2017—Arbovirus Final Report

Summary of Human West Nile Virus and Other Arboviral Infections, Georgia 2017

West Nile virus (WNV) is a mosquito-borne disease of birds. Humans are occasionally infected with WNV through mosquito bites. Approximately 1 in 5 people infected with WNV develop symptoms of "West Nile Fever", which is often characterized by fever, headache, fatigue, and muscle pain or weakness. Less than 1% of people infected with WNV develop neurologic disease such as meningitis, encephalitis, or flaccid paralysis.

West Nile virus was first recognized in Georgia in July 2001. That year, there were 6 human cases of WNV encephalitis reported in Georgia, including one death. Since then cases have been reported each year with varying numbers of human deaths.

To improve identification of Georgians infected with WNV, surveillance for WNV illness in humans was expanded for the 2003 transmission season to include all acute infections of WNV. In addition, routine screening of the nation's blood supply began in 2003, resulting in the identification of persons infected with WNV prior to the development of symptoms, if symptoms developed at all.

While the majority of human infections with arboviruses have resulted from bites by infected mosquitoes, other rare modes of transmission have been identified, including blood transfusion and organ transplantation.

For historical data on arboviral diseases in Georgia since 2010, see the end-of-year summaries posted at https://dph.georgia.gov/EnvironmentalHealth. Summaries from 2002-2009 are available upon request.

In 2017, Georgia reported 48 cases of WNV and 16 WNV presumptive viremic donors (PVD), with 7 deaths. Presumptive viremic donors (PVDs) are people who had no symptoms at the time of blood donation or other testing, but tested positive for the presence of select arboviruses. Although we track and report PVDs to the CDC for epidemiological purposes, we do not count these as cases in our state.

Forty-three (89.5%) of the 48 cases experienced WNV neurologic illness (altered mental status, paralysis, encephalitis, GBS and/or meningitis) and 5 (10.2%) were diagnosed with WNV fever. The average age of cases was 61.4 years (range 17-87). The average age of those with WNV neurologic illness was 64.6 years (range 26-87). Forty (83.3%) of the 48 cases were male. The majority of cases were reported in July, August, and September, with the peak in August.

California serogroup (CS) viruses including California encephalitis, Keystone, La Crosse, Jamestown Canyon, snowshoe hare, and trivittatus are all mosquito-borne arboviral infections. In the United States, La Crosse virus (LACV) is the most common of the California serogroup viruses.

There were 2 cases of CS, non-specified reported in Georgia in 2017. Prior to 2017, all of our reported CS cases were determined to be LAC.

In 2017, two confirmed cases of EEE and one PVD were reported in Georgia.

The first travel-associated case of Zika was reported in Georgia in December 2015. In 2016, there were 113 travel-associated cases reported in Georgia. In 2017, there were a total of 11 travel-associated cases. To date there have been no locally transmitted (mosquito to human) cases of Zika. Travel-associated Dengue (5) and Chikungunya (2) cases continue to be reported but no locally-acquired cases were reported.

Table 1: WNV Positives by County, 2017

County	Count
Ben Hill	1
Bibb	2
Camden	1
Candler	1
Catoosa	1
Chatham	6
Cherokee	1
Cobb	2
Columbia	2
Crisp	2
Decatur	2
DeKalb	7
Dougherty	2
Douglas	1
Floyd	1
Forsyth	1
Fulton	3
Gordon	1
Gwinnett	2
Houston	1
Johnson	1
Jones	1
Lamar	1
Lee	1
McDuffie	1
Miller	1
Mitchell	1
Morgan	1
Muscogee	5
Polk	1
Quitman	1
Rockdale	2
Stephens	1
Sumter	1
Treutlen	1
Upson	1
Washington	1
Whitfield	2

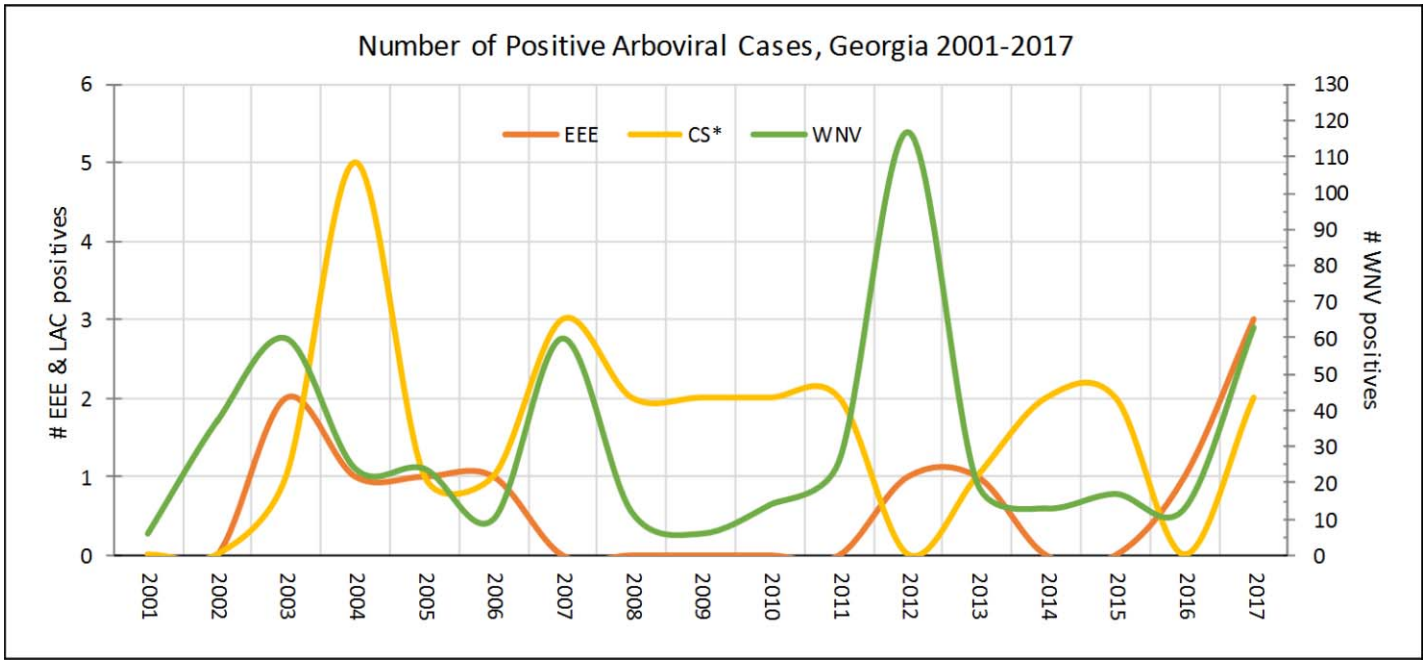
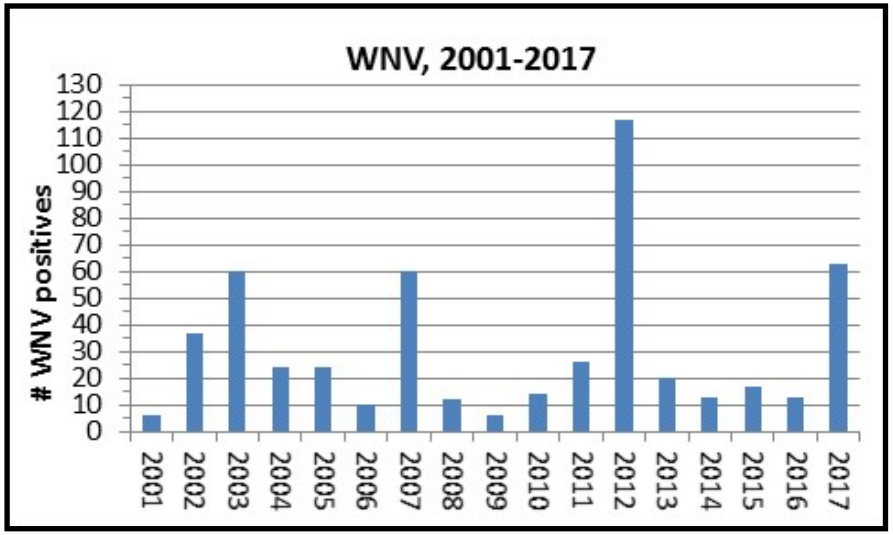


Table 3: Age Ranges, WNV 2017*

age range	WNND	WNF	Asymptomatic	total
0-10				0
11-20			1	1
21-30	2	1		3
31-40	2		2	4
41-50	5		3	8
51-60	5	3	5	13
61-70	9		4	13
71-80	15	1	1	17
>80	5			5
TOTAL	**43**	**5**	**16**	**64**

Table 2: Clinical Syndromes, Endemic Arboviruses, 2017

	Virus					
Diagnosis	**CS, non-specified**	**CHIK**	**DENGUE**	**EEE**	**WNV**	**ZIKV**
ACUTE FLACCID PARALYSIS						
ASYMPTOMATIC				1	16	8
Congenital Infection						
ENCEPHALITIS	2				22	
FEVER		2	5		5	1
GUILLIAN_BARRE_SYNDROME					2	
MENINGITIS					12	
other, clinical						2
other, neuroinvasive				2	7	
TOTALS	**2**	**2**	**5**	**3**	**64**	**11**



Cases by Year (includes asymptomatic cases*)			
Year	EEE	CS	WNV
2001			6
2002			37
2003	2	1	60
2004	1	5	24
2005	1	1	24
2006	1	1	10
2007		3	60
2008		2	12
2009		2	6
2010		2	14
2011		2	26
2012	1		117
2013	1	1	20
2014		2	13
2015		2	17
2016	1		13
2017	3	2	64
Grand Total	11	26	523

Emerging & Reemerging Infectious Diseases

Two major categories of emerging infections—newly emerging and reemerging infectious diseases—can be defined, respectively, as diseases that are recognized in the human host for the first time; and diseases that historically have infected humans, but continue to appear in new locations or in drug-resistant forms, or that reappear after apparent control or elimination.

A high proportion of arboviruses associated with human and animal disease circulate in tropical, and subtropical regions, where mosquitoes, and other flying insects, tend to be abundant. However, many arboviruses also circulate amongst wildlife species in temperate regions of the world.

More than 100 species of arbovirus that cause human/animal or zoonotic diseases have been identified. Four virus families, *Togaviridae, Bunyaviridae, Flaviviridae,* and *Reoviridae*, contain most of the arboviruses that cause human/animal diseases. Many cause a large social and economic burden.

