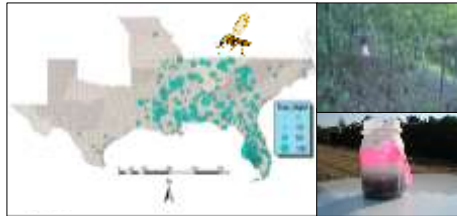


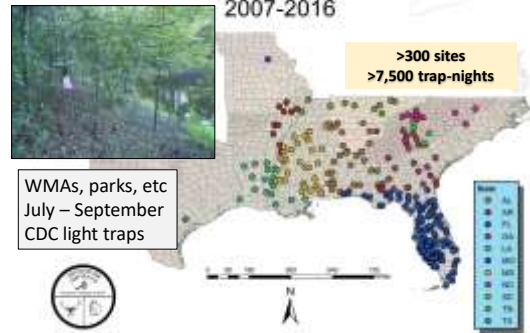
### Update on SCWDS *Culicoides* Surveys in the Southeast



Stacey Vigil, Mark Ruder, and Joseph L. Corn  
 Southeastern Cooperative Wildlife Disease Study  
 College of Veterinary Medicine  
 University of Georgia

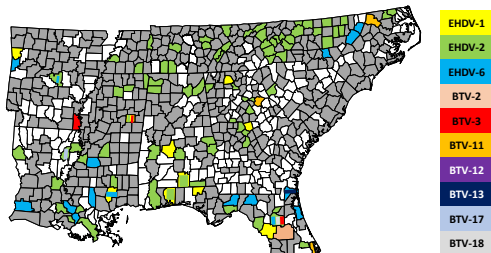


### SCWDS *Culicoides* Survey Sites 2007-2016



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

### SCWDS HD Surveillance



Reported HD and isolations of EHDV & BTV from wild ruminants 2007-2016



### Common *Culicoides* species in the Southeast U.S.

- Total *Culicoides* spp. to date: **44 spp.**
- Total spp. from SE (not FL): **38 spp.**
- Total Florida spp.: **33 spp.**

#### Southeastern U.S. – Top 5 spp.

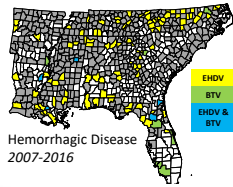
<i>Culicoides</i> sp.	% sites present (1334)
<i>C. haematopodus</i> *	92%
<i>C. debilipalpis</i> * / <i>C. stellifer</i> *	84%
<i>C. paraensis</i> *	66%
<i>C. hinmani</i>	63%
<i>C. insignis</i>	9%
<i>C. sonorensis</i>	2%

#### Florida – Top 5 spp.

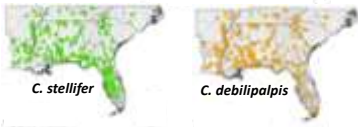
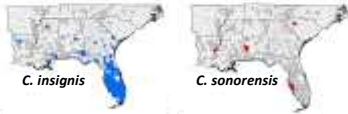
<i>Culicoides</i> sp.	% sites present (178)
<i>C. insignis</i>	64%
<i>C. edeni</i>	33%
<i>C. stellifer</i> *	29%
<i>C. furens</i> *	26%
<i>C. haematopodus</i> *	24%
<i>C. sonorensis</i>	1%

\* Proposed as possible vectors of BTV/EHDV  
 Known vector of BTV/EHDV

- *C. insignis* most common in FL
  - Range increasing in nearby states is increasing
- *C. sonorensis* is rare in the Southeast
  - Documented at 10 sites total



**Confirmed vectors**



**Suspected vectors**

Year	Trap nights	Total <i>Culicoides</i>
2012	16	94
2013	33	1,880
2014	28	482

**Significant findings:**

*C. stellifer* was the most commonly collected species

*C. sonorensis* was not collected in any trap 2012-2014

**Michigan *Culicoides* Survey**

<i>Culicoides</i> species	n	Percent of total
<i>C. stellifer</i>	507	63%
<i>C. haematopodus</i>	179	22%
<i>C. crepuscularis</i>	50	6%
<i>C. venustus</i>	15	2%
<i>C. biguttatus</i>	57	<1% ea
<i>C. chiopterus</i>		
<i>C. mulrennani</i>		
<i>C. obsoletus</i>		
<i>C. paraensis</i>		
<i>C. sanguisuga</i>		
<i>C. spinosus</i>		
<i>C. variipennis</i>		

