



MONITORING *CULICOIDES* (DIPTERA: CERATOPOGONIDAE) SPECIES IN THE PIEDMONT REGION OF GEORGIA

Seasonal Variation and Species composition



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2018 ESA, ESC, and ESBC Joint Annual Meeting
Crossing Borders: Entomology in a Changing World

Diptera > Ceratopogonidae > *Culicoides*

biting midges or “no-see-ums”

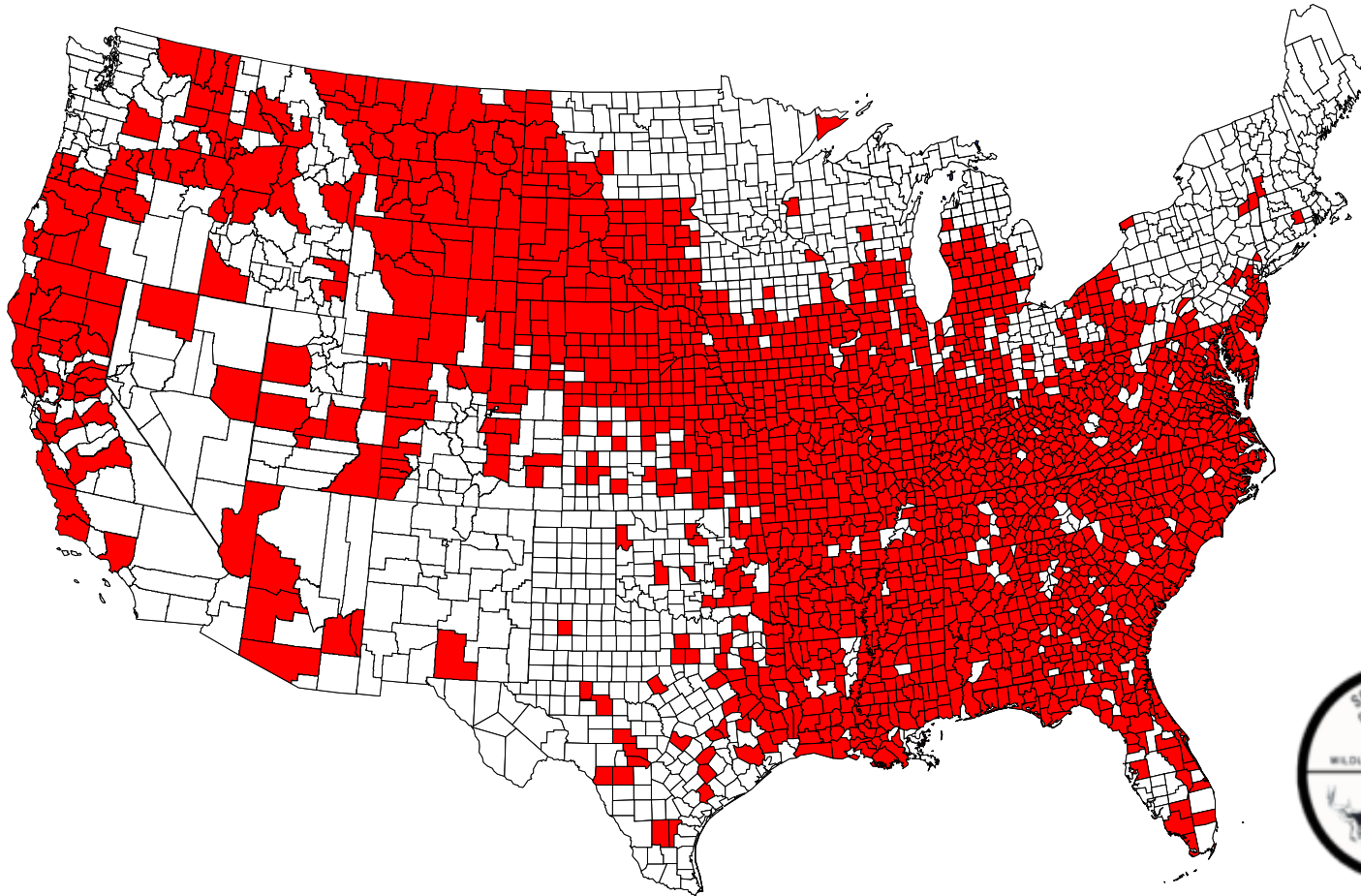
- Large genus with 151 species known in North America, 1300+ worldwide (every continent except Antarctica)
- Females are haematophagous - take a blood meal to produce eggs
- Some species are significant pests to people/livestock/wildlife, also serve as vectors (EHDV and BTV—Hemorrhagic Disease in WTD, ruminants)



Hemorrhagic Disease (HD) in the U.S.



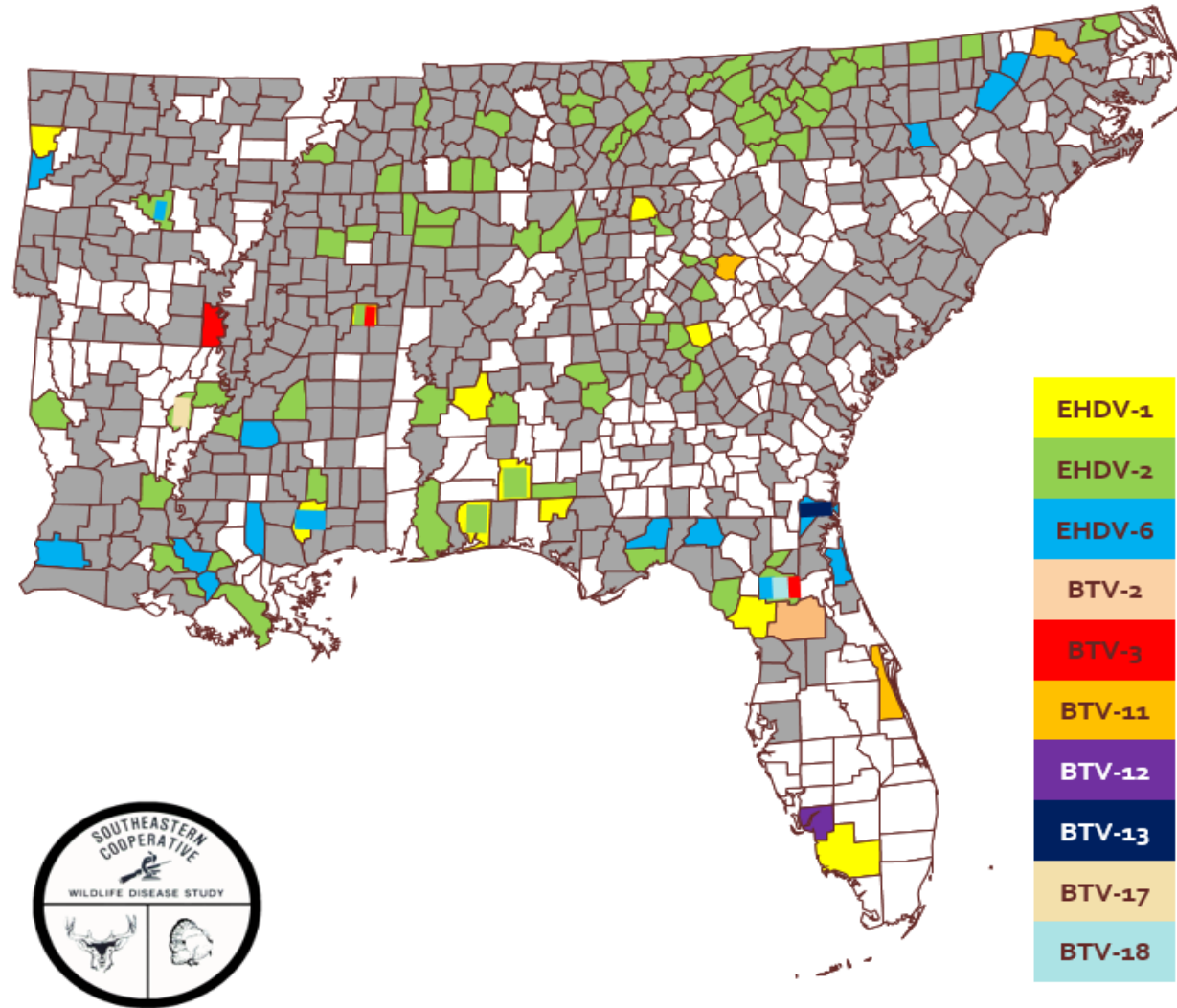
Distribution of Hemorrhagic Disease in the US:1980-2014



- *Culicoides* sp. midges are only known vectors
- Only two confirmed vector species in the SE U.S.
 - *C. sonorensis*
 - *C. insignis*
- There are likely more vector species

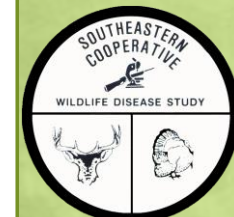
BTV and

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Reported
and BTV

Reported HD and isolations of EHDV and BTV
in wild ruminants 2007-2015



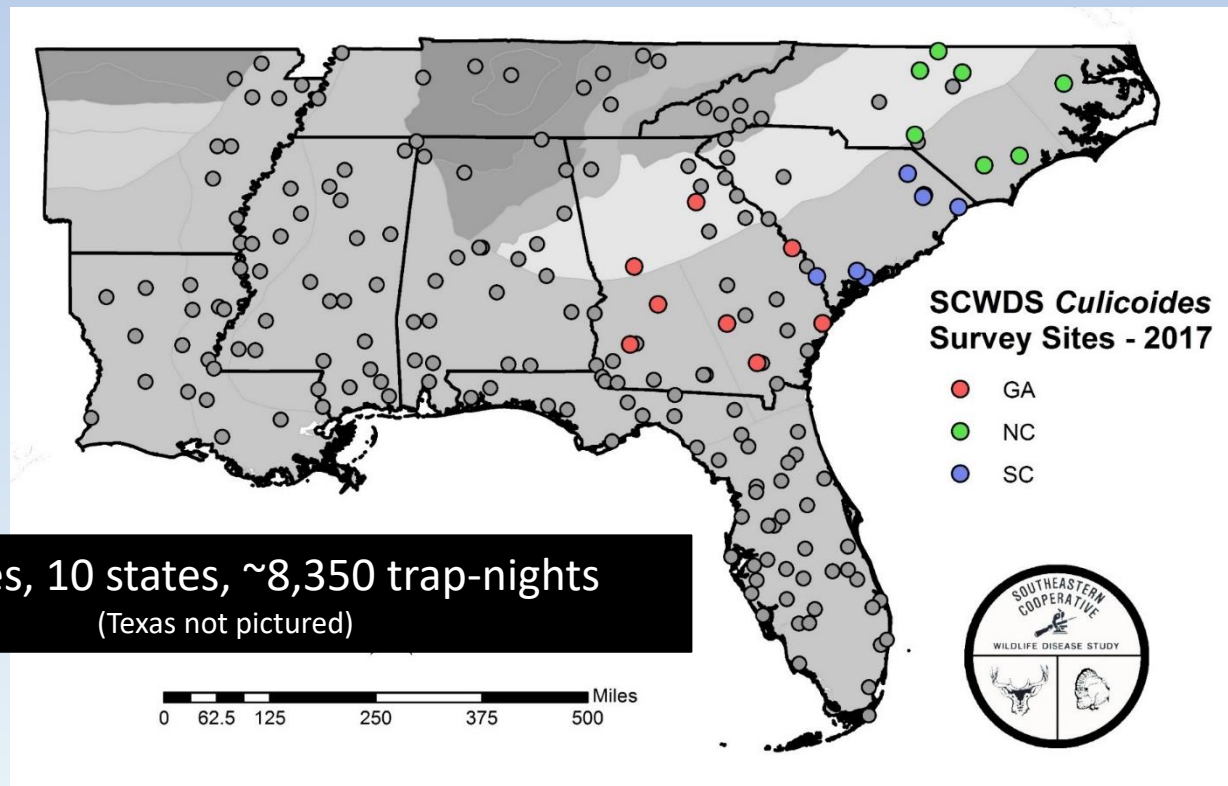
SCWDS *Culicoides* Surveys of the SE U.S.

