2019—Arbovirus Final Report

Summary of Human West Nile Virus and Other Arboviral Infections, Georgia 2019

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.

Historical data on arboviral diseases in Georgia 2002-2018 are available upon request.

In 2019, Georgia reported 14 cases of WNV and 2 WNV presumptive viremic donors (PVD), with 1 death. 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.

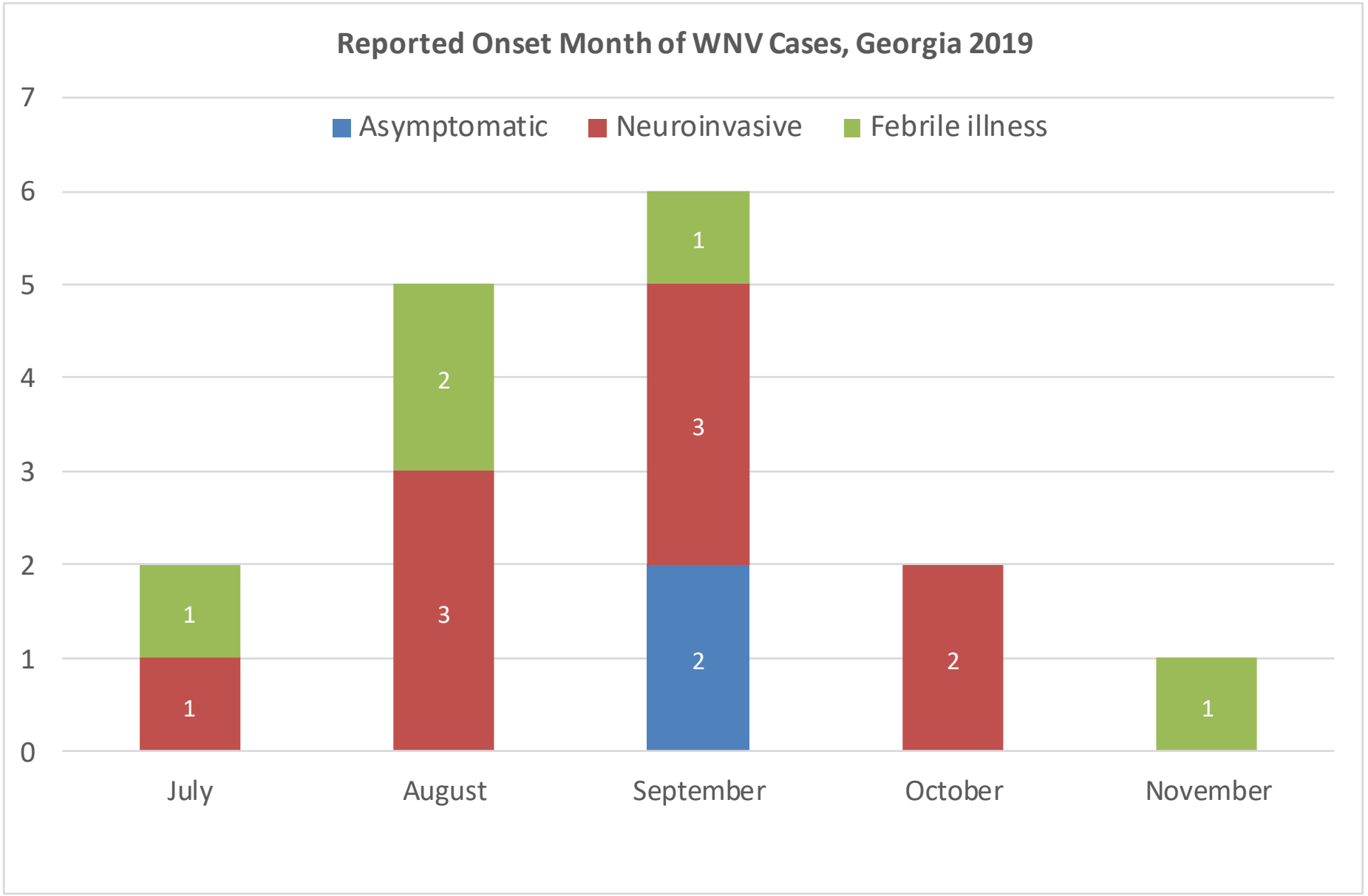
Overall, 14 WNV disease cases were reported from 9 counties in 8 public health districts. Among these cases, 9 (64%) were neuroinvasive, 11 (78%) patients had illness onset during July-September and 12 (86%) cases were male. The average patient age of all WNV disease cases was 52.8 (range: 10-85) and the average patient age of all neuroinvasive cases was 51.2 (range: 10-82). The majority of cases were reported in August and September, with a peak in September.

In 2019, one confirmed case of EEE was reported in Georgia.

California serogroup (CS) viruses, including California encephalitis, Keystone, La Crosse, Jamestown Canyon (JCV), snowshoe hare, and trivittatus, belongs to the Bunyaviridae family of viruses. In the United States, La Crosse virus (LACV) is the most common of the California serogroup viruses. There was one case of LAC reported in Georgia in 2019.

Saint Louis encephalitis virus is related to WNV and is a member of the Flaviviridae subgroup. It was last reported in Georgia in the 1970s. In 2018, one case of SLE was reported in Georgia. There were no SLE cases reported in Georgia in 2019.

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, 8 of which were asymptomatic. In 2018, a total of 2 asymptomatic travel-associated ZIKV cases were reported. In 2019, there were 5 travel-related ZIKV cases reported, 4 of which were asymptomatic. There was also 1 case of occupationally-acquired ZIKV. To date there have been no locally transmitted (mosquito to human) cases of Zika. Travel-associated Dengue (6) and Chikungunya (1) cases were reported in 2019, but no locally-acquired cases were reported.


Reported Onset Month of WNV Cases, Georgia 2019
Asymptomatic
Neuroinvasive
Febrile illness
7
6
5
4
3
2
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0
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1
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1
July
August
September
October
November

