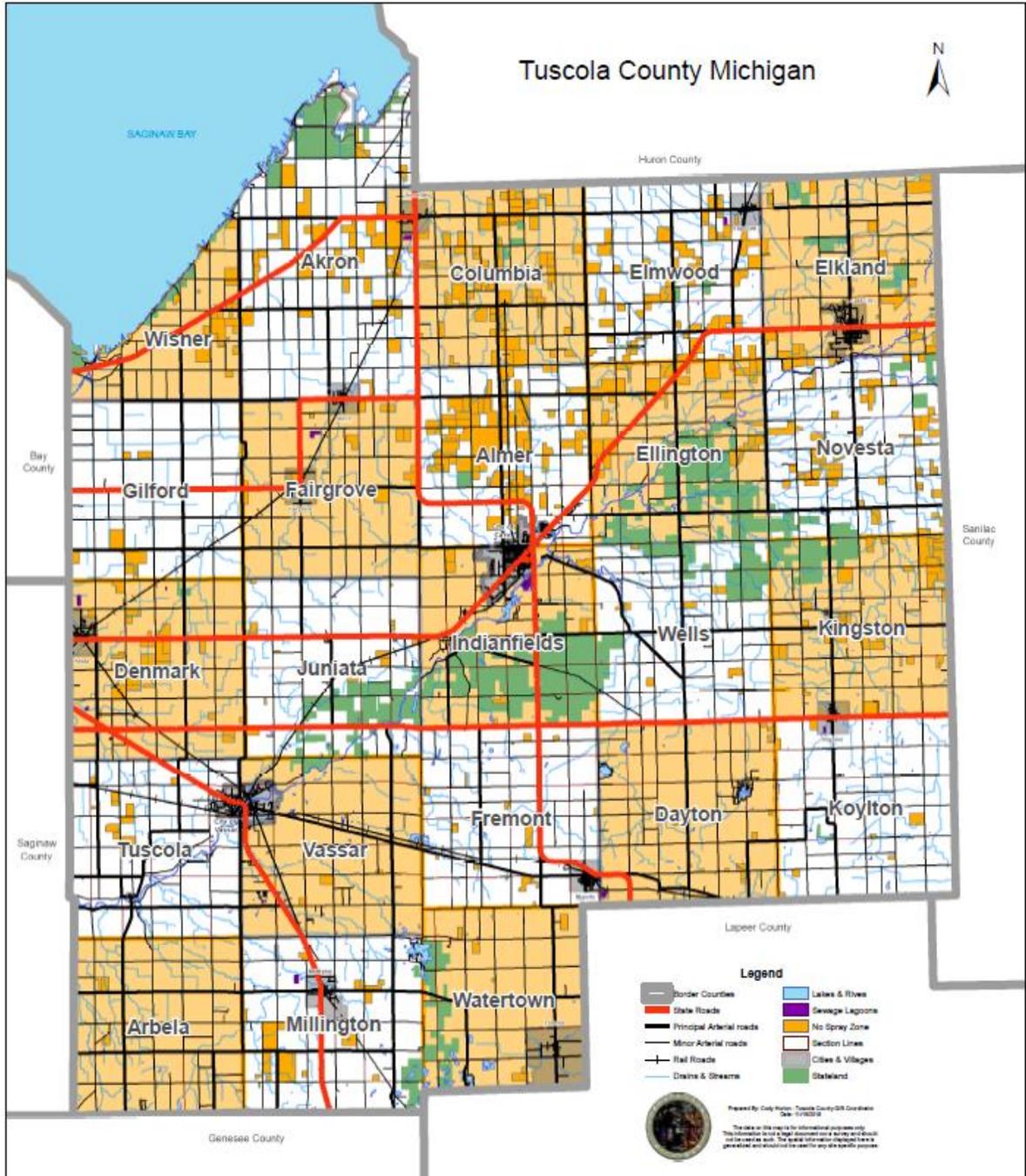
With the help of Steve Anderson of Tuscola County Emergency Management, our Director was able to procure an AED Machine. Shelly Lutz, Tuscola County HR Director, helped to coordinate a day and evening shift CPR and Basic First Aid Class. The class was instructed by Daniel Aday, a Safety and Loss Prevention Specialist of Compone Administrators.