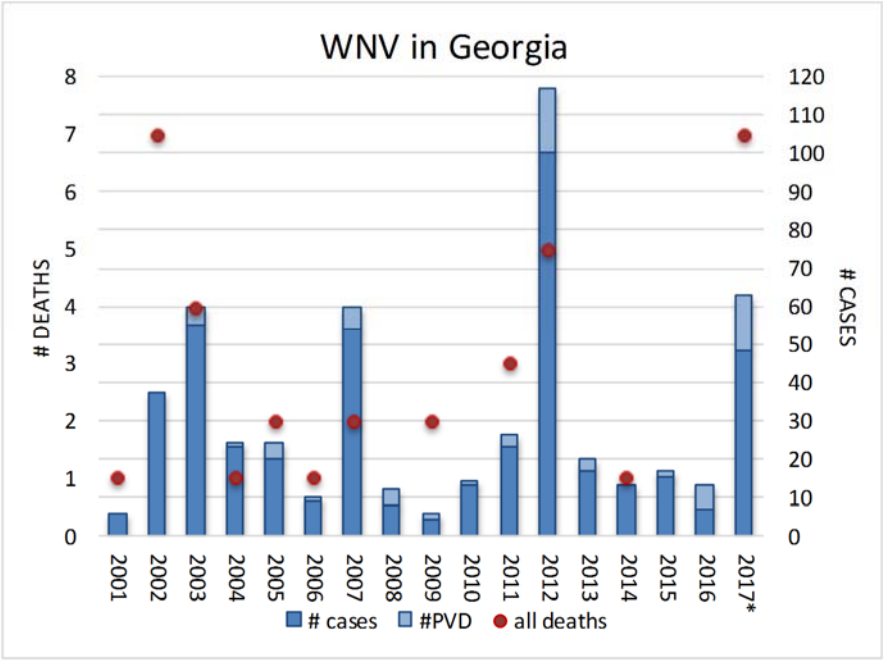


Table 4: Travel Associated Cases

Exotic Viruses - County of Origin			
Virus	**County of Origin**	**# cases**	**Month of Onset**
CHIK	India	1	July
	unknown	1	August
DEN	Brazil	1	May
	Ivory Coast	1	July
	Puerto Rico	1	May
	US Virgin Islands	1	June
	unknown	1	November
ZIKV	Dominican Republic	1	July
	El Salvador	3	January (2), March
	Mexico	1	September
	Turks & Caicos Islands	1	April
	Unknown	5	January (2), April (2)

Zika virus was first discovered in 1947 and is named after the Zika Forest in Uganda. In 1952, the first human cases of Zika were detected. Before 2007, at least 14 cases of Zika had been documented, although other cases were likely to have occurred and were not reported. In May 2015, the Pan American Health Organization (PAHO) issued an alert regarding the first confirmed Zika virus infection in Brazil and on Feb 1, 2016, the World Health Organization (WHO) declared Zika virus a public health emergency of international concern (PHEIC).

Zika virus is transmitted to people primarily through the bite of an infected *Aedes* species mosquito (*Ae. aegypti* and *Ae. albopictus*). These are the same mosquitoes that spread dengue and chikungunya viruses.

Chikungunya was first identified in Tanzania in the early 1952 and has caused periodic outbreaks in Asia and Africa since the 1960s. In late 2013, the first local transmission of chikungunya virus in the Americas was identified in Caribbean countries and territories. Local transmission means that mosquitoes in the area have been infected with the virus and are spreading it to people.

With more than one-third of the world's population living in areas at risk for infection, dengue virus is a leading cause of illness and death in the tropics and subtropics. As many as 400 million people are infected yearly. Dengue is caused by any one of four related viruses transmitted by mosquitoes. Dengue has emerged as a worldwide problem only since the 1950s. Although dengue rarely occurs in the continental United States, it is endemic in Puerto Rico and in many popular tourist destinations in Latin America, Southeast Asia and the Pacific islands.

If you have questions or comments, please contact Shawna Stuck, MPH, Human Arboviral Epidemiologist (404-657-6442 or Shawna.Stuck@dph.ga.gov) at the Georgia Department of Public Health.

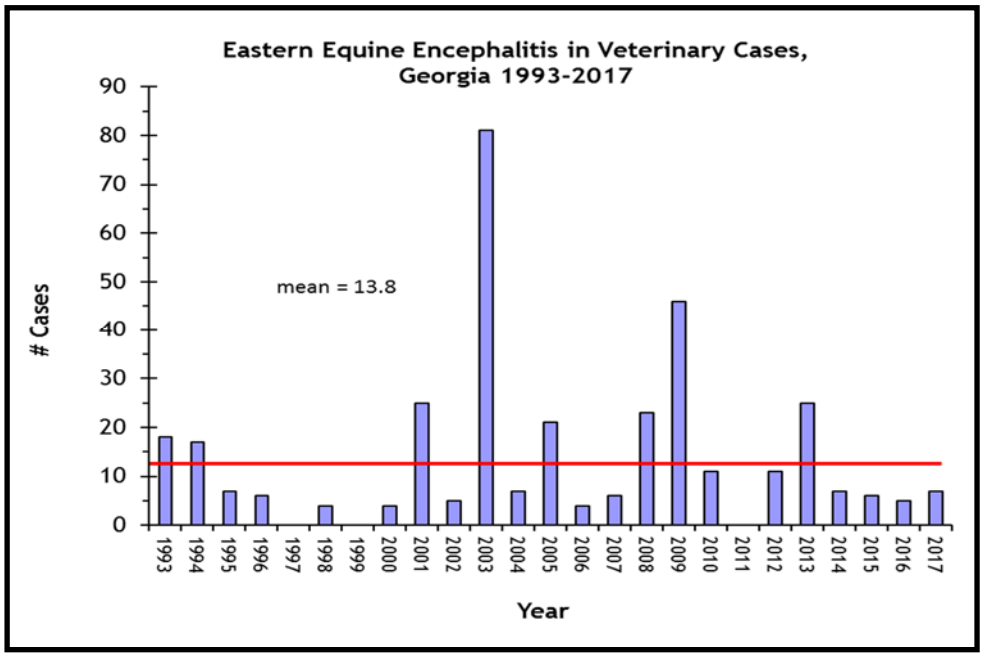
Veterinary Data

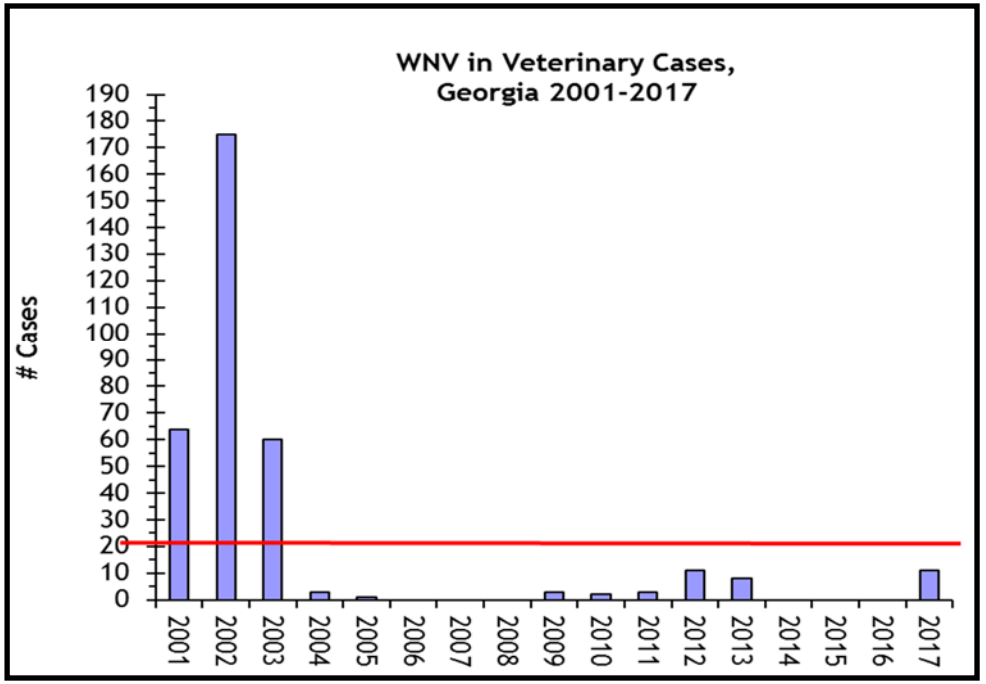
Eleven horses tested positive for WNV in 2017. The number of reported cases of WNV in horses decreased rapidly after 2002, likely due to increased immunity, increased vaccination, and/or decreased testing, but had lately begun to increase again, although somewhat sporadically.

Seven horses tested positive for EEE in 2017. Eastern equine encephalitis is endemic in the Coastal and Coastal Plains areas of Georgia. During an average year, four or five EEE+ horses are reported from these areas. The true number of horse cases is probably higher, and lack of reporting is due primarily to under-testing, although subclinical infections can occur with EEE.

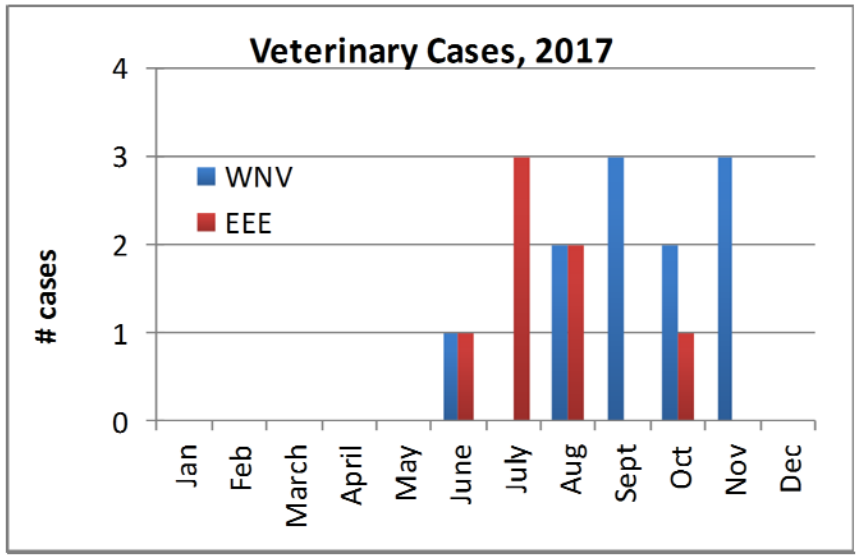
Vaccinating at the proper time of the year against EEE and WNV is critical to protecting horses from the potentially fatal mosquito-borne diseases.

