MOSQUITO SURVEILLANCE 2021

GEORGIA DEPARTMENT OF PUBLIC HEALTH, ENVIRONMENTAL HEALTH

Mosquito Surveillance 2021

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.

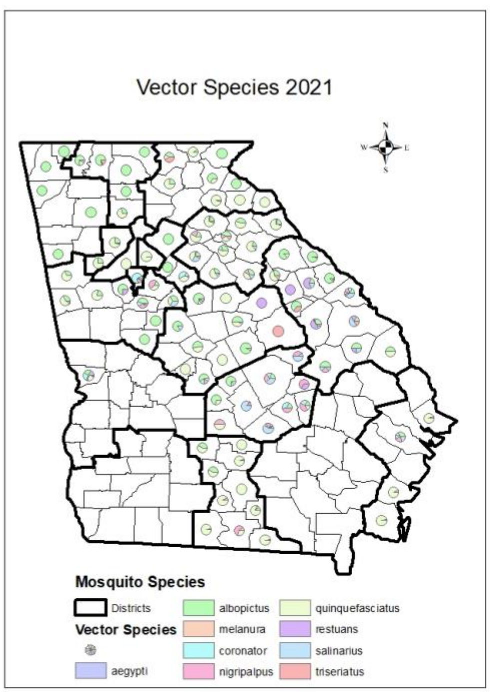
Although our surveillance team was seriously diminished by funding cuts, our goals for the 2021 mosquito surveillance season included doing some level of mosquito surveillance in as many county in Georgia as possible, assisting mosquito control programs with surveillance where possible, and providing local outreach for mosquito complaints. We also planned to continue to do pesticide resistance testing in a few areas of Georgia. The accomplishment of these goals allows 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, lack of funding and the COVID-19 pandemic continued to change a lot of our plans.

MOSQUITO SURVEILLANCE 2021

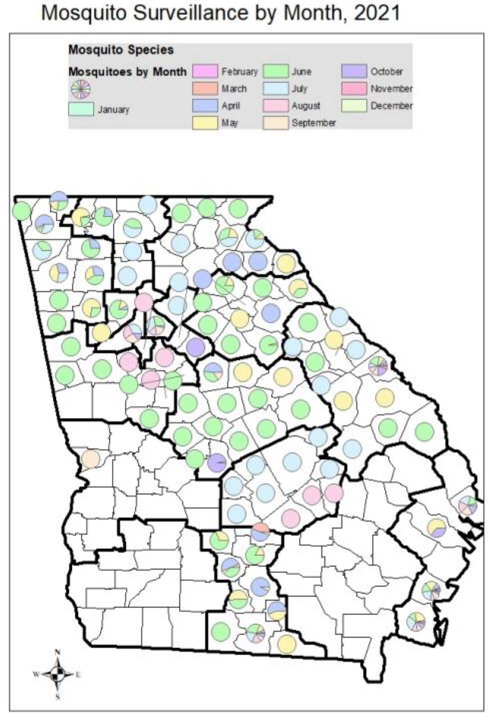
Overview

The Vector Surveillance Coordinator (VSC) program ended in 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. The loss of this program left surveillance to the 2 entomologists at the State level and the District-level programs in 1-1, 1-2, 2-0, 3-1, 3-2 (Bug Busters), 3-5, 6-0, and 8-1. We also collaborated with Chatham County Mosquito Control, Mosquito Control Services (Glynn and Camden counties), and Valdosta State University (Lowndes County).

The maps used in this document were all created in February 2022. 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.



Mosquito Surveillance by Month, 2021



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.

Surveillance and mosquito identification was done by the two GDPH entomologists, by District or County Environmental Health Specialists (EHS), and by local mosquito control.

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. Aedes 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.

Species	CDC	Exit	Gravid	TOTAL
Ae. aegypti	9		9	18
Ae. albopictus	2229		456	2685
Ae. cinerius	1			1
Ae. vexans	1257		209	1466
Ae. vexans (male)	1			1
Aedes/Ochlerotatus spp.	39		2	41
An. crucians	735		1	736
An. punctipennis	486		16	502
An. quadrimaculatus	281		3	284
An. quadrimaculatus (male)	3			3
Anopheles spp.	68			68
Cq. perturbans	3909		189	4098
Cs. inornata	24		2	26
Cs. melanura	3047	7	549	3603
Culex spp.	449		9186	9635
Cx. coronator	1375		26	1401
Cx. erraticus	911		31	942
Cx. nigripalpus	15216	47	11291	26554
Cx. peccator	1		1	2
Cx. pilosus			1	1
Cx. quinquefasciatus	1321		132091	133412
Cx. restuans	174		990	1164
Cx. salinarius	3328		57	3385
Cx. territans	12		34	46
Ma. titillans	91		28	119
Oc. atlanticus	1918		6	1924
Oc. canadensis	139		12	151
Oc. dupreei	1			1
Oc. fulvus pallens	17			17
Oc. hendersoni			1	1
Oc. infirmatus	131			131
Oc. japonicus	176		128	304
Oc. sollicitans	5			5
Oc. sticticus	80			80
Oc. taeniorhynchus	135			135
Oc. thibaulti	12			12

Species	CDC	Exit	Gravid	TOTAL
Oc. triseriatus	63		67	130
Oc. trivittatus	3		1	4
Or. signifera	2		8	10
Ps. ciliata	223			223
Ps. columbiae	201			201
Ps. cyanescens	1139			1139
Ps. ferox	611		6	617
Ps. horrida	140			140
Ps. howardii	160			160
Psorophora spp.	28		2	30
Tx. rutilus	2		18	20
unknown	47		75	122
Ur. lowii	4			4
Ur. sapphirina	43			43
Ur. sapphirina (male)			1	1

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 (https://academic.oup.com/jme/article/42/4/511/910895?login=true). 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*

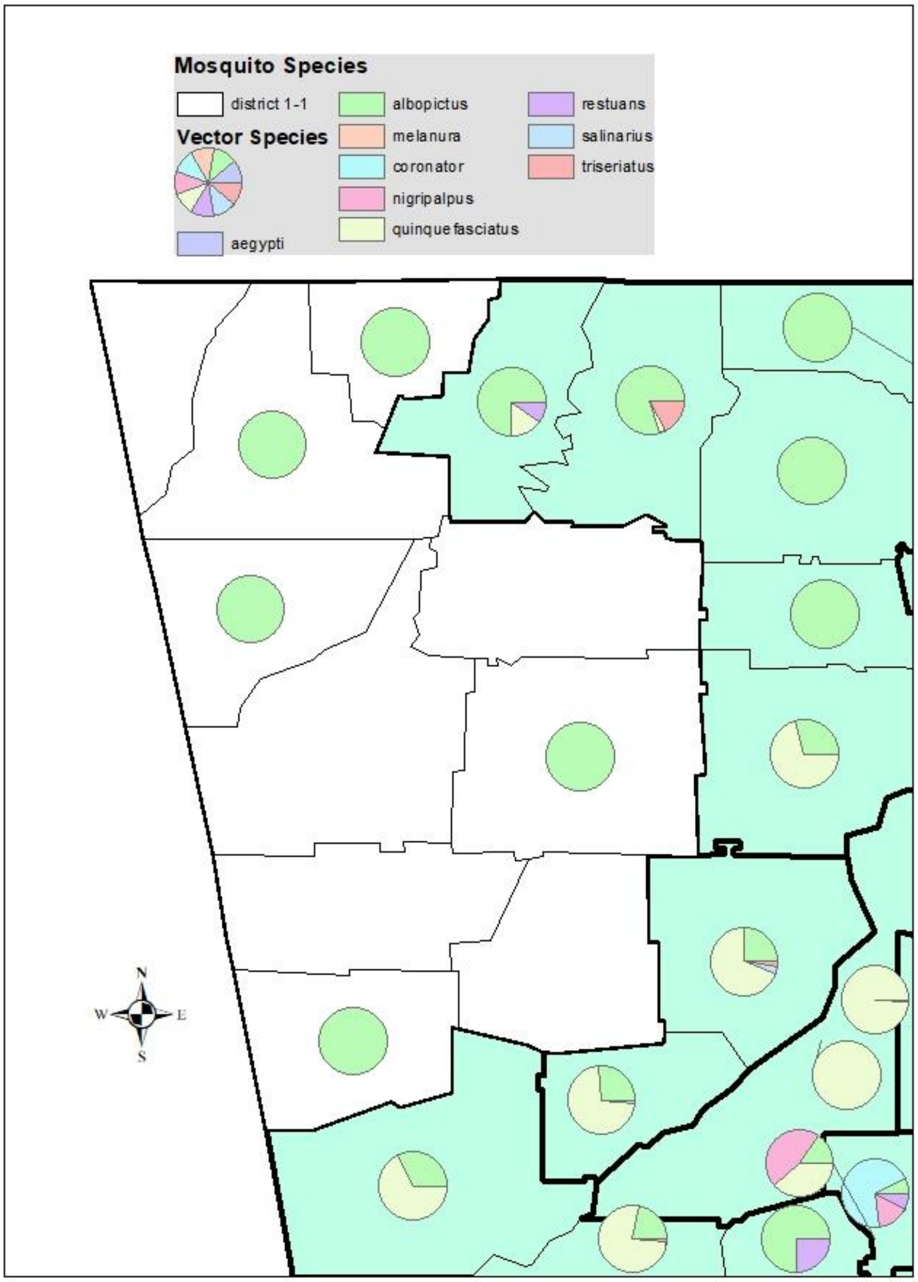
Data by District

District 1-1

Surveillance in District 1-1 was done by local EHS. Surveillance was done from March through July over 27 trap nights.

District 1-1		trap type	
County	**Species**	**CDC**	**Gravid**
Bartow	*Ae. albopictus*		6
	Ae. vexans		14
	Culex spp.	8	20
Catoosa	*Ae. albopictus*		7
	Ae. vexans	4	
	Culex spp.	1	35
Chattooga	*Ae. albopictus*	8	8
	Culex spp.	29	6
Dade	*Culex spp.*	6	3
Floyd	*Ae. vexans*		38
	Culex spp.	10	21
Gordon	*Ae. vexans*		6
	Culex spp.	6	3
Haralson	*Ae. albopictus*	6	
	Ae. vexans		5
	Culex spp.	6	
Paulding	*Ae. vexans*		6
	Culex spp.	3	18
Polk	*Ae. vexans*		7
	Culex spp.	8	7
Walker	*Ae. albopictus*	4	17
	Ae. vexans	8	4
	Culex spp.	21	43

Vector Species 2021



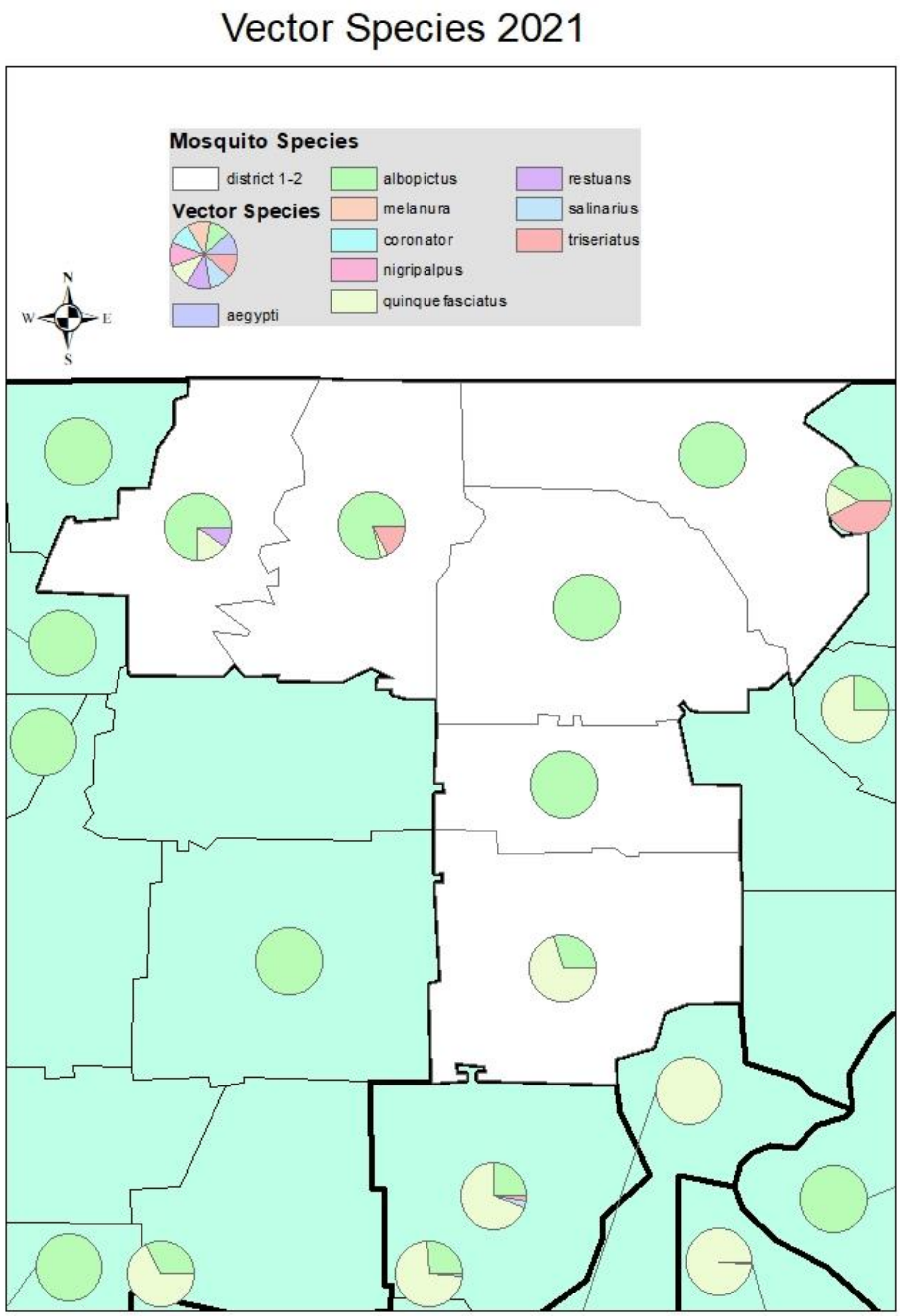
District 1-2

Surveillance in District 1-2 was done by the District EH Director, with assistance from the State entomologists. Surveillance was done from April-July over 39 trap nights.

