



**CERVIDAE HEALTH  
RESEARCH INITIATIVE**

# **Epidemiology of Epizootic Hemorrhagic Disease Virus in White-tailed Deer in Florida: Surviving Year Around Exposure**

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Overwintering: Why does it matter?

# Talk Outline

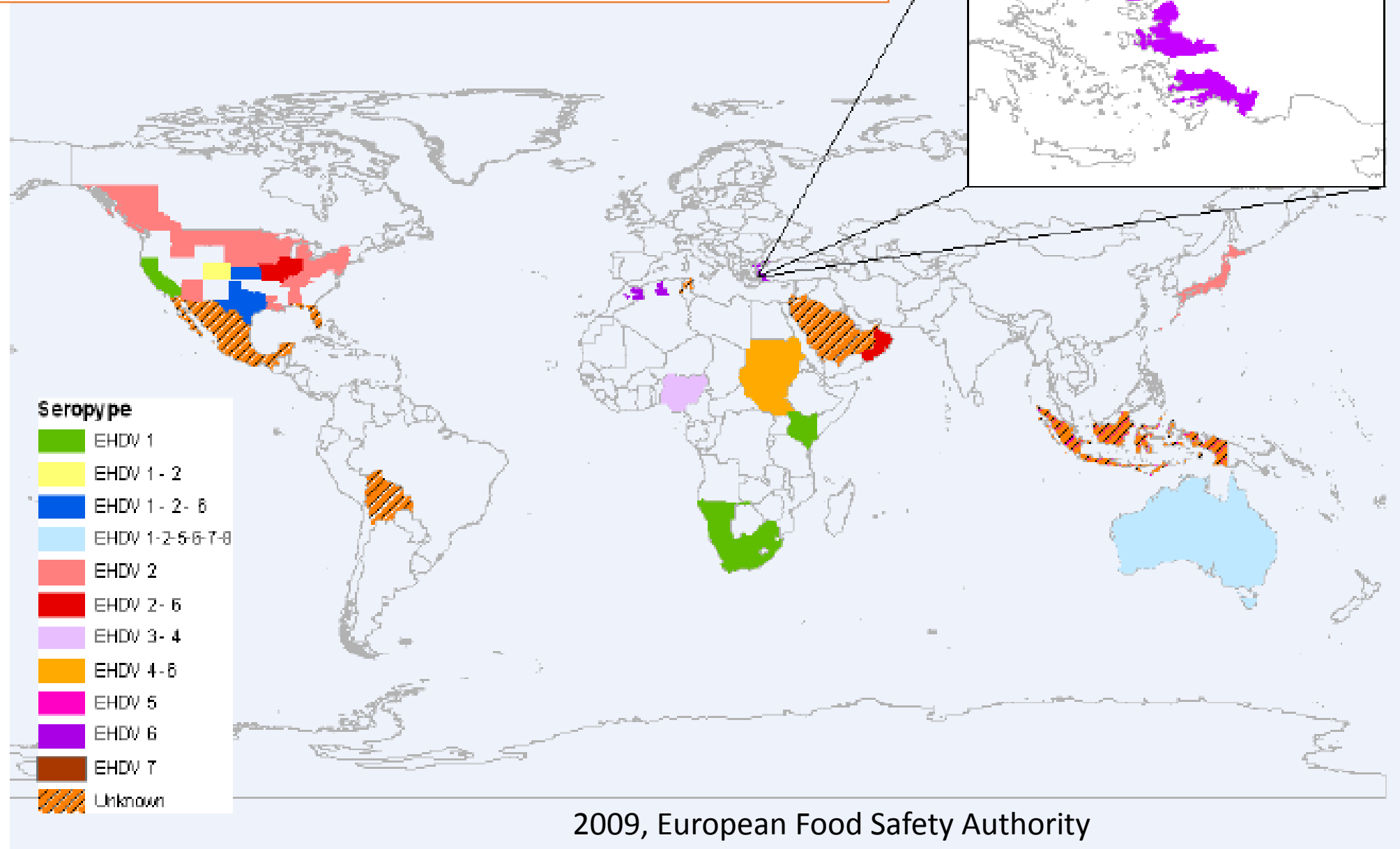
- EHD and global expansion
- Overwintering in Florida sentinel herd
- Detection of EHDV in live animals
- Next steps

# Signs of EHD and Bluetongue

- Replication of virus occurs in vascular endothelial cells, intravascular thrombosis → hemorrhage
- Signs: disorientation, lethargy, bleeding from oronasal cavity, oral ulcers, swelling and excessive salivation, respiratory distress, weakness, altered gait



- Globally- distributed & expanding



- Maps courtesy of Dr. Eileen Ostlund, NVSL, USDA, APHIS

Legend:

- BTV isolate / PCR positive (Green)
- BTV serotype identified (Numbers)

Map Data:

