



Village of Vernon Hills

2016 Mosquito Management Program Annual Service Report

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Clarke Environmental Mosquito Management 2016 Annual Report

Introduction

Mosquitos dominated public health headlines once again in 2016, with the introduction of mosquito-borne Zika virus (ZikV) throughout the country as imported, travel-related cases and eventual local transmission in areas in Miami, Fl. And while locally transmitted cases were unlikely in Illinois climates, public attention was drawn to Florida, which battled a significant outbreak of ZikV (which continues to this day), prompting the CDC to issue Miami-area travel warnings to pregnant women.

Here in the Midwest, the mosquito season of 2016 followed a mild winter with little snowfall that led to a wet and warm spring then moderate, wet summer. July was the third wettest on record, with more than 7 inches of rain. A late warming period in August and September gave a boost to West Nile Virus.

Overall, West Nile made an early debut in Illinois, with first positive mosquito pools identified in May. As always, West Nile is endemic to the area, and annual outbreaks are weather-dependent, with temperature and precipitation directly affecting the prevalence and spread of the disease. Clarke remains committed to the Village of Vernon Hills as its partner in working to suppress West Nile infection rates for the community now and in the future.

Service Contracts

Our primary goal at Clarke is to help our partner communities improve the health and quality of life for residents. As such, Clarke created and implemented an integrated pest management program specifically designed for the Village of Vernon Hills. This annual report provides context for the various challenges faced by mosquito control professionals in the Village of Vernon Hills, with detail on the weather, mosquito breeding habits and control efforts undertaken by Clarke in the area.

Clarke worked closely with the Village of Vernon Hills to monitor changing mosquito populations and used industry-recognized standards to achieve the greatest control.

Innovation, Community, Sustainability

We continue to serve our residents with highly effective, low-impact treatments with more benevolent environmental footprints. In 2015, Clarke was awarded the Illinois Governor's Sustainability Award recognizing its efforts in helping communities maintain the health and comfort of its residents with a greener approach. OMRI-certified product options and treatments done via bicycle, electric golf carts and a fleet of hybrid vehicles, demonstrates our commitment to community, the environment and public health.

Together, we realize our vision to make communities more liveable, safe and comfortable.



Seasonal Overview

3rdth Wettest July, Wet & Mild Winter and Spring

For the third year running, Illinois remained in a wetter cycle, though temperatures were more moderate in winter and spring.

A mild spring followed a winter with very little snow. Significant rain events in May, July and August created floodwater mosquito breeding opportunities.

While the summer months were mostly cool and rainy, late August and September saw a spike in temperatures – with average temperatures in September registering 5 degrees above normal.

Some weather highlights:

- 3rd wettest July on record for Illinois, with 7+ inches of rain
- Summer precipitation was 11% above normal
- 9 significant rainfall events between July 1- August 30
- August temps averaged 3.5 degrees above normal (76.6 degrees)
- September temps averaged 5 degrees above normal



About Zika Virus

Zika virus is a mosquito-borne disease that is transmitted primarily by the *Aedes aegypti* mosquito and through sexual transmission. While Zika symptoms are generally mild in adults (fever, rash, joint pain, conjunctivitis), pregnant women who contract Zika virus can pass the virus to their unborn children, increasing the risks of serious birth defects like microencephaly. Zika virus has been widely detected in the United States in 2016.

