2015—Arbovirus Final Report

Summary of Human West Nile Virus and Other Arboviral Infections, Georgia 2015

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.

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

In 2015, Georgia reported 15 cases of WNV and 2 WNV presumptive viremic blood donors (PVD), with no deaths. Thirteen (86.7%) of the 15 cases experienced WNV neurologic illness (altered mental status, paralysis, encephalitis, GBS and/or meningitis) and 2 (13.3%) were diagnosed with WNV fever. The average age of cases was 60.8 years (range 26-90). The average age of those with WNV neurologic illness was 59.5 years (range 26-89). Ten (66.7%) of the 15 cases were male. The majority of cases were reported in July and September.

Table 1: Cases by County, 2015

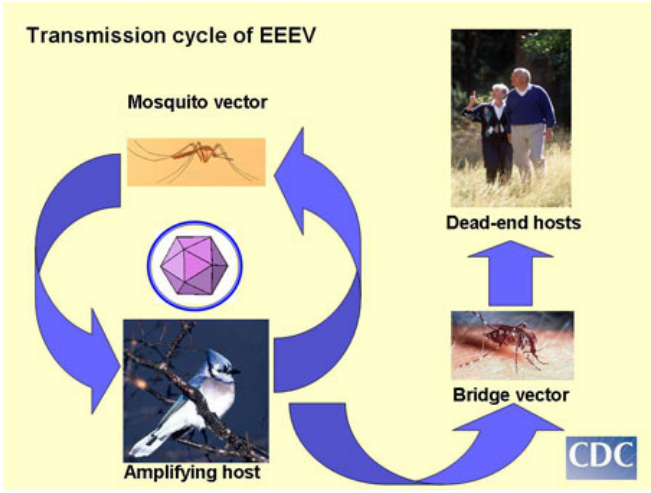
WNV Cases by County	
County	**Count**
Cobb	4
DeKalb	3
Forsyth	1 PVD
Fulton	1
Glynn	1
Muscogee	2
Richmond	3, 1 PVD
Spalding	1

Table 1 shows the counties of residence of each case.

Table 2 shows the clinical syndrome for each case

Table 2: Clinical Syndromes, 2015

Arbovirus	Month of Onset	County of Residence	Clinical Syndrome	Fatality
CE (LAC)	August	Macon	Altered Mental Status	No
	September	Franklin	Meningitis	No
WNV	July	Cobb	Fever	No
		DeKalb	Encephalitis	No
			Meningitis	No
		Muscogee	Encephalitis	No
		Richmond	Meningitis	No
	August	DeKalb	Other/Neuroinvasive	No
		Muscogee	Fever	No
		Richmond	Guillian Barre Syndrome	No
	September	Cobb	Meningitis	No
			Meningitis	No
		Fulton	Encephalitis	No
		Richmond	Meningitis	No
		Spalding	Encephalitis	No
	October	Cobb	Meningitis	No
		Glynn	Encephalitis	No



Eastern equine encephalitis virus (EEEV) is transmitted to humans by the bite of an infected mosquito. Eastern equine encephalitis (EEE) is a rare illness in humans, and only a few cases are reported in the United States each year. Most cases occur in the Atlantic and Gulf Coast states (see map). Most persons infected with EEEV have no apparent illness. Severe cases of EEE (involving encephalitis, an inflammation of the brain) begin with the sudden onset of headache, high fever, chills, and vomiting. The illness may then progress into disorientation, seizures, or coma. EEE is one of the most severe mosquito-transmitted diseases in the United States with approximately 33% mortality and significant brain damage in most survivors. There is no specific treatment for EEE; care is based on symptoms.

http://www.cdc.gov/EasternEquineEncephalitis/tech/epi.html

Eastern equine encephalitis virus neuroinvasive disease cases reported by state, 2004–2013

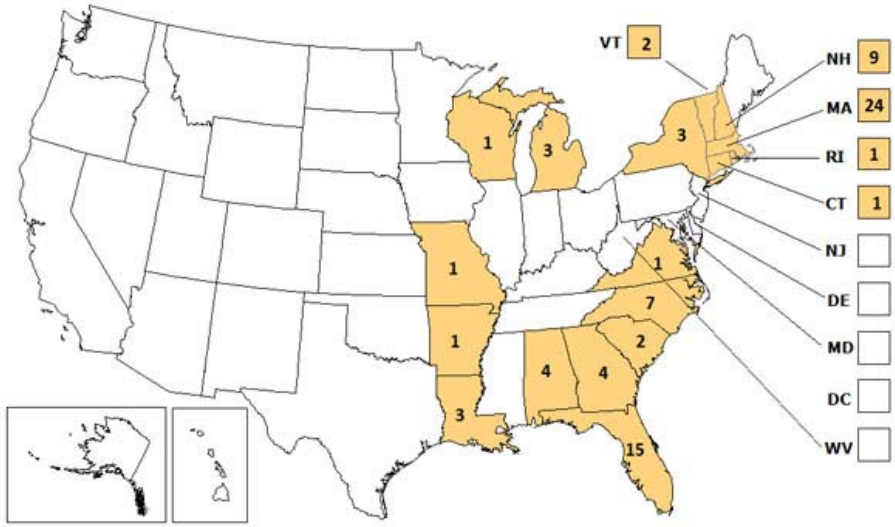


Table 3: Clinical Syndromes Travel-Associated Arboviruses, 2015

Arbovirus	Month of Onset	County of Residence	Clinical Syndrome	Fatality
CHIK	February	DeKalb	Other symptoms	No
	March	Gwinnett	Fever	No
	May	Cobb	Fever	No
		Houston	Fever	No
	June	Fayette	Other symptoms	No
		Rabun	Fever	No
	July	Whitfield	Fever	No
			Fever	No
	October	DeKalb	Fever	No
DEN	January	Fulton	Fever	No
	March	Bulloch	Fever	No
	July	Fulton	Fever	No
			Fever	No
	October	Columbia	Fever	No
	November	Cherokee	Fever	No
		Fulton	Fever	No
	December	Fulton	Fever	No
ZIKV	December	Fulton	Fever	No

Zika virus is spread to people primarily through the bite of an infected *Aedes* species mosquito. The most common symptoms of Zika are fever, rash, joint pain, and conjunctivitis (red eyes). The illness is usually mild with symptoms lasting for several days to a week after being bitten by an infected mosquito.

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 and since then, outbreaks of Zika have been reported in tropical Africa, Southeast Asia, and the Pacific Islands.

Before 2007, at least 14 cases of Zika had been documented. 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). Local transmission has been reported in many other countries and territories. Zika virus likely will continue to spread to new areas.

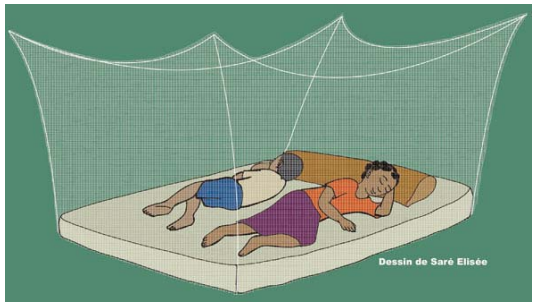
In addition to WNV, two cases of California Encephalitis (LAC) were reported from Macon and Franklin counties. Eight internationally acquired cases of Dengue and 9 cases of internationally-acquired Chikungunya were also reported, as was one case of internationally-acquired Zika virus.

If you have questions or comments, please contact Amanda Feldpausch, MPH, Human Arboviral Infections Surveillance Coordinator at the Georgia Department of Public Health, at 404-657-2604 or Amanda.feldpausch@dph.ga.gov.

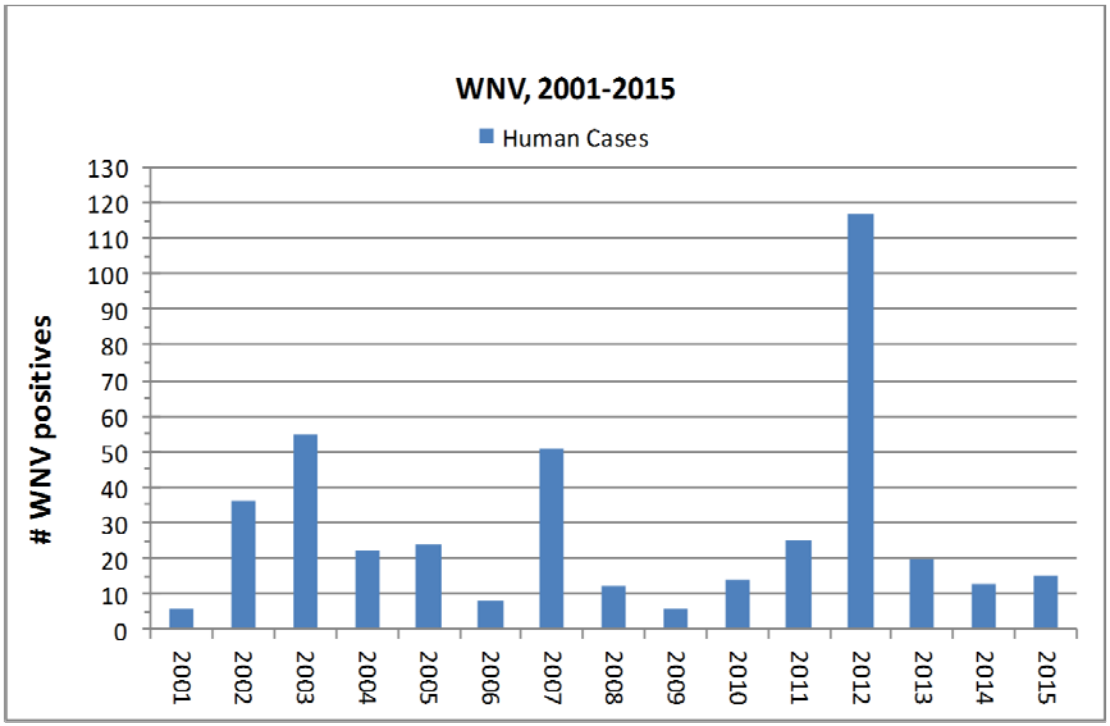
Table 4: Age Ranges, WNV 2015

age range	WNND	WNF
0-10		
11-20		
21-30	1	
31-40	2	
41-50	1	
51-60	3	
61-70	2	1
71-80	1	1
>80	3	
TOTAL	**13**	**2**

