2014—Arbovirus Final Report

Summary of Human West Nile Virus and Other Arboviral Infections, Georgia 2014

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 2014, Georgia reported 13 cases of WNV, with 1 death. Eleven (84.6%) of the 13 cases experienced WNV neurologic illness (altered mental status, paralysis, encephalitis, and/or meningitis) and 2 (15.3%) were diagnosed with WNV fever. There were no viremic blood donors reported. The average age of cases was 53 years (range 9-86). The average age of those with WNV neurologic illness was 49 years (range 9-76). Nine (69.2%) of the 13 cases were male. The majority of cases were reported in July, August, and September.

Table 1 shows the clinical syndrome for each case.

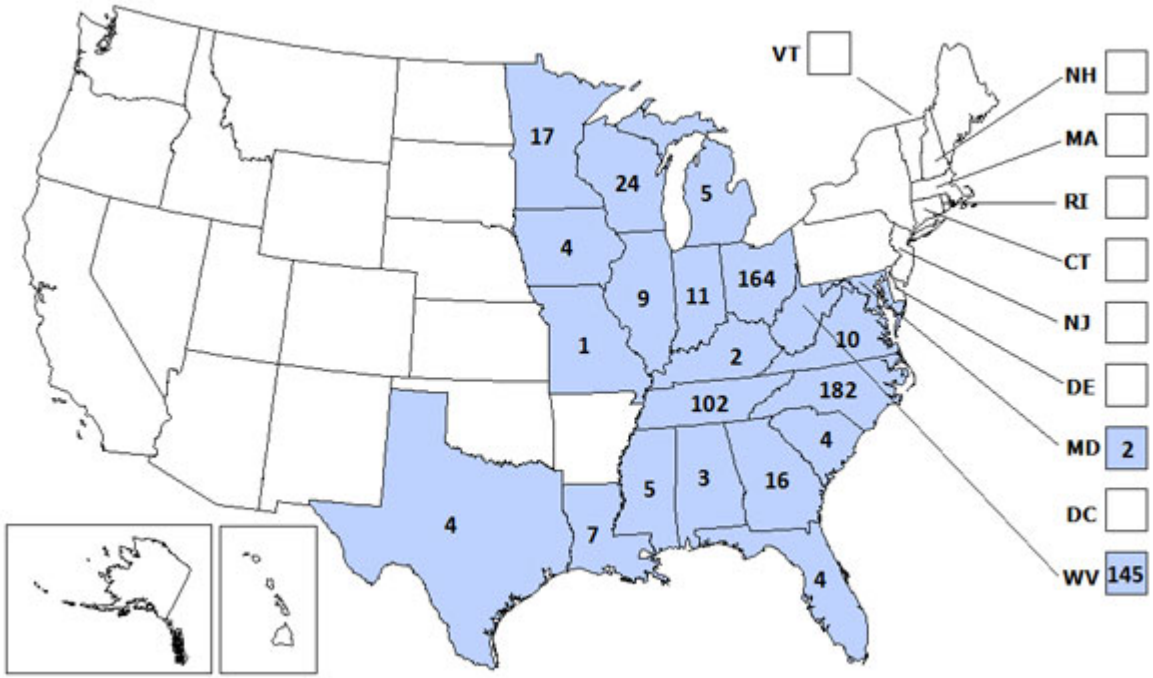
Table 2 shows the counties of residence of each case.

Table 2: Cases by County, 2014

WNV Cases by County	
County	**Count**
Brantley	1
Cobb	1
Coffee	1
DeKalb	1
Forsyth	1
Fulton	6
Richmond	2

Table 1: Clinical Syndromes, 2014

LAC (CE)	June	Murray	Altered Mental Status	No
	September	Catoosa	ENCEPHALITIS	Yes
WNV	June	Coffee	MENINGOENCEPHALITIS	No
	July	DeKalb	ENCEPHALITIS	No
		Fulton	ENCEPHALITIS	No
			MENINGOENCEPHALITIS	No
			Altered Mental Status	No
	August	Forsyth	ENCEPHALITIS	No
		Fulton	ENCEPHALITIS	No
		Richmond	MENINGOENCEPHALITIS	No
	September	Fulton	ENCEPHALITIS	No
				Yes
		Richmond	FEVER	No
	October	Cobb	FEVER	No
	December	Brantley	ENCEPHALITIS	No



La Crosse encephalitis virus (LACV) is transmitted to humans by the bite of an infected mosquito. Most cases of LACV disease occur in the upper Midwestern and mid-Atlantic and southeastern states (see map). Many people infected with LACV have no apparent symptoms. Among people who become ill, initial symptoms include fever, headache, nausea, vomiting, and tiredness. Some of those who become ill develop severe neuroinvasive disease (disease that affects the nervous system). Severe LACV disease often involves encephalitis (an inflammation of the brain) and can include seizures, coma, and paralysis. Severe disease occurs most often in children under the age of 16. In rare cases, long-term disability or death can result from La Crosse encephalitis. There is no specific treatment for LACV infection - care is based on symptoms. If you or a family member have symptoms of severe LACV disease or any symptoms causing you concern, consult a healthcare provider for proper diagnosis.

The best way to reduce your risk of infection with LACV or other mosquito-borne viruses is to prevent mosquito bites. Use insect repellent, wear long sleeves, long pants and socks or even stay indoors while mosquitoes are most active. The mosquitoes that spread LACV are most active during the daytime.

La Crosse virus neuroinvasive disease cases reported by state, 2004–2013

Table 1: Clinical Syndromes, 2014

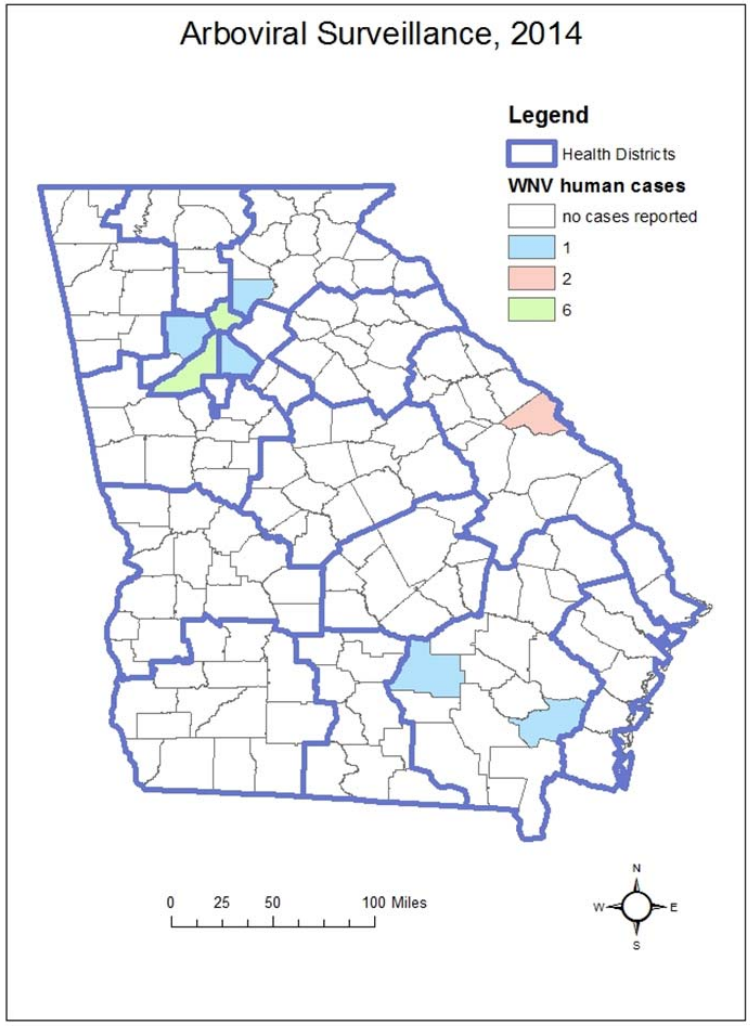
Arbovirus	Month of	County of Residence	Clinical Syndrome	Fatality
CHIK	May	Bulloch	FEVER	No
		Cobb	FEVER	No
	June	Bulloch	FEVER	No
		Cherokee	FEVER	No
		Clarke	FEVER	No
		Dougherty	FEVER	No
		Franklin	FEVER	No
		Fulton	FEVER	No
		Gwinnett	FEVER	No
		Hall	FEVER	No
		Muscogee	FEVER	No
	July	Cobb	FEVER	No
		Columbia	FEVER	No
		DeKalb	FEVER	No
		Fulton	FEVER	No
		Gwinnett	FEVER	No
		Liberty	FEVER	No
		Oconee	FEVER	No
		Tattnall	FEVER	No
	August	Gwinnett	FEVER	No
	September	Cobb	FEVER	No
		DeKalb	FEVER	No
		Fulton	FEVER	No
		Gordon	FEVER	No
	October	Gwinnett	FEVER	No
		Liberty	FEVER	No
	December	Gwinnett	FEVER	No
DENGUE	Feb	Fulton	FEVER	No
		Walton	Unknown	Unknown
	April	Fulton	FEVER	No
	July	Douglas	FEVER	No
	September	Coweta	FEVER	No

In addition to WNV, two cases of California Encephalitis (LAC) were reported from Catoosa and Murray counties. Four internationally acquired cases of Dengue, and one suspect dengue case, and 34 cases of internationally-acquired Chikungunya were also reported.