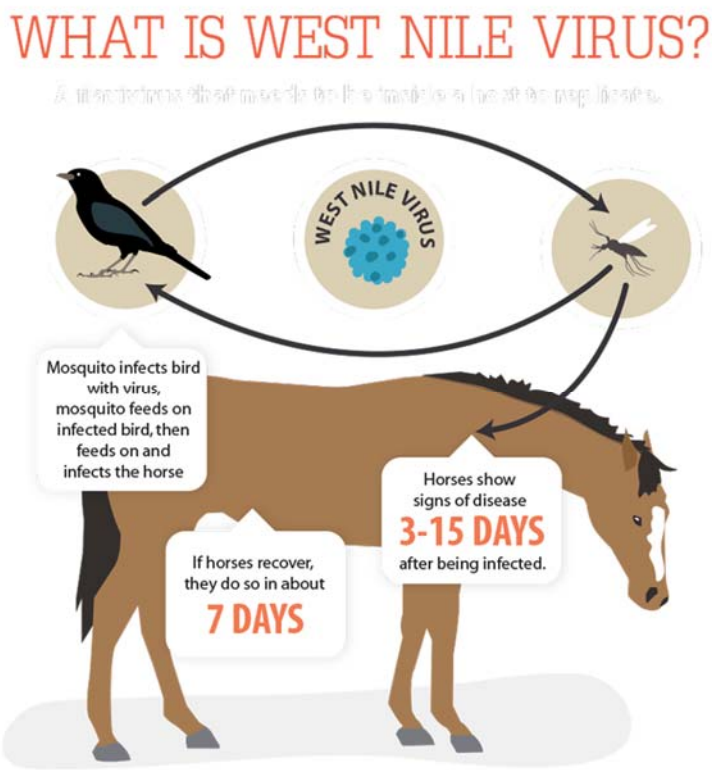
	WNV Vaccination Status			
County	**unknown**	**unvaccinated**	**owner**	**Grand Total**
Brantley			1	1
Carroll	1			1
Coweta	1			1
Elbert		1		1
Gordon	1			1
Laurens	1			1
Pike		1		1
Richmond	1			1
Screven	1			1
Walker		1		1
Worth	1			1
Grand Total	**7**	**3**	**1**	**11**





	EEE Vaccination Status			
County	**unknown**	**unvaccinated**	**vaccinated**	**Grand Total**
Brooks	1			1
Bryan			1	1
Camden			1	1
Echols	1			1
Effingham	1			1
Houston		1		1
Lowndes		1		1
Grand Total	**3**	**2**	**2**	**7**





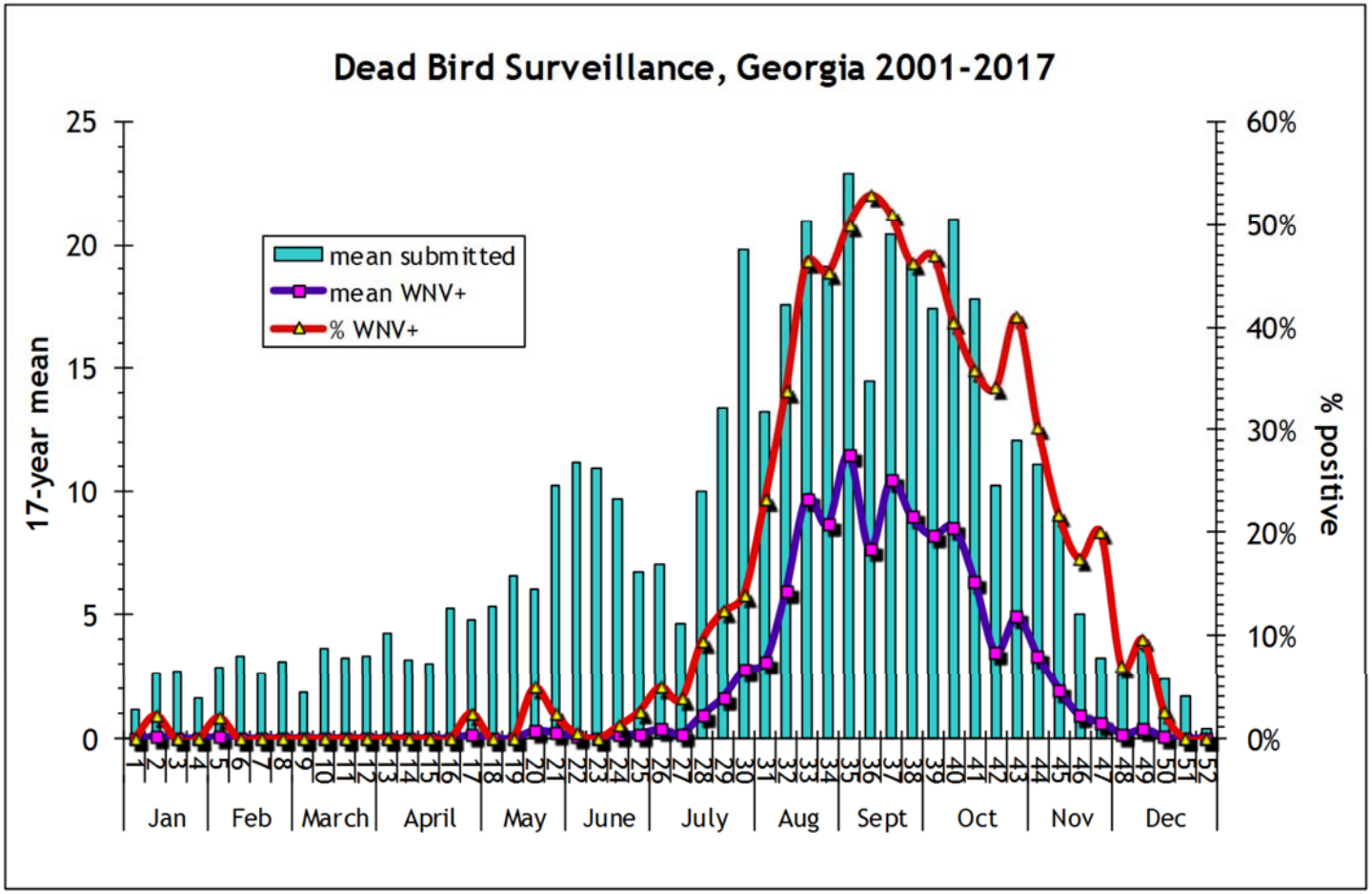
Know the signs of EEE and WNV in horses – EEE generally affects a horse much more quickly and severely than WNV. The death rate for unvaccinated horses with EEE is much higher compared to WNV. You may see any of the following symptoms in horses affected by EEE or WNV :

- Fever
- Stumbling
- Blindness
- Muscle twitching around face, neck, muzzle
- Can't get up, falling over
- Leaning against stall, fence
- Depression
- Change in behavior, appetite
- Seizures, seizure-like activity
- Sudden death, found dead
- Sudden onset of symptoms/illness (few hours – 2 days with EEE, 3-10 days with WNV)

Dead Bird Surveillance

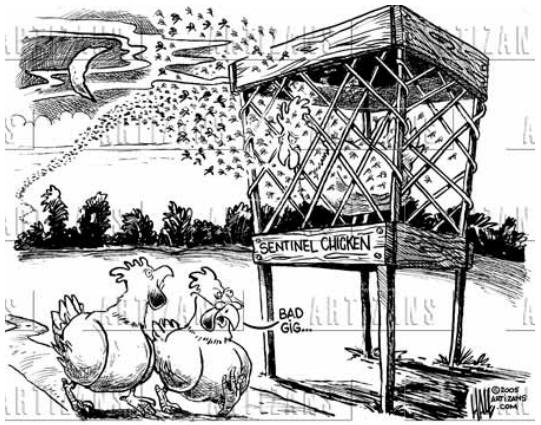
As of 2012, federal funding was no longer available to test birds; no birds were reported as submitted for testing between 2014 and 2016. In 2017, 5 birds were submitted for testing from one county; 1 tested WNV+.

Dead bird surveillance continues to lose ground as a surveillance tool, and even more so now when no funding is available at the State level to support testing; most counties do not have the resources to pick up and ship birds for testing in any case. Bird testing does continue to have some utility, esp where mosquito surveillance data are not available. In addition, positive dead bird reports can be used to trigger public education messages reminding people to wear repellent and to dump out standing water.



In addition to dead bird testing, the Chatham County Mosquito Control Program also sets out sentinel chickens for EEE surveillance.

This information is used by the program to focus mosquito control efforts on EEE risk reduction in the county.