District 1-2		trap type	
County	**Species**	**CDC**	**Gravid**
Cherokee	*Ae. albopictus*	10	13
	Ae. vexans	16	5
	An. punctipennis	4	
	Cx. quinquefasciatus	23	32
	Ps. ciliata	2	
	Tx. rutilus		1
Fannin	*Ae. albopictus*	16	
	An. punctipennis	14	
	Oc. japonicus	5	
	Ps. columbiae	1	
Gilmer	*Ae. albopictus*	10	
	Ae. vexans	4	
	An. punctipennis	2	
Murray	*Ae. albopictus*	46	
	Ae. vexans	5	
	An. punctipennis	12	
	An. quadrimaculatus	1	
	Cx. quinquefasciatus	2	
	Oc. canadensis	1	
	Oc. infirmatus	1	
	Oc. japonicus	16	
	Oc. sticticus	2	
	Oc. triseriatus	10	
Pickens	*Ae. albopictus*	35	
	An. crucians	12	
	An. punctipennis	44	
	Ps. columbiae	2	

District 1-2		trap type
County	**Species**	**CDC**
Whitfield	*Ae. albopictus*	120
	Ae. cinerius	1
	Ae. vexans	40
	Ae. vexans (male)	1
	An. crucians	1
	An. punctipennis	100
	An. quadrimaculatus	1
	An. quadrimaculatus (male)	3
	Cq. perturbans	259
	Cx. erraticus	3
	Cx. peccator	1
	Cx. quinquefasciatus	24
	Cx. restuans	16
	Oc. canadensis	2
	Oc. fulvus pallens	11
	Oc. japonicus	87
	Oc. sticticus	2
	Or. signifera	1
	Ps. ciliata	1
	Ps. columbiae	2

AEDES AEGYPTI


Vector Species 2021
Mosquito Species
district 1-2
Vector Species
aegypti
albopictus
melanura
coronator
nigripalpus
quinquefasciatus
restuans
salinarius
triseriatus
N
W
E
S

MOSQUITO SURVEILLANCE 2021

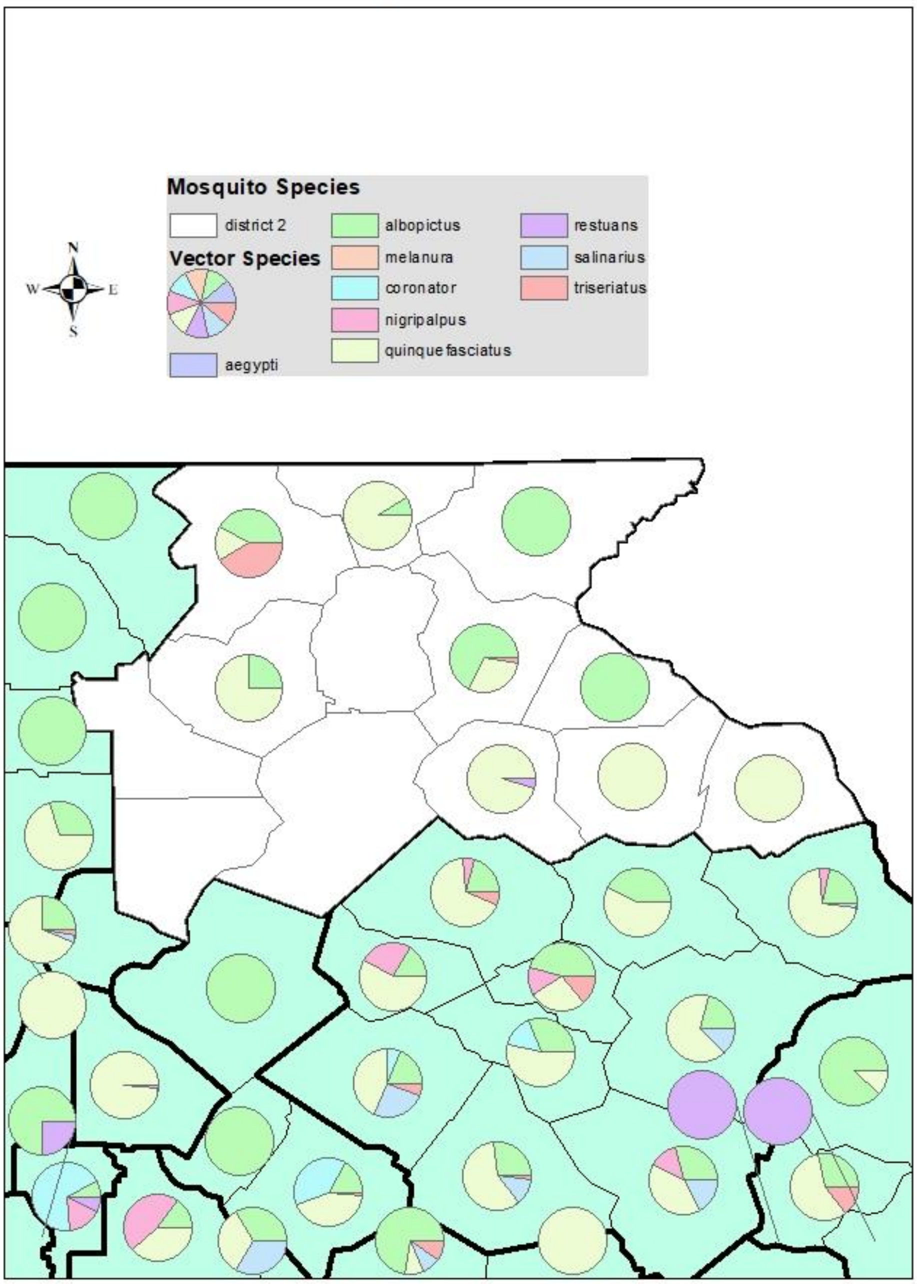
District 2-0

Surveillance in District 2-0 was done by local EHS. Surveillance was done from March-July over 15 trap nights.

District 2-0		trap type	
County	***Species***	**CDC**	**gravid**
Banks	*An. crucians*	3	
	An. quadrimaculatus		1
	Cx. quinquefasciatus		20
	Cx. restuans	1	
	Oc. japonicus	1	
Franklin	*Ae. vexans*	1	
	An. punctipennis	2	
	Cx. quinquefasciatus		38
	Oc. japonicus		13
	Ps. cyanescens	2	
Habersham	*Ae. albopictus*	30	1
	An. punctipennis	22	
	Cx. quinquefasciatus		14
	Oc. japonicus	17	3
	Oc. triseriatus	1	
	Ps. columbiae	1	
	Ps. ferox	5	
	Ps. howardii	1	
Hart	*An. punctipennis*	1	
	An. quadrimaculatus	1	
	Cx. quinquefasciatus		6
	Oc. japonicus		12
Lumpkin	*Ae. albopictus*	3	1
	Ae. vexans		3
	Cx. quinquefasciatus	12	
	Oc. japonicus	4	
Rabun	*Ae. albopictus*		5
	An. punctipennis		4
	Oc. japonicus	3	
Stephens	*Ae. albopictus*	32	
	An. punctipennis	25	
	Oc. japonicus	12	
Towns	*Ae. albopictus*	1	1
	Cx. quinquefasciatus	1	19
	Oc. japonicus		1
Union	*Ae. albopictus*	4	1
	An. quadrimaculatus	1	
	Cx. quinquefasciatus		2
	Oc. japonicus	2	13
	Oc. triseriatus	5	

AEDES ALBOPICTUS

Vector Species 2021



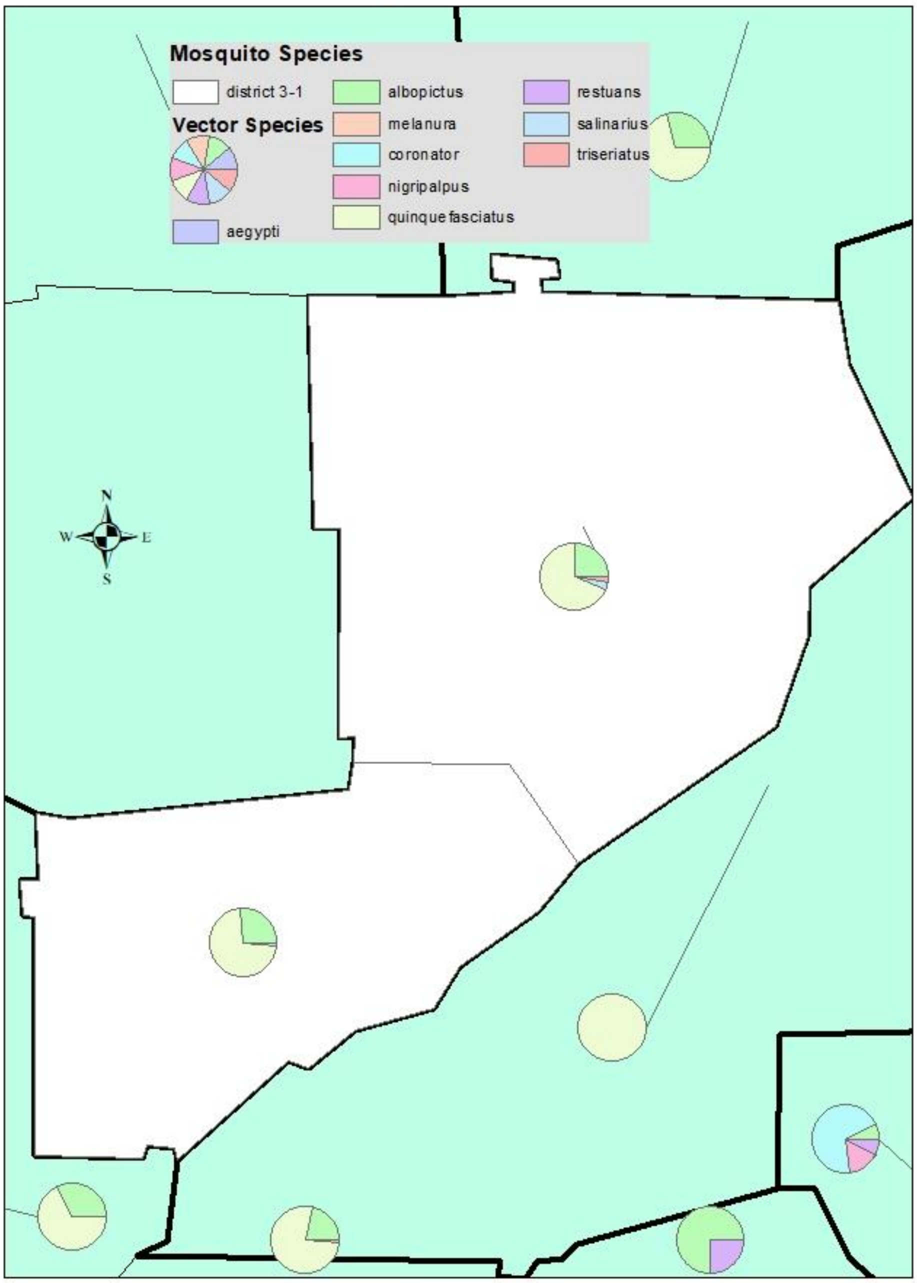
District 3-1

District 3-1		trap type	
County	**Species**	**CDC**	**gravid**
Cobb	*Ae. albopictus*	21	8
	Ae. vexans	5	1
	An. punctipennis	2	
	Cx. quinquefasciatus	19	60
	Cx. salinarius		4
	Oc. japonicus	2	
	Oc. triseriatus	3	
	Ps. ferox	1	
Douglas	*Ae. albopictus*	13	6
	Ae. vexans	5	1
	Cx. quinquefasciatus	5	47
	Cx. salinarius		1

Surveillance in District 3-1 was done by an intern and the DPH entomologists. Surveillance was done from April - June over 11 trap nights.

CULEX ERRATICUS

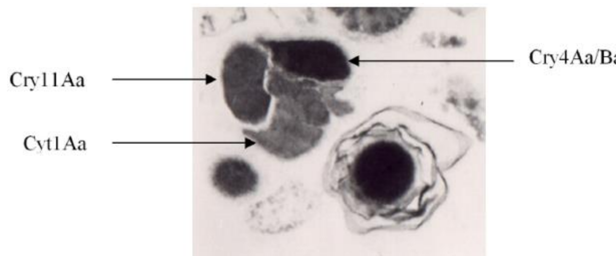
Vector Species 2021



District 3-2

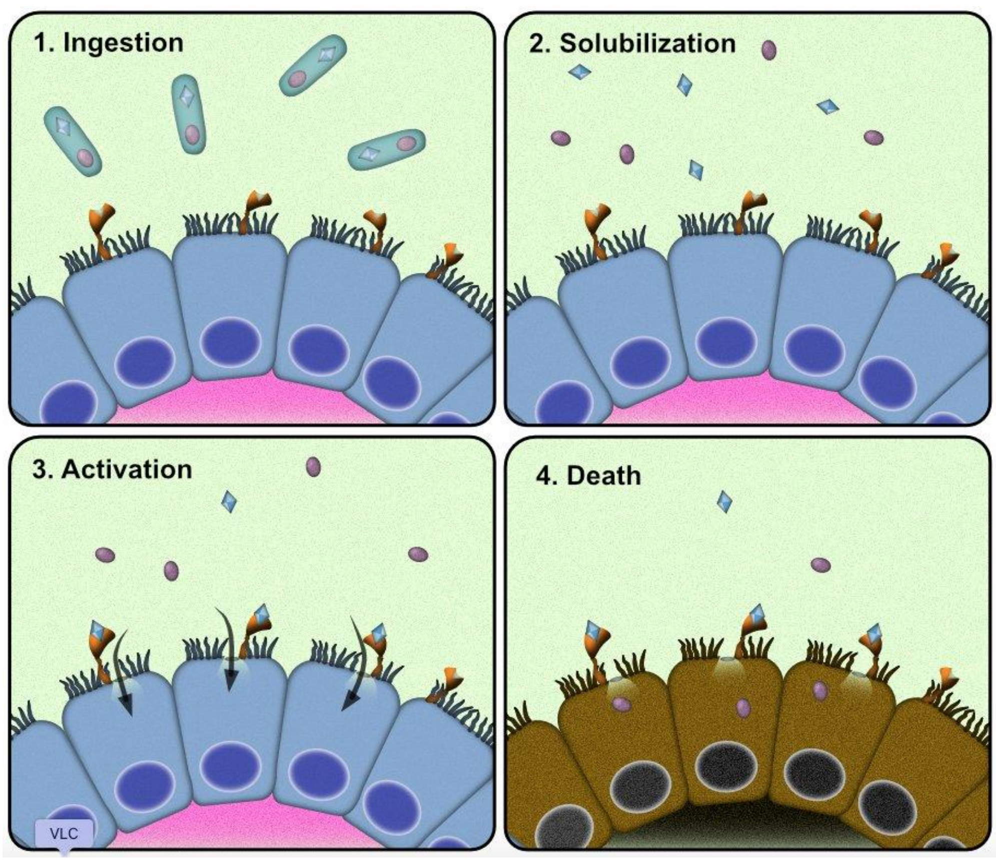
Surveillance in District 3-2 was done by Bug Busters, a company that contracted with the District to do mosquito surveillance and control. Surveillance was done from July-October over 208 trap nights.