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 3: Age Ranges, WNV 2014

age range	WNND	WNF	other
0-10	1		
11-20			
21-30	1		
31-40			1
41-50	2		
51-60	4		
61-70		1	
71-80	2		
>80		1	
TOTAL	**10**	**2**	**1**

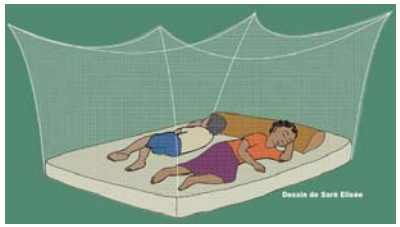


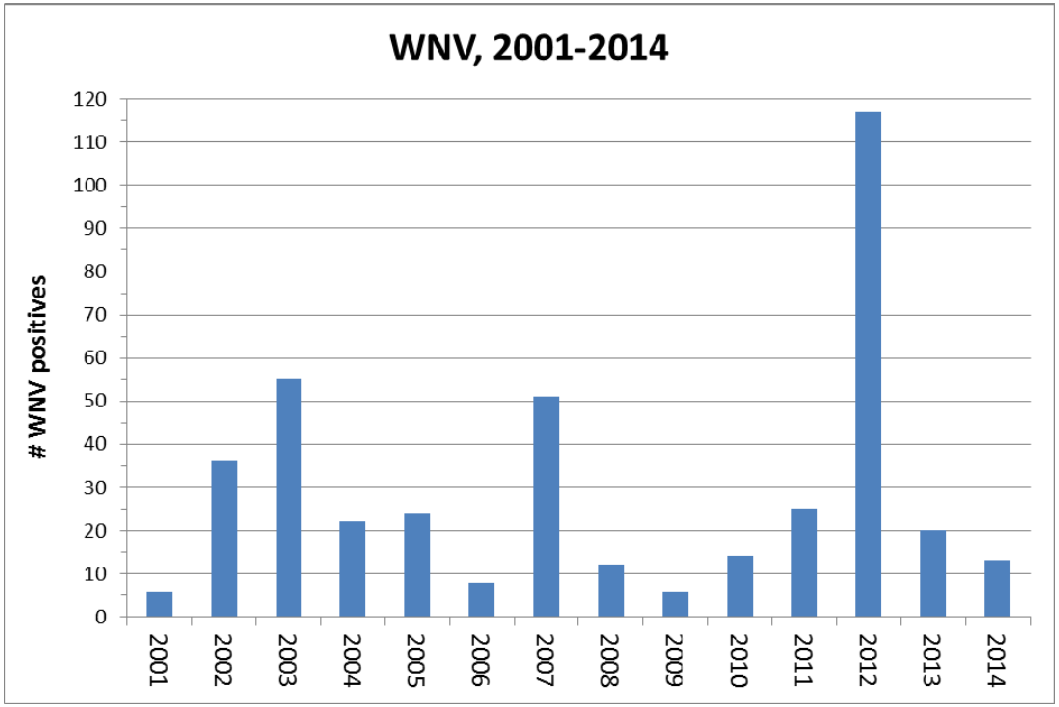
Dengue - County of Origin			
Virus	**County of Origin**	**# cases**	**Month of Onset**
DEN	Costa Rica	1	July
DEN	Honduras	1	September
DEN	Indonesia	1	April
DEN	Mexico	1	February
DEN	Unknown	1	February

TRAVEL-ASSOCIATED CASES

CHIK - County of Origin			
Virus	**County of Origin**	**# cases**	**Month of Onset**
CHIK	Dominican Republic	1, 7, 1, 1 (10)	May, July, Sept, Oct
CHIK	Haiti	1, 10, 1 (12)	May, June, Aug
CHIK	Haiti/Dominican Republic	1	June
CHIK	India	1	Sept
CHIK	Jamaica	1, 1, 1 (3)	Sept, Oct, Dec
CHIK	Puerto Rico	3, 3 (6)	July, Sept
CHIK	Virgin Islands	1	Oct

	Virus			
Diagnosis	**CE (LAC)**	**DENGUE**	**CHIK**	**WNV**
Altered Mental Status	1			1
ENCEPHALITIS	1			7
FEVER		4	34	2
MENINGOENCEPHALITIS				3
Unknown		1		





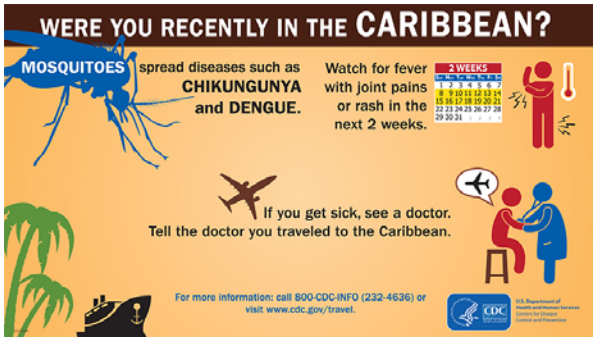
Because zoonotic arboviral illnesses have a high inapparent-to-apparent infection ratio, the prevalence of arbovirus antibodies can be high some populations. A diagnosis of arboviral encephalitis requires that the patient have signs and symptoms compatible with neuroinvasive disease.

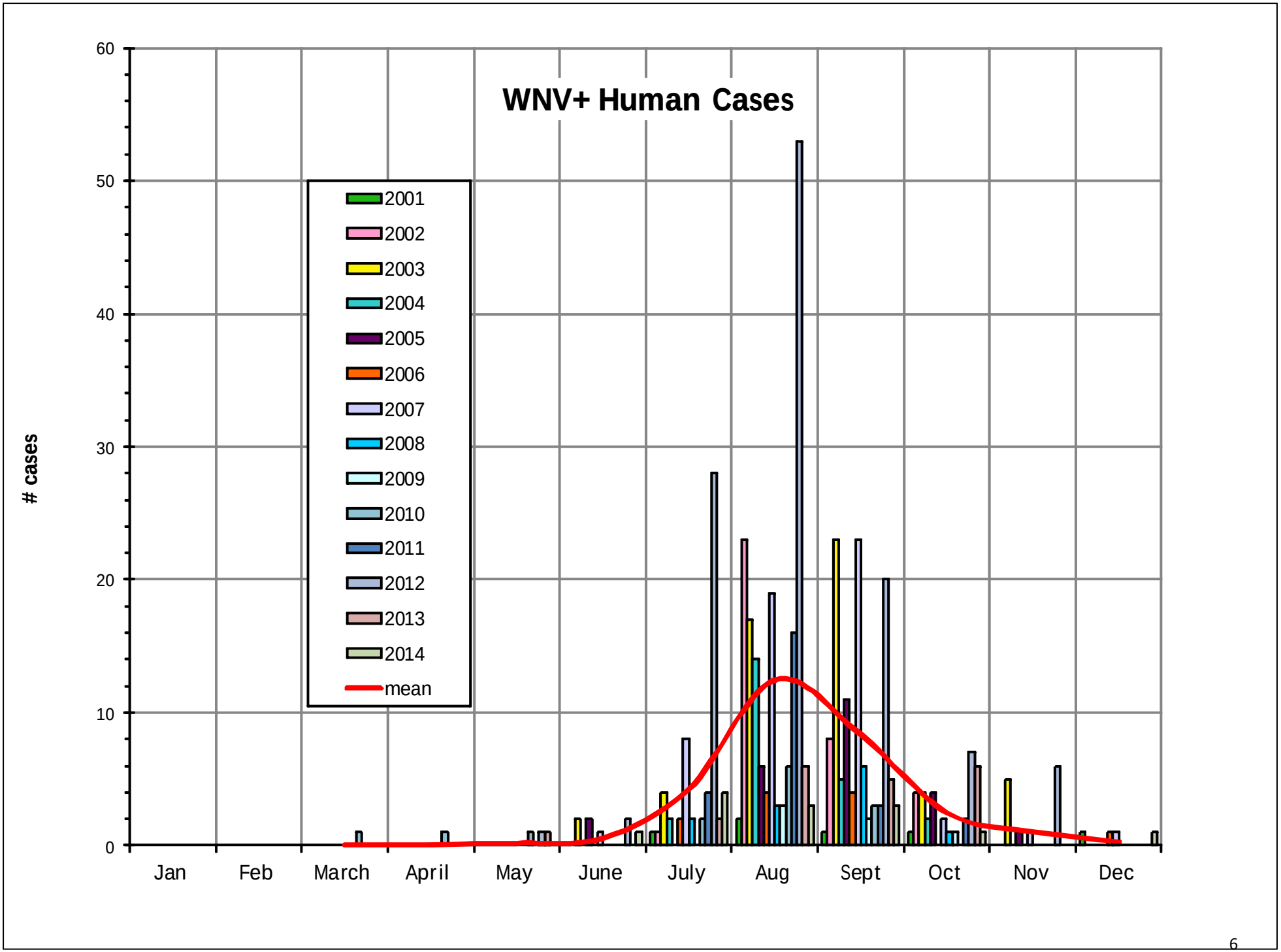
For reporting purposes, clinical data should be obtained to ensure that the patient meets the criteria for the surveillance case-definition. From patients with such signs and symptoms, physicians should obtain both acute phase (1-7 days post-onset) and convalescent phase (>14 days post-onset) serum and cerebrospinal fluid specimens.

http://www.cdc.gov/ncezid/dvbd/pdf/arboguid_508.pdf

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
Grand Total	**7**	**22**	**426**

Chikungunya is a viral fever caused by an alphavirus that is spread by *Aedes aegypti* and *Aedes albopictus*. With Chikungunya, a disease of humans, the apparent-to-inapparent infection ratio varies from 1:3 to 1:50. More importantly, infected individuals develop a high titer viremia. The symptoms, which include high fever and extreme joint pain, will appear on average 4 to 7 days (but can range from 1 to 12 days) after being bitten by an infected *Aedes* mosquito. The CDC reports that there is a potential for large scale epidemics with significant human morbidity. However, experience with other viruses that use similar mosquito vectors suggests that large scale outbreaks in US may not occur, but they could.