TRAVEL-ASSOCIATED CASES			
Dengue - Country of Origin			
Virus	**County of Origin**	**# cases**	**Month of Onset**
DEN	Australia/ Christmas Island	2	July
	Costa Rica	1	January
	Haiti	1, 1, 1	March, Oct, Nov
	India	1	Nov
	Nicaragua	1	Dec
CHIK - Country of Origin			
Virus	**County of Origin**	**# cases**	**Month of Onset**
CHIK	Columbia	1	May
	Ecuador	1	May
	El Salvador	1	July
	Guatemala	1	July
	Haiti	2	June
	Honduras	1	March
	Mexico	1	Oct
	Tahiti	1	Feb
ZIKV - Country of Origin			
ZIKV	El Salvador/ Guatemala	1	Dec



	Virus				
Diagnosis	**CE (LAC)**	**CHIK**	**DENGUE**	**WNV**	**ZIKV**
ASYMPTOMATIC					
ENCEPHALITIS				5	
FEVER		7	8	2	1
GUILLIAN BARRE SYNDROME				1	
MENINGITIS	1			6	
ALTERED MENTAL STATUS	1				
OTHER SYMPTOMS		2		1	



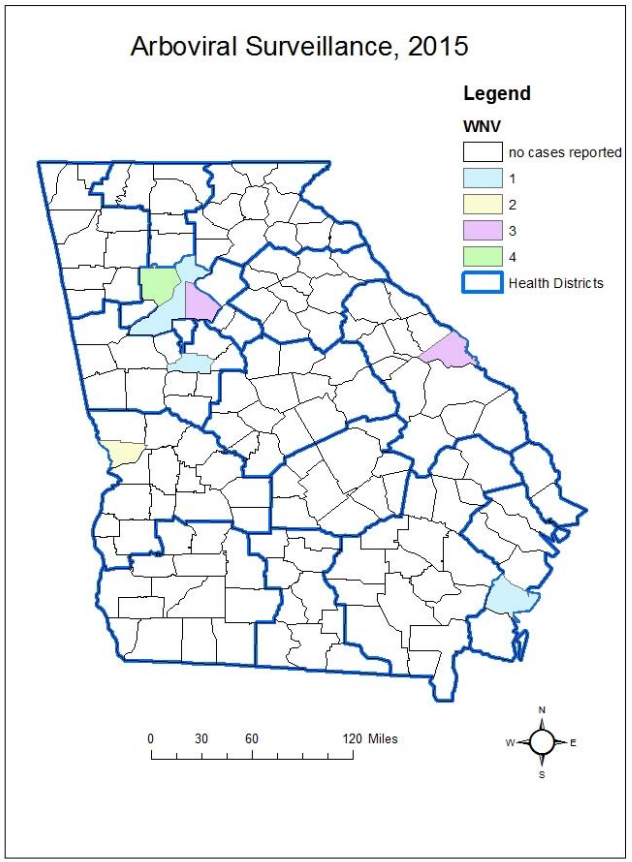
Year	EEE	LAC	WNV
2001			6
2002			45
2003	2	1	55
2004	1	5	23
2005	1	1	24
2006	1	1	11
2007		3	55
2008		2	12
2009		2	6
2010		2	14
2011		2	25
2012	1		117
2013	1	1	20
2014		2	13
2015		2	15
Grand Total	**7**	**24**	**441**

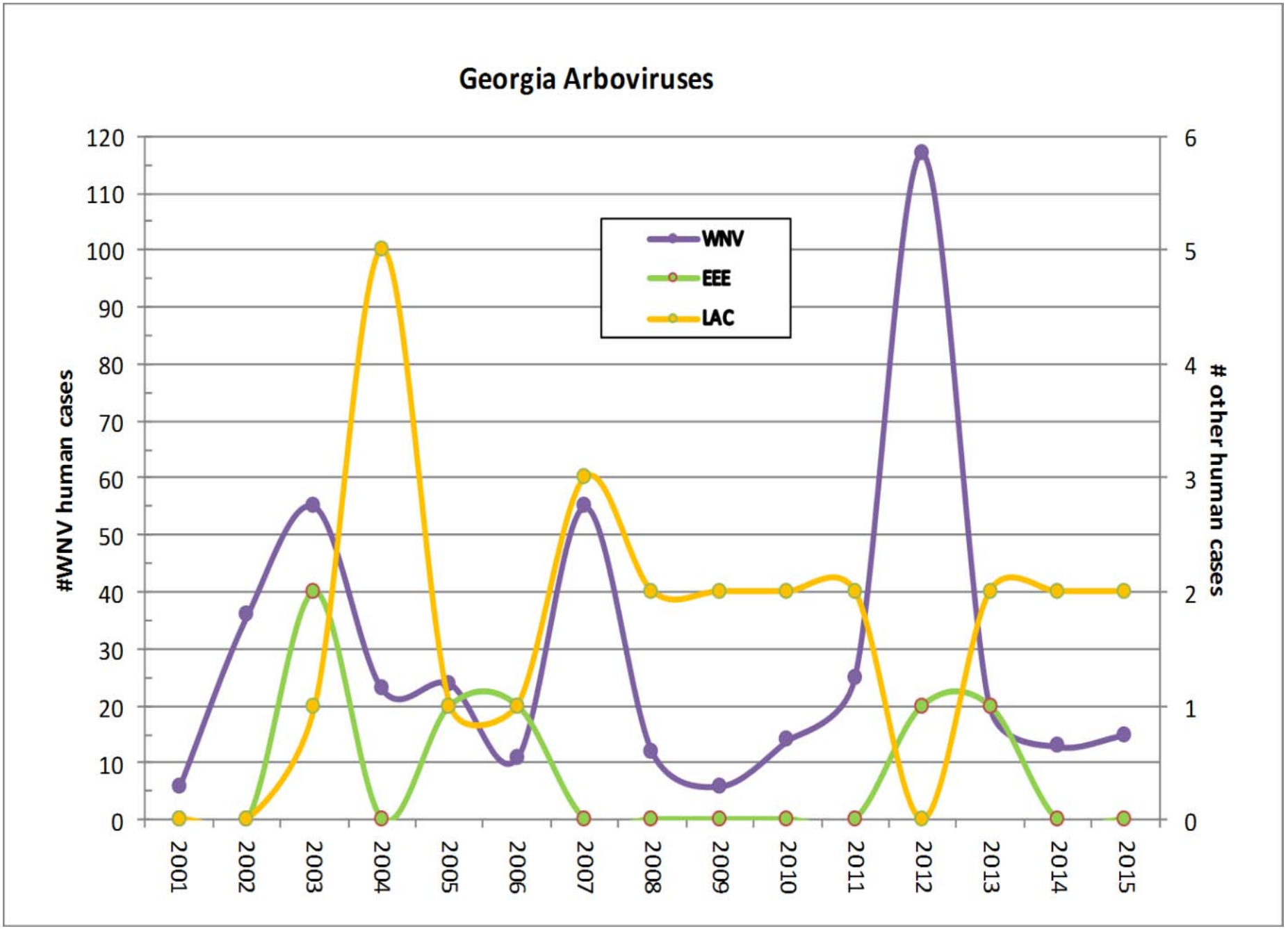
Emerging & Reemerging Infectious Diseases

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.