The class was interesting and informative with all members of Tuscola County Mosquito Abatement in attendance along with a few employees from Tuscola County. Following the class, TCMA ordered and distributed small CPR Safety Kit keychains and attached them to each set of keys of every Mosquito Abatement truck.

We are thankful to have such great team who contribute and brainstorm to improve all areas of our organization. We are very grateful to all those who helped this suggestion come to fruition.



TUSCOLA COUNTY MAP



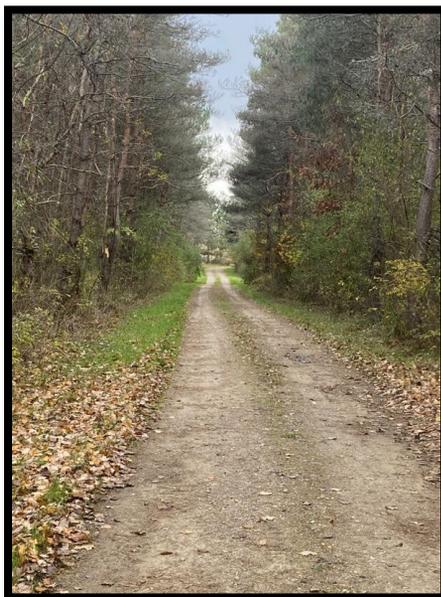
LONG DRIVEWAY PROGRAM

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 aduclticing 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 2021, we held our open enrollment for the long driveway program from March through April. Tuscola County currently has 546 residents enrolled in this program.



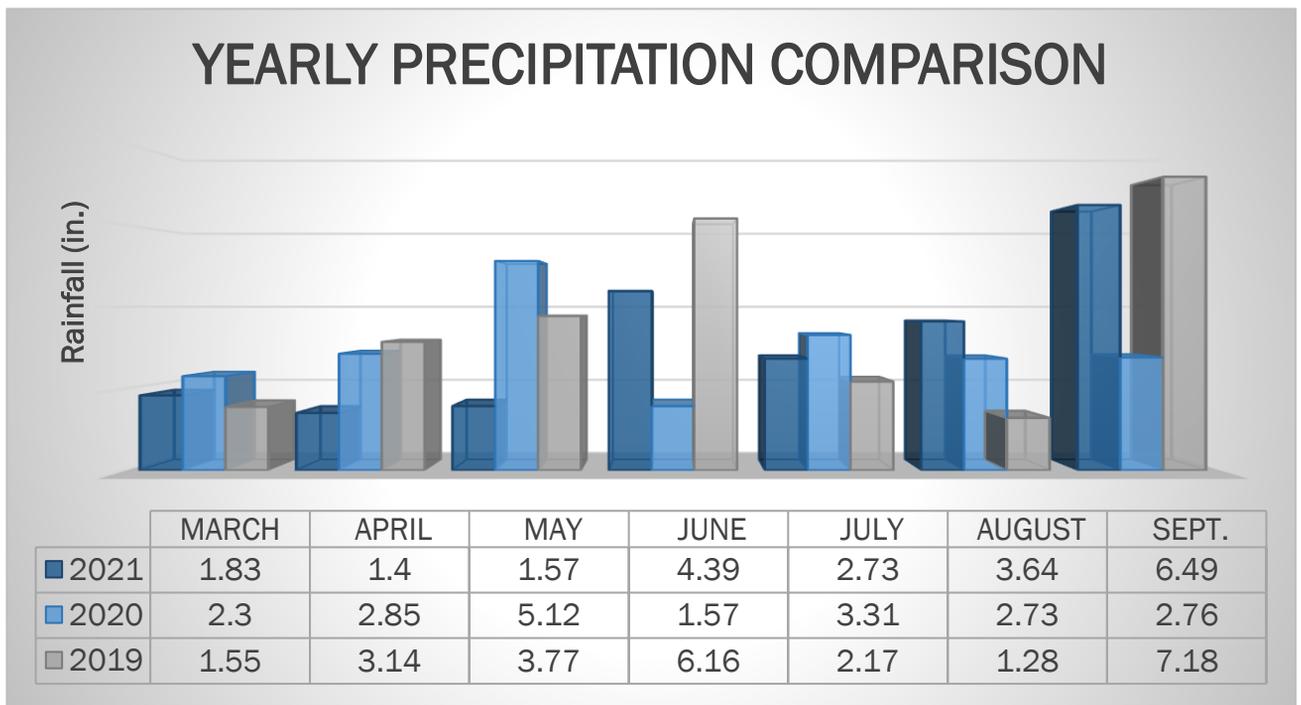
WEATHER DATA

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 2021 season began relatively dry. On Monday April 5th, TCMA was able to staff a full larviciding crew and began treatments of flooded woodlots.

