MOSQUITO SURVEILLANCE 2020

GEORGIA DEPARTMENT OF PUBLIC HEALTH, ENVIRONMENTAL HEALTH

Mosquito Surveillance 2020

Limited mosquito surveillance programs occur in many Georgia counties (http://www.gamosquito.org/resources/GA_Mosquito_Control_Programs2017.pdf), but most counties with mosquito control programs conduct control activities without appropriate mosquito surveillance. Data obtained from mosquito surveillance activities are important to guide vector control operations by identifying vector species, providing an estimate of vector species abundance, and by indicating geographic areas where humans and animals are at greatest risk of exposure to WNV or other arboviruses.

Our goals for the 2020 mosquito surveillance season included doing some level of mosquito surveillance in every county in Georgia, assisting mosquito control programs with surveillance where possible, continuing to provide equipment and training to Environmental Health Specialists in all 18 Public Health Districts, and having the ability to support local outreach for mosquito complaints. We also planned to continue to do pesticide resistance testing throughout Georgia. The accomplishment of these goals will allow the Georgia Department of Public Health to be better prepared for dealing with endemic mosquito-borne disease issues and for dealing with the next mosquito-borne disease to emerge. Unfortunately, the COVID-19 pandemic changed a lot of our plans and, since our funding was cut, requiring the disbanding of the Vector Surveillance Coordinator program in Aug 2020.

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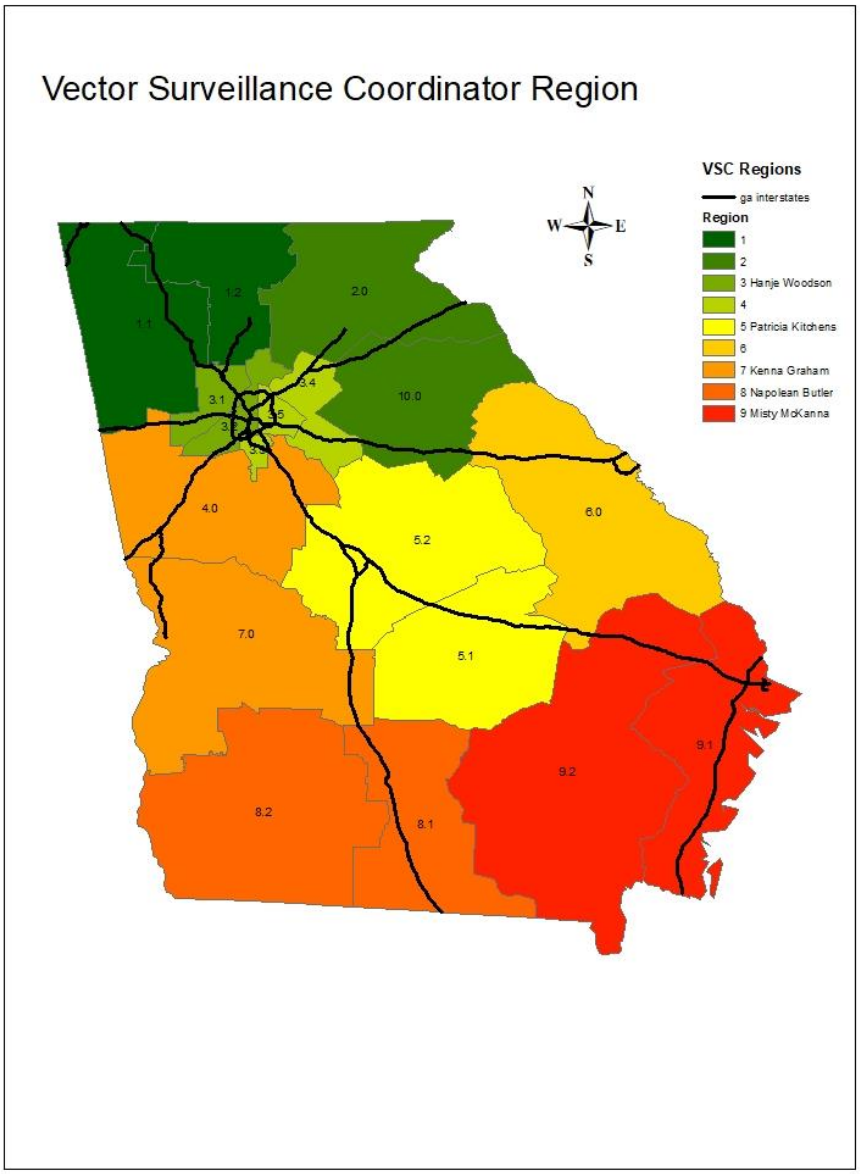
Overview

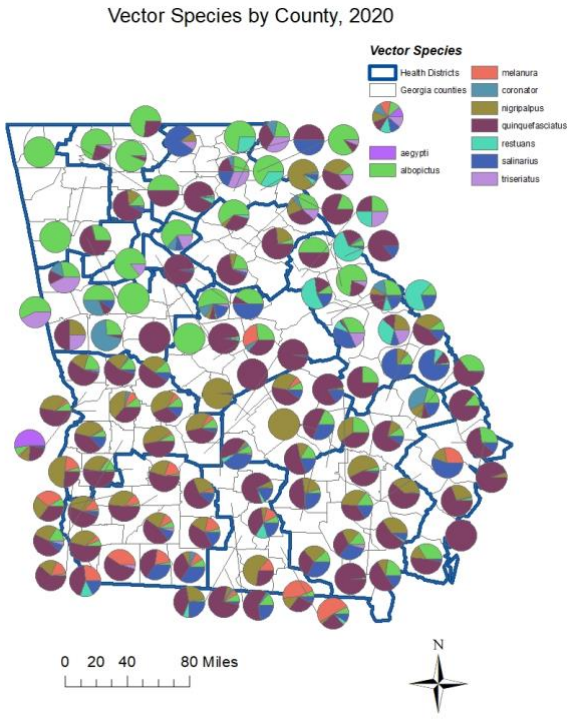
The Vector Surveillance Coordinator (VSC) program continued until the end of August 2020. In addition to mosquito surveillance, the VSCs were involved in collecting mosquito eggs for statewide pesticide resistance testing and distributing collection vials to area veterinarians as part of our collaborative effort with GDA to survey ticks attached to animals. They also provided outreach and training in their regions.

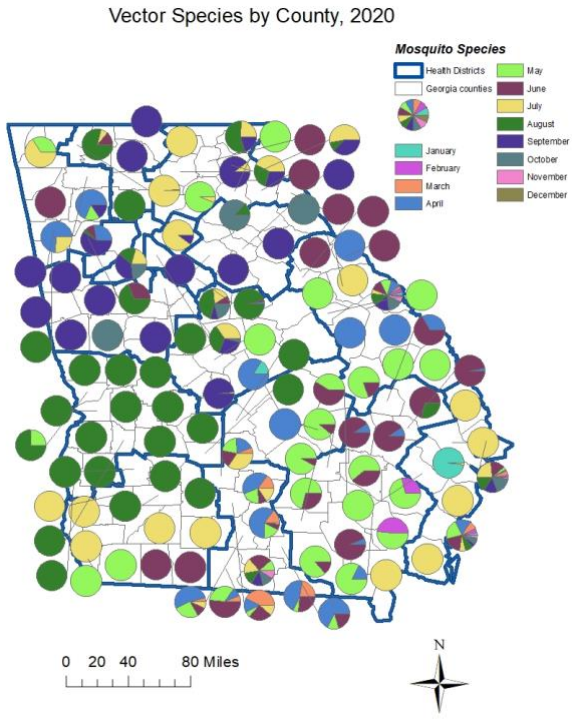


Non-VSC Districts

Not all Health Districts were assigned a VSC. These Districts (1-1, 1-2, 2-0, 3-4, 3-5, 6-0, and 10-0) were assigned to the State Entomologists, Dr. Thuy-vi Thi Nguyen and Dr. Rosmarie Kelly. However, most of these Districts already had in-house or contracted mosquito surveillance programs, and some of them had an Environmental Health Director or Environmental Health Specialists (EHS) who had an interest in doing mosquito surveillance within their District or county. Also, VSCs stepped in to assist as needed.

The maps used in this document were all created in March 2021. They depict the month(s) in which surveillance was done in each county and the presence or absence of the important vector species *Aedes aegypti*, *Ae albopictus*, *Culiseta melanura*, *Cx coronator*, *Cx nigripalpus*, *Cx quinquefasciatus*, *Cx restuans*, *Cx salinarius*, and *Ochlerotatus triseriatus*. All species trapped are listed in a table for each District by county.





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Surveillance

Adult mosquito monitoring is a necessary component of surveillance activities and is directed toward identifying where adults are most numerous. This information drives response to service requests and helps determine whether interventions (source reduction, larviciding, and/or adulticiding) are effective.

There are a variety of different mosquito traps, but generally two different types of traps are used. One type, a gravid trap, selectively attracts container- breeding mosquitoes that have had a blood meal and are looking for a place to lay eggs. The other type, a light trap, attracts mosquitoes looking for a blood meal. Recently, a third type of trap, the BG-Sentinel trap has been used in areas where exotic arbovirus cases have been detected. This trap is very specific for the ZIKV, CHIK, and DEN vectors, *Ae aegypti* and *Ae albopictus*. With all three traps, as the mosquito gets close, it gets suctioned into the trap by a small fan. Mosquitoes caught in these traps are counted and identified. They may also be pooled according to date, species, and location and sent to a lab for testing.

Most of the surveillance and mosquito identification was done by the Vector Surveillance Coordinator (VSC) and the two GDPH entomologists, as well as by Environmental Health Specialists (EHS) in the non-VSC Districts.

GRAVID TRAP

This trap selectively attracts container-breeding mosquitoes that lay eggs in stagnant organically rich water. These mosquitoes will have had at least one blood meal, so may possibly have picked up an infected blood meal if there are arbovirus-positive enzootic hosts in the area.

LIGHT TRAP

Light traps attract mosquitoes looking for a blood meal. The attractants used are light and CO_2, in the form of dry ice or as compressed gas in canisters. These traps are useful for providing information about the mosquito species found in the area under surveillance. Because they attract mosquitoes looking for a blood meal that may have just emerged and never had a blood meal previously, the likelihood of finding virus in these mosquitoes is much reduced.

BG SENTINEL TRAP

What makes the BG-S trap different? It:

- Mimics convection currents created by a human body
- Employs attractive visual cues
- Releases artificial skin emanations through a large surface area
- Can be used without CO2 to specifically capture selected mosquito species

Used in combination with the BG-Lure, a dispenser which releases a combination of non-toxic substances that are also found on human skin (ammonia, lactic acid, and caproic acid), the BG-Sentinel trap is especially attractive for the yellow fever (or ZIKV) mosquito, *Aedes aegypti*, the Asian tiger mosquito, *Aedes albopictus*, the southern house mosquito, *Culex quinquefasciatus*, and selected other species.

With the addition of carbon dioxide, the BG-Sentinel trap is an excellent surveillance tool for mosquitoes in general.

MOSQUITO BREEDING HABITAT TYPES

There are two general categories within which mosquito breeding habitats exist: natural mosquito breeding habitats and man-made mosquito breeding habitats. Female mosquitoes lay their eggs either on water or on soils that are periodically flooded. These breeding areas can be found in habitats that exist naturally, such as within a pond or flood plain, or in habitats that have been created by humans, such as bird baths, water-filled tires, or catch basins. Mosquitoes can breed in a wide variety of locations, and the discussion below provides a description of the general types of habitats where mosquitoes are known to breed.

NATURAL MOSQUITO BREEDING HABITATS

Temporary Woodland Pools:

Shallow, temporary pools are common in woodland areas during the spring and wet summers in low lying areas or in small depressions where a variety of mosquito species will breed, most commonly *Ochlerotatus canadensis* and *Aedes vexans*. These mosquitoes lay their eggs along the edges of the pool and when rainwater or melting snow fills these pools the larvae hatch.

Freshwater Ponds:

The larvae of Anopheles are found primarily in small ponds among the emergent vegetation. Ponds clogged with vegetation can breed large numbers of mosquitoes because of the vast

amounts of organic matter available to mosquito larvae for feeding and because fish and other aquatic predators cannot readily feed on the larval mosquitoes.

Streams and Floodplains:
Streams with running water rarely produce mosquitoes. However, mosquitoes need to be near water in order to lay their eggs. Anopheles and Culex mosquitoes are two types of species that can sometimes be found in isolated pockets adjacent streams or within floodplain areas that undergo only periodic flooding.

Tree Holes and Other Natural Containers:
Tree holes and other natural containers, such as pitcher plants or water trapped in or on plant leaves, can also serve as breeding habitats for mosquitoes, such as *Ochlerotatus triseriatus*. Frequent rainfalls maintain standing water within these types of microhabitats and can breed mosquitoes throughout the summer.

Freshwater Marshes and Swamps:
Mosquitoes, such as *Coquillettidia perturbans*, breed in freshwater marshes and swamps consisting of emergent vegetation. These types of habitats can occur in both woodland and open field habitats. Larvae attach themselves to the stems and roots of the vegetation to obtain oxygen, and do not need to swim up and down in the water column to feed and to breath. Due to this adaptation, these larvae can avoid exposure to predatory fish.

MAN-MADE MOSQUITO BREEDING HABITATS
Stormwater/Wastewater Detention:
A catch basin typically includes a curb inlet where storm water enters the basin to capture sediment, debris and associated pollutants. Similarly, detention/retention basins that perform similar functions for other types of wastewaters, such as waste treatment settlement ponds, provide a similar type of breeding habitat to that of the storm water catch basin. These detention basins provide breeding habitat for urban mosquito species, such as *Culex quinquefasciatus*. Moisture and organic debris captured within the detention basin can aid in development and provide nutrients for growing larvae.

Roadside Ditches:
Roadside ditches are the suitable habitat for many species of Culex mosquitoes. The larvae of *Culex quinquefasciatus* and *Culex restuans*, for example, can survive in waters with high organic content. Culex mosquitoes will lay their eggs directly on the water's surface; therefore, ditches that hold water for extended periods of time can breed large numbers of mosquitoes.

Artificial Containers:
Artificial containers left out to collect rainwater such as tires, bottles, buckets, and birdbaths can provide an excellent mosquito-breeding habitat free from any predators. Many tree-hole mosquitoes have learned to adapt to using these man-made mosquito nurseries. *Aedes albopictus*, our most common pest species, also breeds readily in these artificial containers. The abundance of organic debris, which can also collect in these containers, allows for the proliferation of mosquito breeding during a season.

Control – A Message for the Public
The mosquitoes of most importance to public health in Georgia are *Culex quinquefasciatus*, the Southern house mosquito, and *Aedes albopictus*, the Asian tiger mosquito. Both these species lay eggs in such artificial containers as birdbaths, gutters, tires, flowerpots, and any other container that holds water for at least a week. The Southern house mosquito prefers organically polluted water for laying its eggs, and bites at dusk. It feeds primarily on birds, but will bite mammals, and is our primary vector for WNV. The Asian tiger mosquito prefers cleaner water for laying its eggs, and bites during the day. It feeds primarily on mammals. It has been found positive for WNV in Georgia and is a vector of ZIKV.

The best way to control these species is to dump out or treat standing water, treat catch basins with larvicide, and to cut back heavy vegetation where the mosquito will rest when not out biting. These mosquitoes will shelter in abandoned houses. Thermal fogging or barrier spray around these houses can help to reduce resting and overwintering mosquitoes. Two larvicides are available to the public for treating standing water, Mosquito Torpedoes (Methoprene) and Mosquito Dunks (Bti). Both are available online, and from Home Goods or Hardware Stores, and occasionally from large chain Pet Stores. Hand-held foggers can also be used to reduce biting populations of mosquitoes, but this solution is temporary and needs to be followed up with good source reduction (removing breeding sites) and larviciding.

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Species	BGS	CDC	Exit	Gravid	TOTAL
Ae. aegypti	15	20			35
Ae. albopictus	301	3393		1692	5386
Ae. albopictus (male)		31		157	188
Ae. cinereus		19			19
Ae. vexans	16	7539		204	7759
Ae. vexans (male)		3		1	4
Aedes/Ochlerotatus spp.		113		17	130
Aedes/Ochlerotatus spp. (male)		4		3	7
An. barberi		1			1
An. crucians	11	5830		120	5961
An. crucians (male)				5	5
An. perplexens		72		2	74
An. punctipennis		2414		104	2518
An. quadrimaculatus	3	808		17	828
An. quadrimaculatus (male)				4	4
Anopheles spp.		27		33	60
Anopheles spp. (male)		1			1
Cq. perturbans		4026	14	104	4144
Cq. perturbans (male)		2			2
Cs. inornata		8			8
Cs. melanura		3157	35	863	4055
Cs. melanura (male)		4			4
Culex spp.	46	967		8913	9926
Culex spp. (male)		34		289	323
Cx. coronator		1334		32	1366
Cx. erraticus	17	7344	22	315	7698
Cx. erraticus (male)				5	5
Cx. inornata		1			1
Cx. nigripalpus	1	9696	129	4985	14811
Cx. peccator		1			1
Cx. quinquefasciatus		3555		126032	129587
Cx. quinquefasciatus (male)				2	2
Cx. restuans		351		2110	2461
Cx. restuans (male)				2	2
Cx. salinarius		4191		603	4794
Cx. salinarius (male)				2	2

Cx. territans		31		37	68
Ma. dyari		6			6
Ma. titillans		288		1	289
Oc. atlanticus		2558		61	2619
Oc. canadensis		2631		25	2656
Oc. canadensis (male)				1	1
Oc. fulvus pallens		121			121
Oc. infirmatus		391		10	401
Oc. japonicus		103		197	300
Oc. japonicus (male)		2			2
Oc. mitchellae		55		1	56
Oc. mitchellae (male)		1			1
Oc. sollicitans		22			22
Oc. sticticus		3633		24	3657
Oc. sticticus (male)				1	1
Oc. taeniorhynchus		211			211
Oc. thibaulti				1	1
Oc. triseriatus	72	172	5	159	408
Oc. triseriatus (male)				6	6
Or. signifera		4		47	51
Ps. ciliata		163		3	166
Ps. columbiae		584		10	594
Ps. cyanescens		3			3
Ps. cyanescens (male)		2			2
Ps. ferox	1	909		15	925
Ps. ferox (male)				3	3
Ps. howardii		85		5	90
Ps. howardii (male)		2			
Psorophora spp.				1	
Tx. rutilus	9			7	
unknown		109		227	
Ur. lowii		30		1	
Ur. sapphirina		80		7	
Ur. sapphirina (male)		2		3	

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NOTE: Is it *Aedes*, or is it *Ochlerotatus*?

Ochlerotatus had been originally established as a genus in 1891. It became an aedine subgenus in the 1930s, but in 2000 John Reinert and his colleagues elevated the subgenus *Ochlerotatus* back to a genus based upon microscopic differences in the male genitalia between it and other subgenera of *Aedes*. However, in 2005 the *Journal of Medical Entomology* and the Entomological Society of America decided to put *Ochlerotatus* back to subgenera level (http://www.entsoc.org/Pubs/Periodicals/JME/mosquito_name_policy). After a contentious worldwide debate regarding the effect the taxonomic changes would have on names established over decades of work in scientific, government and lay communities, many scientists (including those at the CDC) and others affected by the change espoused the continued use of the previously established names. So, for the time being, everything is *Aedes* again.

HOWEVER, since the GDPH mosquito surveillance database was established after *Ochlerotatus* was elevated to genus status, we appreciate you continuing to use *Ochlerotatus* to make data access easier.

Aedes

- *Ae. aegypti*
- *Ae. albopictus*
- *Ae. cinerius*
- *Ae. vexans*

Ochlerotatus

- *Oc. atlanticus/tormentor*
- *Oc. atropalpus*
- *Oc. canadensis*
- *Oc. dupreei*
- *Oc. fulvus pallens*
- *Oc. hendersoni*
- *Oc. infirmatus*
- *Oc. japonicus*
- *Oc. mathesoni*
- *Oc. mitchellae*
- *Oc. sollicitans*
- *Oc. sticticus*
- *Oc. taeniorhynchus*
- *Oc. thibaulti*
- *Oc. triseriatus*
- *Oc. trivittatus*

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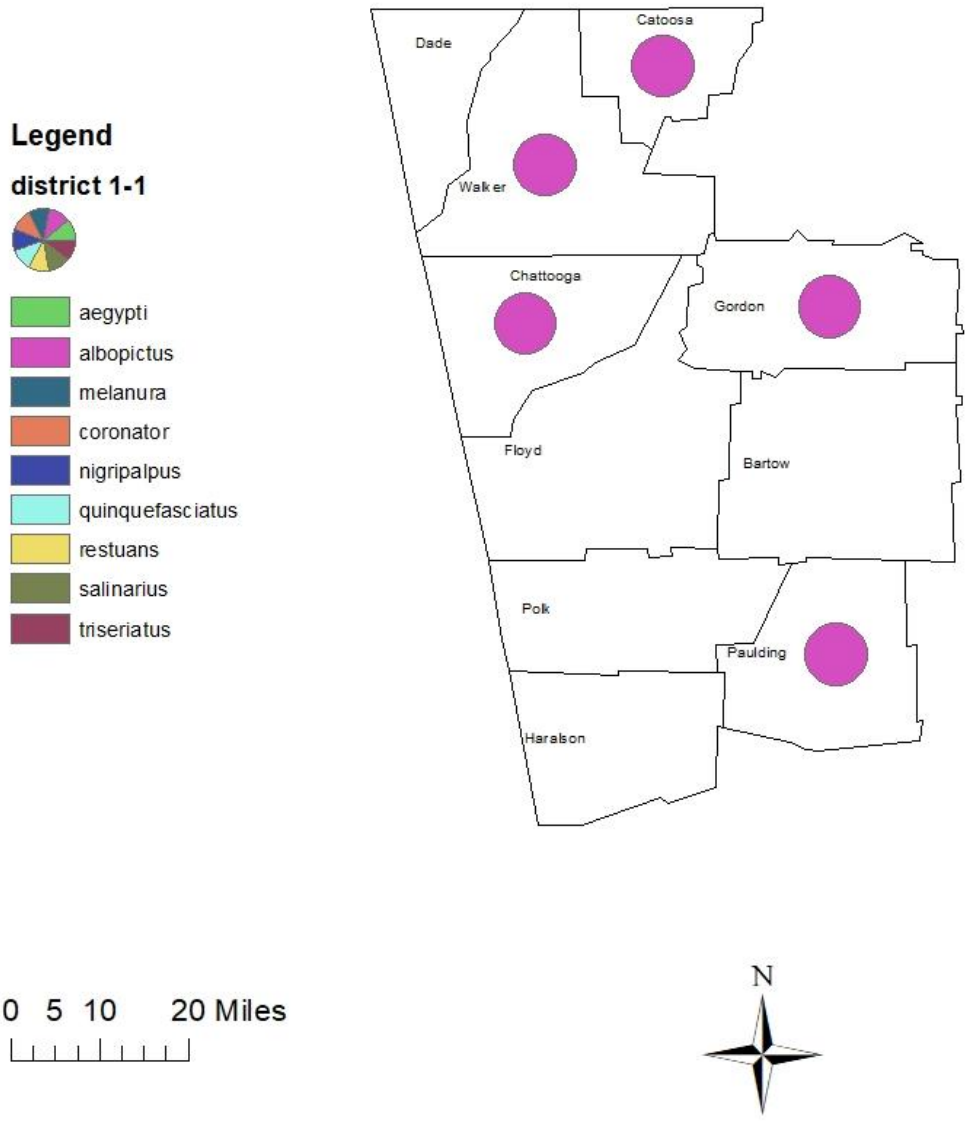
Data by District

District 1-1

Surveillance in District 1-1 was done by local EHS. Surveillance was done from April through September over 24 trap nights.