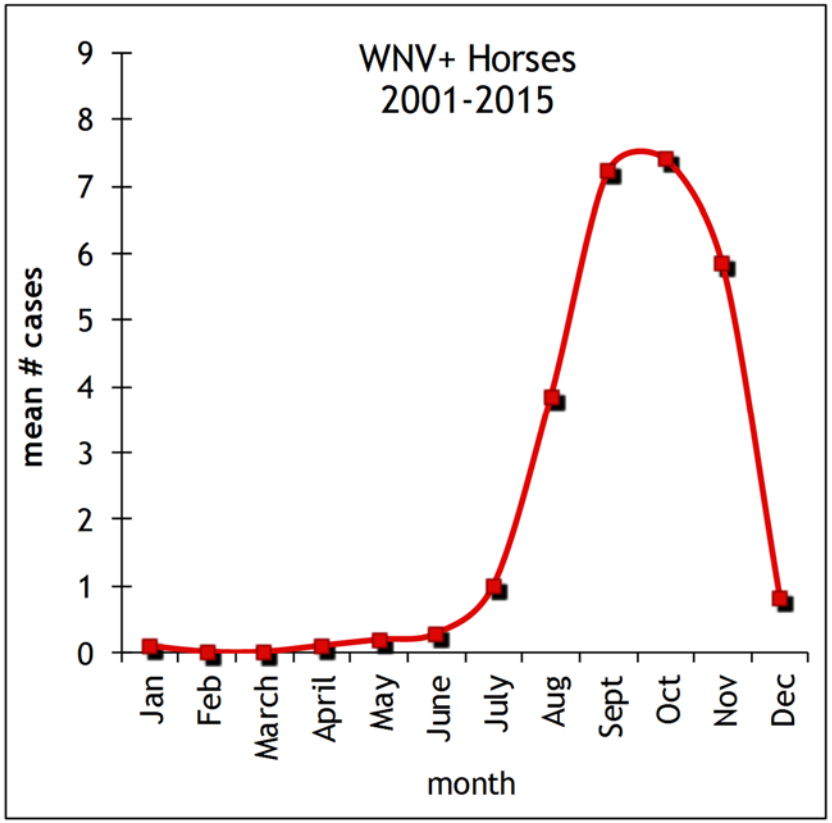


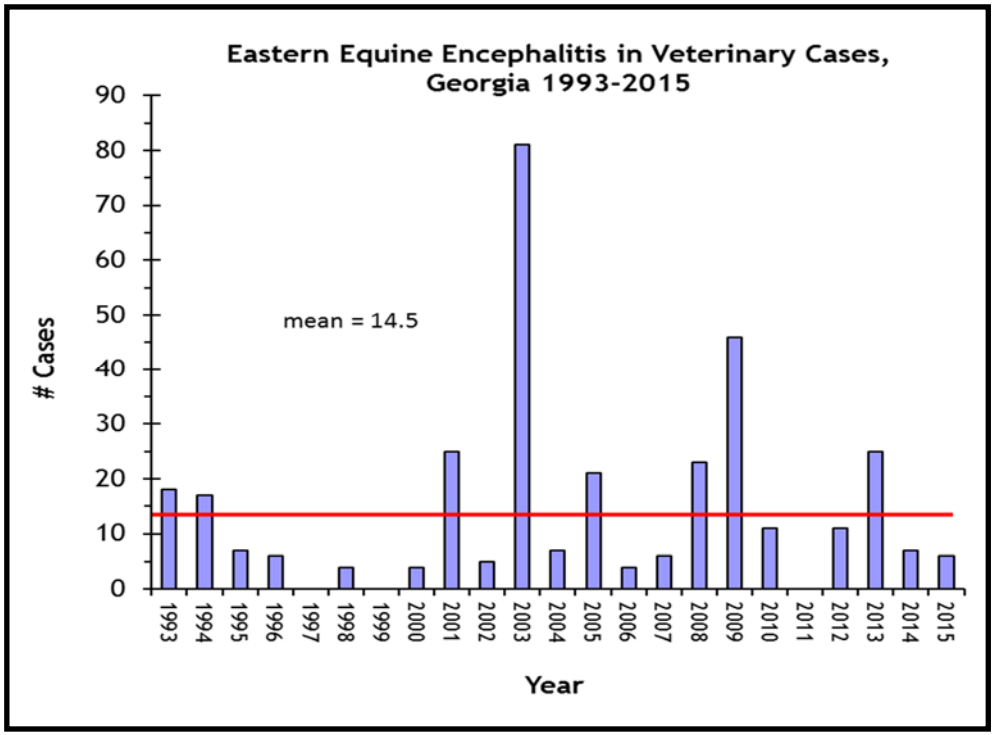

Georgia Arboviruses
#WNV human cases
other human cases
WNV
EEE
LAC
120
110
100
90
80
70
60
50
40
30
20
10
0
6
5
4
3
2
1
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015

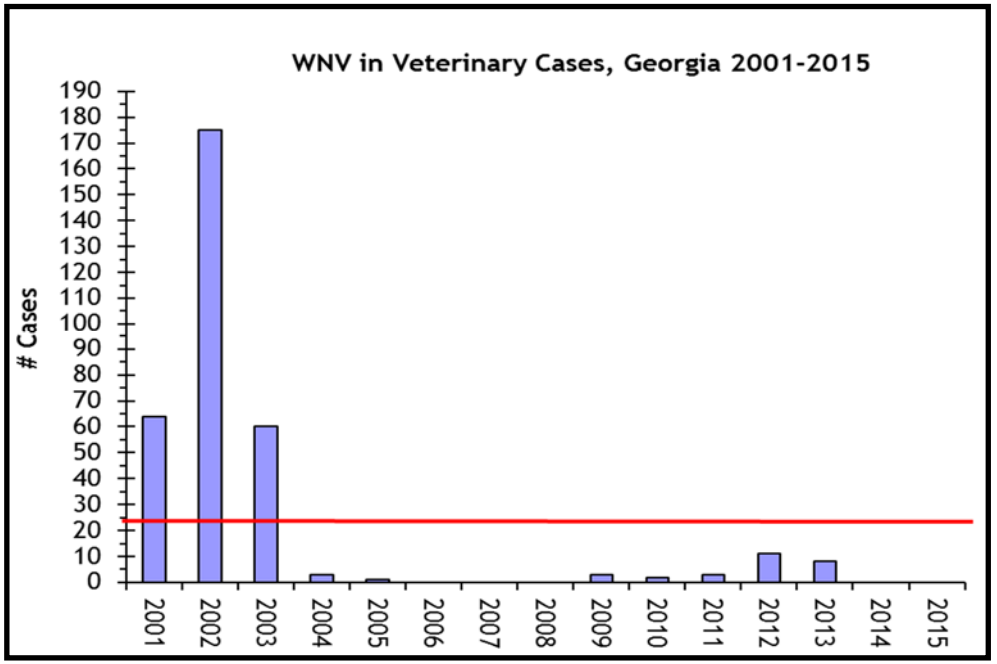
Veterinary Data

No horses tested positive for WNV in 2015. 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.

Six horses tested positive for EEE in 2015. 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 due primarily to under-testing, although subclinical infections can occur with EEE.







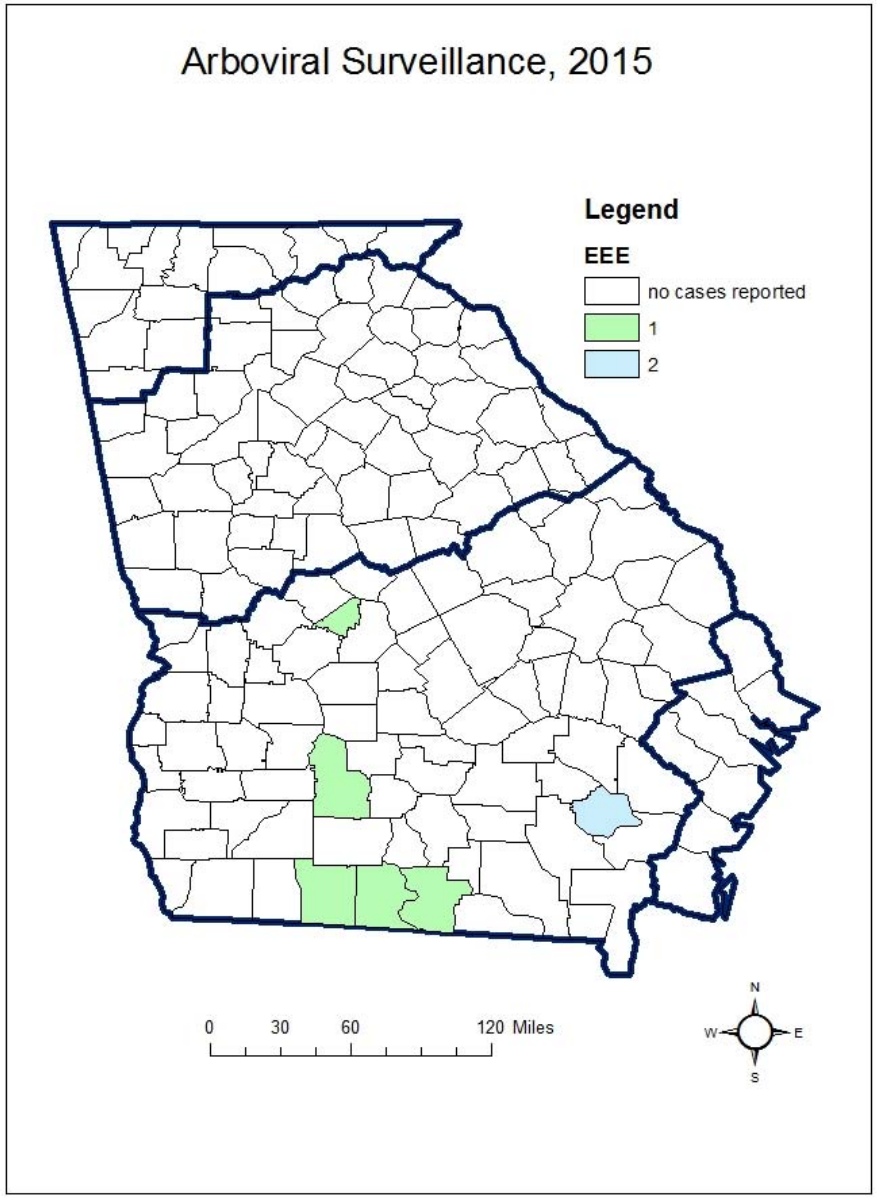
A horse with West Nile virus or EEE will display some of the following symptoms:

General loss of appetite
Hind limb weakness
Fever
Impaired vision
Walking in circles
Inability to swallow
Coma

Mortality in horses with WNV is ~35%. However, sometimes a horse can be infected with West Nile virus and not show any symptoms.

Symptoms in horses with Eastern Equine Encephalitis begin with a fever that may reach as high as 106 °F. Nervous signs appearing during the fever include sensitivity to sound, periods of excitement, and restlessness. Mortality rates among horses with EEE range from 70 to 90%.