Known *C. sonorensis* distribution



**Update on 2015-16 Hemorrhagic Disease Activity in Wild Ruminants**

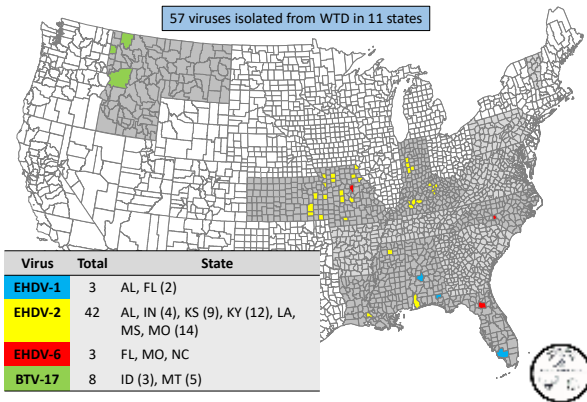
Mark G. Ruder, Clara Kienzle, Rebecca L. Poulson, David E. Stallknecht  
 Southeastern Cooperative Wildlife Disease Study  
 Department of Population Health  
 College of Veterinary Medicine  
 University of Georgia

**SCWDS EHDV & BTV Diagnostics**

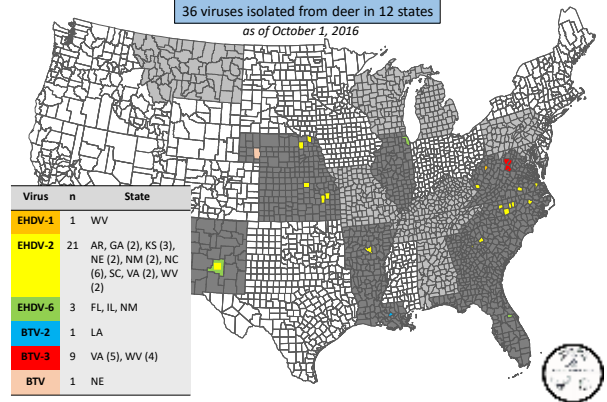
- Virus isolation attempts on tissues submitted by state wildlife agencies and diagnostic labs
  - Primarily dead/moribund wild ruminants
    - Primarily spleen, lung, and/or blood
  - Isolates typed by neutralization or RT-PCR