District 1-1		trap type	
County	**Species**	**CDC**	**Gravid**
Bartow	*Culex spp.*	3	13
	Oc. infirmatus	3	
Catoosa	*Ae. albopictus*		6
	Ae. vexans		17
	Culex spp.	11	16
Chattooga	*Ae. albopictus*		5
	Ae. vexans		5
	Culex spp.	7	
Dade	*Ae. vexans*		4
	Culex spp.	7	2
Floyd	*Ae. vexans*		5
	Culex spp.	13	15
Gordon	*Ae. albopictus*	5	
	Ae. vexans		8
	Culex spp.	1	5
Haralson	*Ae. vexans*	3	
Paulding	*Ae. albopictus*	3	
	Ae. vexans		8
	Culex spp.	5	
Polk	*Ae. vexans*	2	2
Walker	*Ae. albopictus*		2
	Ae. vexans		6
	Culex spp.	5	43

Vector Species by County, 2020



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District 1-2

Surveillance in District 1-2 was done by the District EH Director, with assistance from the State entomologists. Surveillance was done in March and from June-September over 57 trap nights.

District 1-2		trap type	
County	**Species**	**CDC**	**Gravid**
Cherokee	*Ae. albopictus*	2	9
	Ae. vexans	3	7
	An. punctipennis	2	
	Culex spp. (male)	1	
	Cx. nigripalpus	1	11
	Cx. quinquefasciatus	40	18
	Cx. salinarius	5	
	Oc. triseriatus	1	
Fannin	*Ae. albopictus*	7	15
	Cx. quinquefasciatus	4	4
Gilmer	*Ae. albopictus*	126	11
	Ae. albopictus (male)	12	
	Ae. vexans	15	3
	An. punctipennis	1	
	Cx. quinquefasciatus	3	3
	Oc. triseriatus		2
Murray	*Ae. albopictus*	64	
	Ae. cinereus	15	
	Ae. vexans	1	
	An. punctipennis	54	
	An. quadrimaculatus	1	
	Cs. inornata	1	
	Cx. erraticus	11	
	Cx. peccator	1	
	Cx. quinquefasciatus	22	
	Oc. japonicus	30	
	Oc. japonicus (male)	2	
	Oc. mitchellae	3	
	Oc. triseriatus	5	
	Ps. ciliata	1	
	Ps. ferox	1	
	Ur. sapphirina	6	

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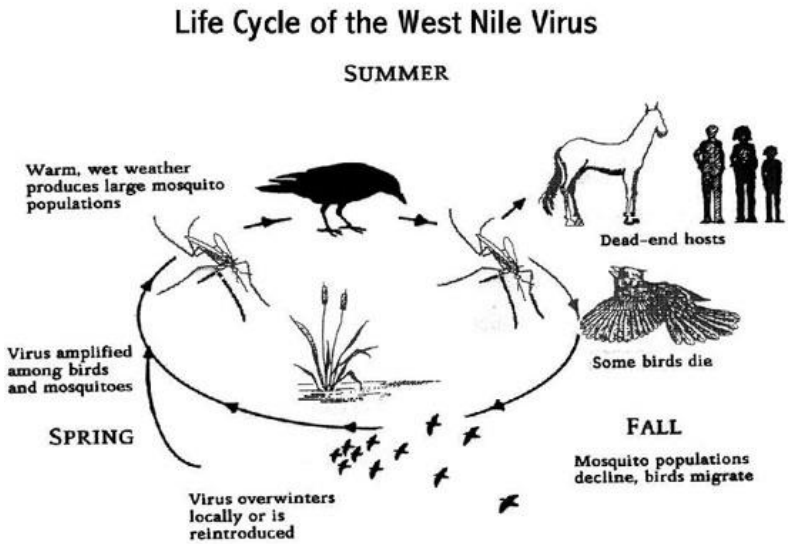
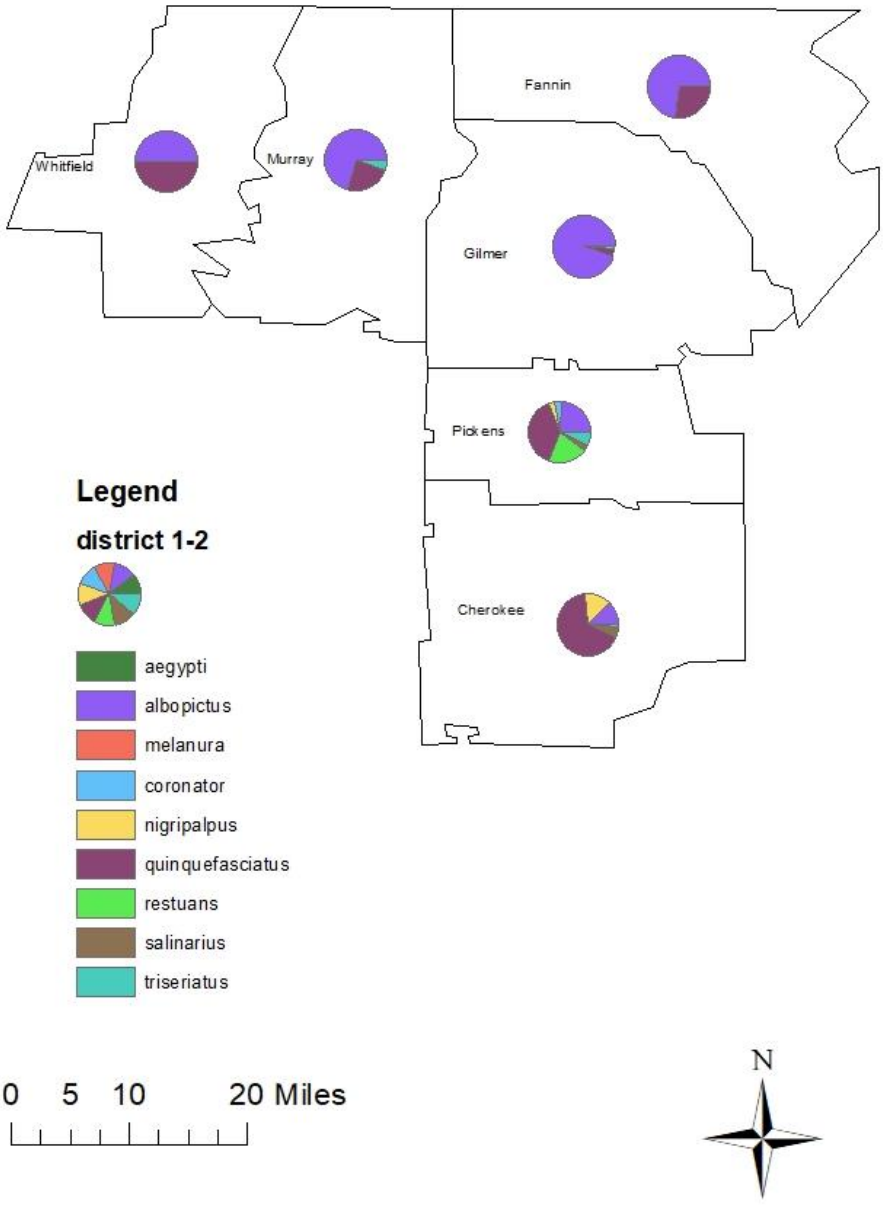
Pickens	*Ae. albopictus*	2	5
	Ae. vexans	2	
	Cx. coronator	1	
	Cx. erraticus	21	
	Cx. nigripalpus		1
	Cx. quinquefasciatus	4	7
	Cx. restuans	6	
	Cx. salinarius	1	
	Oc. mitchellae	4	
	Oc. triseriatus	2	
Whitfield	*Ae. albopictus*	52	
	Ae. vexans	10	
	An. punctipennis	153	
	An. quadrimaculatus	7	
	Cq. perturbans	362	
	Cx. quinquefasciatus	52	
	Oc. japonicus	9	
	Oc. sticticus	4	
	Or. signifera	1	
	Ps. cyanescens	1	
	Ps. cyanescens (male)	2	



Vector Species by County, 2020



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District 2-0

Surveillance in District 2-0 was done by local EHS. Surveillance was done from May-September over 25 trap nights.

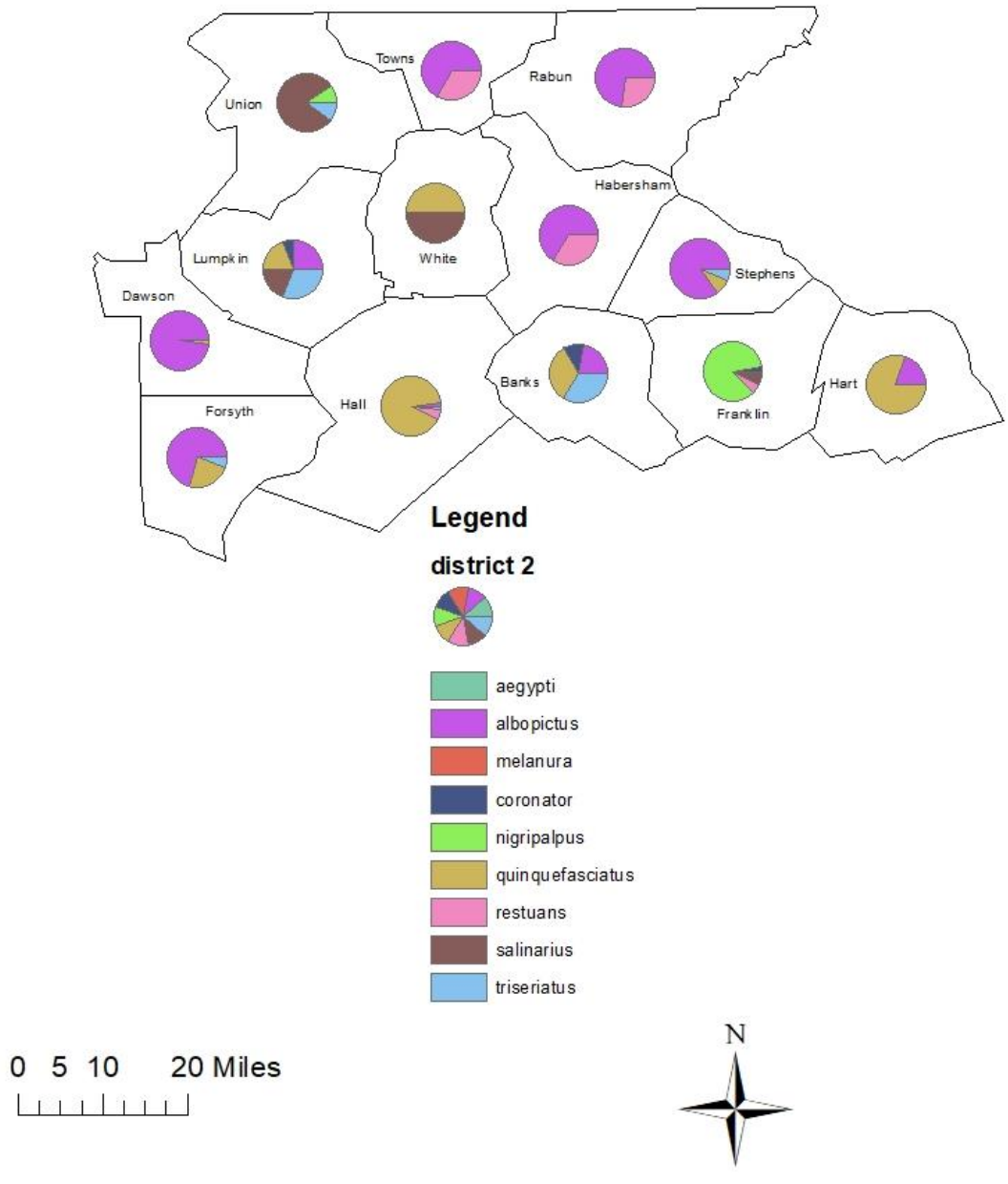
District 2-0		trap type	
County	***Species***	**CDC**	**gravid**
Banks	*Ae. albopictus*	2	
	An. crucians	7	
	An. punctipennis	4	
	An. quadrimaculatus	1	
	Cx. coronator	1	
	Cx. erraticus		1
	Cx. quinquefasciatus		3
	Cx. territans		2
	Oc. japonicus		1
	Oc. triseriatus		3
Dawson	*Ae. albopictus*	90	5
	An. crucians		2
	An. punctipennis	3	
	Cx. quinquefasciatus	2	
	Oc. japonicus		3
Forsyth	*Ae. albopictus*	3	9
	Ae. vexans	1	
	An. punctipennis	1	
	Cx. quinquefasciatus	3	1
	Oc. japonicus		2
	Oc. triseriatus		1
Franklin	*Ae. vexans*	57	
	An. punctipennis	12	
	Cx. coronator		2
	Cx. erraticus	2	
	Cx. nigripalpus	59	
	Cx. restuans	4	
	Cx. salinarius		5
	Oc. japonicus	3	4

AEDES ALBOPICTUS

Towns	*Ae. albopictus*	21	13
	An. punctipennis	9	
	Cx. restuans		17
	Oc. japonicus	3	6
	Ps. ferox	5	
Union	*An. punctipennis*		3
	Cx. nigripalpus	2	
	Cx. salinarius	1	15
	Oc. triseriatus	2	
White	*Cx. erraticus*	1	
	Cx. quinquefasciatus		2
	Cx. salinarius	2	
	Oc. japonicus		10

Habersham	*Ae. albopictus*	74	
	Aedes/Ochlerotatus spp.		4
	An. punctipennis	21	
	Cx. restuans	26	12
	Ps. ferox	26	
Hall	*Ae. albopictus*	4	3
	Ae. vexans	21	
	An. punctipennis	14	3
	Cx. coronator		1
	Cx. erraticus	4	
	Cx. quinquefasciatus		304
	Cx. restuans		18
	Oc. atlanticus	4	
	Oc. japonicus	8	10
	Oc. triseriatus		5
	Or. signifera		1
Hart	*Ae. albopictus*		1
	Cx. quinquefasciatus	1	3
	Oc. japonicus		3
Lumpkin	*Ae. albopictus*	1	3
	An. barberi	1	
	An. punctipennis	1	
	Cx. coronator	1	
	Cx. quinquefasciatus	1	2
	Cx. salinarius		3
	Oc. japonicus		11
	Oc. triseriatus	5	
Rabun	*Ae. albopictus*	30	5
	An. punctipennis	15	
	Cx. restuans	6	7
	Oc. japonicus	33	9
Stephens	*Ae. albopictus*	41	
	Ae. vexans	2	
	An. punctipennis	33	
	Cx. quinquefasciatus		4
	Oc. japonicus	8	
	Oc. triseriatus	3	

Vector Species by County, 2020



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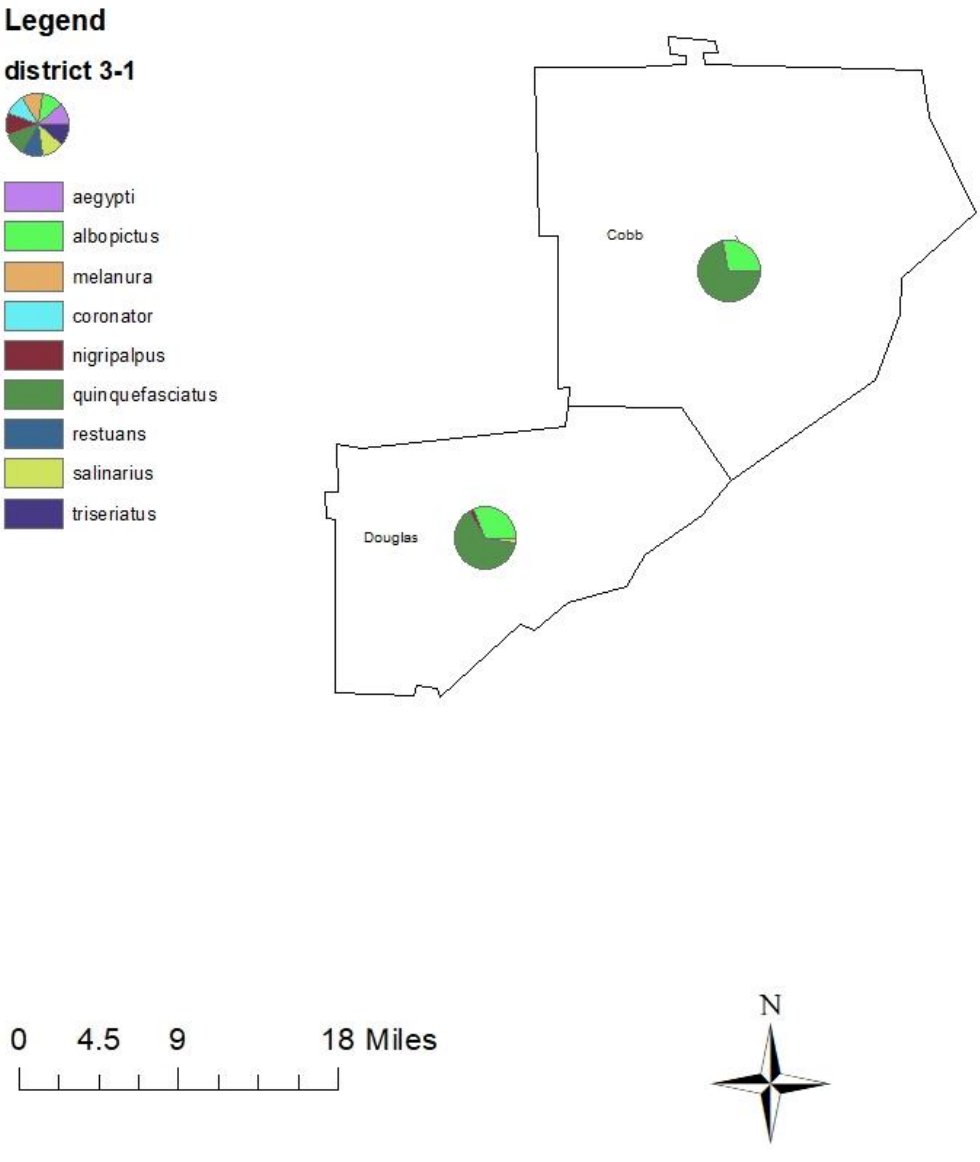
District 3-1

District 3-1		trap type	
County	**Species**	**CDC**	**gravid**
Cobb	*Ae. albopictus*	19	7
	Ae. albopictus (male)		1
	Ae. vexans	4	
	An. punctipennis	10	
	Cx. coronator	1	
	Cx. quinquefasciatus	30	35
Douglas	*Ae. albopictus*		13
	Ae. vexans		4
	An. punctipennis	1	
	Cx. nigripalpus	1	
	Cx. quinquefasciatus	12	15
	Cx. salinarius	1	

Surveillance in District 3-1 was done by an intern and the DPH entomologists. Surveillance was done in April, June, August, and September over 23 trap nights.

CULEX ERRATICUS

Vector Species by County, 2020



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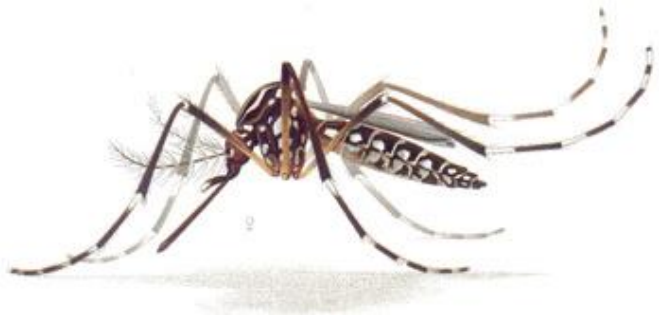
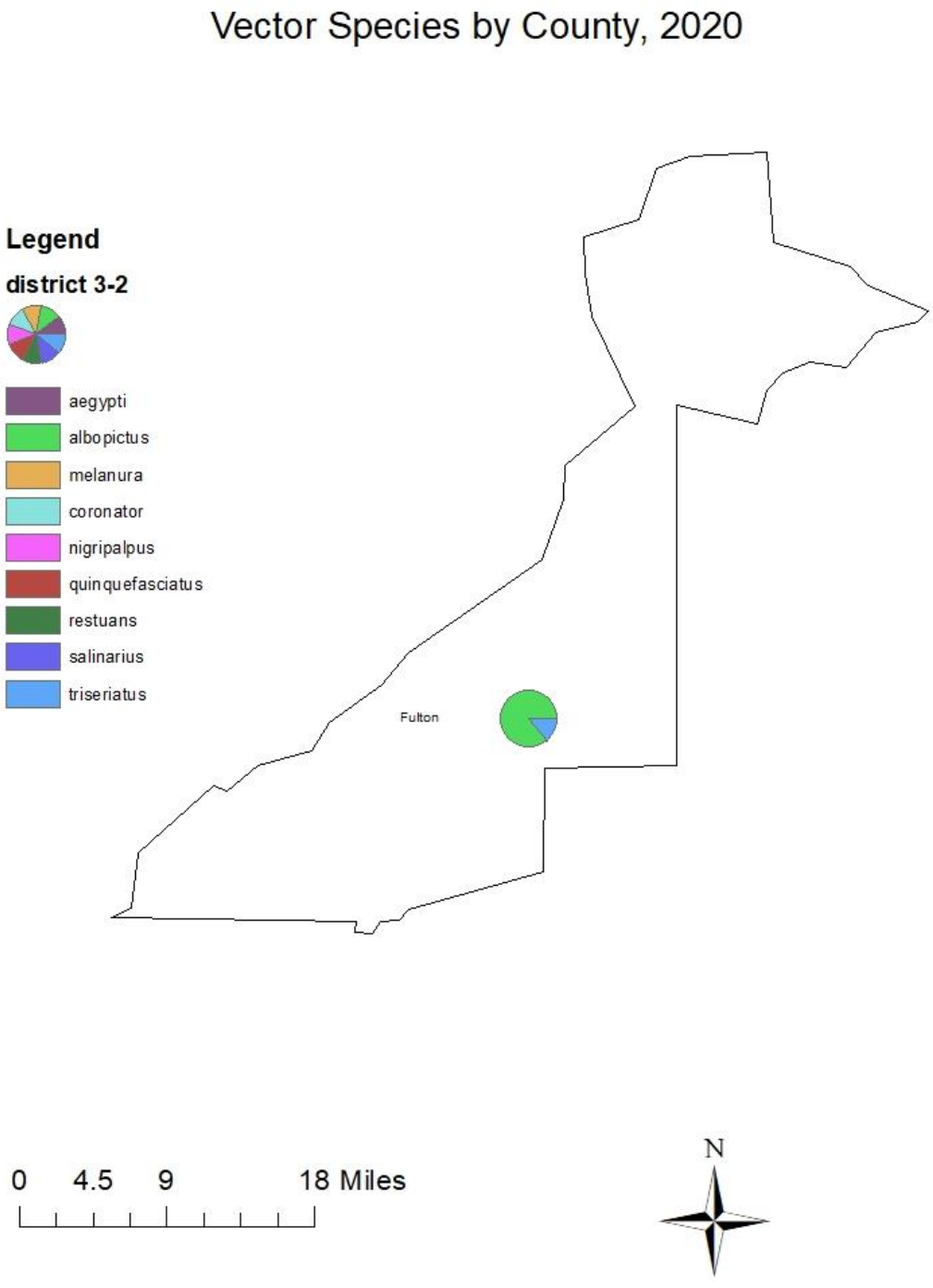
District 3-2

Surveillance in District 3-2 was done by Clarke Mosquito, a company that contracts with the District to do mosquito surveillance and control. Surveillance was done from July-October over 183 trap nights.