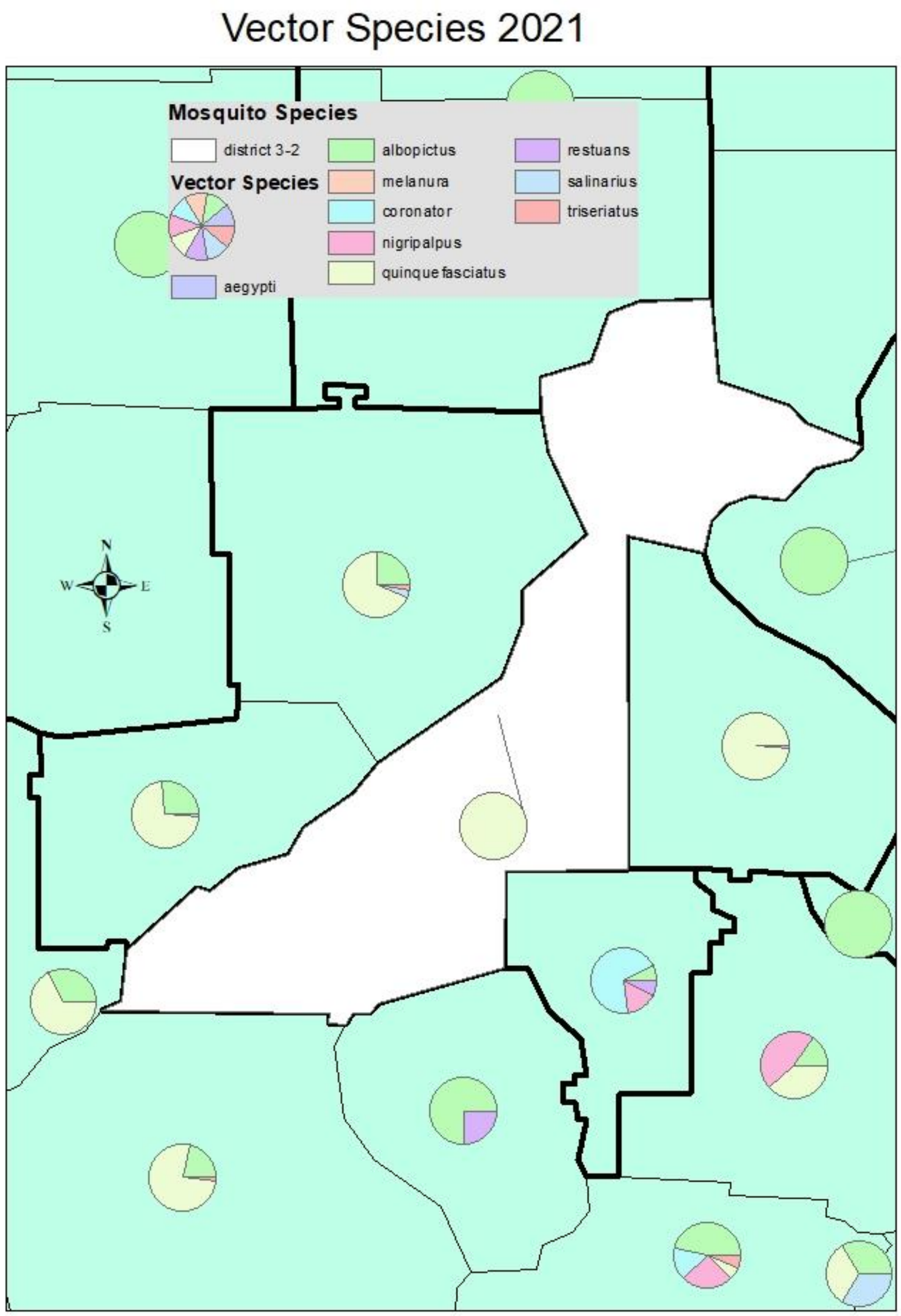
District 3-2		trap type	
County	**Species**	**CDC**	**Gravid**
Fulton	*Cx. quinquefasciatus*	479	5493
	Tx. rutilus	2	14



BTI CRYSTAL AND SPORE

BTI MODE OF ACTION



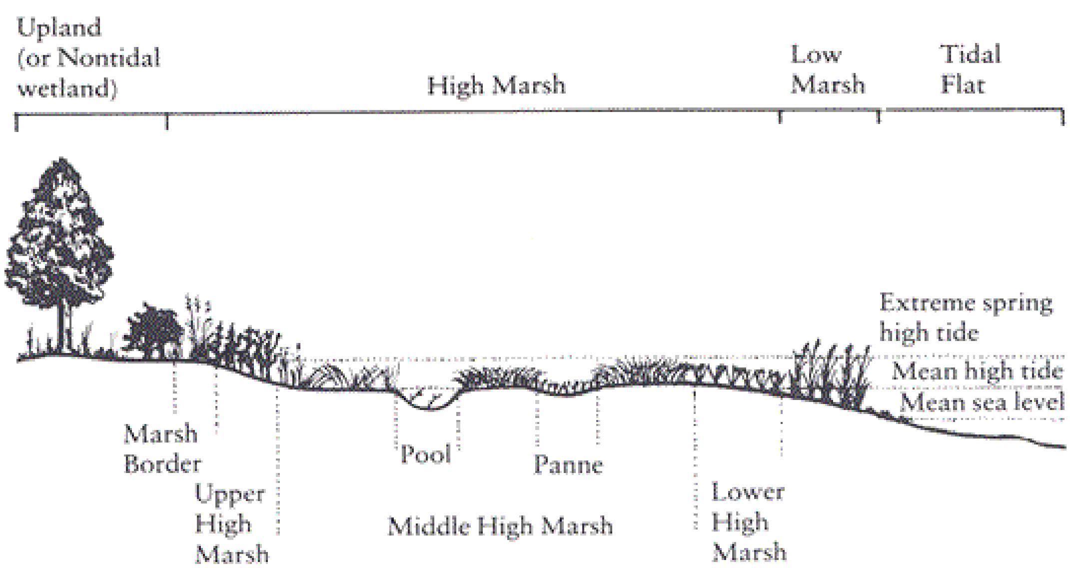

Vector Species 2021
Mosquito Species
district 3-2
Vector Species
aegypti
albopictus
melanura
coronator
nigripalpus
quinquefasciatus
restuans
salinarius
triseriatus
N
W
E
S

District 3-3

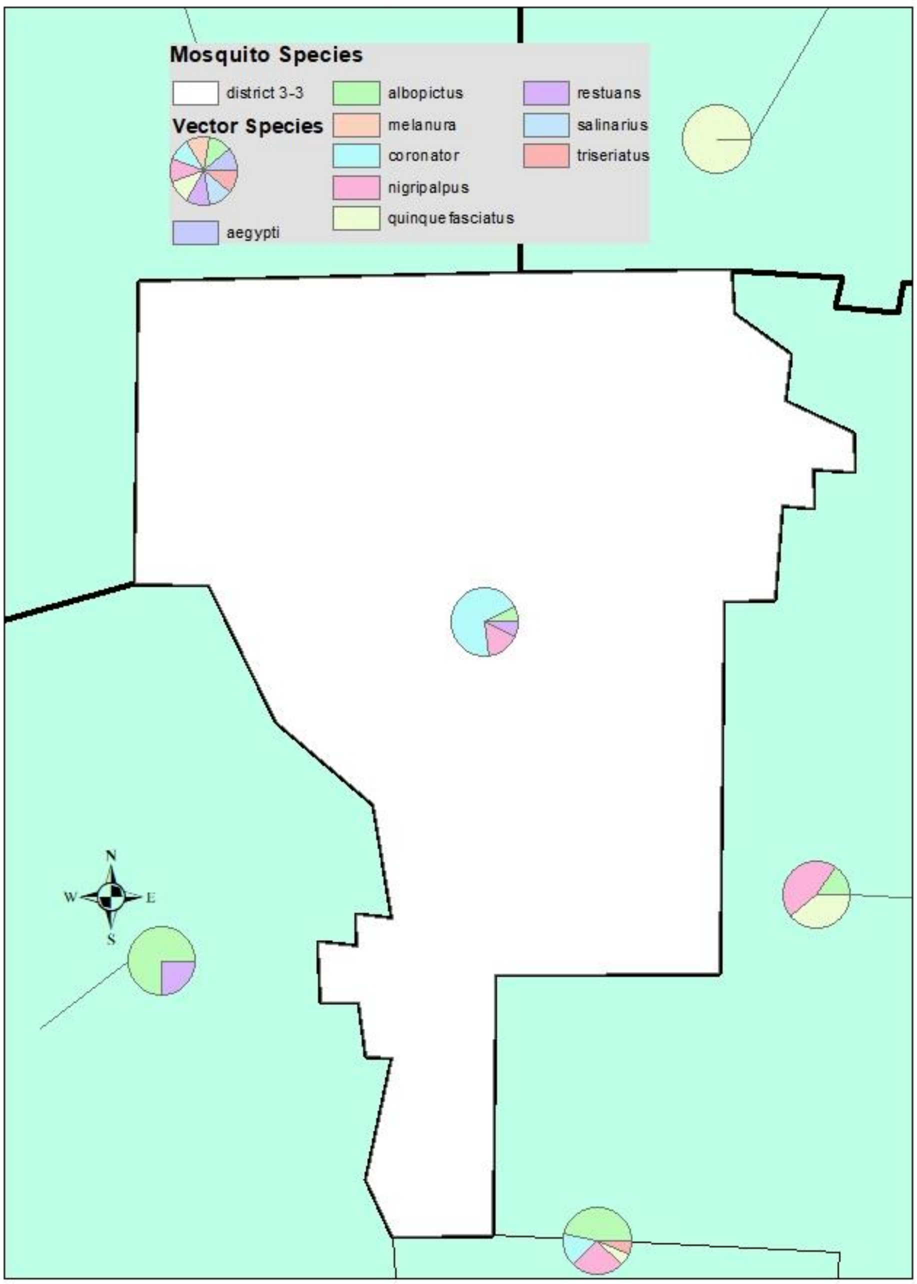
Surveillance in District 3-3 was done by the DPH entomologists. Surveillance was done in August over 1 trap night.

District 3-3		trap type	
County	**Species**	**CDC**	**Gravid**
Clayton	*Ae. albopictus*		1
	Ae. vexans	1	
	Cx. coronator	9	
	Cx. erraticus	1	
	Cx. nigripalpus	2	
	Cx. restuans	1	
	Oc. atlanticus		1

floodwater mosquito habitat



Vector Species 2021



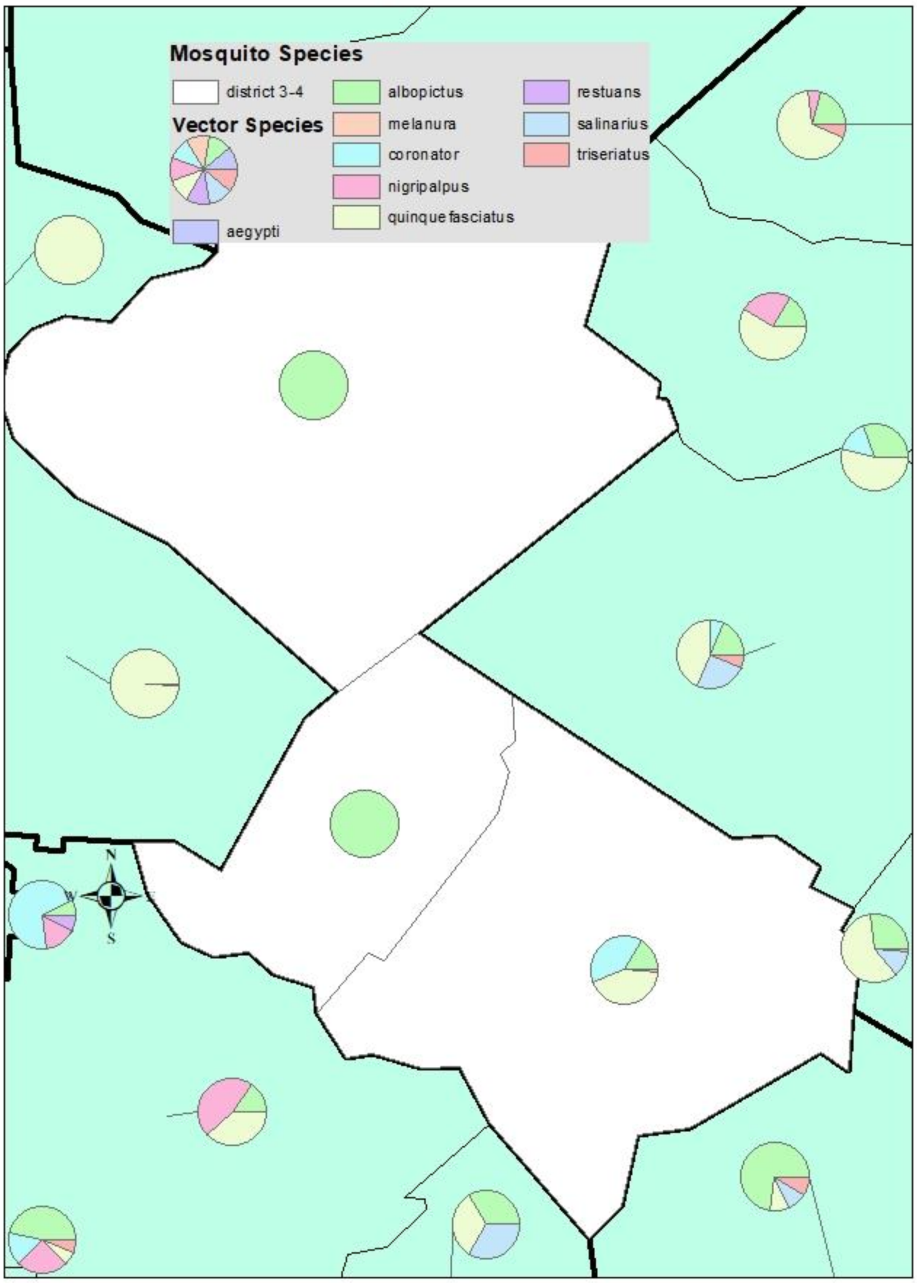
District 3-4

District 3-4		trap type	
County	**Species**	**CDC**	**gravid**
Gwinnett	*Ae. albopictus*	3	1
Newton	*Ae. albopictus*	20	3
	Ae. vexans	52	
	An. crucians	2	
	An. punctipennis	1	
	An. quadrimaculatus	4	
	Cx. coronator	54	1
	Cx. erraticus	1	
	Cx. quinquefasciatus	58	2
	Cx. restuans		1
	Oc. atlanticus	365	4
	Oc. japonicus		1
	Oc. triseriatus		2
	Oc. trivittatus	1	1
	Ps. ciliata	199	
	Ps. columbiae	53	
	Ps. cyanescens	1134	
	Ps. ferox	299	1
	Ps. horrida	140	
	Ps. howardii	149	
Rockdale	*Ae. albopictus*		1
	Ae. vexans	1	
	Cx. erraticus	1	
	Oc. japonicus		1

Surveillance in District 3-4 was done by the DPH entomologists. Surveillance was done in May, July, and August over 11 trap nights.

