

2020—Arbovirus Final Report

Summary of Human West Nile Virus and Other Arboviral Infections, Georgia 2020

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 2002-2019 are available upon request.

In 2020, Georgia reported 8 cases of WNV and 4 WNV presumptive viremic donors (PVD), with no known 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.

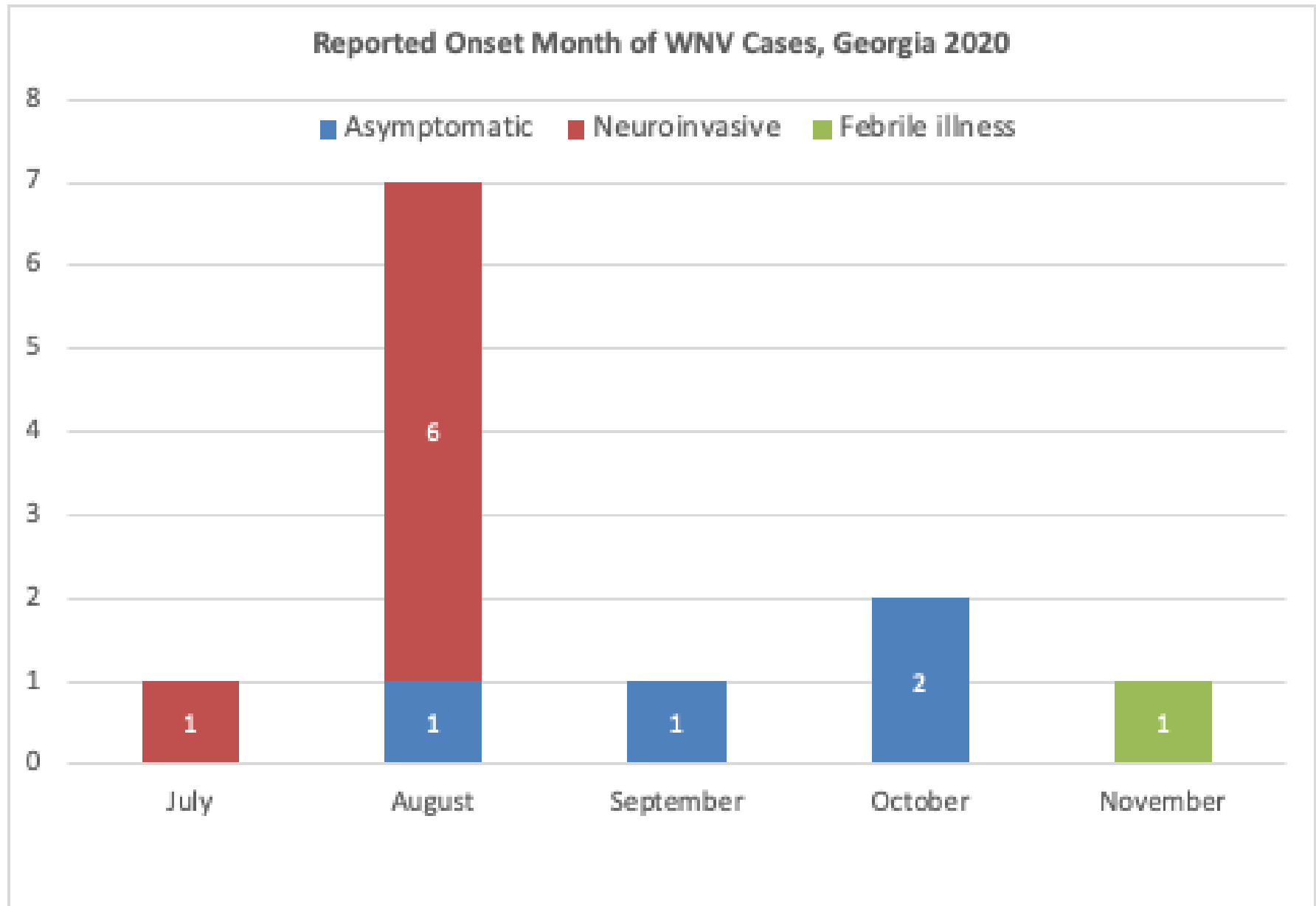
To date, 8 WNV disease cases were reported from 6 counties in 6 public health

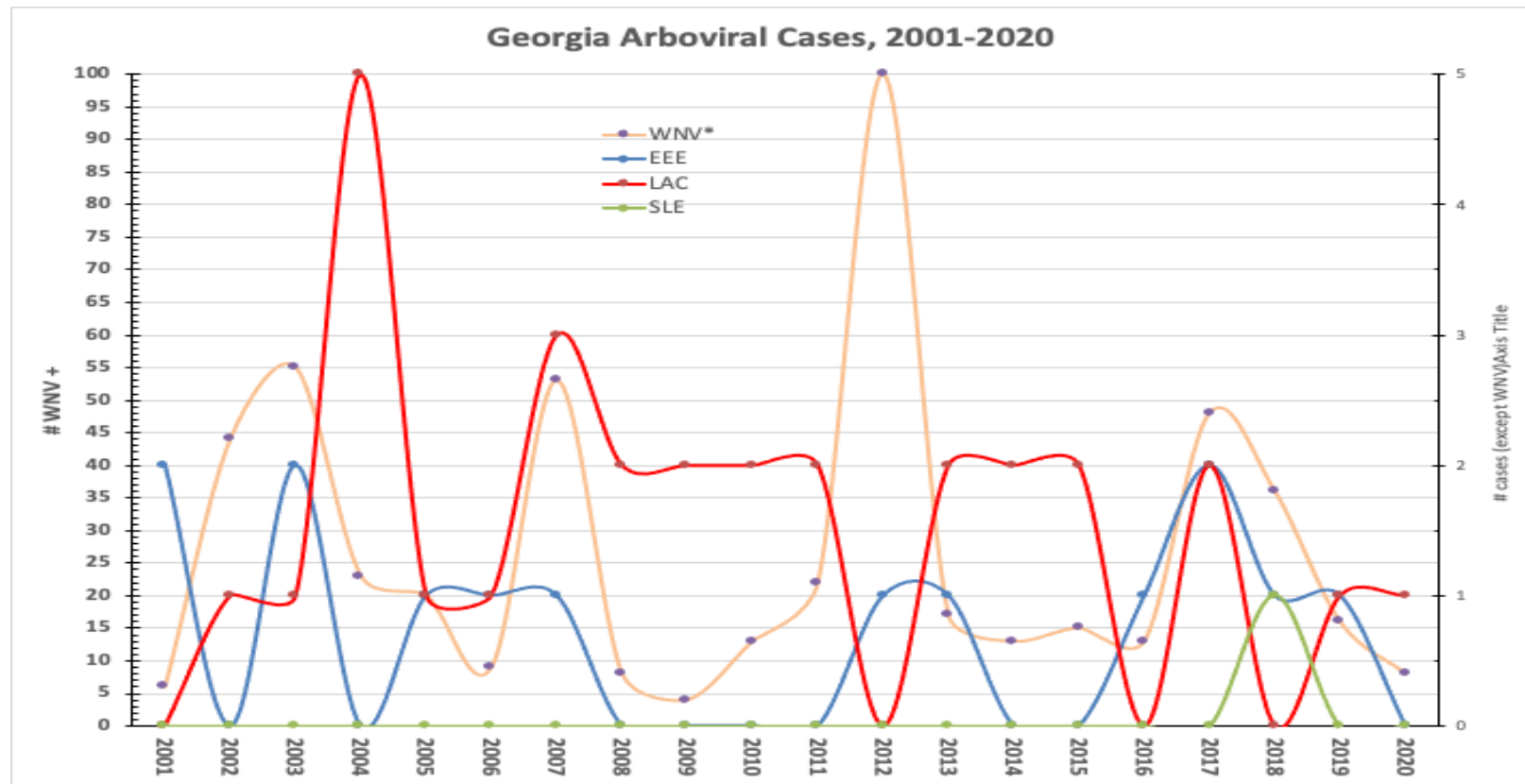
districts. Among these cases, 7 (87.5%) were neuroinvasive, 5 (62.5%) patients had illness onset during July-September and 6 (75%) cases were male. The average patient age of all WNV disease cases was 60.6 (range: 39-84) and the average patient age of all neuroinvasive cases was 61.5 (range: 39-84). The majority of cases were reported in August and September, with a peak in August.

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 2020. This case is suspected to have been infected in North Carolina.

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 2020.

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. In 2020, no travel-related cases of ZIKV were reported. To date there have been no locally transmitted (mosquito to human) cases of Zika. A travel-associated Dengue case was reported in 2020, but no locally-acquired cases were reported. No travel-related cases of CHIK were reported in 2020; no locally-acquired cases of CHIK have ever been reported in Georgia.