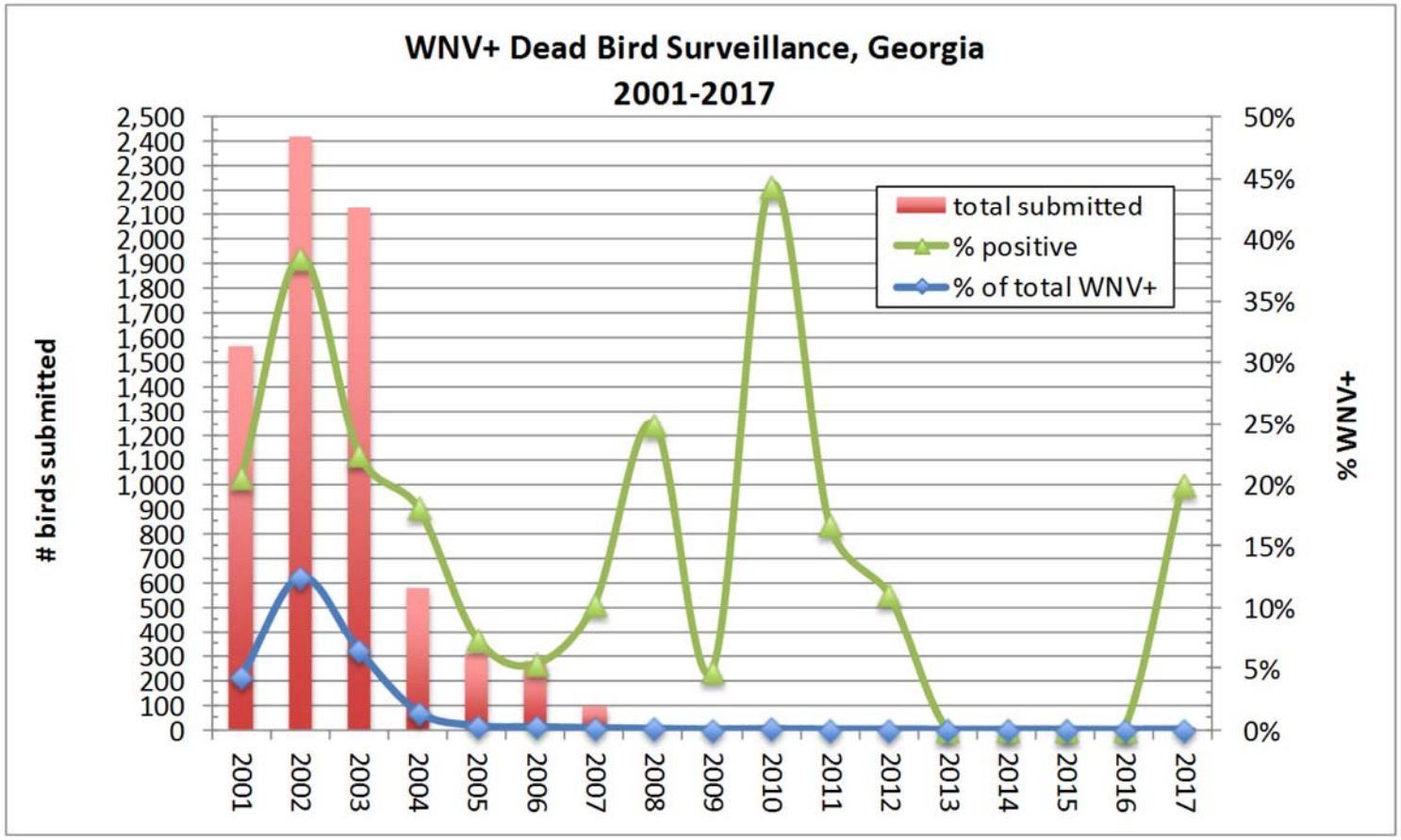
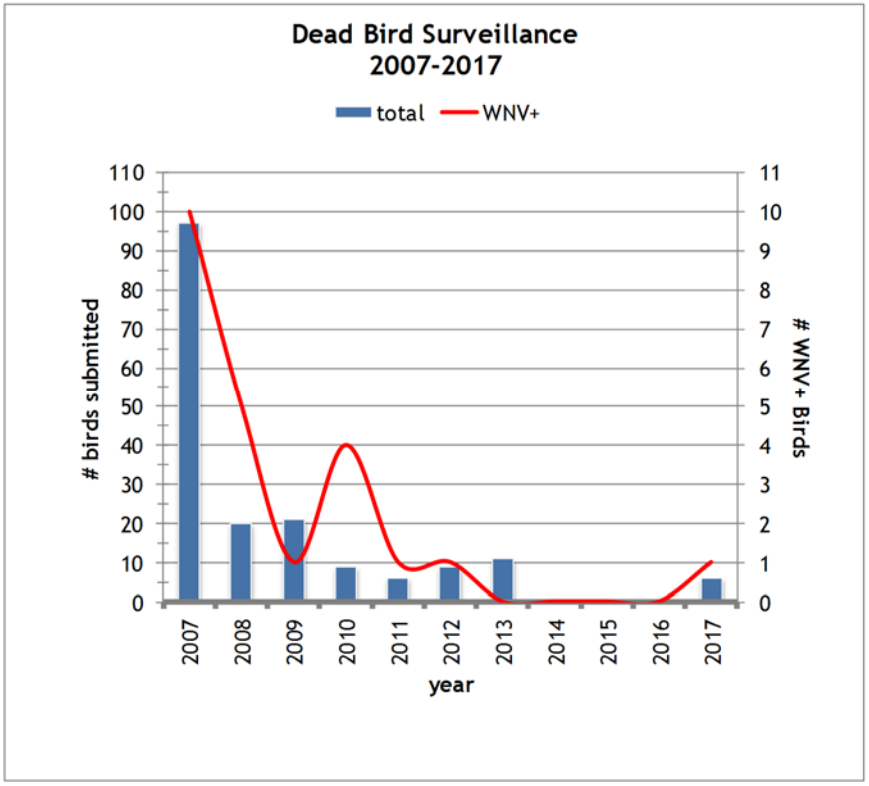
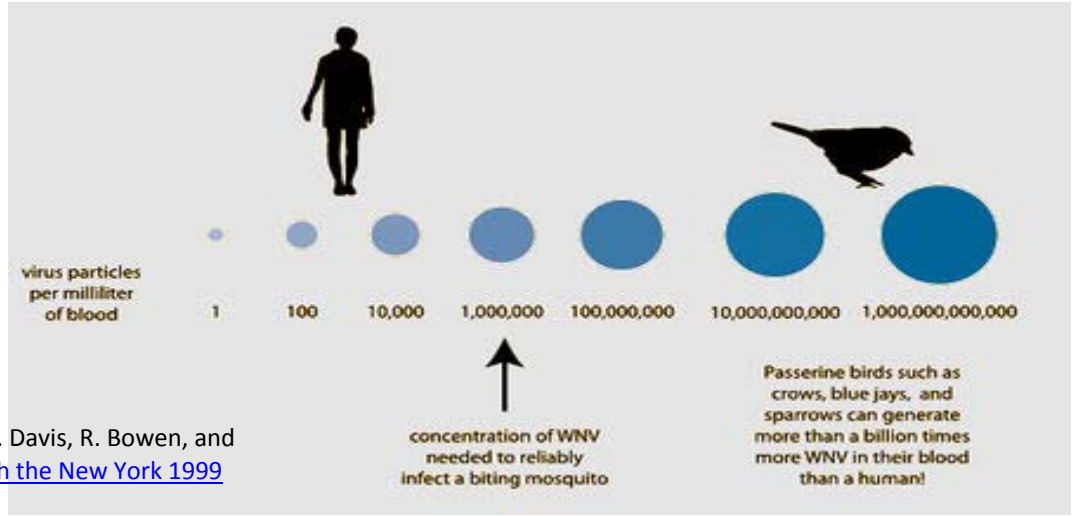


Table of West Nile Virus host competency of 23 species of birds. A larger index number correlates to higher amounts of viral load in concurrence with long durations of viremia. Data adapted from Komar et al. 2003.

Species	Reservoir Competence Index
Blue Jay	2.55
Common Grackle	2.04
House Finch	1.76
American Crow	1.62
House Sparrow	1.59
Ring-billed Gull	1.26
Black-billed Magpie	1.08
American Robin	1.08
Red-winged Blackbird	0.99
American Kestrel	0.93
Great Horned Owl	0.88
Killdeer	0.87
Fish Crow	0.73
Mallard	0.48
European Starling	0.22
Mourning Dove	0.19
Northern Flicker	0.06
Canada Goose	0.03
Rock Dove	0
American Coot	0
Ring-necked Pheasant	0
Monk Parakeet	0





Komar, N., S. Langevin, S. Hinten, N. Nemeth, E. Edwards, D. Hettler, B. Davis, R. Bowen, and M. Bunning. 2003. Experimental Infection of North American Birds with the New York 1999 Strain of West Nile Virus. Emerging Infectious Diseases 9(3): 311-322.

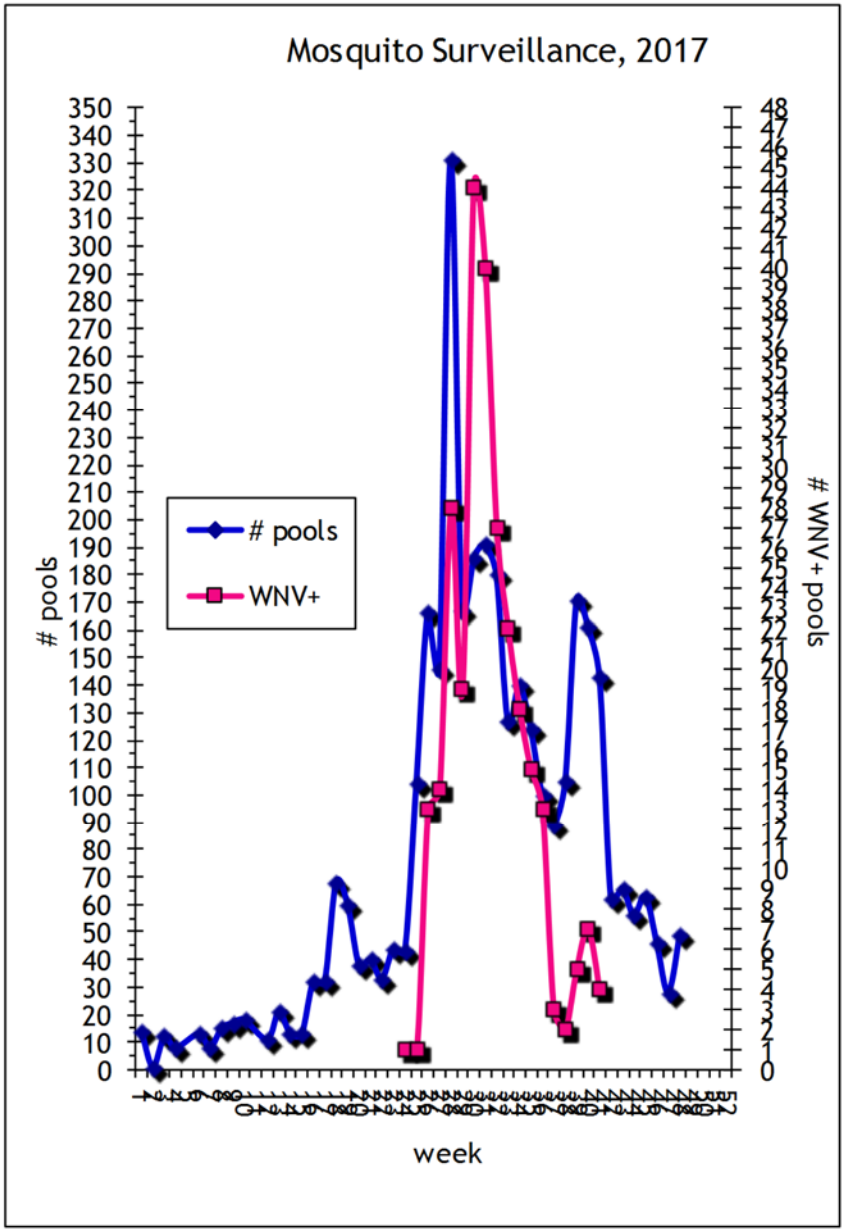
Mosquito Surveillance

In 2012, due to funding cuts, mosquito testing was no longer supported by the State Department of Public Health. Counties holding independent contracts with SCWDS, or other labs, for testing continued doing mosquito surveillance and shared some of the test results with the GDPH; 3 counties sent mosquitoes to SCWDS for testing in 2017. Fulton County had their mosquito pools tested at the Fairfax County Health Department laboratory in Virginia. Glynn County also sent mosquitoes to an outside lab. Unfortunately, data submitted to the GDPH are likely to be incomplete, making data analysis difficult and results suspect.

A total of 6418 pools of mosquitoes (119735 individuals) were sent for testing with results reported to the GDPH. Three species were found to be WNV+, *Culex nigripalpus* (2 pools), *Cx quinquefasciatus* (262 pools) and *Cx restuans* (1 pool). There were also 11 pools of unspecified *Culex* spp found WNV+. Two EEE+ pools were reported from *Culiseta melanura* in 2017.