Psorophora howardii

Vector Species 2021

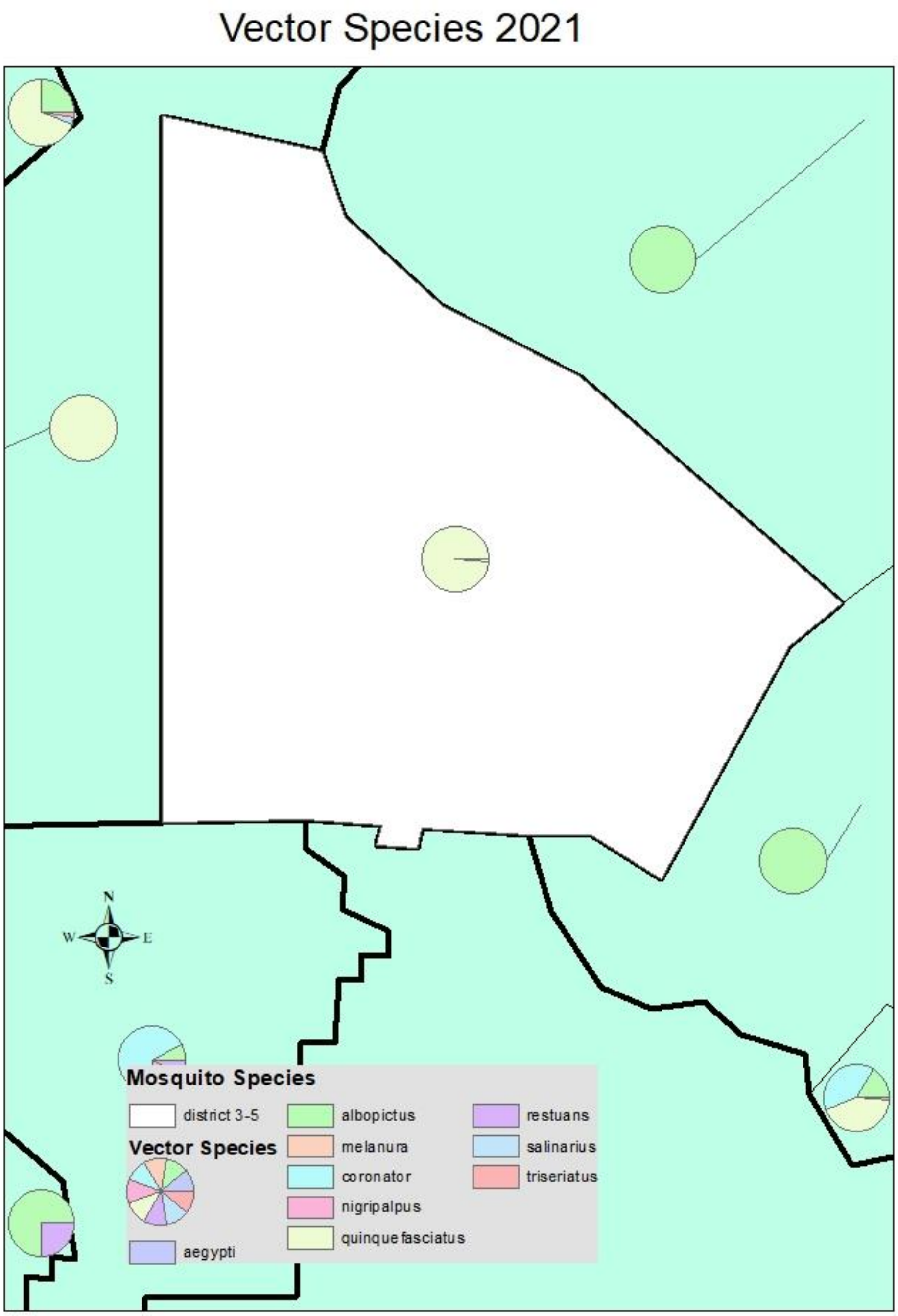


District 3-5

District 3-5		trap type
County	**Species**	**Gravid**
DeKalb	*Cx. quinquefasciatus*	11966
	Cx. restuans	125

Surveillance in District 3-5 was done by interns in the County Environmental Health program. Surveillance was done from June - Oct over 64 trap nights. County-level tested mosquito data were shared with the DPH.

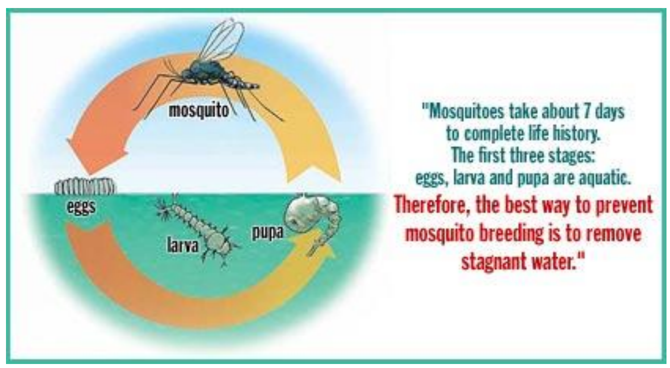
SALT MARSH HABITAT


Vector Species 2021
N
W
E
S
Mosquito Species
district 3-5
Vector Species
aegypti
albopictus
melanura
coronator
nigripalpus
quinquefasciatus
restuans
salinarius
triseriatus

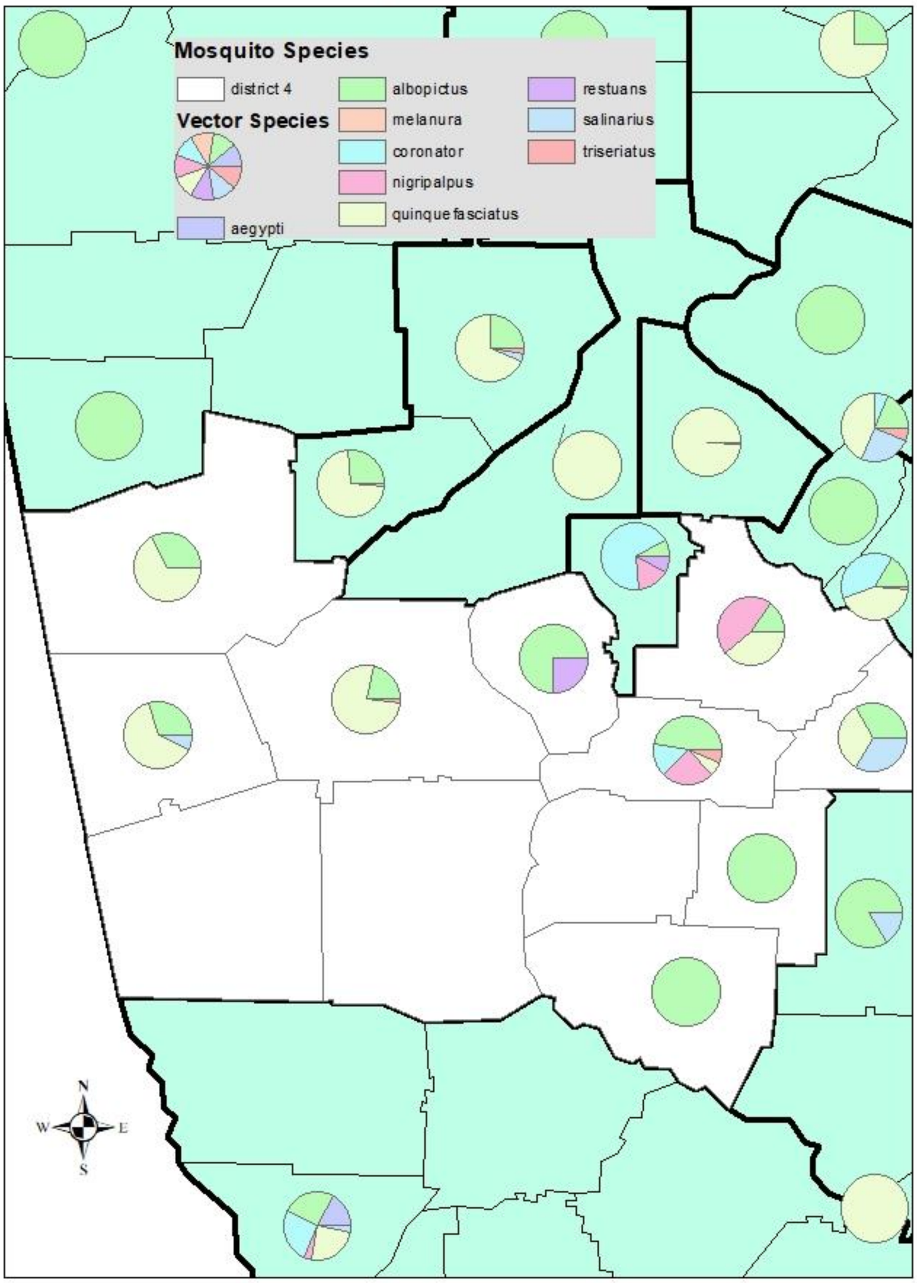
District 4-0

Surveillance in District 4-0 was done by the DPH entomologists. Surveillance was done in May, June, and August over 13 trap nights.

District 4-0		trap type	
County	**Species**	**CDC**	**Gravid**
Carroll	*Ae. albopictus*	9	6
	Ae. vexans	8	
	Cx. quinquefasciatus	11	20
Coweta	*Ae. albopictus*	13	13
	Ae. vexans	3	
	An. punctipennis	1	
	Cx. quinquefasciatus	9	83
	Oc. triseriatus	2	
Fayette	*Ae. albopictus*	1	2
	Ae. vexans	1	
	An. quadrimaculatus	1	
	Cx. restuans	1	
Heard	*Ae. albopictus*	8	1
	Ae. vexans	4	
	An. punctipennis	4	
	Cx. quinquefasciatus	4	15
	Cx. salinarius		2
	Oc. japonicus	3	
Henry	*Ae. albopictus*		2
	Ae. vexans	1	
	An. quadrimaculatus	10	
	Cx. erraticus	42	
	Cx. nigripalpus	6	
	Cx. quinquefasciatus	5	
	Oc. atlanticus	1	
	Ps. ciliata	3	
	Ps. columbiae	6	
Spalding	*Ae. albopictus*	11	4
	Ae. vexans	3	
	Cx. coronator	5	
	Cx. erraticus	8	
	Cx. nigripalpus	8	
	Cx. quinquefasciatus	2	
	Oc. japonicus	1	
	Oc. triseriatus	2	



Vector Species 2021

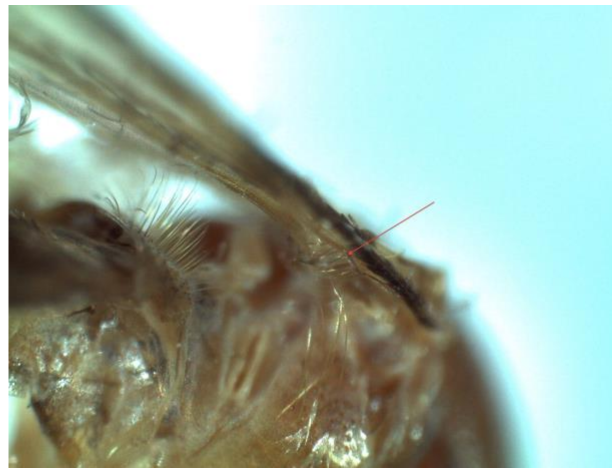


District 5-1

Surveillance in District 5-1 was done by the DPH entomologists. Surveillance was done from June - August over 10 trap nights.