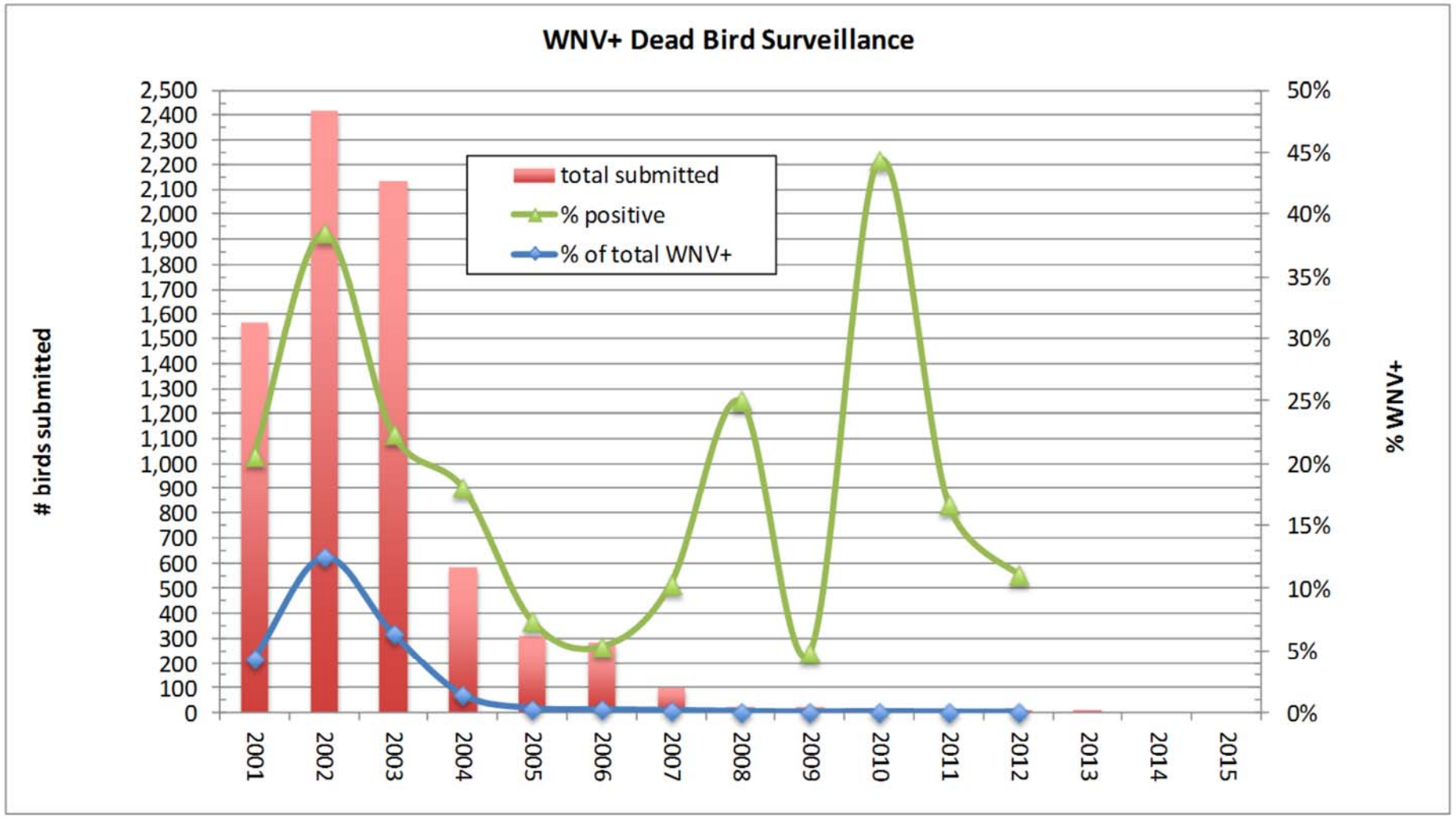
County	**EEE+ horses**
Brooks	1
Lowndes	1
Peach	1
Pierce	2
Thomas	1
Worth	1



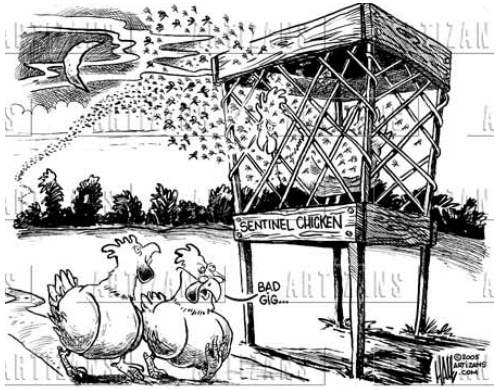
Dead Bird Surveillance

As of 2012, federal funding was no longer available to test birds. In 2014 and 2015, no birds were submitted for testing.

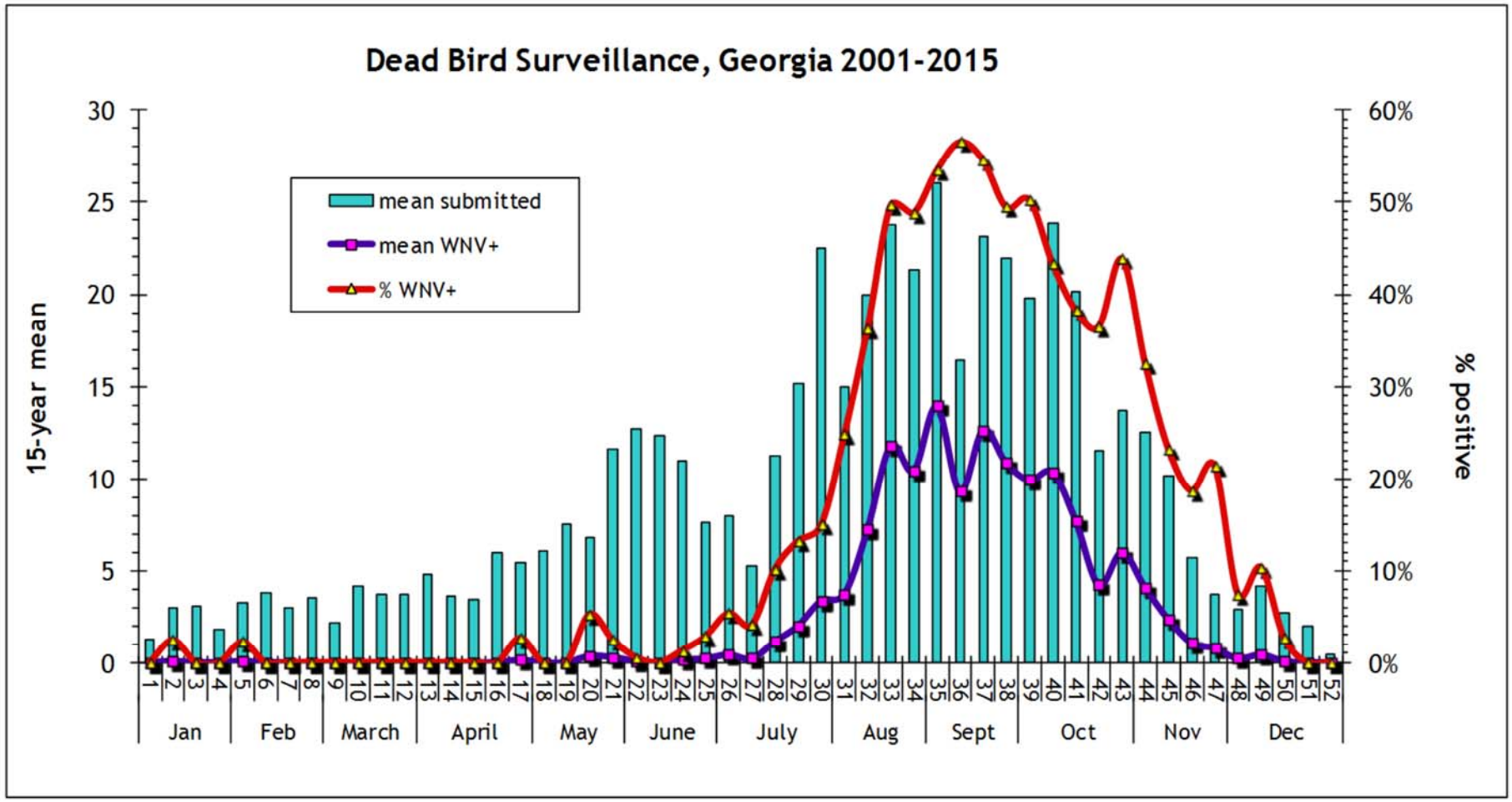
Dead bird surveillance continues to lose ground as a surveillance tool, and even more so now when no funding is available at the State level to support testing; most counties do not have the resources to pick up and ship birds for testing in any case. Bird testing does continue to have some utility, 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 for the county.