### 2015 Virus Isolations by SCWDS

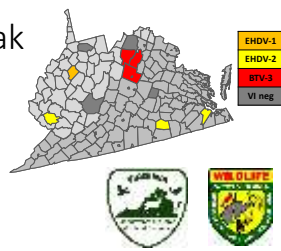


### 2016 Virus Isolations by SCWDS

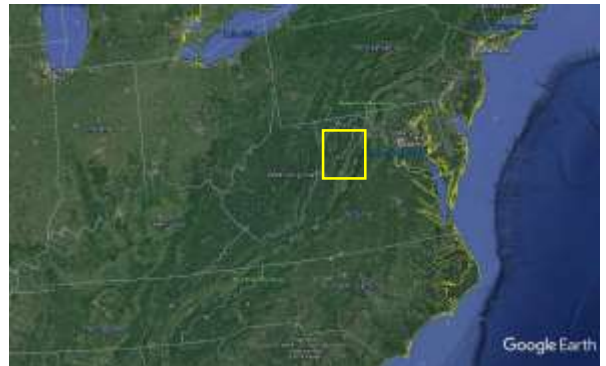


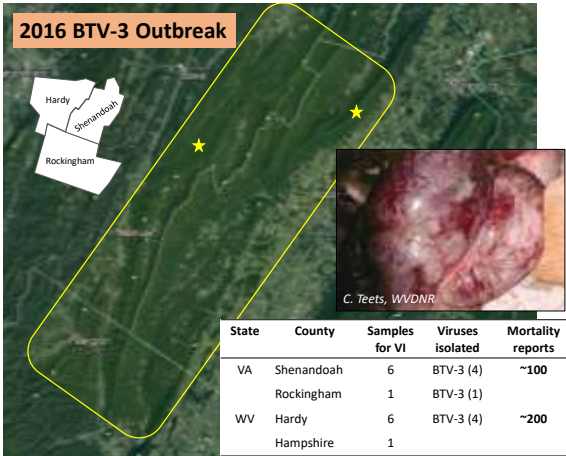
### 2016 BTV-3 Outbreak

- First report August 5
  - Deer found dead in pond
  - Shenandoah County, VA
- BTV isolated at SCWDS sent to NVSL
  - Identified as BTV-3
- Reports of dead deer continued through Sept
  - WVDNR and VDGIF personnel continued to investigate and collect diagnostic samples



State	County	Samples for VI	Viruses isolated
VA	Shenandoah	6	BTV-3 (4)
	Rockingham	1	BTV-3 (1)
WV	Hardy	6	BTV-3 (4)
	Hampshire	1	





## 2016 BTV-3 Outbreak

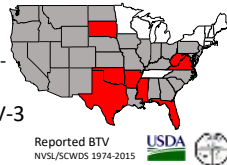
### Next steps

- Truly localized or more widespread?
  - Follow-up serological survey from hunter-harvested deer in the area
- New or old virus?
  - Full genome sequence
- *Culicoides* present during and after outbreak?
  - Insect collections mid-Sept 2016
    - CDC light traps
    - Hardy County, WV in outbreak area
    - 13 total trap nights
  - Continue during 2017



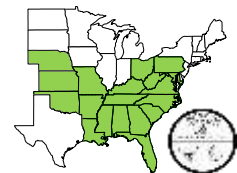
## 2016 BTV-3 Outbreak

- BTV rarely isolated from WV and VA by SCWDS
  - WV: BTV-10 in Jackson County (2012)
  - VA: BTV-10 in Bedford County (2002)
- BTV-3 not historically endemic serotype of BTV
  - First documented in FL in 1999
  - Has been detected by various labs over wide geographic region 1999-2016
- Northeastern most report of BTV-3
  - Concern for northern expansion



## Acknowledgements

- SCWDS member agencies
- Cooperative agreement
  - USDA-APHIS-VS
- WVDNR
  - J Crum, E Barton, C Teets, S Hincks, S Houchins
- VDGI
  - M Knox, M Kirchgessner, F Frenzel
- NCWRC
  - J Allen, D Shaw, M Palamar, G Batts
- NVSL
  - E Ostlund, D Johnson, & T Sturgill
- ABADRU
  - B Pfannenstiel, B Wilson, & E Schirtzinger
- SCWDS staff
  - C McElwee, J Brewton, M Willis, D Shaw, M Walter
  - SCWDS Diagnosticians





### Michigan *Culicoides* Survey

- Over the past decade, Michigan has experienced a dramatic increase in confirmed EHD outbreaks

CONFIRMED EHD IN MICHIGAN 1955-2013		
Year	No. of counties	Estimated WTD mortality
1955	4	100
1974	5	100
2006	1	50-75
2008	2	150-200
2009	1	300-400
2010	6	1,025
2011	2	300
2012	30	14,900
2013	6	150

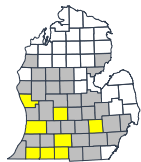


What are the drivers?  
 Will this trend continue?  
 What *Culicoides* spp are involved?