2007-2018

- Investigate seasonal and annual patterns of EHDV and BTV activity through long-term monitoring of vector and host populations, starting with the Piedmont region of Georgia

14 species of *Culicoides* have been identified outside of previously established ranges.

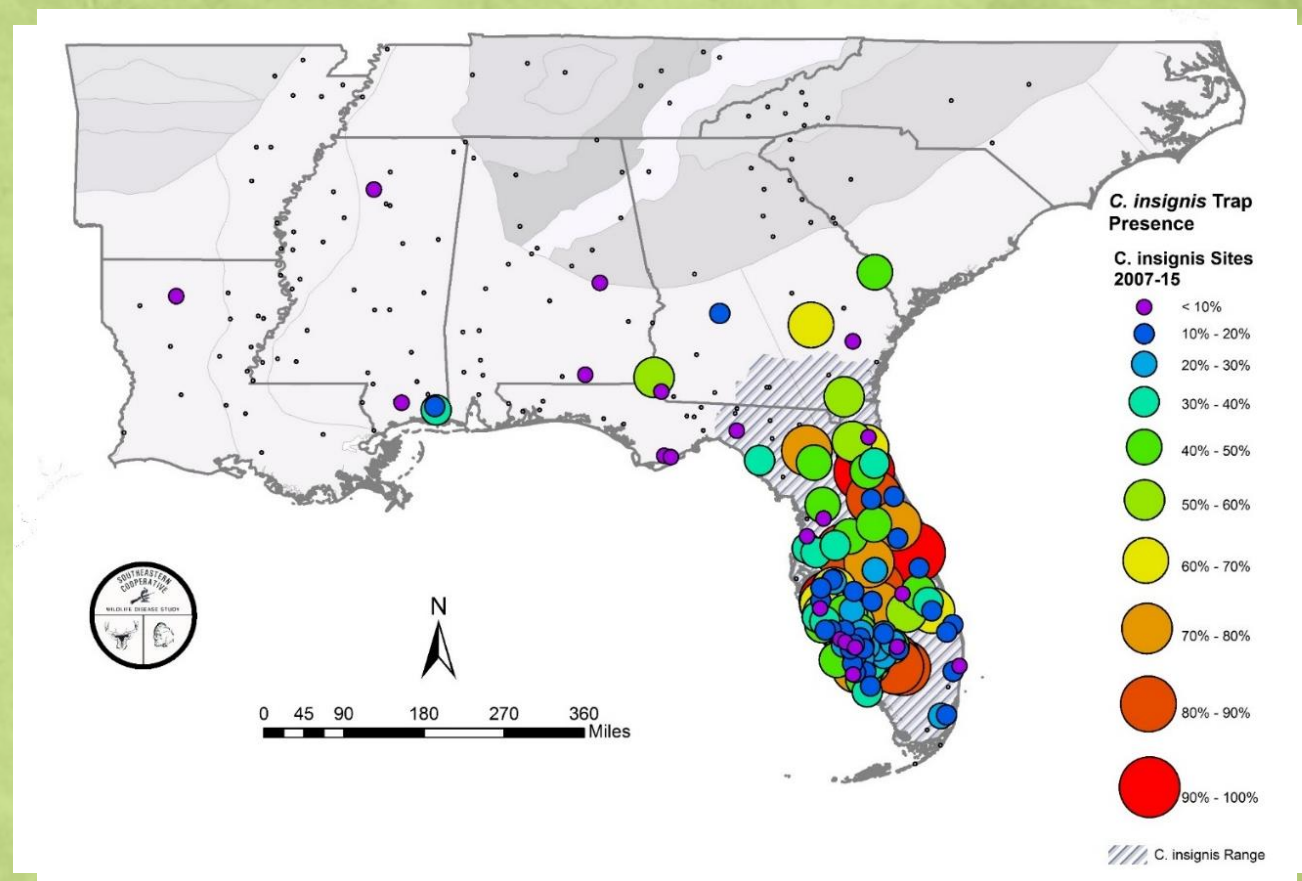
- CDC type UV suction traps
- Primarily July-Sept
- Natural areas
- 10-12 traps per site



USDA-APHIS-VS funded project to document *Culicoides* spp. SE US distributions

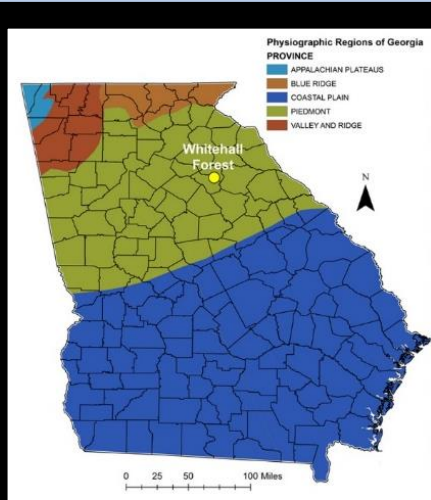
The “primary vector” is probably not the “primary vector”...in the southeastern United States

- *Culicoides sonorensis*, the only confirmed vector of BTV/EHDV in most of N. America is infrequently collected in the SE.
- The only other confirmed vector *C. insignis* (BTV), while common in Florida and expanding its range, is not a major player in most of the SE north of the peninsula.



Long-term *Culicoides* and HD Monitoring Whitehall Experimental Forest (UGA)

Document seasonal species composition across diverse habitats at a local managed forest in order to better inform future studies to incriminate additional vector species



Whitehall Forest – 840 acres of natural and planted pine, mixed pine-hardwood, upland and bottomland hardwood habitats



Monthly UV light trapping at 10 recurring locations

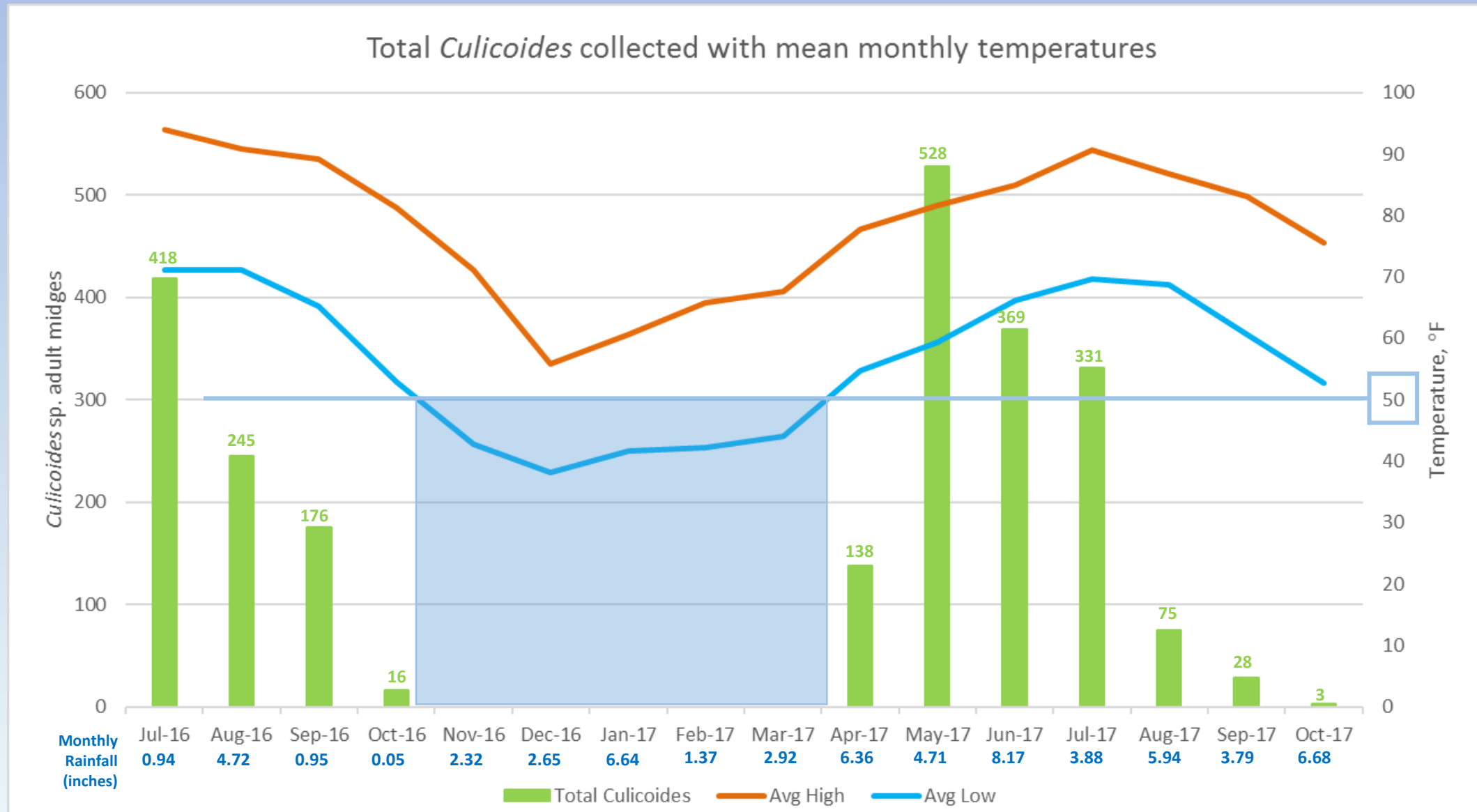
Monitoring has been ongoing since July 2016