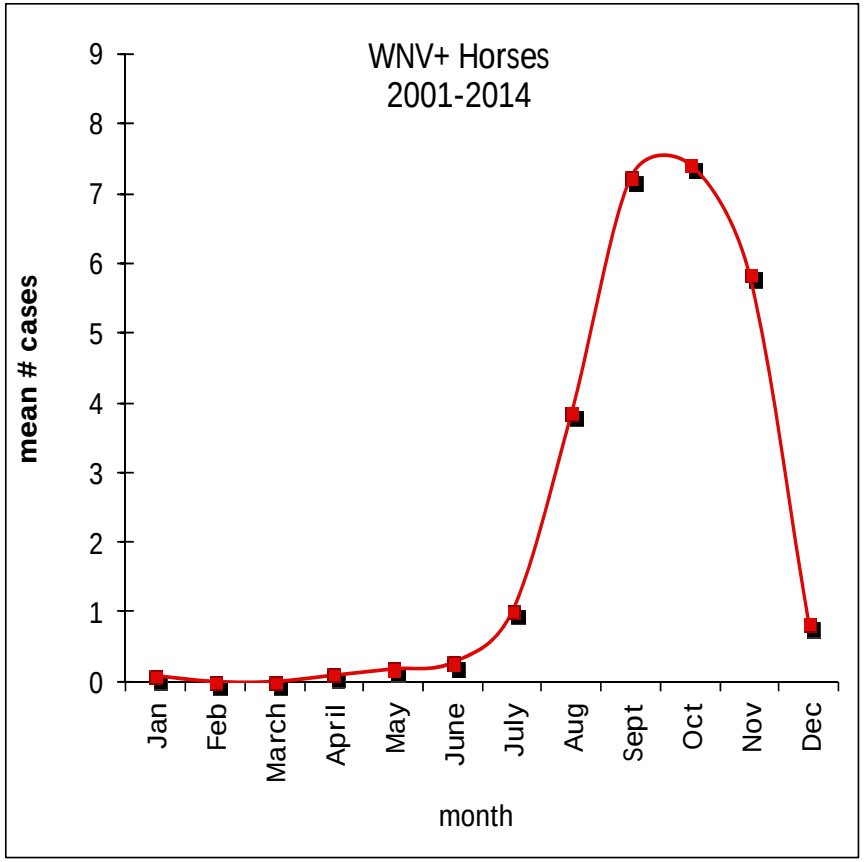


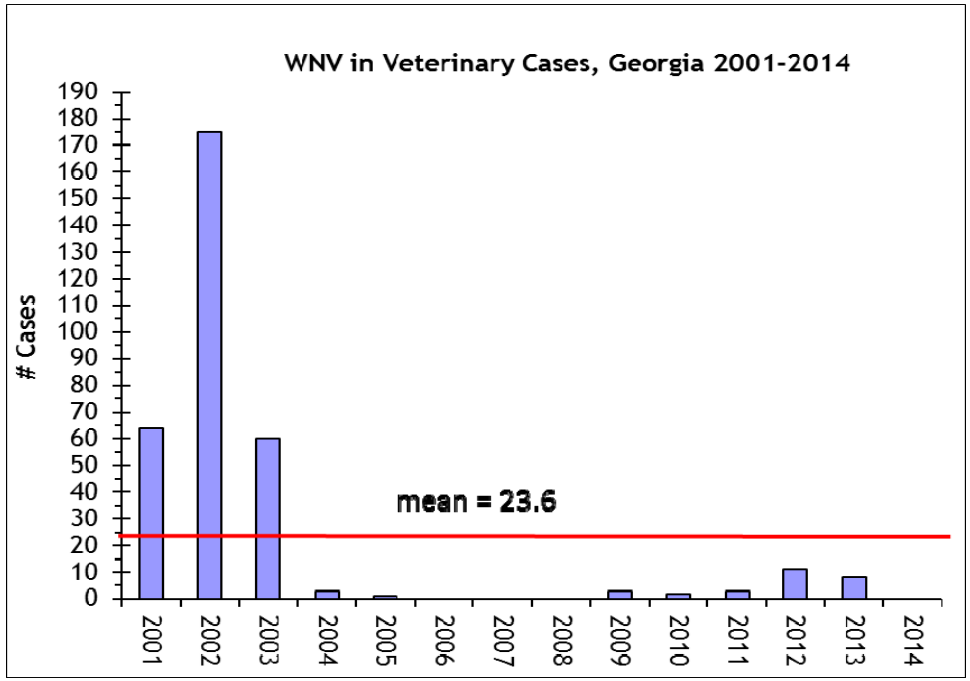

WNV+ Human Cases
cases
60
50
40
30
20
10
0
Jan
Feb
March
April
May
June
July
Aug
Sept
Oct
Nov
Dec
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
mean

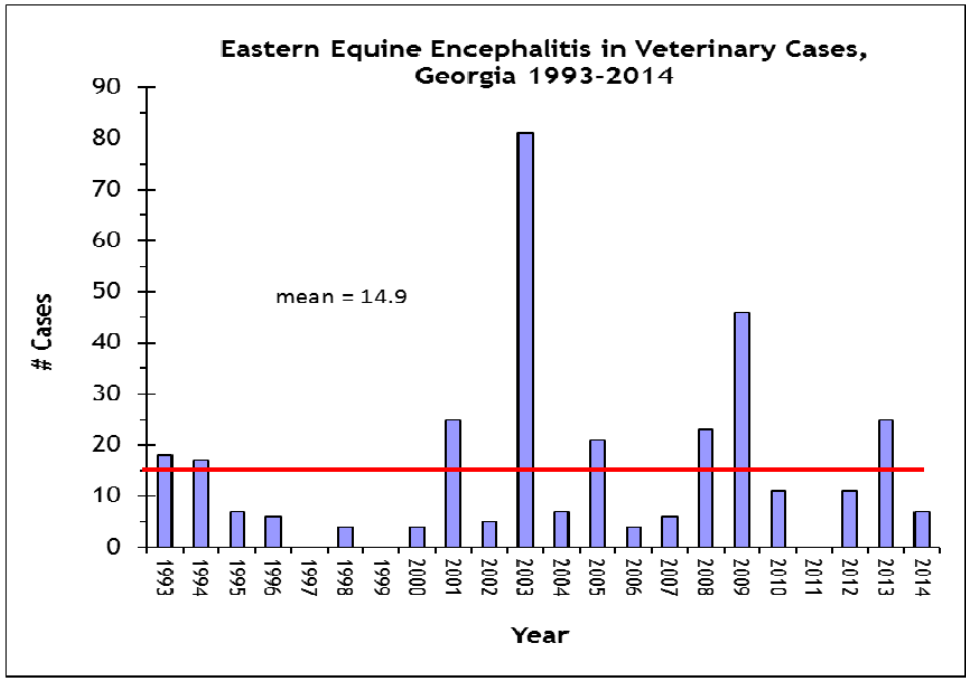
Veterinary Data

No horses tested positive for WNV in 2014. 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.

Seven horses tested positive for EEE in 2014. 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.







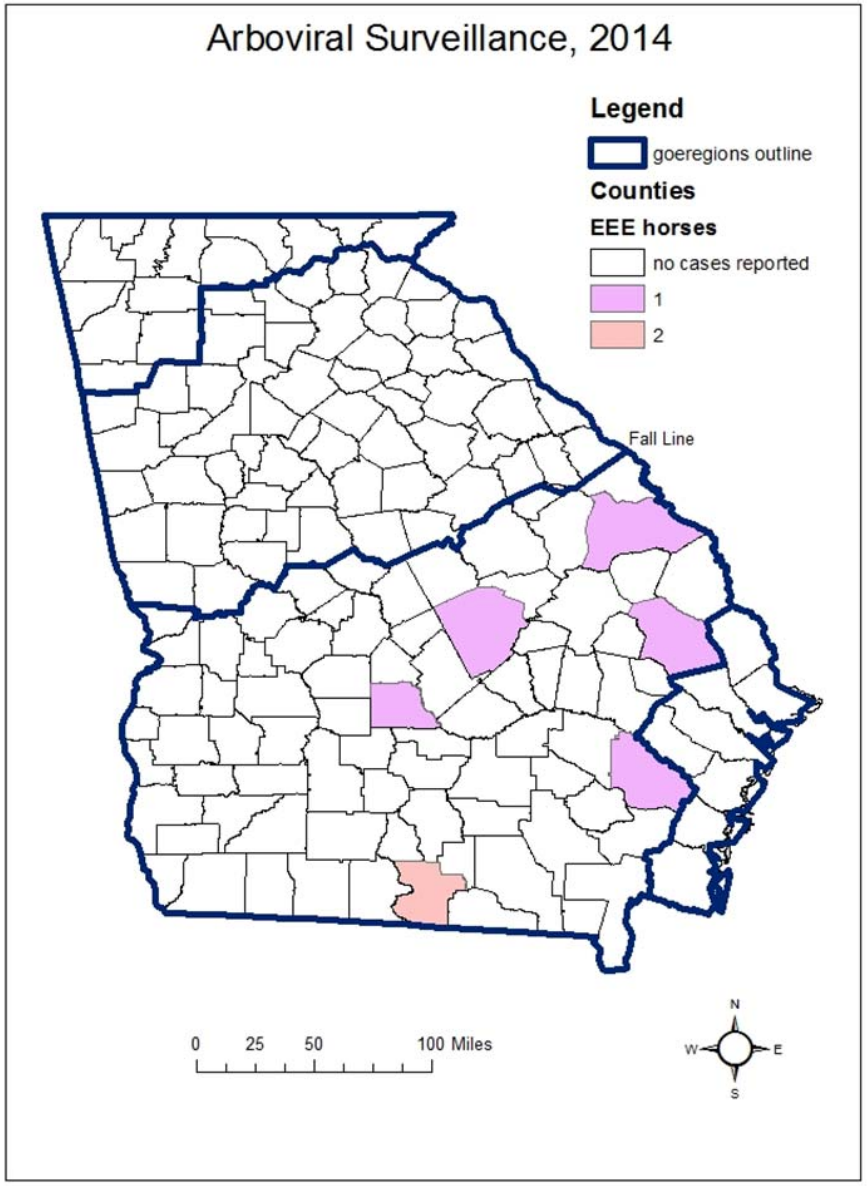
A horse with West Nile virus or EEE will display some of the following symptoms:

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%.