### Michigan *Culicoides* Survey

**Objective:** Identify the resident *Culicoides* species in areas of EHD outbreaks in southern Michigan

Reported *C. sonorensis* distribution

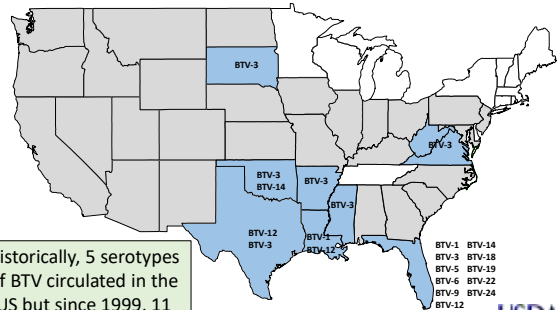


CDC light trap locations July-Sept 2012-2014

Year	Trap nights	Total <i>Culicoides</i>
2012	16	94
2013	33	1,880
2014	28	482

### Detections of exotic BTV from ruminants

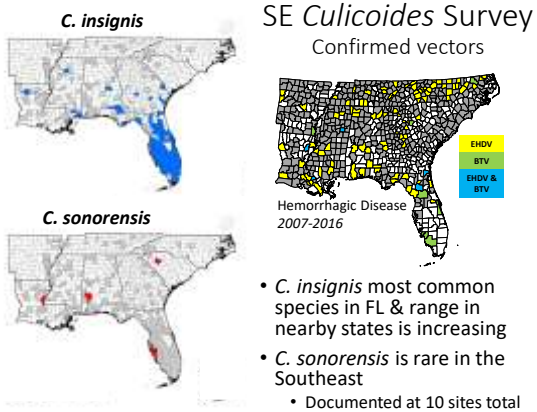
Since 1999



Historically, 5 serotypes of BTV circulated in the US but since 1999, 11 exotic BTV serotypes have been detected



Johnson et al. 2001, Gibbs et al. 2008; Schirtzinger et al. unpub



### EHDV & BTV Transmission

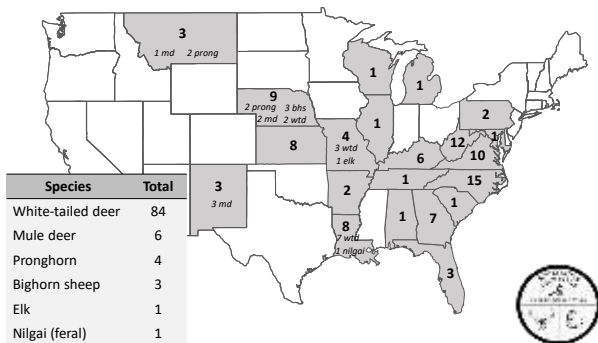
#### Future directions

- Entomological investigations of outbreaks
- Regional *Culicoides* surveys with animal-baited aspirations
- Experimental infection of field populations of *Culicoides* spp.
- Virus transmission studies using field populations of *Culicoides* spp.

### 2016 HD Submissions to SCWDS

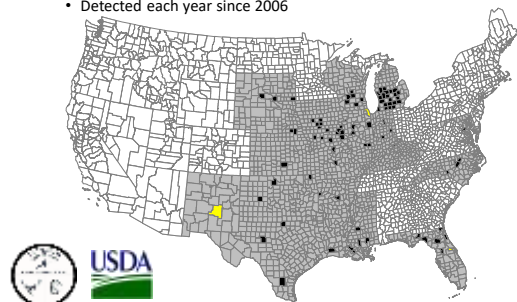
as of October 1, 2016

99 submissions from wild ruminants in 21 states



### EHDV-6...year 11

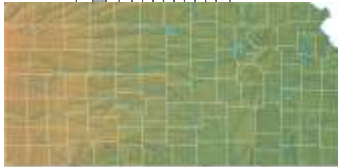
- Continue to isolate EHDV-6 from deer throughout the US
  - First detection in New Mexico by SCWDS or NVSL
  - Detected each year since 2006





## HD in the Central Great Plains

Nebraska & Kansas 2016  
HD submissions to SCWDS



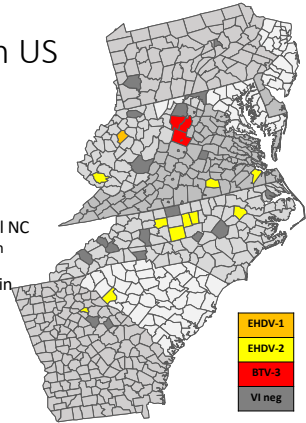
Dramatic east-west gradients exist in Great Plains