*Does not include asymptomatic cases

Table 3: Age Ranges, WNV 2020

age range	WNND/other neurological	WNF	Asymptomatic
0-10			
11-20			
21-30			
31-40	1		1
41-50	2		1
51-60		1	1
61-70	1		1
71-80	2		
>80	1		
TOTAL	7	1	4

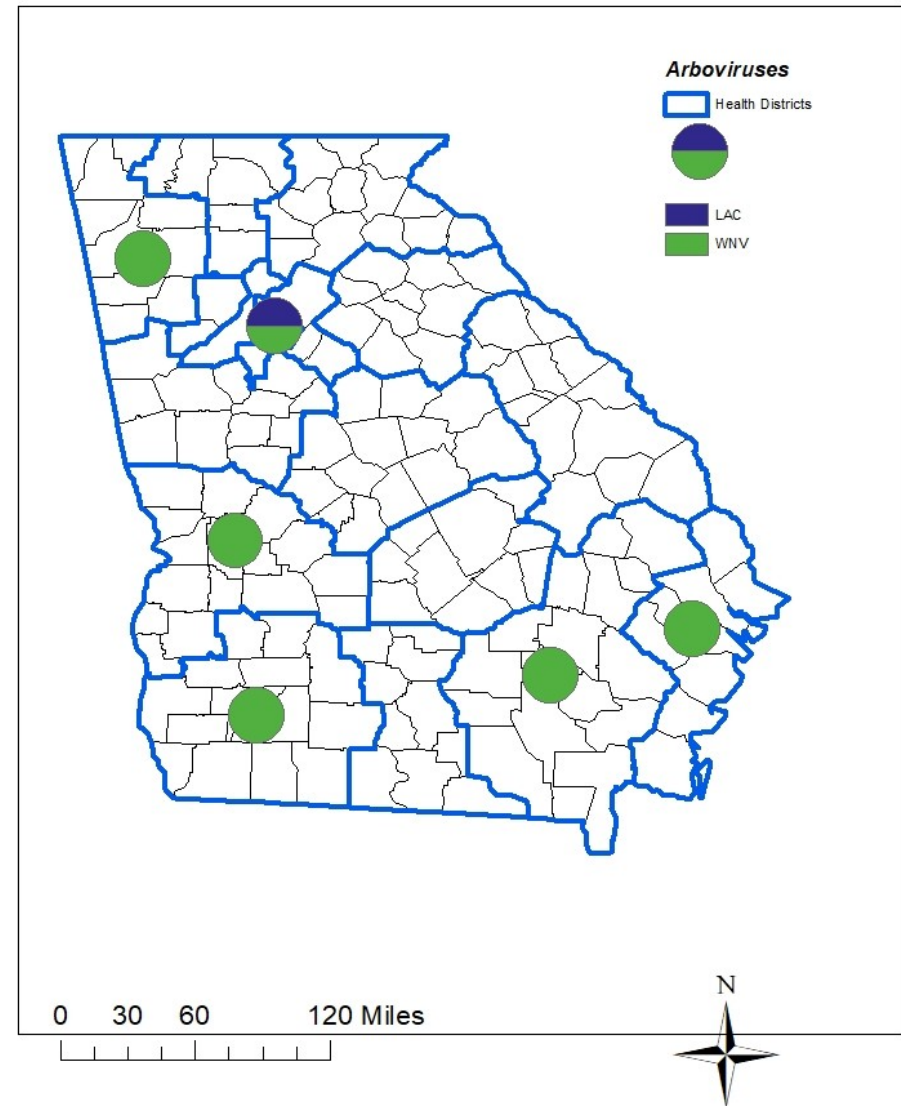
Table 2: Clinical Syndromes, 2020

Diagnosis	Virus		
	DEN	LAC	WNV
Asymptomatic			4
Dengue	1		
Encephalitis		1	2
Fever			1
Meningitis			2
other, neuroinvasive			3
other, clinical			
	1	1	12

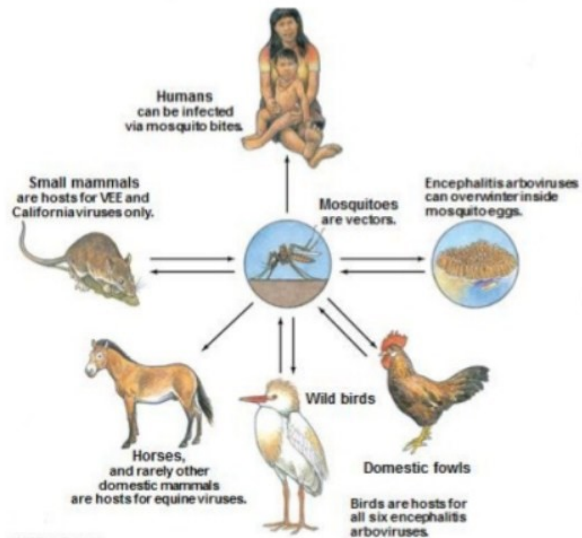
2020

District	# cases (including asymptomatic)			
	LAC	EEE	WNV	TOTAL
1-1			1	1
1-2				0
2-0				0
3- (1,2,3,4,5)	1		1	2
4-0				0
5-1				0
5-2				0
6-0				0
7-0			3	3
8-1				0
8-2			3	3
9-1			2	2
9-2			2	2
TOTAL	1	0	12	13

Arboviruses, 2020



Arboviral (Arthropod-born viruses) encephalitis



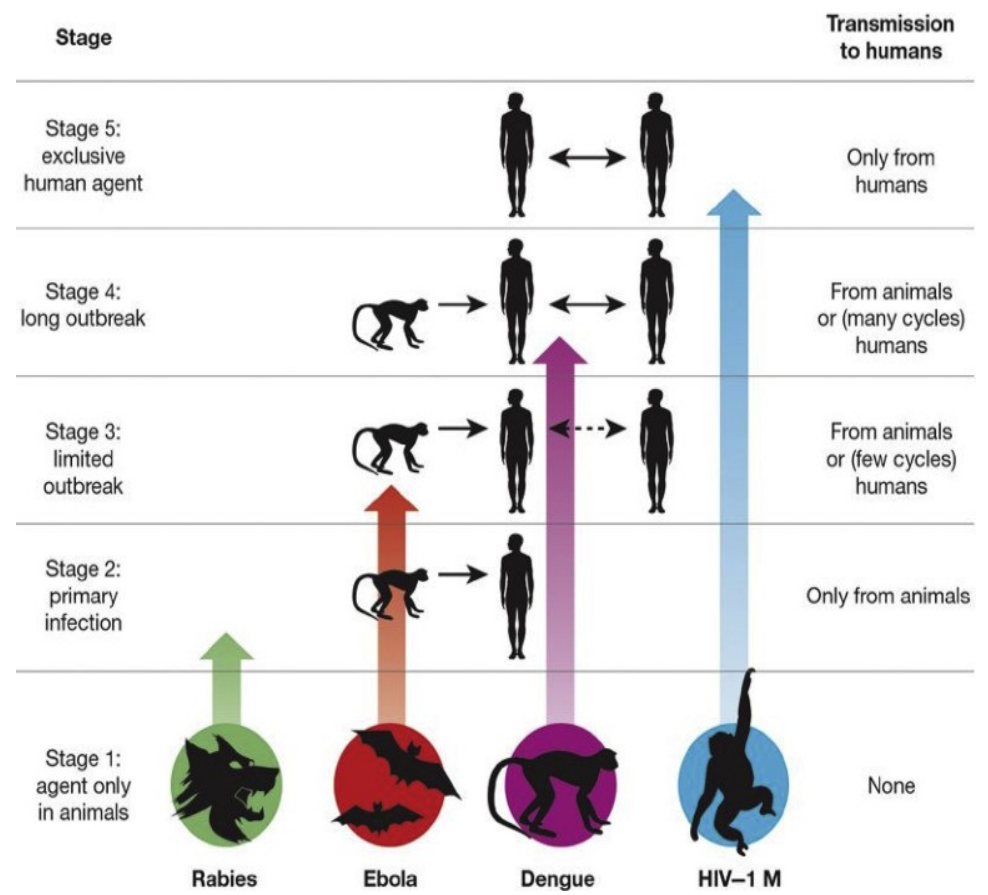
- Zoonotic diseases, typically affect birds, horses, rodents
- Seasonal incidence related to the mosquitoes

Zoonotic Diseases

Zoonotic diseases are those diseases transmitted from animals to humans through direct contact or through food, water, or the environment, contributing to 61% of infectious organisms affecting humans. Zoonotic diseases may be categorized by their ability to spread among humans through 5 stages ranging from only spread among animals (stage 1) to fully human pathogens (stage 5). Fig. 1 illustrates the stages through which pathogens of animals evolve to cause human diseases.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7096727/>

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
2020			1	12
Grand Total	14	1	30	583