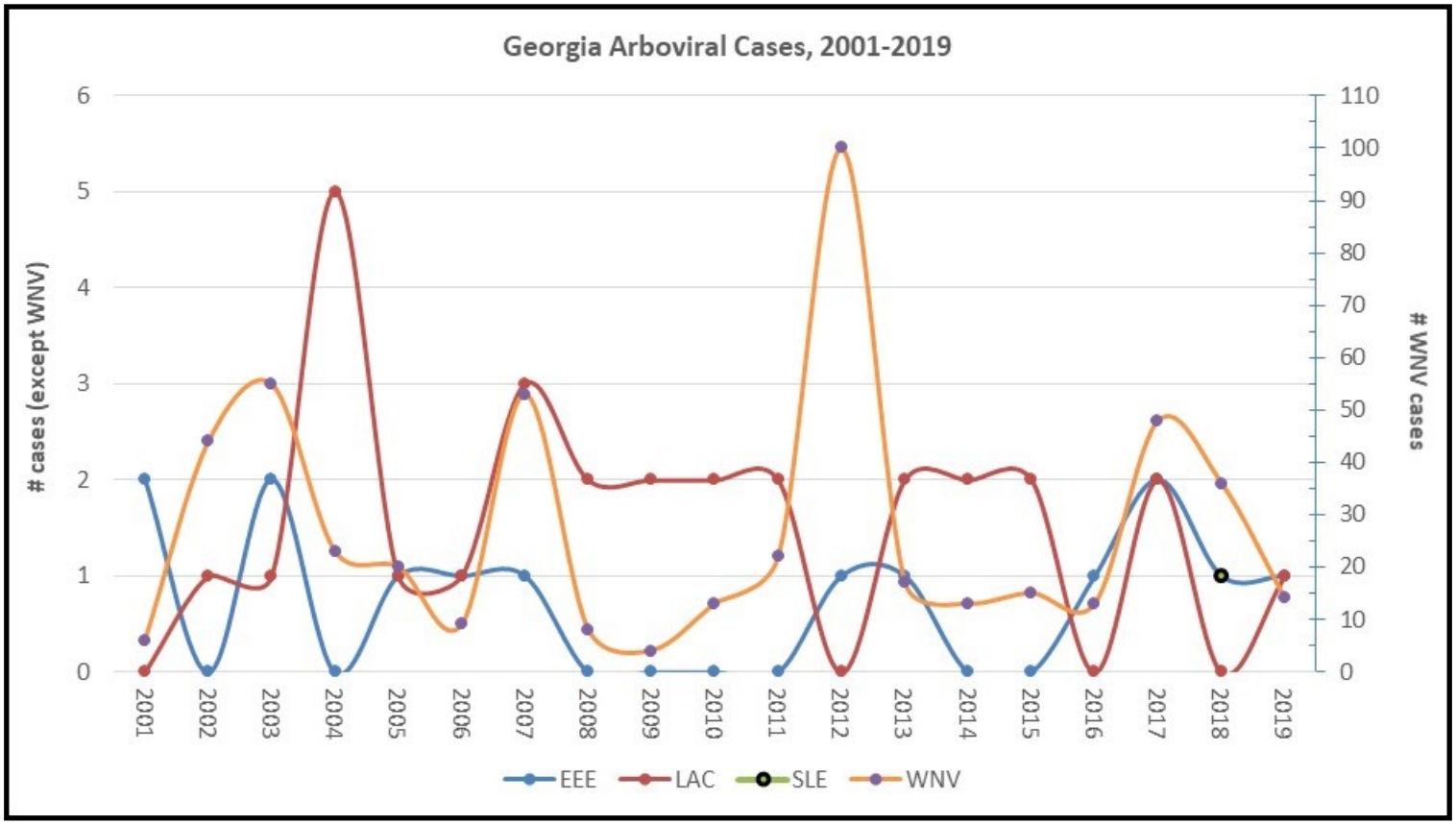


Table 3: Age Ranges, WNV 2019

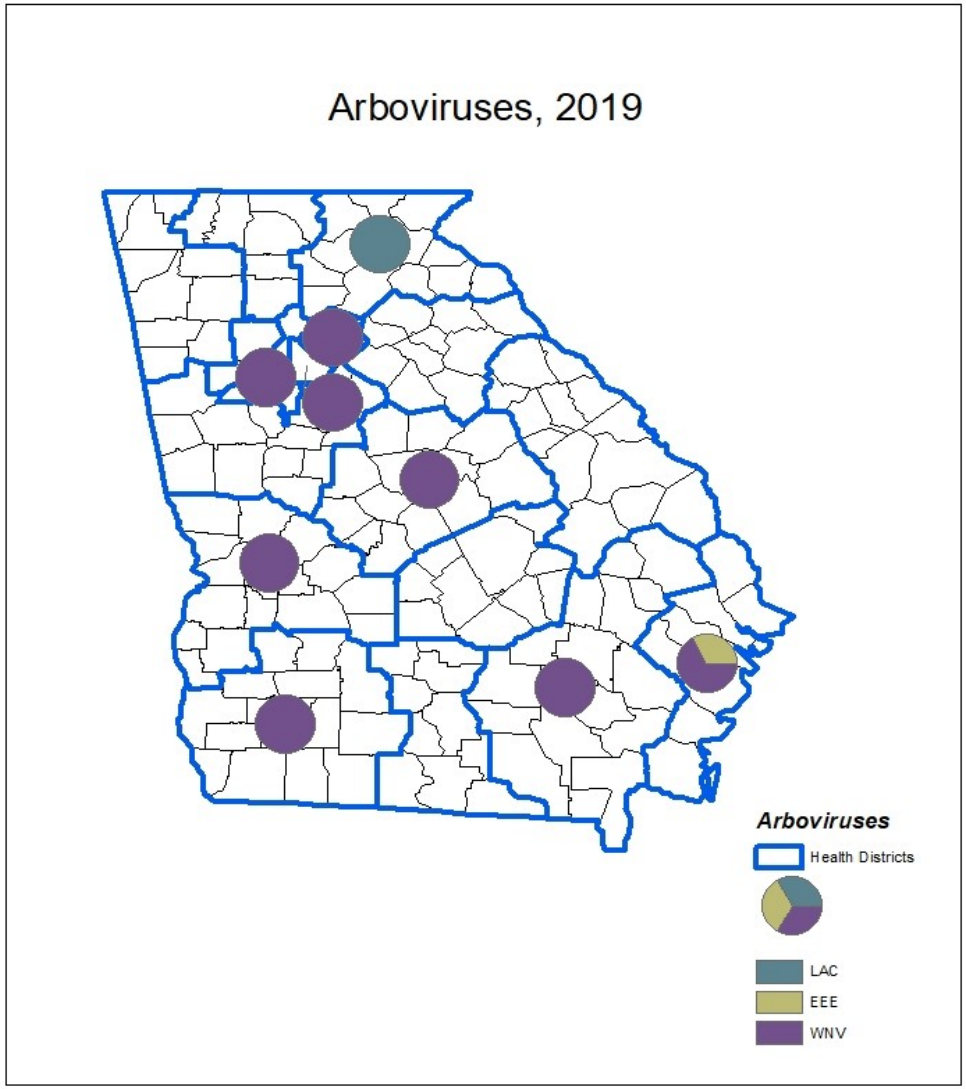
age range	WNND	WNF	Asymptomatic
0-10	1		
11-20			1
21-30	1		
31-40	1		
41-50	2	1	
51-60		2	1
61-70	1	1	
71-80	2		
>80	1	1	
TOTAL	**9**	**5**	**2**

Table 2: Clinical Syndromes, 2019

	Virus					
Diagnosis	**CHIK**	**DEN**	**EEE**	**LAC**	**WNV**	**ZIKV**
ASYMPTOMATIC					2	4
Dengue		5				
ENCEPHALITIS			1	1	1	
FEVER		1			5	2
MENINGITIS					2	
Other, neuroinvasive					6	
Other, clinical	1					

2019

	# cases (including asymptomatic)			
District	**LAC**	**EEE**	**WNV**	**Total**
1-2				
2-0	1			1
3- (1,2,3,4,5)			9	9
4-0				
5-2			1	1
6-0				
7-0			1	1
8-1				
8-2			1	1
9-1		1	3	4
9-2			1	1
Grand Total	1	1	16	18

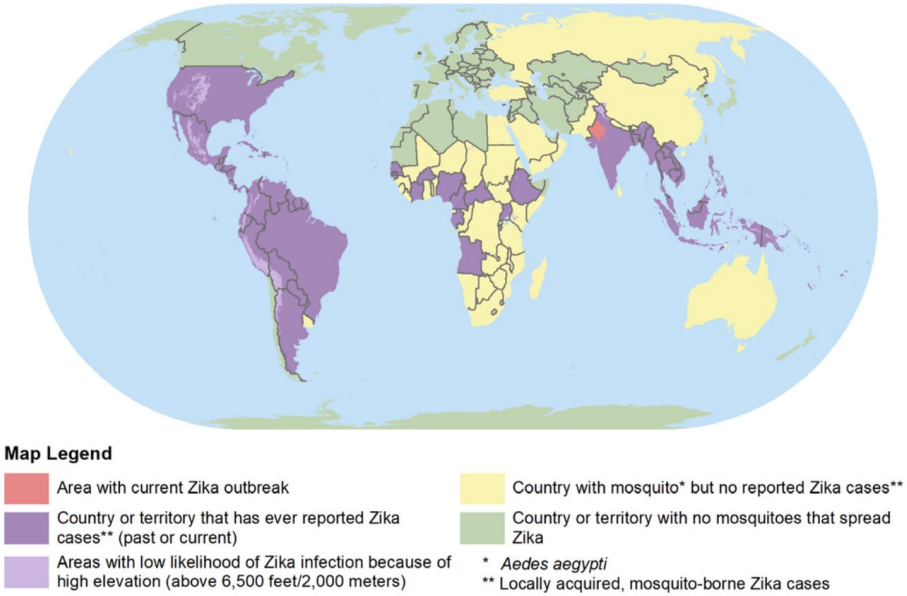


Cases by Year (includes asymptomatic cases*)				
Year	EEE	SLE	LAC	WNV
2001	2			6
2002			1	45
2003	2		1	55
2004			5	23
2005	1		1	24
2006	1		1	11
2007	1		3	55
2008			2	12
2009			2	6
2010			2	14
2011			2	25
2012	1			117
2013	1		2	20
2014			2	13
2015			2	15
2016	1			13
2017	2		2	63
2018	1	1		38
2019	1		1	16
Grand Total	14	1	29	571

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.

The recent global (re)emergence of arthropod-borne viruses (arboviruses), such as chikungunya and Zika virus, was widely reported in the media as though it was a new phenomenon. This is not the case. Arboviruses and other human microbial pathogens have been (re) emerging for centuries. The major difference today is that arbovirus emergence and dispersion are more rapid and geographically extensive, largely due to intensive growth of global transportation systems, arthropod adaptation to increasing urbanization, our failure to contain mosquito population density increases and land perturbation.

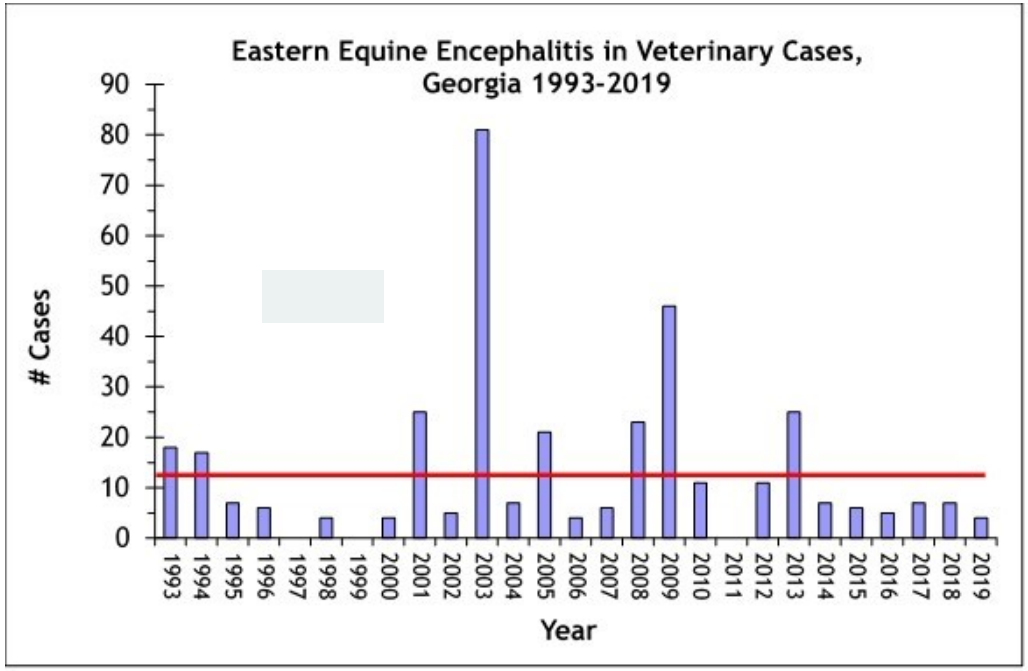


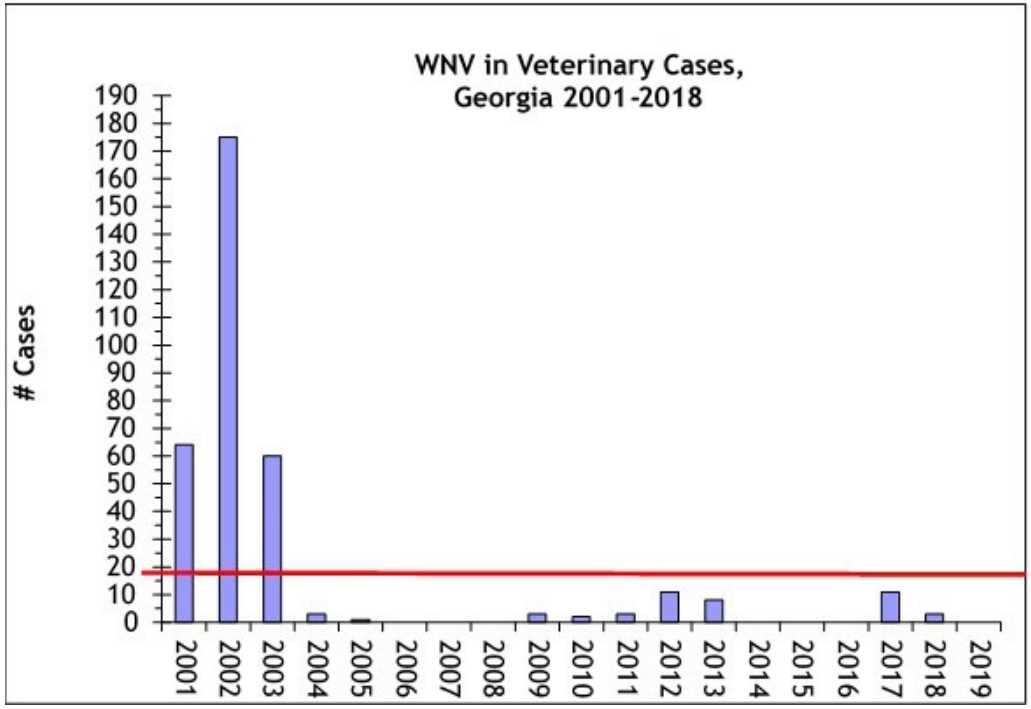
Veterinary Data

No horses tested positive for WNV in 2019. 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.