Kansas VI Results 2000-2016 71 viruses isolated		
Year	County reports	Viruses isolated
2000	3	EHDV-2 (1)
2001	4	EHDV-2 (7), BTV-17 (1)
2002	4	EHDV-2 (4)
2003	11	EHDV-2 (5), BTV-17 (1)
2004	1	EHDV-2 (1)
2005	6	EHDV-2 (5)
2006	6	EHDV-2 (2), BTV-17 (1)
2007	6	EHDV-2 (2)
2008	2	EHDV-2 (1), EHDV-6 (1)
2009	2	EHDV-2 (2)
2010	0	
2011	31	EHDV-2 (8), BTV-17 (1)
2012	47	EHDV-1 (1), EHDV-2 (16)
2013	9	EHDV-2 (1)
2014	7	
2015		EHDV-2 (6)
2016		EHDV-2 (3)



## HD in Eastern US

- West Virginia
  - Serotype diversity
- EHDV-2
  - Most widespread isolate
  - Larger outbreak in central NC
    - 2012 EHDV-2 outbreak in western NC
  - Example of cryptic event in Athens, GA
- BTV-3
  - WV/VA outbreak



EHDV-2 Outbreak  
North Carolina

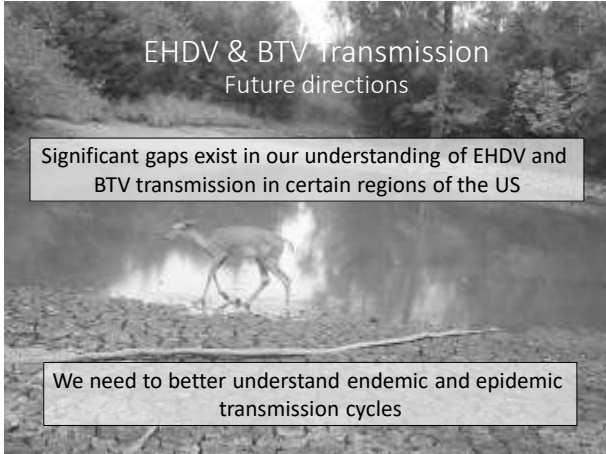


Jason Allen, NC Wildl. Res. Comm.

## EHDV-2 Outbreak Athens, Georgia

- Cryptic outbreak on UGA property
  - Whitehall Forest: 4 deer
  - Botanical Garden: 4 deer
  - No other reports



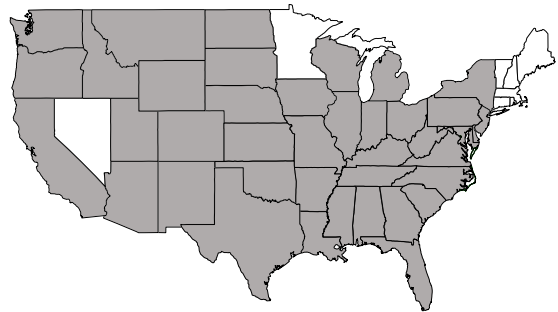
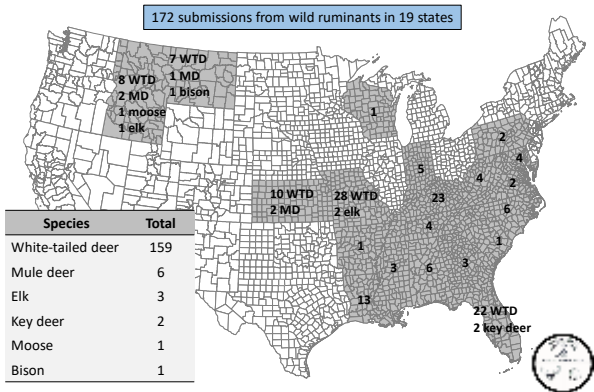


### SCWDS EHDV & BTV Diagnostics

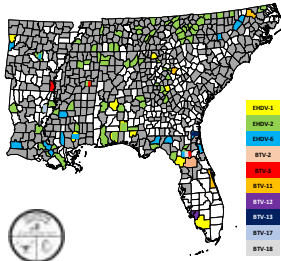
- Virus isolation attempts
  - Cattle pulmonary artery endothelium
    - 2 passages
  - Serotype identification by virus neutralization or RT-PCR