Veterinary Data

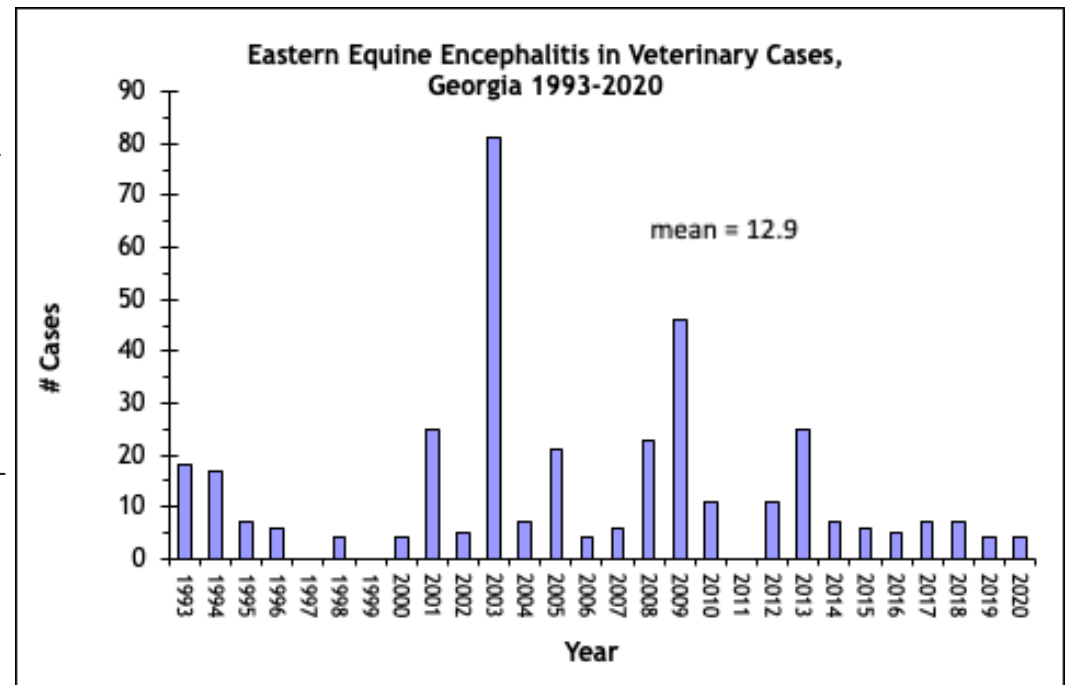
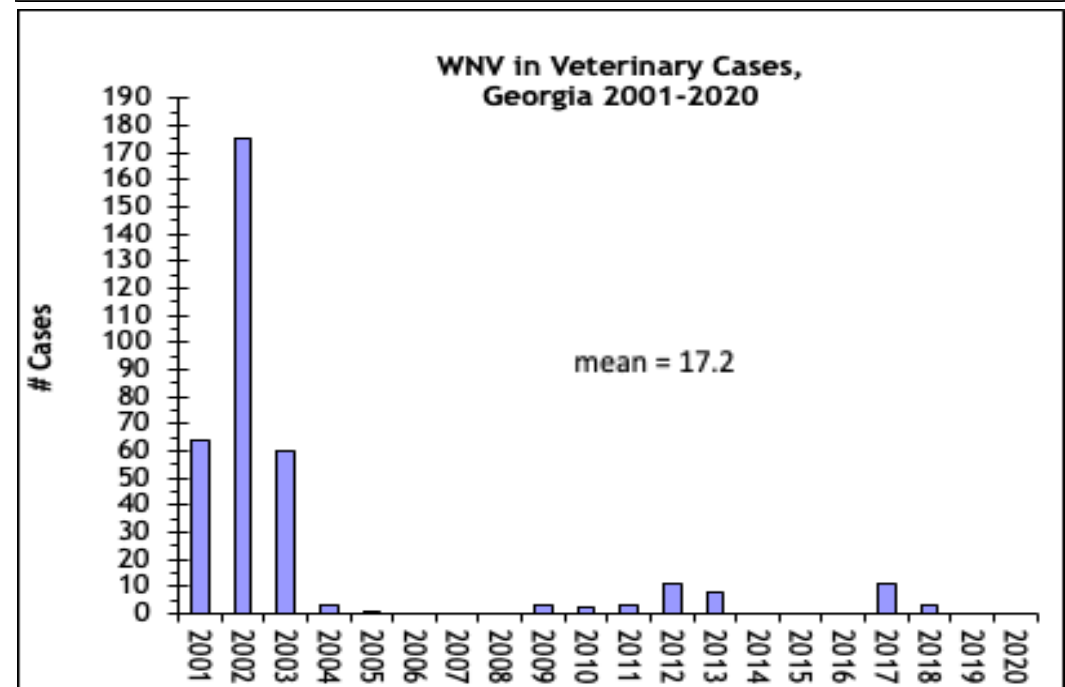
No horses tested positive for WNV in 2020. The number of reported cases of WNV in horses decreased rapidly after 2002, likely due to increased immunity, increased vaccination, and/or decreased testing, but had lately begun to increase again, although somewhat sporadically.

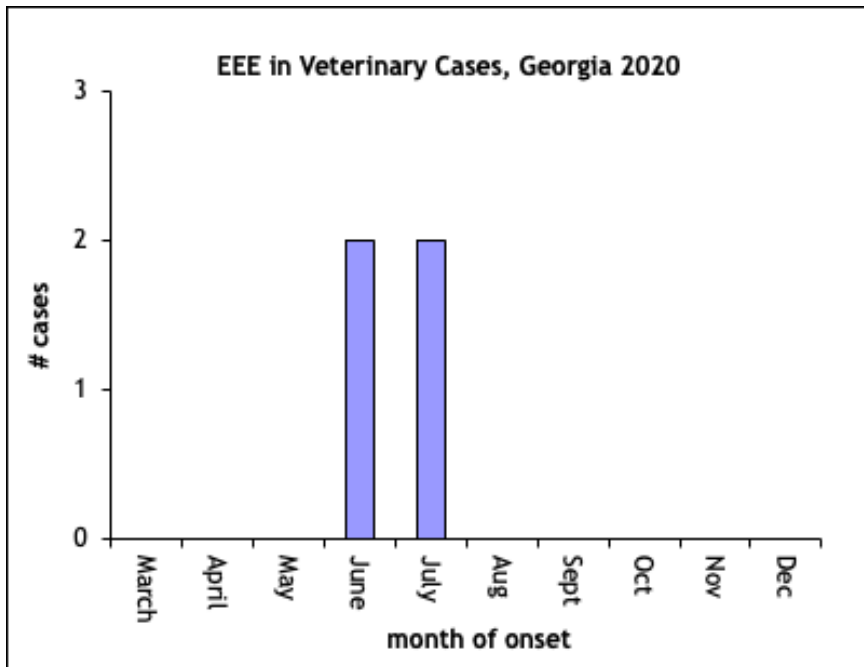
Four horses tested positive for EEE in 2020. Eastern equine encephalitis is endemic in the Coastal and Coastal Plains areas of Georgia. During an average year, four or five EEE+ horses are reported from these areas. The true number of horse cases is probably higher, and lack of reporting is due primarily 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.



County	EEE Vaccination Status			Grand Total
	unknown	unvaccinated	vaccinated	
Thomas		1		1
Long	1			1
Lowndes	1			1
Tift	1			1
Grand Total	3	1	0	4





Eastern Equine Encephalitis (EEE) virus is a rare cause of brain infections (encephalitis). Usually 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 October 20, 2020, CDC has received reports of 9 confirmed human cases of Eastern equine encephalitis virus disease for this year. Cases have been reported from the following states: Indiana (1), Massachusetts (4), Michigan (2), and Wisconsin (2).

EEE is vector borne. This virus is transmitted by mosquitoes. Birds act as reservoirs for the virus; mosquitoes 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%.

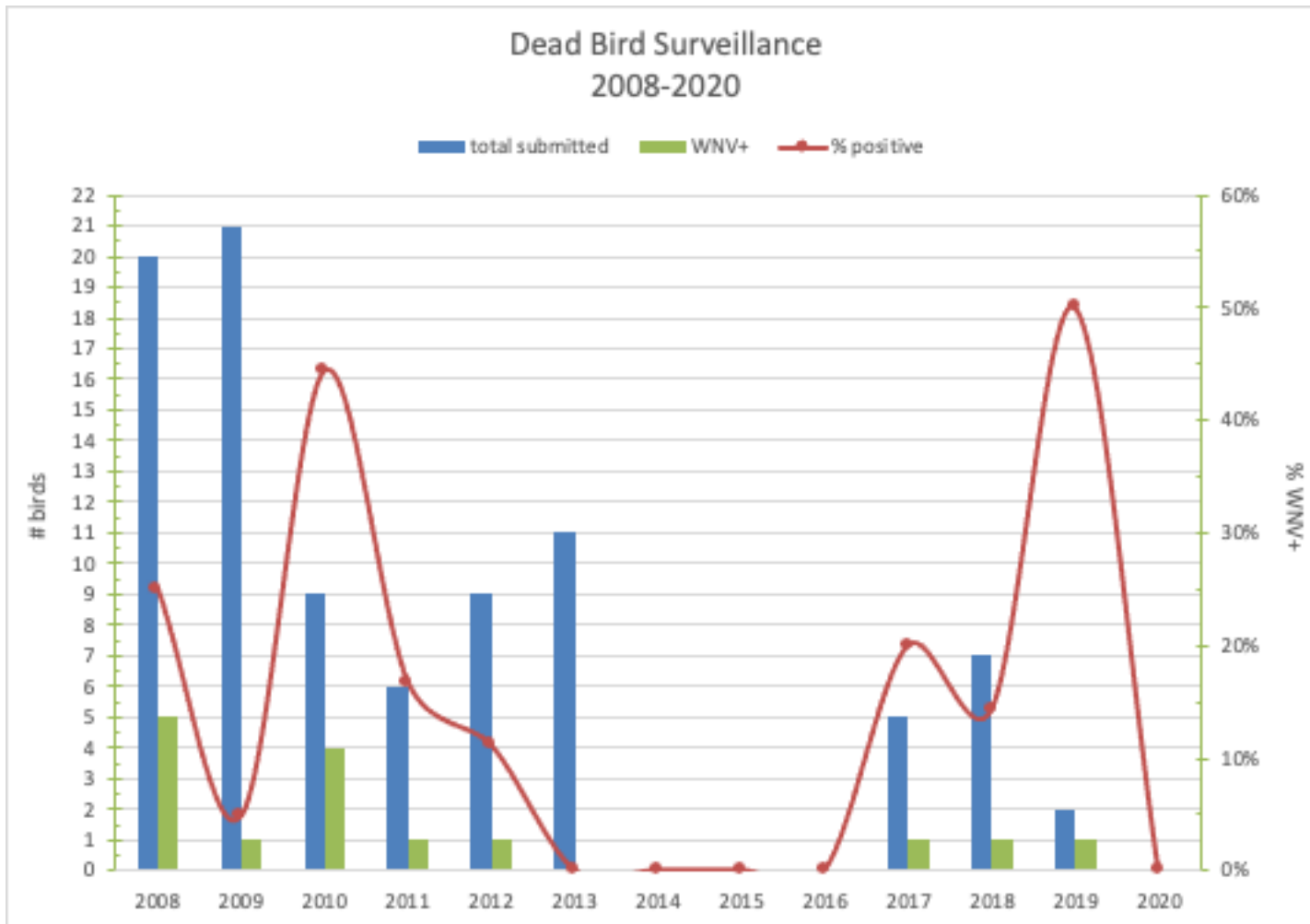
In 2020, 3 EEE+ emu were reported from south Georgia. Emu have both a high attack rate from EEE and a high case fatality rate. Signs of EEE in emu include sudden onset of weakness, staggering, bloody diarrhea and rapid death, usually within 24 hours of first onset of symptoms. The virus can be “shed” in feces, blood or vomit. Humans can pick up this disease through contact with the virus through mucous membranes and/or open wounds, so caution should be used when handling the carcasses or cleaning up feces, blood, and vomit. Fortunately, the same vaccine used to prevent EEE in horses can be used off-label to protect emu. Emu chicks should be vaccinated starting at 6-8 weeks then again at 10-12 weeks, with a final injection at 16-18 weeks and every 6 months thereafter.