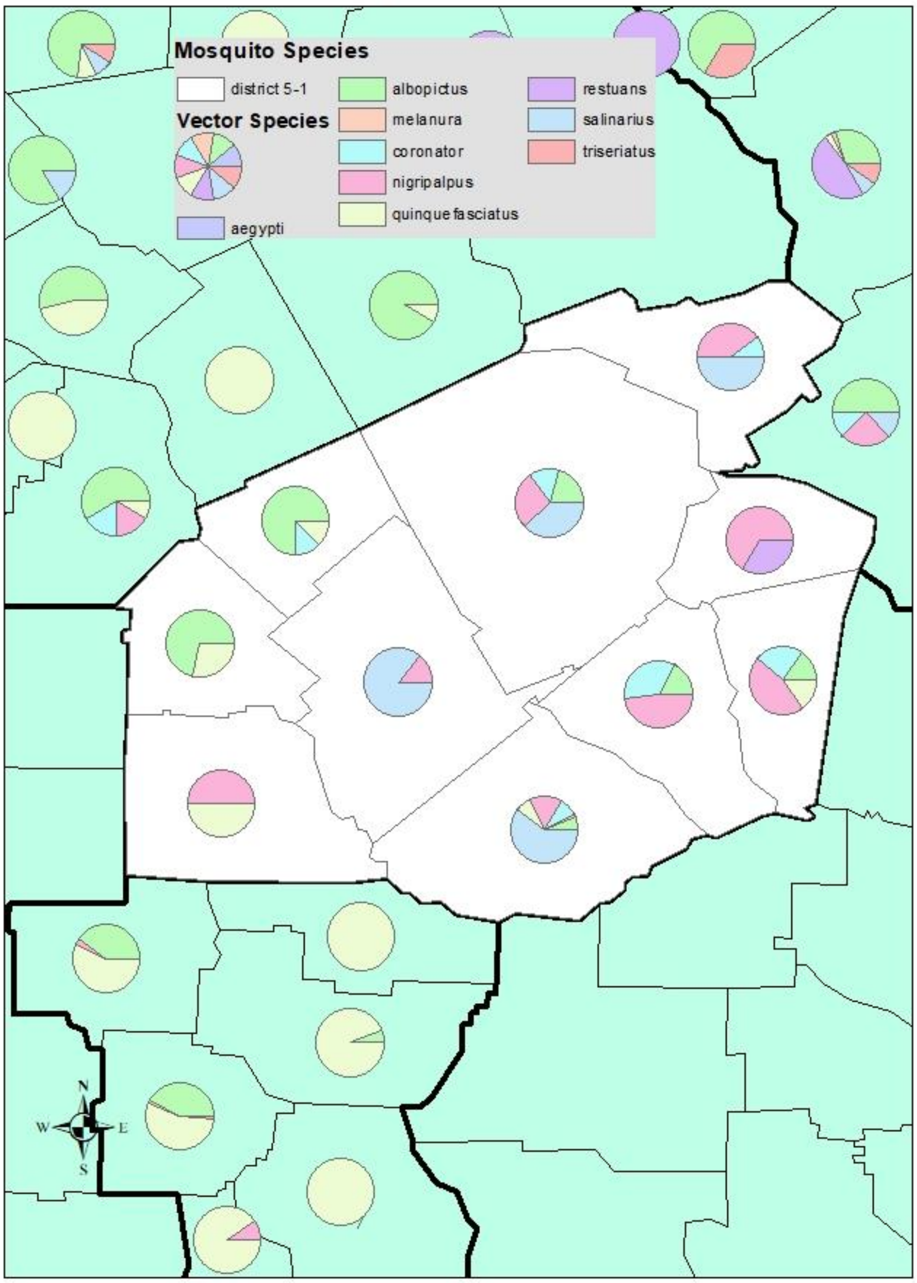
District 5-1		trap type		District 5-1		trap type	
County	**Species**	**CDC**	**gravid**	**County**	**Species**	**CDC**	**gravid**
Bleckley	*Ae. albopictus*		6	**Dodge**	*Ae. vexans*	8	
	Cx. coronator	1			*An. crucians*	1	
	Cx. erraticus	2			*An. quadrimaculatus*	2	
	Cx. quinquefasciatus		1		*Cx. erraticus*	6	
Montgomery	*Ae. albopictus*		2		*Cx. nigripalpus*	1	
	An. crucians	2			*Cx. salinarius*	6	
	An. quadrimaculatus	1			*Oc. atlanticus*		1
	Cx. coronator	3			*Ps. ciliata*	1	
	Cx. erraticus	2	1		*Ps. columbiae*	5	
	Cx. nigripalpus	6		**Wilcox**	*Ae. vexans*	1	
	Cx. quinquefasciatus	1	1		*Culex spp.*	1	
	unknown	1			*Cx. erraticus*	5	5
Pulaski	*Ae. albopictus*		5		*Cx. nigripalpus*	1	
	Cx. quinquefasciatus	2			*Cx. quinquefasciatus*		1
	Ps. columbiae	1			*Ps. columbiae*	1	
Wheeler	*Ae. albopictus*		9	**Johnson**	*An. crucians*	1	
	An. crucians	26			*Culex spp.*	1	
	Cq. perturbans	1			*Cx. coronator*	1	
	Cx. coronator	18			*Cx. nigripalpus*	4	
	Cx. erraticus	16	1		*Cx. salinarius*	5	
	Cx. nigripalpus	25			*Ps. ciliata*	1	
	Oc. atlanticus	1			*Ps. columbiae*	1	
	Oc. japonicus	1					
	Ps. columbiae	22					

District 5-1		trap type	
County	**Species**	**CDC**	**gravid**
Laurens	*Ae. albopictus*	5	1
	Ae. vexans	1	
	An. crucians	2	
	An. punctipennis	1	
	An. quadrimaculatus	2	
	Cq. perturbans	1	
	Cx. coronator	4	
	Cx. erraticus	3	
	Cx. nigripalpus	8	
	Cx. salinarius	11	
	Ps. ferox	1	
Treutlen	*Cx. nigripalpus*	2	
	Cx. restuans	1	
	Ps. columbiae	35	
Telfair	*Ae. albopictus*	3	1
	Ae. vexans	3	
	An. quadrimaculatus	1	
	Cs. melanura	1	
	Cx. coronator	6	
	Cx. erraticus	4	
	Cx. nigripalpus	11	
	Cx. quinquefasciatus	1	4
	Cx. salinarius	41	
	Oc. atlanticus	3	
	Ps. columbiae	4	



CULISETA MELANURA **WING SETAE**

Vector Species 2021



District 5-2

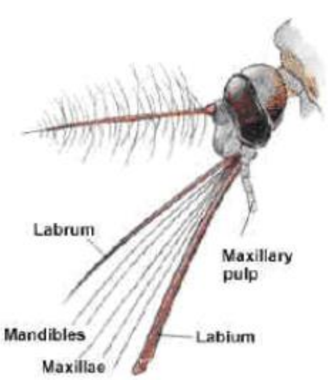
Surveillance in District 5-2 was done by the DPH entomologists from April-June and September-October over 21 trap nights.

District 5-2		trap type		District 5-2		trap type	
County	**Species**	**CDC**	**gravid**	**County**	**Species**	**CDC**	**gravid**
Baldwin	*Ae. albopictus*	4	2	**Crawford**	*An. quadrimaculatus*	2	
	Ae. vexans	11			*Cq. perturbans*	1	
	An. crucians	2			*Culex spp.*		1
	An. punctipennis	4			*Cx. erraticus*	1	
	An. quadrimaculatus	1			*Oc. japonicus*		1
	Cx. erraticus	1			*unknown*		2
	Cx. quinquefasciatus		5	**Hancock**	*Ae. vexans*	2	
	Cx. salinarius	1			*An. crucians*	5	
	Oc. japonicus		1		*Anopheles spp.*	1	
Bibb	*Ae. albopictus*	5	2		*Cx. erraticus*	6	
	An. punctipennis	1			*Cx. restuans*		6
	Cx. quinquefasciatus	1	5		*Oc. canadensis*	1	
Butts	*Ae. albopictus*	1			*Oc. japonicus*		5
	Ae. vexans	1		**Houston**	*Ae. albopictus*	15	6
	An. punctipennis	1			*Ae. vexans*	3	
	Cq. perturbans	1			*An. quadrimaculatus*	1	
	Cx. quinquefasciatus		1		*Cx. coronator*	6	
	Cx. salinarius	1			*Cx. nigripalpus*	6	
	Oc. japonicus		1		*Cx. quinquefasciatus*	2	1
	Ps. ciliata	1					

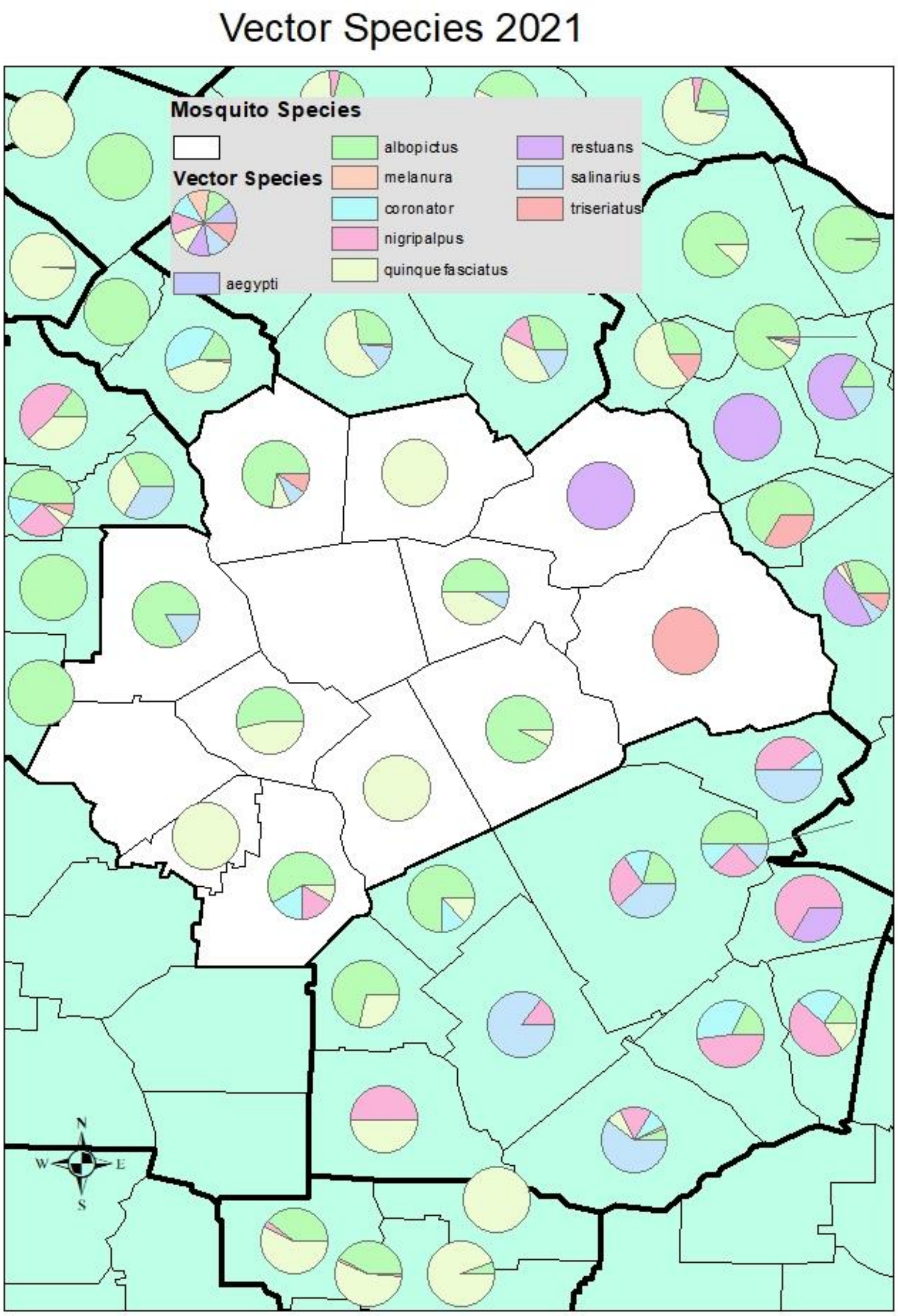
Prespiracular setae

District 5-2		trap type	
County	**Species**	**CDC**	**gravid**
Jasper	*Ae. albopictus*	6	2
	Ae. vexans	2	
	An. punctipennis	4	
	Culex spp.		2
	Cx. erraticus	2	
	Cx. quinquefasciatus	1	
	Cx. salinarius	1	
	Oc. canadensis	1	
	Oc. japonicus		6
	Oc. triseriatus		1
	Oc. trivittatus	1	
	Ps. columbiae	3	
	Ps. cyanescens	1	
Jones	*Ae. vexans*	17	
	An. crucians	2	
	An. punctipennis	6	
	An. quadrimaculatus	8	
Lamar	*Ae. albopictus*		2
	An. crucians	2	
	An. quadrimaculatus	1	
	Oc. japonicus		1

District 5-2		trap type	
County	**Species**	**CDC**	**gravid**
Monroe	*Ae. albopictus*	3	2
	An. crucians	3	
	An. quadrimaculatus	1	
	Cx. salinarius	1	
	Oc. japonicus	1	
Peach	*Cx. quinquefasciatus*		2
	Tx. rutilus		1
Putnam	*Cx. quinquefasciatus*		3
	Oc. japonicus		2
Twiggs	*Cx. quinquefasciatus*		1
	Oc. japonicus		1
Upson	*Ae. albopictus*		1
	Ae. vexans	5	
	An. punctipennis	1	
	An. quadrimaculatus	1	
	Cx. erraticus	4	1
	Ps. columbiae	1	
Washington	*Ae. vexans*	3	
	Anopheles spp.	1	
	Oc. triseriatus		1
	unknown	1	
Wilkinson	*Ae. albopictus*	8	3
	Ae. vexans	4	
	An. crucians	1	
	An. punctipennis	2	
	Cx. quinquefasciatus		1
	Oc. japonicus		1



Mosquito


Vector Species 2021
Mosquito Species
Vector Species
aegypti
albopictus
melanura
coronator
nigripalpus
quinquefasciatus
restuans
salinarius
triseriatus
N
S
E
W

District 6-0

Surveillance in District 6-0 was done by the Richmond County Mosquito Control program. Surveillance was done from January – November over 518 trap nights.