### 2015 HD Submissions to SCWDS



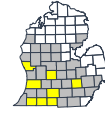
Reported EHDV detections by NVSL & SCWDS 1974-2015



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

### Michigan *Culicoides* Survey

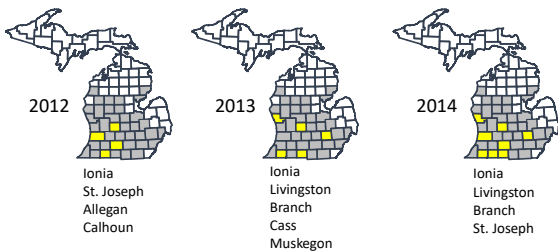
Year	Trap nights	Total <i>Culicoides</i>
2012	16	94
2013	33	1,880
2014	28	482



Species	SEPTEMBER 2012			
	Allegan	Calhoun	Ionia	St. Joseph
<i>C. haematopodus</i>	60		3	2
<i>C. crepuscularis</i>		10	3	2
<i>C. stellifer</i>		1	6	
<i>C. venustus</i>		1	1	5

### Methods

- CDC UV light traps operated overnight
- Four locations every 2-3 weeks July – September
- Collections into 70% ethanol
- Morph. identification of *Culicoides* (Blanton & Wirth 1979)



Light traps located in clearings adjacent to waterways where dead WTD had been recovered during the 2012 EHD outbreak

## Results

JULY-SEPTEMBER 2013					
Species	Branch	Cass	Ionia	Livingston	Muskegon
<i>C. stellifer</i>	18	14	36	431	1
<i>C. haematopodus</i>	1	1	6	96	10
<i>C. crepuscularis</i>	6	13	10	4	2
<i>C. venustus</i>	2	4	1	1	
Other species*	1		29	25	2

\* *C. biguttatus*, *C. chiopterus*, *C. mulrennani*, *C. obsoletus*, *C. paraensis*,  
*C. sanguisuga*, *C. spinosus*, *C. variipennis*

AUGUST-SEPTEMBER 2014				
	Branch	Ionia	Livingston	St. Joseph
Total <i>Culicoides</i>	2	344	145	1

## EHDV/BTV transmission



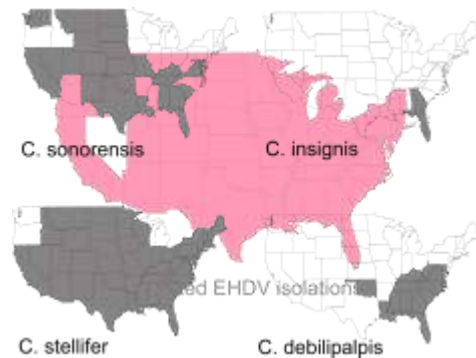
## *Culicoides* Surveys in the Southeast

2007-2015

- *C. sonorensis* is uncommon in the Southeast
  - Not the primary vector of orbiviruses in this region—especially in wild ruminants.
- *C. insignis* a neotropical vector of BTV and is abundant in FL
  - Recent detections north of historical range
- Orbivirus-*Culicoides* systems are dynamic
  - Changes in climate, ruminant populations, land-use, etc change will continue to make things exciting.

## Known *Culicoides* distributions

Confirmed and suspected vectors

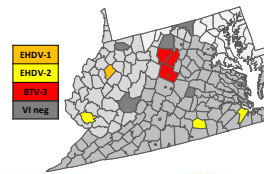


## SCWDS EHDV/BTV Diagnostics

- Submissions
  - State wildlife management agencies and diagnostic labs
  - Primarily WTD (and other wild and domestic ruminants)
  - Dead or moribund
    - Primarily spleen, lung, and/or blood



Jason Allen, NC Wildl. Res. Comm.



## West Virginia & Virginia Serotype diversity

- West Virginia
  - EHDV-1 &-2 in Appalachian Plateau
  - BTV-3 in Blue Ridge
- Virginia
  - EHDV-2 in Coastal Plain
  - BTV-3 in Blue Ridge

High serotype diversity observed in WV is not typical for this state