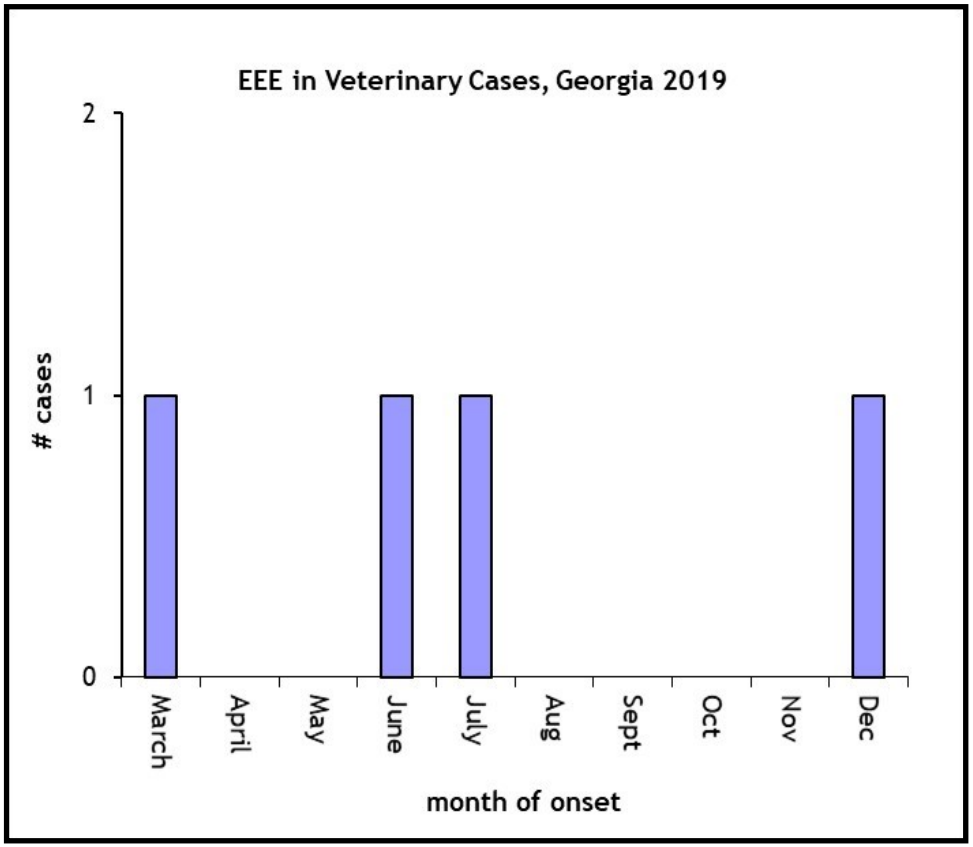
Four horses tested positive for EEE in 2019. Eastern equine encephalitis is endemic in the Coastal and Coastal Plains areas of Georgia. During an average year, four or five EEE+ horses are reported from these areas. The true number of horse cases is probably higher, and lack of reporting is due primarily to undertesting, 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.





	EEE Vaccination Status			
County	**unknown**	**unvaccinated**	**vaccinated**	**Grand Total**
Lowndes		1		1
	1			1
Dooly		1		1
Irwin		1		1
Grand Total	**1**	**3**	**0**	**4**



Eastern Equine Encephalitis (EEE) virus is a rare cause of brain infections (encephalitis). Only a few cases are reported in the United States each year. Most occur in eastern or Gulf Coast states. Approximately 30% of people with EEE die and many survivors have ongoing neurologic problems.

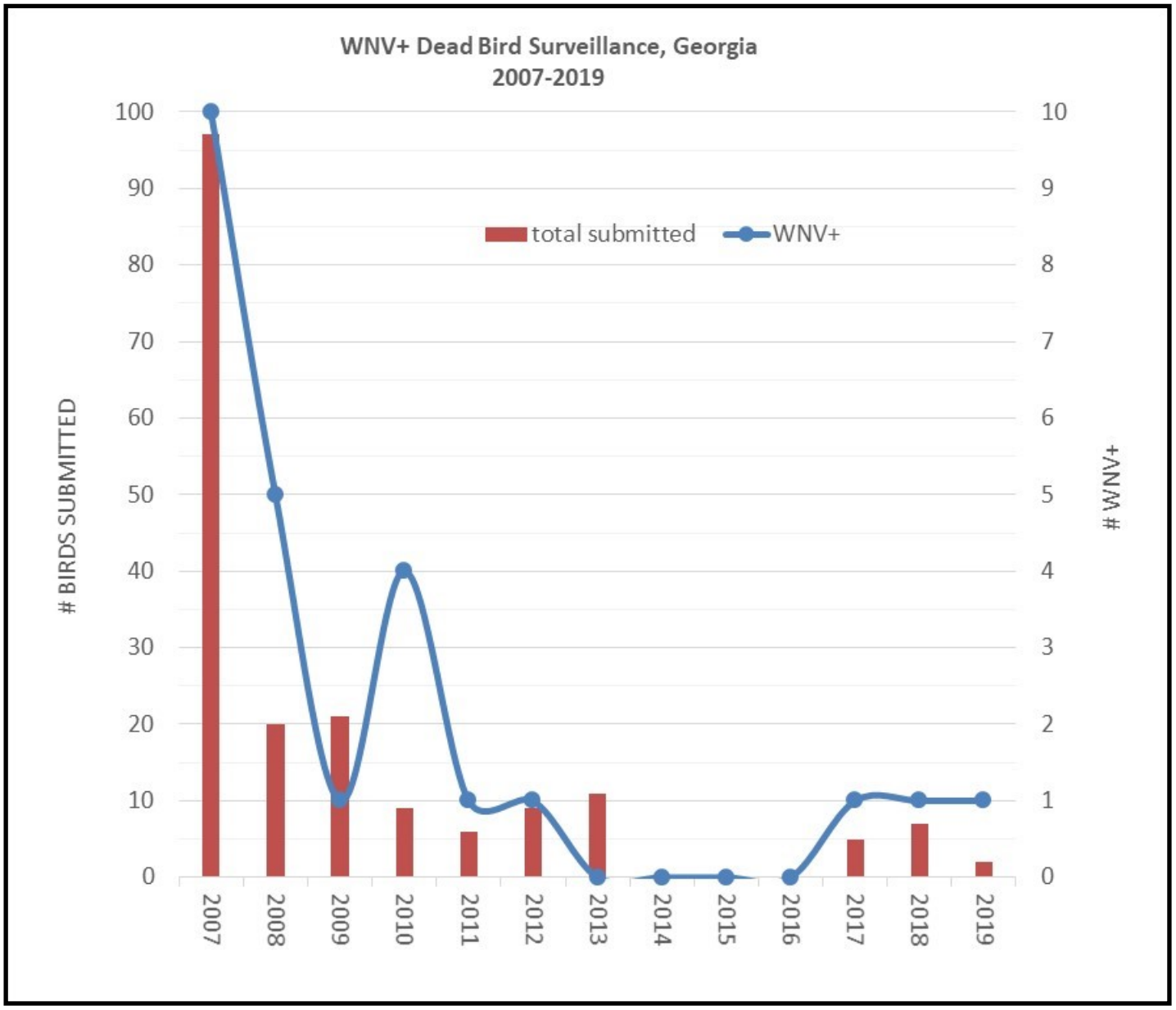
As of December 17, 2019, CDC has received reports of 38 confirmed cases of Eastern equine encephalitis virus disease for this year, including 15 deaths. Cases have been reported from the following ten states: Alabama (1), Connecticut (4), Georgia (1), Indiana (1), Massachusetts (12), Michigan (10), New Jersey (4), North Carolina (1), Rhode Island (3), and Tennessee (1).

EEE is vector borne. This virus is transmitted by mosquitoes or other biting insects. Birds act as reservoirs for the virus; mosquitoes and other biting insects then carry the pathogen from infected birds and transmit it to horses or humans when they bite. A horse affected with EEE is not contagious and poses no risk to other horses, humans or birds. Morbidity rate in horses infected with EEE is 75-95%.