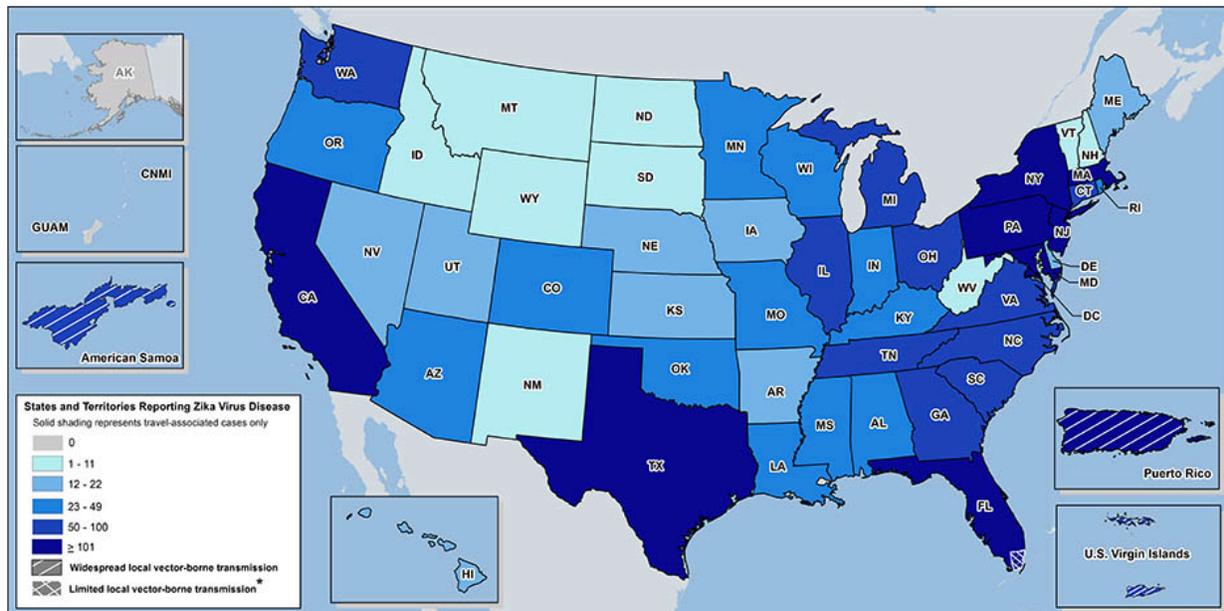
Zika Virus in the United States 2016

ZIKV CASES (as of 10-28)	UNITED STATES	TERRITORIES
Total	4,091	28,723
Pregnant Women	953	2,027

In addition, 139 locally transmitted cases of Zika have been identified in Florida -- all in Miami-Dade County.

Zika Cases Reported in the United States

Laboratory-confirmed Zika virus disease cases reported to ArboNET by state or territory (as of October 26, 2016)



Source: <http://www.cdc.gov/zika/intheus/maps-zika-us.html> Retrieved 10-28-16

Zika Virus in Illinois

Illinois does not have a significant population of *Aedes aegypti* mosquitoes, so local transmission risk is small. However, Illinois reported 76 travel-related human cases.



About West Nile Virus

West Nile virus is primarily a mosquito-borne disease, which can cause West Nile encephalitis (swelling of the brain) and West Nile fever in humans. Though the majority of humans infected will not show symptoms, those who develop West Nile virus risk debilitating effects and possibly death. While the most severe cases and the highest risk of West Nile occur traditionally in people over 50 years of age or with compromised immune systems, all people who spend time outside are at risk of contracting the virus. The disease also affects birds, horses and other animals, with higher mortality rates.

West Nile Virus has spread rapidly across North America since it was discovered in the Western hemisphere, reports the U.S. Geological Survey. West Nile Virus swept from the New York City region in 1999 to almost all of the continental U.S., seven Canadian provinces and throughout Mexico and parts of the Caribbean by 2004. Of those infected, one in five will develop symptoms.

West Nile in the United States 2016

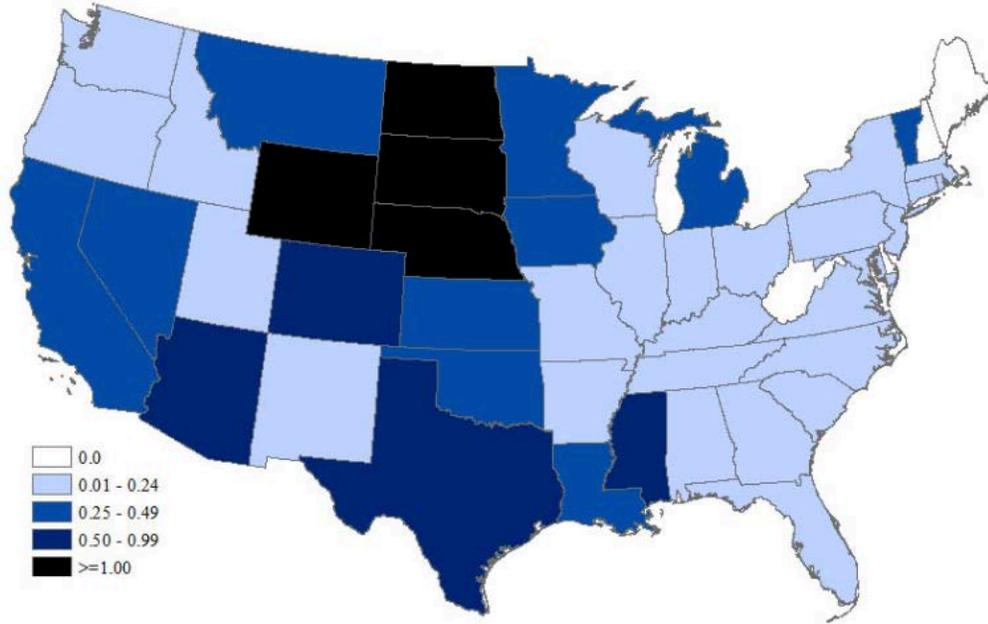
West Nile cases dropped slightly in 2016, with 1,428 cases reported in the U.S.