Ostriches and some non-native species of game birds (such as pheasants and quail) are also susceptible to EEE. As with the detection of EEE in horses, EEE detected in emu or other non-native birds indicates an increased risk of EEE transmission to humans.

County	District	Animal's Breed	Onset Date	week	Virus
Lanier	8-1	emu	6/6/20	23	EEE
Dougherty	8-2	emu	7/6/20	28	EEE
Meriwether	4-0	emu	10/29/20	44	EEE



Dead Bird Surveillance

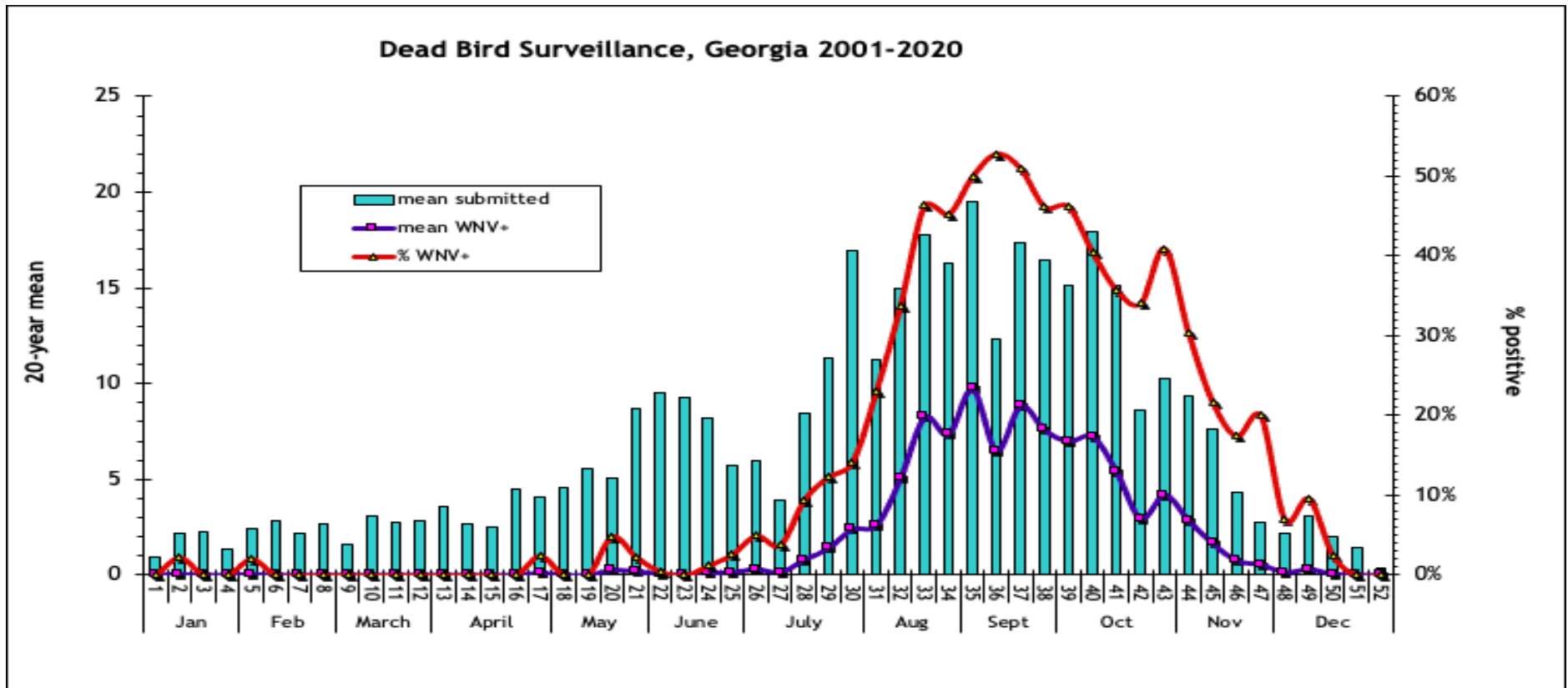


As of 2012, federal funding was no longer available to test birds. Submission of dead birds had already decreased from a high of 2421 birds submitted to SCWDS for testing in 2002 to 6 birds submitted in 2011.

In 2020, no birds were reported as 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.





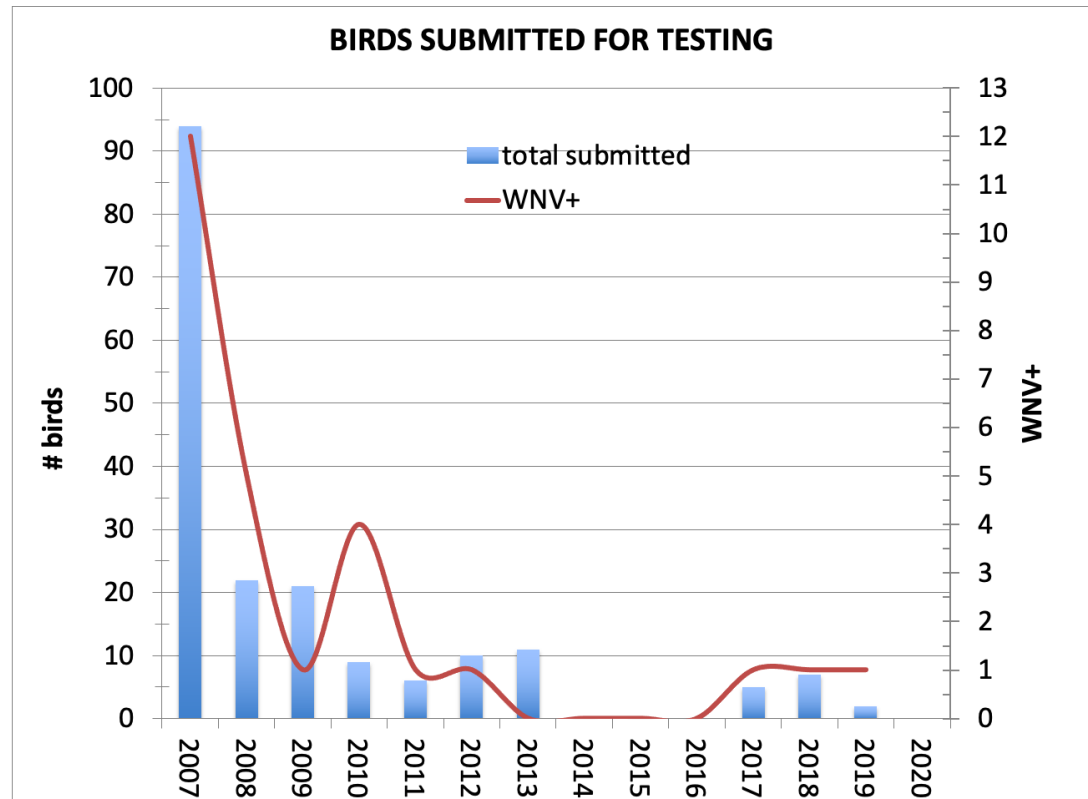
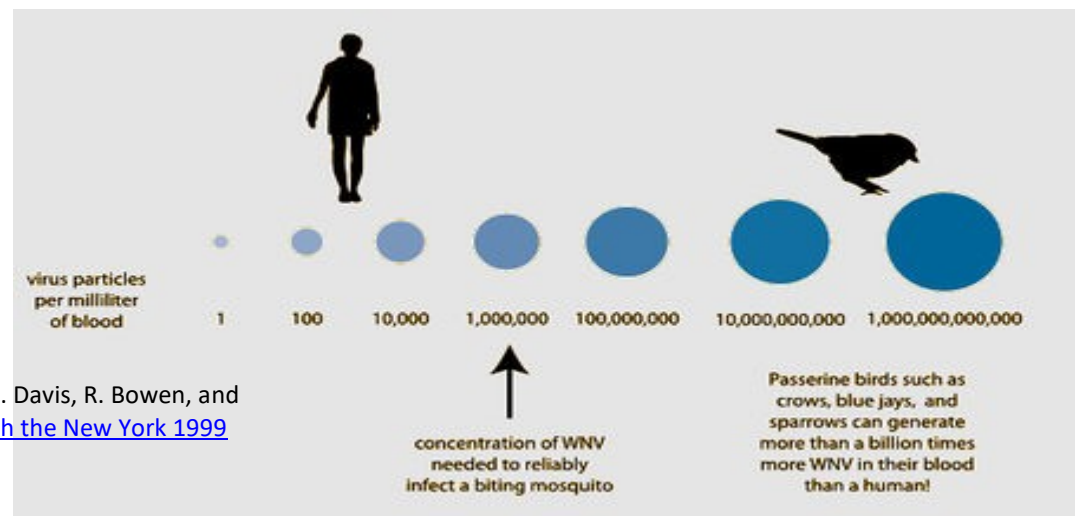
Sentinel chickens are used primarily for detection of the mosquito-borne Eastern Equine Encephalitis virus, which causes disease in people, horses and other animals. In some areas they are also used to detect the presence of West Nile Virus activity. That's because chickens become infected with EEE or WNV if bitten by infected mosquitoes, but don't develop symptoms of the disease and don't produce enough virus to infect other mosquitoes. Their bodies develop antibodies to EEE or WNV within a week of being bitten by an infected mosquito, and it is the detection of these antibodies that is used to determine if EEE or WNV is active in the area.