Clinical signs and symptoms:

- Depression and anorexia without fever when initially infected
- Moderate to high fever 102.5-104.5F (39.17-40.28C)
- Lack of appetite
- Lethargy/drowsiness
- Neurologic signs- Onset of neurologic disease is frequently sudden and progressive
    - ◊ Periods of hyperexcitability, apprehension and/or drowsiness
    - ◊ Fine tremors and fasciculations of the face and neck muscles
    - ◊ Convulsions
    - ◊ Cranial nerve paralysis-- facial paralysis and weakness of the tongue are very common
    - ◊ Head tilt, droopy lip, muzzle deviation
    - ◊ Weakness, ataxia, and dysmetria (incoordination) in one or all limbs
    - ◊ Complete paralysis of one or more limbs
    - ◊ Colic
    - ◊ Recumbency (inability to stand)
    - ◊ Death

Dead Bird Surveillance



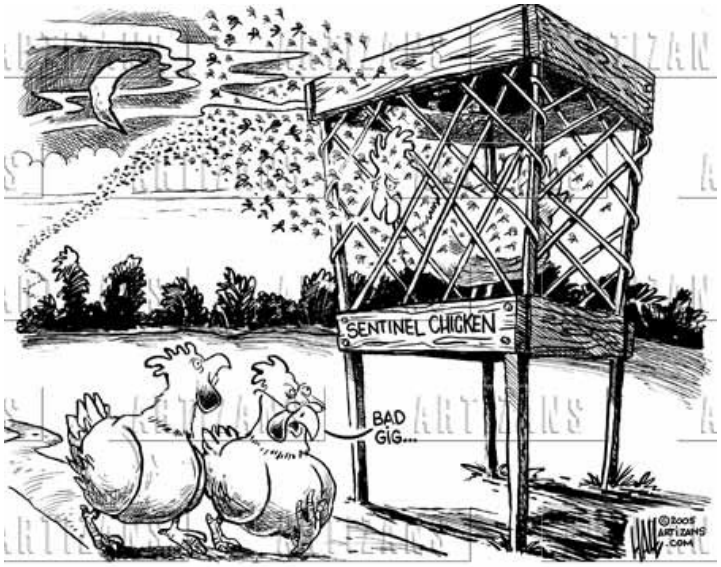
As of 2012, federal funding was no longer available to test birds; no birds were reported as submitted for testing between 2014 and 2016. In 2019, 2 birds were submitted for testing from one county; 1 tested WNV+.

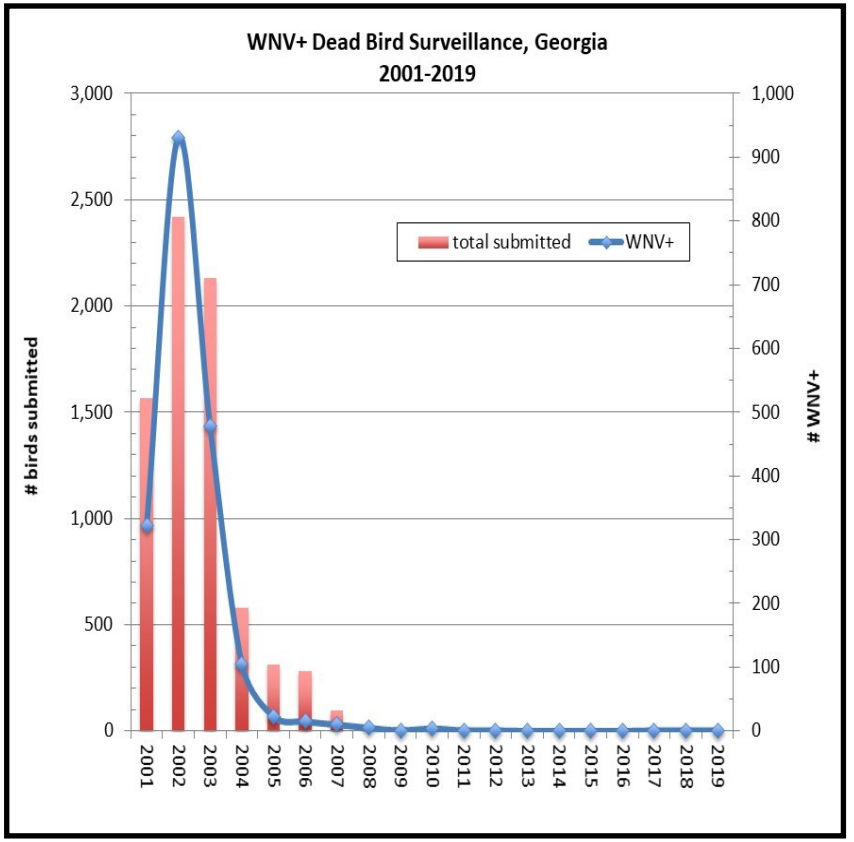
Dead bird surveillance continues to lose ground as a surveillance tool, and even more so now when no funding is available at the State level to support testing; most counties do not have the resources to pick up and ship birds for testing in any case. Bird testing does continue to have some utility,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

Sentinel chickens are used primarily for detection of the mosquito-borne Eastern Equine Encephalitis virus, which causes disease in people, horses and other animals. That's because chickens become infected with EEE if bitten by mosquitoes, but don't develop symptoms of the disease and don’t produce enough virus to infect mosquitoes. Their bodies develop antibodies to EEE within a week of being bitten by an infected mosquito. Public health officials know that the potentially deadly disease is in a particular vicinity because of the sentinel chickens' response. In some areas, chickens are also used to monitor for the presence of another viral disease, West Nile virus.

In 2019, CCMC reported 1 WNV+ sentinel chicken.

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





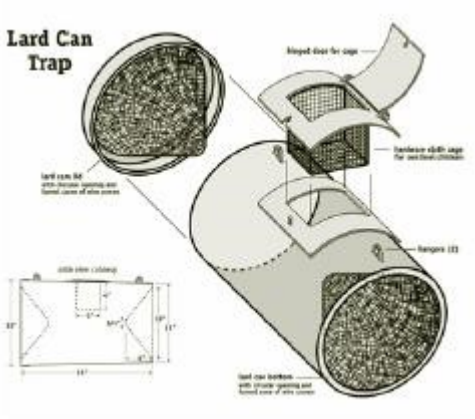
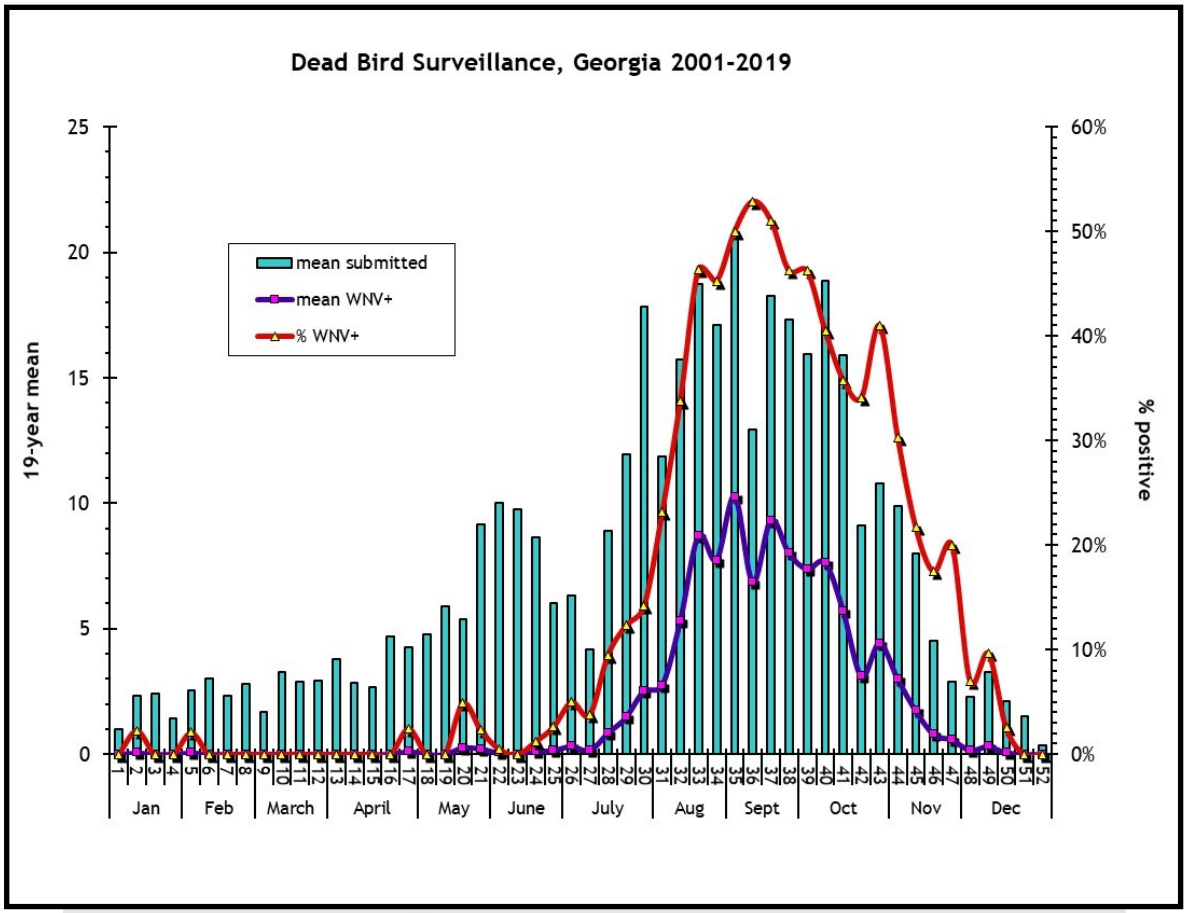
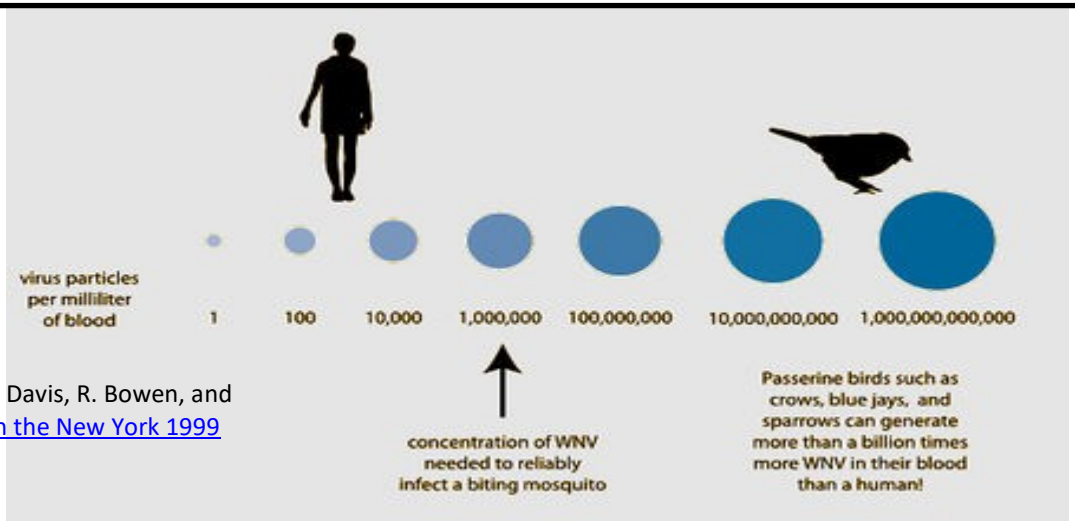


Table of West Nile Virus host competency of 23 species of birds. A larger index number correlates to higher amounts of viral load in concurrence with long durations of viremia. Data adapted from Komar et al. 2003.