Overall, the county received 20.64 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
MLO (Mosquio 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)	Public Use Area, Private Property
Mosquito Dunks (Bacillus thuringiensis)	Small water hole, artificial containers
Altosid P35 Pellets (Methoprene)	Catch Basins
Suspend Polyzone (Deltamethrin)	Public use areas, 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 2,591 flooded woodlot sites during the 2021 season, compared to 1,430 last season. In 2021 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 2021 season, using liquid BTI (VectoBac® 12 AS), BTI (VectoBac® G), and MLO® Mosquito Larvicide Oil. Catch Basins are treated 2-3 times throughout the season, depending on need, using Altosid P35® pellets.

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 773 “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

TOWNSHIP	MILES DRIVEN	GALLONS USED
AKRON	531	3.55
ALMER	154	.75
ARBELA	177	.95
COLUMBIA	172	.95
DAYTON	178	.60
DENMARK	169	1.31
ELKLAND	251	1.10
ELLINGTON	289	1.91
ELMWOOD	374	2.13
FAIRGROVE	159	.94
FREMONT	139	.55
GILFORD	157	.90
INDIANFIELDS	192	1.70
JUNIATA	145	.65
KINGSTON	330	1.17
KOYLTON	159	1.15
MILLINGTON	186	.65
NOVESTA	167	1.05
TUSCOLA	150	1.00
VASSAR	173	.90
WATERTOWN	132	.45
WELLS	339	1.72
WISNER	196	1.17

ROADSIDE TRUCK FOGGING

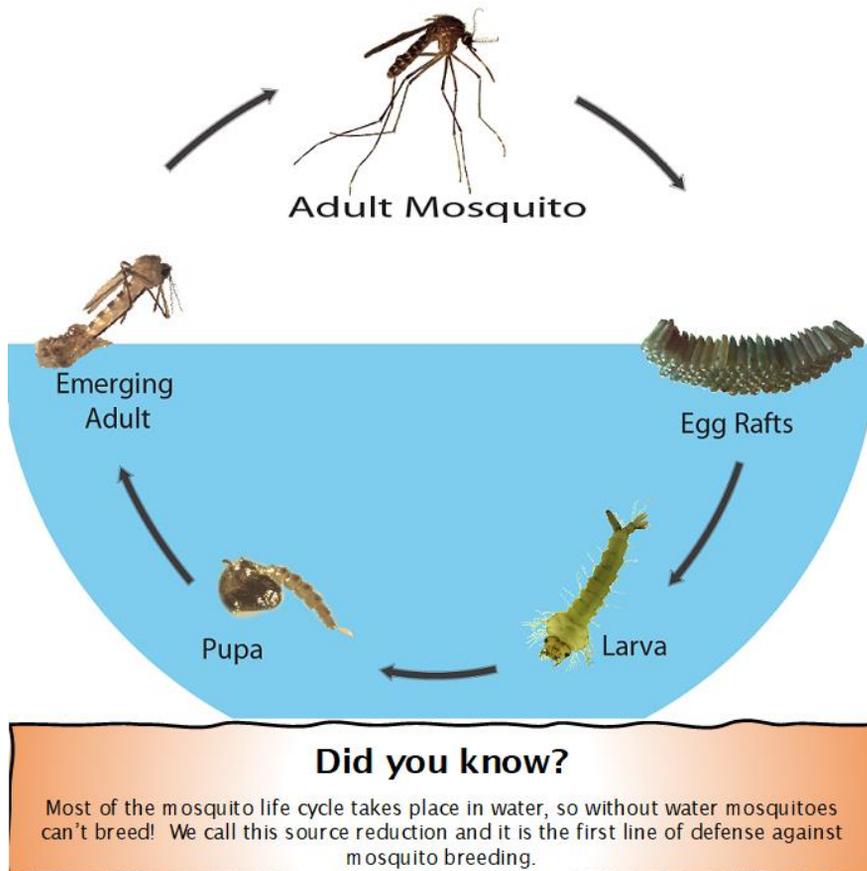
TOWNSHIP	MILES DRIVEN	GALLONS USED
AKRON	1533.70	249.10
ALMER	969.51	120.62
ARBELA	2135.73	431.65
COLUMBIA	97.71	23.95
DAYTON	2121.10	357.03
DENMARK	1225.80	209.22
ELKLAND	1151.60	184.17
ELLINGTON	973	141.78
ELMWOOD	1140.70	141.55
FAIRGROVE	1600.40	265.16
FREMONT	1134.19	217.85
GILFORD	1112.70	186.57
INDIANFIELDS	2520.10	343.80
JUNIATA	904.30	222.59
KINGSTON	1284.80	174.23
KOYLTON	1354	200.54
MILLINGTON	1776.50	452.23
NOVESTA	1159.30	154.77
TUSCOLA	877.50	199.23
VASSAR	2535.30	434.97
WATERTOWN	990.90	186.91
WELLS	2211.80	347.74
WISNER	957.10	185.27