WNV+ pools

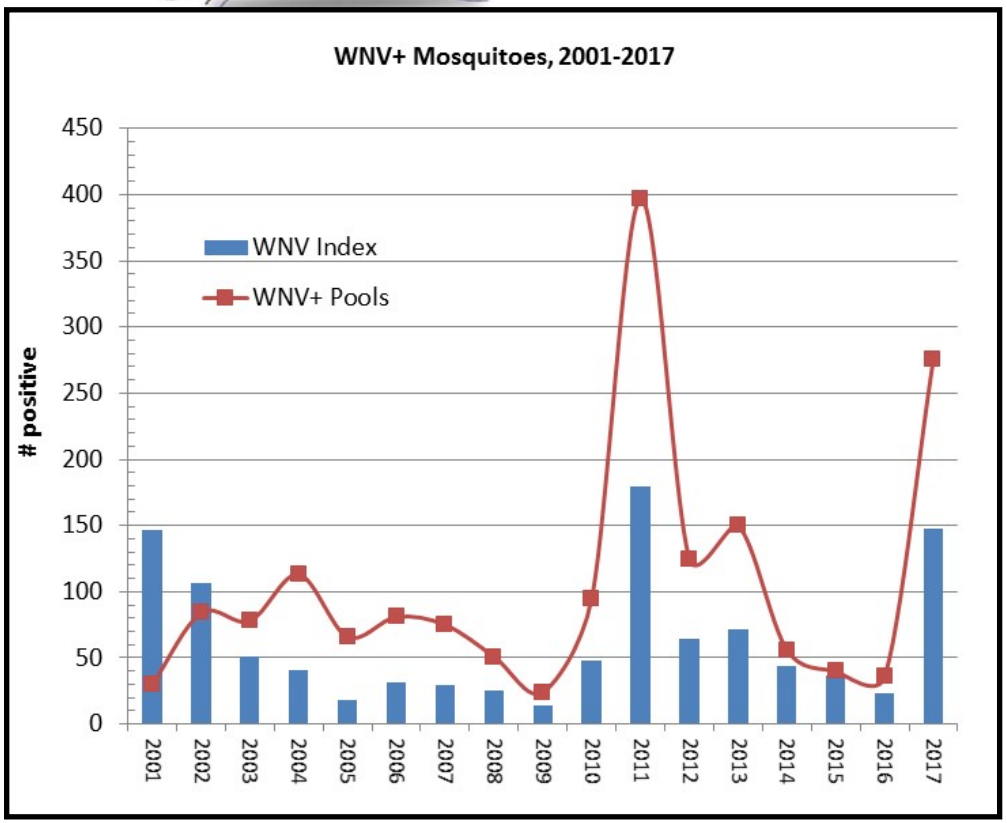
County	# mosquitoes submitted	# WNV+ pools	MIR
Chatham	46126	93	2.02
DeKalb	13719	155	11.30
Fulton	5042	27	5.36
Glynn	23912		
Lowndes	30936	1	0.03



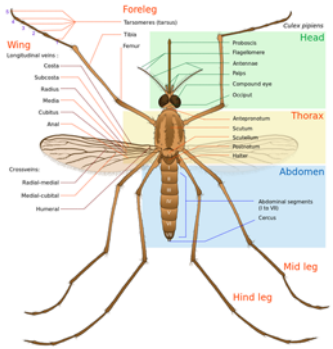
The first WNV+ mosquitoes were detected in Fulton County in mid-June. The last WNV+ pools were collected in Chatham County in mid-October. Peaks in numbers of WNV+ pools occurred in July. Three WNV+ pools were collected from BGS traps. Two pools were collected from CDC light traps. The rest (271) of the WNV+ mosquitoes were caught in gravid traps.

The Minimum Infection Rate or MIR = (# WNV+ Pools/Total # Mosquitoes Tested) X 1000. The WNV Index is the MIR multiplied by the number of mosquitoes per trap night. An MIR of 0 suggests that there is no viral activity in the area. An MIR of 0.1 to 3.9 indicates that some viral activity is present, and increased vigilance and testing are needed. An MIR of 4.0 or above means that a high level of viral activity is present, human infections are imminent (if not already present), and prompt action is required.

The monthly MIR for Georgia in 2017 ranged from 0.71 to 5.17, with an average of 1.27.

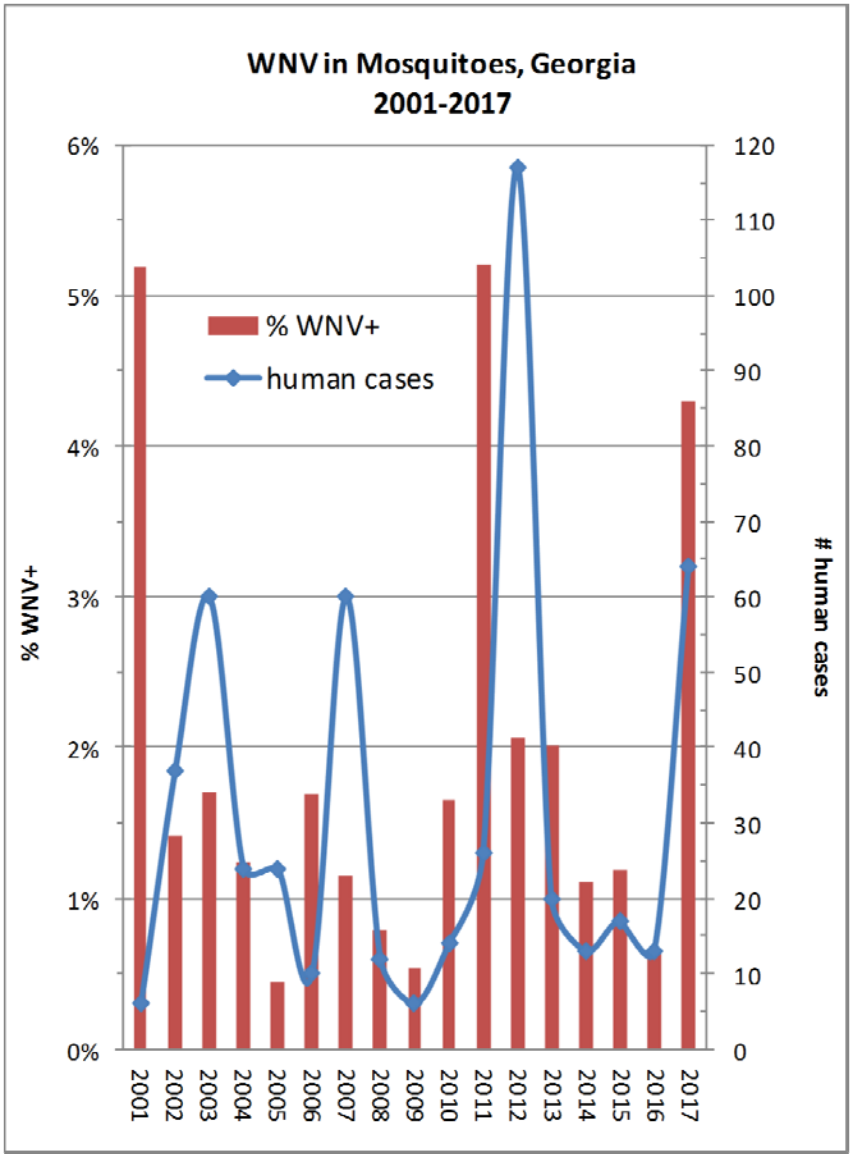


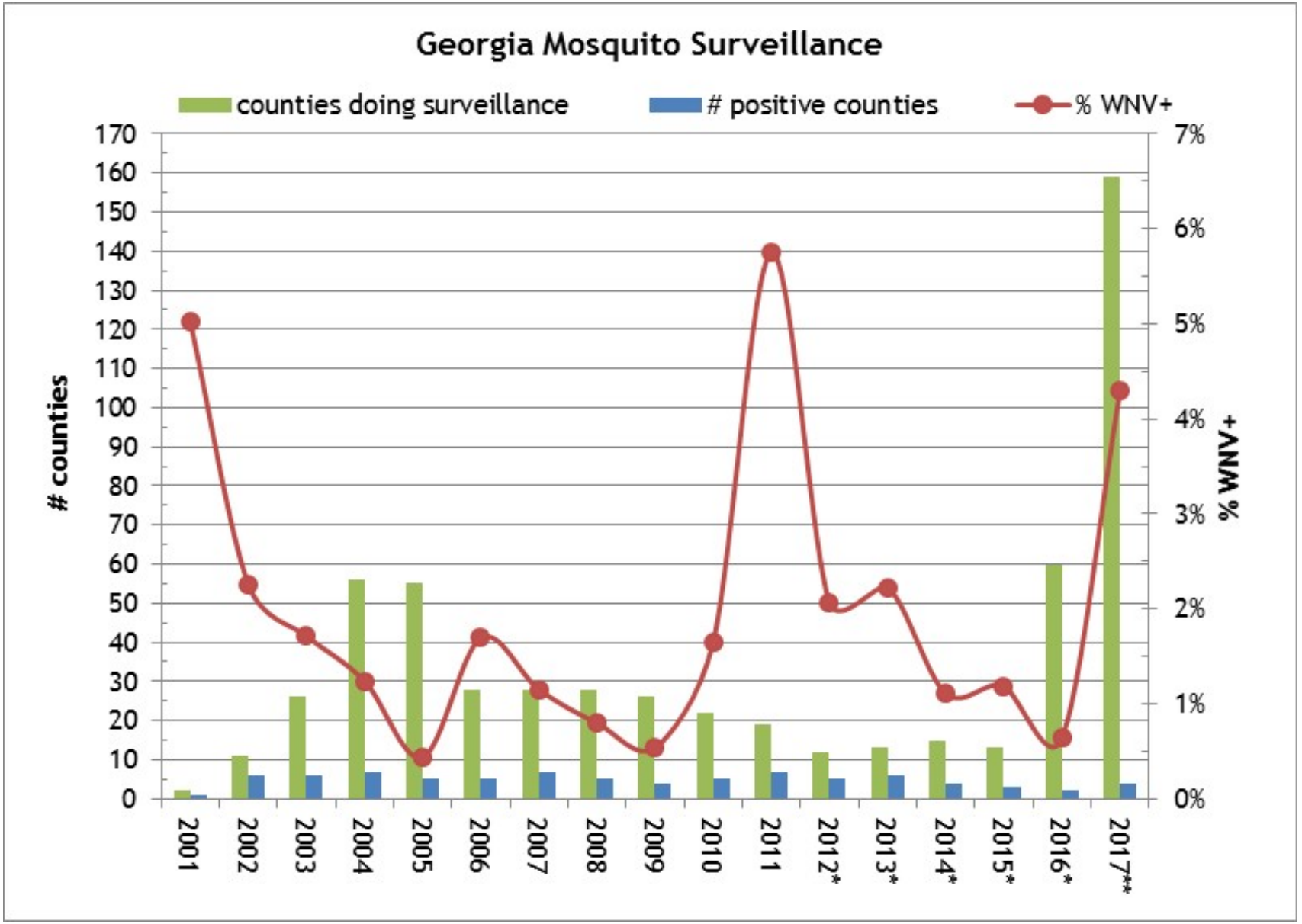
year	WNV Index	WNV+ Pools	human cases
2001	146.3	31	6
2002	106.6	57	37
2003	50.7	105	60
2004	40.7	126	24
2005	17.7	67	24
2006	31.5	81	10
2007	29.9	75	60
2008	25.3	50	12
2009	13.7	24	6
2010	47.7	99	14
2011	179.6	397	26
2012	64.3	125	117
2013	72.0	150	20
2014	43.6	56	13
2015	37.00	40	17
2016	22.80	36	13
2017	148.00	276	64



2001-2017	human cases	WNV+ mosquito pool	veterinary case	positive bird
total	523	1795	341	1897
mean	30.8	105.6	20.1	111.6