District 3-2		trap type		
County	**Species**	**CDC**	**Gravid**	**BGS**
Fulton	*Ae. albopictus*	127	195	300
	Ae. vexans	58	7	16
	An. crucians		11	11
	An. quadrimaculatus	2	2	3
	Cq. perturbans	25		
	Culex spp.	394	1237	46
	Cx. erraticus	87	127	17
	Cx. nigripalpus			1
	Oc. infirmatus	212		
	Oc. japonicus	2	4	
	Oc. triseriatus	6	23	72
	Or. signifera	1	3	
	Ps. ferox	187		1
	Tx. rutilus		4	9



AEDES AEGYPTI

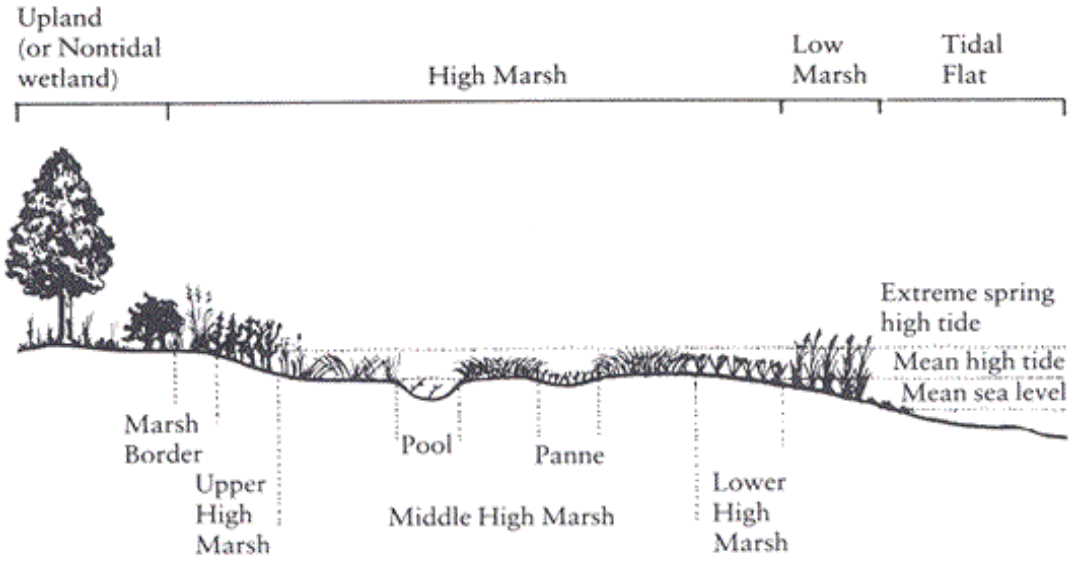

Vector Species by County, 2020
Legend
district 3-2
aegypti
albopictus
melanura
coronator
nigripalpus
quinquefasciatus
restuans
salinarius
triseriatus
Fulton
0 4.5 9 18 Miles
N

District 3-3

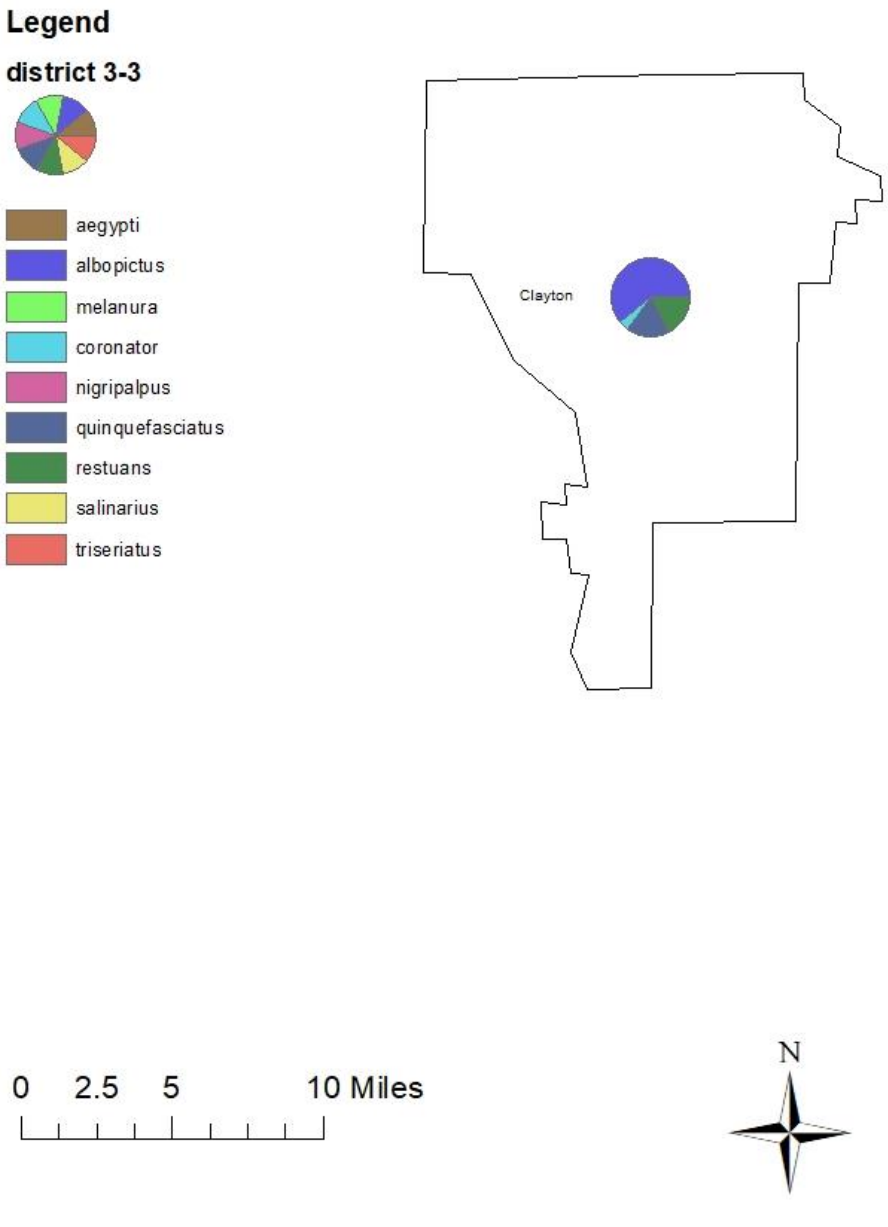
Surveillance in District 3-3 was done by the DPH entomologists. Surveillance was done in April and August over 4 trap nights.

District 3-3		trap type	
County	**Species**	**CDC**	**Gravid**
Clayton	*Ae. albopictus*	2	12
	Ae. vexans	2	
	An. punctipennis	2	
	An. quadrimaculatus	1	
	Cx. coronator	1	
	Cx. erraticus	2	
	Cx. quinquefasciatus	2	2
	Cx. restuans	3	1

floodwater mosquito habitat



Vector Species by County, 2020



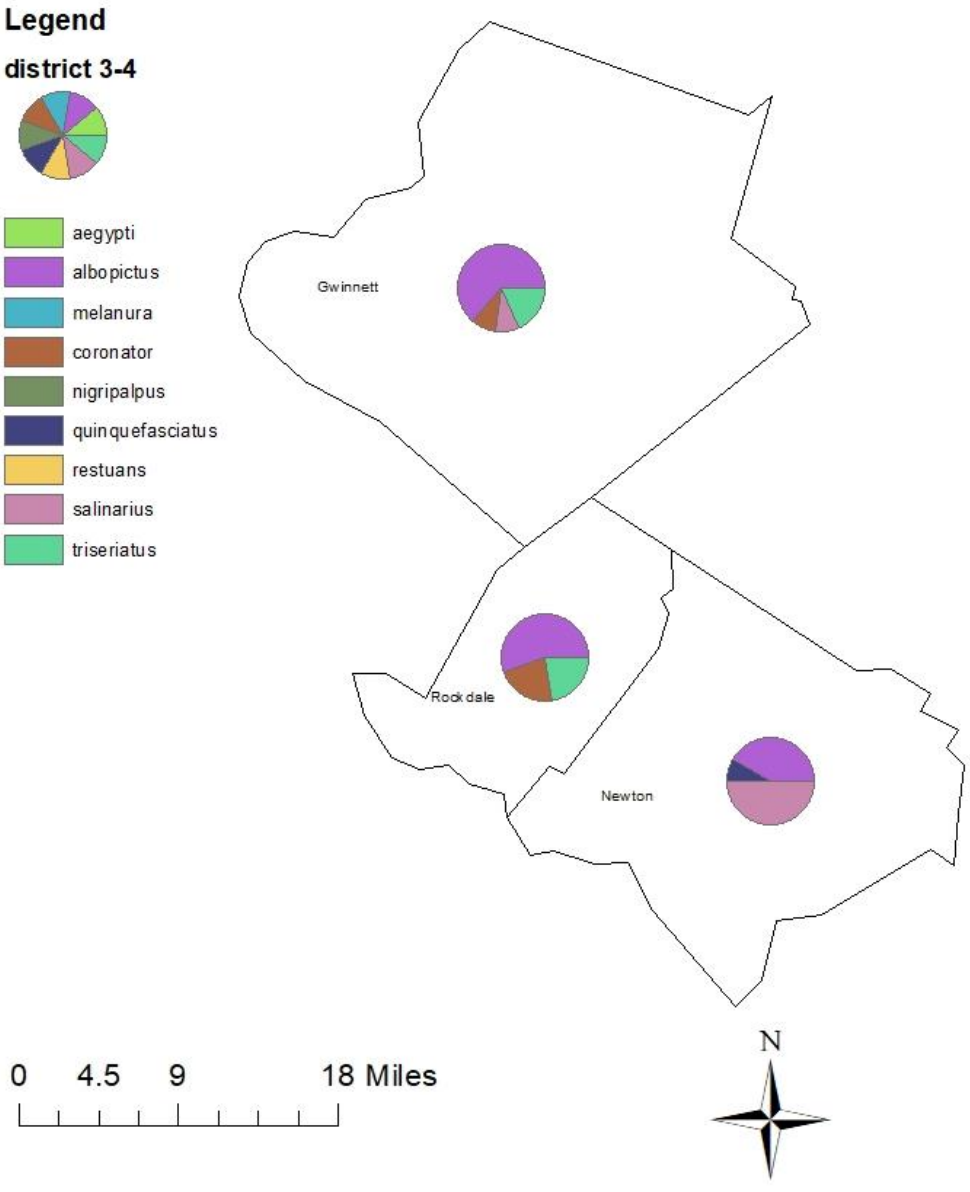
District 3-4

District 3-4		trap type	
County	**Species**	**CDC**	**gravid**
Gwinnett	*Ae. albopictus*	9	5
	Ae. vexans	15	
	An. crucians	5	
	An. punctipennis	11	
	Cq. perturbans	3	
	Culex spp.		1
	Cx. coronator	2	
	Cx. erraticus	10	
	Cx. salinarius	2	
	Oc. japonicus	1	
	Oc. triseriatus	4	
	Tx. rutilus		1
Newton	*Ae. albopictus*		5
	Ae. albopictus (male)		5
	Ae. vexans	3	
	An. crucians	4	
	An. punctipennis	2	
	Cx. erraticus	6	
	Cx. quinquefasciatus		1
	Cx. salinarius	6	
	Oc. canadensis	1	
	Ps. columbiae	12	
Rockdale	*Ae. albopictus*	4	1
	Ae. vexans	1	
	An. crucians	4	
	An. quadrimaculatus	5	1
	Cq. perturbans	2	
	Cx. coronator	2	
	Cx. erraticus	18	1
	Oc. triseriatus	1	1
	Ps. ferox	1	
	Ps. howardii (male)	2	

Surveillance in District 3-4 was done by the DPH entomologists. Surveillance was done in April and in June- September over 9 trap nights.

PSOROPHORA HOWARDII

Vector Species by County, 2020



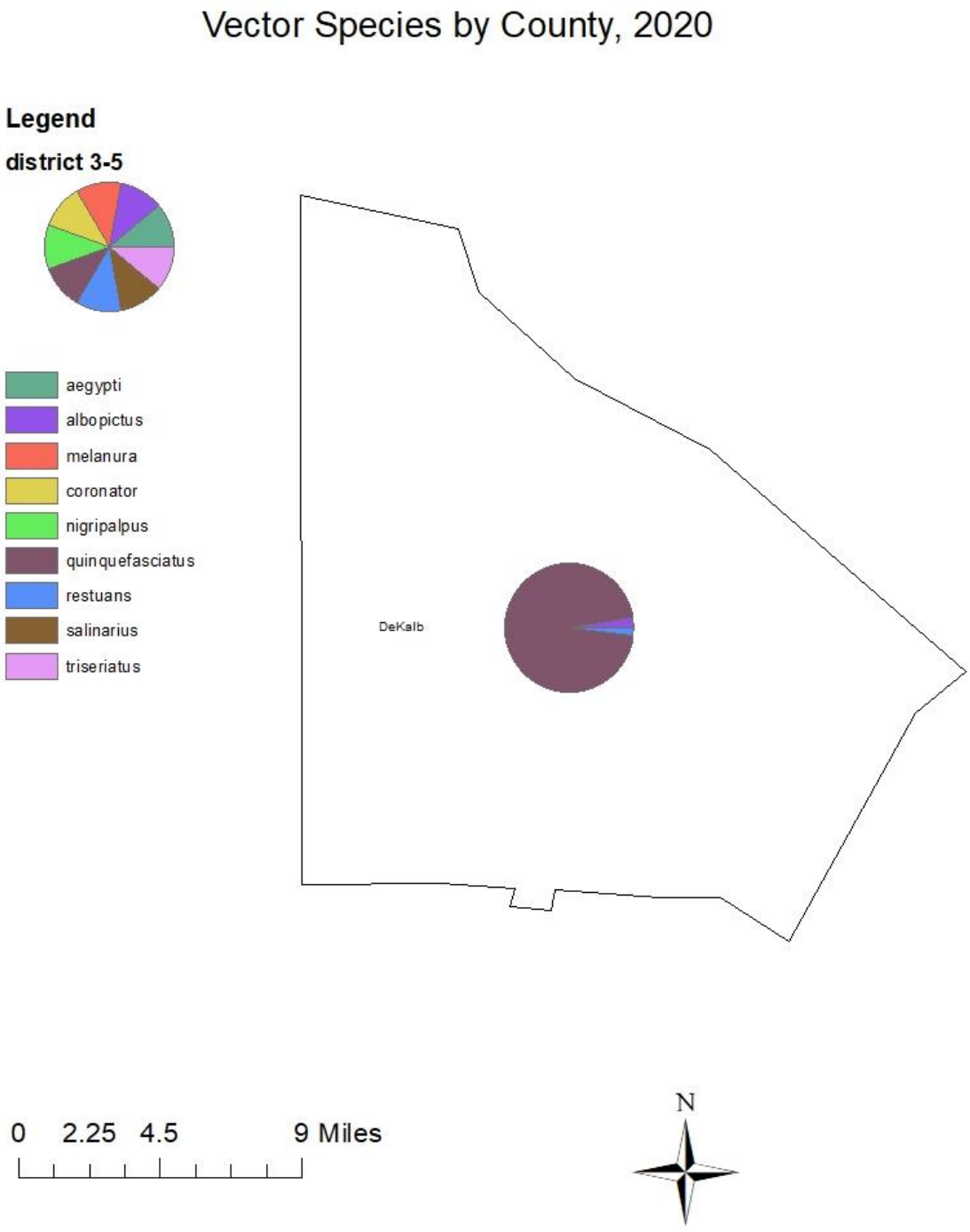
MOSQUITO SURVEILLANCE 2020

District 3-5

District 3-5		trap type
County	**Species**	**Gravid**
DeKalb	*Ae. albopictus*	470
	Ae. albopictus (male)	62
	Aedes/Ochlerotatus spp.	5
	An. punctipennis	6
	An. quadrimaculatus	4
	An. quadrimaculatus (male)	2
	Culex spp.	329
	Culex spp. (male)	115
	Cx. quinquefasciatus	17261
	Cx. restuans	373
	Oc. japonicus	113
	Oc. triseriatus	65
	Oc. triseriatus (male)	5
	Or. signifera	14
	Tx. rutilus	1
	Ur. sapphirina	1

Surveillance in District 3-5 was done by interns in the Environmental Health program. Surveillance was done from July - Oct over 93 trap nights. County-level tested and untested mosquito data were shared with the DPH.

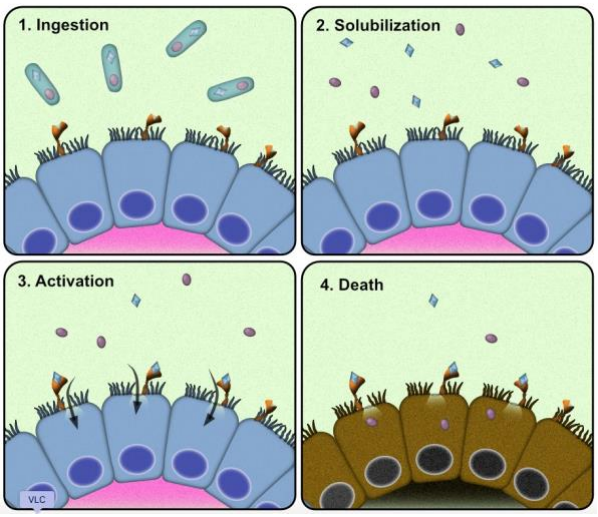
SALT MARSH HABITAT


Vector Species by County, 2020
Legend
district 3-5
aegypti
albopictus
melanura
coronator
nigripalpus
quinquefasciatus
restuans
salinarius
triseriatus
DeKalb
0 2.25 4.5 9 Miles
N

District 4-0

Surveillance in District 4-0 was done by the DPH entomologists. Surveillance was done from August-October over 27 trap nights.

District 4-0		trap type	
County	**Species**	**CDC**	**Gravid**
Butts	*Ae. albopictus*		4
	Ae. vexans	1	
	Cx. erraticus	1	2
	Cx. quinquefasciatus		7
Carroll	*Ae. albopictus*	2	
	An. crucians	2	
	An. punctipennis	1	
	An. quadrimaculatus	1	
	Cx. coronator	1	
	Cx. erraticus	5	1
	Cx. quinquefasciatus	1	
	Oc. japonicus		1
	Oc. triseriatus		3
	Or. signifera		1
Coweta	*Ae. albopictus*	14	2
	Ae. vexans	3	
	Culex spp.	1	
	Cx. coronator	10	
	Cx. erraticus	7	
	Cx. quinquefasciatus	3	
	Cx. salinarius	3	



BTI MODE OF ACTION

MOSQUITO SURVEILLANCE 2020

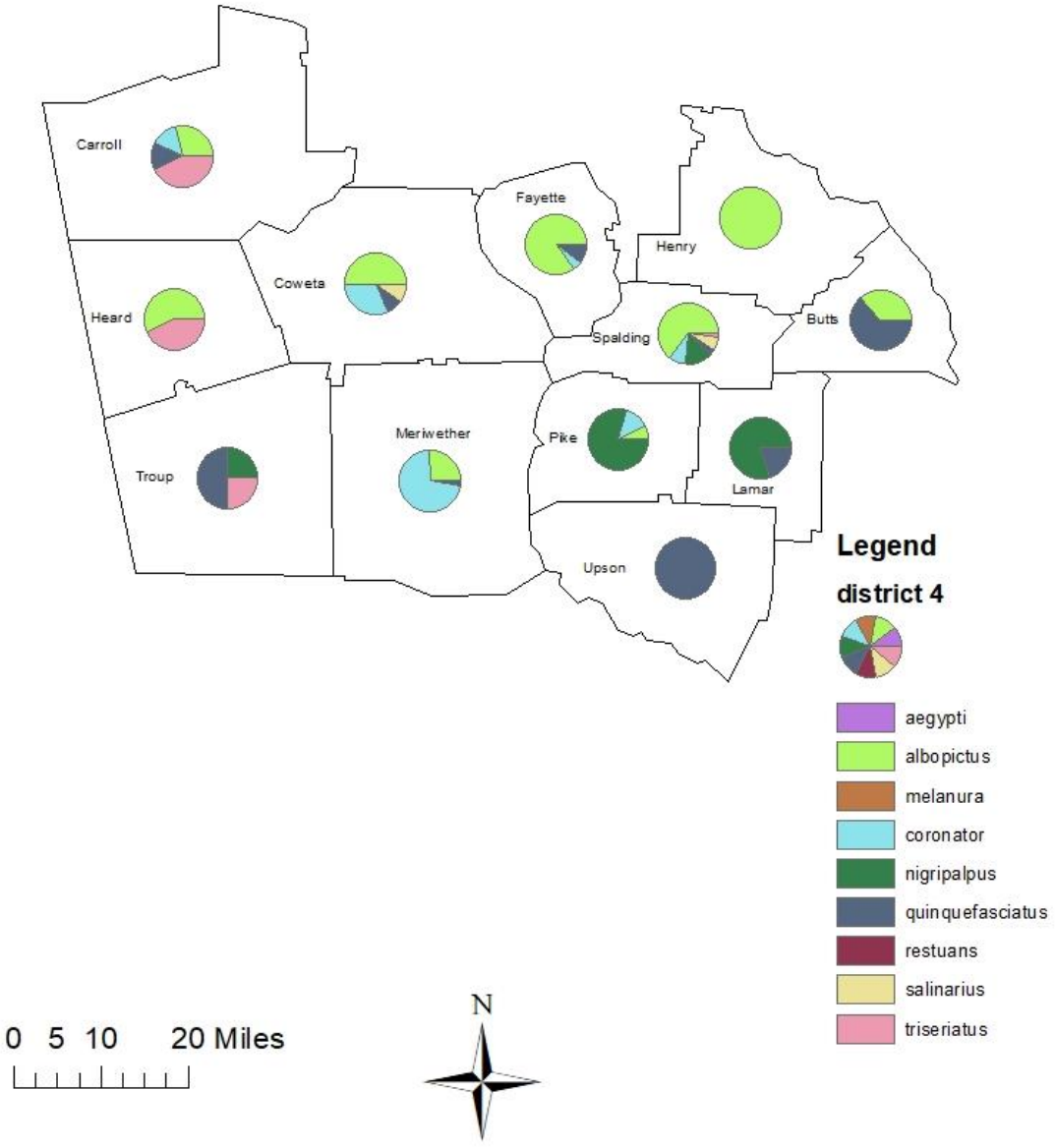
Henry	*Ae. albopictus*		7
	Ae. albopictus (male)		8
Lamar	*An. crucians*	1	
	Cx. erraticus	1	
	Cx. nigripalpus	4	
	Cx. quinquefasciatus	1	
Meriwether	*Ae. albopictus*	1	7
	Ae. vexans	2	
	Cx. coronator	22	
	Cx. erraticus	1	
	Cx. quinquefasciatus		1
	Ps. columbiae	1	
Pike	*Ae. albopictus*	1	1
	Cx. coronator	3	1
	Cx. erraticus	4	
	Cx. nigripalpus	23	
	Oc. infirmatus	1	
	Ps. columbiae	1	
	Ps. ferox	1	
Spalding	*Ae. albopictus*	24	12
	An. punctipennis	1	
	An. quadrimaculatus	3	
	Cx. coronator	5	
	Cx. erraticus	9	
	Cx. nigripalpus	8	
	Cx. quinquefasciatus		2
	Cx. salinarius	4	
	Oc. triseriatus	1	
	Ps. columbiae	1	
	Ps. ferox	1	

Fayette	*Ae. albopictus*		17
	Ae. albopictus (male)		3
	Cx. coronator	1	
	Cx. erraticus	1	2
	Cx. quinquefasciatus		2
Heard	*Ae. albopictus*	1	3
	Culex spp.	1	
	Oc. japonicus	1	
	Oc. triseriatus	1	2

Troup	*Ae. vexans*	1	
	An. punctipennis	1	
	Cx. nigripalpus	1	
	Cx. quinquefasciatus	2	
	Oc. triseriatus		1

Upson	*Culex spp.*	2	
	Cx. quinquefasciatus	46	
	Ps. columbiae	1	

Vector Species by County, 2020



MOSQUITO SURVEILLANCE 2020

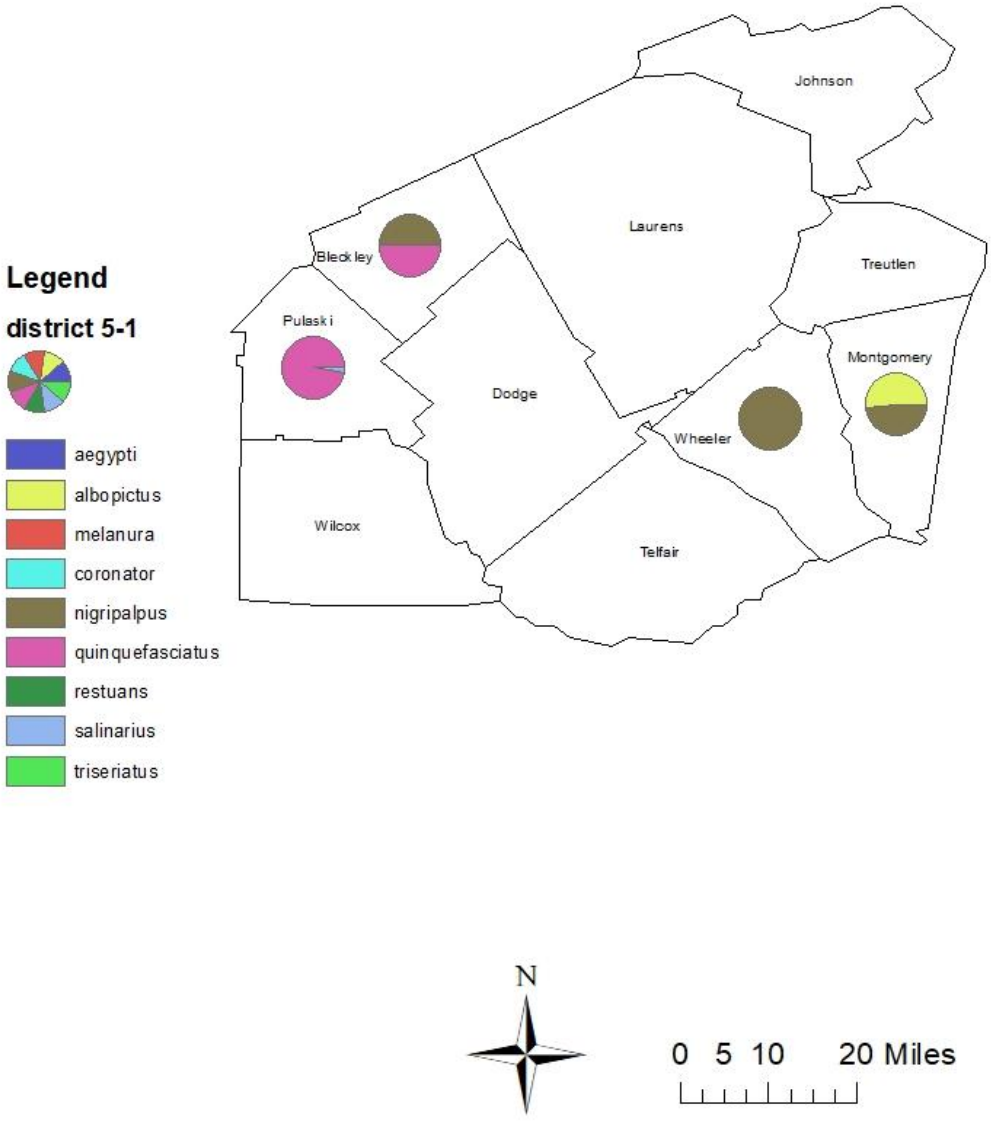
District 5-1

Due to loss of funding, very little surveillance was done in District 5-1 in 2020. Limited surveillance was done in April and August over 8 trap nights.