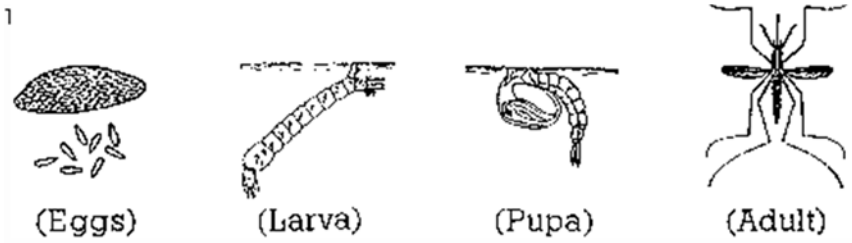


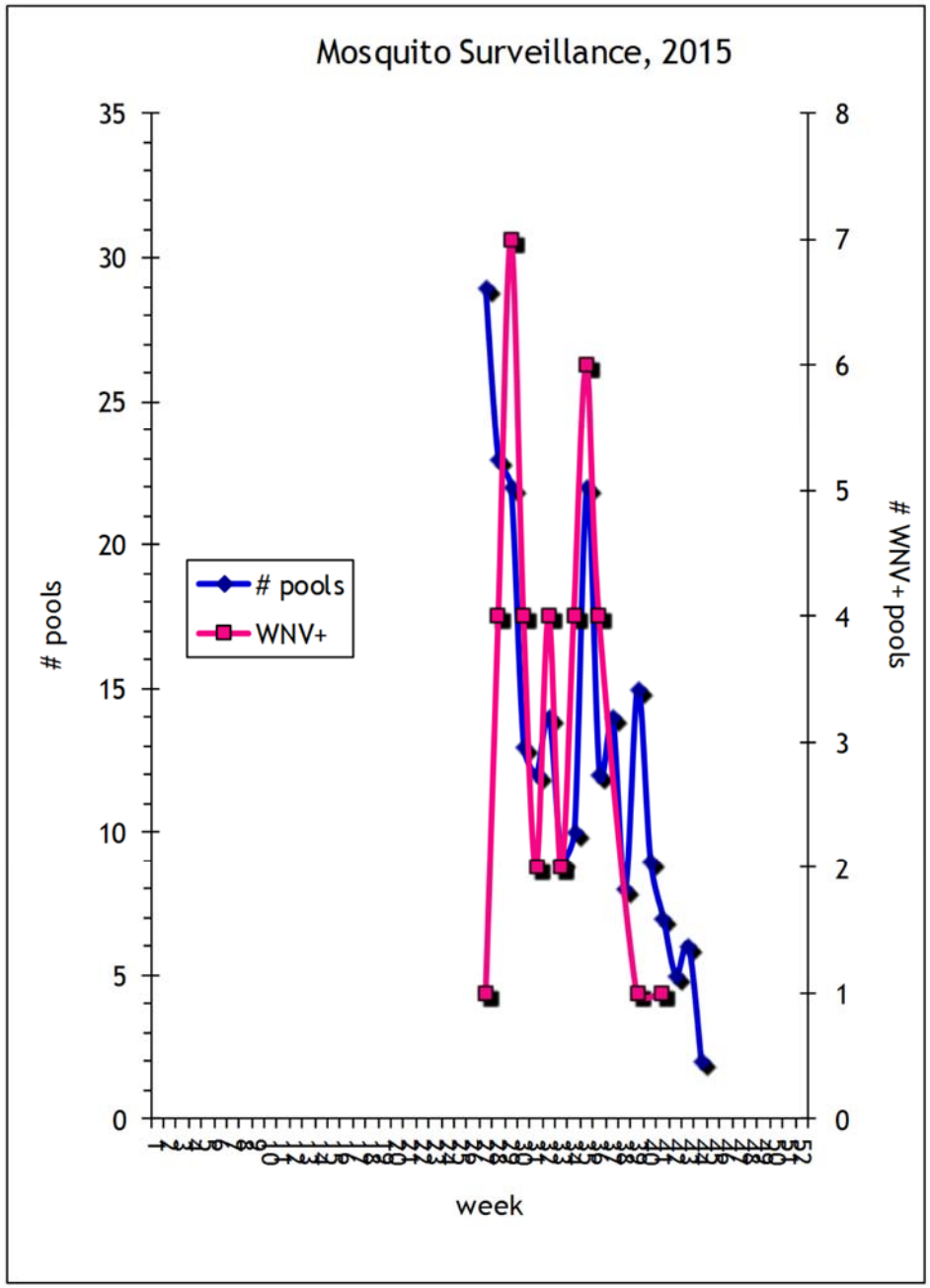
Mosquito Surveillance

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 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 2015. 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. Data submitted to the GDPH are likely to be incomplete, making data analysis difficult and results suspect.

A total of 3366 pools of mosquitoes (73234 individuals) were sent for testing with results reported to the GDPH. The only species found WNV+ (40 pools) was *Culex quinquefasciatus*. No other viruses were reported from mosquito pools in 2015.

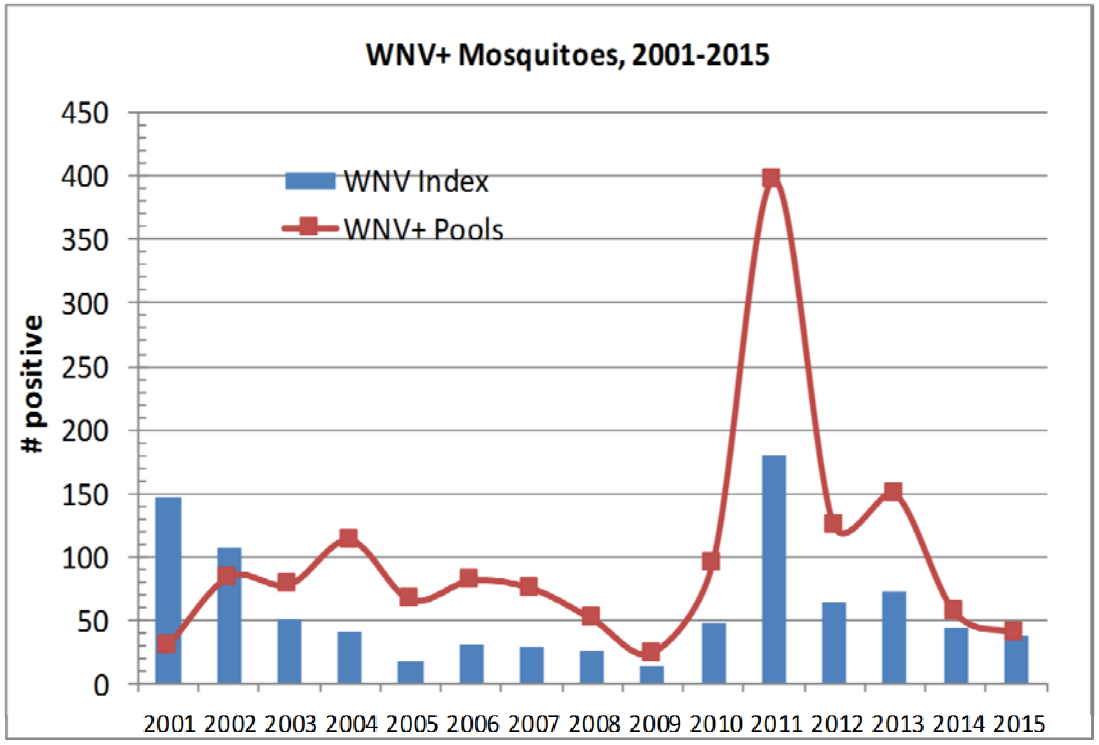
County	# pools	#WNV+ pools
Chatham	1267	1
Fulton	230	38
Glynn	413	
Liberty	8	
Lowndes	1357	
Richmond	91	10
Grand Total	**3366**	**40**





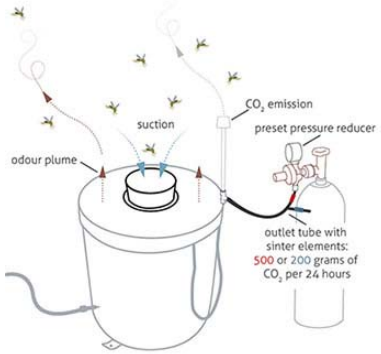
The first WNV+ mosquitoes were detected in Fulton County in late June. The last WNV+ pool was collected in Fulton County in early October. Peaks in numbers of WNV+ pools occurred in July and August. All but one of the WNV+ mosquitoes were caught in gravid traps.

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.



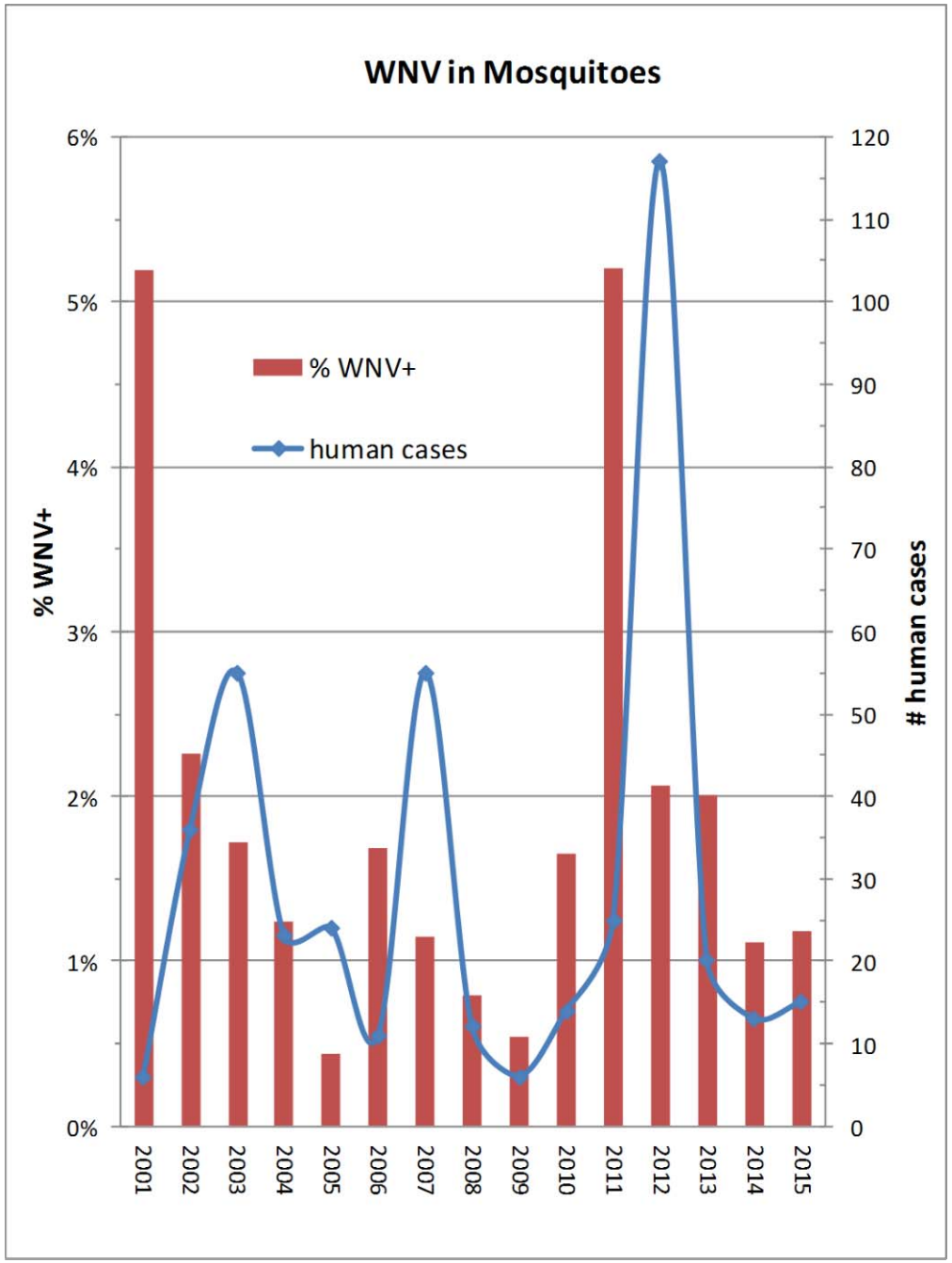
year	WNV Index	WNV+ Pools	human cases
2001	146.3	30	6
2002	106.6	84	36
2003	50.7	78	55
2004	40.7	113	22
2005	17.7	66	24
2006	31.5	81	8
2007	29.9	75	55
2008	25.3	51	12
2009	13.7	24	6
2010	47.7	95	13
2011	179.6	397	25
2012	64.3	125	117
2013	72.0	150	20
2014	43.6	56	13
2015	37.00	40	15