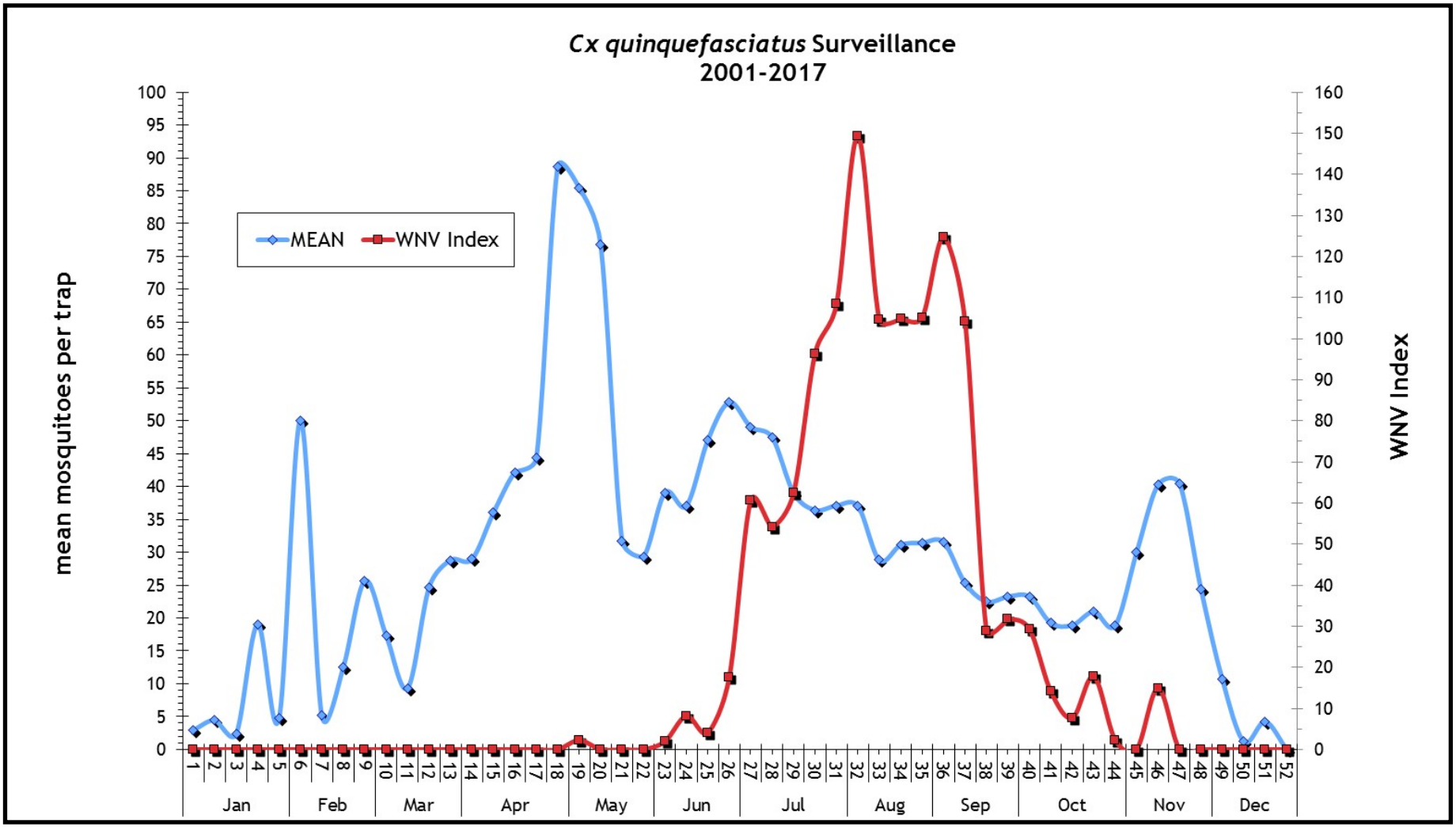
year	total pools	WNV+	% WNV+	human cases
2001	597	31	5.2%	6
2002	4032	57	1.4%	37
2003	6177	105	1.7%	60
2004	10161	126	1.2%	24
2005	15248	67	0.4%	24
2006	4785	81	1.7%	10
2007	6513	75	1.2%	60
2008	6383	50	0.8%	12
2009	4446	24	0.5%	6
2010	5990	99	1.7%	14
2011	7622	397	5.2%	26
2012	6042	125	2.1%	117
2013	7453	150	2.0%	20
2014	5038	56	1.1%	13
2015	3366	40	1.2%	17
2016	5620	36	0.6%	13
2017	6418	276	4.3%	64
MEAN	6228.9	105.6	1.7%	30.8
TOTAL	105892	1795	32%	523





*6 counties doing testing

**5 counties doing testing



The Vector Index (VI) equals the MIR times the number of vectors per trap night . It is a Measure of infectivity that takes into account the following information:

- **Vector species composition** – Key species carrying West Nile virus in our region.
- **Vector species population density** – Vector abundance relative to trapping effort (vectors per trap night).
- **Vector species infection rate** – Proportion of vector population infected with WNV (MIR).

The VI is an objective method of following trends in mosquito infection rates, adjusted for mosquito abundance in the area.

Mosquito Surveillance: Untested Mosquitoes

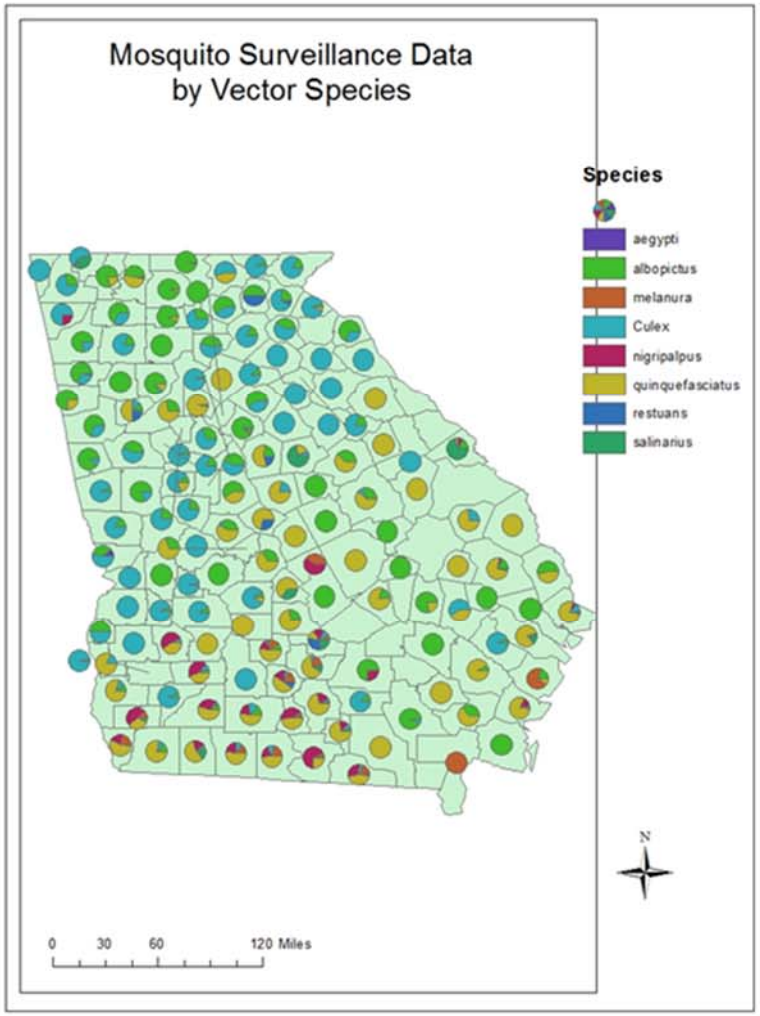
Due to loss of funding, mosquitoes collected during surveillance by the GDPH are no longer sent for testing. These mosquitoes are identified and the data are shared with the county mosquito control agency to assist with control efforts. In 2017, some level of surveillance was done in every county in Georgia. Mosquitoes were sent for testing from 5 counties.

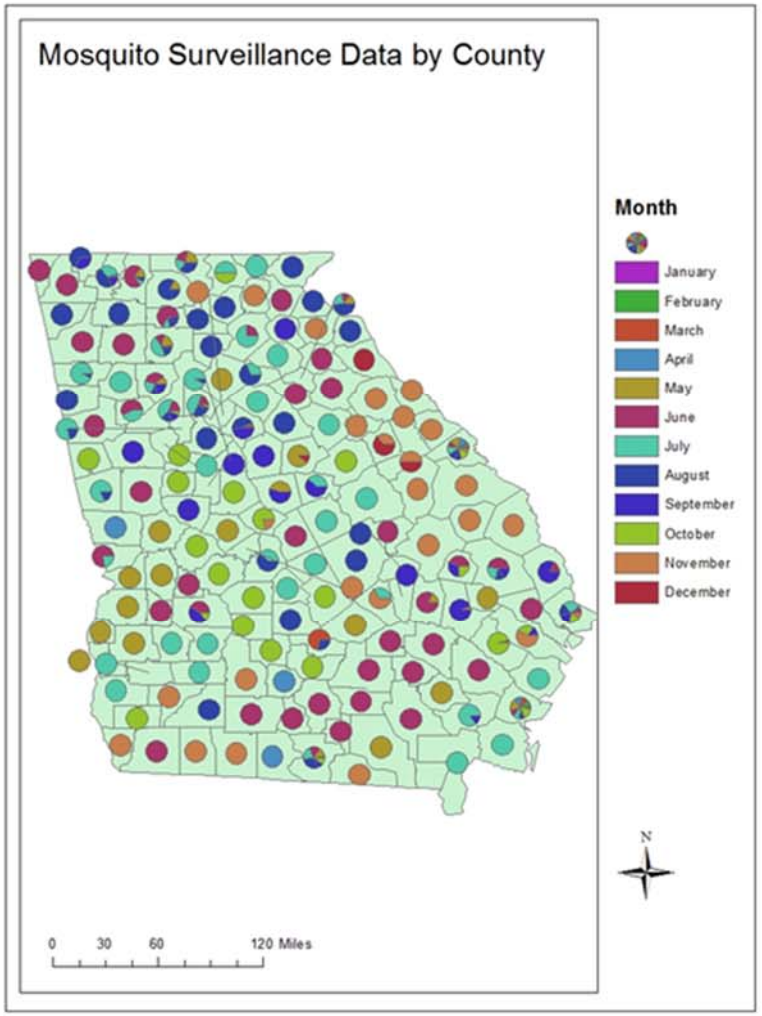
Month	# mosquitoes
January	413
February	613
March	235
April	1726
May	2772
June	5456
July	6833
August	3591
September	2768
October	4908
November	3115
December	428
Grand Total	**32858**

Month	# trap nights
January	33
February	25
March	12
April	26
May	83
June	109
July	102
August	84
September	73
October	66
November	66
December	24
Grand Total	**703**

Month	# mosquitoes/trap night
January	12.52
February	24.52
March	19.58
April	66.38
May	33.40
June	50.06
July	66.99
August	42.75
September	37.92
October	74.36
November	47.20
December	17.83
Mean	**41.13**