District 5-1		trap type	
County	**Species**	**CDC**	**gravid**
Bleckley	*Cx. nigripalpus*	1	
	Cx. quinquefasciatus	1	
Montgomery	*Ae. albopictus*	17	2
	Ae. vexans	46	
	An. crucians	17	
	An. punctipennis	8	
	Culex spp.	4	
	Cx. erraticus	12	
	Cx. nigripalpus	18	
	Oc. atlanticus	8	
	Ps. ciliata	1	
	Ps. columbiae	2	
Pulaski	*An. punctipennis*	1	
	Cx. erraticus		2
	Cx. quinquefasciatus	4	32
	Cx. salinarius		1
Wheeler	*Cx. nigripalpus*		2

AERIAL PESTICIDE APPLICATION

Vector Species by County, 2020

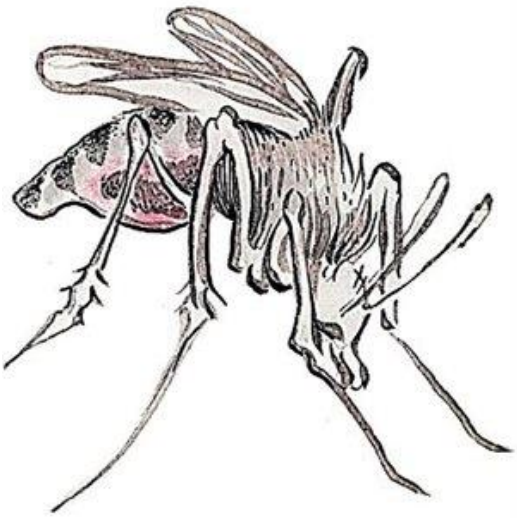


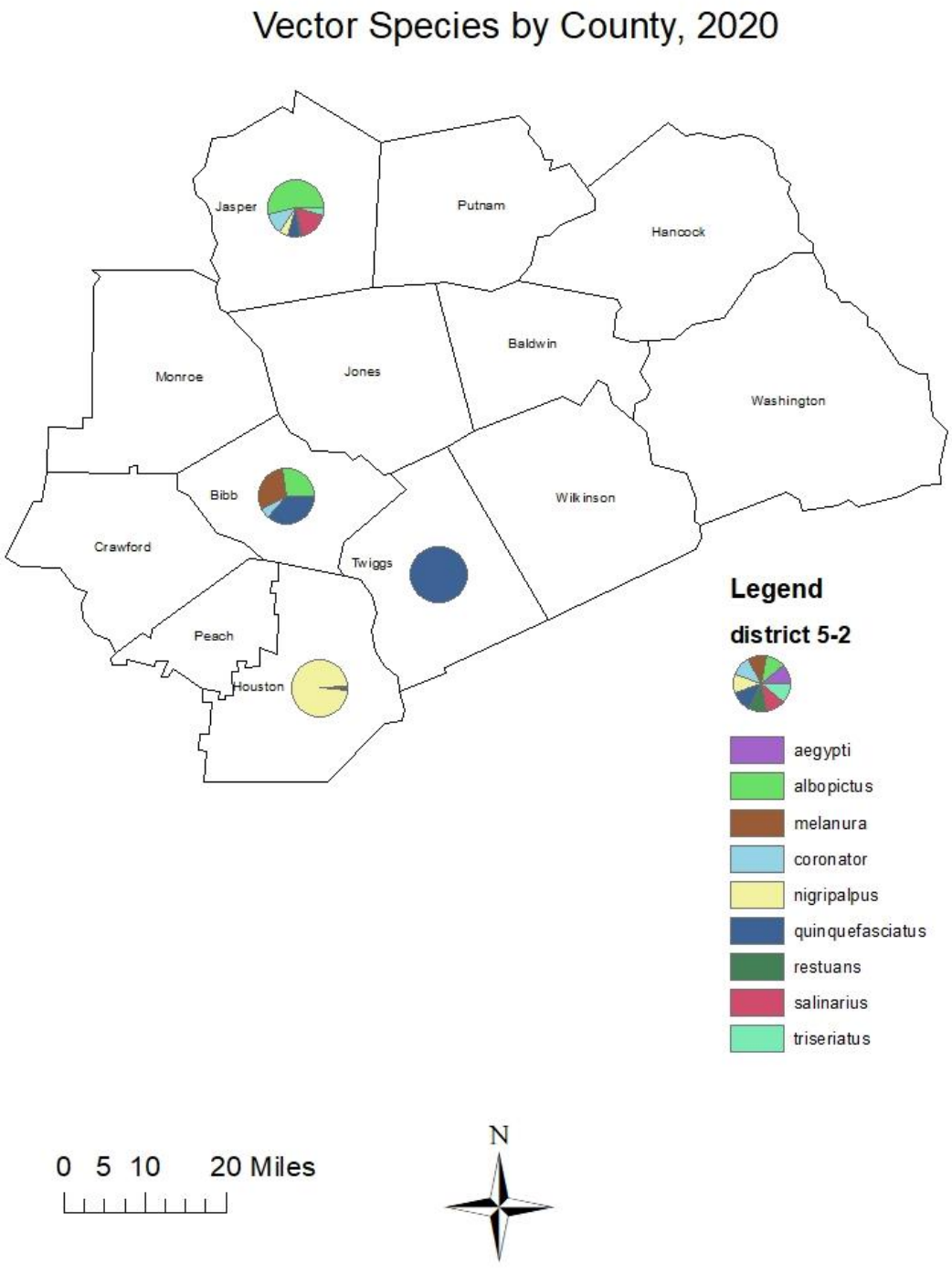
MOSQUITO SURVEILLANCE 2020

District 5-2

District 5-2		trap type	
County	**Species**	**CDC**	**gravid**
Bibb	*Ae. albopictus*	9	
	An. punctipennis	5	
	Cs. melanura		10
	Cx. coronator	2	
	Cx. quinquefasciatus		12
	Oc. japonicus	2	
Houston	*Ae. albopictus*	5	1
	Ae. vexans	8	
	Cx. coronator	2	
	Cx. erraticus	2	
	Cx. nigripalpus	550	13
	Cx. quinquefasciatus		8
	Cx. salinarius		2
	Oc. atlanticus	1	
	Oc. infirmatus		1
Jasper	*Ae. albopictus*	21	19
	Ae. albopictus (male)	5	5
	Ae. vexans	11	
	An. crucians	22	
	An. punctipennis	1	
	An. quadrimaculatus	5	1
	Cx. coronator	9	
	Cx. erraticus	27	1
	Cx. nigripalpus	4	
	Cx. quinquefasciatus	1	4
	Cx. restuans		1
	Cx. salinarius	13	
	Oc. infirmatus	4	
	Oc. triseriatus		3
	Or. signifera		1
	Ps. ciliata	2	
	Ps. columbiae	2	
	Ps. ferox	1	
Twiggs	*Cx. quinquefasciatus*		6

Due to loss of funding, very little surveillance was done in District 5-2 in 2020. Limited surveillance was done in April and from April-October over 20 trap nights.

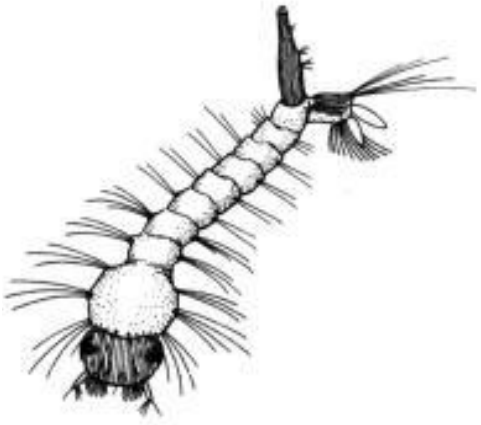


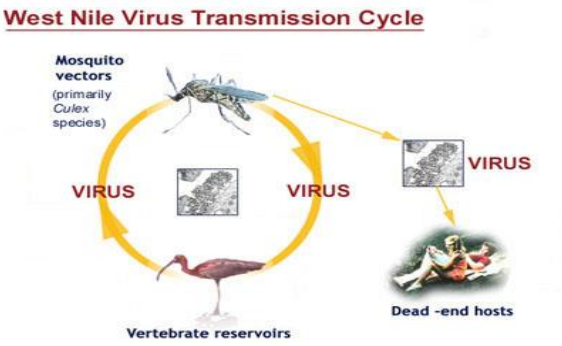

Vector Species by County, 2020
Jasper
Putnam
Hancock
Monroe
Jones
Baldwin
Washington
Bibb
Wilkinson
Crawford
Twiggs
Peach
Houston
Legend
district 5-2
aegypti
albopictus
melanura
coronator
nigripalpus
quinquefasciatus
restuans
salinarius
triseriatus
0 5 10 20 Miles
N

District 6-0

Surveillance in District 6-0 was done by the Richmond County Mosquito Control program. Surveillance was done from Jan - Dec over 475 trap nights.

District 6-0		trap type	
County	***Species***	**CDC**	**gravid**
Burke	*An. perplexens*	1	
	An. punctipennis	2	
	An. quadrimaculatus	1	
	Cx. nigripalpus	5	
	Cx. quinquefasciatus		3
	Cx. restuans		7
	Cx. salinarius		2
	Oc. triseriatus	1	3
Columbia	*Ae. albopictus*	7	4
	Ae. vexans		1
	Cx. quinquefasciatus	2	1
	Cx. territans		3
	Oc. triseriatus		1
Emanuel	*Ae. albopictus*		1
	An. punctipennis	1	
	Cx. quinquefasciatus		3
Glascock	*Ae. albopictus*		2
	Ae. vexans	2	
	An. crucians	1	
	Cx. restuans		10
	Cx. salinarius	1	2





MOSQUITO SURVEILLANCE 2020

Jefferson	*Ae. albopictus*	26	2
	Ae. vexans	22	2
	An. crucians	44	5
	An. perplexens	8	1
	An. punctipennis	51	11
	An. quadrimaculatus	5	
	Cq. perturbans	24	2
	Cx. coronator	1	
	Cx. erraticus	6	
	Cx. nigripalpus	1	
	Cx. quinquefasciatus		2
	Cx. restuans	4	3
	Cx. salinarius	33	
	Cx. territans	1	1
	Oc. canadensis	12	
	Oc. triseriatus	16	
Jenkins	*Ae. albopictus*		1
	Ae. vexans	5	
	An. quadrimaculatus	3	
	Cx. erraticus	29	1
	Cx. nigripalpus	1	
	Cx. salinarius	6	
	Cx. territans		1
	Oc. canadensis		1
	Or. signifera		1
	Ur. lowii	1	
Lincoln	*Ae. cinereus*	1	
	Ae. vexans	10	
	An. crucians	1	
	Cx. erraticus	1	1
	Cx. quinquefasciatus	10	2
	Cx. salinarius	2	
	Oc. thibaulti		1
	Ps. ferox	3	

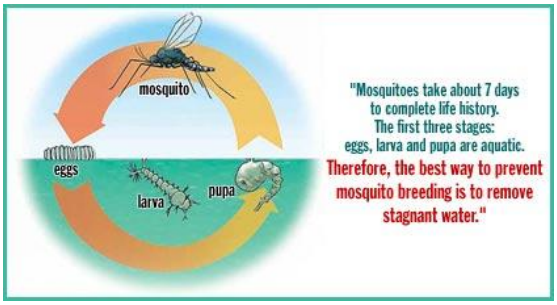
McDuffie	*Ae. albopictus*	2	
	An. punctipennis	4	
	An. quadrimaculatus	1	
	Cx. coronator		1
	Cx. erraticus	1	
	Cx. quinquefasciatus	4	2
	Cx. restuans	3	16
	Cx. salinarius	1	
	Cx. territans		2
	Oc. japonicus		1
Richmond	*Ae. albopictus*	1482	94
	Ae. vexans	877	4
	An. crucians	786	2
	An. perplexens	60	
	An. punctipennis	318	1
	An. quadrimaculatus	161	3
	Cq. perturbans	453	1
	Cs. melanura	8	2
	Cx. coronator	822	4
	Cx. erraticus	727	10
	Cx. nigripalpus	433	5
	Cx. quinquefasciatus	524	742
	Cx. restuans	177	392
	Cx. salinarius	1058	30
	Cx. territans	2	19
	Oc. atlanticus	156	
	Oc. canadensis	2	
	Oc. fulvus pallens	6	
	Oc. infirmatus	4	
	Oc. japonicus	3	18
	Oc. triseriatus	27	14
	Or. signifera		1
	Ps. ciliata	4	
	Ps. columbiae	30	2
	Ps. cyanescens	2	
	Ps. ferox	276	1
	Ps. howardii	14	

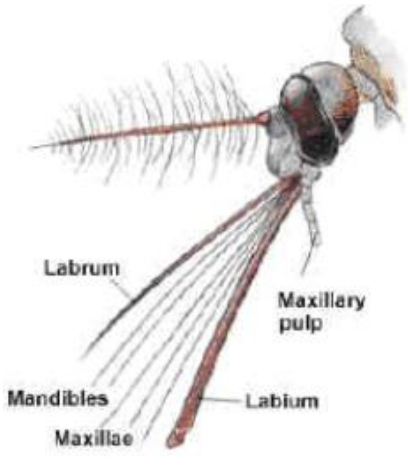
CULEX QUINQUEFASCIATUS

Richmond	*Ur. lowii*	28	
	Ur. sapphirina	36	2

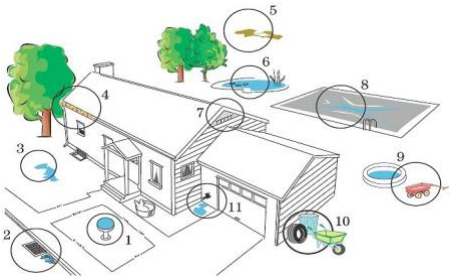
MOSQUITO SURVEILLANCE 2020

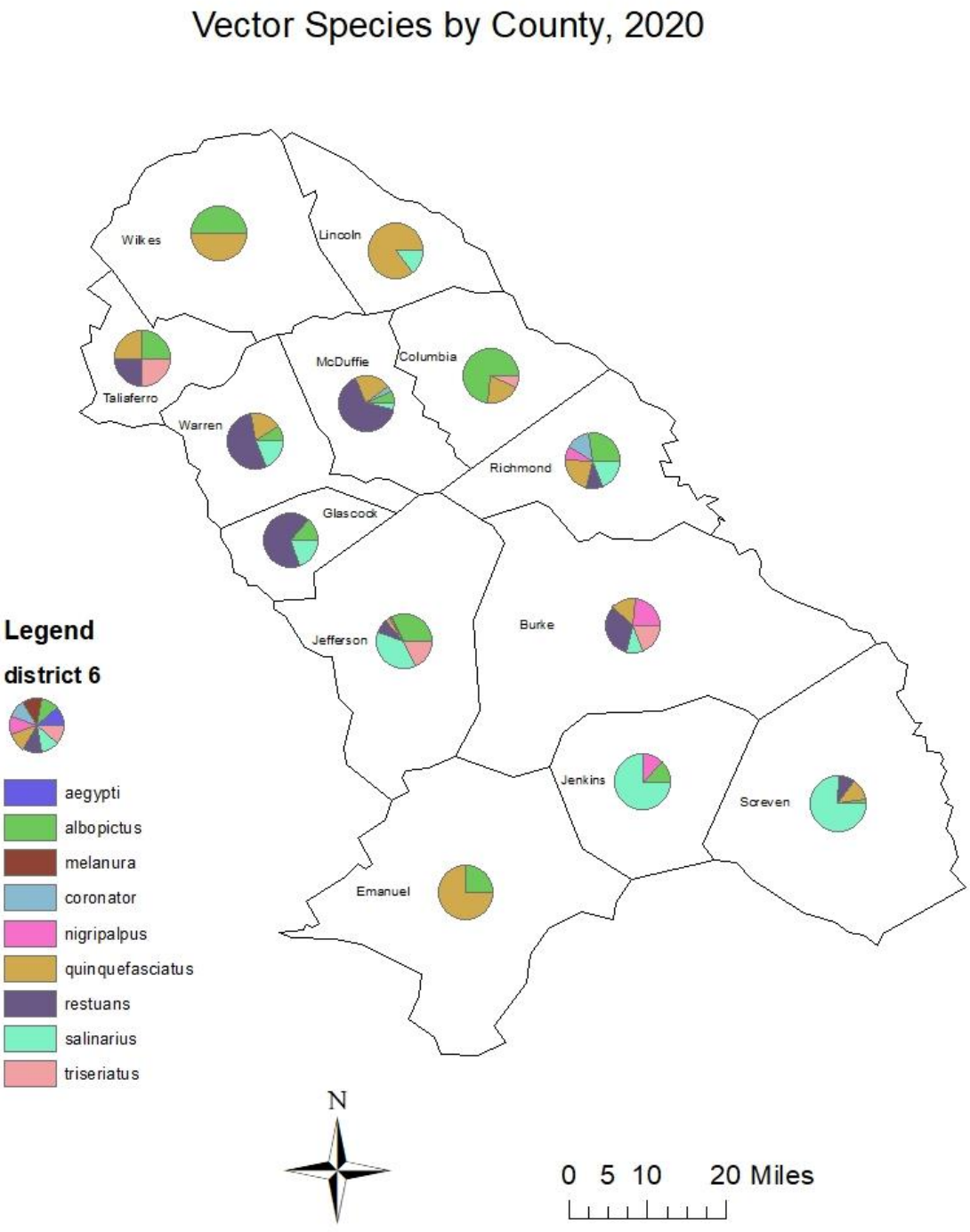
Screven	*Ae. albopictus*	1	
	Ae. vexans	20	
	An. crucians	26	2
	An. perplexens	3	1
	An. punctipennis	7	
	An. quadrimaculatus	1	
	Cq. perturbans	3	
	Cx. erraticus	7	
	Cx. quinquefasciatus	5	
	Cx. restuans	4	
	Cx. salinarius	31	
	Cx. territans	1	1
Taliaferro	*Ae. albopictus*		1
	Cx. quinquefasciatus		1
	Cx. restuans		1
	Oc. japonicus		1
	Oc. sollicitans	1	
	Oc. triseriatus		1
Warren	*Ae. albopictus*	1	
	An. punctipennis	7	
	Cx. quinquefasciatus	1	1
	Cx. restuans		6
	Cx. salinarius	2	
	Oc. canadensis	1	2
Wilkes	*Ae. albopictus*	1	
	Ae. vexans	1	
	Cx. quinquefasciatus		1
	Cx. territans		1





Mosquito




Vector Species by County, 2020
Wilkes
Lincoln
Taliaferro
McDuffie
Columbia
Warren
Richmond
Glascock
Jefferson
Burke
Jenkins
Screven
Emanuel
Legend
district 6
aegypti
albopictus
melanura
coronator
nigripalpus
quinquefasciatus
restuans
salinarius
triseriatus
N
0 5 10 20 Miles

District 7-0

Surveillance in District 7-0 was done by one of the VSCs. Surveillance was done in May & August over 45 trap nights.