- 2013: 1,135 cases
- 2014: 1,177 cases
- 2015: 1,605 cases
- 2016: 1,428 cases



West Nile in the United States 2016

West Nile Virus Neuroinvasive Disease Incidence by State – United States, 2016 (as of October 25, 2016)



West Nile Virus Activity by State – United States, 2016 (as of October 25, 2016)



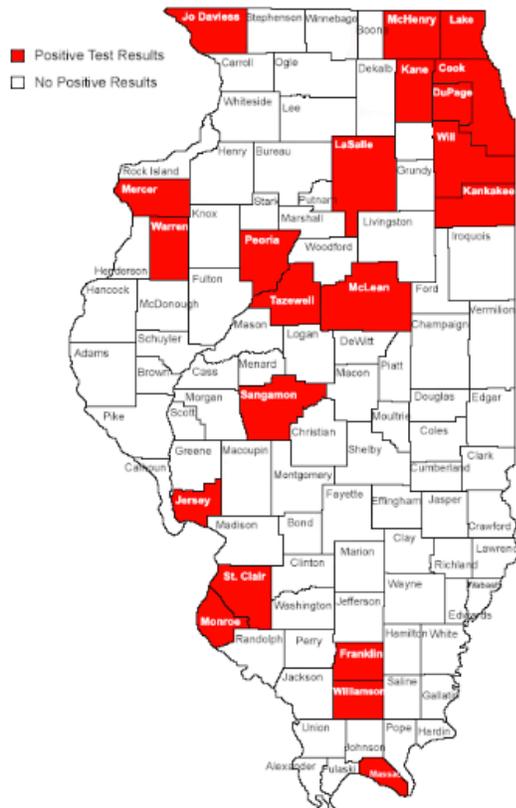


West Nile in Illinois 2016

As of October 28, 2016, Illinois has reported 136 human cases of West Nile virus -- nearly double the number of human cases from 2015. This continues a sharply increasing trend from 2014:

- 2014 – 44 human cases
- 2015 – 77 human cases
- 2016 – 136 human cases

16 Human Case Data



Illinois West Nile Virus statistics in 2016 (reported to-date) are:

- 136 human cases (up from 77 in 2015)
- 0 fatalities (down from 9 in 2015)
- 59 counties reporting West Nile activity
- 73 positive birds (up from 51 in 2015)
- 2,429 positive mosquito batches (up from 1,713 in 2015)
- 4 positive horses (down from 13 reported in 2015)



Illinois first identified West Nile virus this year on May 31, with a positive mosquito pool in from North Shore MAD in Glenview.

On June 6, the first human case of West Nile virus was reported in west-central Illinois.

Below are the specific county West Nile virus statistics as of October 28, 2016, according to the Illinois Department of Public Health¹

2016 Positive Birds, Mosquitoes, Horses and other Mammals

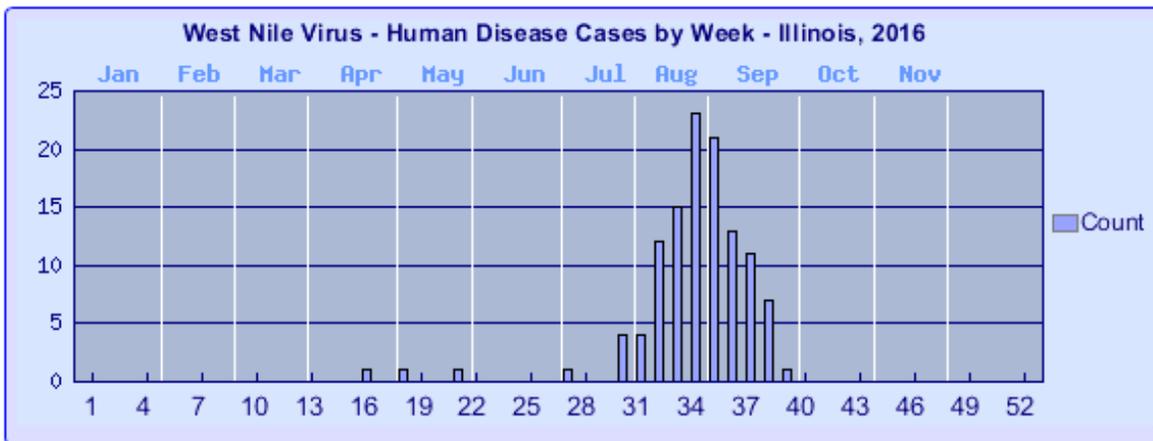
County	American Crow	Blue Jay	Other Birds	Mosquito Batches	Horse	Other Mammals
<u>BOONE</u>	0	1	0	0	0	0
<u>BROWN</u>	0	0	1	0	0	0
<u>BUREAU</u>	1	1	0	0	0	0
<u>CARROLL</u>	1	0	0	3	0	0
<u>CHAMPAIGN</u>	4	0	0	9	0	0
<u>CLAY</u>	0	0	0	1	0	0
<u>CLINTON</u>	0	0	1	0	0	0
<u>COLES</u>	0	0	0	0	1	0
<u>COOK</u>	1	1	0	1708	0	0
<u>CRAWFORD</u>	1	0	0	0	0	0
<u>DEKALB</u>	1	1	0	16	0	0
<u>DOUGLAS</u>	0	1	0	0	0	0
<u>DUPAGE</u>	0	0	0	193	0	0
<u>FORD</u>	1	0	0	0	0	0
<u>FULTON</u>	0	0	0	3	0	0
<u>GALLATIN</u>	0	0	0	7	0	0
<u>GREENE</u>	0	0	0	1	0	0
<u>GRUNDY</u>	0	0	0	9	0	0
<u>JACKSON</u>	0	0	0	6	0	0
<u>JERSEY</u>	0	0	0	2	0	0
<u>JO DAVIESS</u>	0	0	0	0	1	0
<u>KANE</u>	0	0	0	53	0	0
<u>KANKAKEE</u>	0	0	0	9	0	0
<u>KENDALL</u>	0	0	1	28	0	0
<u>KNOX</u>	2	0	0	0	0	0
<u>LAKE</u>	1	0	0	135	0	0
<u>LASALLE</u>	7	0	0	1	0	0
<u>LEE</u>	4	0	2	1	0	0
<u>LIVINGSTON</u>	1	0	0	0	0	0
<u>LOGAN</u>	0	1	0	1	0	0
<u>MACON</u>	1	0	0	36	0	0
<u>MADISON</u>	0	0	0	9	0	0
<u>MASSAC</u>	0	0	0	2	0	0
<u>MCDONOUGH</u>	0	2	1	0	0	0
<u>MCHENRY</u>	1	0	0	36	0	0
<u>MCLEAN</u>	3	1	0	10	0	0
<u>MENARD</u>	0	0	0	3	0	0