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.

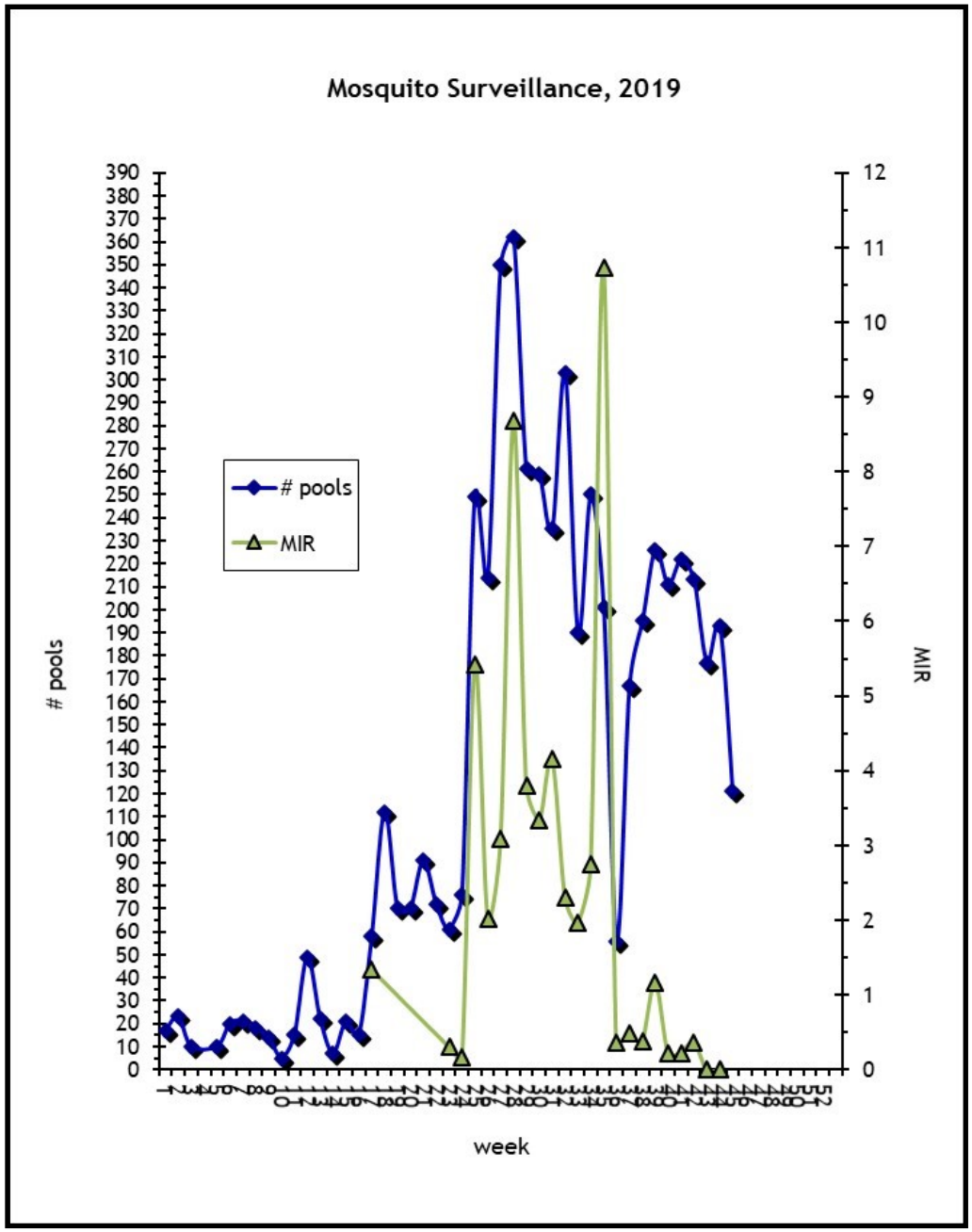
Mosquito Surveillance

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. Ten counties sent mosquitoes to SCWDS for testing in 2019. 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 5532 pools of mosquitoes (128899 individuals) were sent for testing in 2019, with results reported to the GDPH. Three species were found to be WNV+, *Culex nigripalpus* (1 pool), *Cx restuans* (2 pools), and *Cx quinquefasciatus* (223 pools). There were also 17 pools of unspecified *Culex* spp found WNV+.

2019 WNV+ Mosquitoes

county	# mosquitoes submitted	WNV+ pools	MIR
Chatham	50384	192	3.81
DeKalb	12766	30	2.35
Glynn	43108	12	0.28
Lowndes	18588	5	0.27
Fulton	2432	4	1.64
Muscogee	926		
Echols	265		
Coweta	140		
Richmond	113		
Henry	100		
Spalding	40		
Brooks	37		
Grand Total	**128899**	**243**	



In 2019, the first WNV+ mosquitoes were detected in Lowndes County in late April. The last WNV+ pools were collected in Chatham and Glynn counties in October. Peaks in numbers of WNV+ pools occurred in July. One WNV+ pool was collected from a CDC light trap. The rest (242) of the WNV+ mosquitoes were caught in gravid traps.

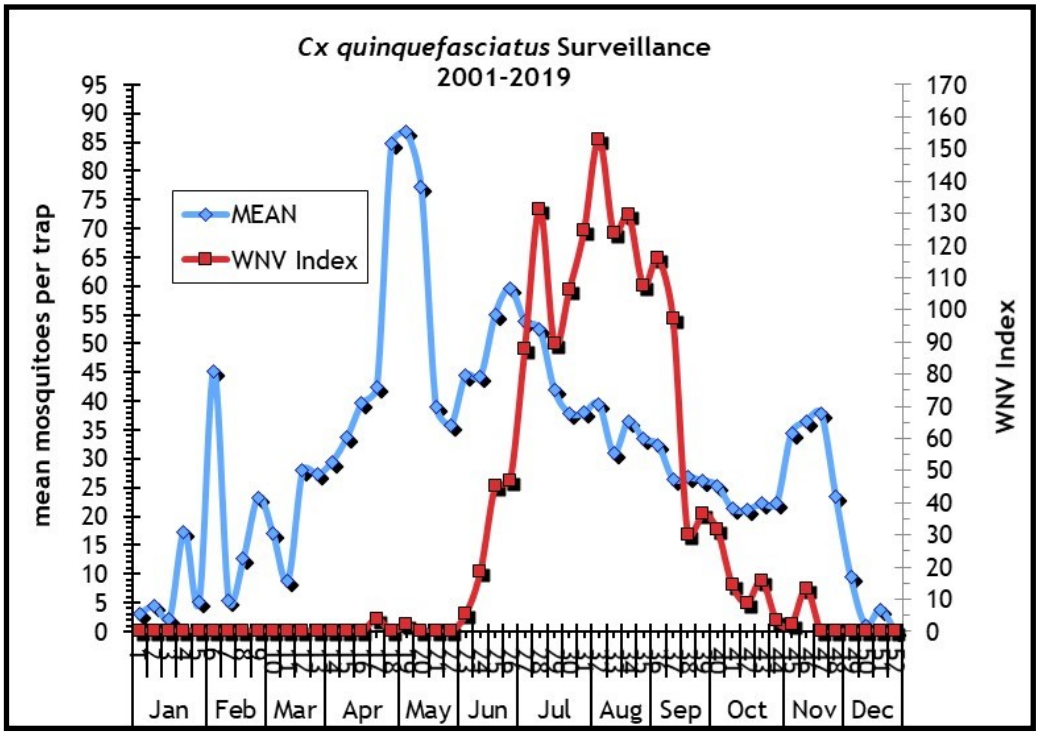
The Vector Index (VI) equals the MIR times the number of vectors per trap night . It is a Measure of infectivity that takes into account the following information:

- **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.

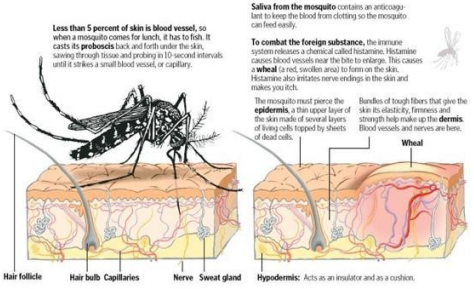
The Minimum Infection Rate or MIR = (# WNV+ Pools/Total # Mosquitoes Tested) X 1000. The WNV Index is the MIR multiplied by the number of mosquitoes per trap night. An MIR of 0 suggests that there is no viral activity in the area. An MIR of 0.1 to 3.9 indicates that some viral activity is present, and 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 2018 ranged from 0.2 to 4.9, with an average of 1.24.