Plans to pair with clinical and serological monitoring of WTD

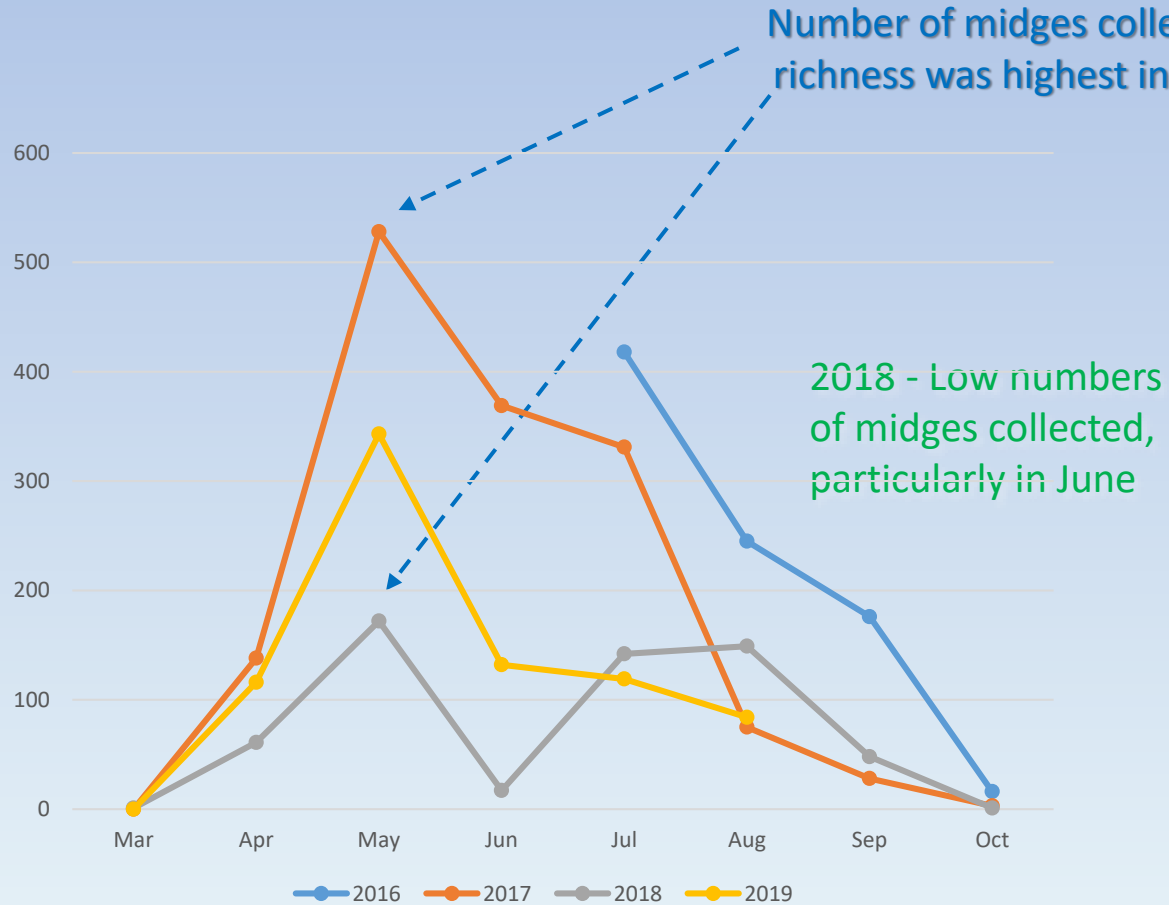


Wild and captive white-tailed deer herds

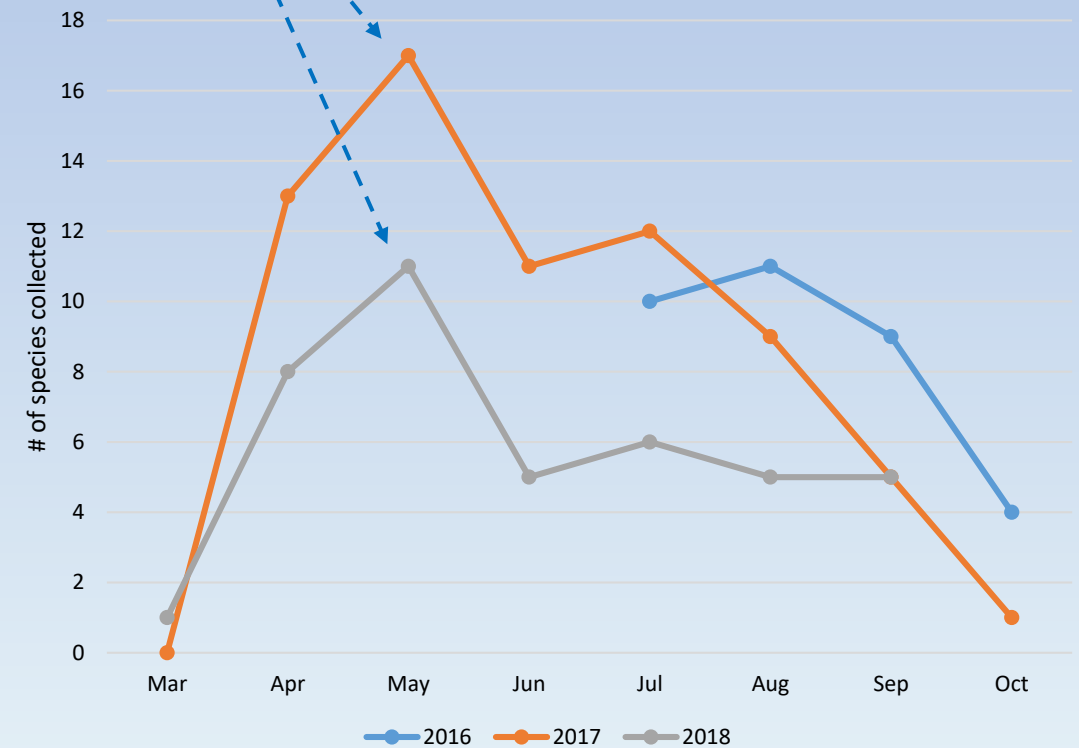
Whitehall *Culicoides* Surveys—Big Picture, 2016-2017



Long-term *Culicoides* and HD Monitoring Whitehall Experimental Forest (UGA)



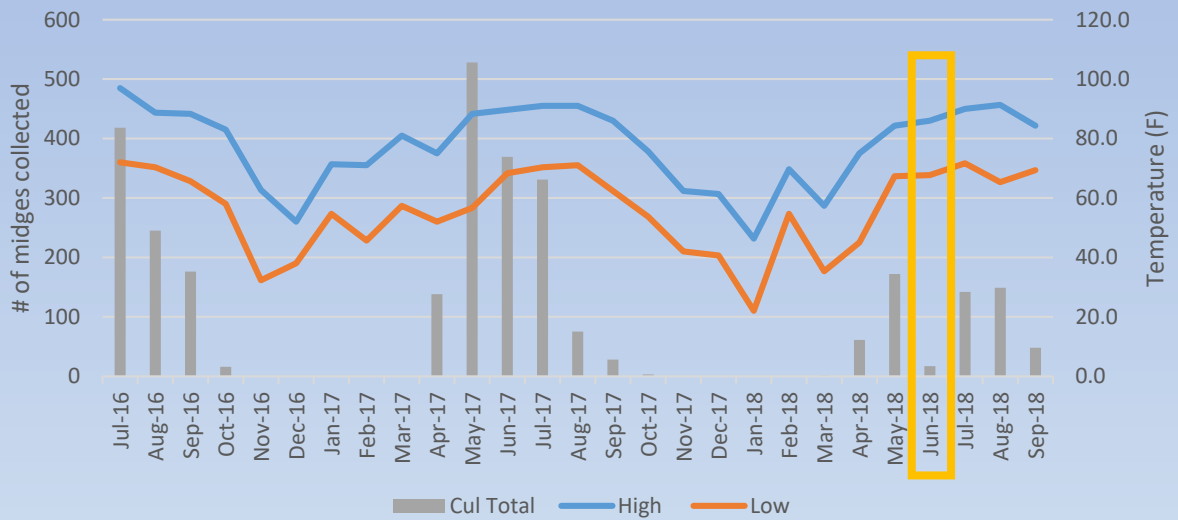
Total *Culicoides* by Month



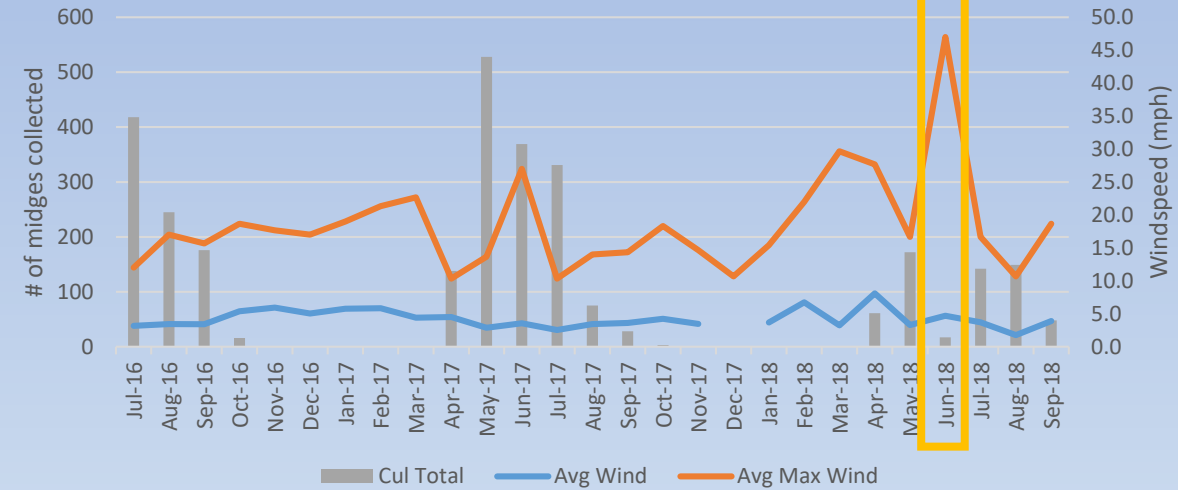
Species Richness by Month

What happened in June 2018?