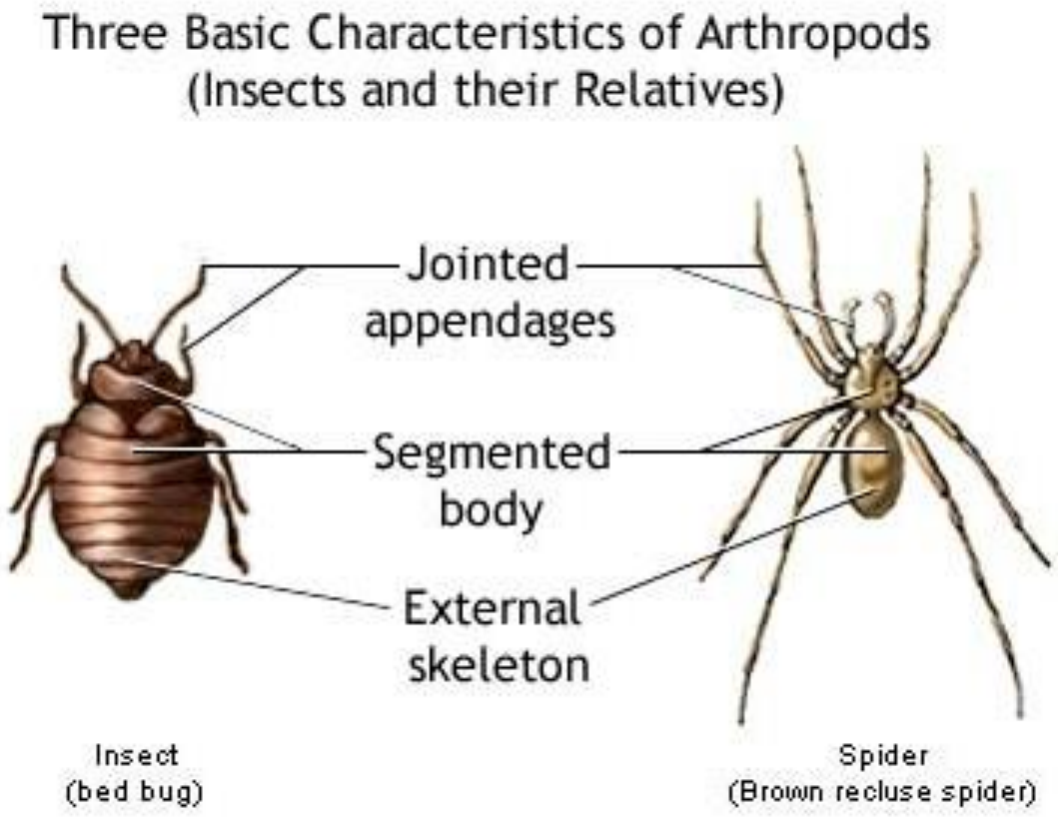
District 7-0		trap type		
County	***Species***	**CDC**	**Gravid**	**BGS**
Chattahoochee	*Ae. albopictus*	3	2	
	Ae. albopictus (male)		2	
	An. crucians	2		
	Cq. perturbans	2	3	
	Cs. melanura	2		
	Culex spp.	1		
	Cx. erraticus	2		
	Cx. nigripalpus	13	6	
	Cx. quinquefasciatus	3	26	
Clay	*Ae. albopictus*		1	
	Ae. albopictus (male)		2	
	Ae. vexans	4		
	An. crucians		2	
	Cq. perturbans	14		
	Cs. melanura	5	3	
	Culex spp. (male)		1	
	Cx. erraticus	1		
	Cx. nigripalpus		10	
	Cx. quinquefasciatus		30	
Crisp	*Ae. albopictus*	1	5	
	Ae. albopictus (male)		5	
	Cq. perturbans	2		
	Cs. melanura	4	1	
	Cx. nigripalpus	21	3	
	Cx. quinquefasciatus	5	26	
	Cx. salinarius	8		

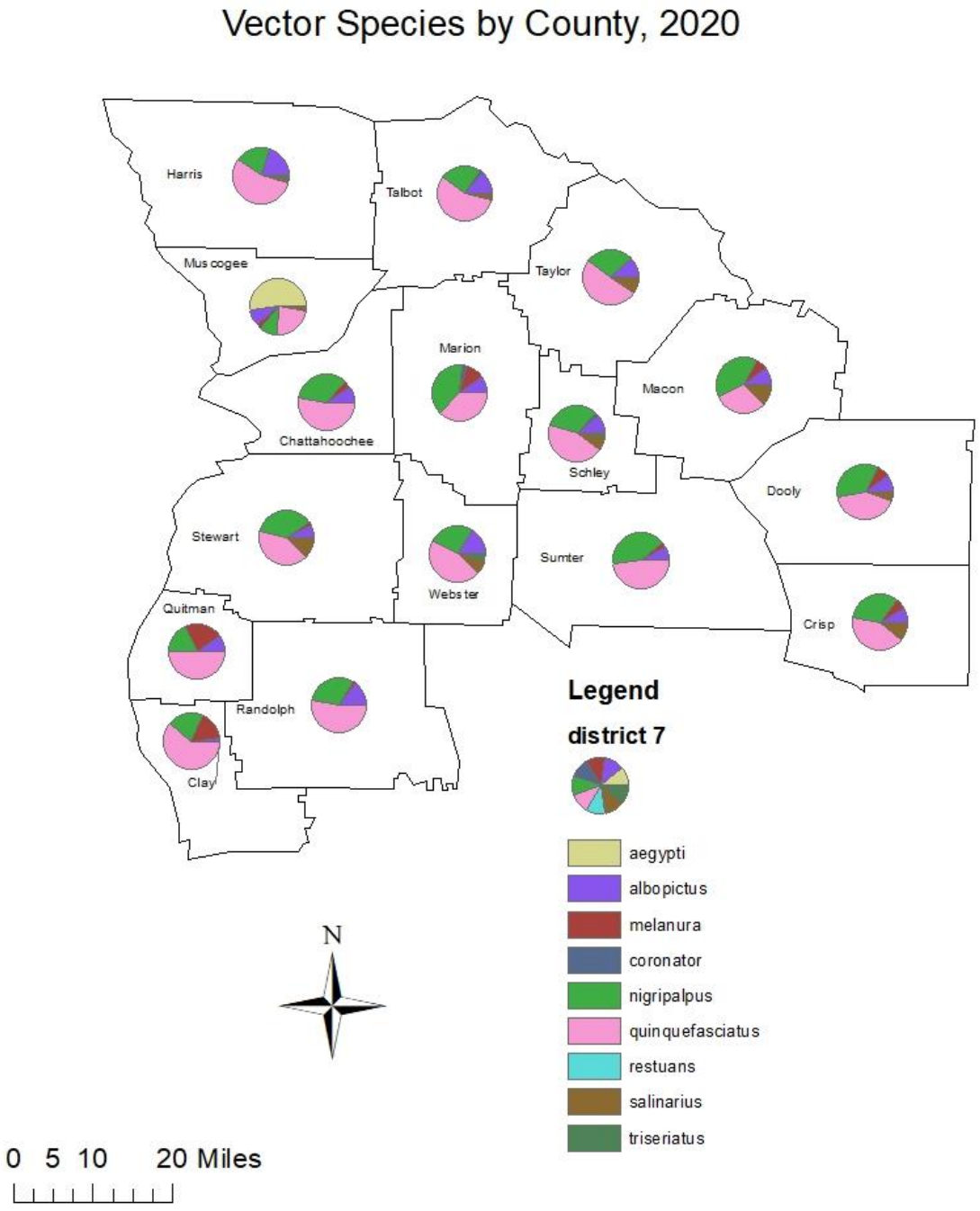
Dooly	*Ae. albopictus*	2	6	
	Ae. albopictus (male)		3	
	Cq. perturbans	3		
	Cs. melanura	4	1	
	Culex spp.		1	
	Cx. nigripalpus	19	9	
	Cx. quinquefasciatus		32	
	Cx. salinarius	4		
Harris	*Ae. albopictus*	4	5	
	Ae. albopictus (male)	1	3	
	Culex spp.		2	
	Culex spp. (male)		1	
	Cx. erraticus	1		
	Cx. nigripalpus	4	5	
	Cx. quinquefasciatus		25	
	Cx. salinarius		1	
	Oc. triseriatus		1	
Macon	*Ae. albopictus*	3	4	
	Ae. albopictus (male)	1	2	
	An. crucians	2		
	Cq. perturbans	2		
	Cs. melanura	3	1	
	Culex spp.	1	1	
	Culex spp. (male)		1	
	Cx. erraticus	4		
	Cx. nigripalpus	20	6	
	Cx. quinquefasciatus	1	19	
	Cx. salinarius	4	4	
Marion	*Ae. albopictus*	2	4	
	Ae. albopictus (male)		2	
	An. crucians		3	
	Cq. perturbans	6		
	Cs. melanura	5	1	
	Cx. coronator	2		
	Cx. nigripalpus	18	5	
	Cx. quinquefasciatus	3	19	

Muscogee	*Ae. aegypti*	20		15
	Ae. albopictus	3	2	1
	Ae. albopictus (male)	3	1	
	Ae. vexans	5		
	Cq. perturbans	5	1	
	Cs. melanura	2		
	Culex spp.	2		
	Culex spp. (male)		1	
	Cx. nigripalpus	4	3	
	Cx. quinquefasciatus	5	10	
	Cx. salinarius		2	
Quitman	*Ae. albopictus*	1	4	
	Cq. perturbans	22		
	Cs. melanura	7	4	
	Culex spp.		1	
	Cx. erraticus	14		
	Cx. nigripalpus	2	7	
	Cx. quinquefasciatus		25	
Randolph	*Ae. albopictus*	7	4	
	Ae. albopictus (male)	1	1	
	Cq. perturbans	35		
	Cs. melanura		1	
	Culex spp.		2	
	Cx. erraticus	15		
	Cx. nigripalpus	17	6	
	Cx. quinquefasciatus	4	36	
Schley	*Ae. albopictus*	4	6	
	Ae. albopictus (male)		2	
	Cx. coronator	2		
	Cx. erraticus	8		
	Cx. nigripalpus	19	10	
	Cx. quinquefasciatus	2	39	
	Cx. salinarius	5	2	
	Oc. triseriatus		2	

Stewart	*Ae. albopictus*	3	1	
	Ae. albopictus (male)		2	
	Cq. perturbans	3		
	Cs. melanura	1		
	Culex spp.		2	
	Cx. erraticus	3		
	Cx. nigripalpus	12	8	
	Cx. quinquefasciatus		22	
	Cx. salinarius	1	6	
Sumter	*Ae. albopictus*	3	2	
	Ae. albopictus (male)		4	
	Ae. cinereus	3		
	Ae. vexans	4		
	Ae. vexans (male)	2		
	Cs. melanura	2		
	Culex spp. (male)		1	
	Cx. erraticus	2		
	Cx. nigripalpus	21	5	
	Cx. quinquefasciatus	9	21	
Talbot	*Ae. albopictus*	3	4	
	Ae. albopictus (male)		3	
	Culex spp.		1	
	Culex spp. (male)		1	
	Cx. coronator	1		
	Cx. erraticus	2		
	Cx. nigripalpus	5	7	
	Cx. quinquefasciatus	6	23	
	Cx. salinarius		2	
Taylor	*Ae. albopictus*	5	6	
	Ae. albopictus (male)	2	6	
	An. crucians	2		
	Culex spp.	1		
	Cx. nigripalpus	17	10	
	Cx. quinquefasciatus	3	45	
	Cx. salinarius	3	6	
	Ps. columbiae	2		

Webster	*Ae. albopictus*	2	6	
	Ae. albopictus (male)		2	
	Cq. perturbans	5		
	Cx. nigripalpus	9	4	
	Cx. quinquefasciatus		22	
	Cx. salinarius	2	2	
	Oc. triseriatus		2	
	Oc. triseriatus (male)		1	
	Ps. columbiae	1		




Vector Species by County, 2020
Harris
Talbot
Muscogee
Taylor
Marion
Macon
Chattahoochee
Schley
Dooly
Stewart
Webster
Sumter
Quitman
Crisp
Randolph
Clay
Legend
district 7
aegypti
albopictus
melanura
coronator
nigripalpus
quinquefasciatus
restuans
salinarius
triseriatus
N
0 5 10 20 Miles

District 8-1

Surveillance in District 8-1 was done by the local EHS and students from VSU. Surveillance was done from March - Nov over 971 trap nights.

District 8-1		trap type		
County	***Species***	**CDC**	**Gravid**	**Updraft Gravid**
Ben Hill	*Ae. albopictus*	126	94	
	Ae. albopictus (male)		3	
	Ae. vexans	302	22	
	Ae. vexans (male)		1	
	An. crucians	214	9	
	An. punctipennis	273	1	
	An. quadrimaculatus	23		
	Anopheles spp.		6	
	Cq. perturbans	2		
	Cs. melanura	5	4	
	Culex spp.	15	546	
	Culex spp. (male)	8	5	
	Cx. coronator	12	3	
	Cx. erraticus	58	9	
	Cx. nigripalpus	192	37	
	Cx. quinquefasciatus	197	3355	
	Cx. restuans	2	185	
	Cx. salinarius	125	53	
	Oc. canadensis	14		
	Oc. fulvus pallens	2		
	Oc. infirmatus	2	1	
	Oc. sticticus	10	6	
	Oc. triseriatus	3	2	
	Or. signifera		6	
	Ps. ferox	20	1	
	Ur. sapphirina (male)	1		

Berrien	*Ae. albopictus*	55	13	
	Ae. vexans	1163	22	
	Aedes/Ochlerotatus spp.	33		
	An. crucians	657	18	
	An. crucians (male)		3	
	An. punctipennis	16	2	
	An. quadrimaculatus	23		
	Anopheles spp.	1	3	
	Cq. perturbans	249	39	
	Cs. melanura	104	7	
	Cs. melanura (male)	4		
	Culex spp.	65	187	
	Culex spp. (male)	2	11	
	Cx. coronator	1		
	Cx. erraticus	177	17	
	Cx. erraticus (male)		4	
	Cx. nigripalpus	39	11	
	Cx. quinquefasciatus	3	330	
	Cx. restuans	16	99	
	Cx. salinarius	141	29	
	Cx. territans		1	
	Ma. titillans	124		
	Oc. atlanticus	18	1	
	Oc. canadensis	771	3	
	Oc. fulvus pallens	29		
	Oc. infirmatus	33		
	Oc. mitchellae	25		
	Oc. sticticus	29	1	
	Oc. triseriatus	3	3	
	Or. signifera		1	
	Ps. ciliata	10	3	
	Ps. columbiae	33		
	Ps. ferox	53	2	
	Ps. howardii	12		
	Ur. lowii		1	
	Ur. sapphirina	11	1	

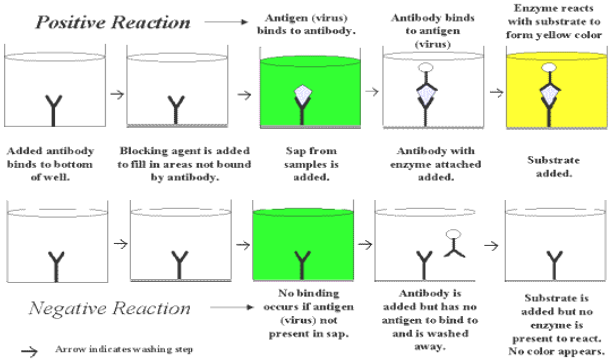
Brooks	*Ae. albopictus*	24	78	4
	Ae. albopictus (male)		1	2
	Ae. vexans	364	2	
	Aedes/Ochlerotatus spp.	2		
	Aedes/Ochlerotatus spp. (male)	2		
	An. crucians	67	15	2
	An. punctipennis	26	1	
	An. quadrimaculatus	8	1	
	An. quadrimaculatus (male)		1	
	Cq. perturbans	84	7	3
	Cs. melanura	52	12	
	Culex spp.	7	339	
	Culex spp. (male)	6	16	2
	Cx. coronator	28	3	
	Cx. erraticus	51	9	
	Cx. nigripalpus	16	49	
	Cx. quinquefasciatus	5	916	16
	Cx. restuans		8	
	Cx. salinarius	30	9	
	Cx. territans		1	
	Oc. atlanticus	645	48	
	Oc. canadensis	25	1	
	Oc. fulvus pallens	4		
	Oc. infirmatus	1		
	Oc. mitchellae	1		
	Oc. sticticus	114	1	
	Oc. triseriatus	3	4	
	Or. signifera		1	
	Ps. ciliata	5		
	Ps. ferox	34		
	Ps. howardii	14		
	Ur. sapphirina	1	2	
	Ur. sapphirina (male)		2	

Cook	*Ae. albopictus*	2	38	
	Ae. vexans	260	8	
	Aedes/Ochlerotatus spp.	6		
	An. crucians	383	6	
	An. punctipennis	35		
	An. quadrimaculatus	53	3	
	Anopheles spp.		1	
	Cq. perturbans	21	2	
	Cs. melanura	1	2	
	Culex spp.	32	184	
	Culex spp. (male)	1	11	
	Cx. erraticus	68	15	
	Cx. nigripalpus	426	41	
	Cx. quinquefasciatus	9	721	
	Cx. restuans		123	
	Cx. restuans (male)		2	
	Cx. salinarius	435	17	
	Cx. salinarius (male)		2	
	Cx. territans		1	
	Ma. titillans	7	1	
	Oc. atlanticus		1	
	Oc. canadensis	5	3	
	Oc. infirmatus		6	
	Oc. sticticus	140	5	
	Oc. triseriatus	10	2	
	Or. signifera		2	
	Ps. columbiae	3		
	Ps. ferox	2	4	
	Ur. sapphirina	1		
	Ur. sapphirina (male)	1		

Echols	*Ae. albopictus*	44	36	
	Ae. vexans	177	1	
	Aedes/Ochlerotatus spp.	16	3	
	Aedes/Ochlerotatus spp. (male)		2	
	An. crucians	235		
	An. crucians (male)		1	
	An. punctipennis	3		
	An. quadrimaculatus	9		
	An. quadrimaculatus (male)		1	
	Cq. perturbans	59	5	
	Cs. melanura	504	115	
	Culex spp.	109	105	
	Cx. erraticus	138	31	
	Cx. nigripalpus	161	14	
	Cx. quinquefasciatus	9	349	
	Cx. restuans		19	
	Cx. salinarius	90	4	
	Cx. territans		1	
	Oc. atlanticus	397	6	
	Oc. canadensis	671	7	
	Oc. fulvus pallens	77		
	Oc. infirmatus		2	
	Oc. mitchellae	6	1	
	Oc. sticticus	1642	7	
	Oc. triseriatus	5		
	Ps. ciliata	15		
	Ps. columbiae	22		
	Ps. ferox	76	2	
	Ps. howardii	7		
	Tx. rutilus		1	
	Ur. sapphirina		1	

Irwin	*Ae. albopictus*	13	38	
	Ae. vexans	379	14	
	Aedes/Ochlerotatus spp.	16	1	
	Aedes/Ochlerotatus spp. (male)	1	1	
	An. crucians	726	19	
	An. punctipennis	36		
	An. quadrimaculatus	38		
	Cq. perturbans	109		
	Cs. melanura	1		
	Culex spp.	58	535	
	Culex spp. (male)	7	1	
	Cx. coronator		17	
	Cx. erraticus	226	7	
	Cx. nigripalpus	244	20	
	Cx. quinquefasciatus	453	2349	
	Cx. restuans	53	101	
	Cx. salinarius	489	156	
	Oc. canadensis	241	2	
	Oc. sticticus	54	1	
	Oc. triseriatus	5	2	
	Or. signifera		10	
	Ps. ferox	2		
	Ps. howardii		1	
	Ur. lowii	1		
	Ur. sapphirina	5		
	Ur. sapphirina (male)		1	

ELISA

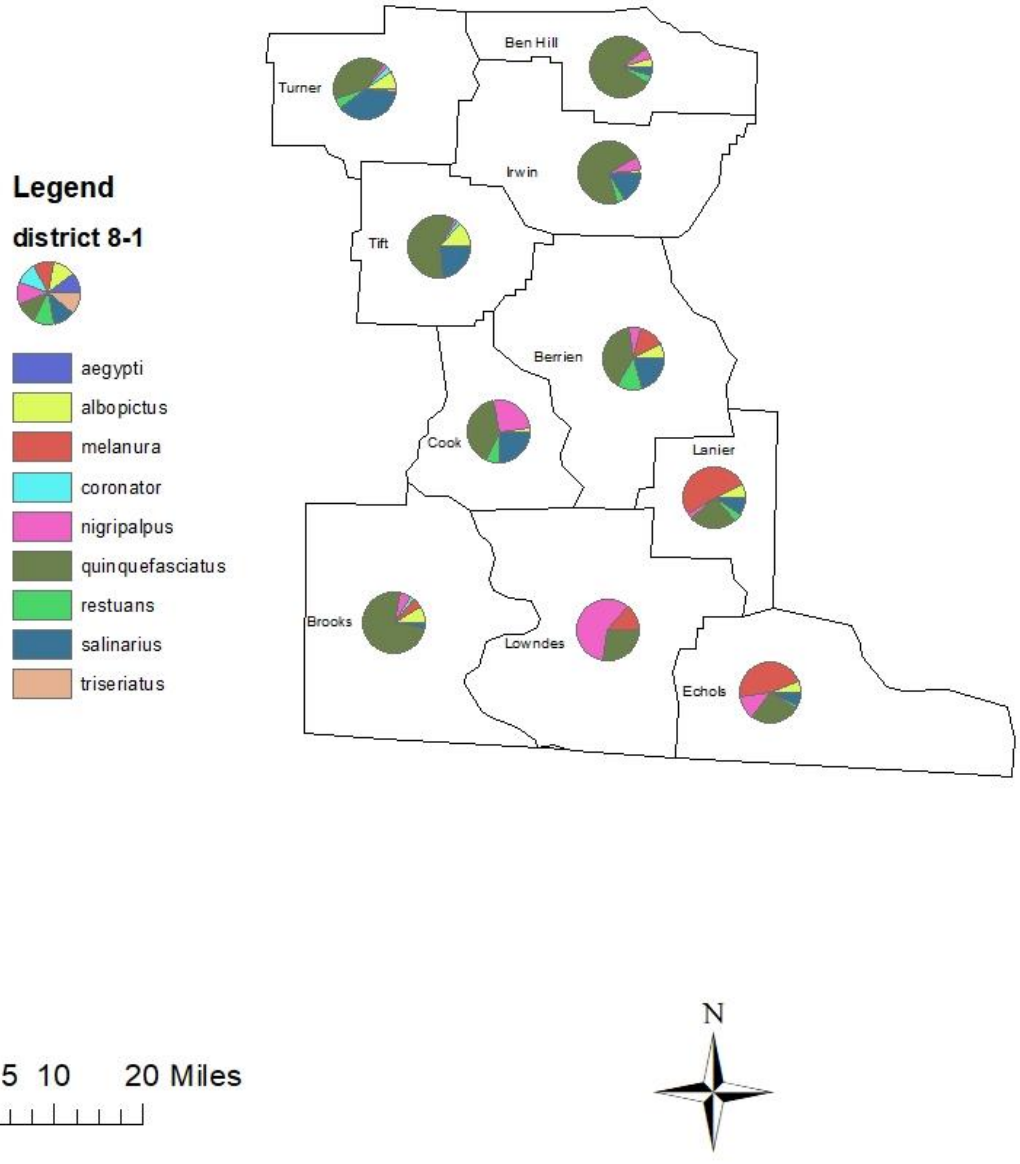


Lanier	*Ae. albopictus*	55	39	
	Ae. vexans	277	1	
	Aedes/Ochlerotatus spp.	26	2	
	An. crucians	1410	8	
	An. punctipennis	2	5	
	An. quadrimaculatus	129	1	
	Anopheles spp.	2		
	Anopheles spp. (male)	1		
	Cq. perturbans	321		
	Cs. melanura	474	209	
	Culex spp.	29	104	
	Culex spp. (male)	3	6	
	Cx. coronator	4		
	Cx. erraticus	407	10	
	Cx. erraticus (male)		1	
	Cx. nigripalpus	33	3	
	Cx. quinquefasciatus		331	
	Cx. restuans		55	
	Cx. salinarius	103	16	
	Cx. territans		2	
	Oc. atlanticus	79	4	
	Oc. canadensis	846	6	
	Oc. fulvus pallens	1		
	Oc. infirmatus	15		
	Oc. mitchellae	16		
	Oc. sticticus	408	1	
	Oc. triseriatus	3	3	
	Or. signifera		1	
	Ps. ciliata	8		
	Ps. columbiae	3		
	Ps. ferox	7		
	Ps. howardii	4	1	
	Ur. sapphirina	3		

Lowndes	*Cq. perturbans*	1039	10	
	Cs. melanura	1508	410	
	Cx. erraticus		2	
	Cx. nigripalpus	5675	2392	
	Cx. quinquefasciatus	29	3763	
	Cx. restuans	15	57	
	Ma. titillans	157		
Tift	*Ae. albopictus*	45	191	
	Ae. albopictus (male)		10	
	Ae. vexans	495		
	Aedes/Ochlerotatus spp.	3		
	An. crucians	146	2	
	An. punctipennis	514	3	
	An. quadrimaculatus	106	1	
	Cq. perturbans	120		
	Cs. melanura		1	
	Culex spp.	10	107	
	Culex spp. (male)	2	91	
	Cx. coronator	44		
	Cx. erraticus	38	7	
	Cx. nigripalpus	17	6	
	Cx. quinquefasciatus	30	1077	
	Cx. quinquefasciatus (male)		1	
	Cx. restuans	1	8	
	Cx. salinarius	385	33	
	Oc. atlanticus	22		
	Oc. canadensis	2		
	Oc. infirmatus	1		
	Oc. sticticus	1232	1	
	Oc. sticticus (male)		1	
	Oc. triseriatus		3	
	Ps. ciliata	2		
	Ps. columbiae	2		
	Ps. ferox	3		
	Ps. ferox (male)		1	
	Ps. howardii	1	1	

Turner	*Ae. albopictus*	37	58	
	Ae. albopictus (male)		2	
	Ae. vexans	106	6	
	Aedes/Ochlerotatus spp.	1	1	
	An. crucians	198	1	
	An. crucians (male)		1	
	An. punctipennis	84	37	
	An. quadrimaculatus	68		
	Anopheles spp.	1		
	Cq. perturbans	73		
	Cq. perturbans (male)	2		
	Culex spp.	38	41	
	Culex spp. (male)	4	2	
	Cx. coronator	30		
	Cx. erraticus	121	25	
	Cx. nigripalpus	17	11	
	Cx. quinquefasciatus	246	174	
	Cx. quinquefasciatus (male)		1	
	Cx. restuans	26	29	
	Cx. salinarius	350	46	
	Cx. territans		1	
	Oc. canadensis	6		
	Oc. canadensis (male)		1	
	Oc. mitchellae (male)	1		
	Oc. sticticus		1	
	Oc. triseriatus	14	3	
	Or. signifera		4	
	Ps. columbiae		1	
	Ps. ferox	56	3	
	Ps. ferox (male)		2	
	Ps. howardii	33	2	
	Psorophora spp.		1	
	Ur. sapphirina	2		