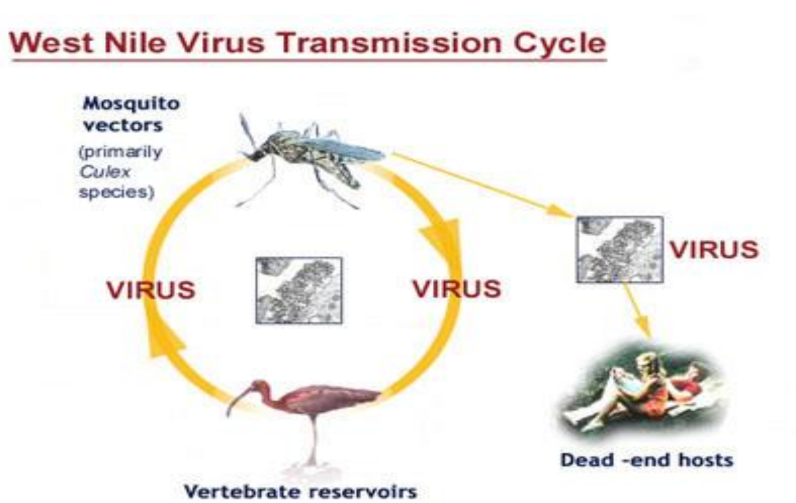
District 6-0		trap type	
County	***Species***	**CDC**	**gravid**
Burke	*Ae. albopictus*	1	
	Ae. vexans	4	
	An. punctipennis	1	
	An. quadrimaculatus	1	
	Cq. perturbans	2	
	Cx. erraticus	6	
	Cx. restuans	1	
	Cx. salinarius	3	
	Oc. sticticus	1	
	Oc. triseriatus	1	
Columbia	*Ae. albopictus*	45	
	An. quadrimaculatus	1	
	Cx. erraticus	5	
	Cx. quinquefasciatus		4
	Cx. restuans	1	
	Cx. territans		2
	Oc. triseriatus	1	
	Ps. ferox	1	
Emanuel	*Ae. albopictus*	3	1
	Cq. perturbans	2	
	Cx. coronator	1	
	Cx. erraticus	2	
	Cx. nigripalpus	2	
	Cx. salinarius	1	
	Oc. atlanticus	27	
	Oc. dupreei	1	
	unknown	2	
Glascock	*Ae. albopictus*	3	1

	An. crucians	6	
	An. quadrimaculatus	1	
	Cx. erraticus	14	
	Oc. japonicus		2
	Oc. triseriatus		2
	Ps. ciliata	1	
Jefferson	*Ae. albopictus*	14	2
	Ae. vexans	18	
	An. crucians	141	
	An. punctipennis	10	
	An. quadrimaculatus	17	
	Cq. perturbans	63	
	Cs. melanura	1	
	Cx. erraticus	1	
	Cx. quinquefasciatus		2
	Cx. restuans	4	21
	Cx. salinarius	4	
	Cx. territans	2	2
	Oc. canadensis	2	
	Oc. japonicus	12	1
	Oc. triseriatus	2	3
	Ur. sapphirina	2	
Jenkins	*Ae. albopictus*	1	1
	Ae. vexans	2	
	An. crucians	2	
	An. quadrimaculatus	4	
	Cx. erraticus	1	
	Cx. restuans		1
	Cx. salinarius	1	
	Cx. territans		1
	Oc. japonicus		1
	Ur. sapphirina	2	
Lincoln	*Ae. albopictus*	410	3
	Ae. vexans	1	

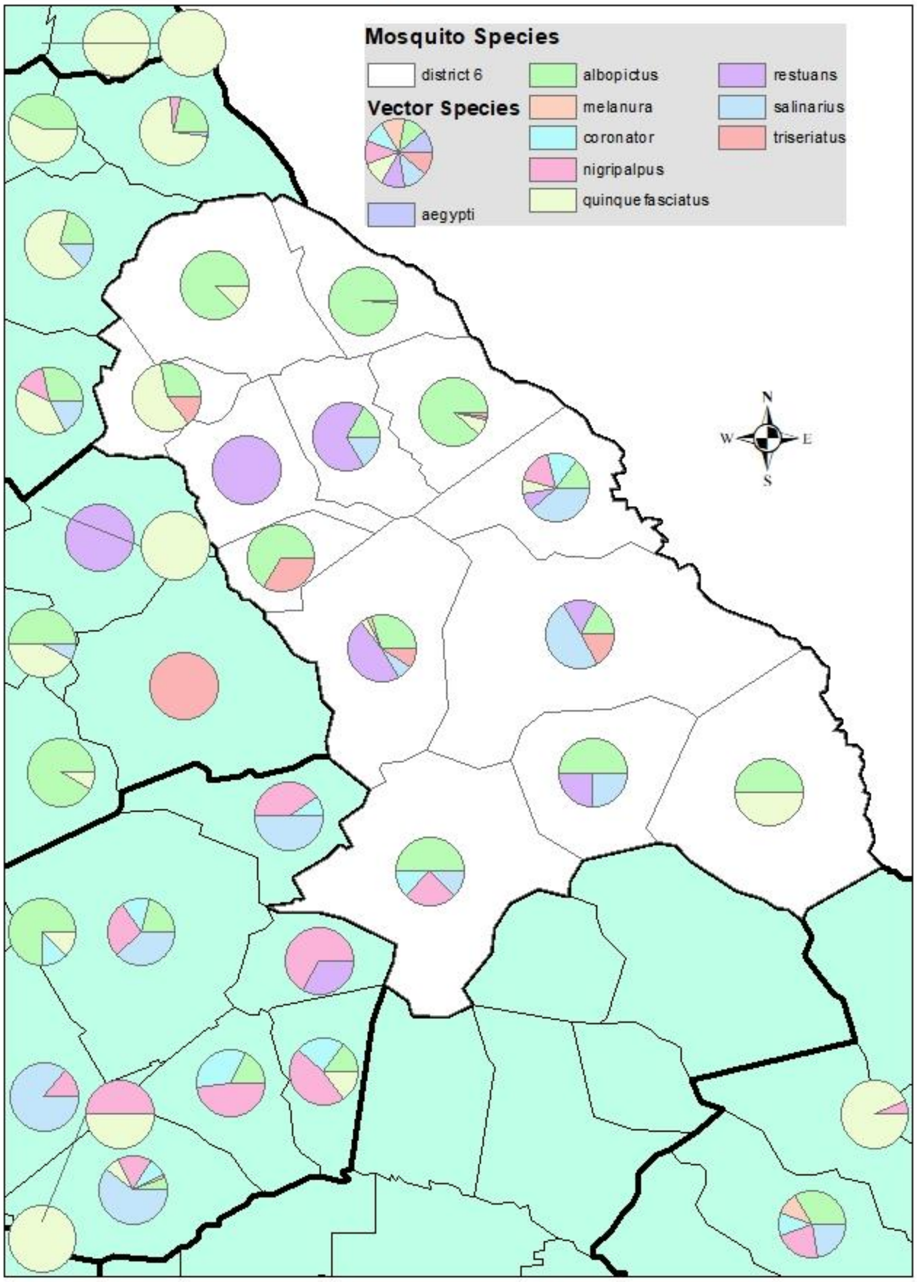
	An. punctipennis	1	
	Cx. coronator	1	
	Cx. erraticus	3	
	Cx. quinquefasciatus		5
	Cx. territans		1
	Oc. japonicus		3
	Oc. triseriatus		1
	Ps. cyanescens	1	
	Ps. ferox	1	
McDuffie	*Ae. albopictus*	1	
	Cq. perturbans	2	
	Cx. erraticus	5	
	Cx. restuans	2	2
	Cx. salinarius	1	
	Oc. canadensis	2	1
Richmond	*Ae. albopictus*	1100	136
	Ae. vexans	866	1
	Aedes/Ochlerotatus spp.	35	2
	An. crucians	469	
	An. punctipennis	203	1
	An. quadrimaculatus	210	2
	Anopheles spp.	63	
	Cq. perturbans	552	11
	Cs. inornata	2	
	Cs. melanura	15	
	Culex spp.	341	7
	Cx. coronator	1213	5
	Cx. erraticus	745	13
	Cx. nigripalpus	1384	18
	Cx. peccator		1
	Cx. pilosus		1
	Cx. quinquefasciatus	317	272
	Cx. restuans	112	624
	Cx. salinarius	3203	27

	Cx. territans	7	26
	Oc. atlanticus	87	
	Oc. canadensis	24	1
	Oc. fulvus pallens	6	
	Oc. hendersoni		1
	Oc. infirmatus	46	
	Oc. japonicus	7	42
	Oc. sticticus	75	
	Oc. taeniorhynchus	1	
	Oc. thibaulti	12	
	Oc. triseriatus	28	49
	Or. signifera		1
	Ps. ciliata	10	
	Ps. columbiae	59	
	Ps. cyanescens	1	
	Ps. ferox	273	
	Ps. howardii	10	
	Psorophora spp.	28	
	Tx. rutilus		1
	unknown	43	
	Ur. lowii	4	
	Ur. sapphirina	35	
Screven	*Ae. albopictus*		1
	Anopheles spp.	1	
	Culex spp.	1	
	Cx. erraticus	1	
	Cx. quinquefasciatus	1	
Taliaferro	*Ae. albopictus*	2	2
	Aedes/Ochlerotatus spp.	1	
	An. punctipennis		1
	An. quadrimaculatus	3	
	Cx. erraticus	1	
	Cx. quinquefasciatus	2	6
	Oc. japonicus	1	3

	Oc. triseriatus	1	1
Warren	*An. crucians*	3	
	Cx. erraticus	1	
	Cx. restuans	1	3
	Cx. territans	1	2
	Oc. japonicus		1
Wilkes	*Ae. albopictus*	91	4
	Ae. vexans	9	
	Aedes/Ochlerotatus spp.	3	
	An. punctipennis	15	
	An. quadrimaculatus	2	
	Culex spp.	3	
	Cx. erraticus	4	
	Cx. quinquefasciatus	7	6
	Cx. salinarius	1	
	Cx. territans	2	
	Oc. japonicus	1	12
	Or. signifera	1	
	Ps. ferox	3	
	Tx. rutilus		1



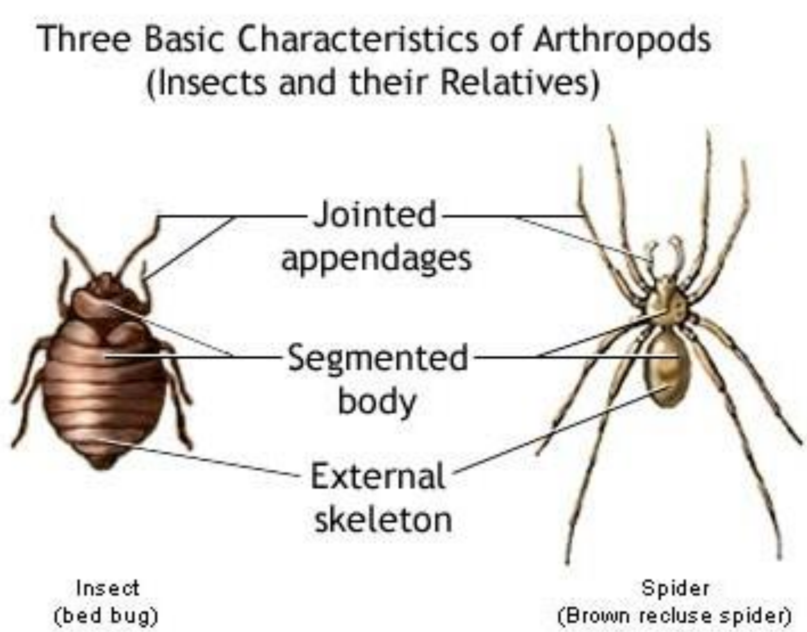
Vector Species 2021

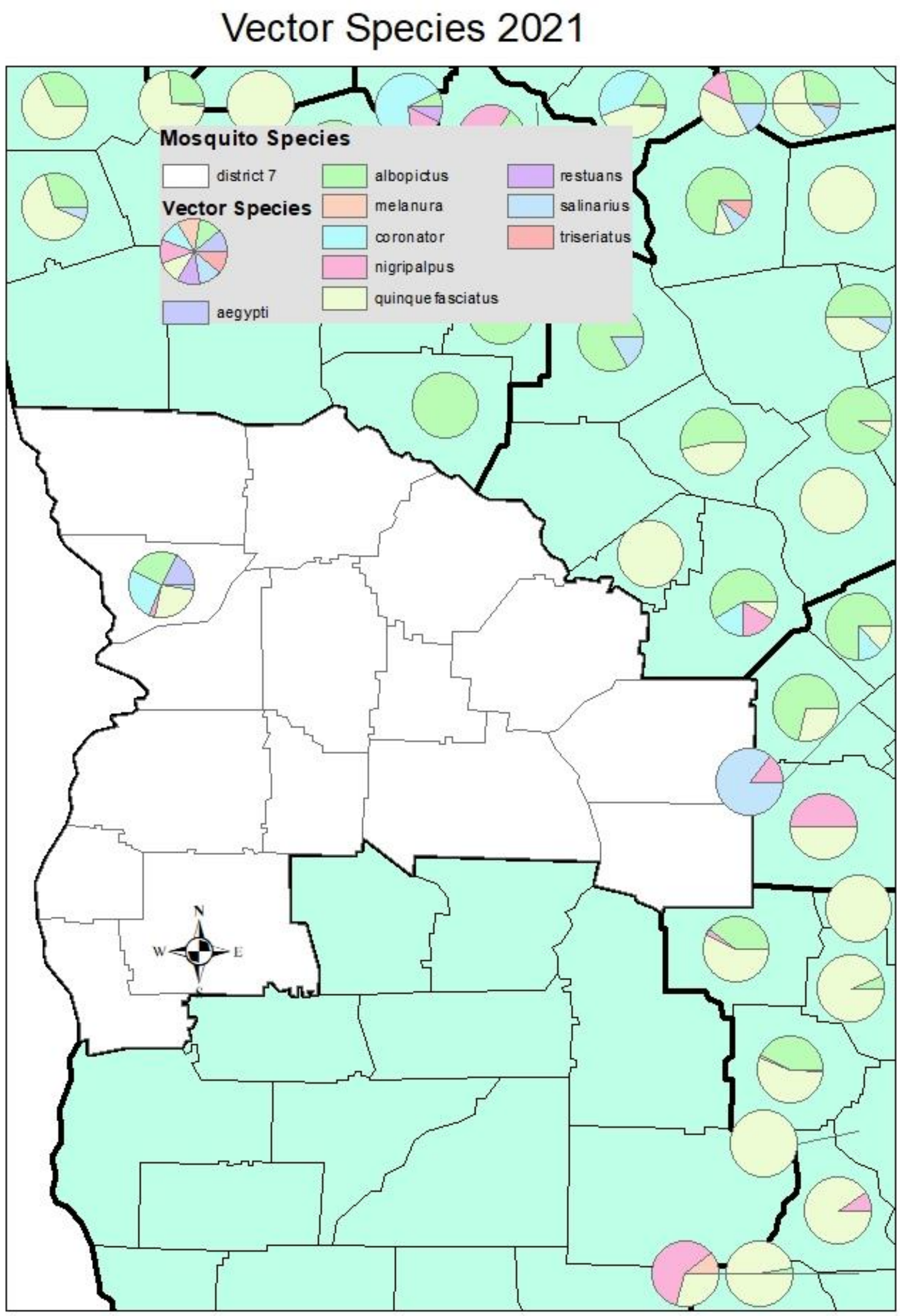


District 7-0

Due to budget cuts, surveillance in District 7-0 was done by the State entomologists and limited to Muscogee County at the Aedes aegypti sites. Surveillance was done once (4 trap nights) in September.