¹ Illinois Department of Public Health, October 28, 2016



County	American Crow	Blue Jay	Other Birds	Mosquito Batches	Horse	Other Mammals
MERCER	0	0	0	9	1	0
MONROE	0	0	0	4	0	0
MONTGOMERY	0	0	0	1	0	0
MOULTRIE	0	0	0	0	1	0
OGLE	2	1	0	0	0	0
PEORIA	0	0	0	4	0	0
ROCK ISLAND	0	1	3	38	0	0
SAINT CLAIR	0	0	0	11	0	0
SALINE	0	0	0	1	0	0
SANGAMON	0	0	1	4	0	0
SCHUYLER	0	0	0	2	0	0
STEPHENSON	6	0	1	3	0	0
TAZEWELL	0	1	0	1	0	0
VERMILION	1	0	0	0	0	0
WARREN	0	0	0	9	0	0
WHITE	0	0	0	4	0	0
WHITESIDE	3	0	0	2	0	0
WILL	2	1	0	49	0	0
WINNEBAGO	1	0	2	5	0	0
WOODFORD	1	0	1	0	0	0
TOTAL	46	13	14	2429	4	0

2016 West Nile Virus Illinois Human Disease Cases By Week (Reported to CDC as of November 3, 2015)



Cumulative 2016 Data as of 3 am, Oct 26, 2016



Climatology and Mosquito Overview

The weather dramatically impacts mosquito breeding and population. Special attention should be paid to weather conditions as weather has a huge impact on mosquito populations – with floodwater mosquitoes, rainfall determines if mosquito eggs will hatch, fierce storm can wash away egg rafts and variations in temperature can affect mosquito activity and larval development. In periods of hot, dry weather, water sources dwindle for vector species, and virus transmission can amplify, creating a greater percentage of infected mosquitoes.

2016 weather highlights:

- April: Mild, cloudy conditions, first below-average monthly temps since September 2015
- May: Big rainfalls around Memorial day
- June: Record number of 80 degree days for the year set
- July: 3rd wettest July on record for Illinois
- August: Above average temps in latter part of month
- September: Above average temps, 5 degrees above normal