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.

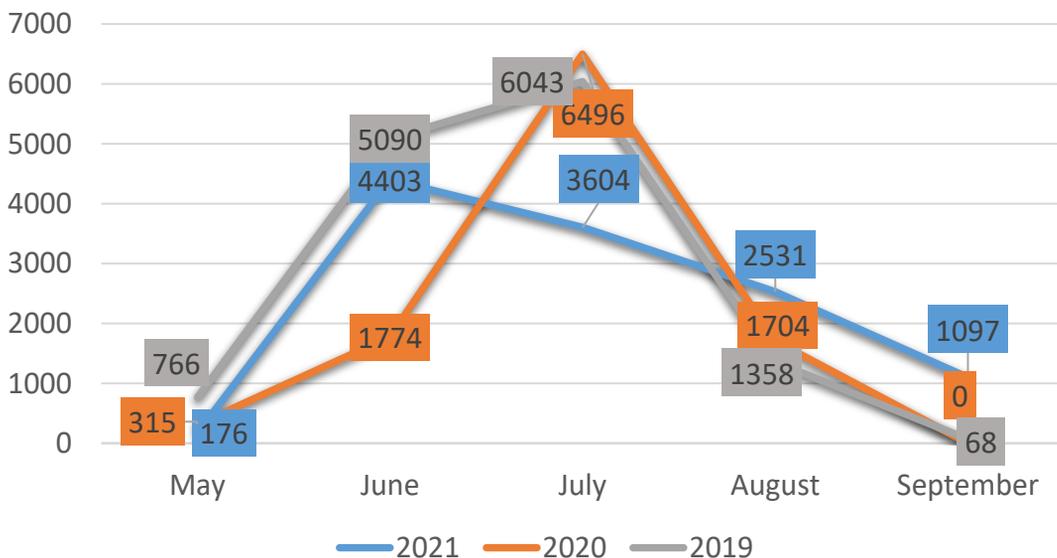


NEW JERSEY LIGHT TRAPS

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 two 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.

In the graph below you can see the monthly totals for the past three years. Unlike prior years, 2021's trapping totals peaked in June and slowly decreased throughout July, August and September. We ended our season in September with an average of 13 mosquitoes per trap, which is below nuisance level.

NJLT Monthly Female Totals



NEW JERSEY LIGHT TRAP YEARLY TOTALS

YEAR OF COLLECTIONS	Average High	Average Low
2021	78	57
SPECIES/LOCATION	TOTAL	
<i>Ae. canadensis</i>	485	
<i>Ae. implicatus</i>	299	
<i>Ae. stim./fit.</i>	1382	
<i>Ae. triseriatus</i>	7	
<i>Ae. trivittatus</i>	9	
<i>Ae. provocans</i>	1438	
<i>Ae. japonicus</i>	42	
<i>Ae. cinereus</i>	0	
<i>Ae. vexans</i>	9	
<i>An. punctipennis</i>	2153	
<i>An. quadrimaculatus</i>	1488	
<i>An. walkeri</i>	0	
<i>Cs. inornata</i>	0	
<i>Cs. minnesotae</i>	9	
<i>Cs. morsitans</i>	0	
<i>Cs. melanura</i>	50	
<i>Cx. pipiens</i>	1464	
<i>Cx. restuans</i>	561	
<i>Cx. tarsalis</i>	55	
<i>Cx. territans</i>	0	
<i>Cq. perturbans</i>	2358	
<i>Ps. ciliata</i>	1	
<i>Ur. sapphirina</i>	0	
Damaged	1	
Total Female	11811	
Total Male	9328	
YEARLY TOTAL: 21139		