Vector Species by County, 2020



District 8-2

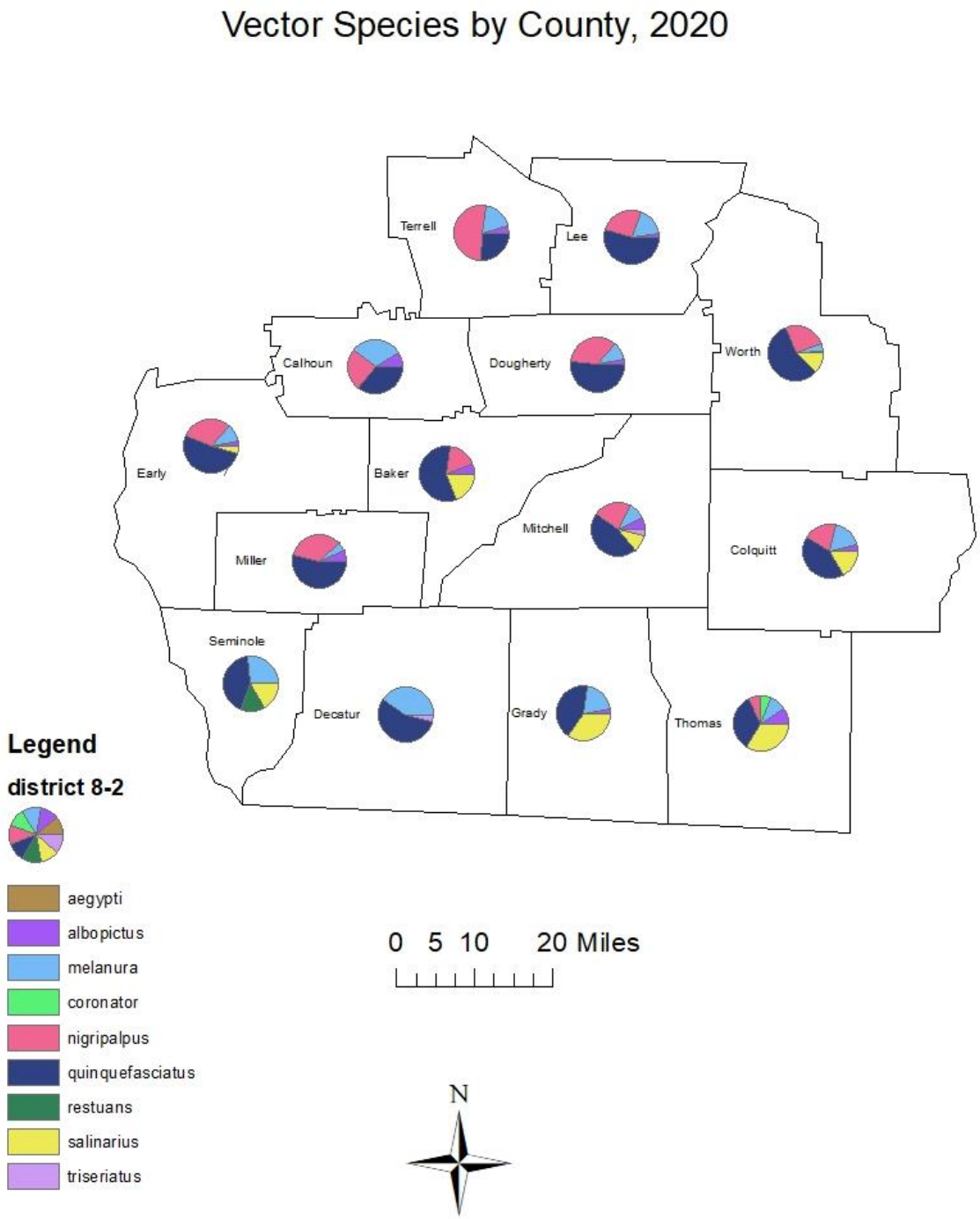
Surveillance in District 8-2 was done by one of the VSCs. Surveillance was done from May-August over 30 trap nights.

District 8-2		trap type	
County	***Species***	**CDC**	**gravid**
Baker	*Ae. albopictus*	2	1
	Ae. vexans	7	
	Ae. vexans (male)	1	
	Cq. perturbans	5	2
	Culex spp. (male)		2
	Cx. erraticus	3	
	Cx. nigripalpus		9
	Cx. quinquefasciatus	4	26
	Cx. salinarius		10
Calhoun	*Ae. albopictus*	2	3
	Ae. albopictus (male)		2
	Cq. perturbans	13	1
	Cs. melanura	13	4
	Cx. nigripalpus	5	9
	Cx. quinquefasciatus	2	18
Colquitt	*Ae. albopictus*	2	2
	Ae. albopictus (male)	1	3
	Cq. perturbans	11	
	Cs. melanura	9	9
	Culex spp. (male)		2
	Cx. nigripalpus	4	16
	Cx. quinquefasciatus		43
	Cx. salinarius	3	14
Decatur	*Cq. perturbans*	20	
	Cs. melanura	10	7
	Culex spp.		1
	Culex spp. (male)		2
	Cx. quinquefasciatus	2	16
	Oc. triseriatus	2	

Dougherty	*Ae. albopictus*		2
	Ae. albopictus (male)		1
	Cq. perturbans	38	
	Cs. melanura	7	
	Cx. erraticus	27	
	Cx. nigripalpus	7	17
	Cx. quinquefasciatus		35
Early	*Ae. albopictus*		3
	Ae. albopictus (male)		1
	An. crucians		1
	Cq. perturbans	9	
	Cs. melanura	6	5
	Culex spp.		2
	Culex spp. (male)		2
	Cx. nigripalpus	16	16
	Cx. quinquefasciatus	2	51
	Cx. salinarius	2	3
Grady	*Ae. albopictus*	3	
	Ae. albopictus (male)		2
	Cq. perturbans	11	5
	Cs. melanura	5	12
	Culex spp.		2
	Culex spp. (male)		
	Cx. quinquefasciatus	4	27
	Cx. salinarius	24	7
Lee	*Ae. albopictus*		2
	Ae. albopictus (male)		1
	An. crucians		4
	Cq. perturbans	8	
	Cs. melanura	4	11
	Cx. nigripalpus	13	9
	Cx. quinquefasciatus	2	45

Miller	*Ae. albopictus*	1	4
	Ae. albopictus (male)		2
	Cq. perturbans	6	
	Cs. melanura	4	
	Culex spp.		1
	Cx. erraticus		5
	Cx. nigripalpus	14	12
	Cx. quinquefasciatus		41
Mitchell	*Ae. albopictus*	4	
	Ae. albopictus (male)	3	
	Ae. vexans	1	
	An. crucians	2	
	An. punctipennis	4	
	Cq. perturbans	14	
	Cs. melanura		6
	Culex spp. (male)		2
	Cx. nigripalpus	4	9
	Cx. quinquefasciatus	4	22
	Cx. salinarius	4	2
	Oc. triseriatus		2
	Ps. columbiae	2	
Seminole	*An. crucians*	6	
	Cq. perturbans	108	
	Cs. melanura	45	
	Culex spp.	2	
	Culex spp. (male)		2
	Cx. quinquefasciatus	13	43
	Cx. restuans		17
	Cx. salinarius	21	5
Terrell	*Ae. albopictus*	2	1
	Ae. albopictus (male)		1
	Cq. perturbans	13	
	Cs. melanura	6	6
	Culex spp. (male)		2
	Cx. nigripalpus	28	7
	Cx. quinquefasciatus		17

Thomas	*Ae. albopictus*	2	8
	Ae. albopictus (male)		1
	Cq. perturbans	22	
	Cs. melanura	11	
	Culex spp.		1
	Culex spp. (male)		2
	Cx. coronator	7	
	Cx. nigripalpus	8	
	Cx. quinquefasciatus		38
	Cx. salinarius	28	10
Worth	*Ae. albopictus*	1	
	Ae. albopictus (male)	1	1
	Cq. perturbans	16	
	Cs. melanura	4	
	Culex spp. (male)		1
	Cx. erraticus		2
	Cx. nigripalpus	7	16
	Cx. quinquefasciatus		52
	Cx. salinarius		11

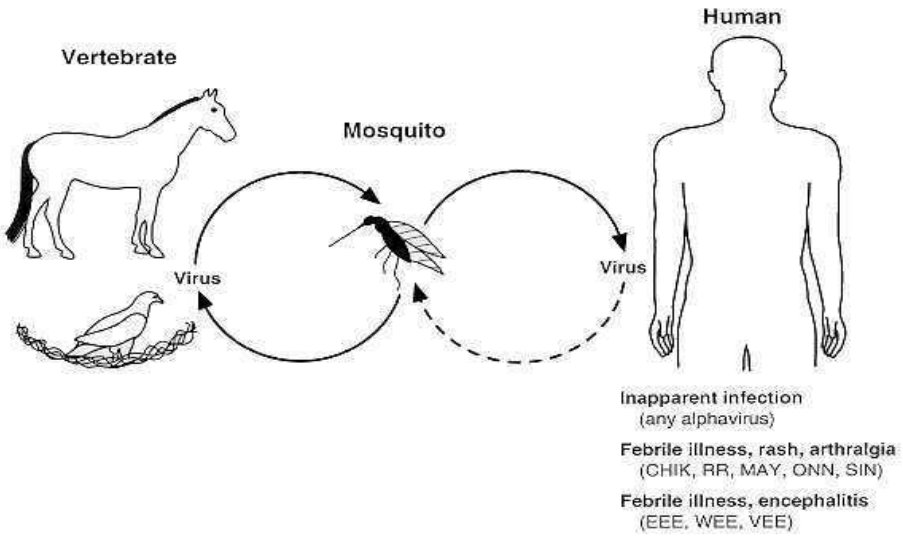

Vector Species by County, 2020
Terrell
Lee
Calhoun
Dougherty
Worth
Early
Baker
Mitchell
Colquitt
Miller
Seminole
Decatur
Grady
Thomas
Legend
district 8-2
aegypti
albopictus
melanura
coronator
nigripalpus
quinquefasciatus
restuans
salinarius
triseriatus
0 5 10 20 Miles
N

District 9-1

Surveillance in District 9-1 was done by one of the VSCs and by Hinesville Public Works (Liberty County), Mosquito Control Services (Glynn County), and Chatham County Mosquito Control programs. Surveillance was done from Jan - Dec over 1770 trap nights.

District 9-1		trap type		
County	***Species***	**CDC**	**Gravid**	**exit**
Bryan	*Ae. albopictus*	55	3	
	Ae. vexans	150	16	
	An. crucians	7		
	Culex spp.	10	6	
	Cx. erraticus	17		
	Cx. quinquefasciatus	103	29	
	Cx. salinarius	23		
	Ps. columbiae	33		
Camden	*Ae. albopictus*	58	4	
	Ae. vexans	8		
	An. crucians	4		
	An. punctipennis	8		
	An. quadrimaculatus	12		
	Anopheles spp.		3	
	Culex spp.		2	
	Cx. erraticus	18	5	
	Cx. nigripalpus	23	4	
	Cx. quinquefasciatus	72	19	
	Cx. salinarius	5		
	Oc. taeniorhynchus	3		
	Ps. ciliata	3		
	Ps. columbiae	6	1	
	Ps. ferox	6		

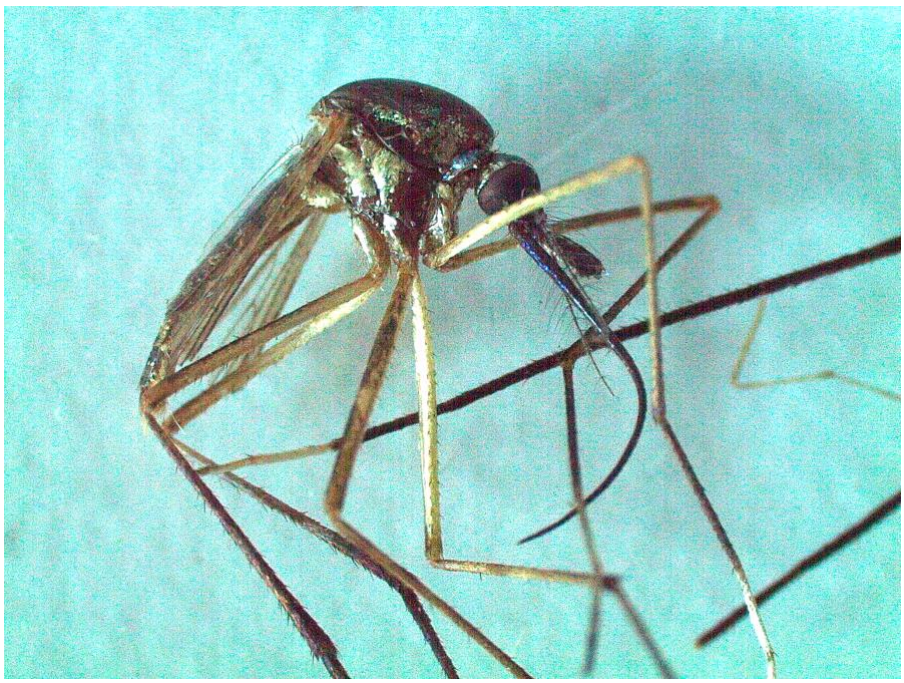
Chatham	*Ae. vexans*	12		
	Cq. perturbans	232		14
	Cs. melanura	283	13	35
	Culex spp.	28	5035	
	Cx. erraticus	4495		22
	Cx. nigripalpus	596	2114	129
	Cx. quinquefasciatus	7	51380	
	Cx. restuans		539	
	Oc. atlanticus	847		
	Oc. infirmatus	59		
	Oc. triseriatus	36	1	5
Effingham	*Ae. albopictus*	13		
	Ae. vexans	2		
	An. crucians	8		
	An. punctipennis	36	2	
	Anopheles spp.		4	
	Cq. perturbans	4		
	Cx. erraticus	18	3	
	Cx. quinquefasciatus	64	18	
	Oc. atlanticus	36	1	
	Ps. ciliata	3		

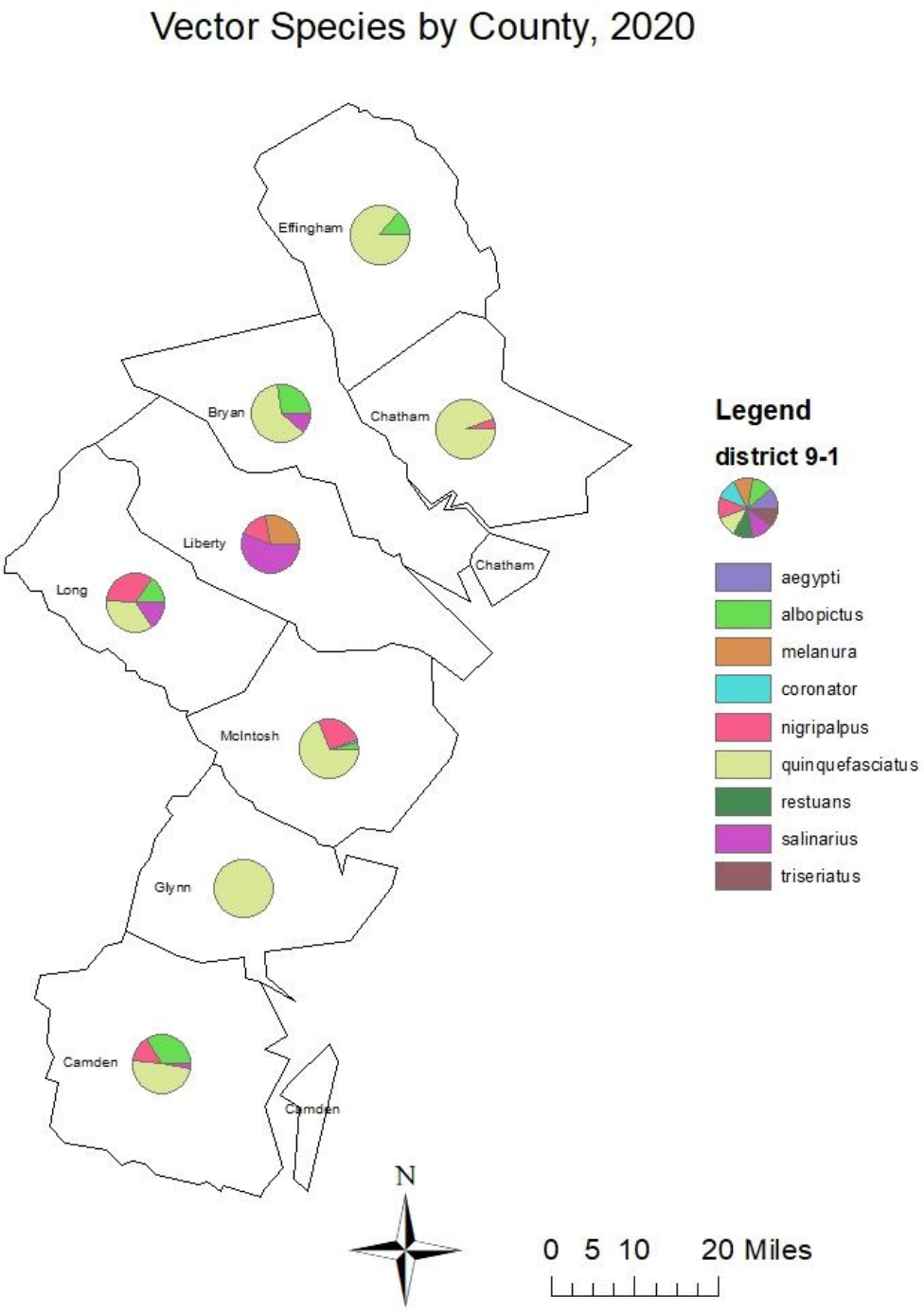


Glynn	*Ae. albopictus*	10		
	Ae. vexans	44		
	An. crucians	197		
	An. quadrimaculatus	37		
	Cq. perturbans	4		
	Cs. inornata	7		
	Culex spp.		15	
	Cx. erraticus	15		
	Cx. inornata	1		
	Cx. nigripalpus	204		
	Cx. quinquefasciatus	66	41268	
	Cx. salinarius	101	45	
	Ma. dyari	6		
	Oc. atlanticus	91		
	Oc. canadensis	5		
	Oc. infirmatus	56		
	Oc. sollicitans	21		
	Oc. taeniorhynchus	185		
	Ps. ciliata	7		
	Ps. columbiae	29		
	Ps. ferox	16		
Liberty	*Ae. vexans*	683		
	An. crucians	8		
	Cs. melanura	58		
	Culex spp.	16		
	Cx. erraticus	6		
	Cx. nigripalpus	33		
	Cx. quinquefasciatus	2		
	Ps. columbiae	1		
Long	*Ae. albopictus*	17		
	Ae. vexans	12		
	An. quadrimaculatus	14		
	Culex spp.	2	5	
	Cx. nigripalpus	37	1	
	Cx. quinquefasciatus	35	4	
	Cx. salinarius	18		

McIntosh	*Ae. albopictus*	5		
	Ae. vexans	12		
	An. crucians	27		
	An. punctipennis	24		
	An. quadrimaculatus	2		
	Anopheles spp.	7	4	
	Cq. perturbans	5		
	Culex spp.	4		
	Cx. coronator	2		
	Cx. erraticus	24		
	Cx. nigripalpus	35		
	Cx. quinquefasciatus	94		
	Oc. atlanticus	109		
	Oc. fulvus pallens	1		
	Oc. taeniorhynchus	23		
	Ps. ciliata	15		
	Ps. columbiae	221		
	Ps. ferox	28		
	Ur. sapphirina	9		

Toxorhynchites rutilus




Vector Species by County, 2020
Effingham
Bryan
Chatham
Chatham
Liberty
Long
McIntosh
Glynn
Camden
Camden
Legend
district 9-1
aegypti
albopictus
melanura
coronator
nigripalpus
quinquefasciatus
restuans
salinarius
triseriatus
N
0 5 10 20 Miles

District 9-2

Surveillance in District 9-2 was done by one of the VSCs. Surveillance was done in January & February and from April-August over 88 trap nights.

District 9-2		trap type	
County	***Species***	**CDC**	**gravid**
Appling	*Ae. albopictus*	4	
	Ae. vexans	34	
	An. crucians	39	
	An. quadrimaculatus	2	
	Anopheles spp.	5	
	Cq. perturbans	41	
	Cx. nigripalpus	50	
	Cx. quinquefasciatus	31	7
	Cx. salinarius	2	
	Ps. columbiae	16	1
Atkinson	*Ae. albopictus*	46	
	Ae. vexans	54	3
	An. punctipennis	114	
	An. quadrimaculatus	41	
	Anopheles spp.		9
	Cx. nigripalpus	34	
	Cx. quinquefasciatus	140	13
	Cx. salinarius	53	
	Oc. canadensis	6	
	Ps. columbiae	21	
Bacon	*Ae. albopictus*	3	
	Ae. vexans	61	
	An. crucians	12	
	An. punctipennis	47	
	Cx. erraticus	41	
	Cx. nigripalpus	3	
	Cx. quinquefasciatus	144	19
	Cx. salinarius	27	4
	Ps. ciliata	19	
	Ps. ferox	9	

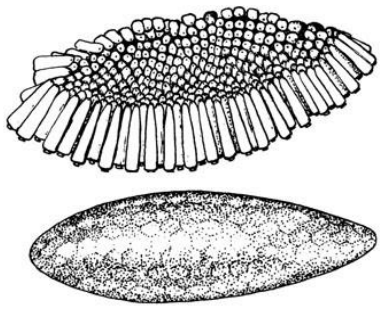
Brantley	*Ae. vexans*	167	
	An. punctipennis	23	
	Culex spp.	6	
	Cx. erraticus	21	8
	Cx. nigripalpus	44	
	Cx. quinquefasciatus	53	16
	Cx. restuans	2	
	Cx. salinarius	11	
	Oc. fulvus pallens	1	
	Or. signifera	2	
Bulloch	*Ae. albopictus*	175	
	Ae. vexans	154	
	An. crucians	234	
	An. punctipennis	172	
	An. quadrimaculatus	2	
	Anopheles spp.	5	
	Cq. perturbans	27	
	Culex spp.	43	
	Cx. coronator	313	
	Cx. erraticus	137	
	Cx. nigripalpus	129	
	Cx. quinquefasciatus	70	
	Cx. salinarius	163	
	Cx. territans	27	
	Oc. atlanticus	5	
	Ps. ciliata	65	
	Ps. columbiae	8	
	Ps. ferox	20	
	unknown	89	
	Ur. sapphirina	6	
Candler	*Ae. albopictus*	11	
	Ae. vexans	9	
	An. crucians	42	
	Cq. perturbans	3	
	Cx. nigripalpus	35	
	Cx. quinquefasciatus	49	
	Cx. salinarius	13	1

Charlton	*Ae. albopictus*	33	5
	Ae. vexans	9	
	Aedes/Ochlerotatus spp.		1
	An. crucians	7	2
	An. punctipennis	34	8
	Culex spp.		3
	Cx. erraticus	31	9
	Cx. nigripalpus	17	
	Cx. quinquefasciatus	72	14
	Cx. salinarius	24	2
	Oc. atlanticus	36	
Clinch	*Ae. albopictus*	18	
	Ae. vexans	120	
	An. crucians	79	
	An. punctipennis	76	15
	Cq. perturbans	26	
	Culex spp.	3	5
	Cx. erraticus	11	2
	Cx. nigripalpus	39	
	Cx. quinquefasciatus	47	
	Cx. salinarius	41	8
	Ps. ciliata	3	
	Ps. ferox	19	1
	unknown	9	
Coffee	*Ae. albopictus*	12	
	Ae. vexans	74	
	An. crucians	113	3
	An. punctipennis	16	
	Cq. perturbans	34	
	Culex spp.	16	2
	Cx. erraticus	8	
	Cx. nigripalpus	60	
	Cx. quinquefasciatus	115	11
	Cx. salinarius	65	
	Oc. atlanticus	31	