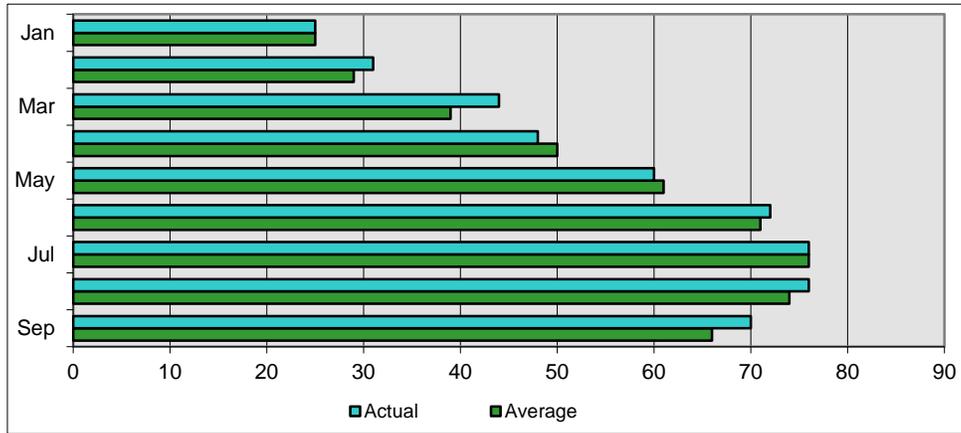


Annual Program Update

2016 O'Hare International Airport (Chicago) Weather Survey

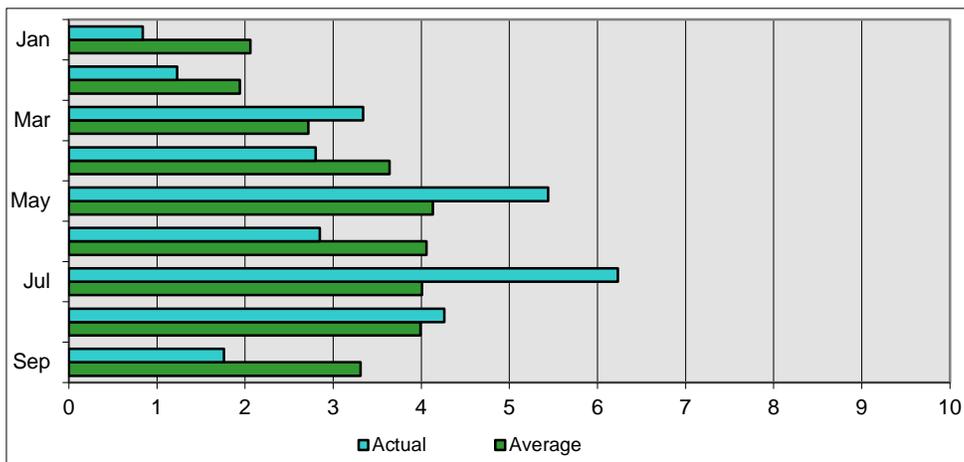
Temperature (degrees Fahrenheit)

	Sep	Aug	Jul	Jun	May	Apr	Mar	Feb	Jan
Actual	70	76	76	72	60	48	44	31	25
Average	66	74	76	71	61	50	39	29	25



Precipitation (inches)

	Sep	Aug	Jul	Jun	May	Apr	Mar	Feb	Jan
Actual	1.76	4.26	6.23	2.85	5.44	2.8	3.34	1.23	0.84
Average	3.31	3.99	4.01	4.06	4.13	3.64	2.72	1.94	2.06

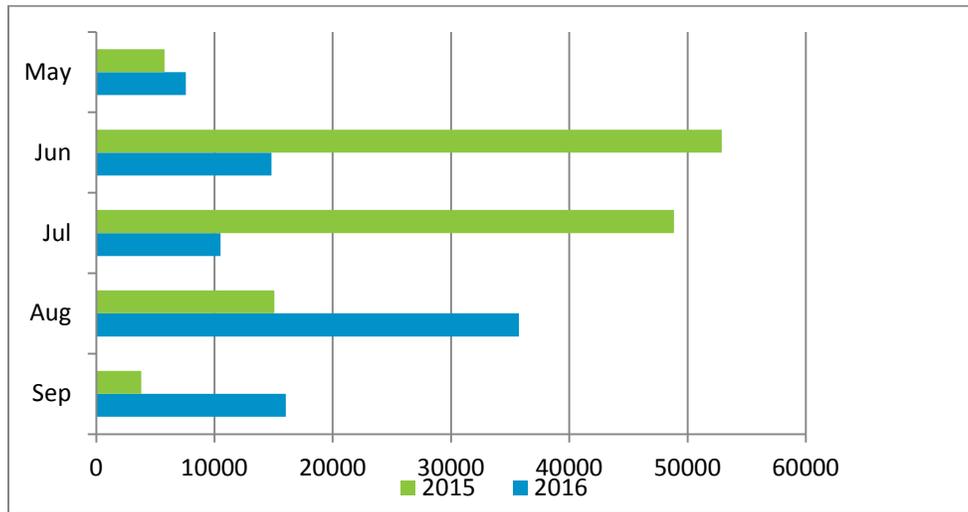




2016 Mosquito Light Trap Network Target Species Comparison

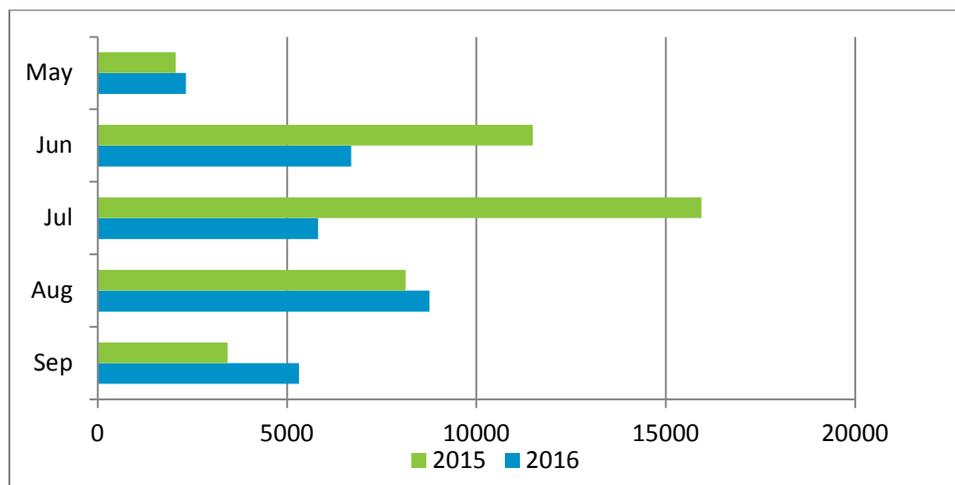
Aedes vexans

	Sep	Aug	Jul	Jun	May
2015	3820	15066	48840	52884	5771
2016	16030	35729	10510	14815	7570