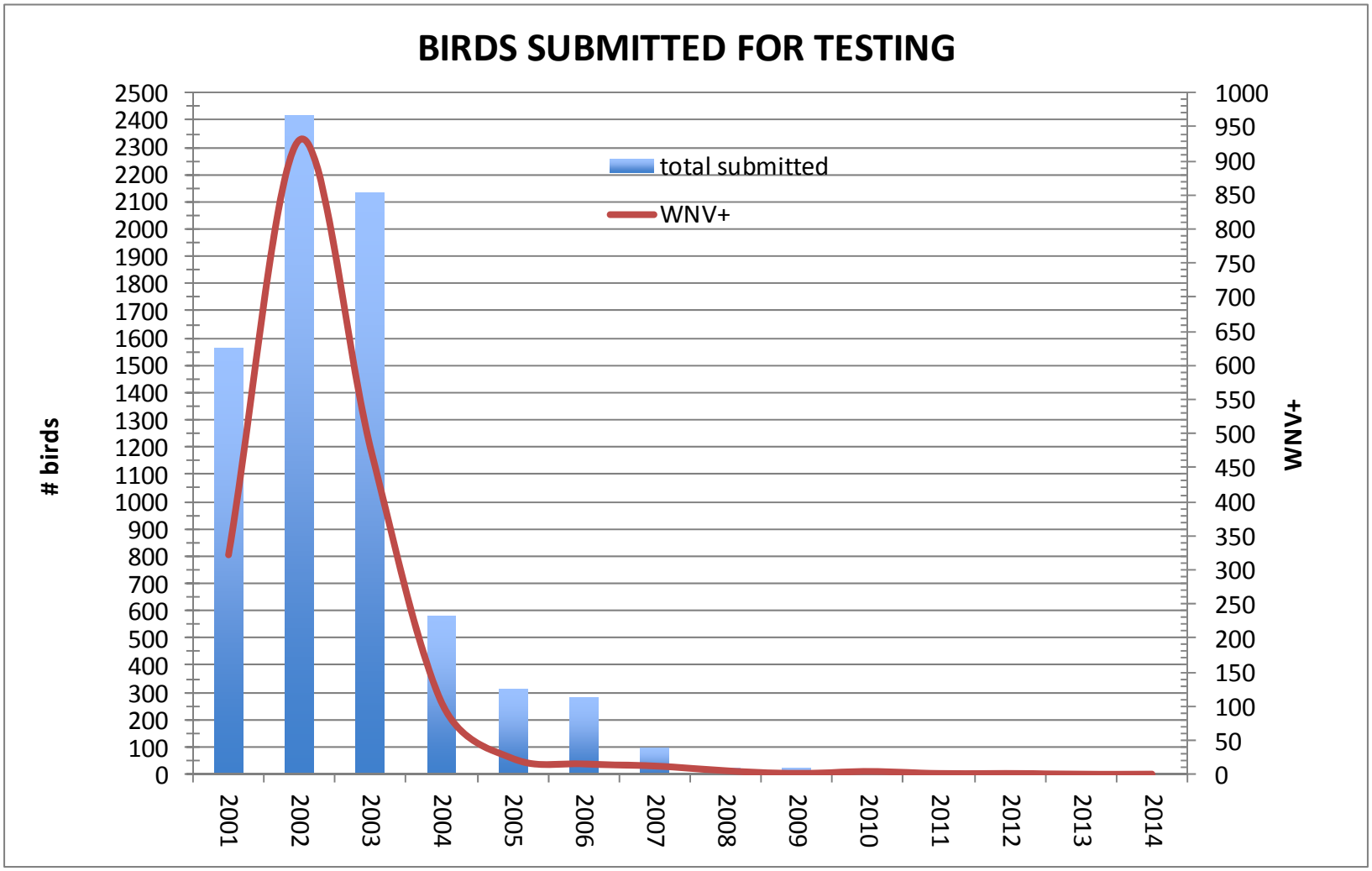
County	EEE
Bulloch	1
Burke	1
Laurens	1
Lowndes	2
Wayne	1
Wilcox	1
Grand Total	**7**



Dead Bird Surveillance

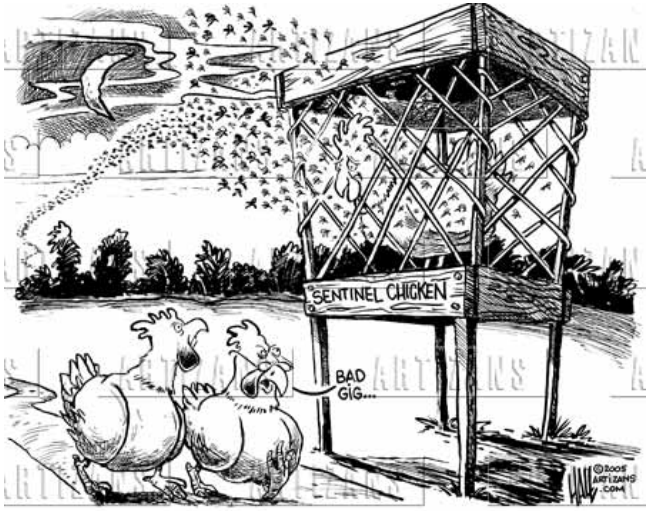
As of 2012, federal funding was no longer available to test birds. In 2014, no birds were submitted for testing.

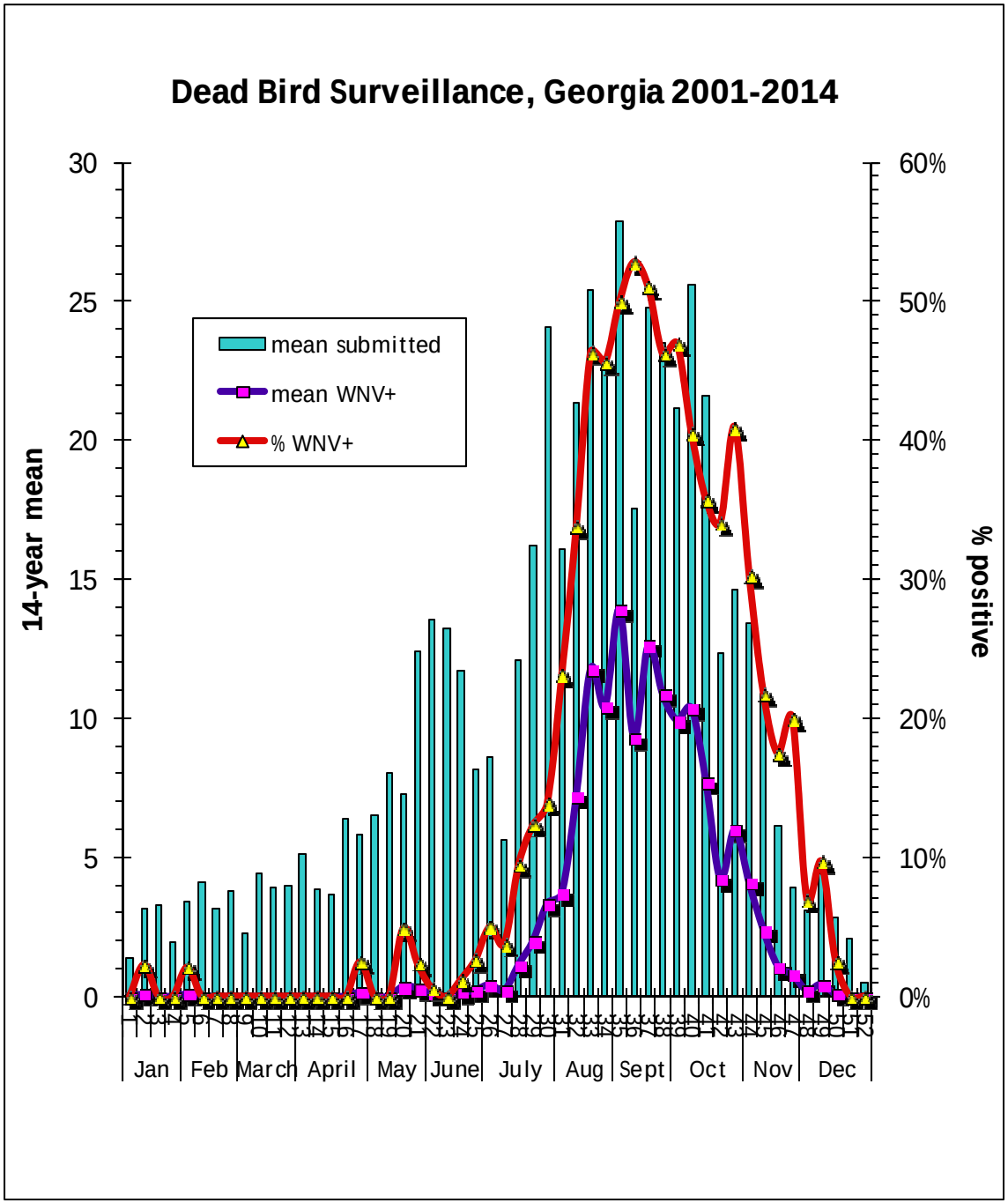
Dead bird surveillance continues to lose ground as a surveillance tool, and even more so now when no funding is available at the State level to support testing; most counties do not have the resources to pick up and ship birds for testing in any case. Bird testing does continue to have some utility, 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. In 2014, a sentinel chicken stationed along the Chatham/Bryan/Effingham county lines tested positive for EEE on 6/17/14. A second sentinel chicken stationed near the Savannah River near Houlihan Bridge just outside Port Wentworth tested positive for EEE on 7/31/14.