In 2020, CCMC reported 3 WNV+ sentinel chicken. This information was used by the program to focus mosquito control efforts on disease 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.



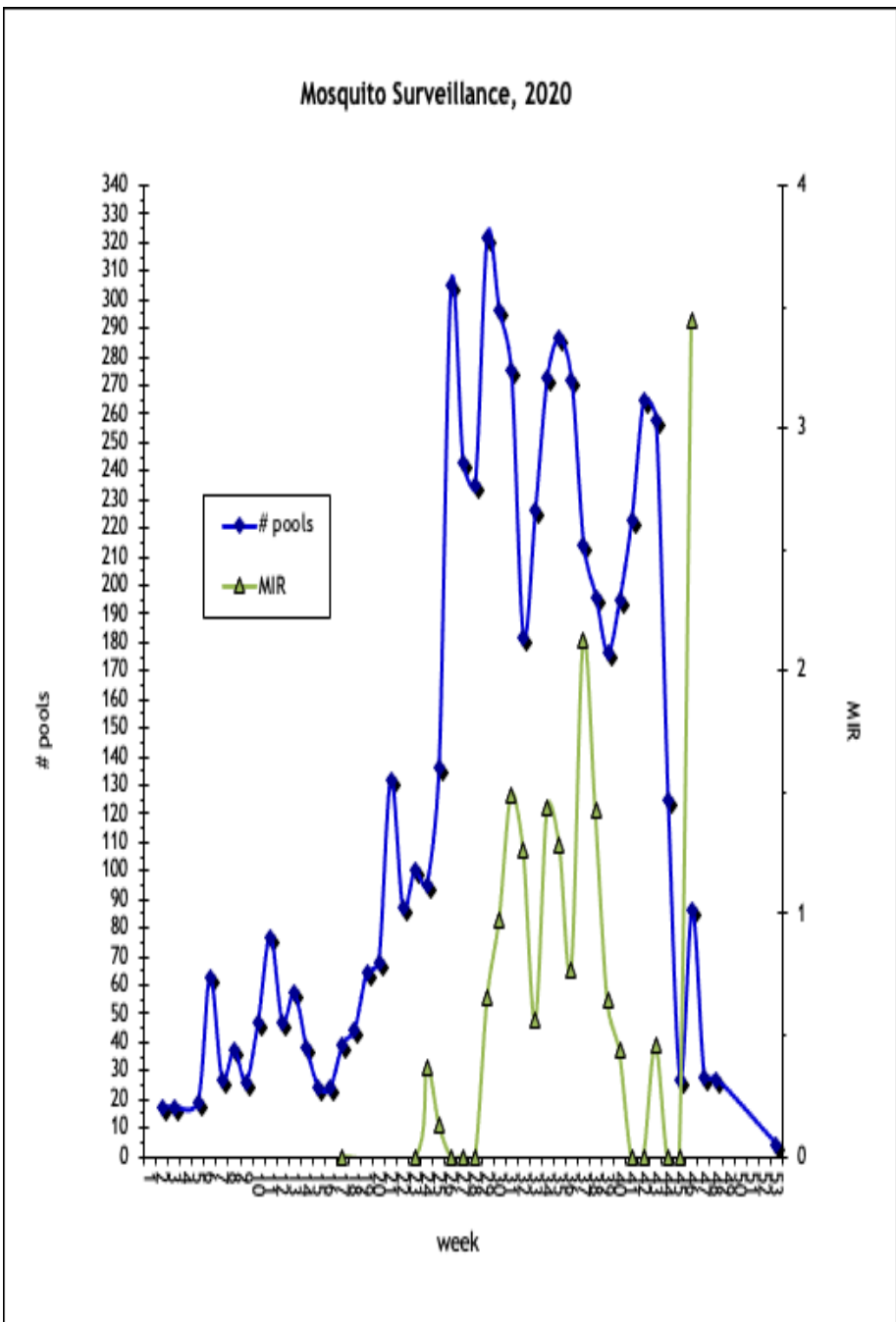
Mosquito Surveillance

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. Nine counties sent mosquitoes to SCWDS for testing in 2020. 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 6025 pools of mosquitoes (135515 individuals) were sent for testing in 2020, with results reported to the GDPH. Two species were found to be WNV+, *Culex nigripalpus* (4 pools) and *Cx quinquefasciatus* (48 pools). There were also 7 pools of unspecified *Culex* spp found WNV+.

2020 WNV+ Mosquitoes

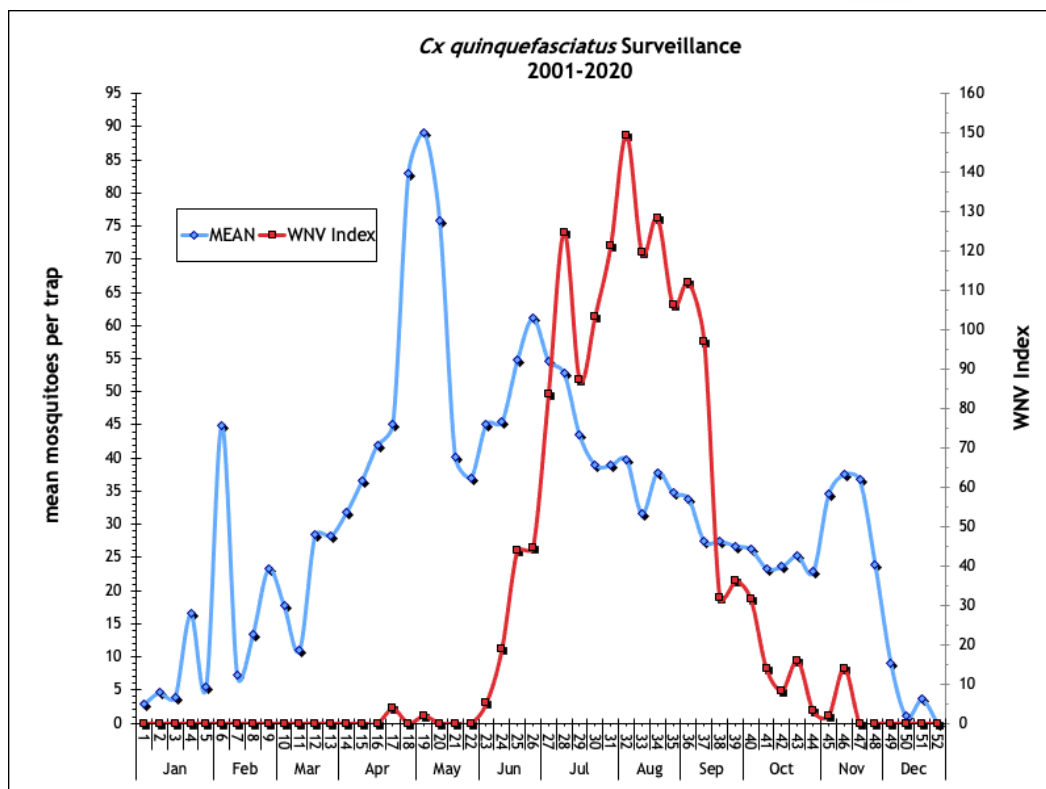
county	# mosquitoes submitted	WNV+ pools	MIR
Chatham	65902	11	0.17
Columbia	3		
DeKalb	8786	33	3.76
Fulton	3190	5	1.57
Glynn	42343		
Lincoln	7		
Lowndes	15057	10	0.66
Richmond	243		
Taliaferro	4		
Grand Total	135535	59	



In 2020, the first WNV+ mosquitoes were detected in Lowndes County in early June. The last WNV+ pool was collected in Chatham in November. Peaks in numbers of WNV+ pools occurred in August and September. Three WNV+ pools were collected from a CDC light trap. The rest (56) 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.

