Update on SCWDS Arthropod Surveys

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James Mertins
National Veterinary Services Laboratories, USDA-APHIS
SCWDS Arthropod Surveillance

Surveys in cooperation with USDA-APHIS-VS and SCWDS Member State Wildlife Agencies

- Cattle Fever Ticks in South Texas
- Tropical Bont Ticks in the Caribbean
- Tick Vectors of Piroplasmosis
- *Culicoides* in the Southeast
- Asian Longhorned Tick Surveillance
Tick Surveys in South Texas

Objective: Determine wildlife species serving as hosts for *Rhipicephalus (Boophilus) annulatus* and *Rhipicephalus (Boophilus) microplus* in South Texas

- Surveys 2012 - present
  - 2012 & 2014: small mammals, mesomammals, birds
  - 2013: check stations feral swine, javelina, white-tailed deer
  - 2015: feral swine
Tick Surveys in South Texas
Deer and other wild ruminants

- Examine deer and other wild ruminants for ticks and other ectoparasites in South Texas
  - November 2016 & January 2017
  - December 2017 & January 2018

- 2016-2017
  - Five processing facilities
  - 342 hunter-harvested animals examined from 17 counties
## Texas Tick Surveys

### December 2017 & January 2018

<table>
<thead>
<tr>
<th>Host species</th>
<th>n</th>
<th># infested with ticks</th>
<th>Tick species identified</th>
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</thead>
<tbody>
<tr>
<td>White-tailed deer</td>
<td>348</td>
<td>109 (31%)</td>
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<tr>
<td>Nilgai</td>
<td>10</td>
<td>7 (70%)</td>
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<td>Mule deer</td>
<td>4</td>
<td>3 (75%)</td>
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<td>Axis deer</td>
<td>2</td>
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<td>Blackbuck</td>
<td>2</td>
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<td>Fallow deer</td>
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<td>Elk</td>
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Upcoming survey in January 2019
Tropical Bont Tick Surveys
St. Croix, US Virgin Islands, 2018

- Survey for the tropical bont tick (*Amblyomma variegatum*) were conducted in St. Croix during September 2018
- Live trapping (300 trap nights) and environmental sampling:
  - Mongoose (44)
  - Green iguana (1)
  - CO₂—baited tick traps (7)
  - Tick drags (3)
- Previous surveys conducted in Jan-Feb and Jun-Jul, 2014
  - 174 mongoose examined for ticks
  - No tropical bont ticks identified during these surveys
Surveys for Tick Vectors of Piroplasmosis

• During 2017, tick surveys on wild small mammals were conducted prior to international equestrian events as requested by USDA-APHIS-VS
  • Tryon International Equestrian Center (Tryon, NC) in preparation for the 2018 World Equestrian Games

• Surveys based on the risk assessment and surveys done at the Kentucky Horse Park in preparation for the 2010 World Equestrian Games
Surveys for Tick Vectors of Piroplasmosis
Tryon International Equestrian Center

**June 2017**
- Mesomammals: 370 trap nights
- Small mammals: 460 trap nights
- 11 tick drags over 1,100 m
  - Yielded three *D. variabilis*

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<tr>
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<tbody>
<tr>
<td>Virginia opossum</td>
<td>21</td>
<td>9 (43%)</td>
<td><em>Dermacentor variabilis</em></td>
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<tr>
<td>Raccoon</td>
<td>7</td>
<td>7 (100%)</td>
<td><em>D. variabilis, Ixodes cookei, I. texanus</em></td>
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<tr>
<td>Striped skunk</td>
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<td>1 (100%)</td>
<td><em>D. variabilis, I. cookei</em></td>
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<tr>
<td><em>Peromyscus</em> spp.</td>
<td>29</td>
<td>0</td>
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</tr>
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**September 2017**
- Mesomammals: 400 trap nights
- Small mammals: 400 trap nights
- 4 tick drags over 400 m
  - Yielded 0 ticks