District 7-0		trap type	
County	***Species***	**CDC**	**Gravid**
Muscogee	*Ae. aegypti*	9	9
	Ae. albopictus	1	25
	Ae. vexans		2
	Cx. coronator	14	13
	Cx. erraticus	1	
	Cx. nigripalpus		3
	Cx. quinquefasciatus	1	25
	Cx. salinarius	3	
	Or. signifera		1




Vector Species 2021
Mosquito Species
district 7
Vector Species
aegypti
albopictus
melanura
coronator
nigripalpus
quinquefasciatus
restuans
salinarius
triseriatus
N
W
E
S

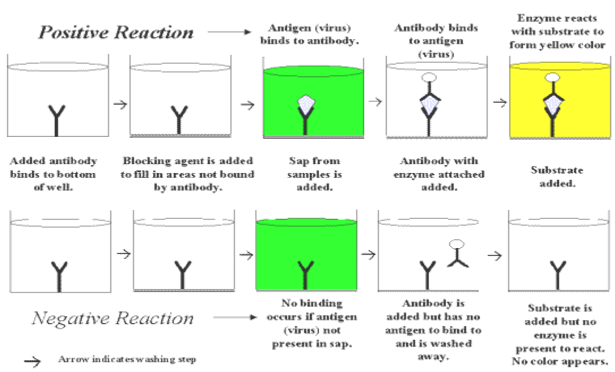
District 8-1

Surveillance in District 8-1 was done by the local EHS and students from VSU. Surveillance was done from February - November over 648 trap nights.

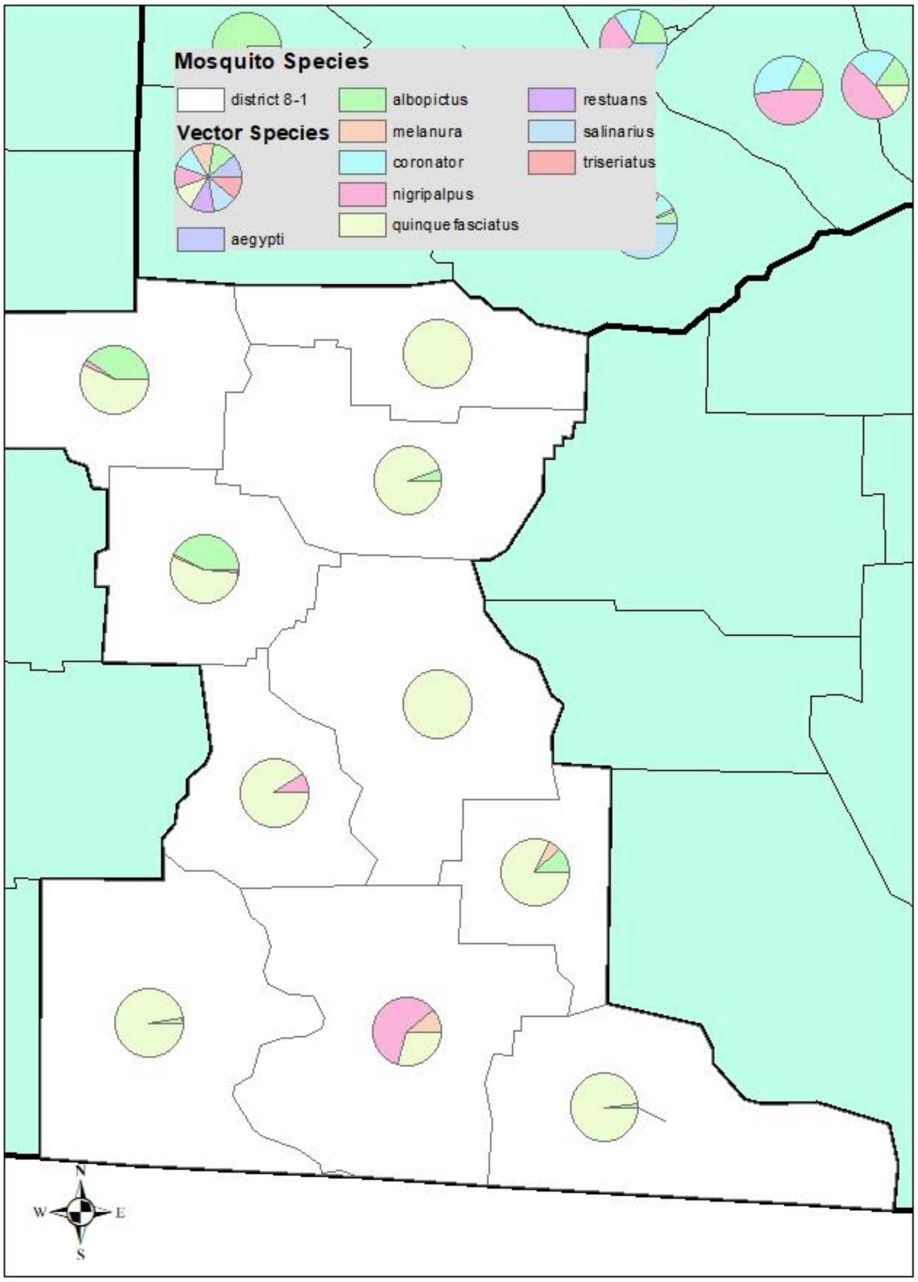
District 8-1		trap type	
County	***Species***	**CDC**	**Gravid**
Ben Hill	*Ae. albopictus*		3
	Cx. erraticus		1
	Cx. quinquefasciatus		1785
	Oc. canadensis		5
	Oc. triseriatus		1
Berrien	*An. punctipennis*		1
	Cs. melanura		2
	Cx. erraticus		1
	Cx. quinquefasciatus		360
	Oc. canadensis		1
	Ur. sapphirina (male)		1
Brooks	*Ae. albopictus*		1
	Cx. quinquefasciatus		40
Cook	*Cx. erraticus*		2
	Cx. nigripalpus		5
	Cx. quinquefasciatus		48
Echols	*Ae. albopictus*		2
	Cs. melanura		1
	Cx. erraticus		1
	Cx. quinquefasciatus		124
	Psorophora spp.		2
Irwin	*Ae. albopictus*		12
	Ae. vexans		110
	An. punctipennis		3
	Cx. erraticus		3
	Cx. nigripalpus		2
	Cx. quinquefasciatus		197
Lanier	*Ae. albopictus*		23

	An. punctipennis		1
	Cs. inornata		2
	Cs. melanura		11
	Cx. quinquefasciatus		153
	Oc. canadensis		4
	Or. signifera		5
	unknown		3
Lowndes	*Cq. perturbans*	3016	178
	Cs. melanura	2756	525
	Cx. coronator	36	6
	Cx. nigripalpus	11683	6146
	Cx. quinquefasciatus	126	8747
	Cx. restuans	33	207
	Ma. titillans	91	28
	Oc. triseriatus		5
Tift	*Ae. albopictus*		37
	An. crucians		1
	An. punctipennis		3
	Cs. melanura		1
	Cx. quinquefasciatus		48
	Oc. triseriatus		1
Turner	*Ae. albopictus*		26
	Cx. nigripalpus		2
	Cx. quinquefasciatus		37
	Or. signifera		1

ELISA



Vector Species 2021



District 8-2

Due to budget cuts, no surveillance was done in District 8-2 in 2021.

MOSQUITO LARVA

MOSQUITO SURVEILLANCE 2021

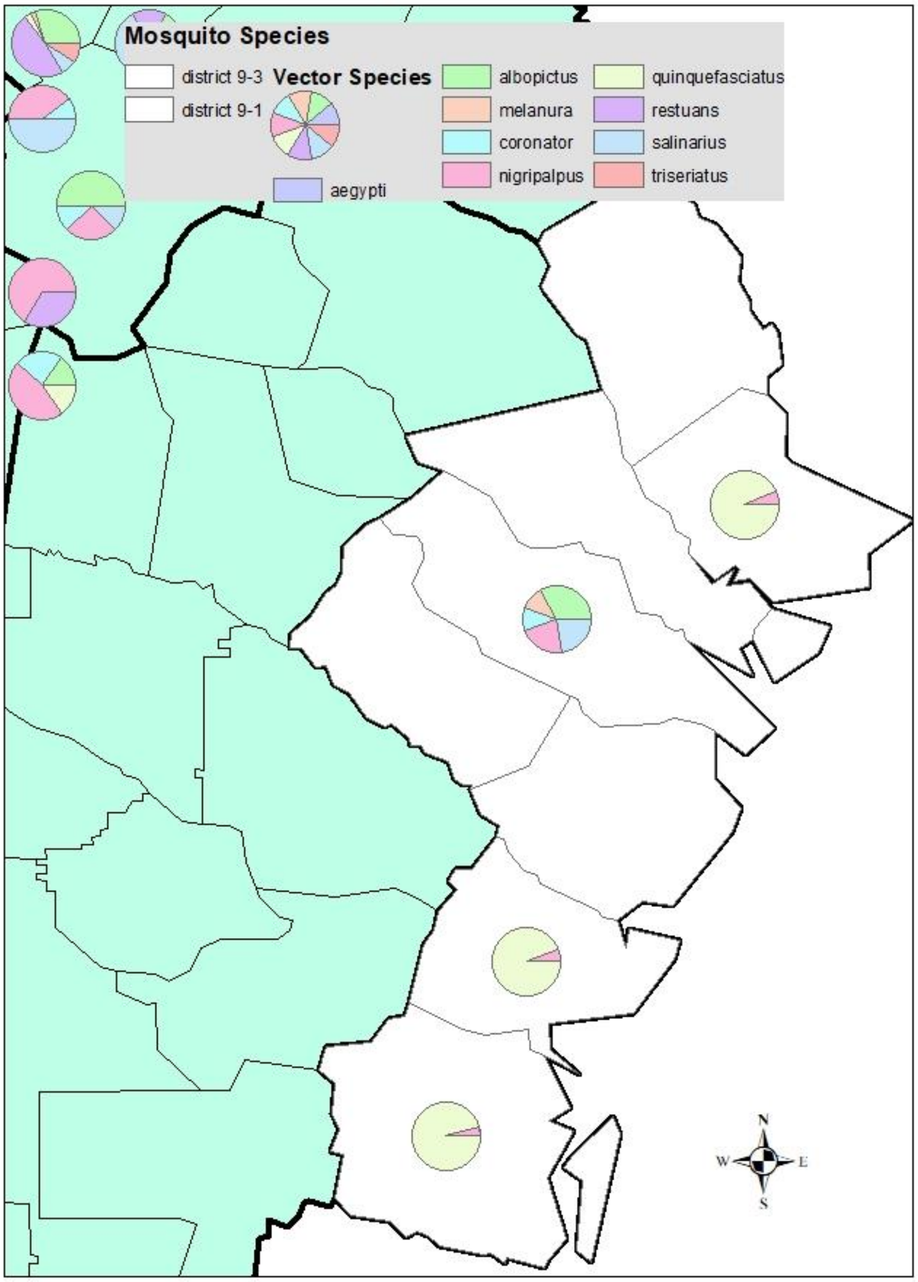
District 9-1

Surveillance in District 9-1 was done by Hinesville Public Works (Liberty County), Mosquito Control Services (Glynn County), and Chatham County Mosquito Control programs. Surveillance was done from January - November over 1790 trap nights.

District 9-1		trap type		
County	***Species***	**CDC**	**Gravid**	**exit**
Camden	*Ae. albopictus*	15		
	Ae. vexans	6		
	An. crucians	5		
	Cq. perturbans	5		
	Cs. inornata	1		
	Culex spp.		3220	
	Cx. nigripalpus	113	4	
	Cx. quinquefasciatus	2	2531	
	Cx. salinarius	5		
	Oc. atlanticus	1110		
	Oc. canadensis	37		
	Oc. infirmatus	6		
	Ps. ciliata	3		
	Ps. ferox	16		
Chatham	*Cs. melanura*	273	9	7
	Culex spp.		5716	
	Cx. nigripalpus		5094	47
	Cx. quinquefasciatus	47	70218	
Glynn	*Ae. albopictus*	13		
	Ae. vexans	41		
	An. crucians	35		
	An. quadrimaculatus	1		
	Cq. perturbans	1		
	Cs. inornata	21		
	Culex spp.		84	
	Cx. erraticus	12		
	Cx. nigripalpus	1948	4	

	Cx. quinquefasciatus	76	29547	
	Cx. salinarius	31	7	
	Oc. atlanticus	263		
	Oc. canadensis	65		
	Oc. infirmatus	73		
	Oc. sollicitans	5		
	Oc. taeniorhynchus	133		
	Ps. ciliata	1		
	Ps. columbiae	4		
	Ps. ferox	10		
	unknown		70	
Liberty	*Ae. albopictus*	3		
	Ae. vexans	56		
	An. crucians	9		
	Anopheles spp.	2		
	Cq. perturbans	3		
	Cs. melanura	1		
	Culex spp.	4		
	Cx. coronator	1		
	Cx. nigripalpus	2		
	Cx. salinarius	2		
	Oc. atlanticus	61		
	Oc. canadensis	4		
	Oc. infirmatus	5		
	Oc. taeniorhynchus	1		
	Oc. trivittatus	1		
	Ps. ferox	1		
	Ur. sapphirina	4		

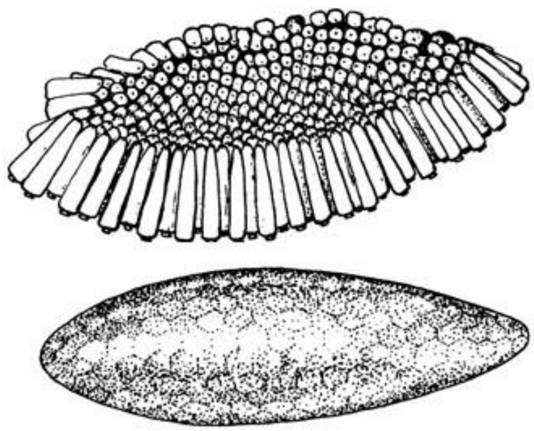
Vector Species 2021



MOSQUITO SURVEILLANCE 2021

District 9-2

Due to budget cuts, no surveillance was done in District 9-2 in 2021.