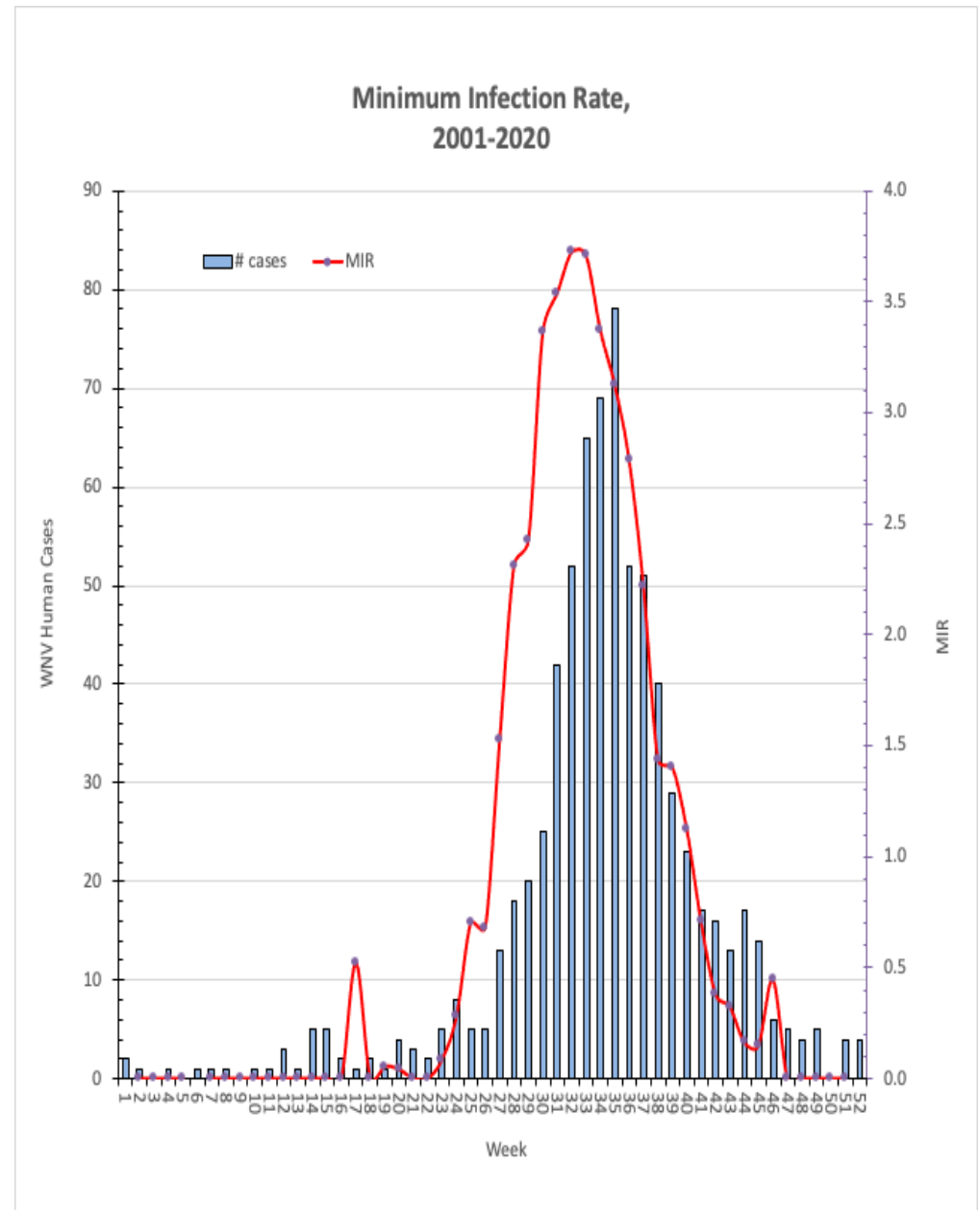
The monthly MIR for Georgia in 2020 ranged from 0.13 to 3.45, with an average of 1.09.

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
2020	24.6	59	12

2001-2020	human cases	WNV+ mosquito pool	veterinary case	positive bird
total	584	2563	344	1903
mean	29.2	128.2	17.2	95.2

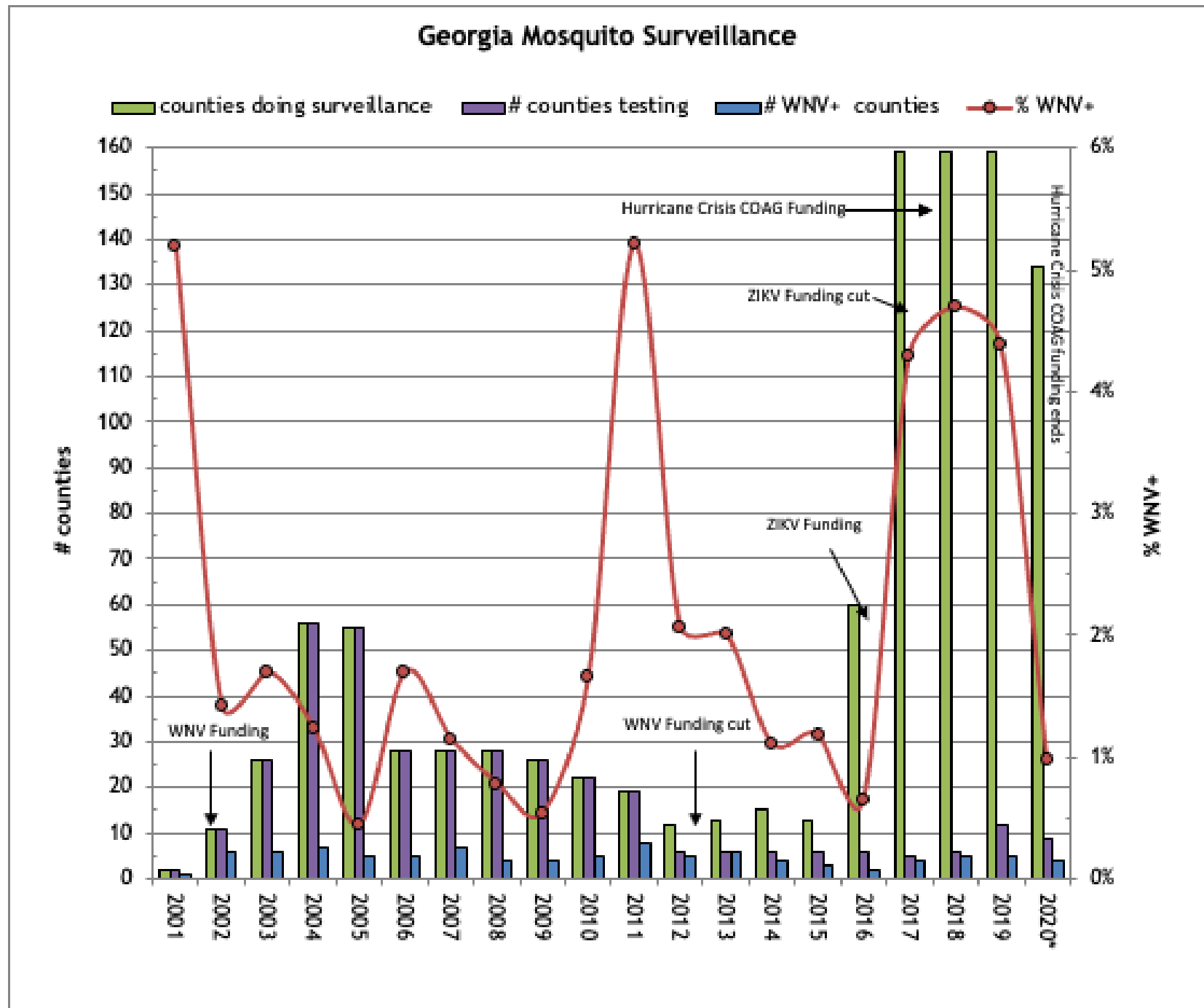


year	total pools	WNV+	% WNV+	human cases
2001	597	31	5.2%	6
2002	4032	57	1.4%	37
2003	6177	105	1.7%	60
2004	10161	126	1.2%	24
2005	15248	67	0.4%	24
2006	4785	81	1.7%	10
2007	6513	75	1.2%	60
2008	6383	50	0.8%	12
2009	4446	24	0.5%	6
2010	5990	99	1.7%	14
2011	7622	397	5.2%	26
2012	6042	125	2.1%	117
2013	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
2020	6025	59	1.0%	12
MEAN	6202.4	120.35	2.1%	29.45
TOTAL	124048	2407	42.4%	589



2020 END-OF-YEAR SUMMARY

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%
2020	59		142	9	4	6015	1.0%





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. Between 2017-2019, some level of surveillance was done in every county in Georgia. Due to loss of funding resulting in the loss of the Vector Surveillance Coordinators in August 2020, and to the COVID-19 response, surveillance was only done in 142 counties. In 2020, mosquitoes were sent for testing from 9 counties.