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<th>Host species</th>
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<th>Tick species identified</th>
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<tr>
<td>Virginia opossum</td>
<td>34</td>
<td>2 (6%)</td>
<td><em>Haemaphysalis longicornis</em>, <em>D. variabilis</em></td>
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<tr>
<td>Raccoon</td>
<td>13</td>
<td>7 (54%)</td>
<td><em>D. variabilis, I. cookei</em></td>
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<td>Eastern woodrat</td>
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<td>Hispid cotton rat</td>
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<tr>
<td><em>Peromyscus</em> spp.</td>
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</table>

*first record of this exotic tick species in North Carolina
From 2007-2017, 14 species of *Culicoides* have been identified outside of previously established ranges. Most notably, *C. insignis*. 

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

SCWDS *Culicoides* Surveys 2007-2018

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

Extensive database with survey information on *Culicoides* species in the SE US
Long-term *Culicoides* and HD Monitoring
Whitehall Experimental Forest (UGA)

- 840 acres in the Piedmont region of Georgia
- Natural and planted pine, mixed pine-hardwood, upland and bottomland hardwood habitats
- Captive white-tailed deer herd, as well as wild deer

*Culicoides* spp. Abundance by Month at Whitehall Forest

To date, 28 species identified
Most Abundant *Culicoides* spp. at Whitehall Forest

**C. stellifer** most abundant in July 2016, 2017, 2018

**EHDV-2 outbreak**

### SPRING ABUNDANCE

- **Culicoides stellifer**: 35%
- **Culicoides haematopotus**: 22%
- **Culicoides biguttatus**: 22%
- **Culicoides travisi**: 4%
- **Culicoides denticulatus**: 4%
- **Culicoides spinosus**: 4%
- **all other spp.**: 9%

### SUMMER-FALL ABUNDANCE

- **Culicoides stellifer**: 45%
- **Culicoides haematopotus**: 38%
- **Culicoides debilipalpis**: 7%
- **Culicoides crepuscularis**: 2%
- **Culicoides paraensis**: 2%
- **Culicoides travisi**: 2%
- **Culicoides spinosus**: 1%
- **Culicoides villosipennis**: 1%
- **Culicoides hinmani**: 1%
- **all other spp.**: 4%

*only sp. present in every month when *Culicoides* were collected*
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
Wildlife Surveillance for the Asian Longhorned Tick (*Haemaphysalis longicornis*)

Mark Ruder¹, Stacey Vigil¹, David Shaw¹, Seth White¹, Jan Lovy², Adam Randall³, Peach VanWick⁴, Ernesto Dominguez⁴, James Mertins⁵ & Michael Yabsley¹

¹ SCWDS, College of Veterinary Medicine, University of Georgia
² New Jersey Department of Fish and Wildlife, Oxford, NJ
³ New Jersey Wildlife Services, USDA-APHIS-Wildlife Services, Pittstown, NJ
⁴ Wildlife Center of Virginia, Waynesboro, VA
⁵ National Veterinary Services Laboratories, USDA-APHIS-VS, Ames, IA
Large Collaborative Effort
Asian longhorneed tick
“New” kid on the block

*Haemaphysalis longicornis*

- Three host tick
- Broad host range with invasive potential
  - Domestic and wild animals
- Some populations reproduce parthenogenetically
  - Does so in introduced NZ and Australia populations
- Native to Southeast Asia
  - Established for >100 yrs in Australia, NZ, and other western Pacific Rim islands
- Important pest of livestock
  - Aggressive tick and severe infestations can directly impact livestock health and production
Asian longhorned tick
Medical and Veterinary Importance

- *Theileria orientalis*
- *Theileria (Babesia) equi*
- *Babesia ovata*
- *Babesia major*
- *Babesia bigemina*
- *Babesia gibsoni*
- *Borrelia* spp. including *B.b* s.l
- *Anaplasma phagocytophilum*
- *Anaplasma bovis*
- *Rickettsia japonica*
- *Coxiella burnetti*
- Russian spring-summer encephalitis flavivirus
- Powassan virus (in Russia)
- Khasan virus
- Tick-borne encephalitis virus (South Korea)
- Severe Fever with Thrombocytopenia Syndrome Virus