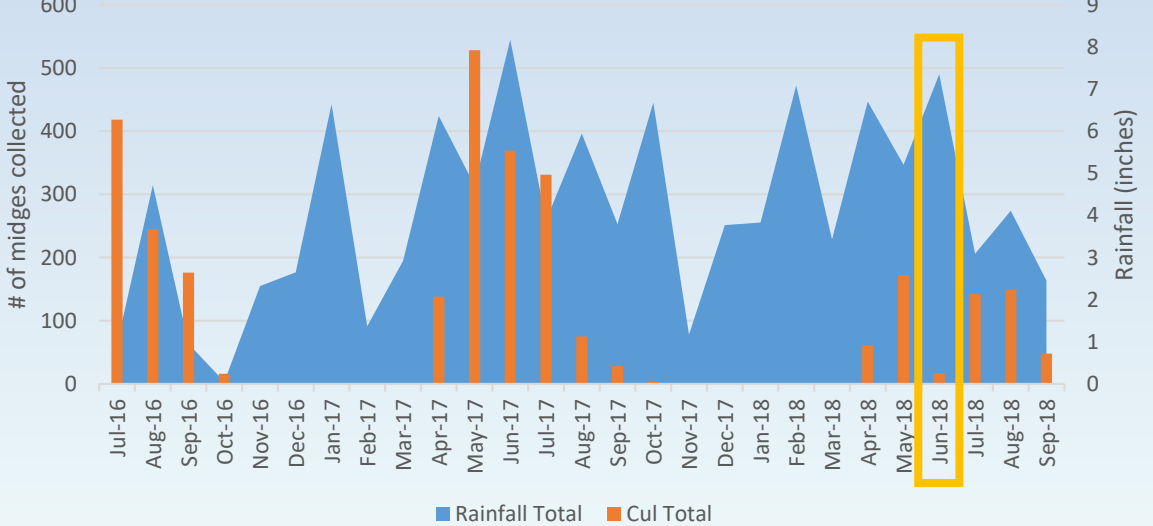
3-day Avg Temperatures



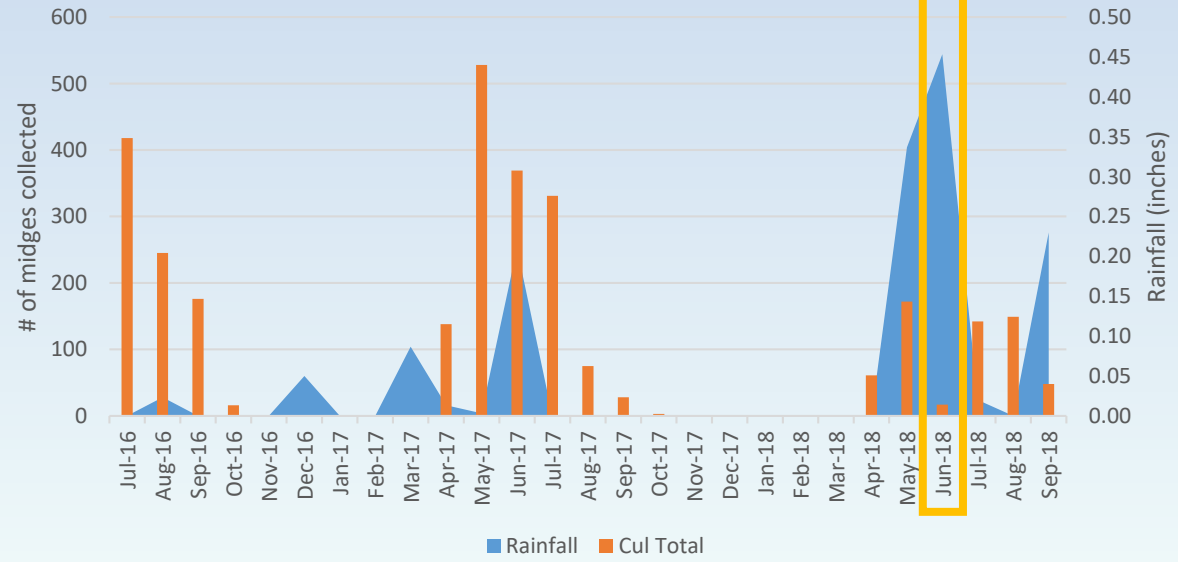
3-day Avg Windspeeds



Monthly Rainfall Totals

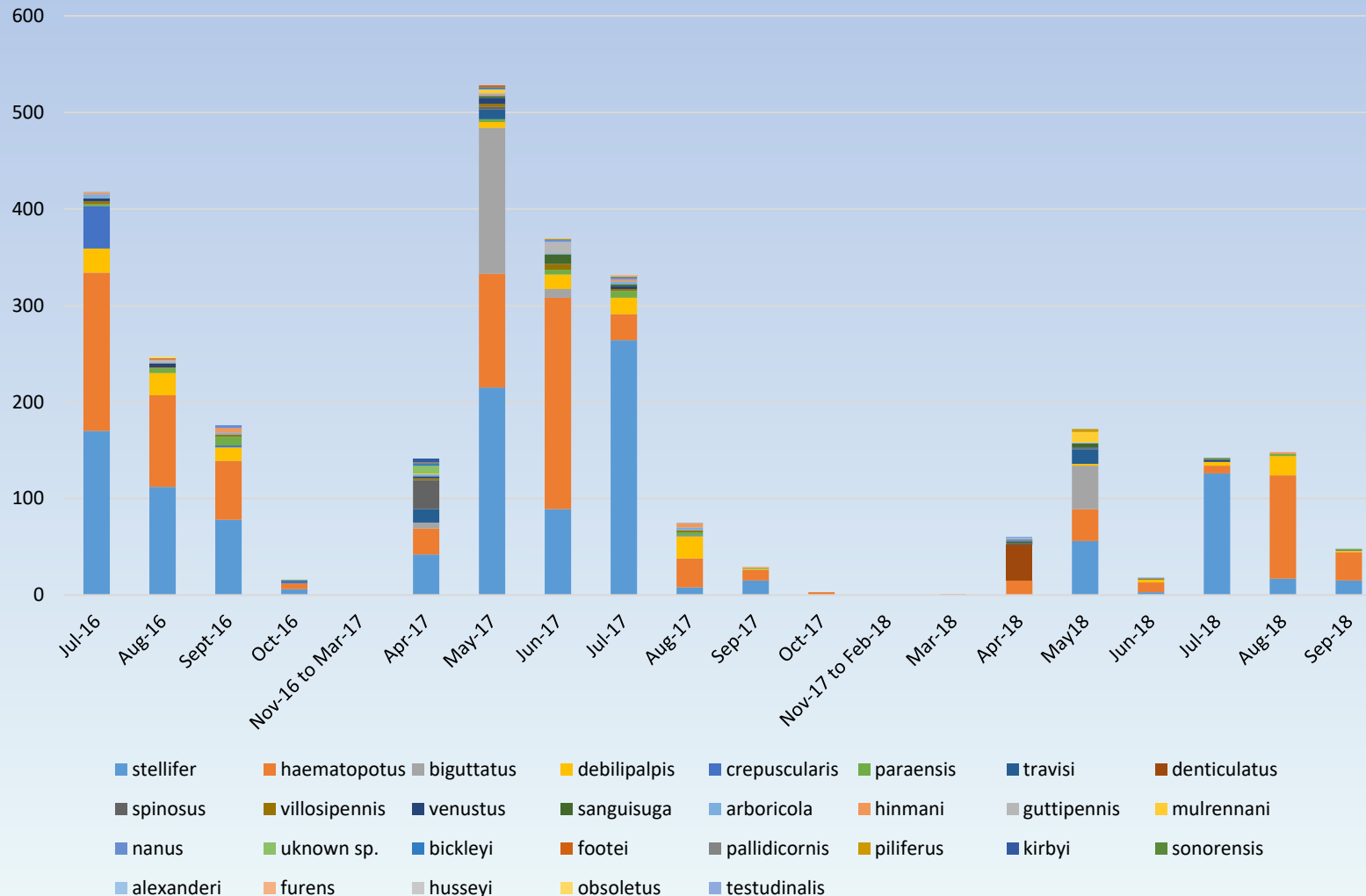


Rainfall, Day of Collection



Long-term *Culicoides* and HD Monitoring Whitehall Experimental Forest (UGA)

Culicoides spp. Abundance by Month



To date, 28 species identified

Most abundant spp.

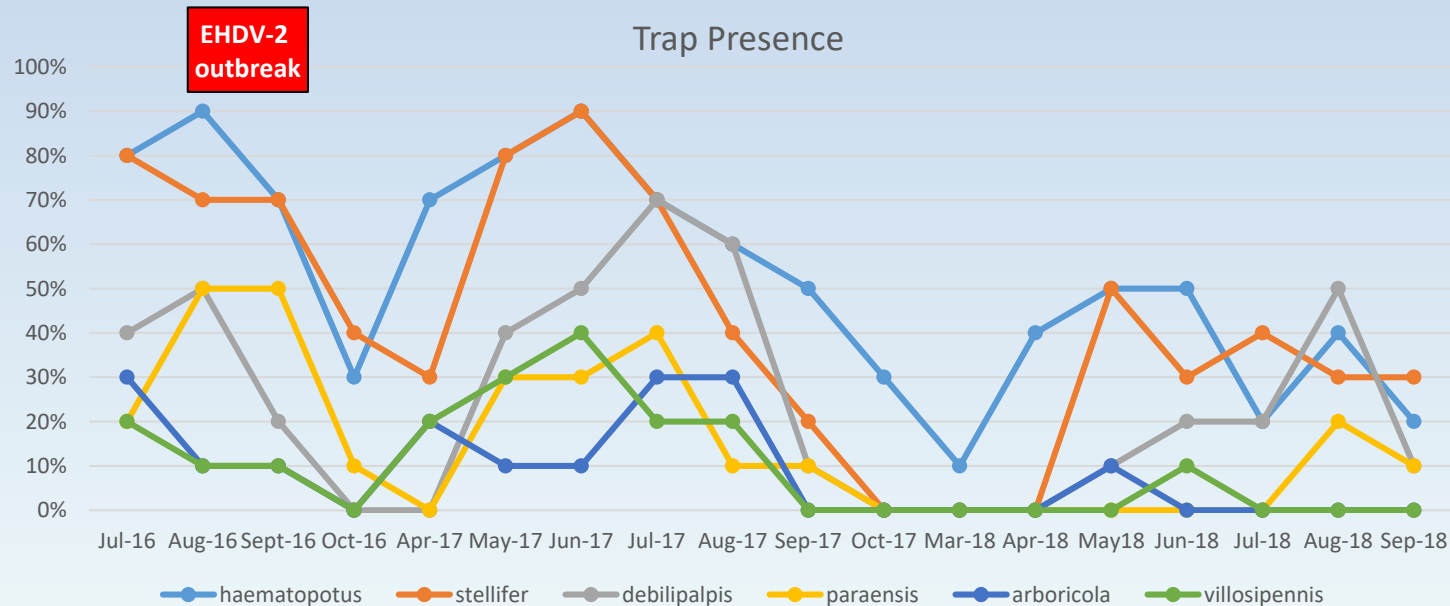
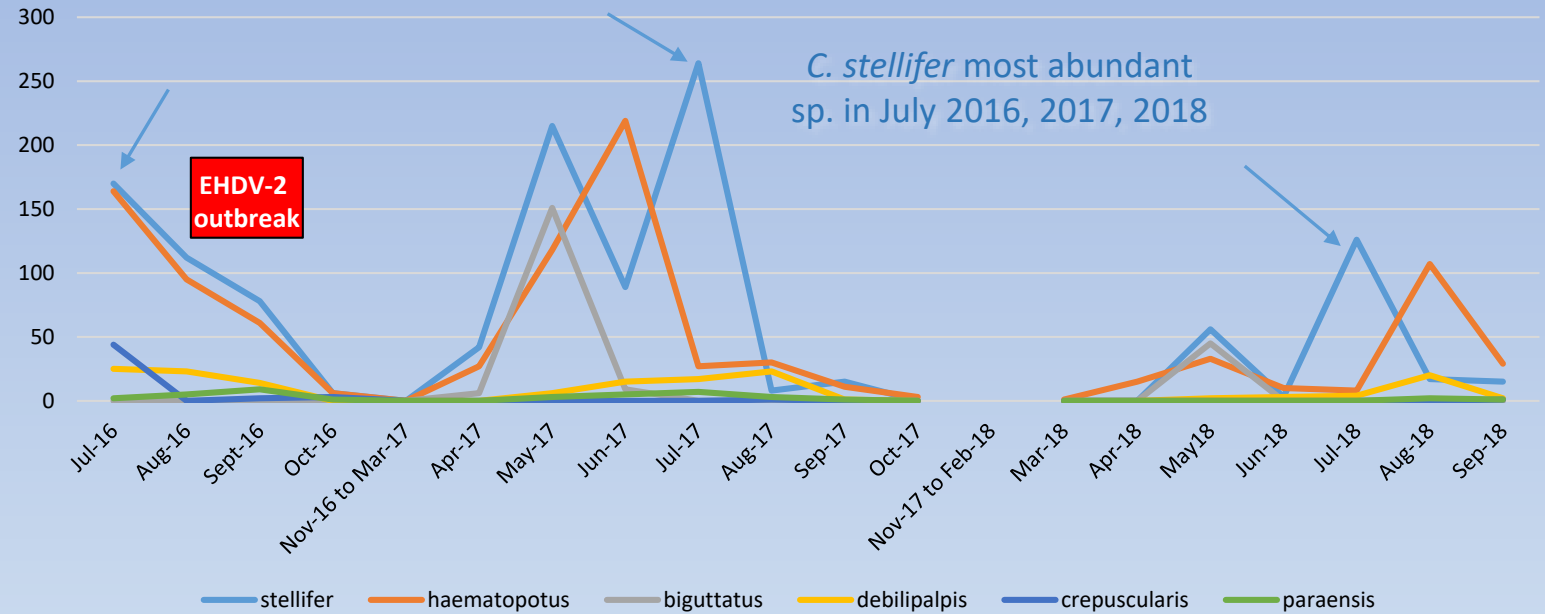
- *C. stellifer*
- *C. haematopodus*
- *C. biguttatus*
- *C. debilipalpis*
- *C. crepuscularis*
- *C. paraensis*

At least 3 species not previously recorded from Georgia

- *C. alexanderi*
- *C. denticulatus*
- *C. husseyi*

Whitehall Experimental Forest (UGA) Species Composition

Most Abundant Culicoides spp. at Whitehall Forest



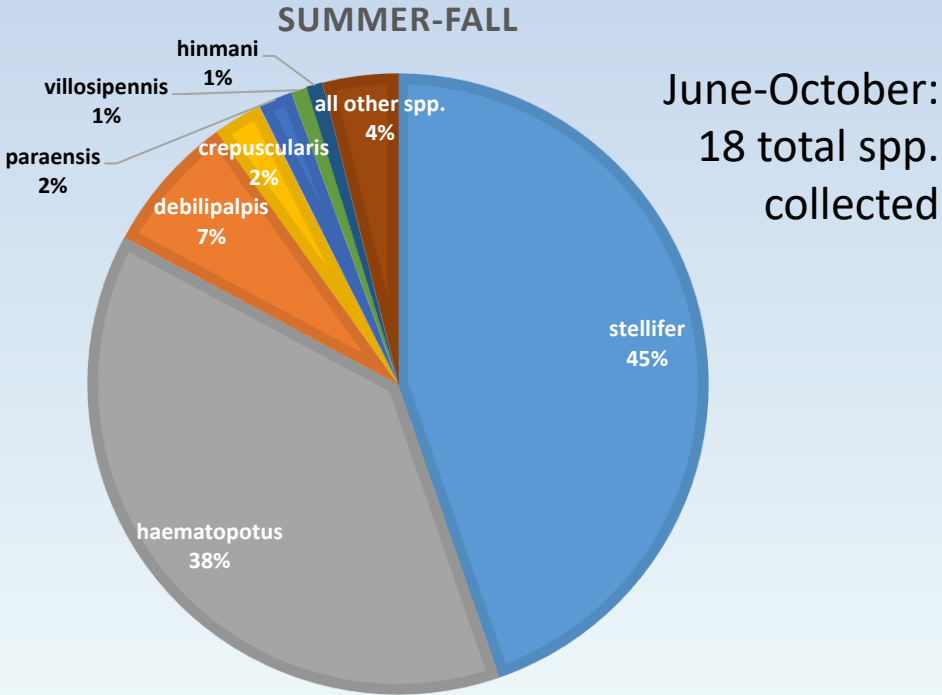
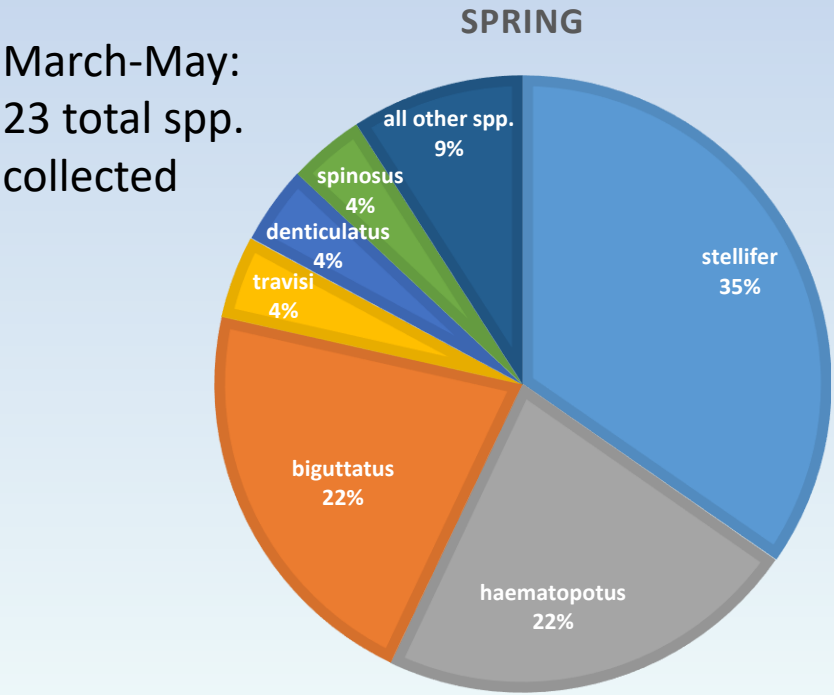
C. stellifer and *C. haematopotus* were most abundant and most widespread across Whitehall