Culex pipiens and Culex restuans

	Sep	Aug	Jul	Jun	May
2015	3427	8127	15942	11484	2061
2016	5310	8760	5816	6691	2327





Surveillance Network

New Jersey Light Trap Network



An important supplement to any mosquito control program is a New Jersey Light Trap. Developed in the 1930s, the trap helps determine species diversity and monitors mosquito populations. These traps are located in residential areas and are operated between dusk and dawn (the peak activity period for many species) and should be maintained each year to identify historic and habitual mosquito sites. A 25-watt bulb in the trap attracts mosquitoes, which are drawn into the trap via an electric fan. Data generated by the trap catches serve several purposes: it confirms the arrival of predicted floodwater mosquito migrations, reflects the effectiveness of mosquito control efforts and identifies fluctuations in adult mosquito populations.

West Nile Virus Surveillance Trap

A vital tool in adult mosquito and arbovirus surveillance is the West Nile virus, or gravid, trap. Developed by the Centers for Disease Control and Surveillance, the trap primarily collects gravid (*Culex*) mosquitoes (principal vectors of West Nile virus), which makes it particularly effective in tracking the disease. A gravid female mosquito has taken a blood meal and is ready to lay her eggs. Typically, (*Culex*) mosquitoes search for water rich in organic material to lay their eggs. If they've obtained their blood meal from an infected animal, they can transmit the virus to their eggs. The mosquitoes are captured live, which allows us to test them for arboviruses and get an early indicator that the virus is present in the area.



Centers for Disease Control and Prevention (CDC) Trap



Mosquitoes looking for a blood meal are mainly attracted by carbon dioxide, exhaled by humans and animals. The CDC trap provides carbon dioxide as bait, though dry ice (frozen carbon dioxide), and a light source to attract female mosquitoes. This trap is set out at prime activity hours for the species targeted. A fan draws mosquitoes into a net and the live mosquitoes are trapped for arbovirus testing. CDC traps often show a very high species diversity and large overall mosquito numbers, indicating the presence of a mosquito-borne virus and relative indices of adult mosquito species.



Light Trap Species Summary

The following table summarizes the species composition from the light trap network operating in the Village of Vernon Hills.

Light Trap Species Summary				
<i>Species</i>	<i>Females</i>	<i>Percent</i>	<i>Males</i>	<i>Percent</i>
<i>Ae cinereus</i>	0	0.0%	0	0.0%
<i>Ae species</i>	40	2.0%	61	7.1%
<i>Ae vexans</i>	602	30.4%	141	16.5%
<i>An punctipennis</i>	10	0.5%	4	0.5%
<i>An quadrimaculatus</i>	101	5.1%	39	4.6%
<i>An species</i>	13	0.7%	5	0.6%
<i>Cq perturbans</i>	398	20.1%	73	8.5%
<i>Cx erraticus</i>	10	0.5%	1	0.1%
<i>Cx pipiens</i>	1	0.1%	0	0.0%
<i>Cx restuans</i>	77	3.9%	3	0.4%
<i>Cx salinarius</i>	0	0.0%	0	0.0%
<i>Cx species</i>	628	31.7%	496	57.9%
<i>Cx tarsalis</i>	0	0.0%	0	0.0%
<i>Cx territans</i>	20	1.0%	4	0.5%
<i>Cs inornata</i>	3	0.2%	5	0.6%
<i>Cs species</i>	0	0.0%	6	0.7%
<i>Mosquito, Misc.</i>	4	0.2%	1	0.1%
<i>Oc canadensis</i>	0	0.0%	0	0.0%
<i>Oc excrucians</i>	0	0.0%	0	0.0%
<i>Oc fitchii</i>	0	0.0%	0	0.0%
<i>Oc japonicus</i>	5	0.3%	1	0.1%
<i>Oc stimulans</i>	0	0.0%	0	0.0%
<i>Oc triseriatus</i>	4	0.2%	2	0.2%
<i>Oc trivittatus</i>	48	2.4%	4	0.5%
<i>Oc. species</i>	0	0.0%	0	0.0%
<i>Or signifera</i>	1	0.1%	0	0.0%
<i>Ps ciliata</i>	0	0.0%	0	0.0%
<i>Ps columbiae</i>	0	0.0%	0	0.0%
<i>Ps ferox</i>	2	0.1%	1	0.1%
<i>Ur sapphirina</i>	16	0.8%	10	1.2%
Total	1,983	100.0%	857	100.0%