Vector of numerous animal and human pathogens

Role that *H. longicornis* will play for native pathogens in the US is unclear
Asian longhroneded tick
Broad Domestic and Wild Animal Host Range

• *H. longicornis* has been documented on a variety of wild and domestic small, medium, and large mammals and birds from its *native and previously established range*

• Cattle are an important preferred host

<table>
<thead>
<tr>
<th>Mammals</th>
<th>Birds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle, horse, sheep, goat, yak, donkey, pig, bear, red deer, roe deer, spotted deer, fallow deer, samba deer, rusa deer</td>
<td>Magpies, budgerigars, house sparrows, thrush, skylark, domestic chicken, domestic duck, turkey, pheasant, kiwi, rail, mallard duck, common myna</td>
</tr>
</tbody>
</table>

Cat, dog, badger, wildcats, foxes, raccoon dogs, wallaby, brushtail possum, rabbit, brown hares, wallaby, bandicoot, hedgehog, ship rat, Norway rat, house mouse, ferret, stoat, weasel
Wildlife surveillance: A critical tool for monitoring many tick species

• Wild animals may be important hosts for different tick life stages and may be a source of pathogen for feeding ticks.

• Effective tick prevention on free-ranging wildlife populations ranges from difficult to impossible

• With such long lists of potential hosts and pathogens, wildlife surveillance is critical to delineate current *H. longicornis* distribution in North America and better understand potential disease risks
Asian Longhorned Tick
Story begins (we thought) in August 2017

August, 2017
Hunterdon Co HD and Rutgers first discovered tick infestation on single Icelandic ewe on private property in Hunterdon Co. NJ

Nov-Dec, 2017
SCWDS, NJDFW, & APHIS-WS surveyed hunter-harvested WTD
No HL found

November, 2017
NVSL confirmed ticks as HL

By spring 2018, it became clear HL is firmly established in the US and that we have a lot to learn regarding geographic distribution, host range, phenology and vector potential
Asian Longhorned Tick
Wildlife Surveillance

As of October 15, 2018

Surveillance strategies

1. Live trapping of small mammals, meso-mammals, and birds by SCWDS personnel

2. Opportunistic regional wildlife surveys by state/federal agency and SCWDS personnel targeting WTD, bear, and other species

3. Wildlife rehabilitation facilities collect and submit ticks
Asian Longhorned Tick
Wildlife Surveillance

656 host animals examined for *H. longicornis* across 15 states

1. Live trapping
   - 394 hosts examined

2. Regional surveys
   - 179 hosts examined

3. Wildlife rehabilitation facilities
   - 83 hosts examined

These three surveys methods have documented HL on eight species of wildlife in six states (NC, VA, WV, PA, MD, NJ)
Asian Longhorned Tick
Wildlife Surveillance

To date, these surveys have documented *H. longicornis* on 8 North American wildlife species

- White-tailed deer
- Virginia opossum
- Groundhog
- Raccoon
- Coyote
- Gray fox
- Red fox
- Red-tailed hawk
Asian Longhorned Tick Surveillance
Live trapping in New Jersey

**Nov-Dec 2017 – Hunterdon Co., NJ**
- hunter-killed white-tailed deer, road-kill

**April-May 2018 – Hunterdon Co. and Union Co., NJ**
- Meso-mammals: 375 trap nights
- Small mammals: 300 trap nights
- 7 drags for 4700m & 15 CO₂ traps