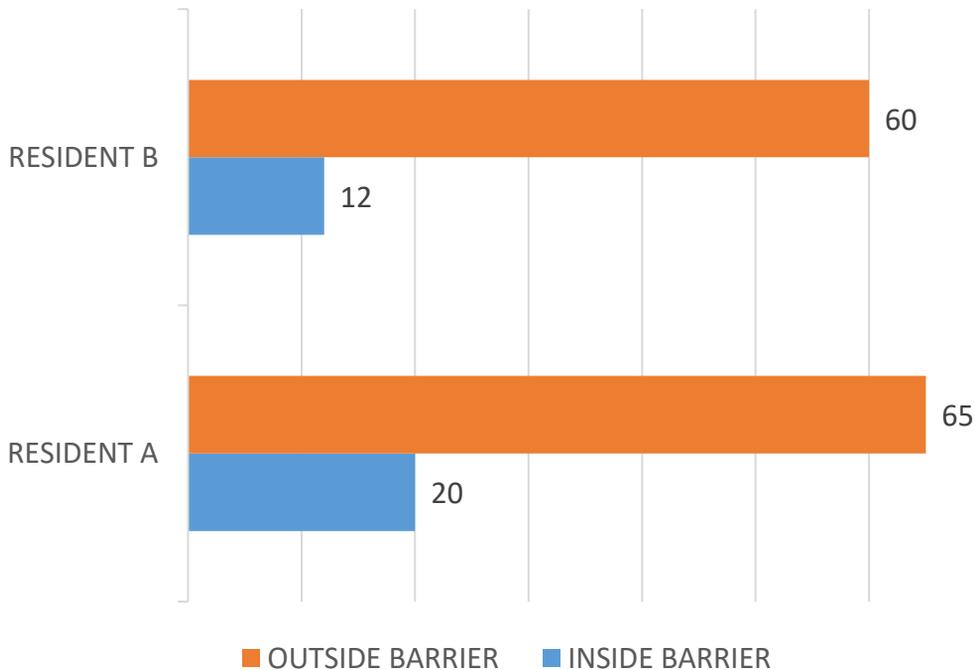
CDC TRAPS

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' barrier treatments during a single season. These totals provide proof that our treatments are very effective.

CDC TRAPPING TOTALS

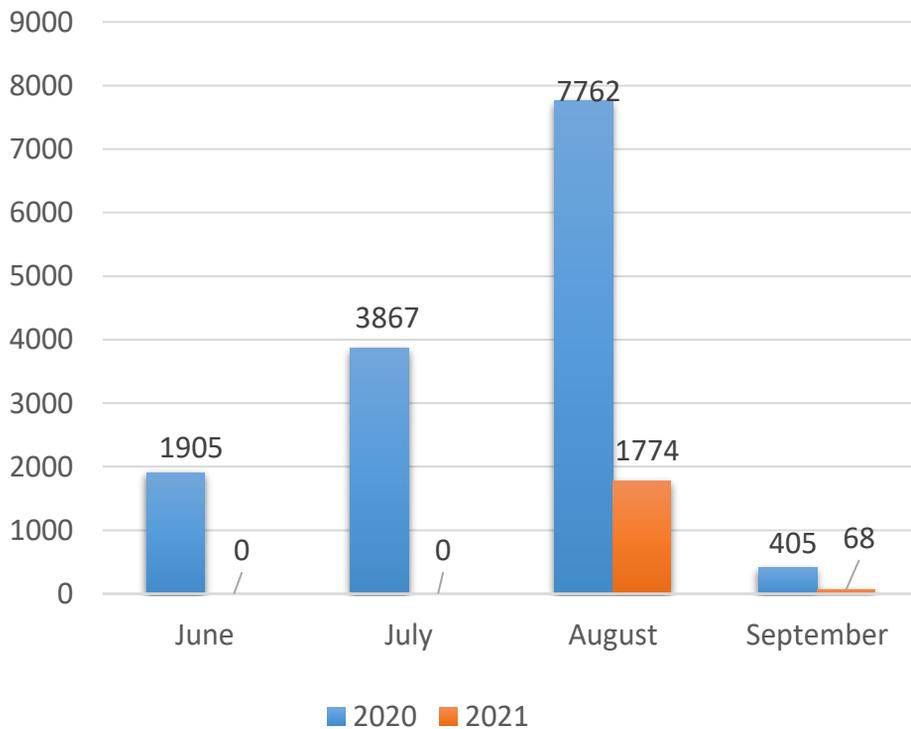


GRAVID TRAPS

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 mosquitoes trapped during both the 2020 and 2021 seasons. As shown in the graph, we were unsuccessful at capturing any mosquitoes until early August. Due to the lack of standing water this season, our counts last season during this same time were over four times the amount that we trapped this season.