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



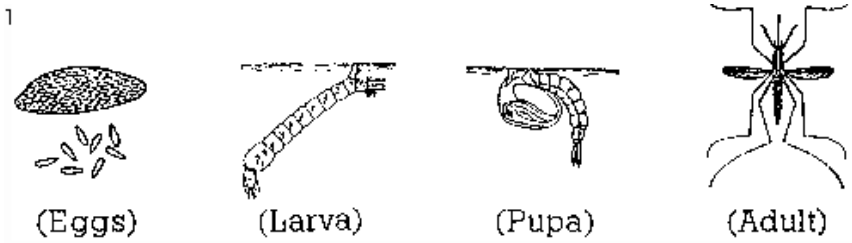


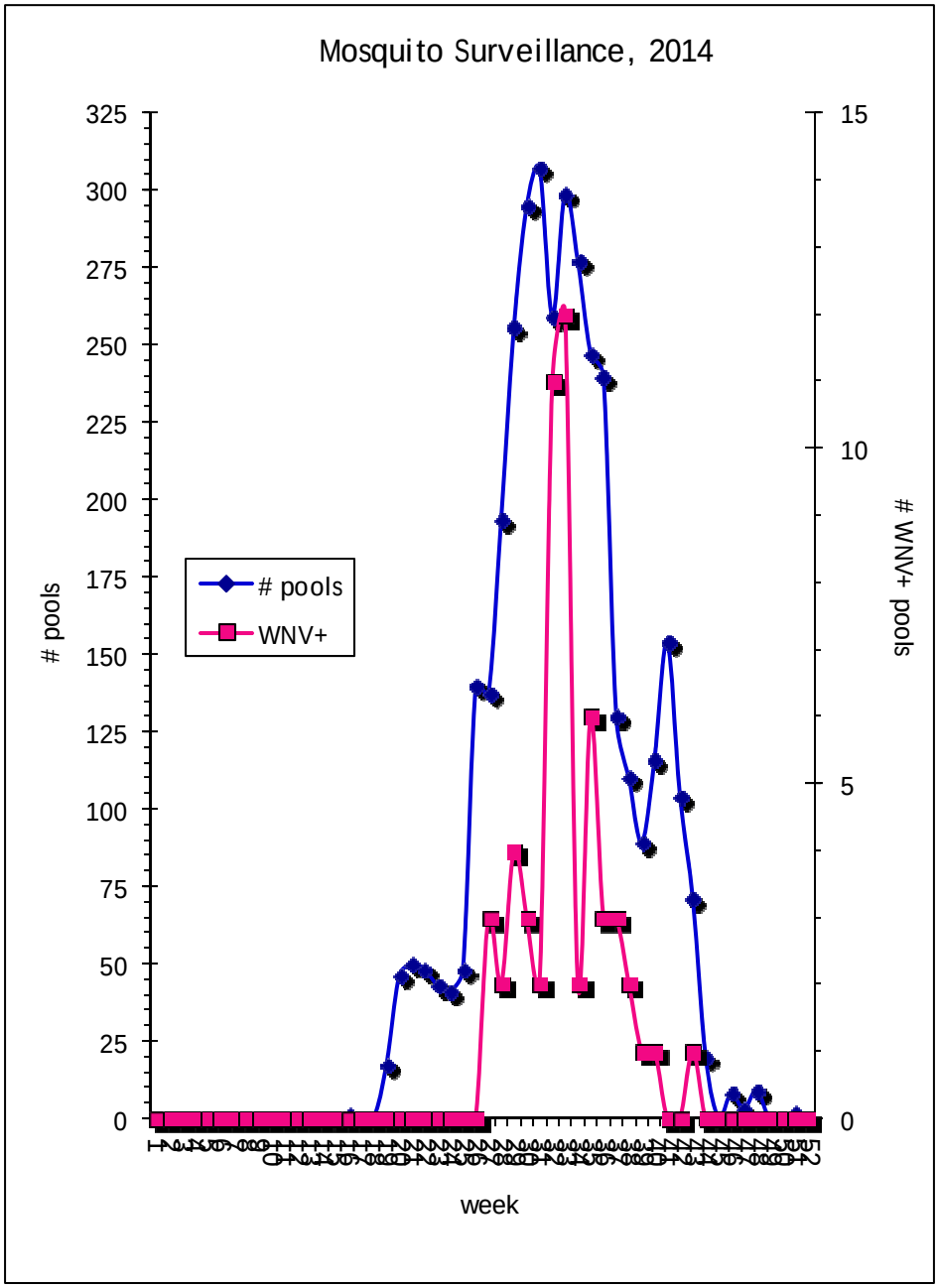
Mosquito Surveillance

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 2014. 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 5021 pools of mosquitoes (107648 individuals) were sent for testing with results reported to the GDPH. Mosquitoes found WNV+ (56 pools) were *Aedes albopictus* and *Culex quinquefasciatus,* as well as unidentified *Culex spp;* the mosquito species most commonly found positive (96.4%) was *Cx quinquefasciatus*. In addition to WNV, 2 pools of *Culiseta melanura* were found to be EEE+ (Lowndes and Chatham counties).

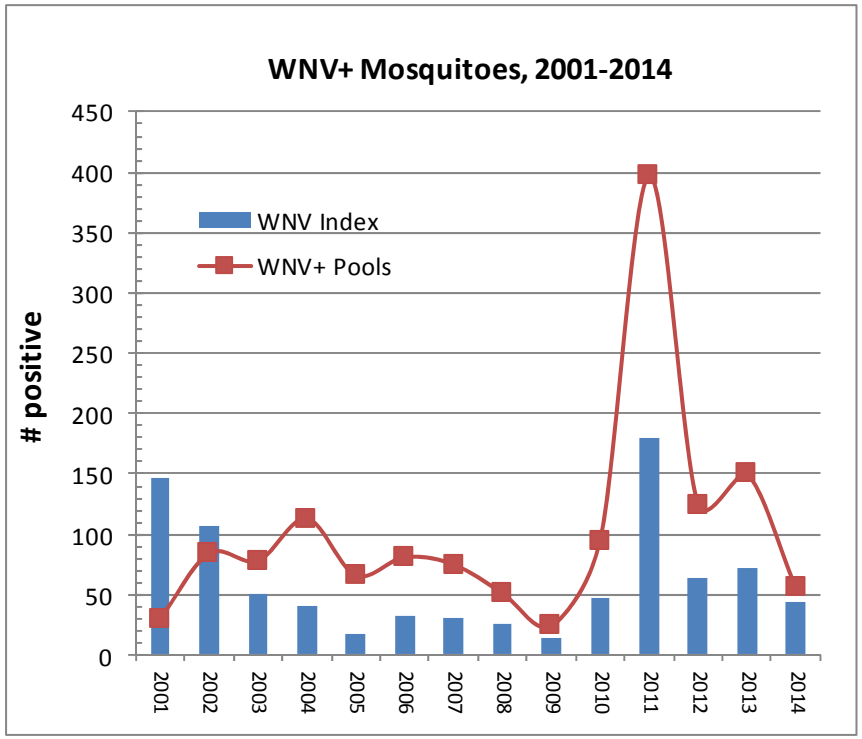
county	# pools	WNV+ pools	EEE+ pools
Chatham	2754	7	1
Fulton	340	38	
Glynn	252		
Liberty (Hinesville)	30	1	
Lowndes	1645	10	1
	5021	**56**	**2**





The first WNV+ mosquitoes were detected in Fulton County in early July. The last WNV+ pool was collected in Chatham County at the end of October. Peaks in numbers of WNV+ pools occurred in August. All but two 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.