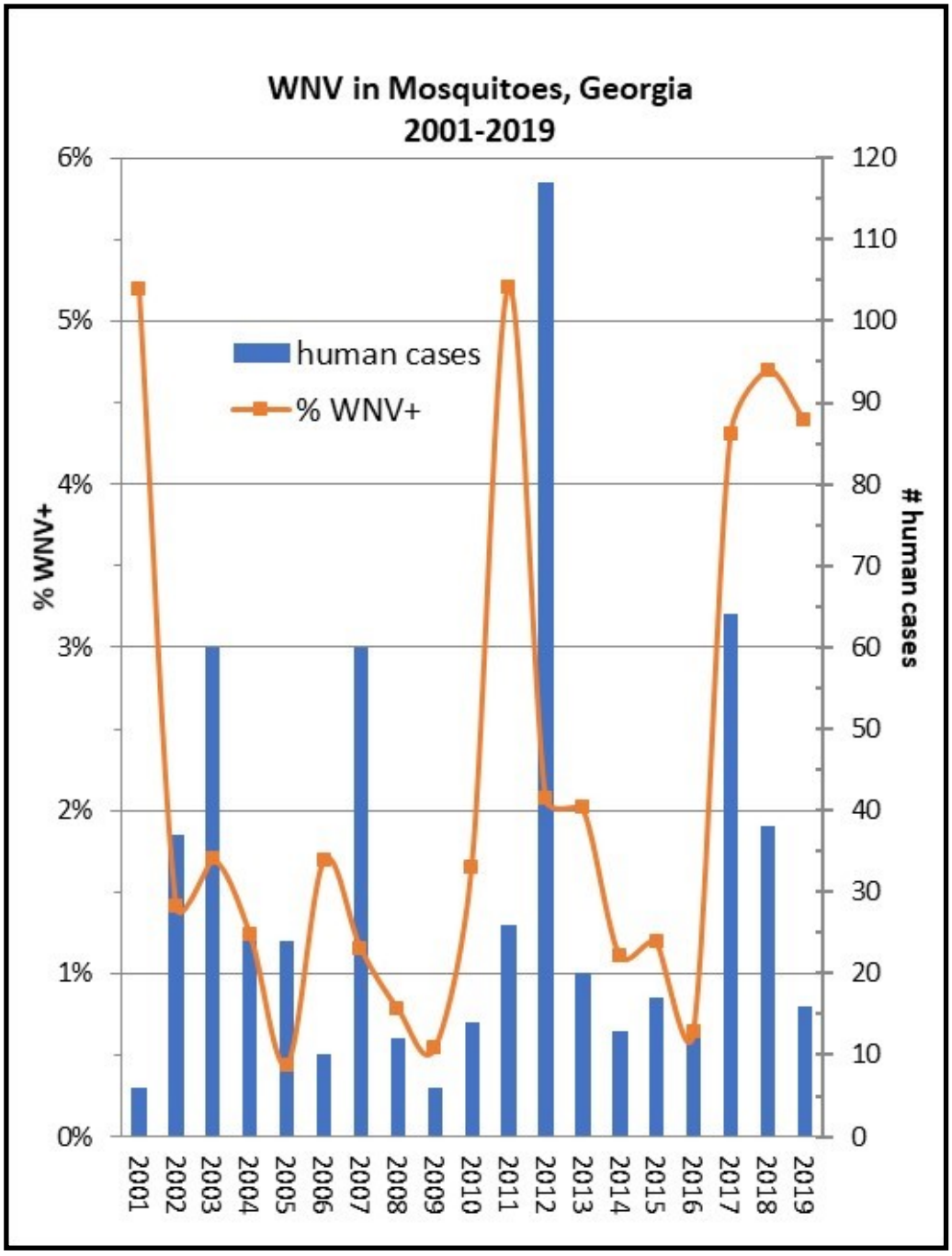


year	WNV Index	WNV+ Pools	human cases
2001	146.3	31	6
2002	106.6	57	37
2003	50.7	105	60
2004	40.7	126	24
2005	17.7	67	24
2006	31.5	81	10
2007	29.9	75	60
2008	25.3	50	12
2009	13.7	24	6
2010	47.7	99	14
2011	179.6	397	26
2012	64.3	125	117
2013	72.0	150	20
2014	43.6	56	13
2015	37.0	40	17
2016	22.8	36	13
2017	148.0	276	64
2018	202.3	310	38
2019	113.4	243	16

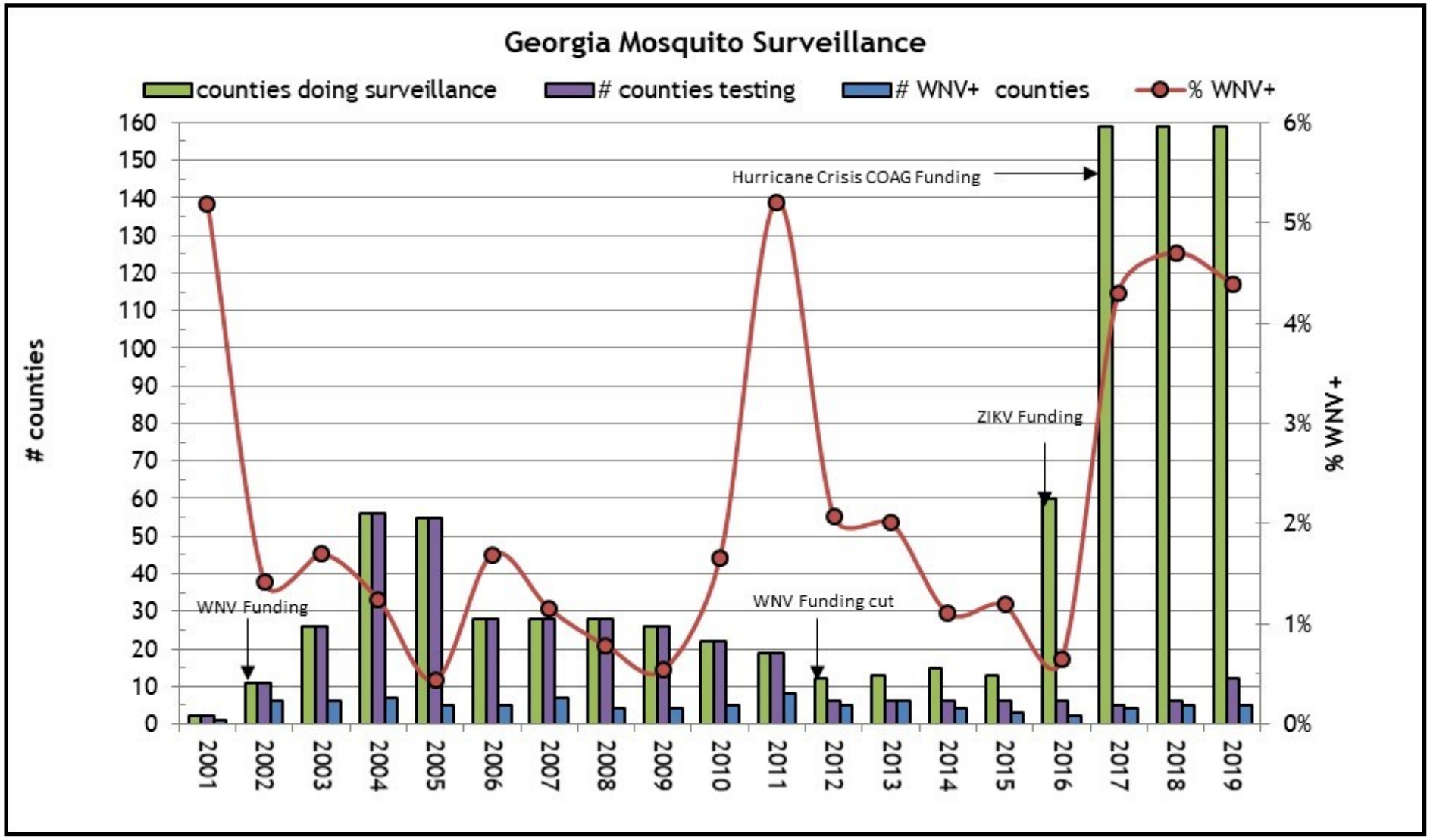
2001-2019	human cases	WNV+ mosquito pool	veterinary case	positive bird
total	572	2504	344	1899
mean	30.1	131.8	18.1	99.9



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	6419	276	4.3%	64
2018	6599	310	4.7%	38
2019	5532	243	4.4%	16
MEAN	6211.7	123.6	2.0%	30.4
TOTAL	118023	2348	37%	577



year	WNV+ pools	EEE+ pools	counties doing surveillance	# counties testing	# WNV+ counties	total mosquito pools tested	% WNV+
2001	30		2	2	1	597	5.2%
2002	91		11	11	6	4032	1.4%
2003	106	1	26	26	6	6177	1.7%
2004	126	2	56	56	7	10161	1.2%
2005	67	8	55	55	5	15248	0.4%
2006	81		28	28	5	4785	1.7%
2007	75		28	28	7	6513	1.2%
2008	51	1	28	28	4	6383	0.8%
2009	24		26	26	4	4446	0.5%
2010	99	3	22	22	5	5990	1.7%
2011	438		19	19	8	7622	5.2%
2012	125	3	12	6	5	6042	2.1%
2013	166	1	13	6	6	7453	2.0%
2014	56	2	15	6	4	5038	1.1%
2015	40		13	6	3	3366	1.2%
2016	36		60	6	2	5620	0.6%
2017	276	2	159	5	4	6419	4.3%
2018	310	3	159	6	5	6598	4.7%
2019	243		159	12	5	5532	4.4%


Georgia Mosquito Surveillance
counties doing surveillance
counties testing
WNV+ counties
% WNV+
# counties
% WNV+
Hurricane Crisis COAG Funding
ZIKV Funding
WNV Funding
WNV Funding cut
0
10
20
30
40
50
60
70
80
90
100
110
120
130
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Mosquito Surveillance: Untested Mosquitoes