Gravid Trapping Data



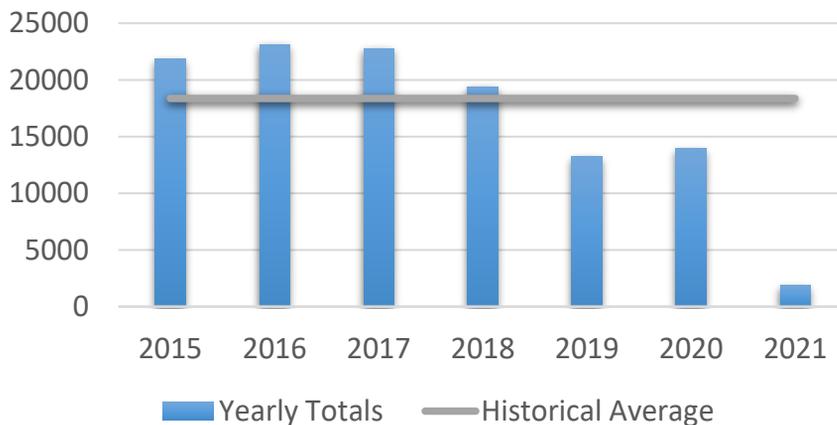
HISTORICAL TRAPPING DATA

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)



Our GAT trap data, as in past years, showed no activity throughout the 2021 season leaving us with no data to record.

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). Although it was MDHHS's first year testing Mosquitoes for disease, we were able to receive results back in a timely manner.

The total amount of mosquito pools that were collected and able to be submitted for testing was much smaller this season than that of previous years. However, of those that were submitted, only one pool came back positive with WNV. The virus showed up in a mosquito pool we collected from a Gravid trap set in the village of Reese. It was sent in for testing on August 31st and we promptly had a return three days later, September 3rd. We immediately focused our efforts on and retested the positive area. Results all came back negative and no further positive pools were reported throughout the county.

The lab also conducts in house testing on dead birds that have been turned in by our county residents using the VectOR Test Kit. We also use this test kit to perform virus testing on mosquito pools in groups too small to send to MDHHS. This season, we had no in house testing on found birds and, as you can see in the chart below, our testing on mosquitoes came back with all negative results. On page 27, you will see the Michigan 2021 summary of arbovirus activity, including EEE and WNV.

In House Vector Testing Results 2021		
DATE	ITEM	NOTES
08/16/2021	Mosquitoes	Results: NEGATIVE
08/17/2021	Mosquitoes	Results: NEGATIVE
08/18/2021	Mosquitoes	Results: NEGATIVE
08/23/2021	Mosquitoes	Results: NEGATIVE
08/24/2021	Mosquitoes	Results: NEGATIVE
08/25/2021	Mosquitoes	Results: NEGATIVE

JAMESTOWN CANYON VIRUS

First identified in 1961 in Jamestown Canyon, Colorado, Jamestown Canyon Virus (JCV) is a virus that is spread by infected mosquitoes. These mosquitoes can transfer the virus to other animals or humans. However, it can not be spread from human to human, human to animal, or human to mosquito contact. Humans and large animals are considered 'dead end hosts' for this type of virus.

According to the CDC, most cases of JCV are reportedly found in the upper Midwest of the country, but like any other disease it's ability to spread is not uncommon. Due to the fact that there are no vaccines or medication to prevent or treat this virus, taking precautions to avoid getting the virus is highly recommended to everyone. These precautions include, but are not limited to:

- Using repellents when outdoors
- Wearing loose fitting, long sleeved clothing
- Maintaining screens on doors and windows of your home
- Empty water retaining containers
- Recycle old tires or store them where they can't collect water
- Have standing water around your home treated



Although no cases of JCV were reported in Tuscola County, many counties surrounding had an outbreak of the virus. Due to these outbreaks being so close to our county, we plan to continue testing for JCV in the upcoming years. On page 27 you can see the CDC's Summary of Mosquito borne diseases in Michigan. The images on this page will show you what counties JCV, along with other Mosquito borne diseases, was detected in during the 2021 season.