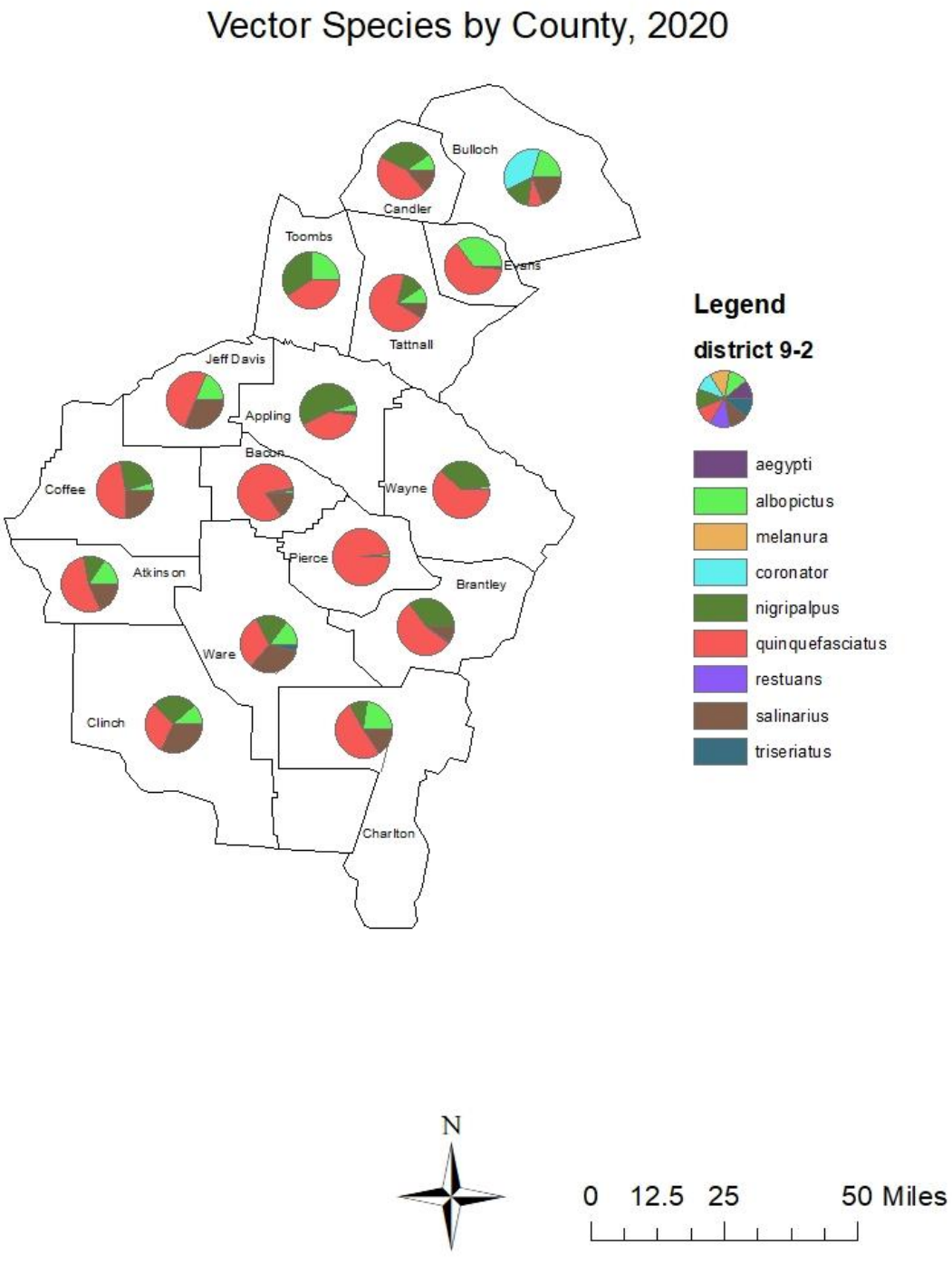
Evans	*Ae. albopictus*	36	2
	Ae. vexans	135	
	An. crucians	8	
	An. punctipennis	19	
	Anopheles spp.	6	
	Cq. perturbans	9	
	Cx. quinquefasciatus	68	
	Cx. salinarius	2	
	Ps. columbiae	4	
Jeff Davis	*Ae. albopictus*	28	
	Ae. vexans	194	17
	An. crucians	31	2
	An. punctipennis	48	4
	Cq. perturbans	107	18
	Cx. quinquefasciatus	48	29
	Cx. salinarius	41	6
	Oc. atlanticus	14	
	Oc. canadensis	2	
	Ps. columbiae	29	5
	Ps. ferox	25	1
Liberty	*Ae. vexans*	335	
	Aedes/Ochlerotatus spp.	10	
	An. crucians	10	
	Cx. salinarius	114	
Pierce	*Ae. albopictus*	2	
	Ae. vexans	100	
	An. crucians	2	
	An. quadrimaculatus	14	
	Cq. perturbans	49	1
	Culex spp.		3
	Cx. erraticus	34	
	Cx. quinquefasciatus	83	39

Tattnall	*Ae. albopictus*	13	
	Ae. vexans	93	
	An. crucians	14	
	An. quadrimaculatus	29	
	Cq. perturbans	43	
	Culex spp.	1	
	Cx. nigripalpus	18	
	Cx. quinquefasciatus	93	7
	Cx. salinarius	13	
	Ps. columbiae	47	
Toombs	*Ae. albopictus*	21	
	Ae. vexans	102	
	An. crucians	11	1
	Culex spp.	2	
	Cx. nigripalpus	29	
	Cx. quinquefasciatus	34	
	Oc. canadensis	9	
	Ps. columbiae	37	
Ware	*Ae. albopictus*	23	
	Ae. vexans	155	
	An. crucians	6	
	An. punctipennis	45	
	Anopheles spp.		3
	Cq. perturbans	66	
	Cx. erraticus	54	
	Cx. nigripalpus	29	
	Cx. quinquefasciatus	51	
	Cx. salinarius	42	9
	Oc. atlanticus	59	
	Oc. canadensis	12	
	Oc. triseriatus	7	
	Ps. columbiae	14	
	Ps. ferox	31	

Wayne	*Ae. albopictus*	2	
	Ae. vexans	64	6
	Cq. perturbans	34	
	Culex spp.	1	
	Cx. erraticus	16	
	Cx. nigripalpus	27	12
	Cx. quinquefasciatus	58	9
	unknown	1	
Washington	*Culex spp.*	7	
Wayne	*Ae. albopictus*	33	
	An. punctipennis	30	
	Culex spp.	3	8
	Cx. erraticus	53	21
	Cx. nigripalpus	50	13
	Cx. quinquefasciatus	21	9
	Cx. salinarius	15	29
	Oc. atlanticus	6	
	Oc. canadensis	3	
Webster	*Ae. albopictus*		4
	Cx. quinquefasciatus		1
Wheeler	*Aedes/Ochlerotatus spp.*	3	
	Cq. perturbans	9	
	Cx. quinquefasciatus	48	
	Ps. columbiae	3	
	unknown	12	9
White	*Cx. restuans*	2	
	Oc. japonicus	1	



Whitfield	*Ae. albopictus*	49	
	Ae. vexans	1	
	An. crucians	1	
	An. punctipennis	10	
	Cx. erraticus	7	
	Cx. quinquefasciatus	5	
	Oc. cinereus	5	
	Oc. dupreei	2	
	Oc. japonicus	5	
	Or. signifera	1	
	Ps. columbiae	1	
	Ur. sapphirina	2	
Wilcox	*Ae. albopictus*		5
	Cx. quinquefasciatus		18
Wilkes	*Ae. albopictus*	1	
	Ae. vexans		1
	An. punctipennis	4	
	Cx. salinarius	1	
	Oc. triseriatus		4
Wilkinson	*Ae. albopictus*	5	
	unknown		2
Worth	*Ae. albopictus*	2	4
	Ae. albopictus (male)		2
	Ae. vexans	6	
	Cq. perturbans	6	3
	Culex spp. (male)		5
	Cx. erraticus	3	
	Cx. nigripalpus	11	11
	Cx. quinquefasciatus	3	44
	Cx. salinarius	4	4

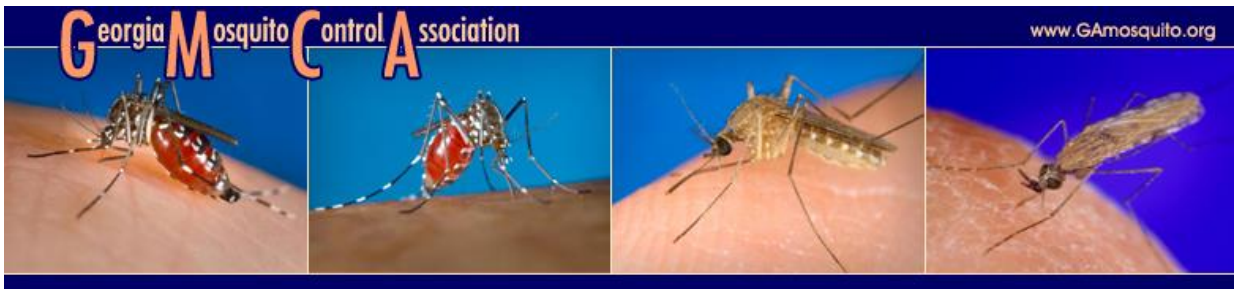

Vector Species by County, 2020
Bulloch
Candler
Toombs
Evans
Tattnall
Jeff Davis
Appling
Bacon
Coffee
Wayne
Atkinson
Pierce
Brantley
Ware
Clinch
Charlton
Legend
district 9-2
aegypti
albopictus
melanura
coronator
nigripalpus
quinquefasciatus
restuans
salinarius
triseriatus
N
0 12.5 25 50 Miles

District 10-0

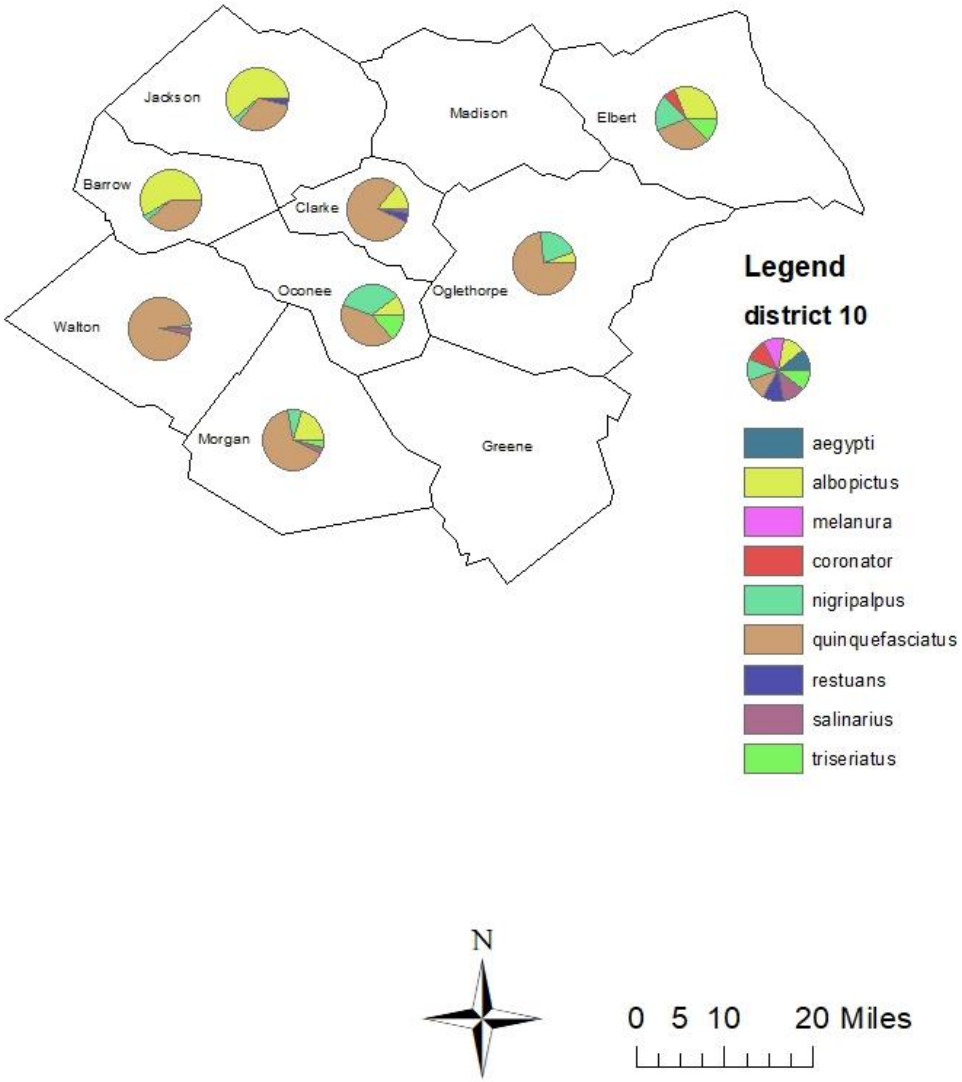
Surveillance in District 10-0 was done initially by local EHS, but due to the COVID-19 response, was completed by DPH entomologists and interns. Surveillance was done from August-October over 21 trap nights.

District 10-0		trap type	
County	***Species***	**CDC**	**gravid**
Barrow	*Ae. albopictus*	18	
	Ae. albopictus (male)	1	
	Cx. nigripalpus	1	
	Cx. quinquefasciatus	4	8
Clarke	*Ae. albopictus*	6	1
	Ae. vexans	1	
	Cx. erraticus	27	
	Cx. quinquefasciatus	19	19
	Cx. restuans	2	
	Cx. salinarius		1
Elbert	*Ae. albopictus*	2	3
	Cx. coronator	1	
	Cx. nigripalpus		3
	Cx. quinquefasciatus	2	3
	Oc. triseriatus	2	
Jackson	*Ae. albopictus*	2	15
	Ae. vexans		3
	Cx. nigripalpus	1	
	Cx. quinquefasciatus	5	4
	Cx. restuans	1	
Morgan	*Ae. albopictus*	6	
	An. punctipennis	1	
	Cx. erraticus	2	
	Cx. nigripalpus		2
	Cx. quinquefasciatus	16	3
	Cx. salinarius	1	
	Oc. triseriatus	1	

Oconee	*Ae. albopictus*	2	1
	Ae. vexans	2	
	An. punctipennis		2
	Cx. nigripalpus	7	3
	Cx. quinquefasciatus	6	6
	Oc. triseriatus	3	1
Oglethorpe	*Ae. albopictus*	1	
	An. punctipennis	1	
	Culex spp. (male)		1
	Cx. nigripalpus	4	
	Cx. quinquefasciatus	12	2
Walton	*Ae. albopictus*	2	
	An. crucians	1	
	Cx. nigripalpus	2	4
	Cx. quinquefasciatus	56	286
	Cx. salinarius	3	8



Vector Species by County, 2020



Integrated Mosquito Management

What does mosquito control do to protect the public health? In Georgia, there are ~60 different mosquito species. Each species of mosquito has a different flight range, host preference, larval habitat and potential for carrying and transmitting infectious disease. Any mosquito that bites or annoys people can be considered a health problem, but in Georgia the definition includes mosquitoes that carry infectious diseases like West Nile Virus (WNV), LaCrosse Encephalitis (LAC), and Eastern Equine Encephalitis (EEE), as well as those can transmit new and emerging viruses like Chikungunya and Zika.

The best way to control the mosquitoes in order to reduce the nuisance factor and protect public health is by utilizing a wide variety of control methods known as Integrated Mosquito Management (IMM). The first part of IMM is trapping and surveillance, which help to quantify the numbers, species, and location of mosquitoes.

What are the techniques of Integrated Mosquito Management (IMM) program that serve to eliminate the mosquito? If your county has mosquito control, it is usually located in the Public Works Department, but may be in Environmental Health or could be a stand- alone agency. The first response to a mosquito complaint is to send an inspector to find the source of the mosquitoes. Source reduction, also known as physical control, is an important part of IMM. This involves finding and eliminating potential mosquito breeding areas and is typically the most effective and economical of the various techniques used to control mosquitoes. Mosquitoes need water for their eggs to hatch and for the larvae to survive until adulthood. In areas around a home these sources may include birdbaths, unscreened swimming pools, and old tires, anything that can retain water. This includes hollow stemmed plants like bromeliads. The inspector should educate the homeowner about keeping these items clean and dry, or rinsing them periodically with fresh water.

If the source is a new pond or other permanent- water area that cannot or should not be drained, the inspector may elect to stock it with small, non- descript mosquito-eating fish called Gambusia. Using the mosquito's natural predator to reduce populations is a method of biological control.

Another technique is called larviciding. Larviciding, as the name implies, kills mosquito larvae and pupae using a variety of products, both chemical and biological. This prevents the metamorphosis of the larvae into the flying, biting pests that we know and hate. Larvicide treatments can be applied by ground or air to standing water depending on the size of the area. Different types of larvicides include chemical pesticides that are absorbed or ingested by the larvae, surface control agents that suffocate the pupae, insect growth regulators, and

microbial larvicides. Larvicides commonly used in Georgia include microbial larvicides and insect growth regulators (IGRs). The microbial larvicide consists of two species of the bacterium, Bacillus (Bti and *B sphaericus*), that are toxic when ingested by mosquito and black fly larvae. Methoprene, an IGR, prevents mosquito larvae from molting to the adult stage. Once adult mosquitoes are on the wing, the only way to control them is to use an adulticide. Using truck-mounted sprayers or aircraft, a condensed plume of ultralow volume (ULV) insecticide is released into the air, which spreads out with the prevailing wind and when it comes into contact with flying mosquitoes, kills them.

Mosquito control may also use a barrier spray to provide the homeowner some temporary relief. This is also one method of controlling day biting mosquitoes. A barrier spray is a coating of pesticide droplets sprayed onto foliage surrounding an area that has been inundated by mosquitoes. This will kill mosquitoes landing in the foliage, and it repels them. It adheres to the underside of the foliage, depriving them of their resting places.

Another technique, thermal fogging, can be used to control day biting mosquitoes or to control mosquitoes in areas where vegetation is dense and ULV does not penetrate. The amount of chemical used is designed to be target specific, in that it kills mosquitoes without harming anything else. Since most mosquitoes do not fly during the daytime, adulticiding is done at dusk and beyond, and the hours just before dawn, when mosquito activity is at its peak. Additionally, pesticide sprayed by ULV machines during the heat of the day rises and never comes into contact with the mosquitoes, and so is wasted.

It is impossible to completely eradicate the mosquito, so the focus should be on controlling mosquito populations in order to reduce the nuisance factor and protect public health by using all aspects of Integrated Mosquito Management. It is important to remind homeowners that they can also play a role in mosquito control, especially where organized mosquito control is not present. Surveillance can be used to determine if the mosquito is *Aedes albopictus*, the Asian tiger mosquito, or some other species. By standing out in the yard during the day and waiting to see if a small black and silver mosquito comes to bite your legs, it is possible to determine if this species is present. This is the most common nuisance species in Georgia and, unless there have been heavy rains recently or the area is along the coast, the mosquito most likely to come and bite during the day.

Why is this important? This species is a container breeder and does not fly very far from where it lays its eggs. Source reduction is the best means of control. Picking up anything that holds water and disposing of it correctly, refilling bird baths and animal water bowls at least once a week, raking up big leaves, and cleaning gutters will help reduce the populations of this species and other container breeders. Additionally, pools need to be maintained properly as

"green" pools breed large numbers of mosquitoes, including the WNV vector. Homeowners can also buy larvicide, both Bti (mosquito dunks) and methoprene (mosquito torpedoes). This can be applied to standing water to control mosquitoes by killing larvae. As with any pesticide, it is important to follow the label instructions explicitly.

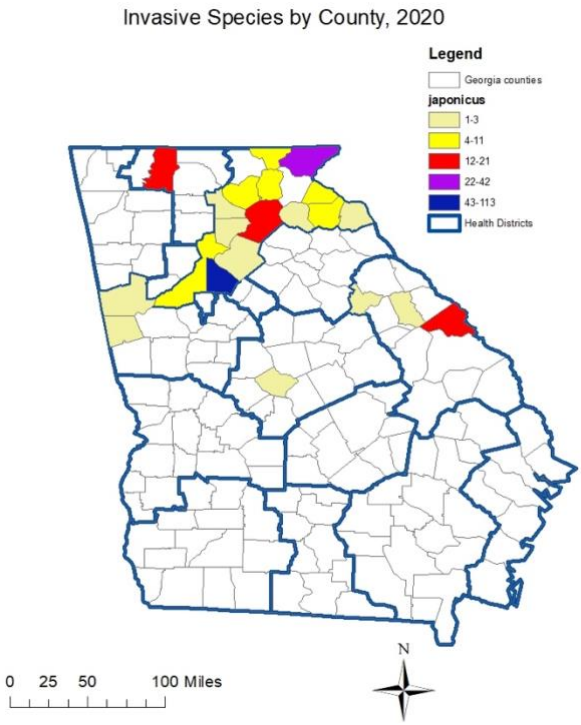
Finally, it is important to wear repellent outside when mosquitoes are biting. Information about the various types of recommended repellents can be found at http://dph.georgia.gov/mosquito-borne-viral-diseases.

Invasive Mosquito Species

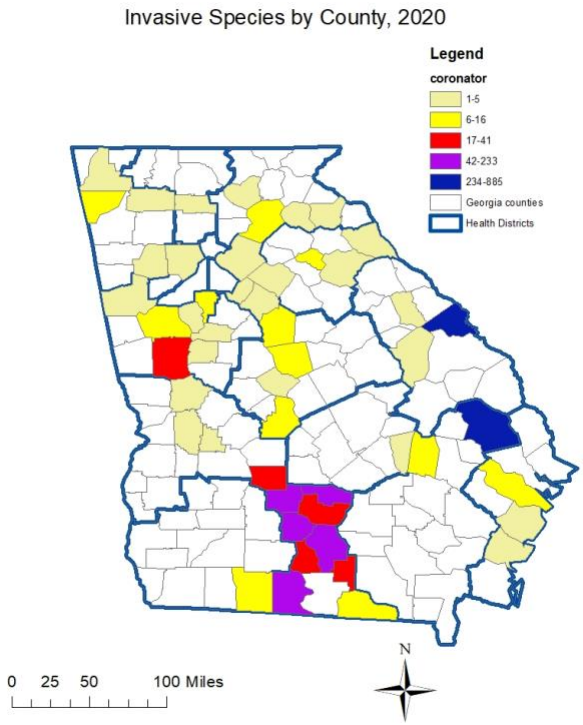
One of the benefits of mosquito surveillance is determining where mosquito species are found. This is especially important for vector species and for invasive species which may become involved in arboviral disease cycle.

Culex coronator was first detected in Georgia in 2006. It was found initially in counties below the Fall line. Mosquito surveillance done in 2017 - 2020 has shown that this species can now be found in most regions of Georgia. It is important to monitor *Cx coronator* as it has the potential to be involved in the WNV cycle.

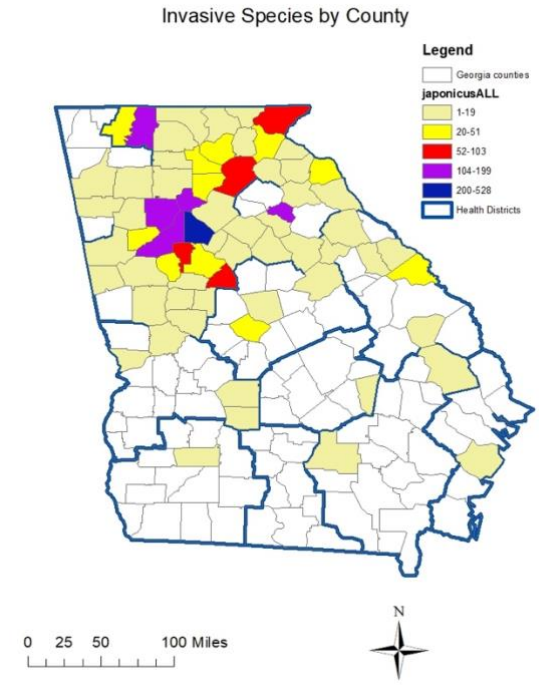
Ochlerotatus japonicus was first detected in Georgia in 2002. This species lays its eggs in rock pools, so was initially found only above the Fall line. Mosquito surveillance done in 2017 - 2020 has shown that this species can now be found in most regions of Georgia. It is important to monitor *Oc japonicus* as it has the potential to be involved in the WNV cycle.