Mosquito Surveillance: Untested Mosquitoes

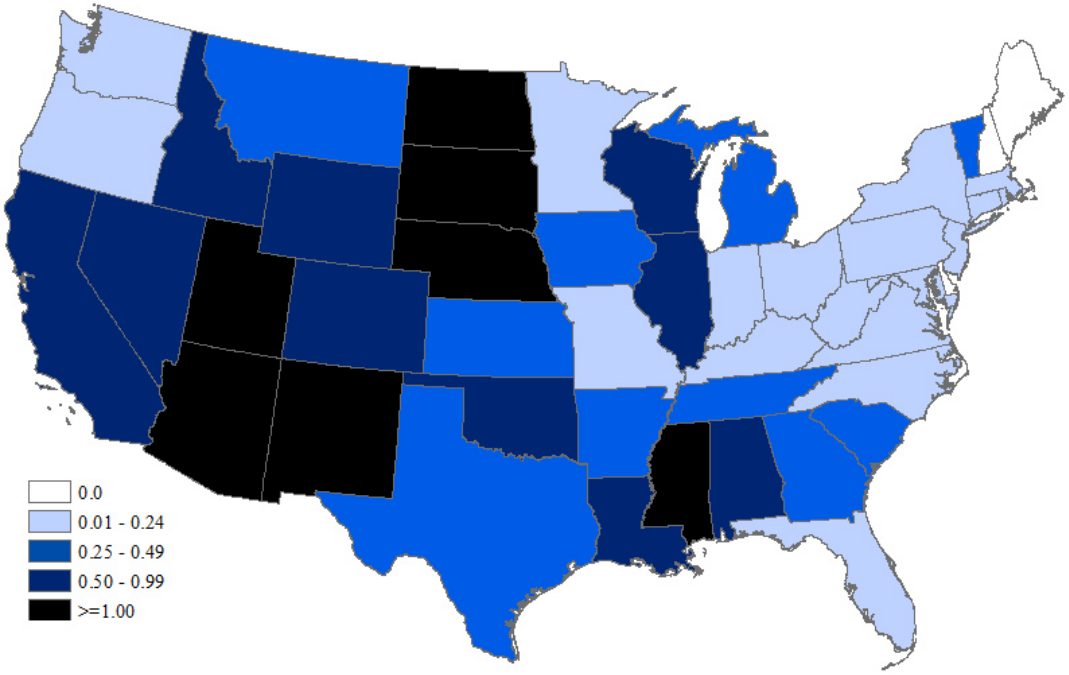




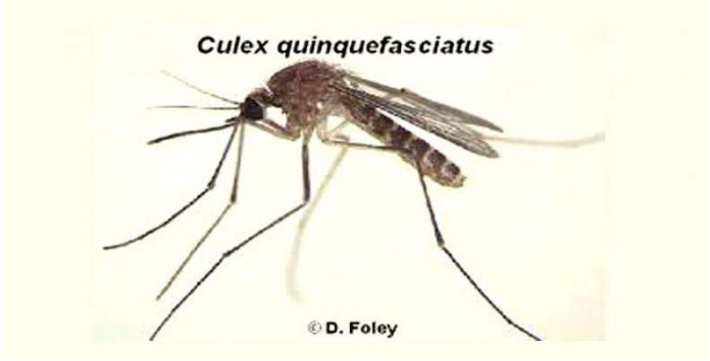
These maps depict the month(s) in which surveillance was done in each county and the presence or absence of the important vector species *Aedes aegypti*, *Ae albopictus*, *Culiseta melanura*, *Culex* spp, *Cx nigripalpus*, *Cx quinquefasciatus*, *Cx restuans*, and *Cx salinarius*.

WNV Activity Map

This map shows the incidence of human West Nile virus neuroinvasive disease (e.g., meningitis, encephalitis, or acute flaccid paralysis) by state for 2016 with shading ranging from 0.01-0.24, 0.25-0.49, 0.50-0.99, and greater than 1.00 per 100,000 population.

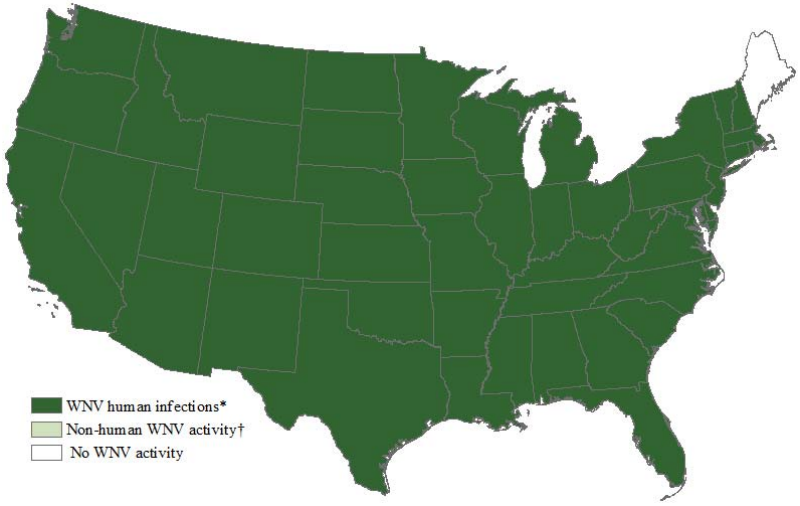


West Nile Virus Neuroinvasive Disease Incidence by State – United States, 2017 (as of January 9, 2018)



*WNV human disease cases or presumptive viremic blood donors. Presumptive viremic blood donors have a positive screening test which has not necessarily been confirmed.

†WNV veterinary disease cases, or infections in mosquitoes, birds, or sentinel animals.



West Nile Virus Activity by State – United States, 2017 (as of January 9, 2018)

ZIKV Activity (2015-2017)

Pregnant Women with Any Lab Evidence of Zika Virus Infection*
US States and DC: 2,364
US Territories: 4,690
*Source: Pregnancy Registries as of December 19, 2017
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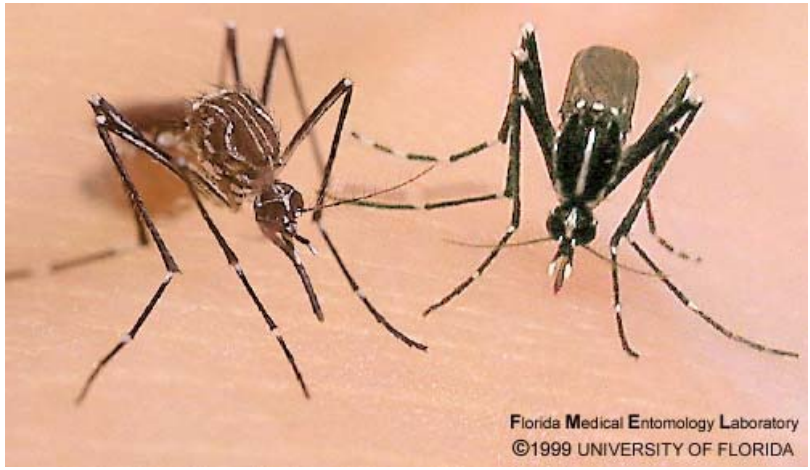
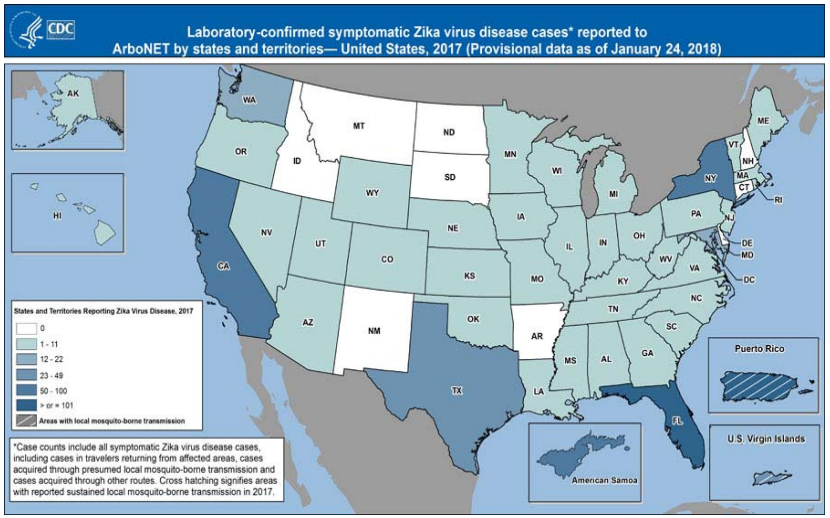
Zika Virus Disease Cases Reported to ArboNET*
US States and DC: 5,646
US Territories: 37,158
*Source: ArboNET as of January 24, 2018



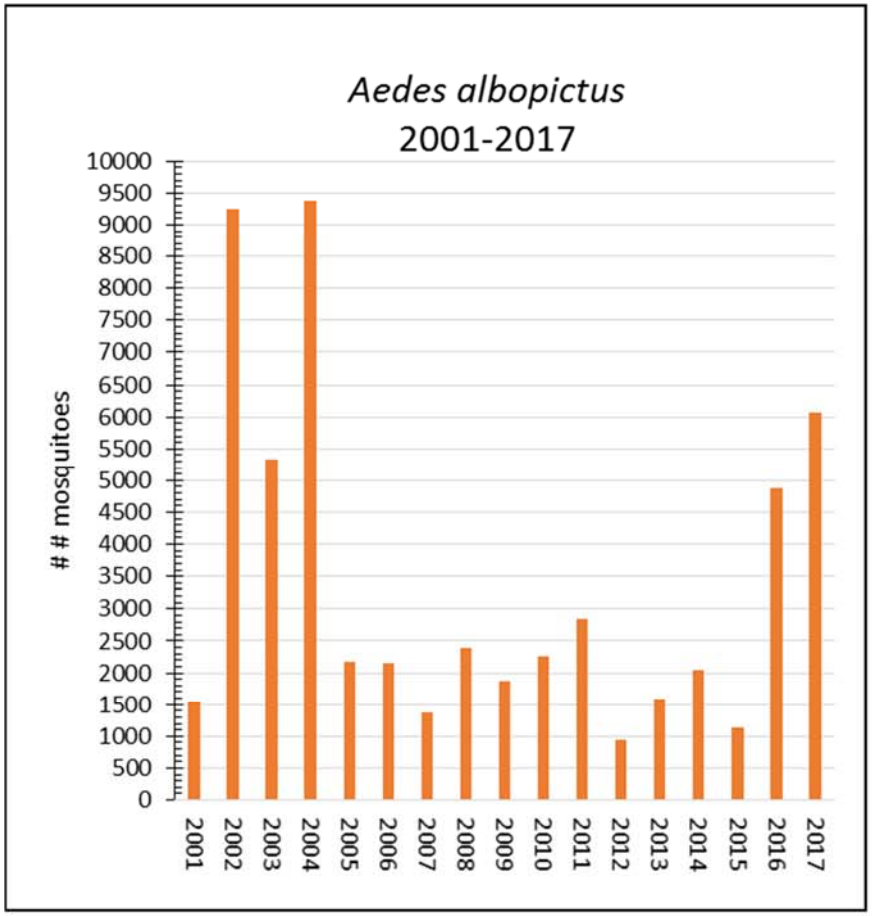
Zika Cases Reported in the United States