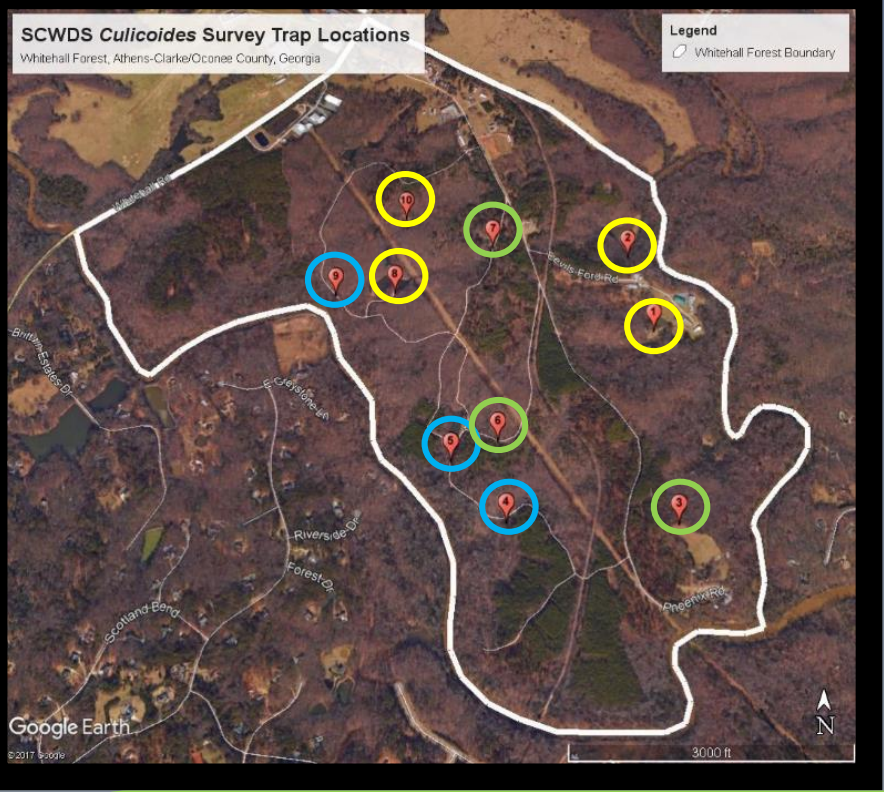
C. sonorensis was collected in July 2017 and July 2018, both times as a single adult in a single trap

Whitehall Experimental Forest (UGA) Seasonal Patterns

	Spring <i>Culicoides</i> spp.	Summer-Fall <i>Culicoides</i> spp.	
55%	<i>stellifer</i>	<i>stellifer</i>	83%
	<i>haematopotus</i> *	<i>haematopotus</i> *	
	<i>biguttatus</i>	<i>debilipalpis</i>	
	<i>travisi</i>	<i>crepuscularis</i>	
	<i>denticulatus</i>	<i>paraensis</i>	
	<i>spinosus</i>	<i>villosipennis</i>	
		<i>hinmani</i>	

*only sp. present in every month when *Culicoides* were collected

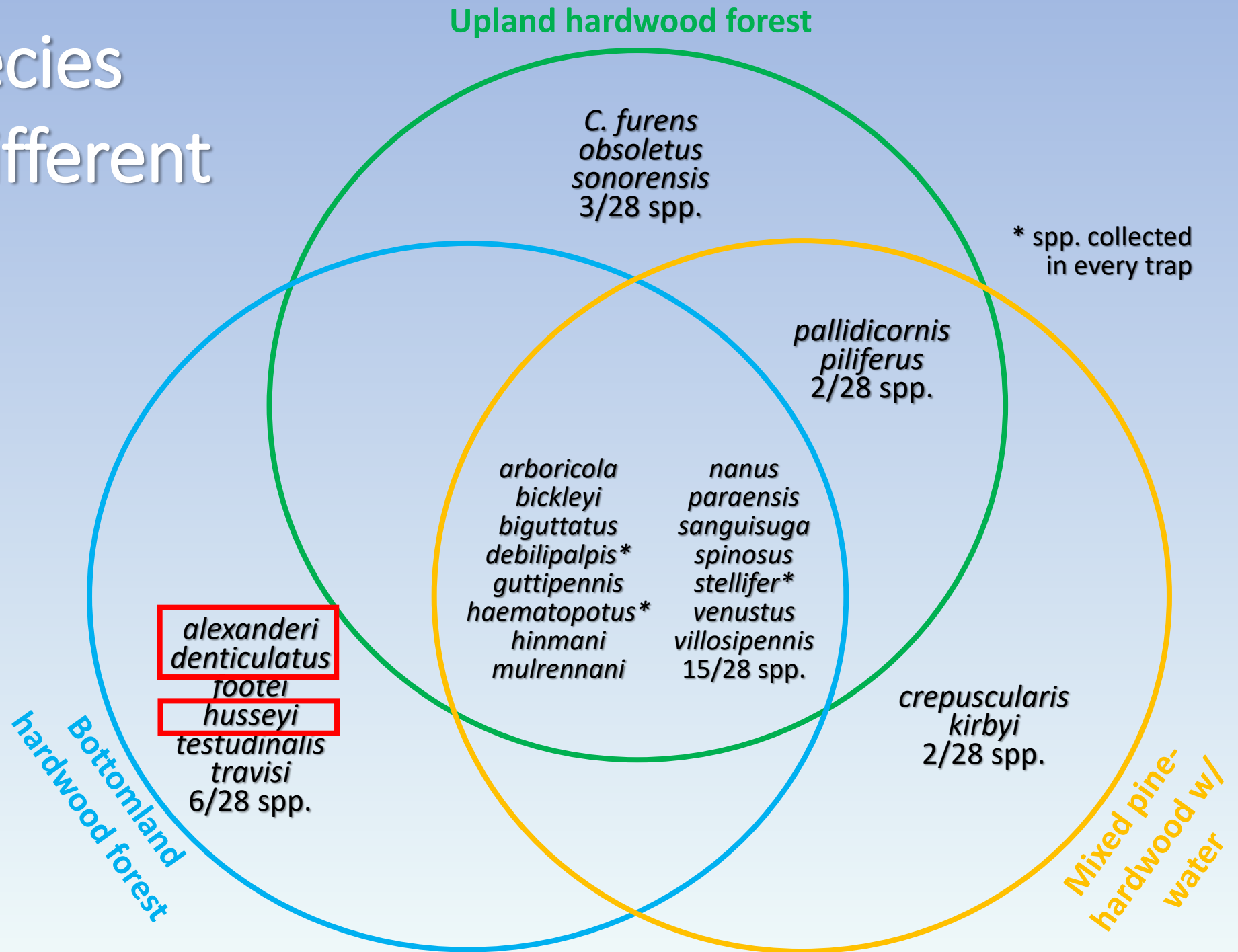




* near the experimental WTD pens



Culicoides species collected in different habitat types



Long-term *Culicoides* and HD Monitoring

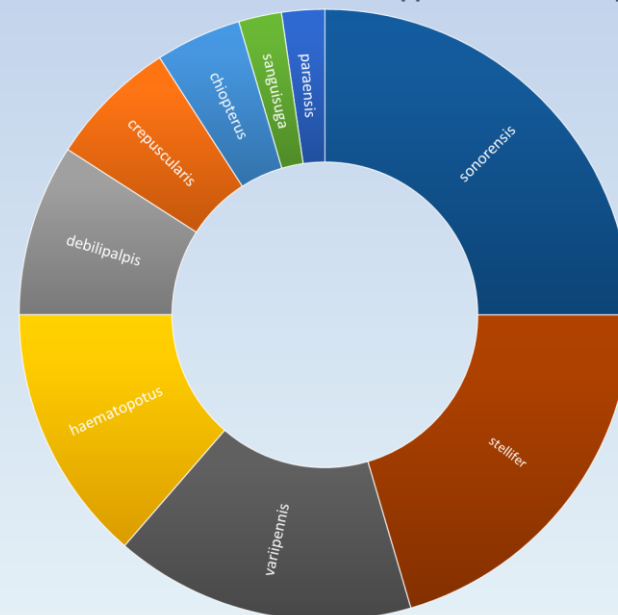
New Site – UGA Dairy

- 570 acre dairy facility with ~200 cows, confined and pastured
- On-site lagoons for barn effluent
- Approximately 6 miles from Whitehall Forest
- Monthly trapping began in July 2018



It's early, but so far...
9 *Culicoides* spp. collected
2 species not previously collected at Whitehall
C. chiopterus
C. variipennis
C. sonorensis is most abundant species

Relative Abundance of *Culicoides* spp. at the UGA Dairy



Long-term *Culicoides* and HD Monitoring

Whitehall Experimental Forest vs. UGA Dairy

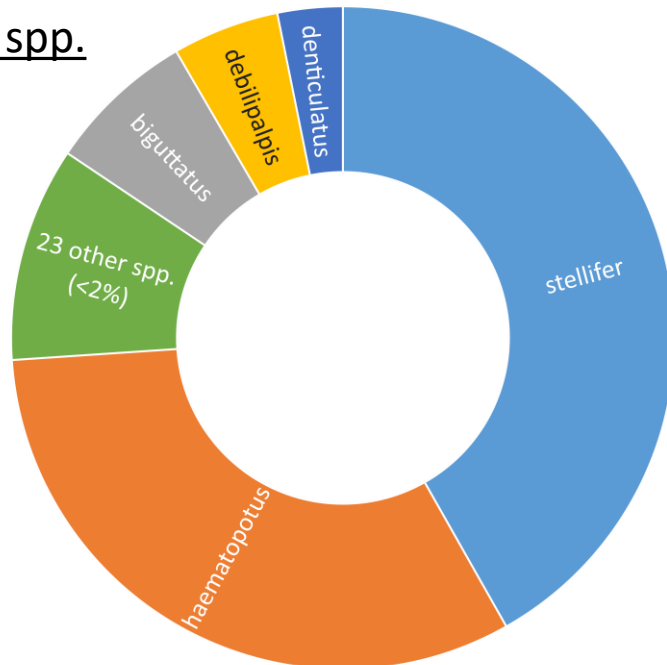


Approximately 6 miles apart



Whitehall Forest - Relative Abundance

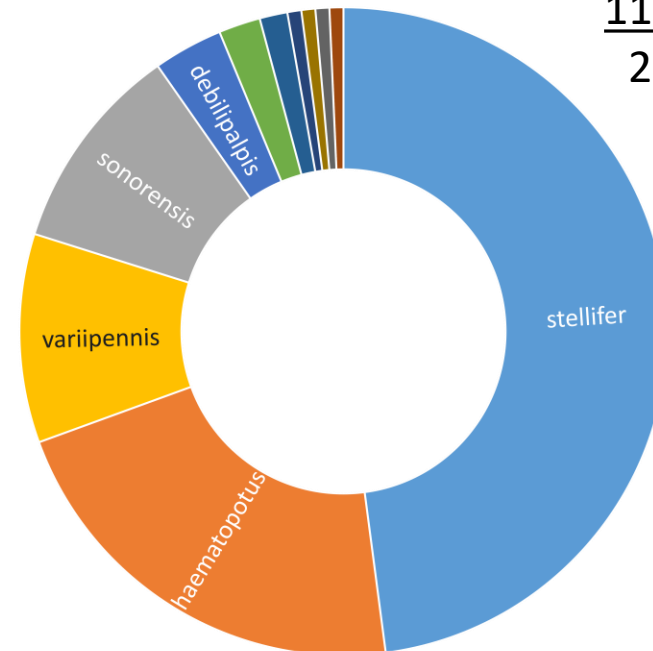
28 *Culicoides* spp.