Arbovirus* Activity, Including West Nile Virus and Eastern Equine Encephalitis: Weekly Summary, Michigan 2021

*Arboviruses are viruses transmitted by mosquitoes or other insects

Updated: November 22, 2021

48 

Mosquito pools testing positive for arboviruses

44 

Animals testing positive for WNV infection

11 

Animals testing positive for EEE infection

50 

Human cases of WNV, JCV, or other arbovirus reported

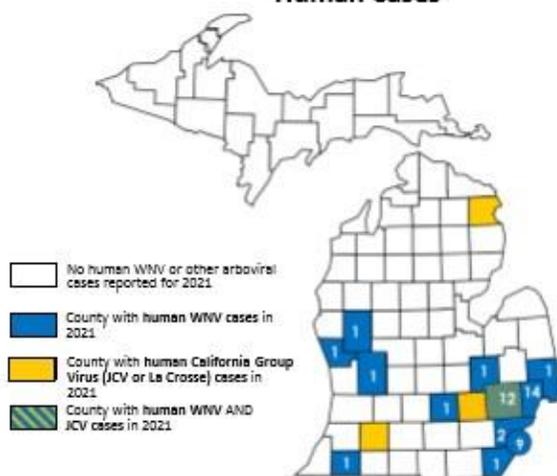
2021 Michigan Arbovirus Surveillance	
EEE Positive Mosquito Pools**	1
JCV Positive Mosquito Pools**	20
WNV Positive Mosquito Pools**	27
Total Number of Mosquito Pools Tested	3,841
Total Number of Mosquitoes Tested	53,399
EEE Positive Mammals**	10
EEE Positive Birds**	1
WNV Positive Birds**	36
WNV Positive Mammals**	8
Human WNV cases**	45
Human California Group virus (JCV or La Crosse) cases	5

Highlights

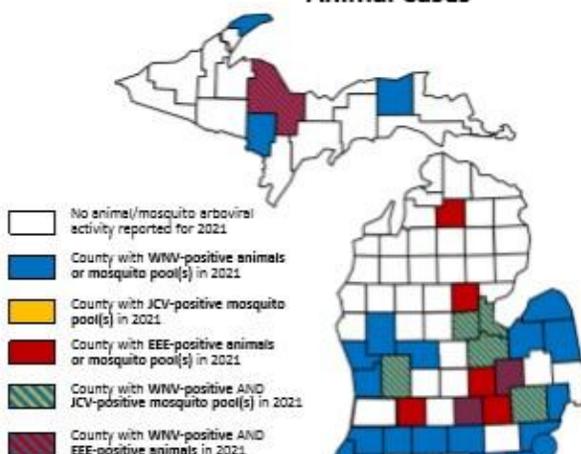
- Recent cold temperatures across the state have ended the season of arbovirus risk. Cases from earlier in the year may continue to be investigated and reported.
- Forty-five Michigan residents have been sickened by West Nile virus this year (1 Cass, 9 Detroit, 1 Genesee, 1 Ingham, 1 Kent, 14 Macomb, 1 Monroe, 1 Muskegon, 1 Newaygo, 12 Oakland, 1 St. Clair, 2 Wayne). Seven asymptomatic blood donors from Charlevoix, Ingham, Macomb, Monroe, Oakland, and Wayne counties have also tested positive for WNV.
- Four Michigan residents have tested positive for Jamestown Canyon virus (1 Alpena, 1 Kalamazoo, 1 Livingston, 1 Oakland) and one resident of Kalamazoo County has tested positive for La Crosse Virus.
- Nine horses (1 Barry, 1 Gladwin, 1 Genesee, 1 Ingham, 2 Livingston, 1 Otsego, 2 Shiawassee), one deer (Livingston), one bird (Marquette) and one mosquito pool (Barry) have tested positive for Eastern Equine encephalitis (EEE).
- Six horses (1 Kent, 1 Lenawee, 1 Midland, 1 Montcalm, 1 Sanilac, 1 Van Buren), one moose from Marquette County, one squirrel from Macomb County, and twenty-eight birds have tested positive for WNV.
- Twenty-seven mosquito pools have tested positive for WNV.
- Twenty mosquito pools have tested positive for Jamestown Canyon virus (JCV).