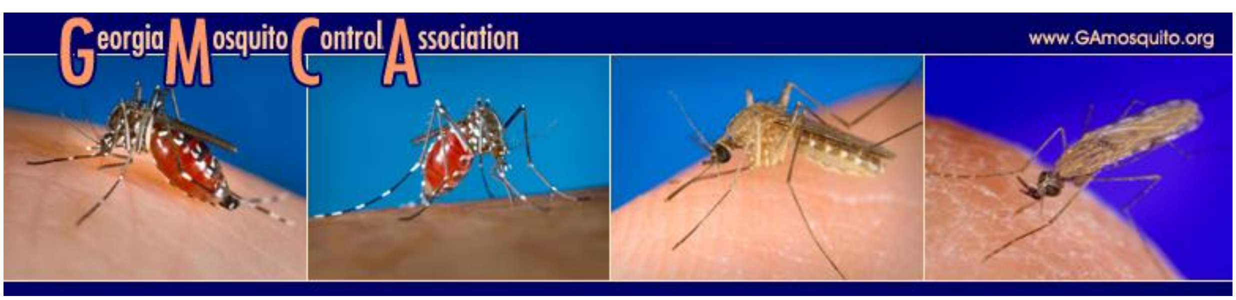
MOSQUITO EGG TYPES

District 10-0

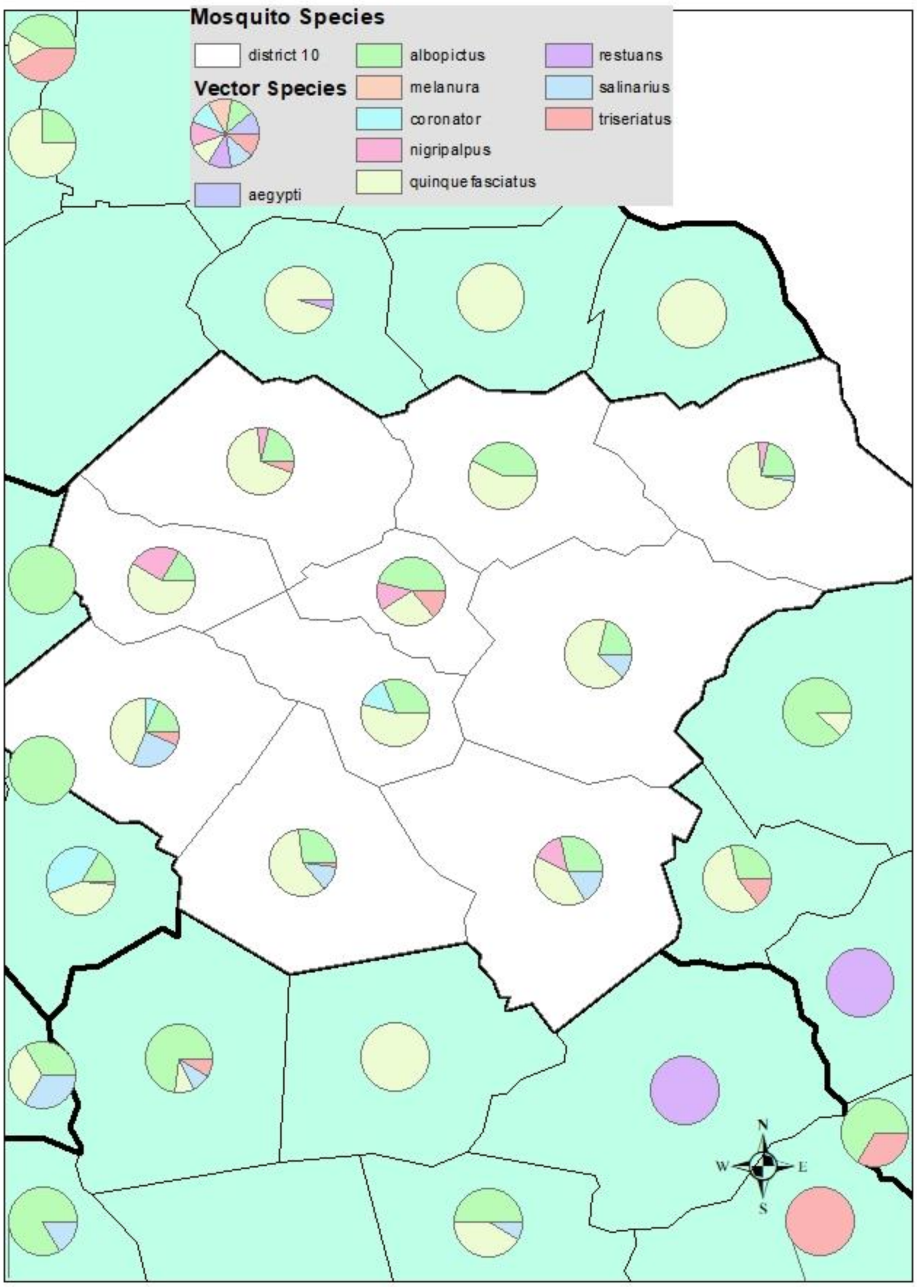
Surveillance in District 10-0 was done by a UGA intern. Surveillance was done from April-June over 27 trap nights.

District 10-0		trap type	
County	***Species***	**CDC**	**gravid**
Barrow	*Ae. albopictus*	1	1
	An. punctipennis	1	
	Cx. nigripalpus		3
	Cx. quinquefasciatus	3	4
Clarke	*Ae. albopictus*	10	
	Ae. vexans	2	
	Cx. nigripalpus		3
	Cx. quinquefasciatus		6
	Oc. triseriatus	3	
Elbert	*Ae. albopictus*	14	3
	Ae. vexans	4	2
	Cx. nigripalpus	4	
	Cx. quinquefasciatus	14	42
	Cx. salinarius	1	1
Jackson	*Ae. albopictus*	2	5
	Ae. vexans	4	
	Cx. erraticus		2
	Cx. nigripalpus		2
	Cx. quinquefasciatus	12	11
	Oc. triseriatus	2	
Morgan	*Ae. albopictus*	12	3
	Ae. vexans	14	
	An. punctipennis	1	
	Cx. quinquefasciatus	29	4
	Cx. salinarius	5	2
	Oc. triseriatus	1	
Oconee	*Ae. albopictus*	2	2

	An. punctipennis		2
	Cx. coronator	2	
	Cx. quinquefasciatus	4	3
Oglethorpe	*Ae. albopictus*	3	2
	Ae. vexans	2	2
	Cx. quinquefasciatus	8	8
	Cx. salinarius		3
Walton	*Ae. albopictus*	3	
	Ae. vexans	3	
	Cx. coronator		1
	Cx. quinquefasciatus	4	3
	Cx. salinarius		4
	Oc. triseriatus	1	
Greene	*Ae. albopictus*	5	5
	Ae. vexans	2	2
	An. quadrimaculatus	1	
	Cx. erraticus	1	
	Cx. nigripalpus		5
	Cx. quinquefasciatus	6	8
	Cx. salinarius		6
	Ps. ferox		5
Madison	*Ae. albopictus*		3
	Cx. quinquefasciatus		4



Vector Species 2021



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 https://dph.georgia.gov/mosquito-borne-diseases.

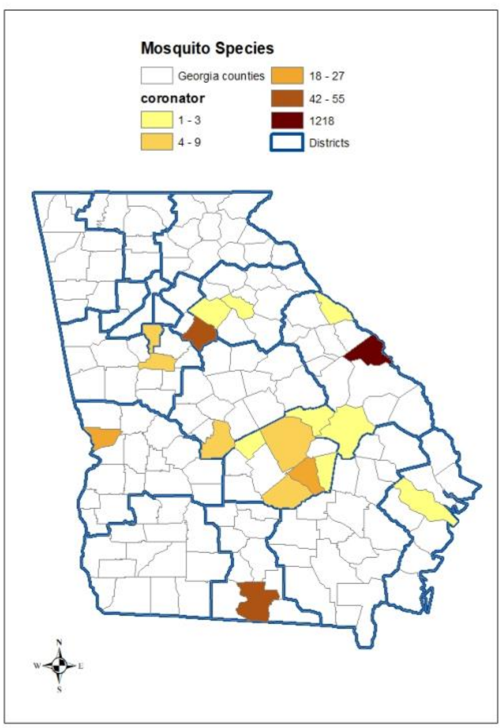
Invasive Mosquito Species

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.

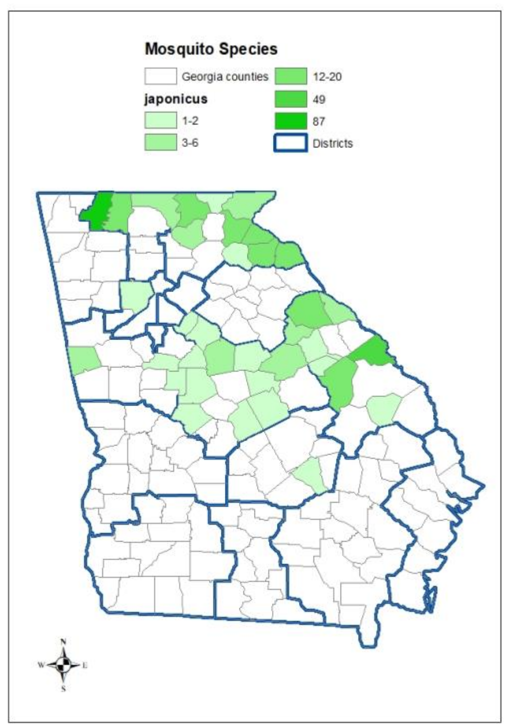
Culex coronator was first detected in Georgia in 2006. It was found initially in counties below the Fall line. Mosquito surveillance done in 2017 - 2020 has shown that this species can now be found in most regions of Georgia. It is important to monitor *Cx coronator* as it has the potential to be involved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

Culex coronator, 2021



Ochlerotatus japonicus, 2021



Pesticide Resistance Testing

Statewide Insecticide Resistance Testing of Mosquitoes in Georgia

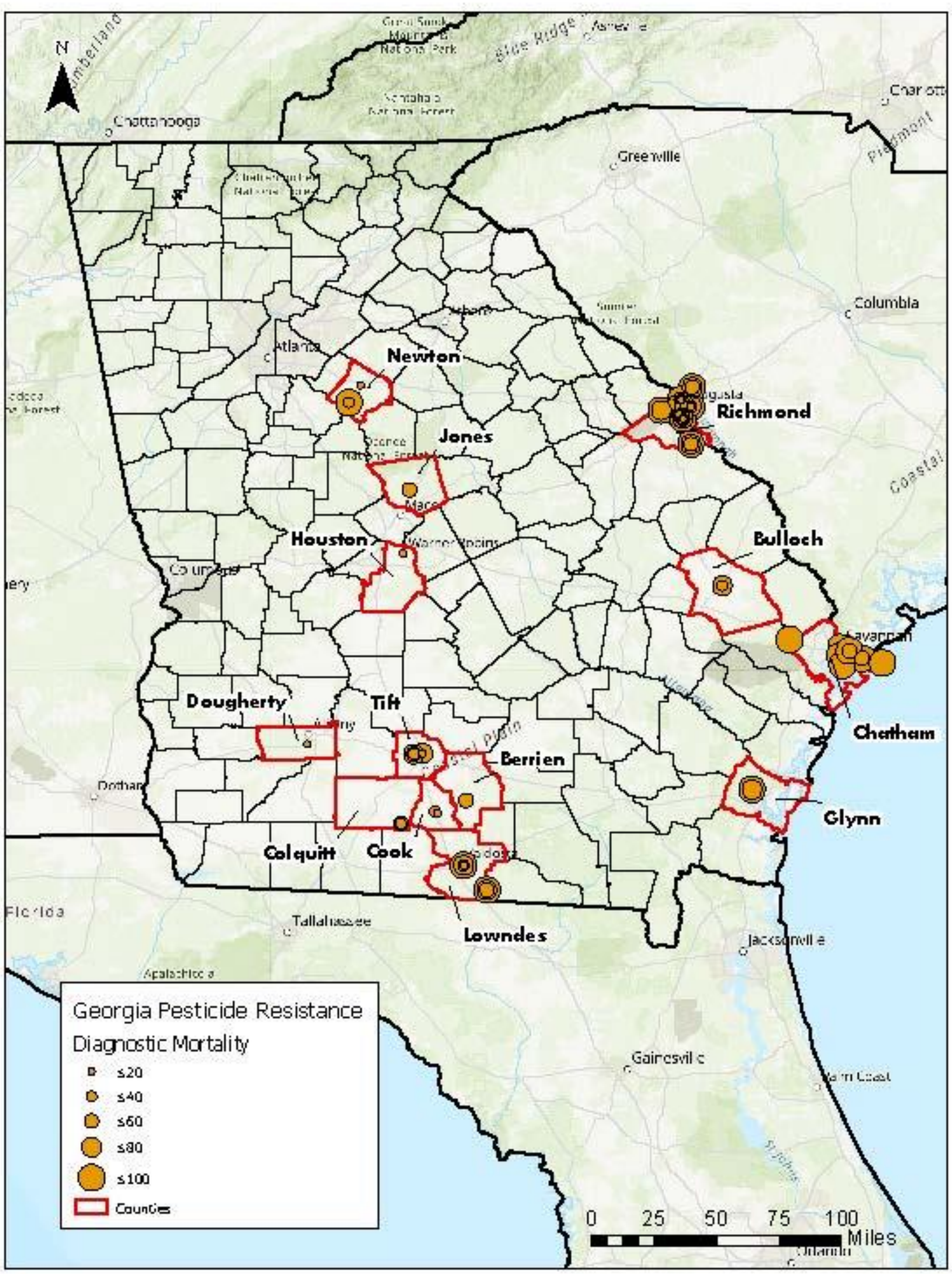
With the continuation of positive human cases of arboviral diseases such as La Crosse Encephalitis, St. Louis Encephalitis, Eastern Equine Encephalitis, and West Nile Virus in Georgia in 2020, mosquito control methods are critical. Pesticide resistance has been found to be a component for ineffective 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://cdn.ymaws.com/www.mosquito.org/resource/resmgr/docs/publications/hr_november_2021_amca_bmp_ma.pdf
- http://www.gamosquito.org/publications.htm
- http://cdcsercoevbd-flgateway.org/
- https://www.cdc.gov/parasites/education_training/lab/bottlebioassay.html

Conclusions

In 2021, due to Covid-19 and loss of funding, mosquito surveillance was only done in 103 of Georgia's 159 counties. Surveillance was done in areas of highest risk of vector-borne diseases, but in many counties, surveillance was non-existent or 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%
2021	103	64.8%

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 2022 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