UGA Dairy - Relative Abundance

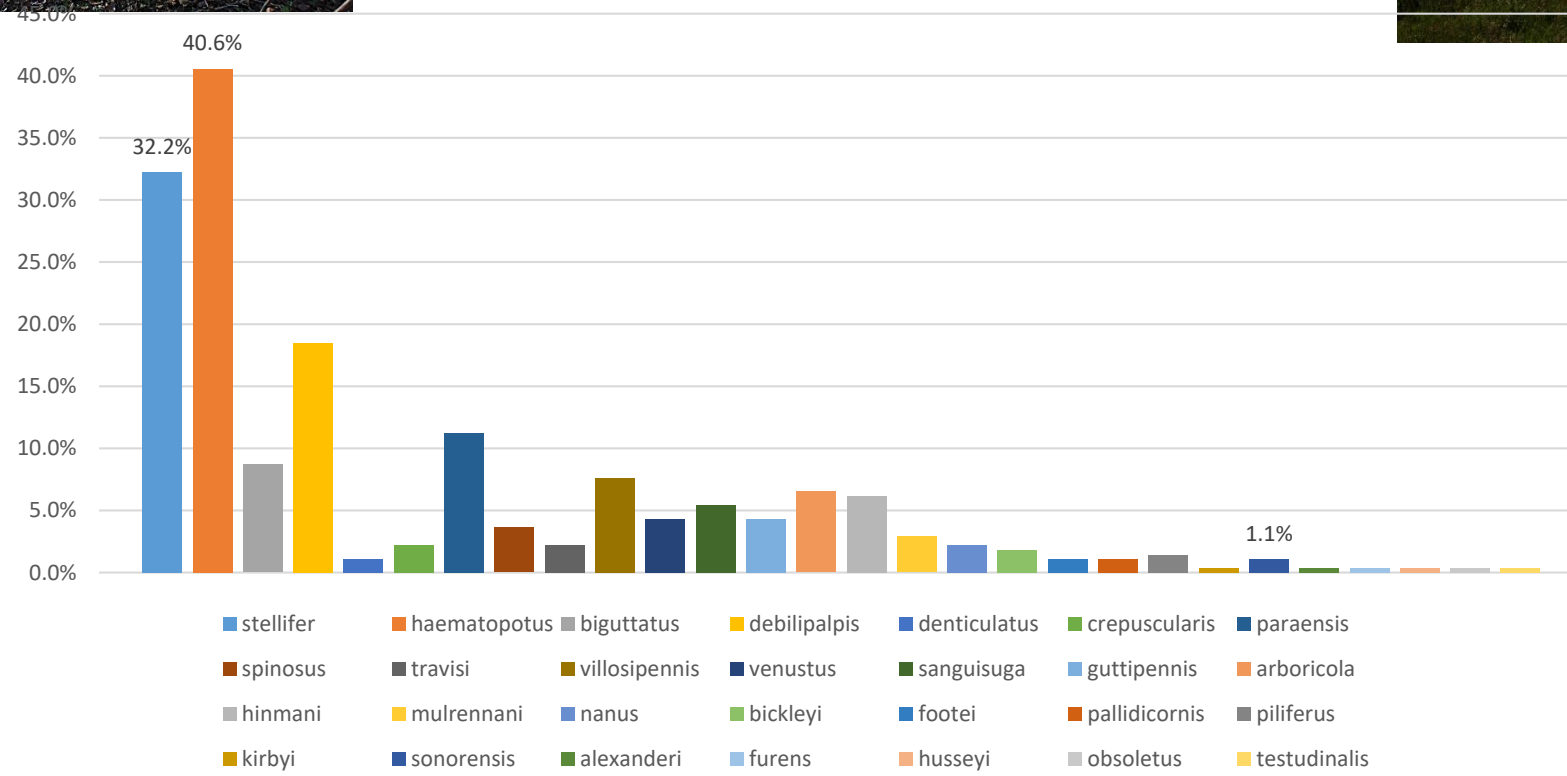
11 *Culicoides* spp.

2 spp. not see at Whitehall



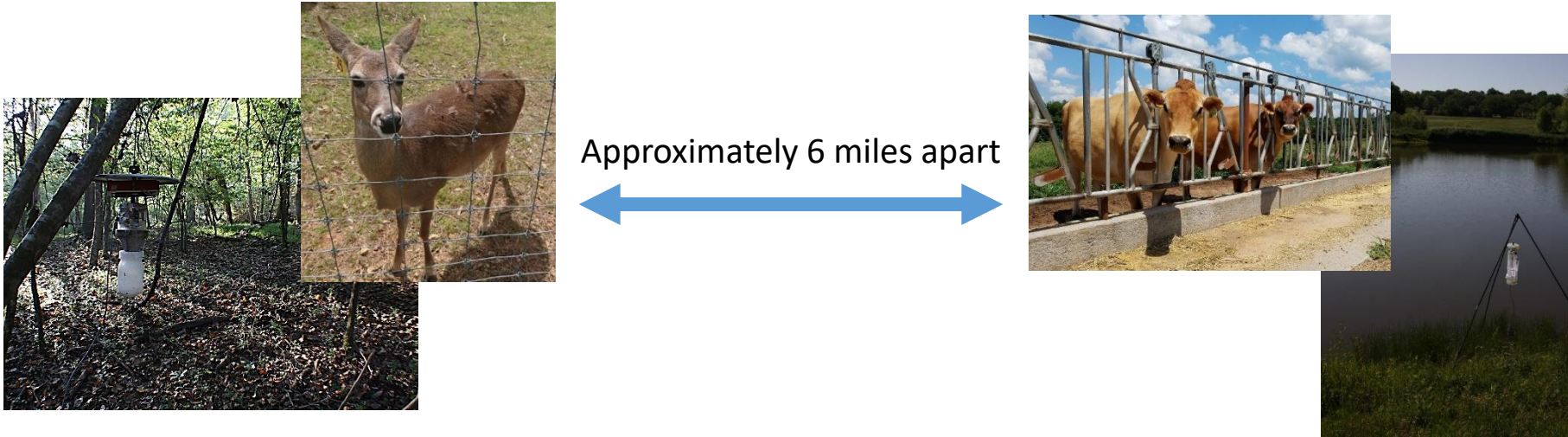
Long-term *Culicoides* and HD Monitoring

Whitehall Experimental Forest vs. UGA Dairy

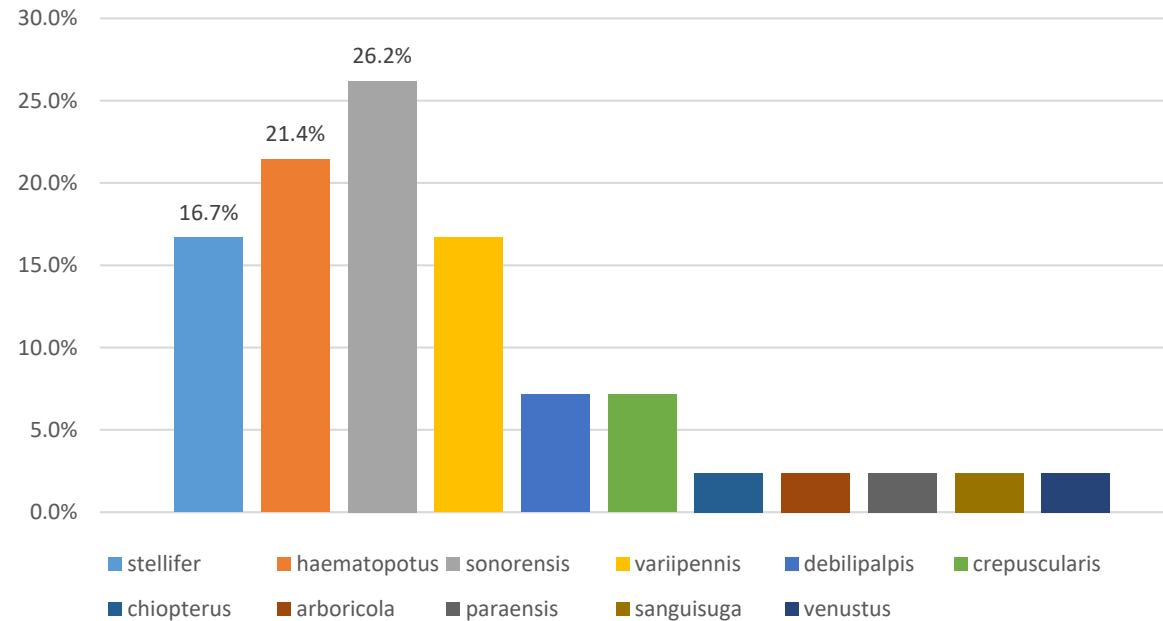


Long-term *Culicoides* and HD Monitoring

Whitehall Experimental Forest vs. UGA Dairy



UGA Dairy - Trap Presence



► Take-aways from Whitehall, so far

- May—highest *Culicoides* collections and sp. richness
- Don't put out light traps when it may be windy and raining!
- *C. stellifer* and *C. haematopodus* are common and abundant in all seasons
- *C. stellifer* seems to peak in July—just in time for HD season
- *C. sonorensis*—uncommon at Whitehall
- Most adult *Culicoides* spp. can be found in a variety of habitats





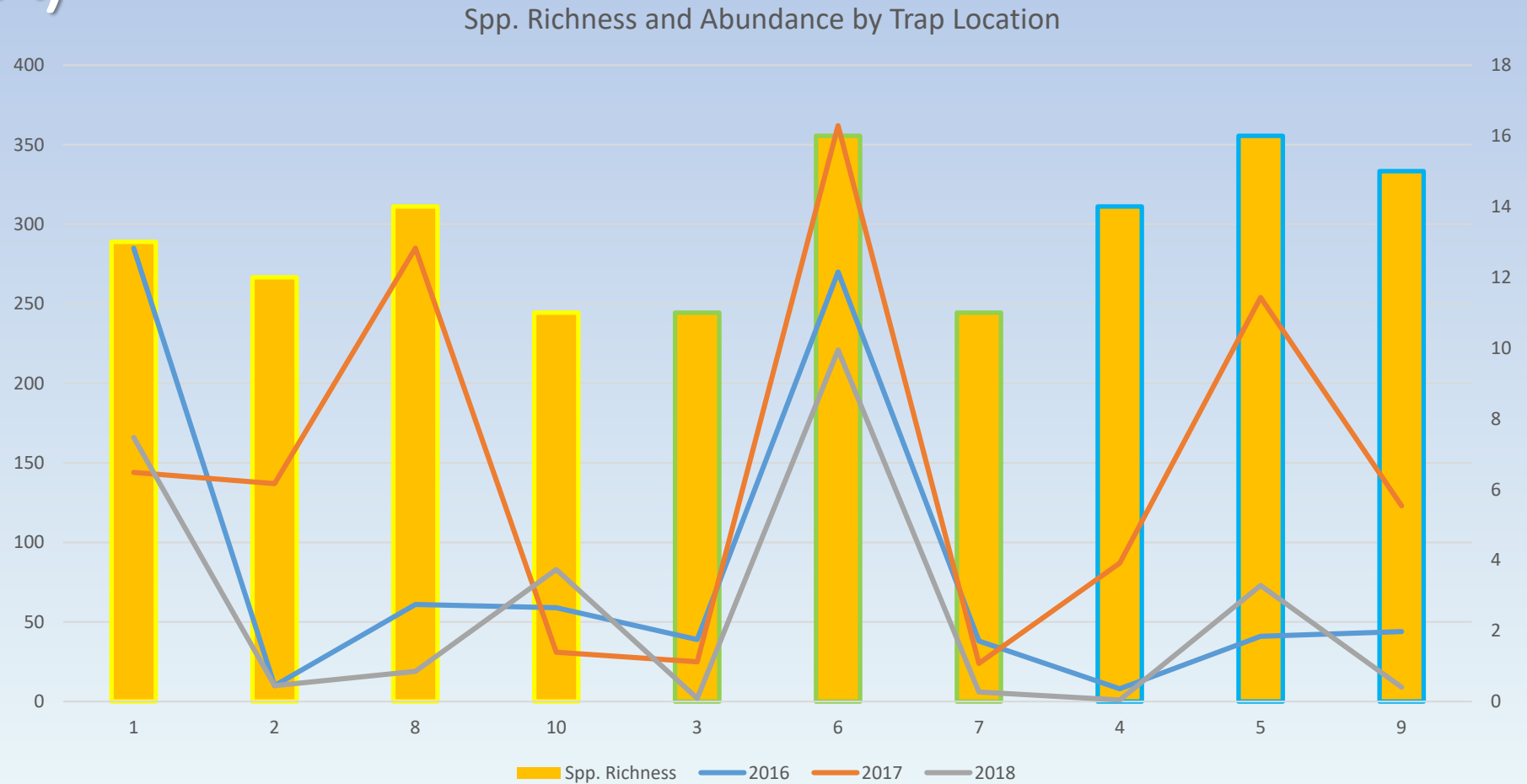
THE UNIVERSITY OF GEORGIA®
College of Veterinary Medicine