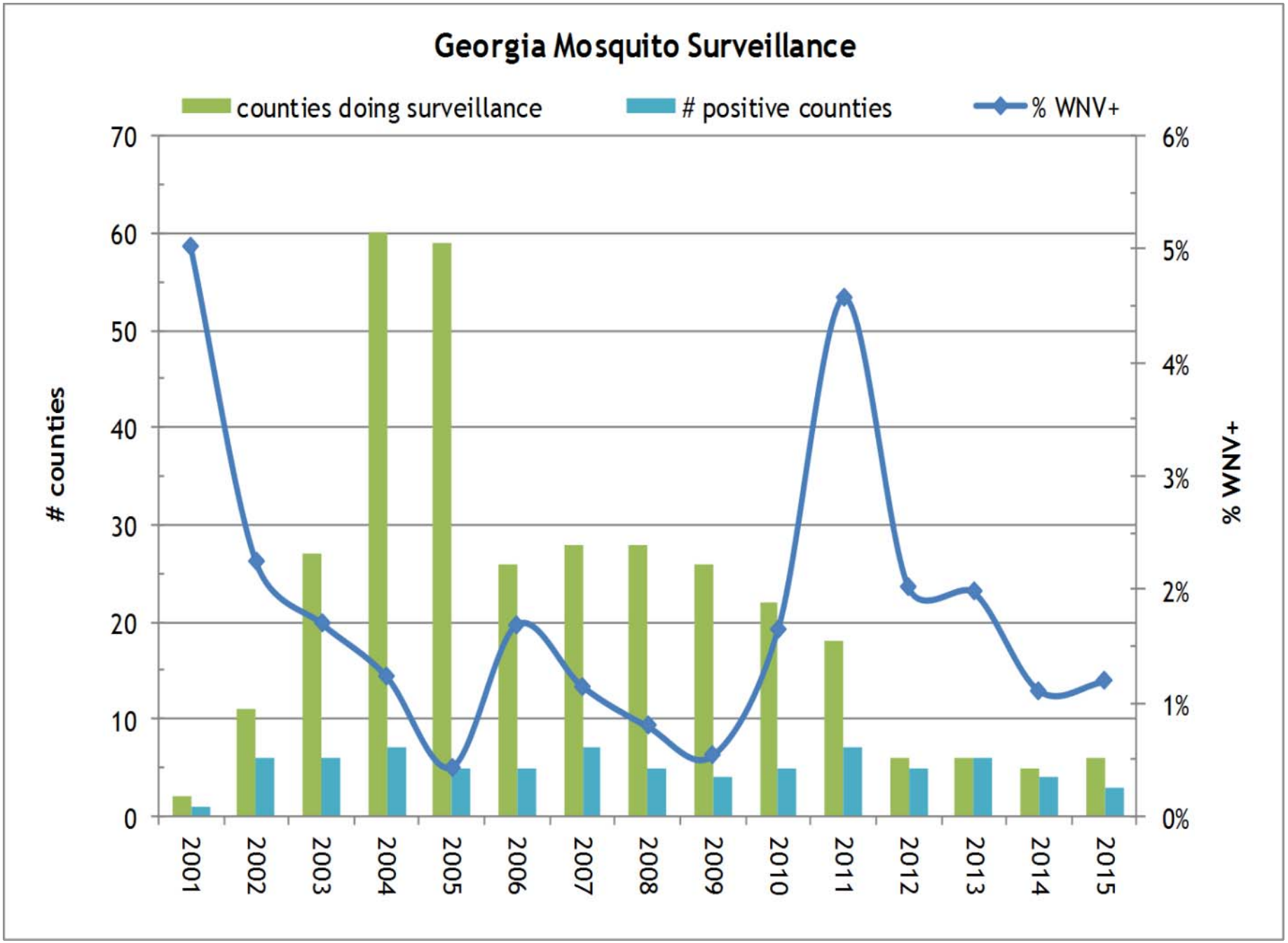
2001-2015	human cases	WNV+ mosquito pool	veterinary case	positive bird
total	441	1639	330	1896
mean	29.4	109.3	22.0	126.4



BG Sentinel Trap

year	total pools	WNV+	% WNV+	human cases
2001	597	31	5.2%	6
2002	4032	91	2.3%	36
2003	6177	106	1.7%	55
2004	10161	126	1.2%	23
2005	15248	67	0.4%	24
2006	4785	81	1.7%	11
2007	6513	75	1.2%	55
2008	6383	51	0.8%	12
2009	4446	24	0.5%	6
2010	5990	99	1.7%	14
2011	7622	397	5.2%	25
2012	6042	125	2.1%	117
2013	7453	150	2.0%	20
2014	5038	56	1.1%	13
2015	3366	40	1.2%	15
MEAN	6256.9	101.3	1.6%	28.8
TOTAL	93853	1519	26%	432




Georgia Mosquito Surveillance
counties doing surveillance
positive counties
% WNV+
# counties
% WNV+
70
60
50
40
30
20
10
0
6%
5%
4%
3%
2%
1%
0%
2001
2002
2003
2004
2005
2006
2007
2008
2009
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2012
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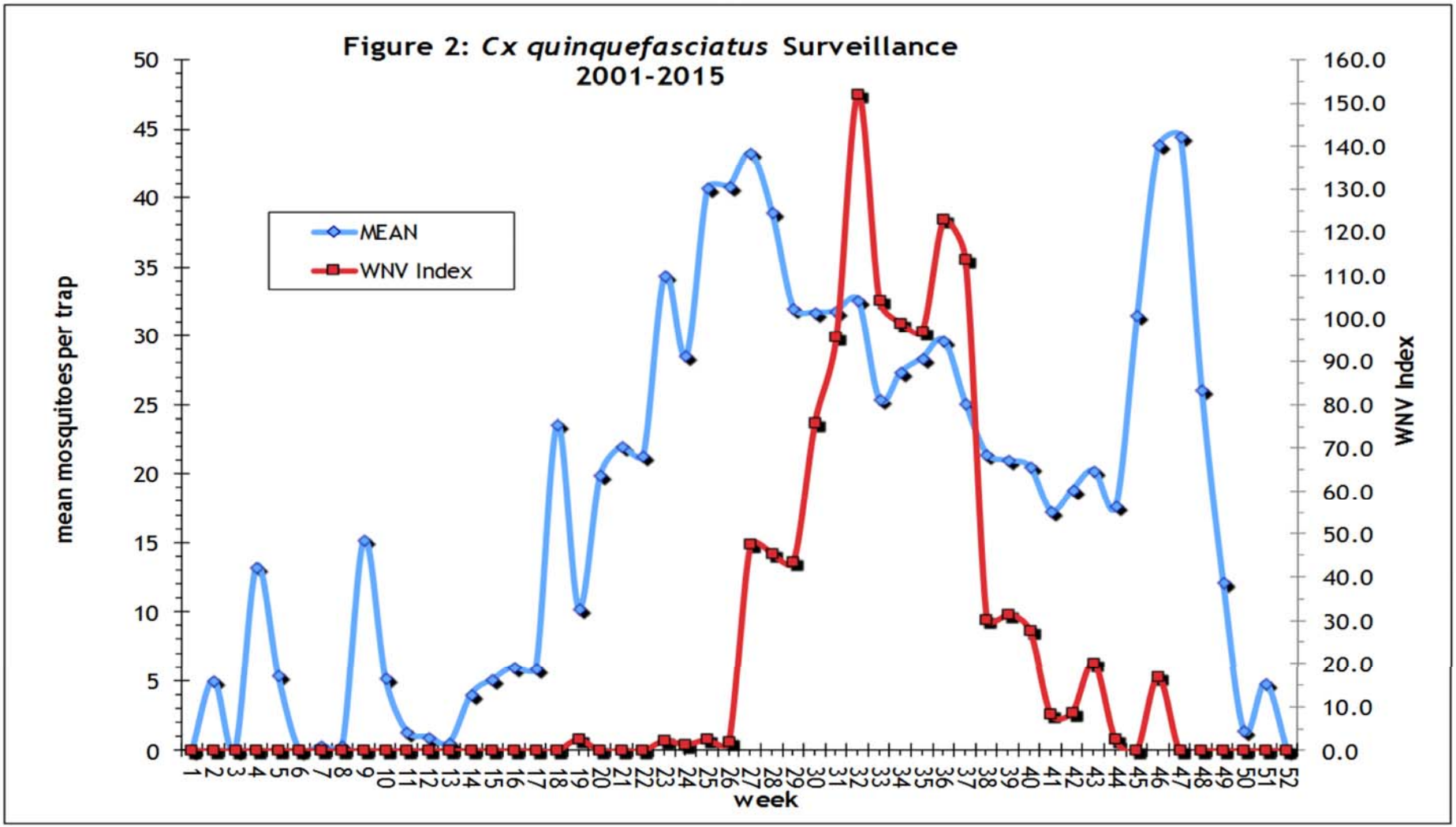
2014
2015



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.

Species	# mosquitoes
Ae. aegypti	82
Ae. albopictus	674
Ae. vexans	143
Aedes/Ochlerotatus spp.	6
An. crucians	22
An. punctipennis	26
An. quadrimaculatus	44
Anopheles spp.	5
Cq. perturbans	9
Culex spp.	24
Cx. coronator	239
Cx. erraticus	176
Cx. nigripalpus	14
Cx. quinquefasciatus	1153
Cx. restuans	25
Cx. salinarius	49
Oc. atlanticus	1
Oc. infirmatus	2
Oc. japonicus	8
Oc. triseriatus	6
Ps. columbiae	85
Ps. cyanescens	2
Ps. ferox	8
Ps. howardii	3
Psorophora spp.	6
Tx. rutilus	1
unknown	3
Ur. sapphirina	2
Grand Total	**2818**

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. Counties where mosquito surveillance has occurred are Bulloch, Dougherty, Fulton, Gwinnett, Muscogee, Oconee, Talbot, and Whitfield.