Total Number of Trap:1

Average Number of Females/Trap Night: 36.72

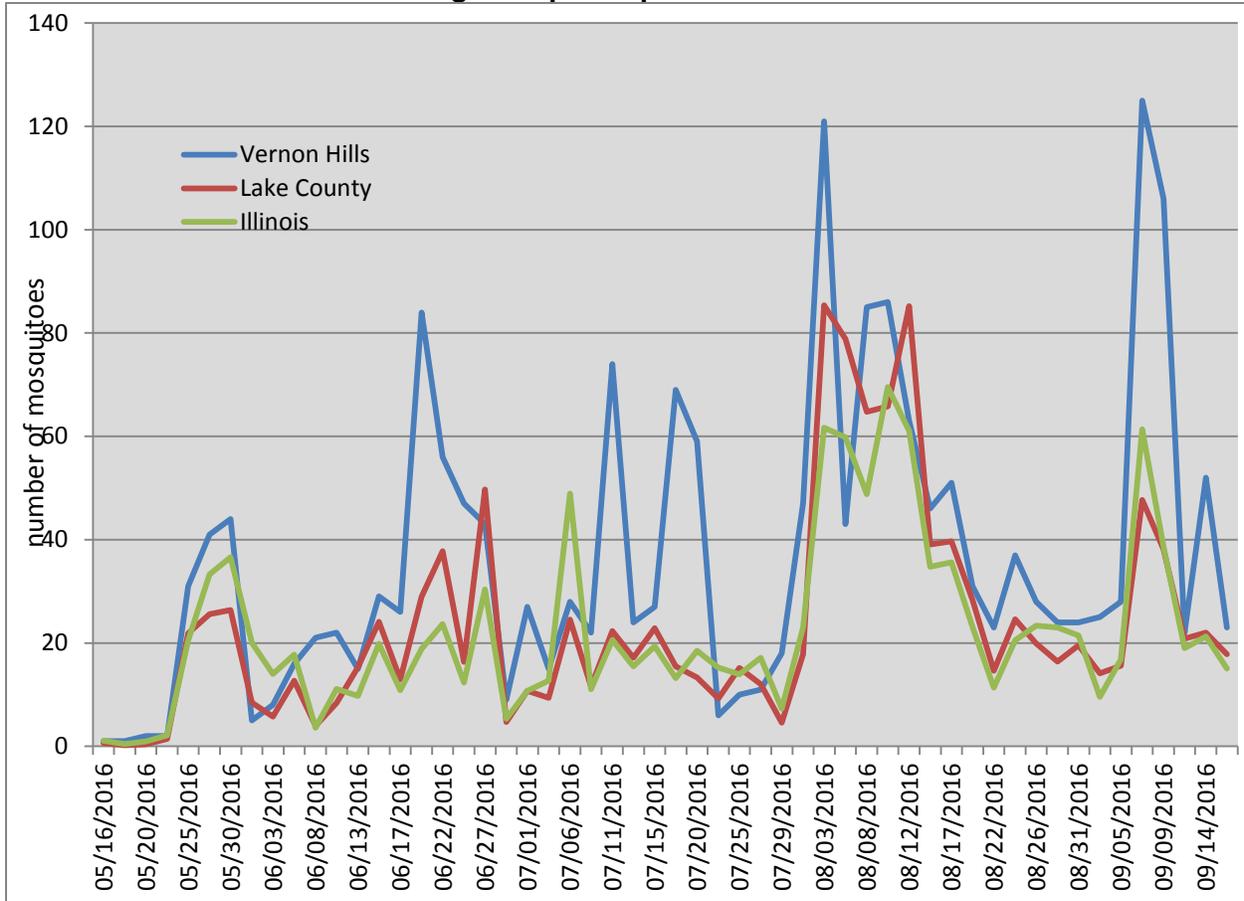
Total Number of Trap Nights: 52

Total Number of Mosquitoes: 2,840



Light Trap Counts by Region, County and Community

Light Trap Comparison Chart





Light Trap Counts by Trap Location

Pool ID	Gravid Trap #	Address	Collection Date	Species	Count of Females	WNV Test	PCR
016-0008	L300	Harvey Lake	06/02/2016	Culex misc spp	50	Negative	Negative
016-0041	L300	Harvey Lake	06/08/2016	Culex misc spp	18	Negative	Negative
016-0094	L300	Harvey Lake	06/15/2016	Culex misc spp	34	Negative	Negative
MAL	L300	Harvey Lake	06/22/2016	Malfunction	Malfunction	N/A	N/A
016-0192	L300	Harvey Lake	06/29/2016	Culex misc spp	10	Negative	Negative
016-0293	L300	Harvey Lake	07/08/2016	Culex misc spp	43	Negative	Negative
016-0292	L300	Harvey Lake	07/08/2016	Culex misc spp	50	Positive	Positive
016-0347	L300	Harvey Lake	07/13/2016	Culex misc spp	36	Negative	Negative
016-0348	L300	Harvey Lake	07/13/2016	Culex misc spp	30	Negative	Negative
016-0434	L300	Harvey Lake	07/20/2016	Culex misc spp	24	Negative	Negative
016-0503	L300	Harvey Lake	07/27/2016	Culex misc spp	12	Positive	Positive
016-0568	L300	Harvey Lake	08/03/2016	Culex misc spp	45	Positive	Positive
016-0654	L300	Harvey Lake	08/10/2016	Culex misc spp	16	Negative	Negative
016-0751	L300	Harvey Lake	08/17/2016	Culex misc spp	50	Positive	Positive
016-0750	L300	Harvey Lake	08/17/2016	Culex misc spp	50	Positive	Positive
016-0820	L300	Harvey Lake	08/24/2016	Culex misc spp	39	Positive	Positive
016-0899	L300	Harvey Lake	08/31/2016	Culex misc spp	38	Positive	Positive
016-1043	L300	Harvey Lake	09/09/2016	Culex misc spp	29	Positive	Positive
016-1113	L300	Harvey Lake	09/14/2016	Culex misc spp	50	Positive	Positive
016-1114	L300	Harvey Lake	09/14/2016	Culex misc spp	50	Negative	Negative
016-1115	L300	Harvey Lake	09/14/2016	Culex misc spp	41	Positive	Positive
016-1204	L300	Harvey Lake	09/21/2016	Culex misc spp	14	Negative	Negative
016-1283	L300	Harvey Lake	09/28/2016	Culex misc spp	13	Negative	Negative



Services Performed Year-to-Date

Service Item	Service Item Description	Treatment Date
ROS1302 - Targeted Site Larval Insp Serv	Inspection of all targeted larval development sites.	05/05/2016
ROS0952 - N.J. Light Trap Seasonal Serv	Seasonal Light Trap Service for adult mosquito population monitoring.	05/11/2016
ROS1302 - Targeted Site Larval Insp Serv	Inspection of all targeted larval development sites.	05/16/2016
ROS1054 - WNV Gravid Trap Service	Seasonal West Nile Virus monitoring trap service.	05/31/2016