Thank you!

- This project is funded through Cooperative Agreements with USDA-APHIS-Veterinary Services.
- Thank you to all the SCWDS staff who have participated in this project over the past several years, particularly:
 - Jackie McCollum
 - Kayla Garrett
 - David Shaw
 - Seth White
- If you have any questions or comments please contact me:
svigil@uga.edu



Whitehall Experimental Forest (UGA)



Whitehall *Culicoides* Species Composition

- Species richness by month:

- 1 species (low) (Oct-17)

- 17 species (hi) (May-17)

- 25 *Culicoides* species identified (>2300 collected)

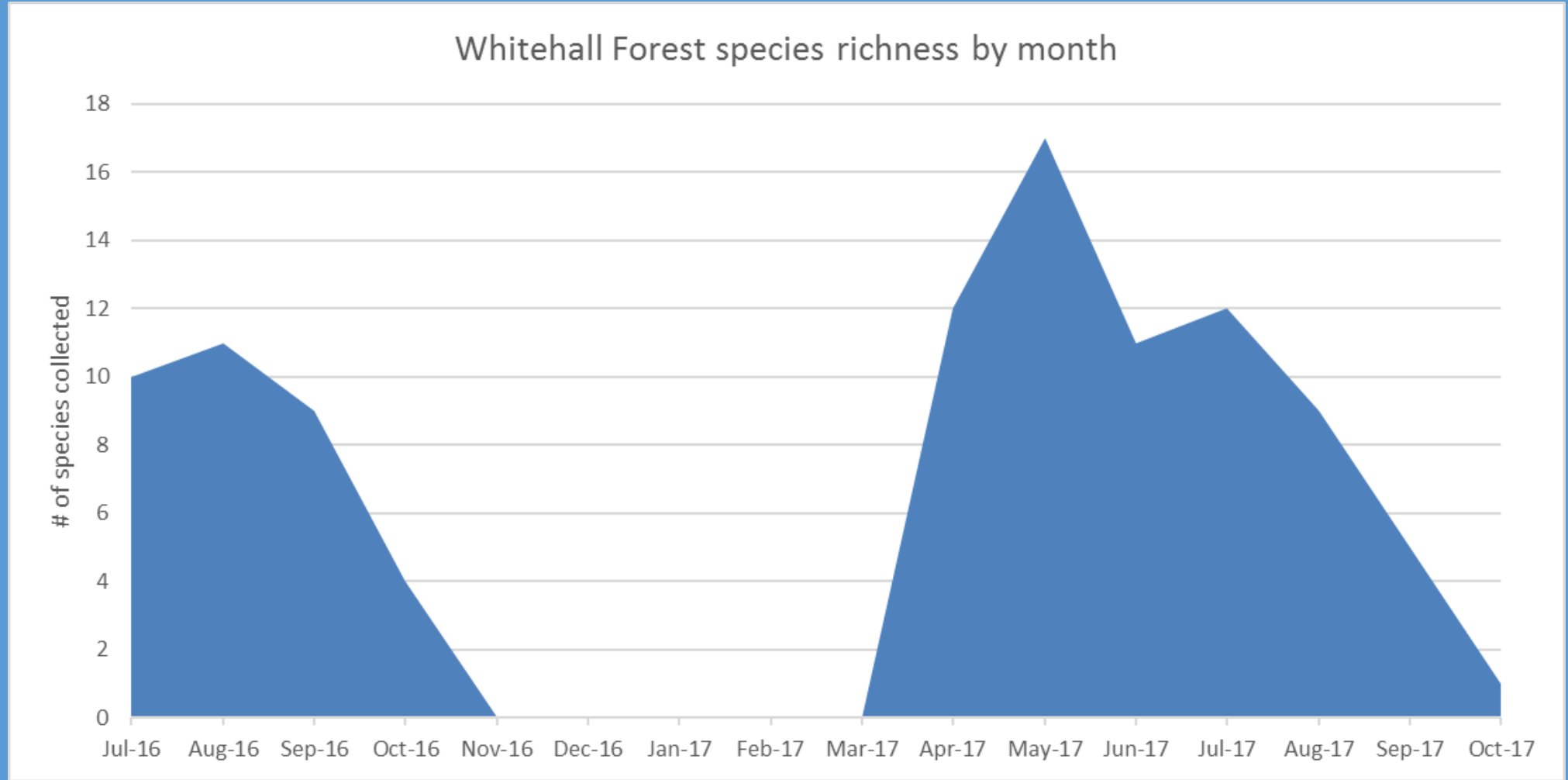
- *C. sonorensis* collected only once (Jul-17)

- *C. furens*, a salt marsh species, collected (Jul-17)

- Two rare species collected; new state records:

- *C. husseyi* (May-17)

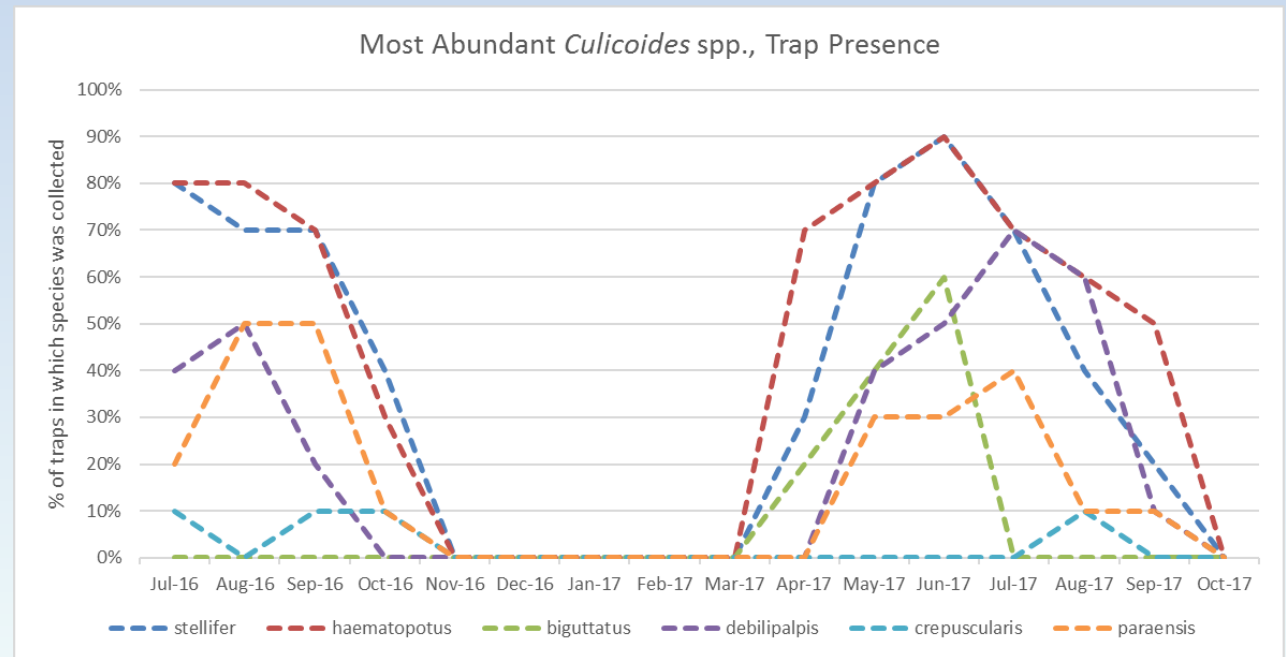
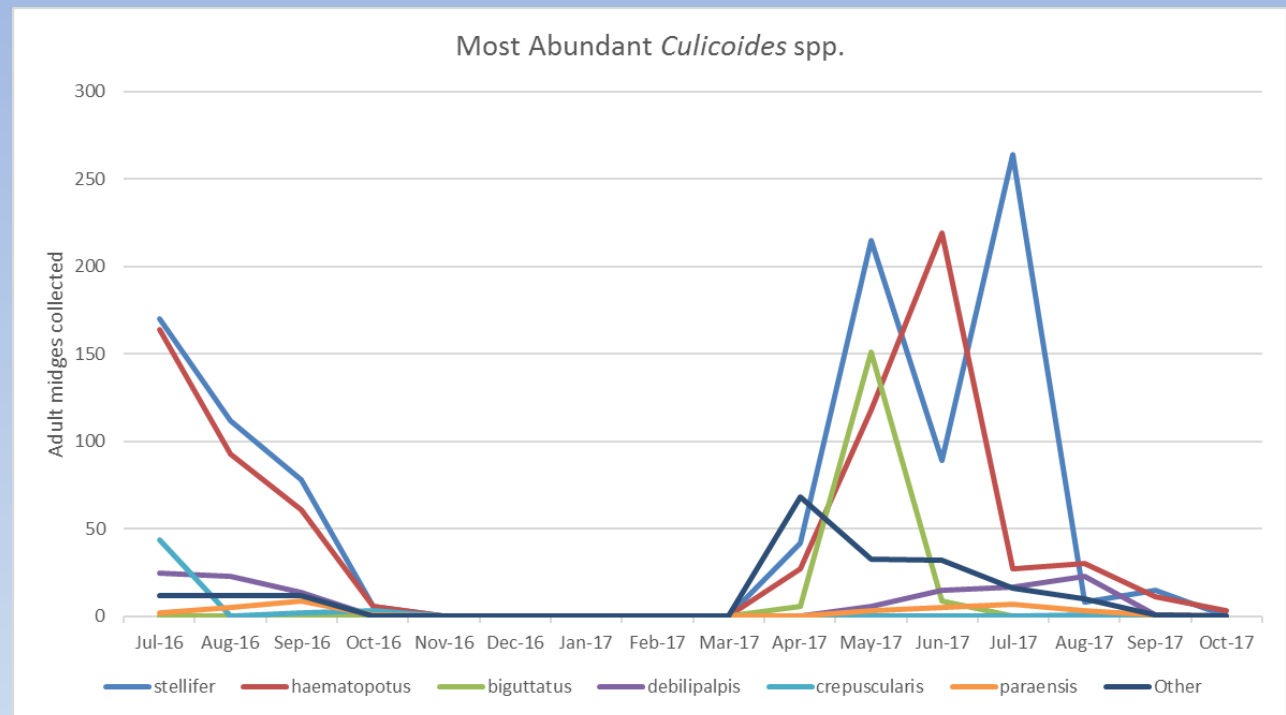
- *C. kirbyi* (Apr-17)