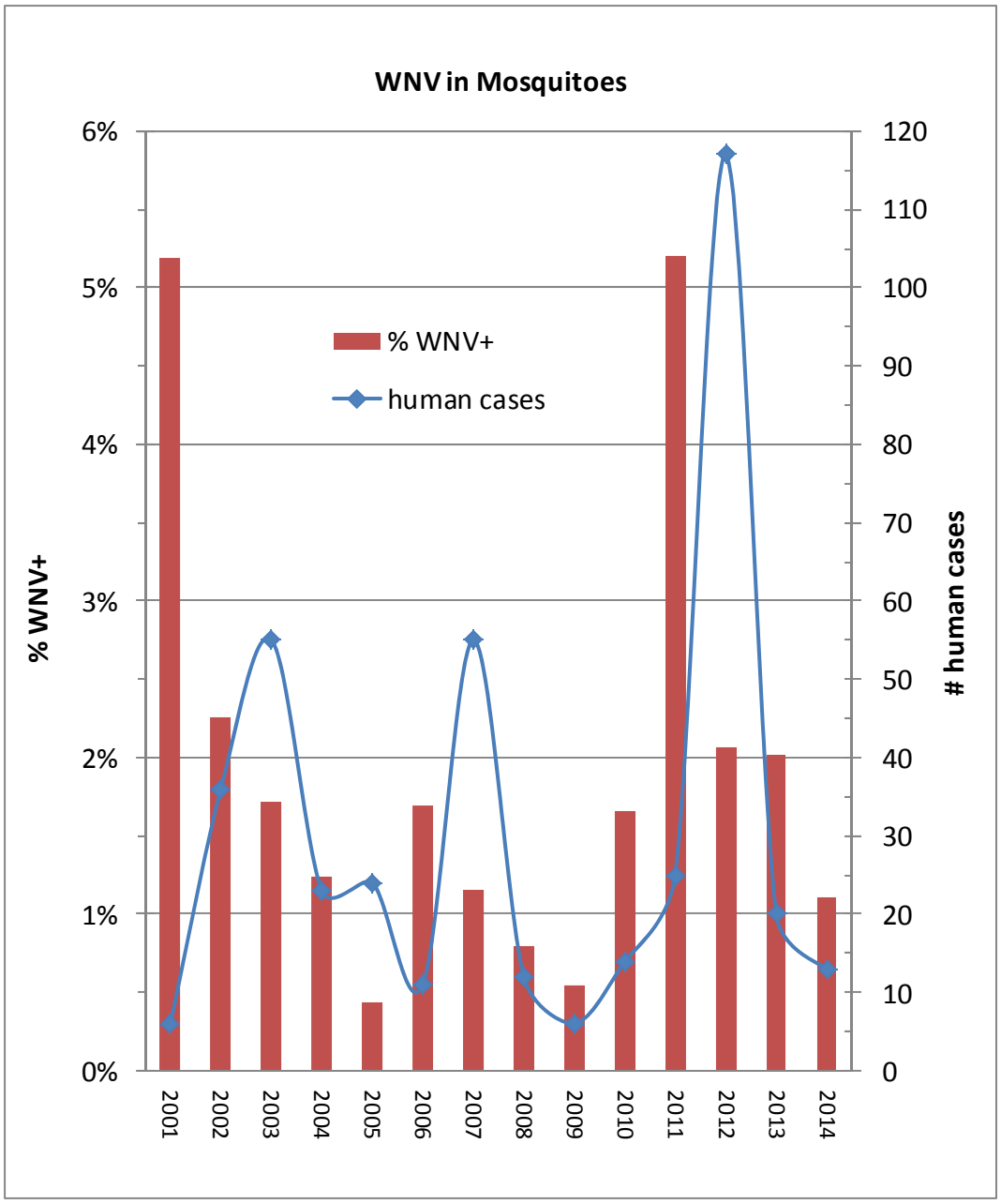
GA Arboviruses 2001-2014					
	trap type				
Virus	**Unknown**	**CDC**	**Other**	**Gravid**	**Total**
Bunyavirus		1			1
Cache Valley	6				6
EEE	1	15	1	4	21
Flanders	16	16		1075	1107
Flanders (variant)		2		43	45
HJV		5		4	9
HP				1	1
Keystone	2	1			3
LAC	1				1
Orbivirus			1		1
Potosi	2	3			5
South River virus	2				2
TENV		1			1
Unknown				1	1
WNV	228	22		1229	1479
Total	**258**	**66**	**2**	**2357**	**2683**

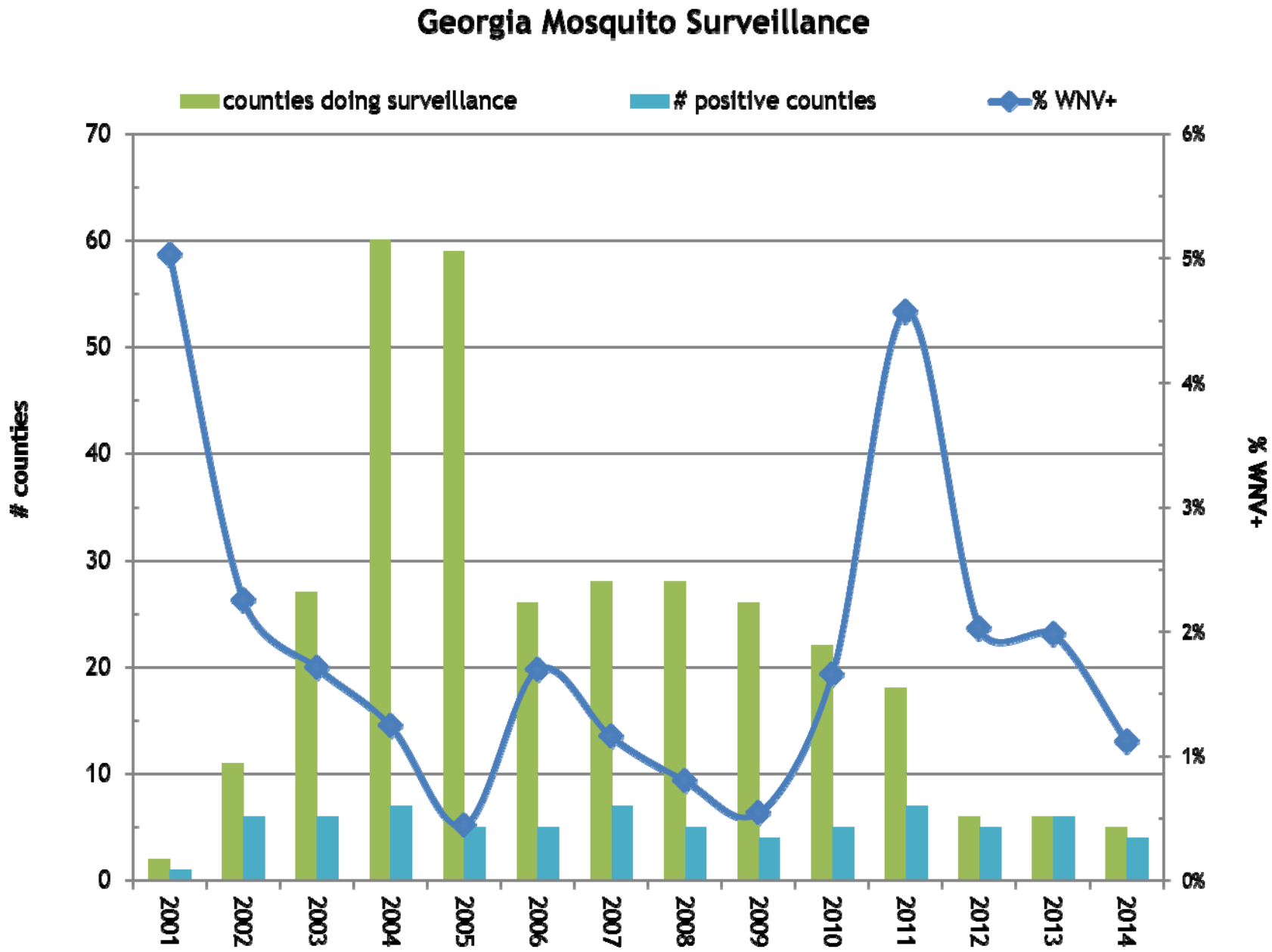
year	WNV Index	WNV+ Pools
2001	146.3	30
2002	106.6	84
2003	50.7	78
2004	40.7	113
2005	17.7	66
2006	31.5	81
2007	29.9	75
2008	25.3	51
2009	13.7	24
2010	47.7	95
2011	179.6	439
2012	64.3	125
2013	72.0	150
2014	43.6	56

DeKalb County reported a total of 15 WNV+ mosquito pools from 11 locations. No other information is available. These data are not used for analysis or in the final counts, being incomplete.

2001-2014	human cases	WNV+ mos-quito pools	veterinary cases	positive birds
total	426	1599	330	1896
mean	30.4	114.2	23.6	135.4

year	total pools	WNV+	% WNV+	human cases
2001	597	31	5.2%	6
2002	4032	91	2.3%	45
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
MEAN	6463.4	105.6	1.6%	30.4
TOTAL	90487	1479	26%	426




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
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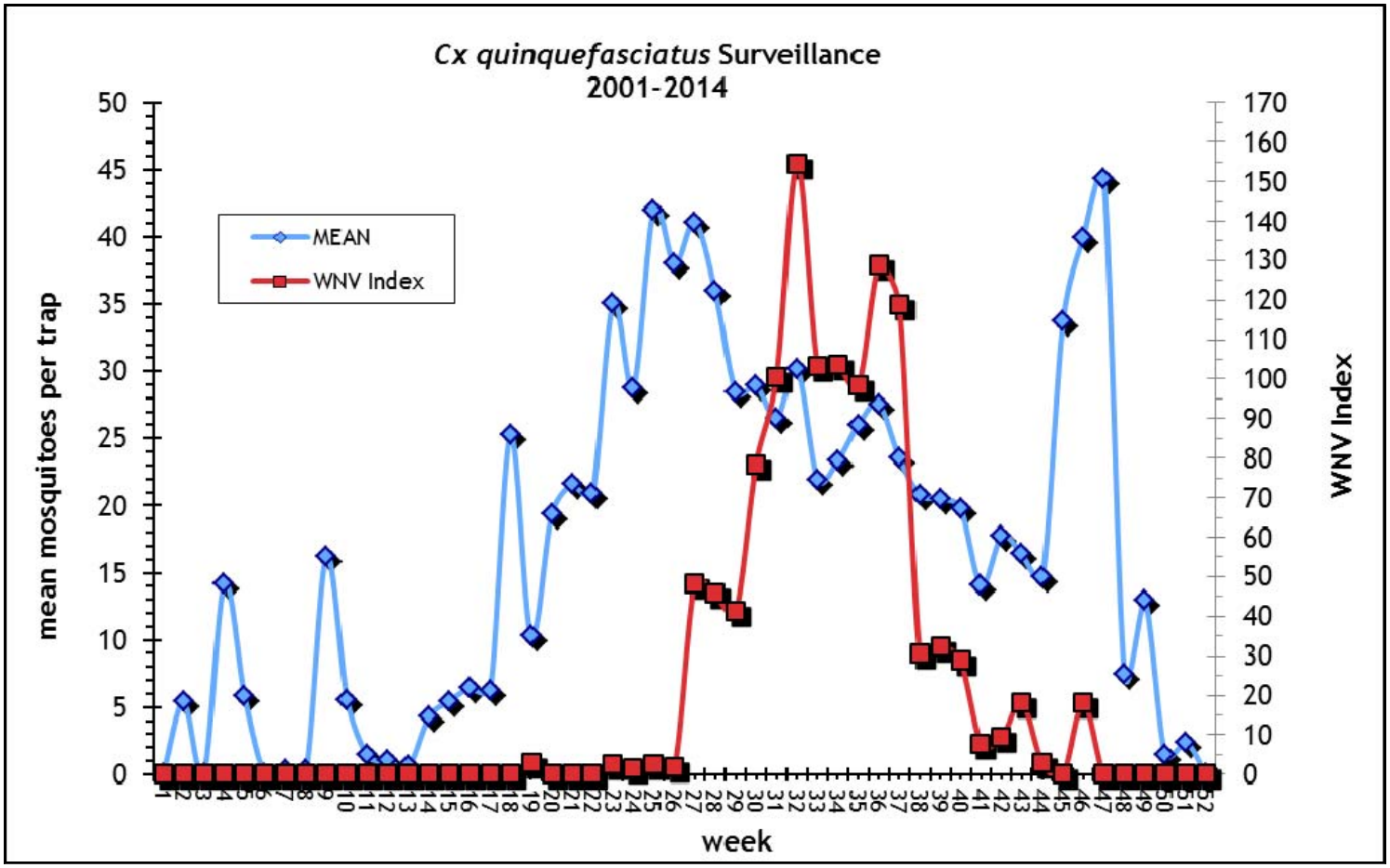
2007
2008
2009
2010
2011
2012
2013
2014