County	# mosquitoes
Bulloch	439
Dougherty	1327
Fulton	189
Gwinnett	44
Muscogee	634
Oconee	115
Talbot	63
Whitfield	7
Grand Total	**2818**

County	# trap nights
Bulloch	2
Dougherty	2
Fulton	3
Gwinnett	2
Muscogee	2
Oconee	1
Talbot	1
Whitfield	1
Grand Total	**14**

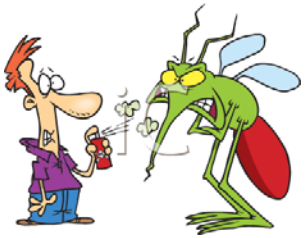
County	# mosquitoes/trap night
Bulloch	219.5
Dougherty	663.5
Fulton	63.0
Gwinnett	22.0
Muscogee	317.0
Oconee	115.0
Talbot	63.0
Whitfield	7.0
MEAN	183.8

Month	# mosquitoes/trap night
May	163.0
June	489.0
July	167.5
Aug	41.0
Sept	241.5
MEAN	**57.0**

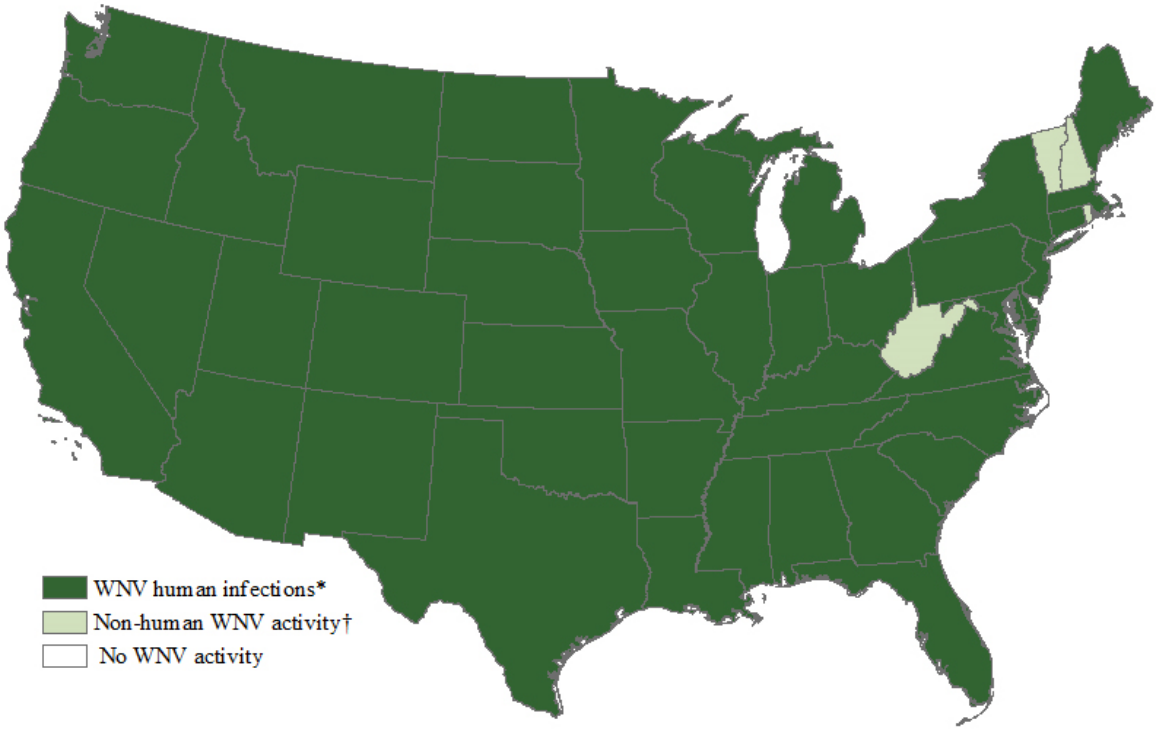
Species	Bulloch	Dougherty	Fulton	Gwinnett	Muscogee	Oconee	Talbot	Whitfield	Grand Total
Ae. aegypti					7				7
Ae. albopictus	14	17	5	3	15	3	2	3	62
Ae. vexans	9	7	6		4				26
Aedes/Ochlerotatus spp.			1		2		1		4
An. crucians	2	2	2			2			8
An. punctipennis	1	3	5		3	1			13
An. quadrimaculatus	6	1	2			2	1		12
Anopheles spp.	2								2
Cq. perturbans	3	2							5
Culex spp.	1	1	1			2			5
Cx. coronator	3	7			1				11
Cx. erraticus	9	6	5		2	2	1		25
Cx. nigripalpus	3	1							4
Cx. quinquefasciatus	11	25	3	2	15	3			59
Cx. restuans			1			2			3
Cx. salinarius	3				1	1			5
Oc. atlanticus		1							1
Oc. infirmatus	2								2
Oc. japonicus			1			1	1		3
Oc. triseriatus		1	2	1		1			5
Ps. columbiae	3	7			1				11
Ps. cyanescens			2						2
Ps. ferox	1				3				4
Ps. howardii	1		1						2
Psorophora spp.	1	1	1						3
Tx. rutilus		1							1
unknown					1				1
Ur. sapphirina			1			1			2
Grand Total	**75**	**83**	**39**	**6**	**55**	**21**	**6**	**3**	**288**

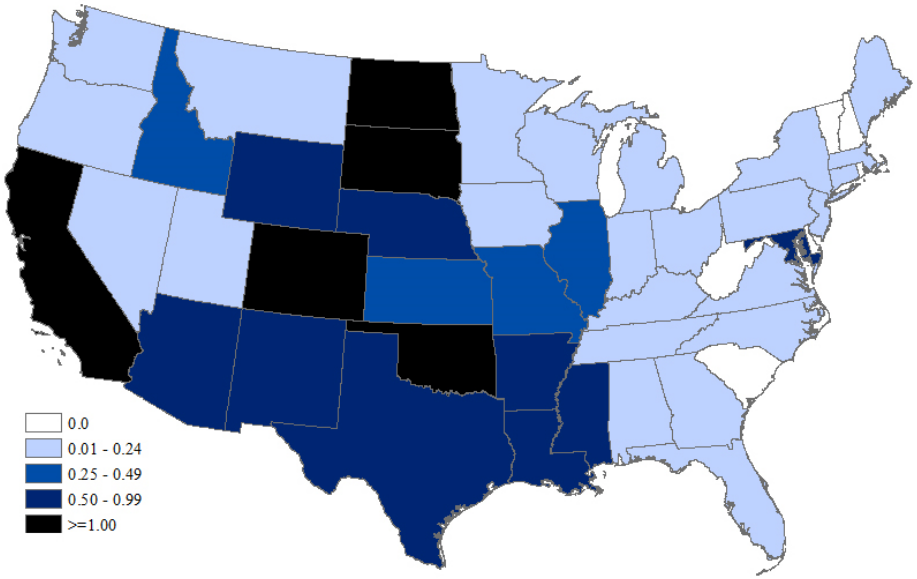
WNV Activity Map

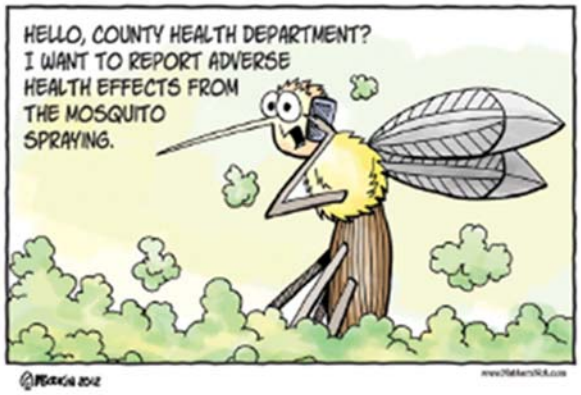
West Nile Virus Activity by State – United States, 2015 (as of January 12, 2016)