**data in linked maps may lag behind this report by 1-2 business days.

Human Cases



Animal Cases



For more information

www.michigan.gov/westnile



Michigan Department of Health & Human Services
Bureau of Epidemiology & Population Health
Emerging & Zoonotic Infectious Diseases (EZID) Section

PRODUCT TRIALS

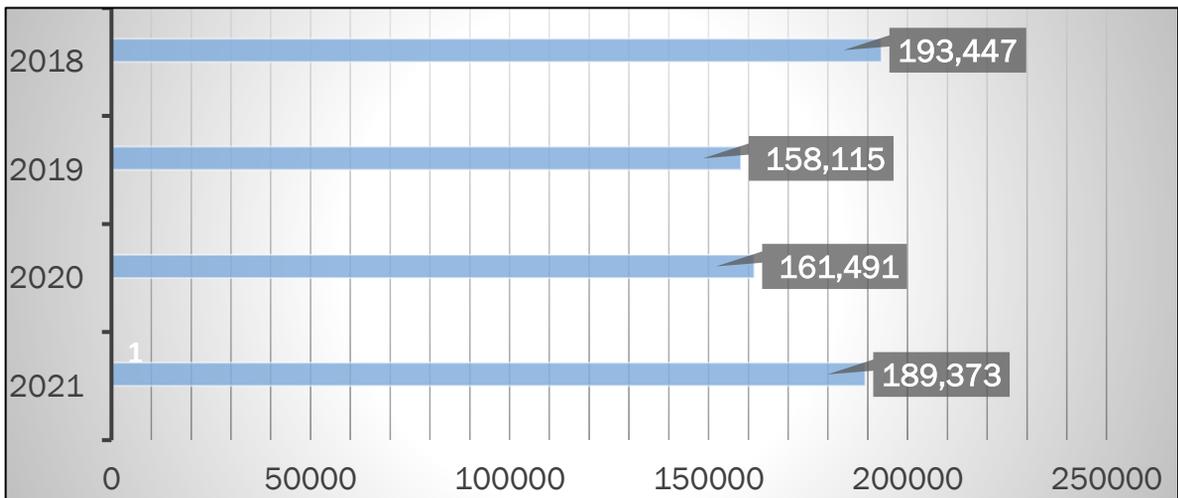
GARAGE NEWS

Pat Dennis has been doing an excellent job in the full time position of Equipment Technician. He has been a great asset to the program. During the year, Pat has rebuilt 1 of our older ULV's, flushed the cooling on multiple trucks, and has done more than 80 truck and ULV oil changes. He calibrated truck mounted ULV equipment at the beginning of the season and again in July. He had the pioneer and thermal foggers ready for the 2021 season. He also made repairs to mosquito traps that were damaged after last season.

Tuscola County Mosquito Abatement's twenty-one truck fleet, added 189,373 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.

Pat's projects for the 21-22 winter season include flushing power steering and draining/filling transmissions on multiple trucks. He also will be maintaining ULVs including cleaning carburetors, adjusting valves, and cleaning sediment screens amongst other projects.



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.

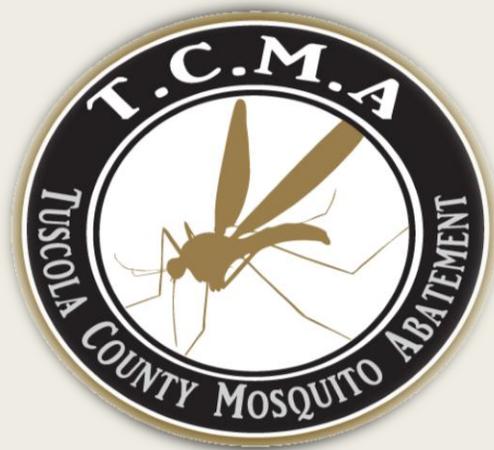
The permanent staff of TCMA also maintains memberships and are active in the Michigan Mosquito Control Association (MMCA) and The American Mosquito Control Association (AMCA).

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



2022 PROGRAM PLANS

- Trial of VecoBac DT
- Trial of Essentria IC-3



1500 Press Drive
Caro, Michigan 48723
www.tuscolacounty.org