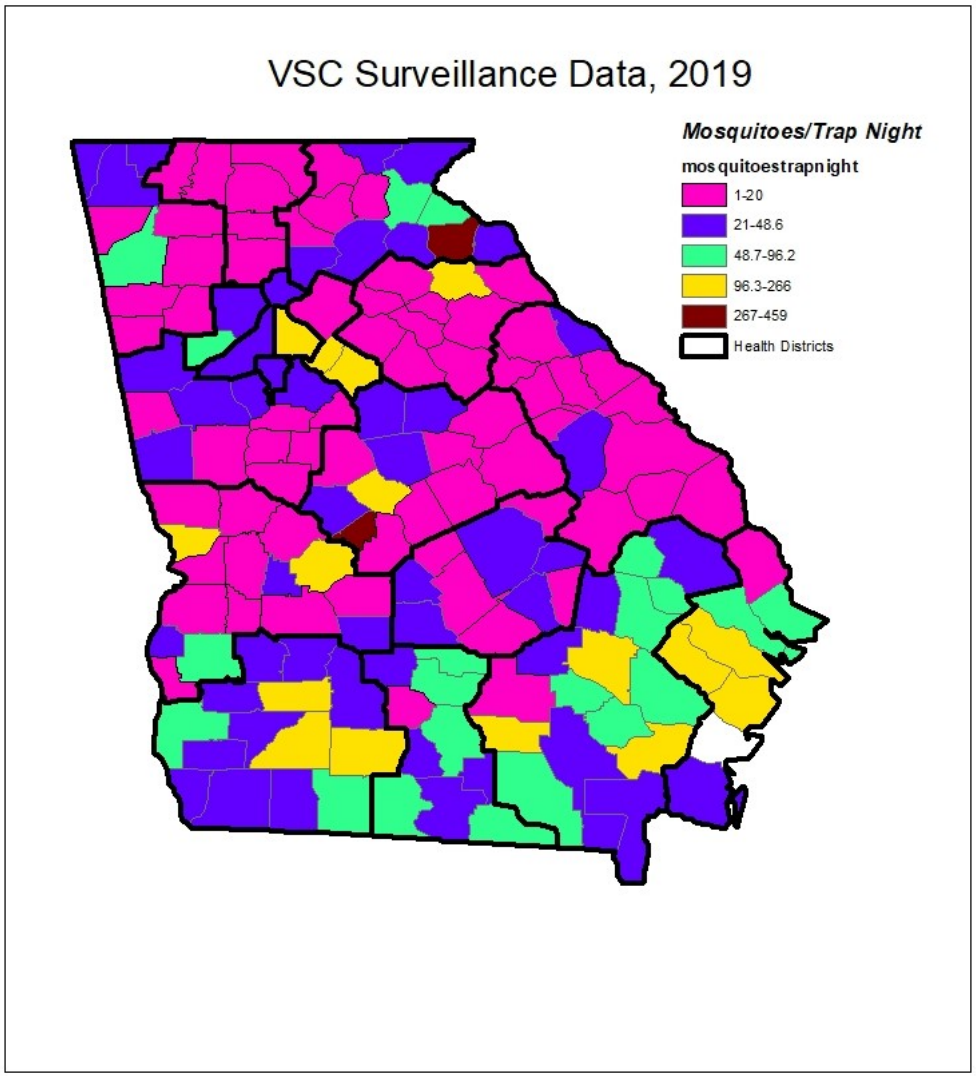
After the loss of WNV funding, mosquitoes collected during surveillance by the GDPH were no longer sent for testing. These mosquitoes are identified and the data are shared with the county mosquito control agency to assist with control efforts. ZIKV funding, followed by Hurricane Crisis CoAg funding allowed GDPH to create 5 Vector Surveillance Coordinator positions and hire a second entomologist in order to increase our ability to do surveillance and to respond to mosquito complaints and arboviral disease issues. Starting in 2017, some level of surveillance was done in every county in Georgia. In 2019, mosquitoes were sent for testing from 12 counties.

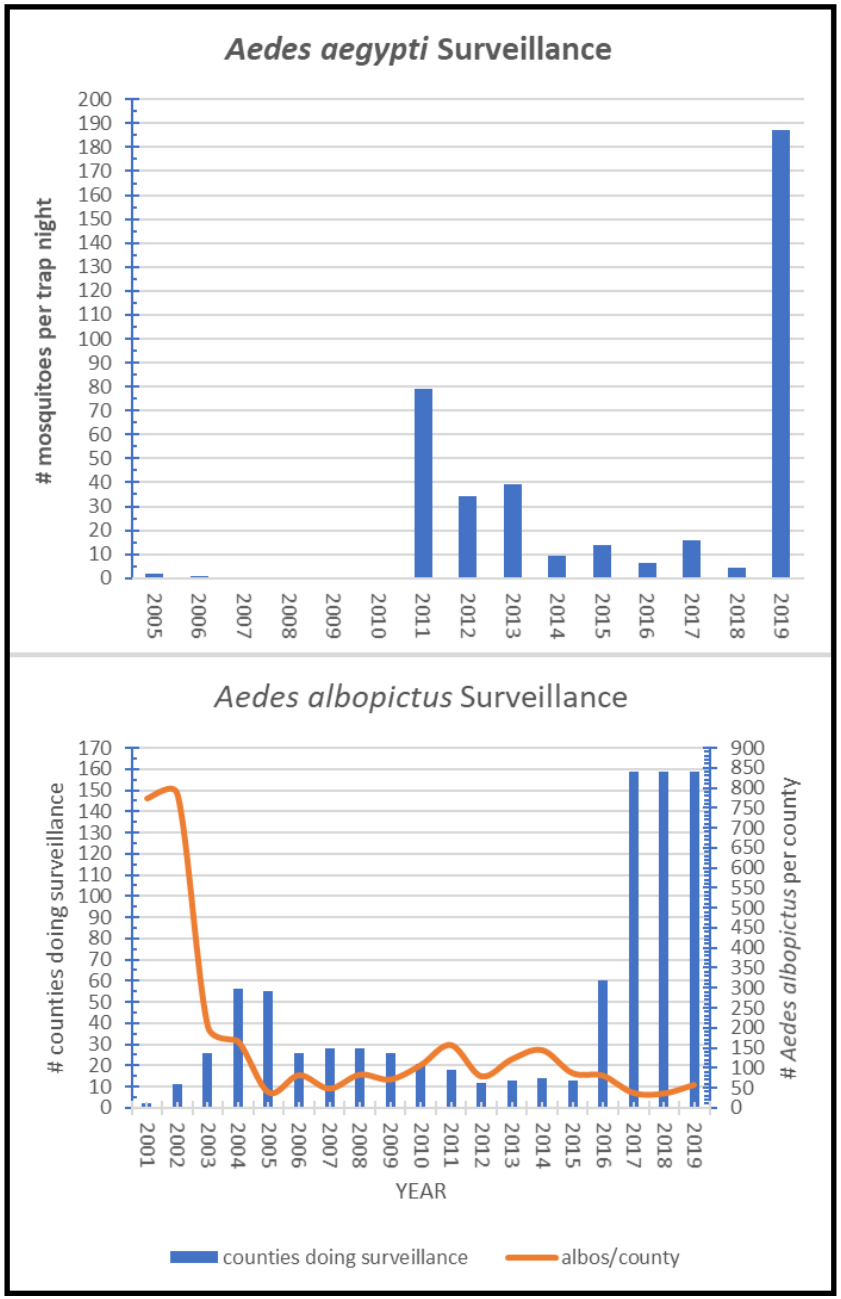
Month	# mosquitoes
January	248
February	273
March	6911
April	16220
May	19961
June	11578
July	14251
August	16313
September	15099
October	17836
November	2442
December	798
Grand Total	**121930**

Month	# trap nights
January	18
February	20
March	186
April	270
May	375
June	376
July	326
August	353
September	237
October	336
November	67
December	20
Grand Total	**2584**

Month	# mosquitoes/trap night
January	13.78
February	13.65
March	37.16
April	60.07
May	53.23
June	30.79
July	43.71
August	46.21
September	63.71
October	53.08
November	36.45
December	39.90
Mean	**40.98**

Mosquito Surveillance





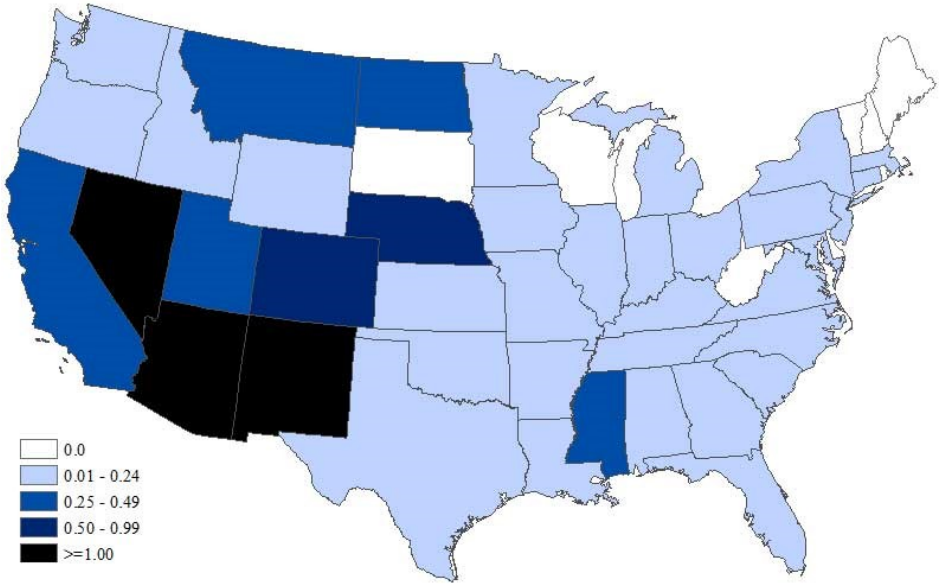
Species	# mosquitoes
Ae. aegypti	4072
Ae. albopictus	8227
Ae. albopictus (male)	54
Ae. cinereus	1
Ae. vexans	3122
Ae. vexans (male)	5
Aedes/Ochlerotatus spp.	155
An. crucians	8316
An. crucians (male)	3
An. punctipennis	1761
An. punctipennis (male)	5
An. quadrimaculatus	971
An. quadrimaculatus (male)	2
Anopheles spp.	102
Anopheles spp. (male)	10
Cq. perturbans	3678
Cq. perturbans (male)	1
Cs. melanura	1758
Cs. melanura (male)	1
Culex spp.	12372
Culex spp. (male)	260
Cx. coronator	1496
Cx. erraticus	7301
Cx. nigripalpus	8184
Cx. perturbans	3
Cx. quinquefasciatus	39201
Cx. quinquefasciatus (male)	4
Cx. restuans	7322