Most Common *Culicoides* spp. at Whitehall

<i>Culicoides</i> sp.	% Abundance	% Traps
<i>stellifer</i>	42.88%	36.9%
<i>haematopotus</i>	32.58%	42.5%
<i>biguttatus</i>	7.12%	7.5%
<i>debilipalpis</i>	5.32%	21.3%
<i>crepuscularis</i>	2.15%	2.5%
<i>paraensis</i>	1.55%	15.6%
Total	91.6%	-

- Every one of these species has been implicated as a vector

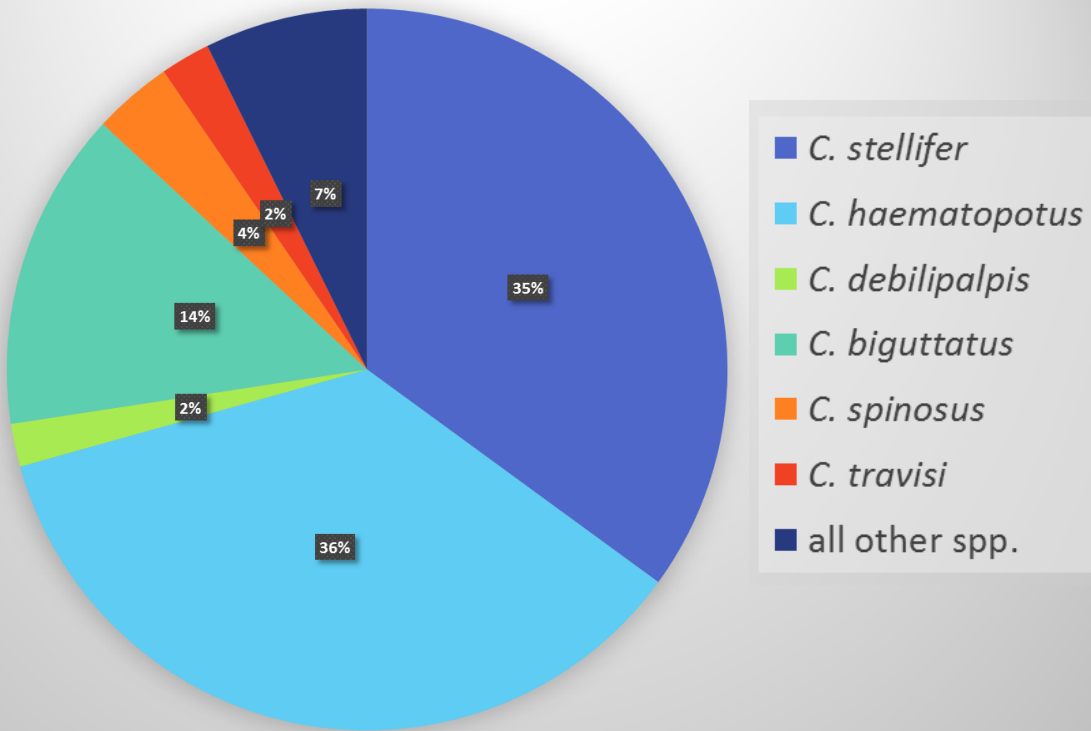


Seasonal Variation in *Culicoides* spp. at Whitehall

Total spp.	20
Total Culicoides	985
Total spp. only present during Spring	9
Total spp. not present during Spring	5

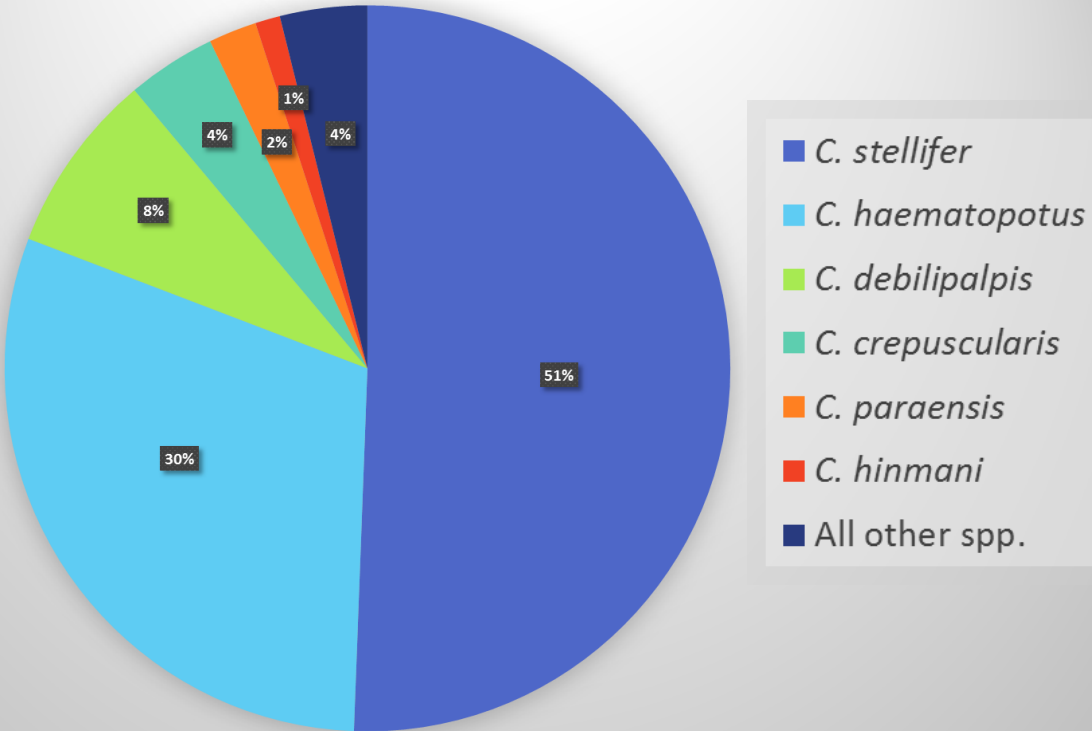
Total spp.	16
Total Culicoides	1261
Total spp. only present during Summer/Fall	5
Total spp. not present during Summer/Fall	9

Whitehall Forest: April - June, Six Most Common *Culicoides* spp. Collected

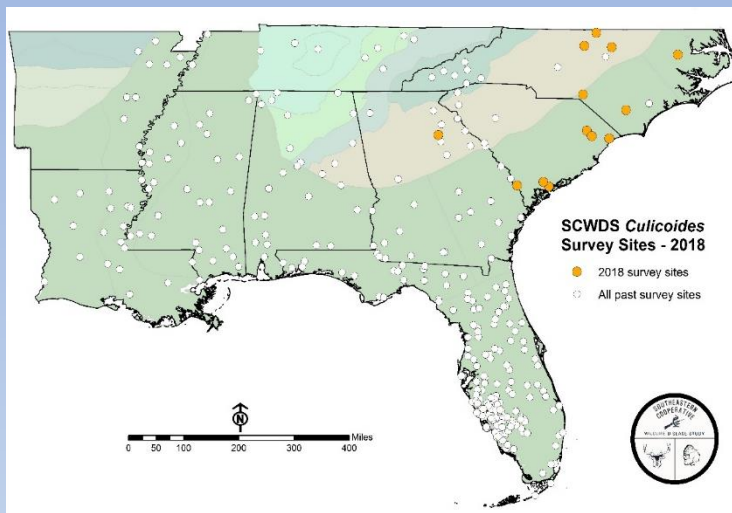


Spring – early Summer

Whitehall Forest: July - October, Six Most Common *Culicoides* spp. Collected



Summer – early Fall



SCWDS *Culicoides* Surveys 2007-2018

Aim to better define spatial variation in species composition across diverse physiographic regions.

State/Region	# of species	Top 5 <i>Culicoides</i> spp. by site presence percentage
Florida	33	<i>C. insignis</i> (79%) <i>C. edeni</i> (40%); <i>C. stellifer</i> (36%) <i>C. haematopotus</i> (31%) <i>C. furens</i> (31%)
Southeast	42	<i>C. debilipalpis</i> (85%) <i>C. haematopotus</i> (76%) <i>C. stellifer</i> (68%) <i>C. paraensis</i> (60%) <i>C. hinmani</i> (56%)
Texas	16	<i>C. sonorensis</i> (100%) <i>C. crepuscularis</i> (80%) <i>C. haematopotus</i> , <i>C. loughnani</i> , and <i>C. jamaicensis</i> (60%)

Extensive database
with survey
information on
Culicoides species in
the SE US

SCWDS *Culicoides* Collaborations

Canadian Food Inspection Agency – Canada-wide *Culicoides* surveys

- monitoring for BTV/EHDV vectors
- provide identification and large scale survey expertise
- held a training on *Culicoides* ID in Lethbridge, Alberta
- have examined *Culicoides* from 8 Canadian provinces



Florida Medical Entomology Lab, CHeRI, University of Florida

- monitoring for BTV/EHDV vectors, particularly important to captive cervid farmers in FL
- provided identification expertise and training

HD Response *Culicoides* trapping

- during and after HD outbreaks in wild cervids
- work with local natural resource agencies
- Examined *Culicoides* spp. present during past outbreaks in: Missouri, Pennsylvania, Michigan, West Virginia, Kentucky

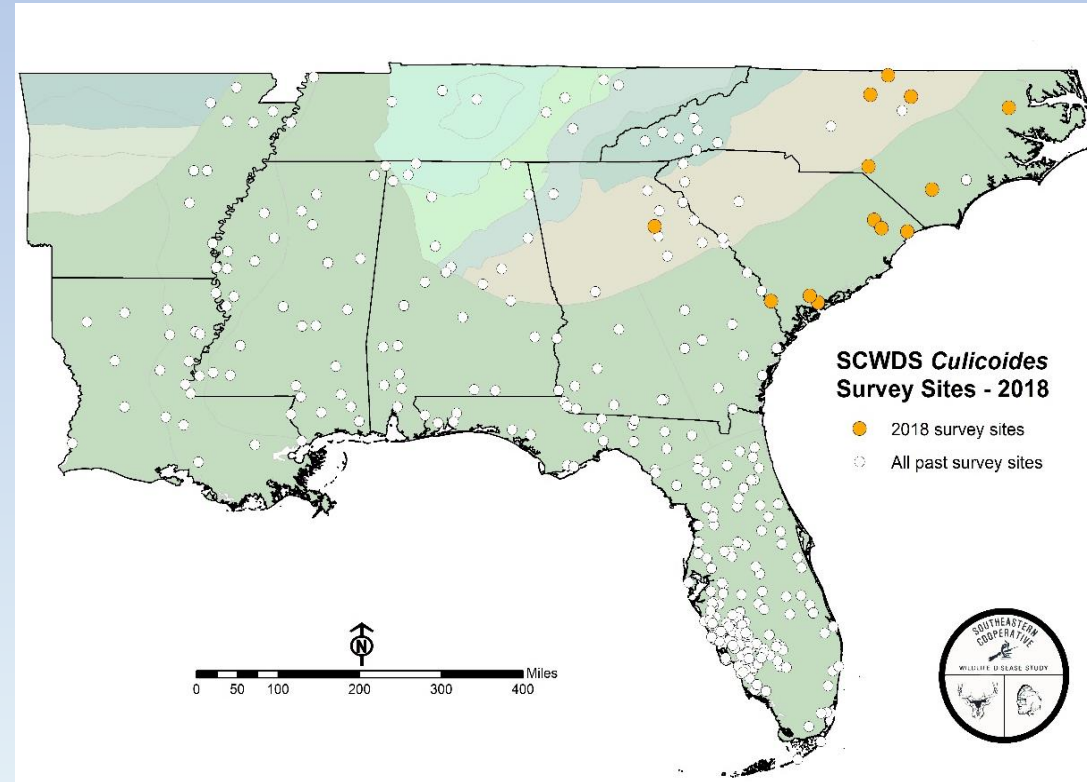
SCWDS *Culicoides* Surveys

2007-2018

- CDC type black light traps
- Primarily Aug-Sept
- Natural areas
- 10-12 traps per site
- 2018 focus on Atlantic Coastal Plain surveys



334 sites, 10 states, ~8,350 trap nights
(Texas not pictured)



From 2007-2017, 14 species of *Culicoides* have been identified outside of previously established ranges. Most notably, *C. insignis*.