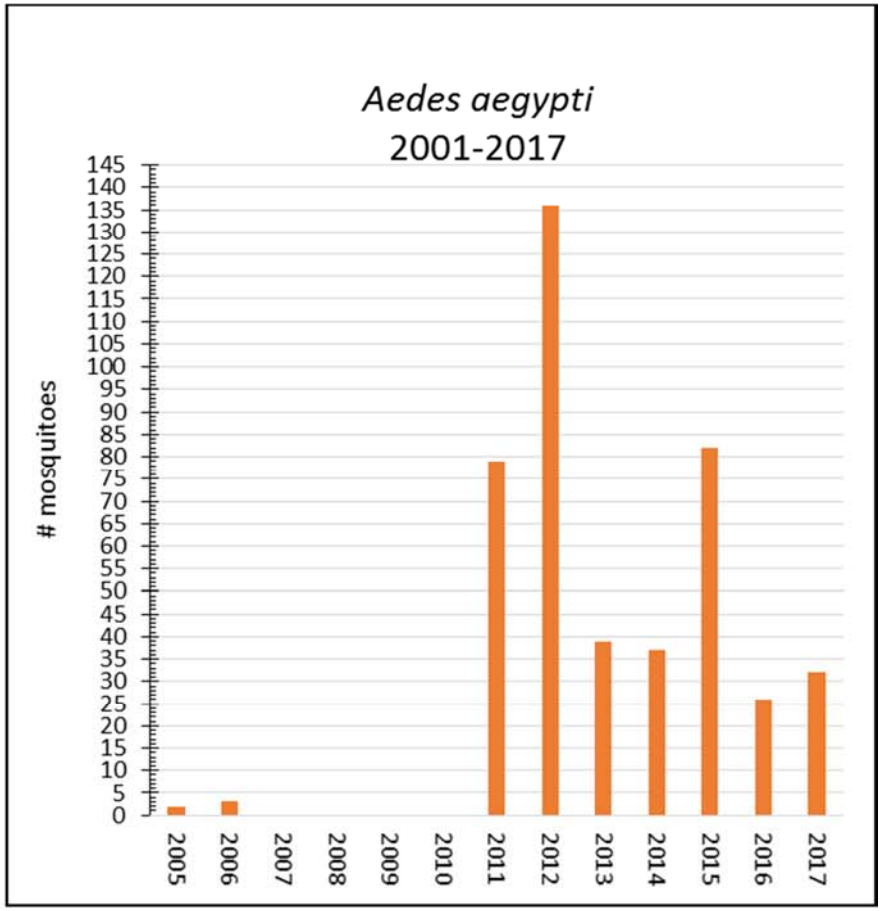
Laboratory-confirmed Zika virus disease cases reported to ArboNET by state or territory (as of January 24, 2018)

US States - 2017
418 symptomatic Zika virus disease cases reported*
*409 cases in travelers returning from affected areas
*4 cases acquired through presumed local mosquito-borne transmission
Florida (N=2)
Texas (N=2)
*5 cases acquired through sexual transmission
US Territories - 2017
637 Zika virus disease cases reported*
*1 case in a traveler returning from affected areas
*636 cases acquired through presumed local mosquito-borne transmission
*0 cases acquired through other routes†

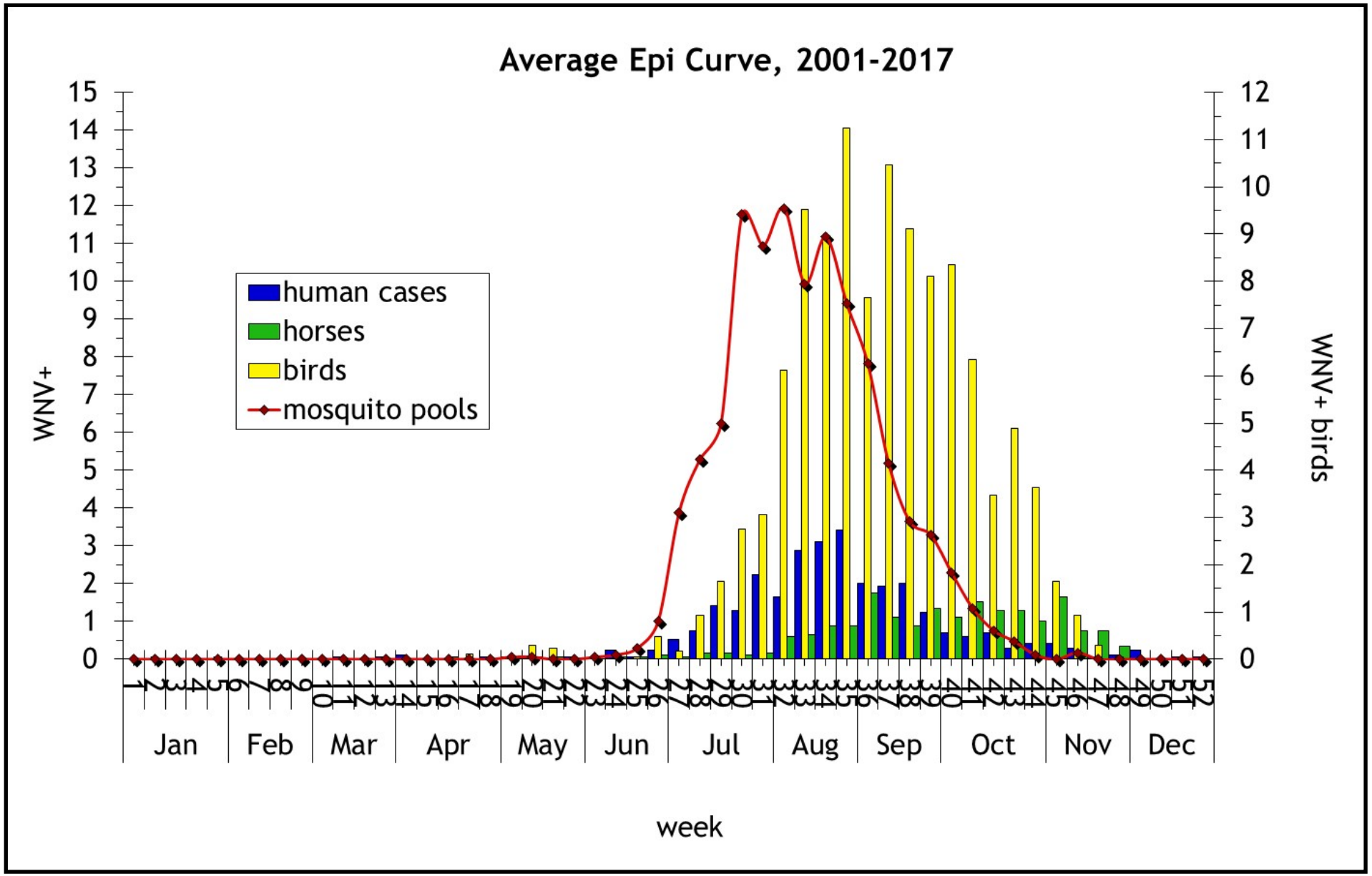


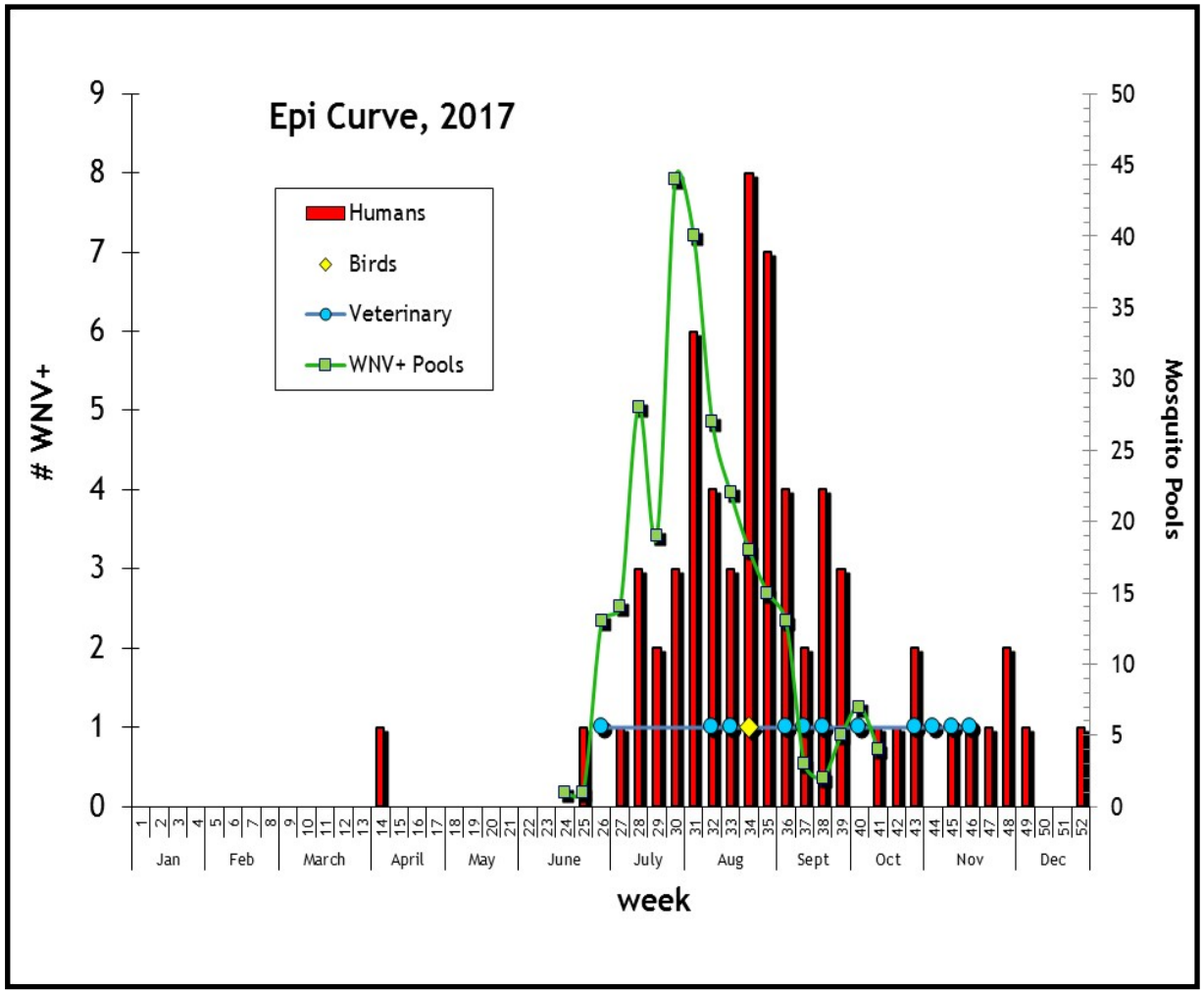
https://www.cdc.gov/zika/reporting/2017-case-counts.html





Zika virus is transmitted to people primarily through the bite of an infected *Aedes* species mosquito (*Ae. aegypti* and *Ae. albopictus*). These are the same mosquitoes that spread dengue and chikungunya viruses.


Average Epi Curve, 2001-2017
WNV+
WNV+ birds
human cases
horses
birds
mosquito pools
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
week



The epidemic curve (epi curve) shows the progression of an outbreak over time.

Constructing epidemic curves is a common and very important practice in epidemiology. Epidemic curves are used to monitor disease occurrence, to detect outbreaks, to generate hypotheses about the cause of an outbreak, to monitor the impact of intervention efforts, and to predict the course of an epidemic.

THANK YOU to the district and county public and environmental health employees, mosquito control workers, veterinarians, and healthcare providers who collected much of the data summarized in this document.

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