Species	# mosquitoes
Cx. salinarius	6038
Cx. territans	5
Ma. titillans	79
Oc. atlanticus	458
Oc. atlanticus (male)	1
Oc. atropalpus	3
Oc. canadensis	225
Oc. cinereus	39
Oc. dupreei	2
Oc. fulvus pallens	9
Oc. hendersoni	1
Oc. infirmatus	141
Oc. japonicus	377
Oc. japonicus (male)	2
Oc. mitchellae	1
Oc. sollicitans	50
Oc. sticticus	8
Oc. taeniorhynchus	1892
Oc. triseriatus	214
Oc. triseriatus (male)	2
Oc. trivittatus	51
Or. alba	2
Or. signifera	23
Ps. ciliata	186
Ps. columbiae	1932
Ps. cyanescens	1
Ps. ferox	512
Ps. horrida	*12*

Species	# mosquitoes
Ps. howardii	7
Psorophora spp.	1
Tx. rutilus	12
unknown	234
Ur. lowii	32
Ur. sapphirina	990
Ur. sapphirina (male)	1
TOTAL	**121930**

WNV Activity Map

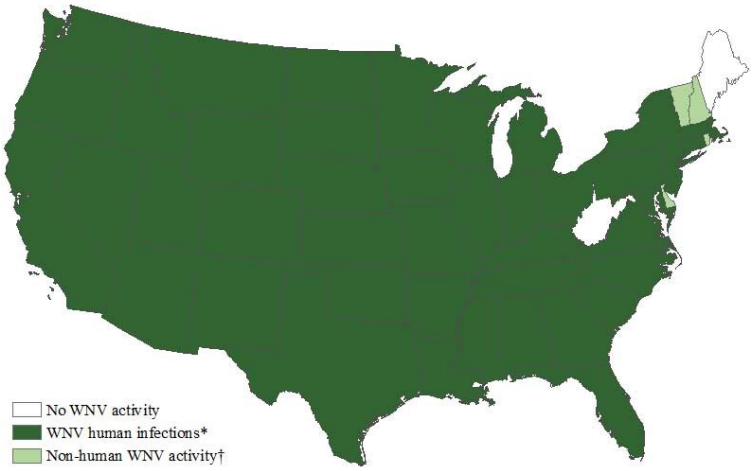
This map shows the incidence of human West Nile virus neuroinvasive disease (e.g., meningitis, encephalitis, or acute flaccid paralysis) by state for 2019 with shading ranging from 0.01-0.24, 0.25-0.49, 0.50-0.99, and greater than 1.00 per 100,000 population.



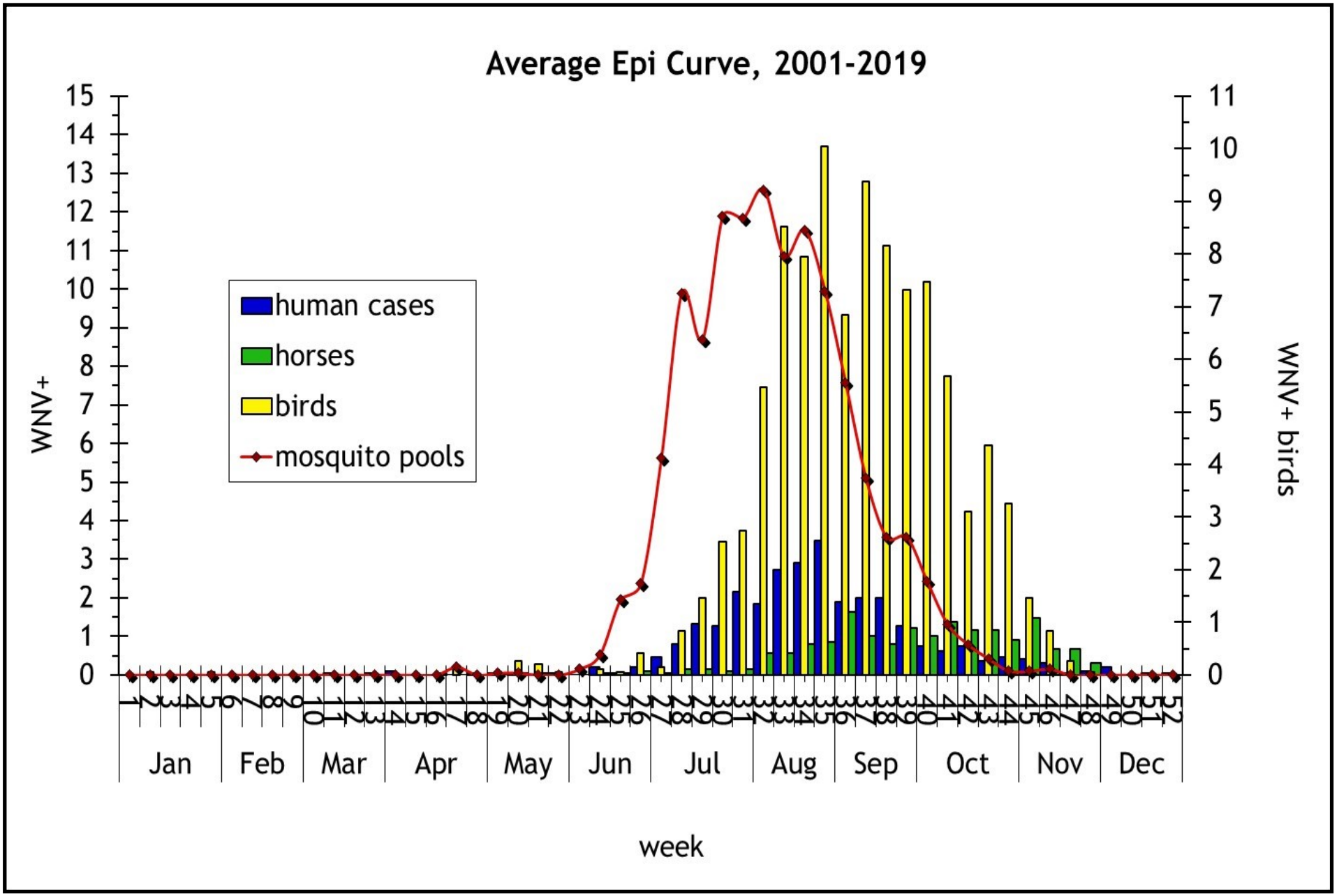
West Nile Virus Neuroinvasive Disease Incidence by State – United States, 2019 (as of January 7, 2020)

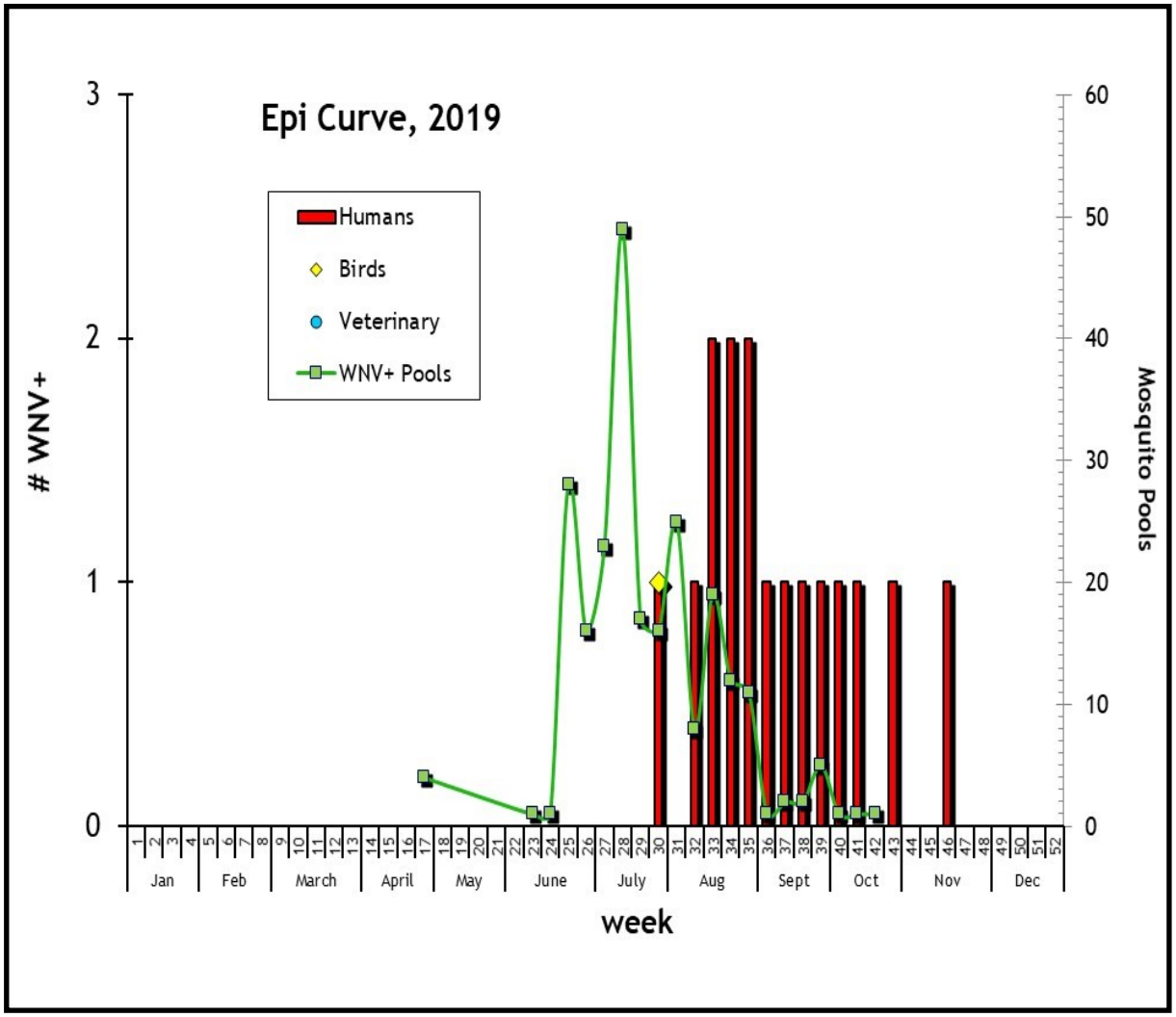
*WNV human disease cases or presumptive viremic blood donors. Presumptive viremic blood donors have a positive screening test which has not necessarily been confirmed.

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



West Nile Virus Activity by State – United States, 2019 (as of January 7, 2020)


Average Epi Curve, 2001-2019
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.

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