ROS2006 - Natular T30 CB Bike	Catch basin treatment for larval control.	06/07/2016
ROS1252 - Complete Site Larval Insp Serv	Inspection service of all potential mosquito larvae development sites.	06/09/2016
ROS1302 - Targeted Site Larval Insp Serv	Inspection of all targeted larval development sites.	06/16/2016
ROS1302 - Targeted Site Larval Insp Serv	Inspection of all targeted larval development sites.	06/27/2016
ROS2888 - Biomist 3+15 Truck ULV	ULV application insecticide for adult mosquito control.	07/01/2016
ROS2754 - Anvil 4th of July ULV Special	ULV "touch-up" application for 4th of July special event for adult mosquito control.	07/03/2016
ROS1252 - Complete Site Larval Insp Serv	Inspection service of all potential mosquito larvae development sites.	07/11/2016
ROS2006 - Natular T30 CB Bike	Catch basin treatment for larval control.	07/19/2016
ROS2888 - Biomist 3+15 Truck ULV	ULV application insecticide for adult mosquito control.	07/20/2016
ROS1302 - Targeted Site Larval Insp Serv	Inspection of all targeted larval development sites.	07/27/2016
ROS2786 - Anvil Truck ULV Festival	Truck ULV "touch-up" application for community festival mosquito control.	08/01/2016
ROS2888 - Biomist 3+15 Truck ULV	ULV application insecticide for adult mosquito control.	08/04/2016
ROS1302 - Targeted Site Larval Insp Serv	Inspection of all targeted larval development sites.	08/08/2016
ROS1252 - Complete Site Larval Insp Serv	Inspection service of all potential mosquito larvae development sites.	08/16/2016
ROS2006 - Natular T30 CB Bike	Catch basin treatment for larval control.	08/17/2016



Service Item	Service Item Description	Treatment Date
ROS1305 - Culex Site Inspection Service	Inspection of culex mosquito larval development sites for the prevention of West Nile Virus and other mosquito-borne diseases.	08/25/2016
ROS2888 - Biomist 3+15 Truck ULV	ULV application insecticide for adult mosquito control.	08/31/2016
ROS1305 - Culex Site Inspection Service	Inspection of culex mosquito larval development sites for the prevention of West Nile Virus and other mosquito-borne diseases.	09/08/2016
ROS2888 - Biomist 3+15 Truck ULV	ULV application insecticide for adult mosquito control.	09/09/2016
ROS1305 - Culex Site Inspection Service	Inspection of culex mosquito larval development sites for the prevention of West Nile Virus and other mosquito-borne diseases.	09/15/2016
ROS2006 - Natular T30 CB Bike	Catch basin treatment for larval control.	09/16/2016

Services Invoiced Per Contract:

Services Invoiced Year-to-Date: \$60,847.00