<table>
<thead>
<tr>
<th>Species</th>
<th>n</th>
<th># infested with ticks</th>
<th># with HL</th>
<th>Tick species identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>White-tailed Deer</td>
<td>77</td>
<td>58 (75%)</td>
<td>0</td>
<td>Dermacentor albipictus, Ixodes scapularis</td>
</tr>
<tr>
<td>Virginia Opossum</td>
<td>1</td>
<td>1 (100%)</td>
<td>0</td>
<td>I. scapularis</td>
</tr>
<tr>
<td>Raccoon</td>
<td>2</td>
<td>1 (50%)</td>
<td>0</td>
<td>I. scapularis</td>
</tr>
<tr>
<td><strong>Virginia Opossum</strong></td>
<td>28</td>
<td>9 (32%)</td>
<td>3</td>
<td>Dermacentor variabilis, H. longicornis, I. cookei, I. scapularis</td>
</tr>
<tr>
<td>Raccoon</td>
<td>66</td>
<td>16 (24%)</td>
<td>1</td>
<td>D. variabilis, I. texanus, I cookei, I. scapularis, H. longicornis</td>
</tr>
<tr>
<td>Peromyscus spp.</td>
<td>15</td>
<td>6 (40%)</td>
<td>0</td>
<td>D. variabilis</td>
</tr>
<tr>
<td>Meadow Vole</td>
<td>1</td>
<td>1 (100%)</td>
<td>0</td>
<td>-</td>
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<tr>
<td>Wild Turkey</td>
<td>2</td>
<td>0 (0%)</td>
<td>0</td>
<td>-</td>
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<tr>
<td>Red Fox</td>
<td>1</td>
<td>1 (100%)</td>
<td>0</td>
<td>pending</td>
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<tr>
<td>Passerines</td>
<td>11</td>
<td>1 (9%)</td>
<td>0</td>
<td>I. scapularis</td>
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<tr>
<td><strong>Virginia Opossum</strong></td>
<td>5</td>
<td>1 (20%)</td>
<td>1</td>
<td>H. longicornis</td>
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<tr>
<td>Raccoon</td>
<td>21</td>
<td>15 (71%)</td>
<td>14</td>
<td>D. variabilis, H. longicornis, Ixodes spp.</td>
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<tr>
<td>Peromyscus spp.</td>
<td>4</td>
<td>0 (0%)</td>
<td>0</td>
<td>-</td>
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<tr>
<td>Woodchuck</td>
<td>1</td>
<td>1 (100%)</td>
<td>1</td>
<td>H. longicornis, Ixodes cookei</td>
</tr>
<tr>
<td>Eastern Cottontail</td>
<td>1</td>
<td>1 (100%)</td>
<td>0</td>
<td>H. leporispalustris</td>
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<tr>
<td>Eastern Chipmunk</td>
<td>1</td>
<td>1 (100%)</td>
<td>0</td>
<td>pending</td>
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<tr>
<td>Passerines</td>
<td>22</td>
<td>17 (77%)</td>
<td>0</td>
<td>Ixodes spp.</td>
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</table>
**H. longicornis Surveys**
**Virginia Rehab Centers**

- Ticks collected by cooperators and submitted to SCWDS for ID

**93 tick submissions from 28 counties in VA**

- Black bear (0/15)
- Eastern cottontail (0/13)
- Fox, unknown (0/2)
- **Gray fox (1/3)**
- Gray squirrel (0/1)
- Raccoon (0/5)
- **Red fox (1/2)**
- Striped skunk (0/2)
- Virginia opossum (0/7)
- **White-tailed deer (7/30)**
- Woodchuck (0/5)
- Canada goose (0/1)
- Eastern phoebe (0/1)
- Grackle (0/1)
- **Red-tailed Hawk (1/1)**
- Wild turkey (0/3)

**SCWDS confirmed HL**

- Other groups confirmed HL

- Ticks submitted, but no HL

**Southwest Virginia Wildlife Center of Roanoke**
Asian Longhorned Tick Surveillance
Southeastern Cooperative Wildlife Disease Study & Warnell School of Forestry and Natural Resources

Below are the known geographic distribution and hosts for *Haemaphysalis longicornis* in the United States. These data should not be considered complete and do not represent all counties in which *H. longicornis* may be present.

Charts and map are interactive. Select sections of the map or chart using the selection box or lasso to filter the other dashboard components. Double click the chart to reset, or click the reset button in the upper right. Select a piece of the pie chart to filter by host. Click the slice again to reset.