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. Counties where mosquito surveillance has occurred are Bulloch, Dougherty, Muscogee, Harris, and Talbot.

Species	# mosquitoes
Ae. aegypti	37
Ae. albopictus	1522
Ae. vexans	171
Aedes/Ochlerotatus spp.	7
An. crucians	26
An. punctipennis	14
An. quadrimaculatus	42
Cq. perturbans	15
Culex spp.	7
Cx erraticus	14
Cx restuans	17
Cx salinarius	80
Cx. coronator	56
Cx. erraticus	221
Cx. nigripalpus	74
Cx. quinquefasciatus	1125
Cx. salinarius	11
Oc. atlanticus	5
Oc. canadensis	3
Oc. fulvus pallens	2
Oc. japonicus	15
Oc. sticticus	99
Oc. triseriatus	16
Or. signifera	6
Ps. ciliata	17
Ps. columbiae	153
Ps. ferox	23
Ps. howardii	14
Tx. rutilus	3
Grand Total	**3795**

County	# mosquitoes
Bulloch	842
DeKalb	33
Dougherty	820
Greene	27
Gwinnett	1
Harris	5
Muscogee	855
Newton	119
Richmond	111
Talbot	982
Grand Total	**3795**

County	# trap nights
Bulloch	3
DeKalb	1
Dougherty	3
Greene	1
Gwinnett	1
Harris	1
Muscogee	3
Newton	1
Richmond	2
Talbot	2
Grand Total	**18**

County	# mosquitoes/trap night
Bulloch	280.7
DeKalb	33.0
Dougherty	273.3
Greene	27.0
Gwinnett	1.0
Harris	5.0
Muscogee	285.0
Newton	119.0
Richmond	55.5
Talbot	491.0
MEAN	157.1

Month	# mosquitoes
Feb	**60**
March	**51**
May	**119**
July	**1496**
August	**1371**
Sept	**697**
Oct	**1**
Grand Total	**3795**

Species	Bulloch	DeKalb	Dougherty	Greene	Gwinnett	Harris	Muscogee	Newton	Richmond	Talbot	Grand Total
Ae. aegypti							4				4
Ae. albopictus	20	2	20	2		1	17	1		13	76
Ae. vexans	12		7		1	1	7	1		3	32
Aedes/Ochlerotatus spp.	1										1
An. crucians	7		1								8
An. punctipennis	1		4				1				6
An. quadrimaculatus	7		4	1			1				13
Cq. perturbans	4		1					1			6
Culex spp.	2						1			1	4
Cx erraticus									1		1
Cx restuans									2		2
Cx salinarius									2		2
Cx. coronator	9		2								11
Cx. erraticus	17		9				5			2	33
Cx. nigripalpus	5		5								10
Cx. quinquefasciatus	18	1	26			1	15				61
Cx. salinarius	3									1	4
Oc. atlanticus	4										4
Oc. canadensis								1			1
Oc. fulvus pallens	2										2
Oc. japonicus				1			1				2
Oc. sticticus								1			1
Oc. triseriatus	2		3	1			4				10
Or. signifera			2				2				4
Ps. ciliata	3		1								4
Ps. columbiae	12		11				1				24
Ps. ferox	4						1	1			6
Ps. howardii	3										3
Tx. rutilus	1						1				2
Grand Total	**137**	**3**	**96**	**5**	**1**	**3**	**61**	**6**	**5**	**20**	**337**

WNV Activity Map

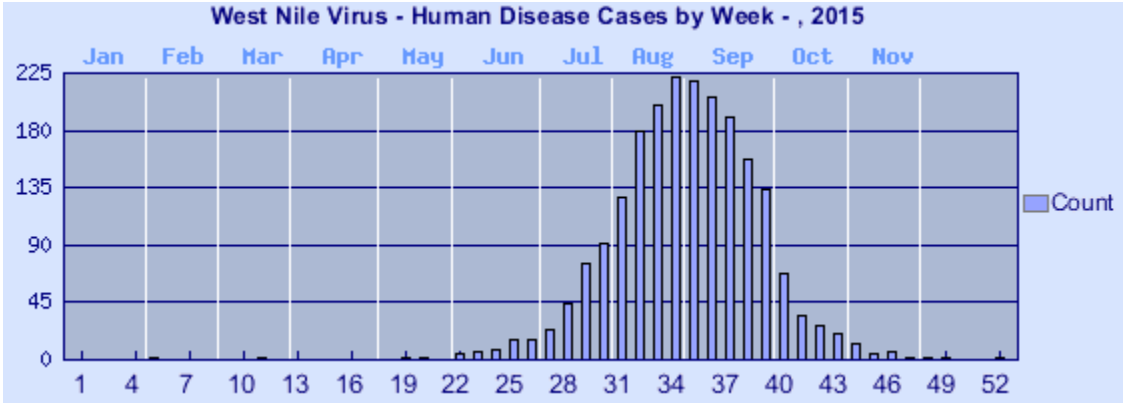
*WNV human disease cases or presumptive viremic blood donors. Presumptive viremic blood donors have a positive screening test which has not necessarily been confirmed.

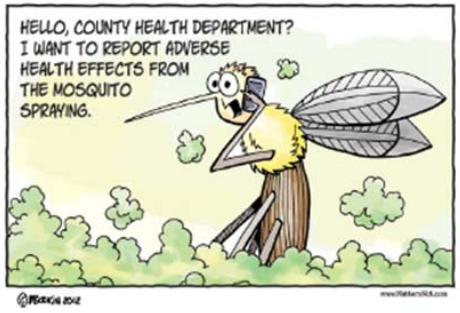
†WNV veterinary disease cases, or infections in mosquitoes, birds, or sentinel animals.

Data table: WNV infections in mosquitoes, birds, sentinel animals, or veterinary animals have been reported to CDC ArboNET from the following states: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

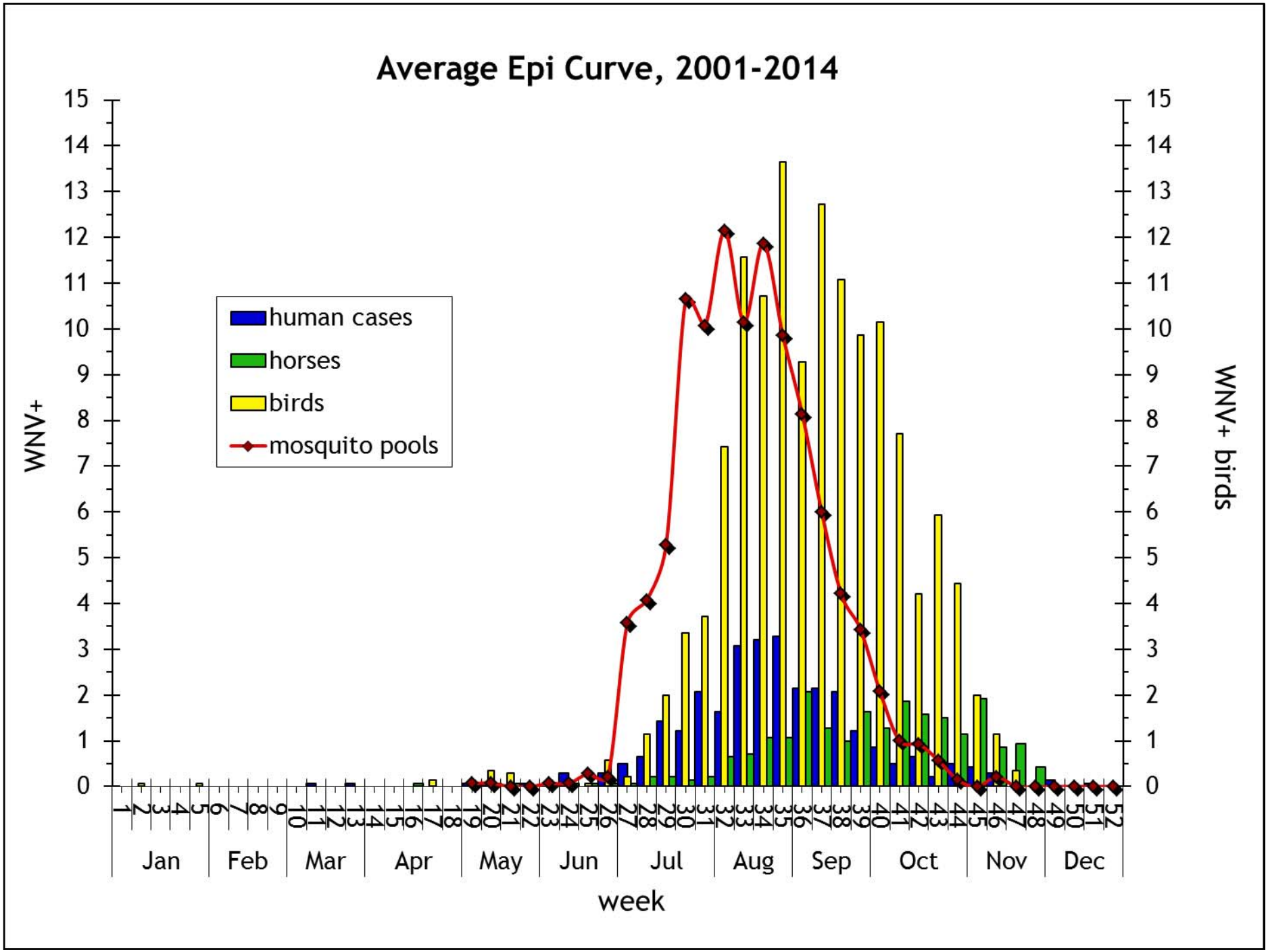
West Nile Virus Neuroinvasive Disease Incidence by State – United States, 2014 (as of January 13, 2015)