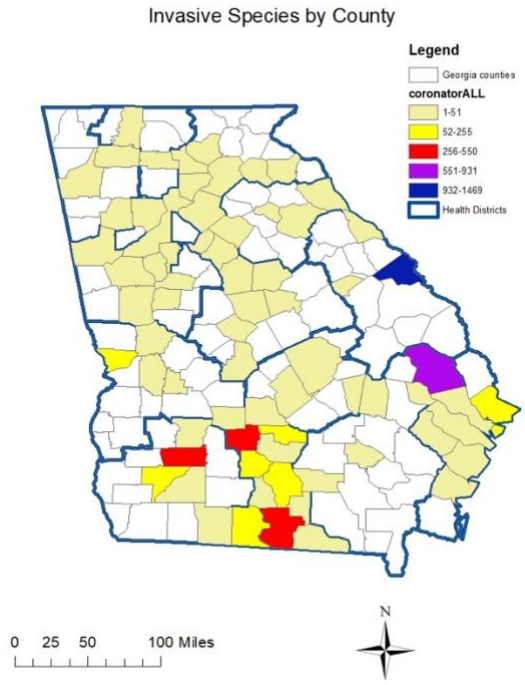
Ochlerotatus japonicus



Culex coronator



Ochlerotatus japonicus, 2002-2020



Culex coronator, 2006-2020

Pesticide Resistance Testing

Statewide Insecticide Resistance Testing of Mosquitoes in Georgia

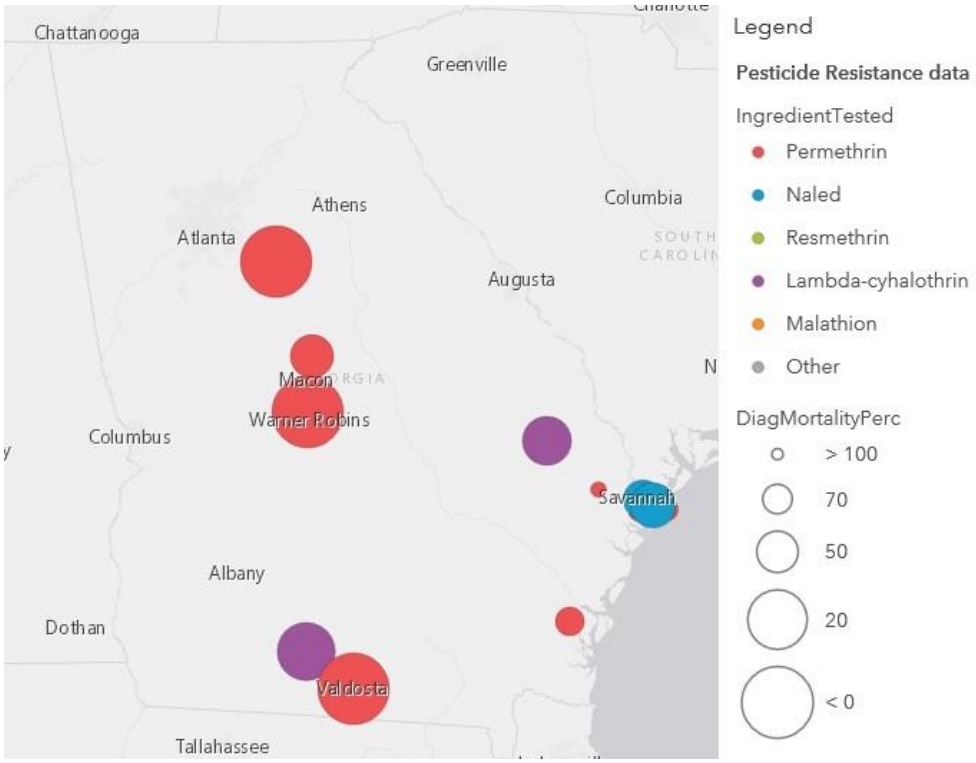
With the continuation of positive human cases of arboviral diseases such as La Crosse Encephalitis, St. Louis Encephalitis, Eastern Equine Encephalitis, and West Nile Virus in Georgia in 2020, mosquito control methods are critical. Pesticide resistance has been found to be a component for ineffective mosquito control. There is a lack of insecticide resistance studies conducted statewide in Georgia and minimal knowledge of which pesticides mosquitoes are resistant to.

The state entomologists and regional entomologist are tasked to conduct insecticide resistance testing in all high-risk urban regions of Georgia for the next two years. Mosquito egg collections were performed by Vector Surveillance coordinators and Environmental Health specialists around the state. Mosquito egg collection training will be provided to all who assist with this endeavor.

Resistance testing is performed using the CDC Bottle Bioassay procedure and the chemicals that were provided in the CDC Bottle Bioassay kits. Preliminary data from several central and southern counties showed *Ae albopictus* to be exhibiting varied levels of resistance to permethrin and deltamethrin but were susceptible at varied levels to bifenthrin and deltamethrin used along with the synergist, PBO. *Culex quinquefasciatus* showed varied levels of resistance to permethrin, lambda cyhalothrin, and deltamethrin; they were susceptible to malathion.

Further testing with mosquitoes from more high-risk counties around the state will be tested with a greater diversity of chemicals in 2021.

With the implementation of the first statewide pesticide resistance testing program, a clearer picture of the type of mosquitoes and their resistance to specific pesticides commonly used in Georgia will be determined. This information enables DPH to advise and train current mosquito control operators in using the most effective and cost-efficient pesticide for their target-mosquito. The statewide pesticide resistance testing program is a major component in reducing the exposure of mosquito-borne disease risk to the public.



PESTICIDE RESISTANCE MAP, GEORGIA

Resources

https://mosquito.site-ym.com/page/control
https://c.ymcdn.com/sites/mosquito.site-ym.com/resource/resmgr/docs/Resource_Center/Mosq_Control_Facts/Best_Practices_Mgmt/amca_guidelines_final_pdf.pdf
http://www.gamosquito.org/publications.htm
http://cdcsercoevbd-flgateway.org/
https://www.cdc.gov/parasites/education_training/lab/bottlebioassay.html

MOSQUITO SURVEILLANCE 2020

Conclusions

In 2020, due to Covid-19 and loss of funding, mosquito surveillance was only done in 142 of Georgia's 159 counties. Surveillance was done in areas of highest risk of vector-borne diseases, but in many counties, surveillance was limited.

Year	# counties doing surveillance	% of counties
2001	2	1.3%
2002	11	6.9%
2003	26	16.4%
2004	56	35.2%
2005	55	34.6%
2006	28	17.6%
2007	28	17.6%
2008	28	17.6%
2009	26	16.4%
2010	22	13.8%
2011	19	11.9%
2012	12	7.5%
2013	13	8.2%
2014	15	9.4%
2015	13	8.2%
2016	60	37.7%
2017	159	100.0%
2018	159	100.0%
2019	159	100.0%
2020	142	89.3%

This level of surveillance was only possible through the combined effort of State, District, and County Environmental Health, as well as assistance from several other agencies.

Our goals for the 2021 mosquito surveillance season include:

- Doing some level of mosquito surveillance in every county in Georgia
- Doing targeted surveillance in areas where *Ae aegypti* were found in the 1950s
- Providing continued training to Environmental Health Specialists
- Support local outreach for mosquito complaints and arboviral disease cases

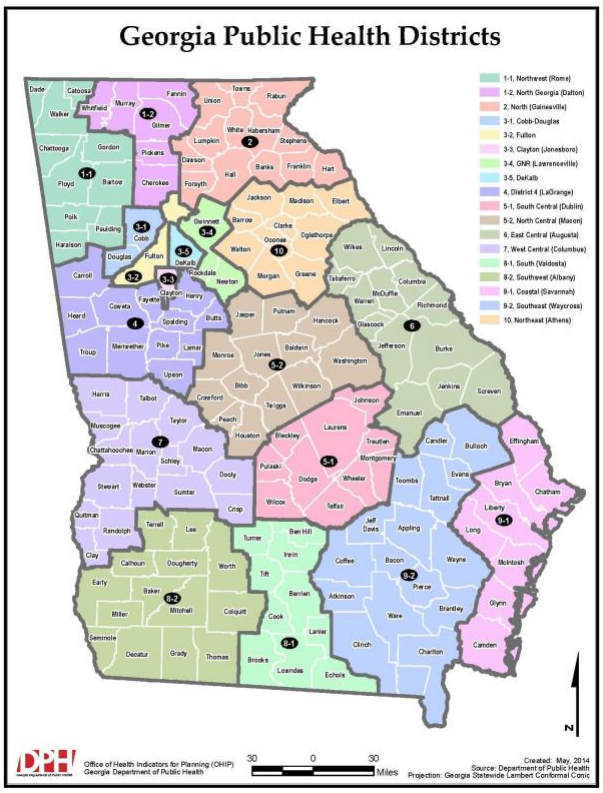
- Continued testing for adulticide resistance, esp in high-risk areas of Georgia
- Beginning testing for larvicide resistance in localized areas
- Spatial analysis of pesticide resistance in Georgia

The accomplishment of these goals will allow the Georgia Department of Public Health to be better prepared for the next mosquito-borne disease to emerge. However, these goals are not attainable without sustainable funding.

Acknowledgements

I would like to thank everyone who assisted with this mosquito surveillance project, at the State, District, and County Public Health levels, as well as the mosquito control programs that contributed data.

District Map



SPECIES	LARVAL HABITAT	GENERATIONS	HOST PREFERENCE
Aedes aegypti	AC	Multiple	Human
Aedes albopictus	AC, TH	Multiple	Humans, Large Mammals
Aedes cinereus	WP,TRP, FW, Bogs	1	Human, Mammals
Aedes vexans	FW, GP, IP	2	Humans, Large Mammals
Anopheles atropos	SM		Humans, Large Mammals
Anopheles barberi	TH, AC	2	Human, Mammals
Anopheles bradleyi/crucians	SM, FS, LM	Multiple	Human, Mammals
Anopheles punctipennis	WP, DD	Multiple	Humans, Mammals
Anopheles quadrimaculatus	FW, GP, LM, RP	Multiple	Large Mammals
Anopheles walkeri	RP, AC, FS	Multiple	Mammals
Coquillettidia perturbans	FS, RE, LM, DD	1+	Humans, Mammals, Birds
Culex coronator			Humans, Large Mammals
Culex erraticus	WP	Multiple	Birds
Culex nigripalpus	GP, FW, DD	Multiple	Humans, Large Mammals
Culex peccator			Reptiles, Amphibians
Culex pilosus	TP	Multiple	Small Mammals
Culex pipiens	AC, SCB, GRP	Multiple	Birds, Humans, Mammals
Culex quinquefasciatus	AC, SCB, GRP	Multiple	Birds, Humans, Mammals
Culex restuans	WP, GRP, DD	Multiple	Birds, Humans, Mammals
Culex salinarius	AC, GP, LM, FS	Multiple	Birds, Humans, Mammals
Culex tarsalis	P, WP, DD	Multiple	Birds, Humans, Mammals
Culex territans	FS, WP, DD	Multiple	Frogs
Culiseta inornata	WP, DD, AC	Multiple	Large Mammals, Humans
Culiseta melanura	FS, WP	Multiple	Birds
Mansonia dyari	FS, RE, LM, DD	1+	
Mansonia titillans	FS, RE, LM, DD	1+	Humans, Mammals
Ochlerotatus atlanticus/tormentor	WP	Multiple	Mammals
Ochlerotatus atropalpus	Rock Piles	Multiple	
Ochlerotatus canadensis	WP, DD, FS	Multiple	Small Mammals, birds, reptiles
Ochlerotatus dupreei	WP, GP	1?	Mammals
Ochlerotatus fulvus pallens	WP		Mammals
Ochlerotatus hendersoni	TH	Multiple	Chipmunks, Squirrels, raccoons

SPECIES	LARVAL HABITAT	GENERATIONS	HOST PREFERENCE
Ochlerotatus infirmatus	WP, GP, LM, FS		Mammals
Ochlerotatus japonicus	AC	Multiple	Humans, Mammals, Birds
Ochlerotatus mathesoni	WP, DD, FS	Multiple	Small Mammals, birds, reptiles
Ochlerotatus mitchellae	TP	Multiple	Mammals, Humans
Ochlerotatus sollicitans	SM	Multiple	Humans, Birds
Ochlerotatus sticticus	Flood Waters	1	Mammals, Humans
Ochlerotatus taeniorhynchus	SM	Multiple	Humans, Birds, Mammals
Ochlerotatus thibaulti	TH, FS		Mammals, Humans
Ochlerotatus triseriatus	TH, AC, Red Maple	1	Humans, Mammals, Squirrels
Ochlerotatus trivittatus	FW, GP	1	Humans, Mammals, reptiles
Orthopodomyia alba	TH	Multiple	Not well none; Birds
Orthopodomyia signifera	TH, AC	Multiple	Birds
Psorophora ciliata	WP	Multiple	Mammals
Psorophora columbiae	IP, RF, GRP	Multiple	Mammals, Cattle Preferred
Psorophora cyanescens	TP	Multiple	Mammals
Psorophora discolor	Barns & Pastures	Multiple	Mammals, Humans
Psorophora ferox	TP, WP	1	Mammals, some birds, reptiles
Psorophora horrida	TP, FW	Multiple	Mammals
Psorophora howardii	TP, FW, DD	Multiple	Mammals especially rabbits
Psorophora mathesoni	TP, WP	1	Mammals, some birds, reptiles
Toxorhynchites rutilus	TH, Tires	Multiple	No Blood Meal
Toxorhynchites septentrionalis	TH, Tires	Multiple	No Blood Meal
Uranotaenia lowii	GP	Multiple	Amphibians and Reptiles
Uranotaenia sapphirina	GP	Multiple	Amphibians and Reptiles
Wyeomyia mitchelli	bromeliads		
Wyeomyia smithii	pitcher plants	Multiple	
KEY TO HABITATS	***KEY TO HABITATS***	***BITING TIME***	
AC-Artificial Containers	RE-Rooted Emerged Vegetation	C-CREPUSCULAR (DUSK AND DAWN)	
DD-Drainage Ditches	RF-Rice Fields	D-DAY	
FS-Freshwater Swamps	RT-Retention/Detention Ponds	N-NIGHT	
FW-Floodwaters	SCB-Sewage Catch Basins		
WP-Woodland Pools	SM-Salt Marshes		

SPECIES	LARVAL HABITAT	GENERATIONS	HOST PREFERENCE
GP-Grassland Pools	TH-Tree Holes		
GRP-Ground Pools	TP-Temporary Pools		
IP-Irrigated Pastures	TRP-Temporary Rain Pools		
LM-Lake Margins	P-Ponds		

SPECIES	OVERWINTER	BITING TIME	FLIGHT RANGE
Aedes aegypti	Adults	D	500 feet
Aedes albopictus	Egg	D	100 to 300 yards
Aedes cinereus	Egg	D	Near Habitat
Aedes vexans	Egg	C, N	1 to 15 miles
Anopheles atropos	Adults	C, N	1 to 5 miles
Anopheles barberi	Larvae	N	
Anopheles bradleyi/crucians	Adults	C, N	1 to 2 miles
Anopheles punctipennis	Adults	D, N	0 to 1/4 mile
Anopheles quadrimaculatus	Adults	C	1/2 to 1 mile
Anopheles walkeri	Egg	N	
Coquillettidia perturbans	Larvae	C	1 to 5 miles
Culex coronator			
Culex erraticus	Adults	N	0 to 1/4 mile
Culex nigripalpus	Adults	C	1/2 to 1 mile
Culex peccator	Adults		
Culex pilosus			
Culex pipiens	Adults	C, N	1/4 to 1/2 mile
Culex quinquefasciatus	Adults	C, N	1/4 to 1/2 mile
Culex restuans	Adults	C, N	1 to 2 miles
Culex salinarius	Adults	C, N	1/4 to 5 miles
Culex tarsalis	Adults	C, N	Up to 17 miles
Culex territans	Adults	C, N	0 to 1/8 mile
Culiseta inornata	Adults		
Culiseta melanura	Larvae	C, N	1/2 to 2 miles
Mansonia dyari	Larvae		
Mansonia titillans	Larvae		
Ochlerotatus atlanticus/tormentor	Egg	C, D	1/4 to 1/2 mile
Ochlerotatus atropalpus	Egg		
Ochlerotatus canadensis	Egg	C, D	0 to 1/4 mile
Ochlerotatus dupreei	Egg		
Ochlerotatus fulvus pallens	Egg	C, N, D	2 to 5 miles
Ochlerotatus hendersoni	Egg		

SPECIES	OVERWINTER	BITING TIME	FLIGHT RANGE
Ochlerotatus infirmatus		C, D	1/4 to 1 mile
Ochlerotatus japonicus	Egg, Larvae	D	
Ochlerotatus mathesoni	Egg	C, D	0 to 1/4 mile
Ochlerotatus mitchellae	Egg		
Ochlerotatus sollicitans	Egg	C, D	5 to 100 miles
Ochlerotatus sticticus	Egg	C, D, N	Up to 7 miles
Ochlerotatus taeniorhynchus	Egg	C, N, D	2 to 40 miles
Ochlerotatus thibaulti	Egg	C, N,D	
Ochlerotatus triseriatus	Egg	C	1/2 to 1 mile
Ochlerotatus trivittatus	Egg	C	Up to 1/2 mile
Orthopodomyia alba	Larvae		
Orthopodomyia signifera	Larvae		
Psorophora ciliata	Egg	C, N, D	1 to 2 miles
Psorophora columbiae	Egg	C, N, D	1 to 8 miles
Psorophora cyanescens	Egg	C	2+ miles
Psorophora discolor	Egg		
Psorophora ferox	Egg	C, N	1 to 2 miles
Psorophora horrida	Egg		
Psorophora howardii	Egg	C, N	1 to 2 miles
Psorophora mathesoni	Egg	C, N	1 to 2 miles
Toxorhynchites rutilus	Larvae		
Toxorhynchites septentrionalis	Larvae		
Uranotaenia lowii	Adults		
Uranotaenia sapphirina	Adults		
Wyeomyia mitchelli	Larvae	D	
Wyeomyia smithii	Larvae	D	
KEY TO HABITATS			
AC-Artificial Containers			
DD-Drainage Ditches			
FS-Freshwater Swamps			
FW-Floodwaters			
WP-Woodland Pools			

SPECIES	OVERWINTER	BITING TIME	FLIGHT RANGE
GP-Grassland Pools			
GRP-Ground Pools			
IP-Irrigated Pastures			
LM-Lake Margins			

SPECIES	ADULT COLLECTION TECHNIQUES
Aedes aegypti	Fay-Prince/CDC w/CO^2/Gravid
Aedes albopictus	CDC w/CO^2/Gravid
Aedes cinereus	Fay-Prince/CDC w/CO^2
Aedes vexans	CDC w/CO^2 & Aspiraton
Anopheles atropos	CDC w/CO^2
Anopheles barberi	CDC w/CO^2, Gravid
Anopheles bradleyi/crucians	CDC w/CO^2
Anopheles punctipennis	CDC w/CO^2
Anopheles quadrimaculatus	CDC w/CO^2 & Aspiraton
Anopheles walkeri	CDC w/CO^2 + octenol
Coquillettidia perturbans	CDC w/CO^2 + light
Culex coronator	CDC w/CO^2, Gravid
Culex erraticus	CDC w/CO^2, Aspiration
Culex nigripalpus	CDC w/CO^2
Culex peccator	
Culex pilosus	
Culex pipiens	CDC w/CO^2, Gravid, Aspiration
Culex quinquefasciatus	CDC w/CO^2, Gravid, Aspiration
Culex restuans	CDC w/CO^2, Gravid
Culex salinarius	CDC w/CO^2 + octenol
Culex tarsalis	CDC w/CO^2 & Gravid
Culex territans	CDC w/CO^2 with light
Culiseta inornata	CDC w/CO^2 with light
Culiseta melanura	CDC w/CO^2, elevate traps
Mansonia dyari	
Mansonia titillans	
Ochlerotatus atlanticus/tormentor	
Ochlerotatus atropalpus	
Ochlerotatus canadensis	Fay Prince, CDC w/CO^2, Aspiration
Ochlerotatus dupreei	
Ochlerotatus fulvus pallens	
Ochlerotatus hendersoni	CDC w/CO^2 and Fay Prince

SPECIES	ADULT COLLECTION TECHNIQUES
Ochlerotatus infirmatus	CDC w/CO^2
Ochlerotatus japonicus	CDC w/CO^2, Gravid
Ochlerotatus mathesoni	Fay Prince, CDC w/CO^2, Aspiration
Ochlerotatus mitchellae	
Ochlerotatus sollicitans	CDC w/CO^2 + octenol
Ochlerotatus sticticus	CDC w/CO^2
Ochlerotatus taeniorhynchus	
Ochlerotatus thibaulti	CDC w/CO^2
Ochlerotatus triseriatus	Fay Prince, CDC w/CO^2, + octenol
Ochlerotatus trivittatus	CDC w/CO^2
Orthopodomyia alba	
Orthopodomyia signifera	CDC w/CO^2 & Aspiration
Psorophora ciliata	CDC w/CO^2
Psorophora columbiae	CDC w/CO^2 and light
Psorophora cyanescens	CDC w/CO^2
Psorophora discolor	CDC w/CO^2
Psorophora ferox	CDC w/CO^2
Psorophora horrida	
Psorophora howardii	CDC w/CO^2
Psorophora mathesoni	CDC w/CO^2
Toxorhynchites rutilus	Dipping, siphoning water
Toxorhynchites septentrionalis	Dipping, siphoning water
Uranotaenia lowii	CDC w/CO^2 and light
Uranotaenia sapphirina	CDC w/CO^2 and light
Wyeomyia mitchelli	
Wyeomyia smithii	
KEY TO HABITATS	
AC-Artificial Containers	
DD-Drainage Ditches	
FS-Freshwater Swamps	
FW-Floodwaters	
WP-Woodland Pools	

SPECIES	ADULT COLLECTION TECHNIQUES
GP-Grassland Pools	
GRP-Ground Pools	
IP-Irrigated Pastures	
LM-Lake Margins	

SPECIES	Sibling Species
Aedes aegypti	
Aedes albopictus	
Aedes cinereus	
Aedes vexans	
Anopheles atropos	
Anopheles barberi	
Anopheles bradleyi/crucians	*Anopheles georgianus*
Anopheles punctipennis	*Anopheles perplexens*
Anopheles quadrimaculatus	*Anopheles smaragdimus, An diluvialis, An maverlius, An inundatus*
Anopheles walkeri	
Coquillettidia perturbans	
Culex coronator	
Culex erraticus	
Culex nigripalpus	
Culex peccator	
Culex pilosus	
Culex pipiens	
Culex quinquefasciatus	
Culex restuans	
Culex salinarius	
Culex tarsalis	
Culex territans	
Culiseta inornata	
Culiseta melanura	
Mansonia dyari	
Mansonia titillans	
Ochlerotatus atlanticus/tormentor	
Ochlerotatus atropalpus	
Ochlerotatus canadensis	
Ochlerotatus dupreei	
Ochlerotatus fulvus pallens	
Ochlerotatus hendersoni	

SPECIES	Sibling Species
Ochlerotatus infirmatus	
Ochlerotatus japonicus	
Ochlerotatus mathesoni	
Ochlerotatus mitchellae	
Ochlerotatus sollicitans	
Ochlerotatus sticticus	
Ochlerotatus taeniorhynchus	
Ochlerotatus thibaulti	
Ochlerotatus triseriatus	
Ochlerotatus trivittatus	
Orthopodomyia alba	
Orthopodomyia signifera	
Psorophora ciliata	
Psorophora columbiae	
Psorophora cyanescens	
Psorophora discolor	
Psorophora ferox	
Psorophora horrida	
Psorophora howardii	
Psorophora mathesoni	
Toxorhynchites rutilus	
Toxorhynchites septentrionalis	
Uranotaenia lowii	
Uranotaenia sapphirina	
Wyeomyia mitchelli	
Wyeomyia smithii	
KEY TO HABITATS	
AC-Artificial Containers	
DD-Drainage Ditches	
FS-Freshwater Swamps	
FW-Floodwaters	
WP-Woodland Pools	

SPECIES	Sibling Species
GP-Grassland Pools	
GRP-Ground Pools	
IP-Irrigated Pastures	
LM-Lake Margins	