References

Northeast Regional Center for Excellence in Vector-Borne Diseases: Longhorned Tick a.k.a. Cattle Tick or Bush Tick
Rutgers Center for Vector Biology: *Haemaphysalis longicornis* in the US: what you need to know
USDA Factsheet

<table>
<thead>
<tr>
<th>State</th>
<th>County</th>
<th>Month Collected</th>
<th>Year Collected</th>
<th>Host</th>
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</table>
SCWDS Update on 2017/18 Hemorrhagic Disease Activity in Wild Ruminants

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Southeastern Cooperative Wildlife Disease Study
Department of Population Health
College of Veterinary Medicine
University of Georgia
Virus isolation attempts on tissues submitted by state wildlife agencies and diagnostic labs

- Primarily dead/moribund wild ruminants
  - Spleen, lung, and/or blood
- Serogroup-specific RT-PCR on tissues
- Virus isolates typed by neutralization or RT-PCR
2017 HD Submissions to SCWDS

<table>
<thead>
<tr>
<th>Species</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>White-tailed deer</td>
<td>285</td>
</tr>
<tr>
<td>Elk</td>
<td>11</td>
</tr>
<tr>
<td>Mule deer</td>
<td>6</td>
</tr>
<tr>
<td>Bighorn sheep</td>
<td>1</td>
</tr>
<tr>
<td>Cow</td>
<td>1</td>
</tr>
<tr>
<td>Domestic goat</td>
<td>1</td>
</tr>
</tbody>
</table>

305 submissions from 23 states
2017 HD Outbreak
EHDV and BTV isolations by SCWDS

Legend

Virus
- EHDV-1
- EHDV-2
- EHDV-6
- EHDV-2, EHDV-6
- BTV-2
- BTV-3

158 detections from 305 submissions

Map by S. Vigil
2018 HD Submissions to SCWDS
As of October 18, 2018

<table>
<thead>
<tr>
<th>Species</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>White-tailed deer</td>
<td>138</td>
</tr>
<tr>
<td>Mule deer</td>
<td>15</td>
</tr>
<tr>
<td>Elk</td>
<td>8</td>
</tr>
<tr>
<td>Pronghorn</td>
<td>3</td>
</tr>
<tr>
<td>Bighorn sheep</td>
<td>1</td>
</tr>
<tr>
<td>Moose</td>
<td>1</td>
</tr>
</tbody>
</table>

No. Submissions by Month

- June: 1
- July: 5
- Aug: 14
- Sept: 11
- Oct: 15
2018 Virus Isolations by SCWDS

72 virus detections from WTD or mule deer in 16 states

As of October 18, 2017

<table>
<thead>
<tr>
<th>Virus</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>EHDV-2</td>
<td>47</td>
</tr>
<tr>
<td>EHDV-6</td>
<td>1</td>
</tr>
<tr>
<td>BTV-1</td>
<td>1</td>
</tr>
<tr>
<td>BTV</td>
<td>8</td>
</tr>
<tr>
<td>EHDV</td>
<td>13</td>
</tr>
<tr>
<td>EHDV/BTV</td>
<td>2</td>
</tr>
</tbody>
</table>

No submissions
VI negative
VI positive
Changes are Occurring in the HD System
Northern Expansion

Increasing frequency and intensity of HD outbreaks in northern regions

544 viruses isolated 1980-2012

Stallknecht et al 2015
SCWDS has isolated 230 viruses from this region over the last six transmission seasons.

West Virginia example:
- Apparent increase in detection frequency and virus diversity

Northern Expansion of HD
The trend continues

1980-2012
544 viruses isolated

2013-2018

- SCWDS has isolated 230 viruses from this region over the last six transmission seasons

*1 BTV-10
Acknowledgements

• We thank SCWDS member state wildlife agencies and supporting federal partners

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• Numerous biologists, veterinarians and other staff at state wildlife agencies

• SCWDS faculty, staff, and students

• APHIS – Wildlife Services

• National Veterinary Services Laboratories