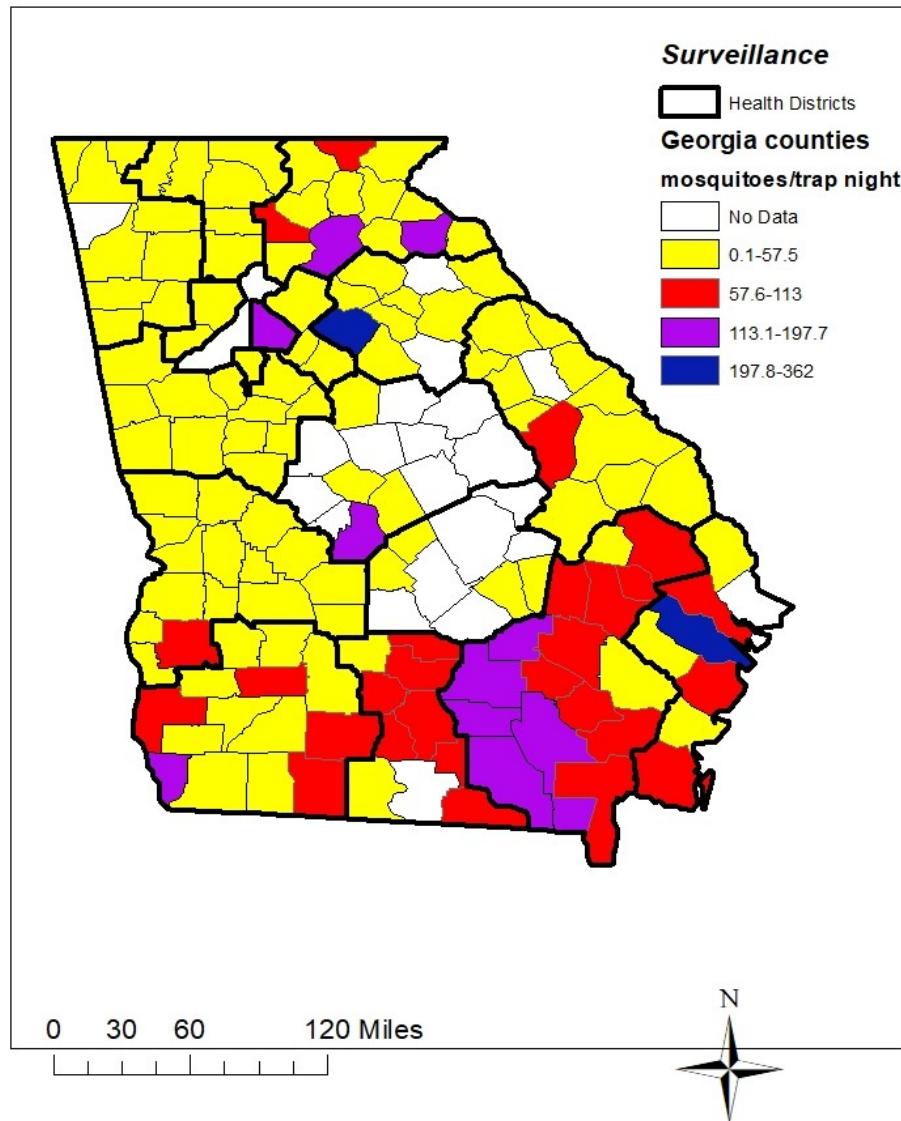
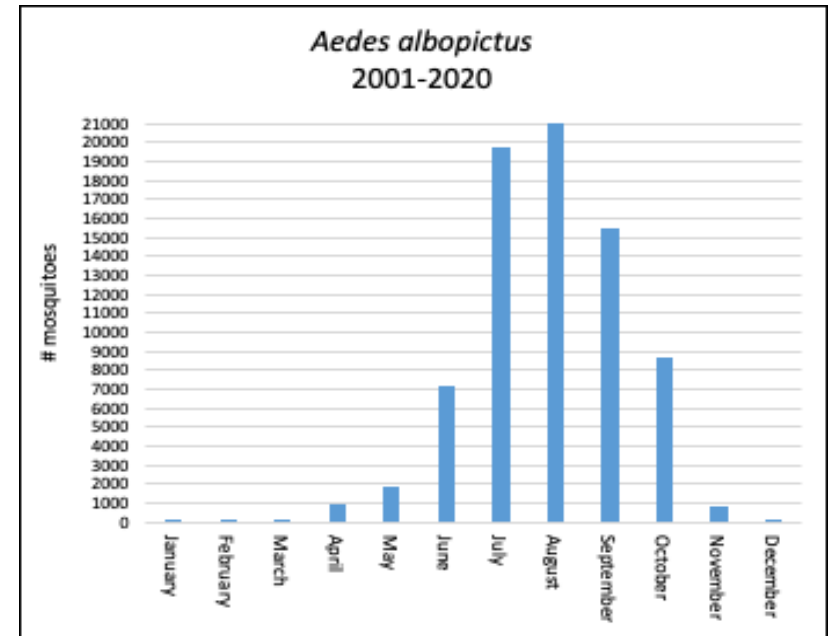
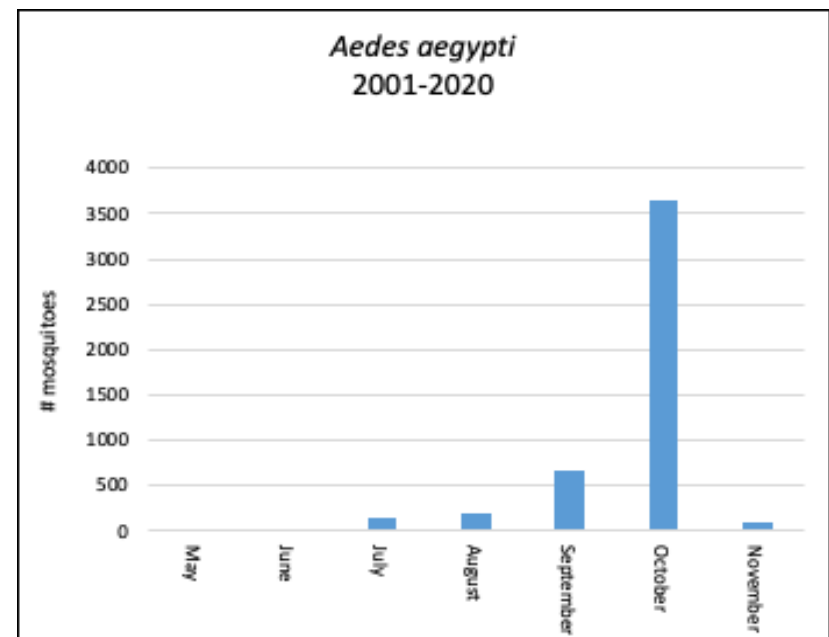
Month	# mosquitoes
January	1523
February	730
March	6057
April	18547
May	12332
June	13174
July	10734
August	8120
September	5642
October	2155
November	587
December	184
Grand Total	79785

Month	# trap nights
January	24
February	28
March	73
April	300
May	176
June	177
July	217
August	168
September	116
October	51
November	29
December	18
Grand Total	1377

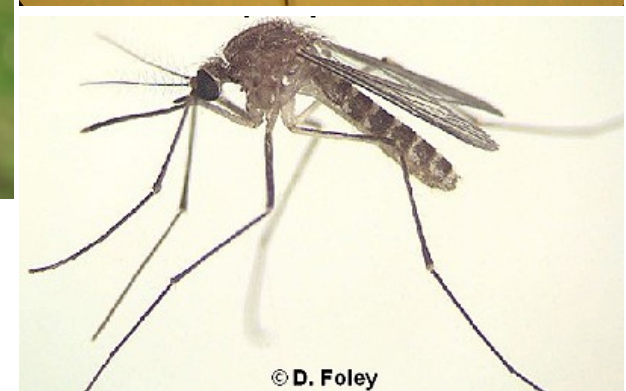
Month	# mosquitoes/trap night
January	63.46
February	26.07
March	82.97
April	61.82
May	70.07
June	74.43
July	49.47
August	48.33
September	48.64
October	42.25
November	20.24
December	10.22
Mean	49.83

Mosquito Surveillance

VSC Surveillance Data, 2020

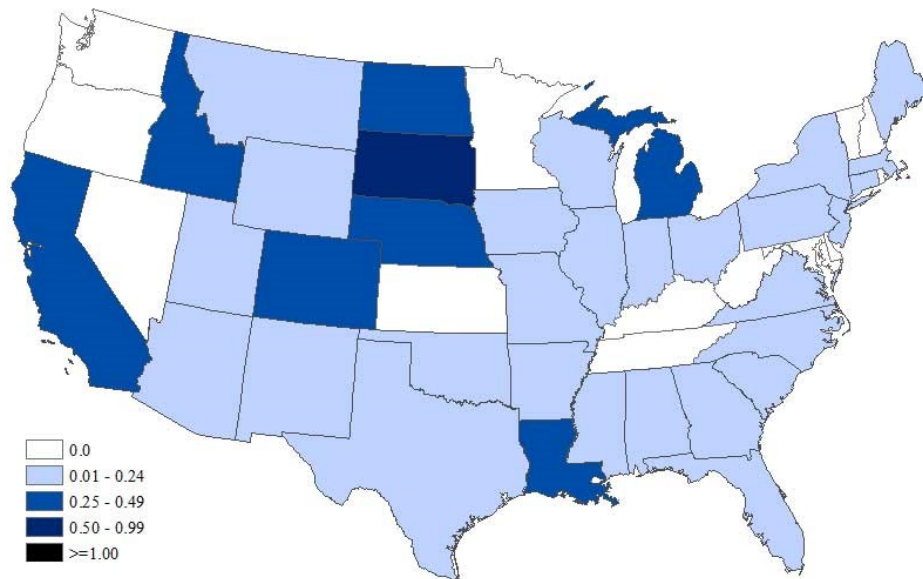


Species	# mosquitoes
<i>Ae. aegypti</i>	35
<i>Ae. albopictus</i>	4517
<i>Ae. cinereus</i>	18
<i>Ae. vexans</i>	7582
<i>An. barberi</i>	1
<i>An. crucians</i>	5839
<i>An. perplexens</i>	60
<i>An. punctipennis</i>	2435
<i>An. quadrimaculatus</i>	784
<i>Cq. perturbans</i>	2788
<i>Cs. inornata</i>	6
<i>Cs. melanura</i>	1806
<i>Cx. coronator</i>	1359
<i>Cx. erraticus</i>	2887
<i>Cx. nigripalpus</i>	3701
<i>Cx. peccator</i>	1
<i>Cx. quinquefasciatus</i>	24381
<i>Cx. restuans</i>	1686
<i>Cx. salinarius</i>	4596
<i>Cx. territans</i>	57
<i>Ma. titillans</i>	132
<i>Oc. atlanticus</i>	1681
<i>Oc. canadensis</i>	2635
<i>Oc. fulvus pallens</i>	121
<i>Oc. infirmatus</i>	74
<i>Oc. japonicus</i>	271
<i>Oc. mitchellae</i>	56
<i>Oc. sollicitans</i>	3
<i>Oc. sticticus</i>	3657
<i>Oc. taeniorhynchus</i>	66
<i>Oc. triseriatus</i>	236
<i>Or. signifera</i>	46
<i>Ps. ciliata</i>	159
<i>Ps. columbiae</i>	570
<i>Ps. cyanescens</i>	3
<i>Ps. ferox</i>	719
<i>Ps. howardii</i>	90
<i>Tx. rutilus</i>	3
<i>Ur. lowii</i>	30
<i>Ur. sapphirina</i>	87



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 2020 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.