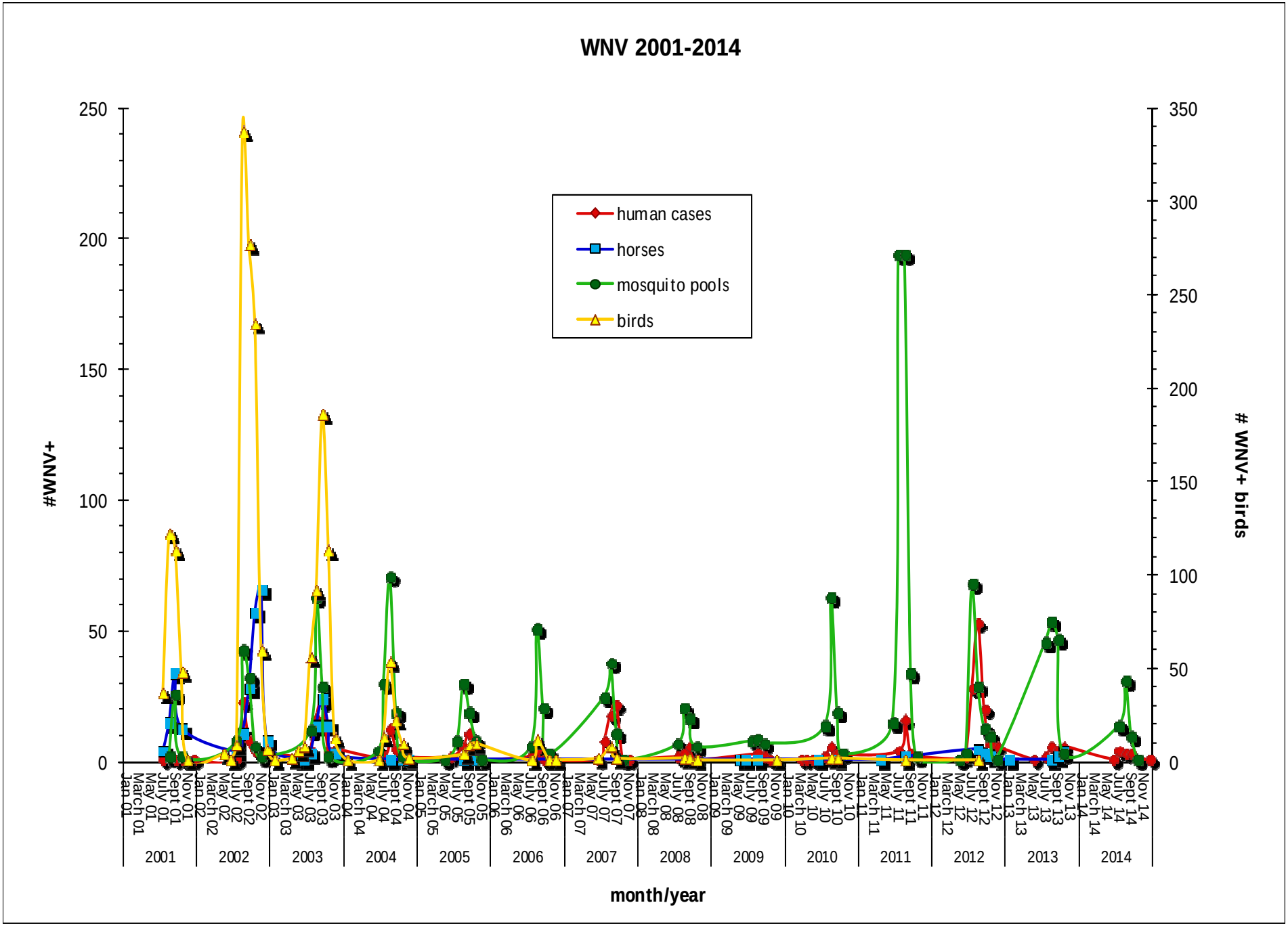
West Nile virus infections in humans have been reported to CDC ArboNET from the following states: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, District of Columbia, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

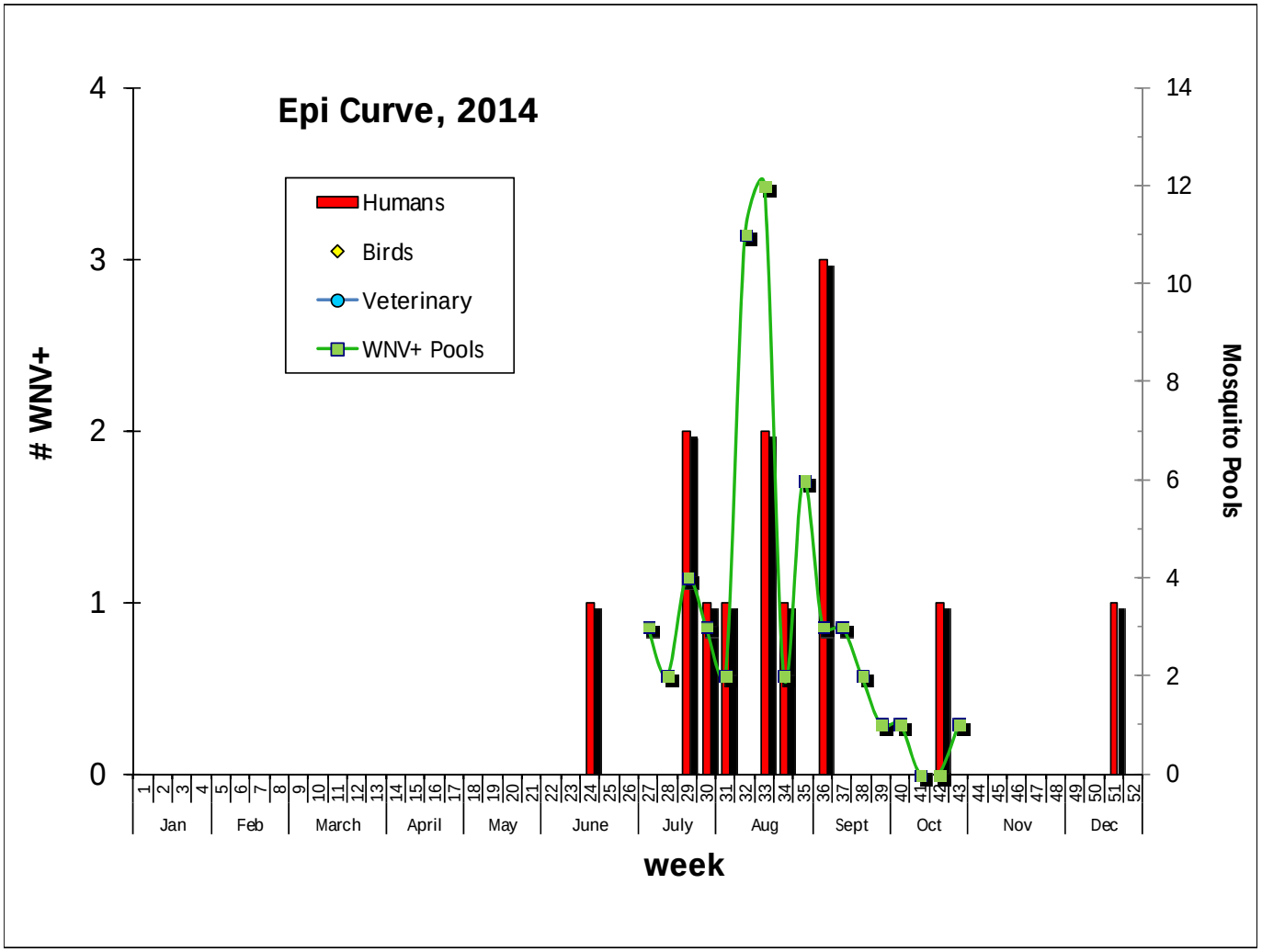




http://diseasemaps.usgs.gov/mapviewer/


Average Epi Curve, 2001-2014
WNV+
WNV+ birds
human cases
horses
birds
mosquito pools
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.

<u>The GDPH Vector-Borne & Zoonotic Diseases Team</u>

- Julie Gabel, DVM
- Amanda Feldpausch (epidemiologist)
- Rosmarie Kelly (entomologist)