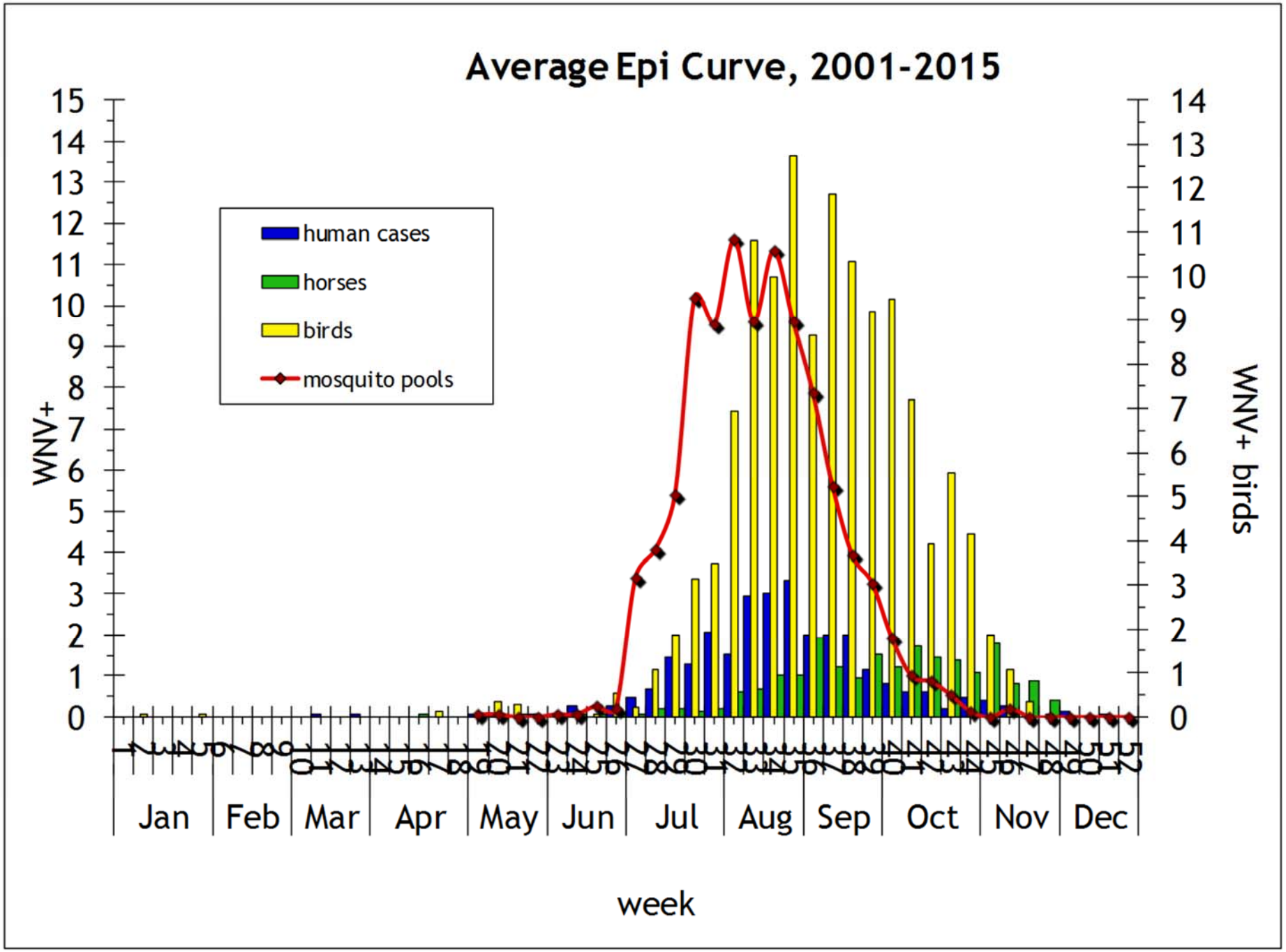
http://diseasemaps.usgs.gov/mapviewer/

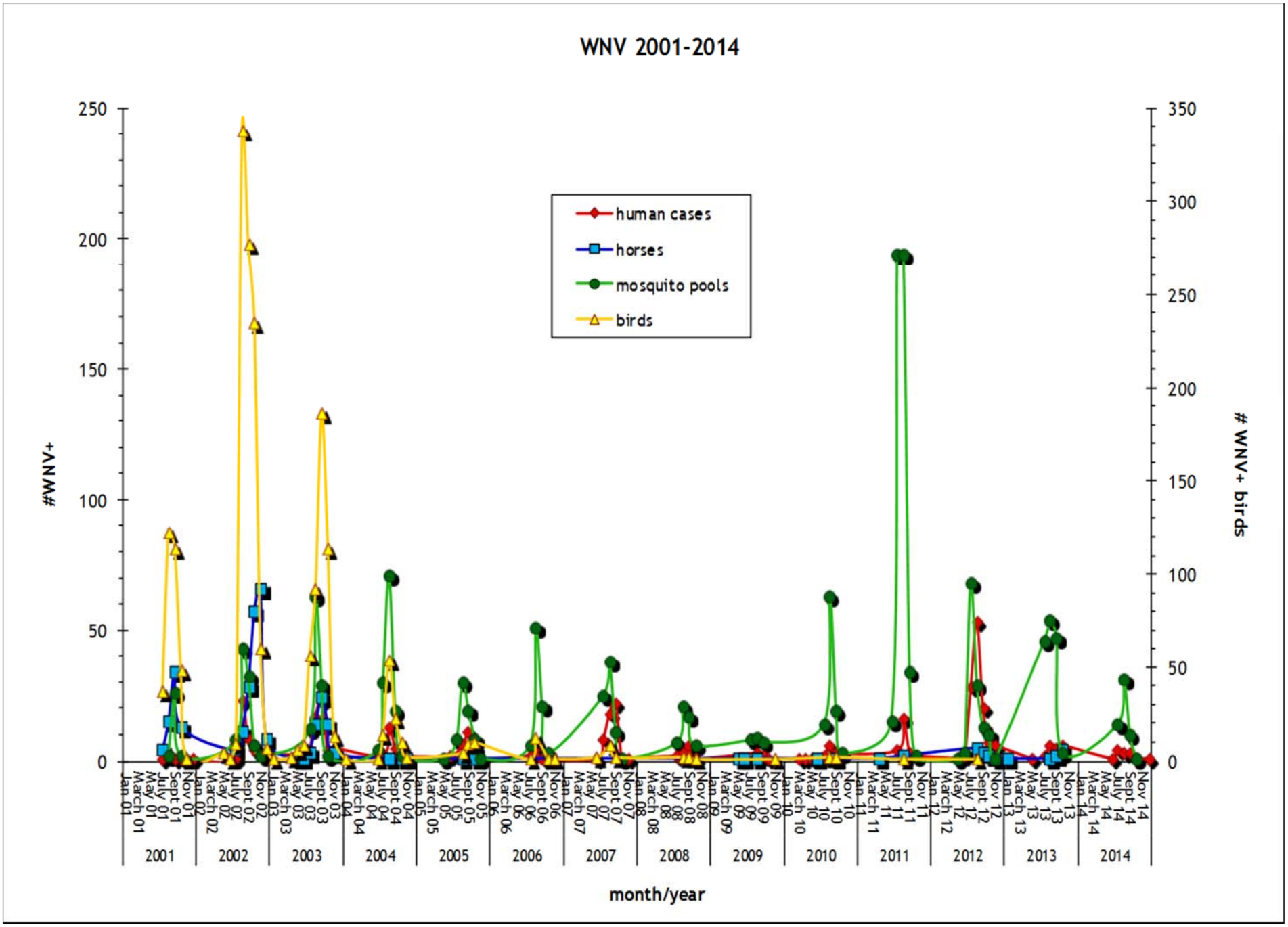


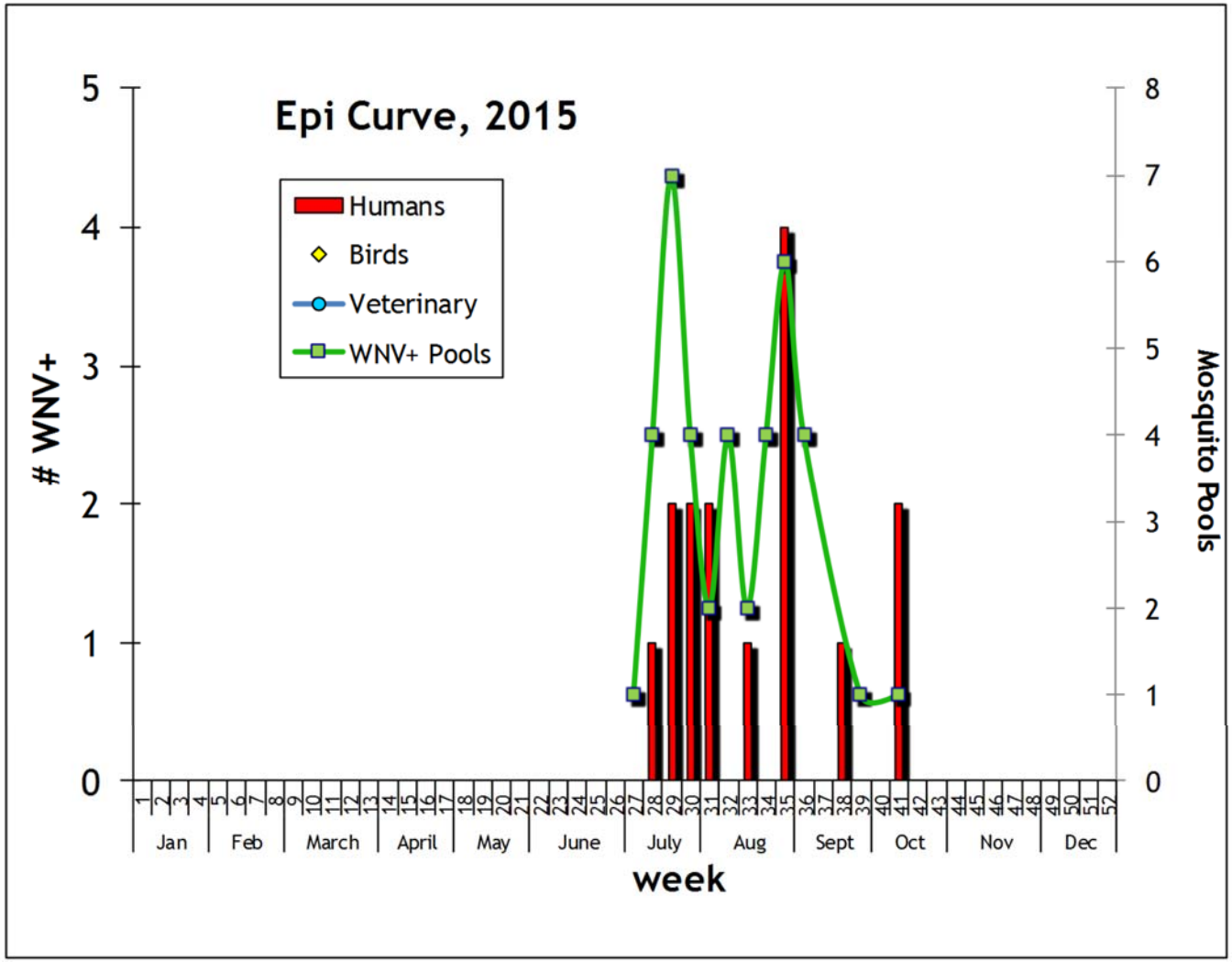




West Nile Virus Neuroinvasive Disease Incidence by State – United States, 2015 (as of January 12, 2016)


Average Epi Curve, 2001-2015
human cases
horses
birds
mosquito pools
WNV+
WNV+ birds
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
week


WNV 2001-2014
human cases
horses
mosquito pools
birds
#WNV+
WNV+ birds
month/year
0
50
100
150
200
250
300
350
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014



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.

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

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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