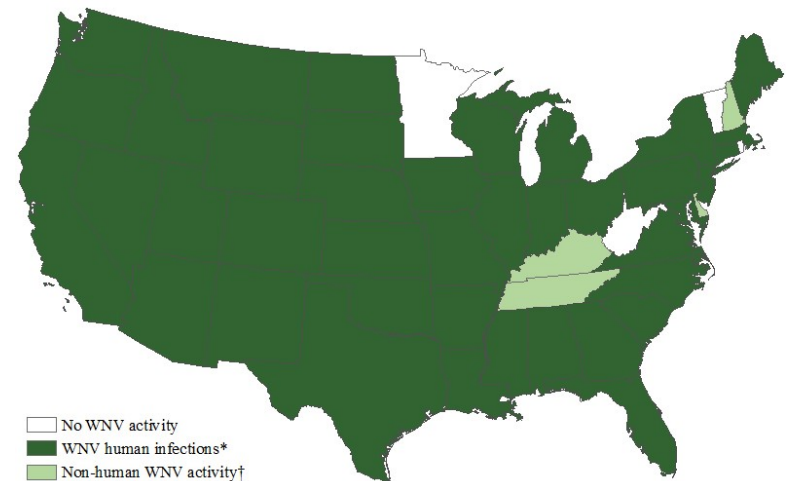


West Nile Virus Neuroinvasive Disease Incidence by State – United States, 2020 (as of January 5, 2021)

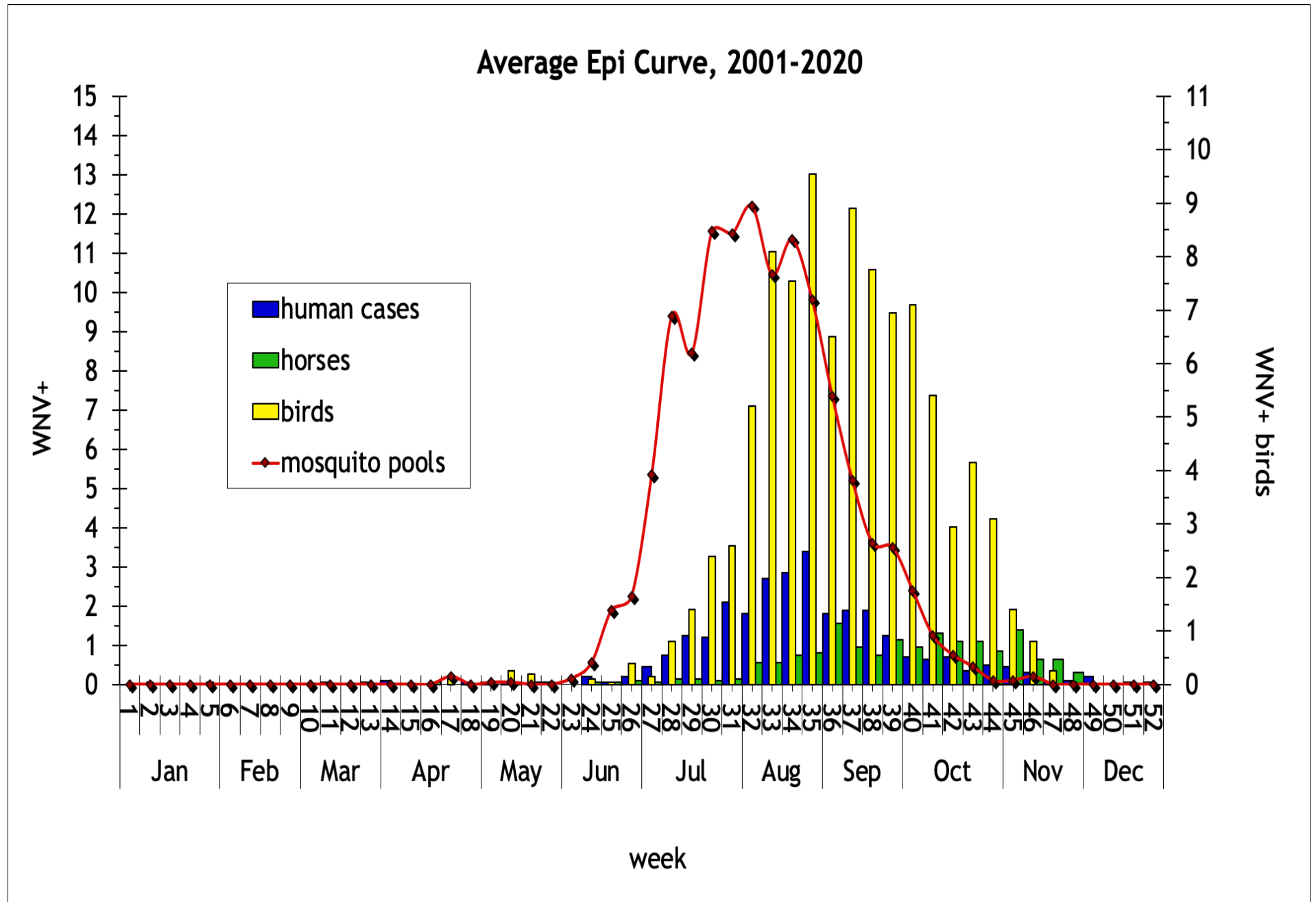


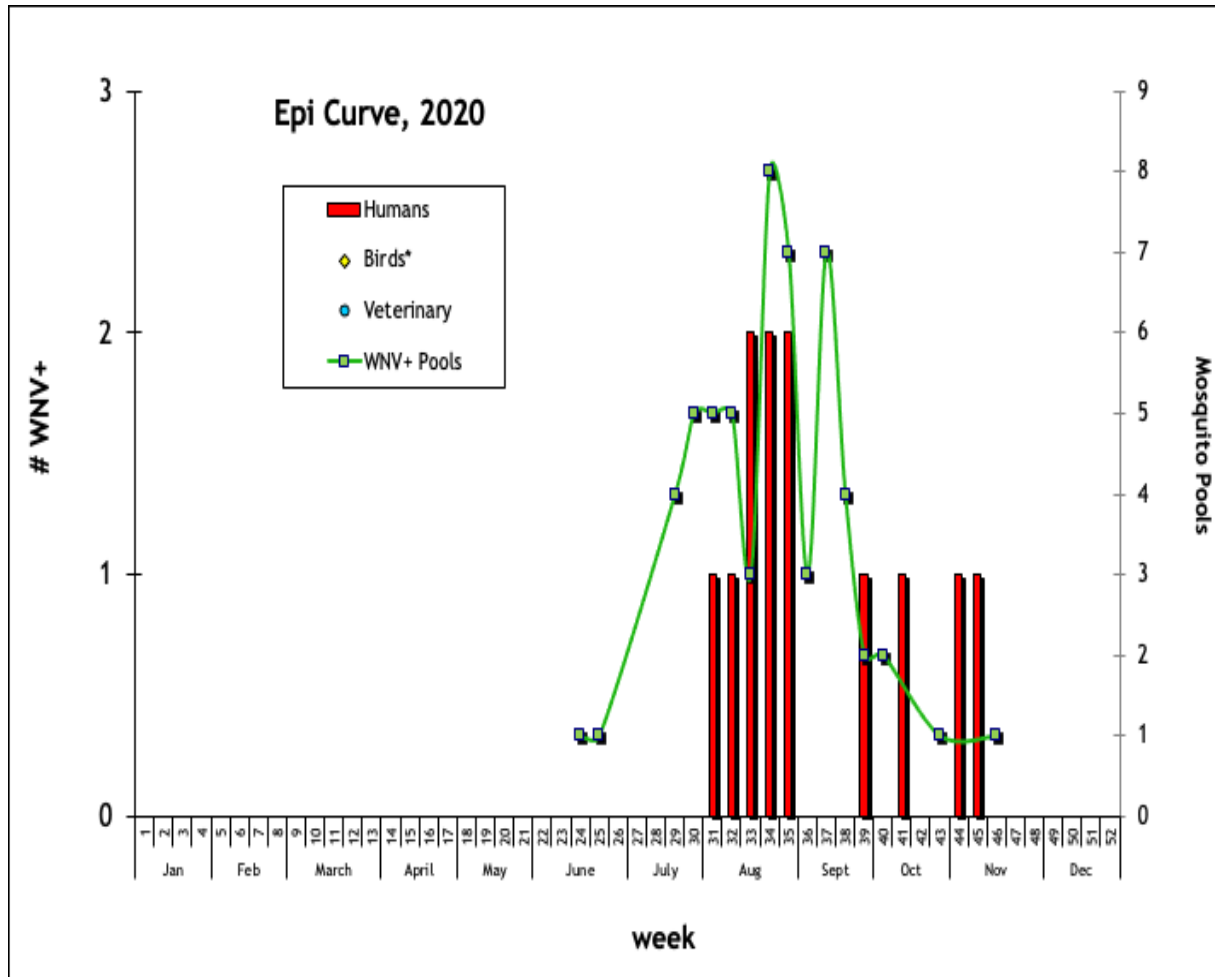
*WNV human disease cases or presumptive viremic blood donors. Presumptive viremic blood donors have a positive screening test which has not necessarily been confirmed.

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



West Nile Virus Activity by State – United States, 2020 (as of January 5, 2021)





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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.