State	BTV isolate / PCR positive	BTV serotype identified
Washington	Yes	10, 11, 17
Oregon	Yes	11, 17
Idaho	Yes	11, 17
Montana	Yes	11, 17
Wyoming	No	No
Utah	No	No
Nevada	Yes	10, 11, 13, 17
California	Yes	10, 11, 13, 17
Arizona	Yes	11, 17
New Mexico	Yes	11, 13, 17
Colorado	Yes	17
Nebraska	Yes	13
South Dakota	Yes	11
North Dakota	No	No
Minnesota	No	No
Iowa	Yes	17
Missouri	Yes	13, 17
Kansas	Yes	11, 17
Oklahoma	Yes	13, 17
Texas	Yes	11, 17
Louisiana	Yes	13, 17
Mississippi	Yes	13
Alabama	Yes	10
Georgia	Yes	10
South Carolina	Yes	11
North Carolina	Yes	11
Tennessee	No	No
Kentucky	Yes	17
Illinois	Yes	17
Indiana	No	No
Ohio	No	No
Pennsylvania	No	No
West Virginia	No	No
Virginia	No	No
Delaware	No	No
Maryland	No	No
New Jersey	No	No
Connecticut	No	No
Rhode Island	No	No
Massachusetts	No	No
New Hampshire	No	No
Maine	No	No
Vermont	No	No
Michigan	No	No
Wisconsin	No	No

Legend:

- Blue shaded area: BTV isolate / PCR positive
- Number: BTV serotype identified

\*BTV-2 isolated and identified by UC Davis, CA  
 †BTV-10 WI- cattle originated in ID



# Proposed explanations

Climate Change



Movement of  
animals



Expanding  
vector range



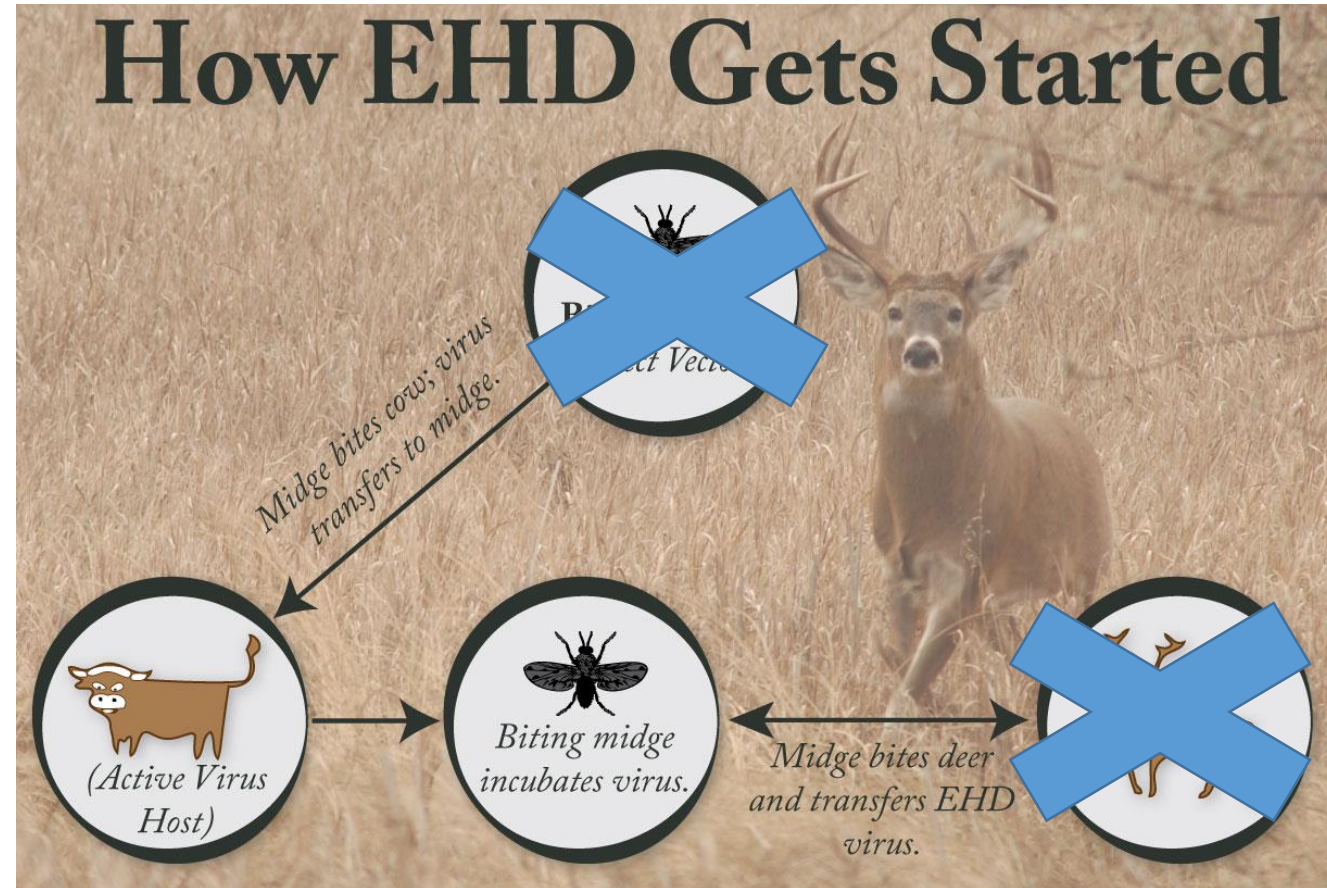
Overwintering  
of the virus



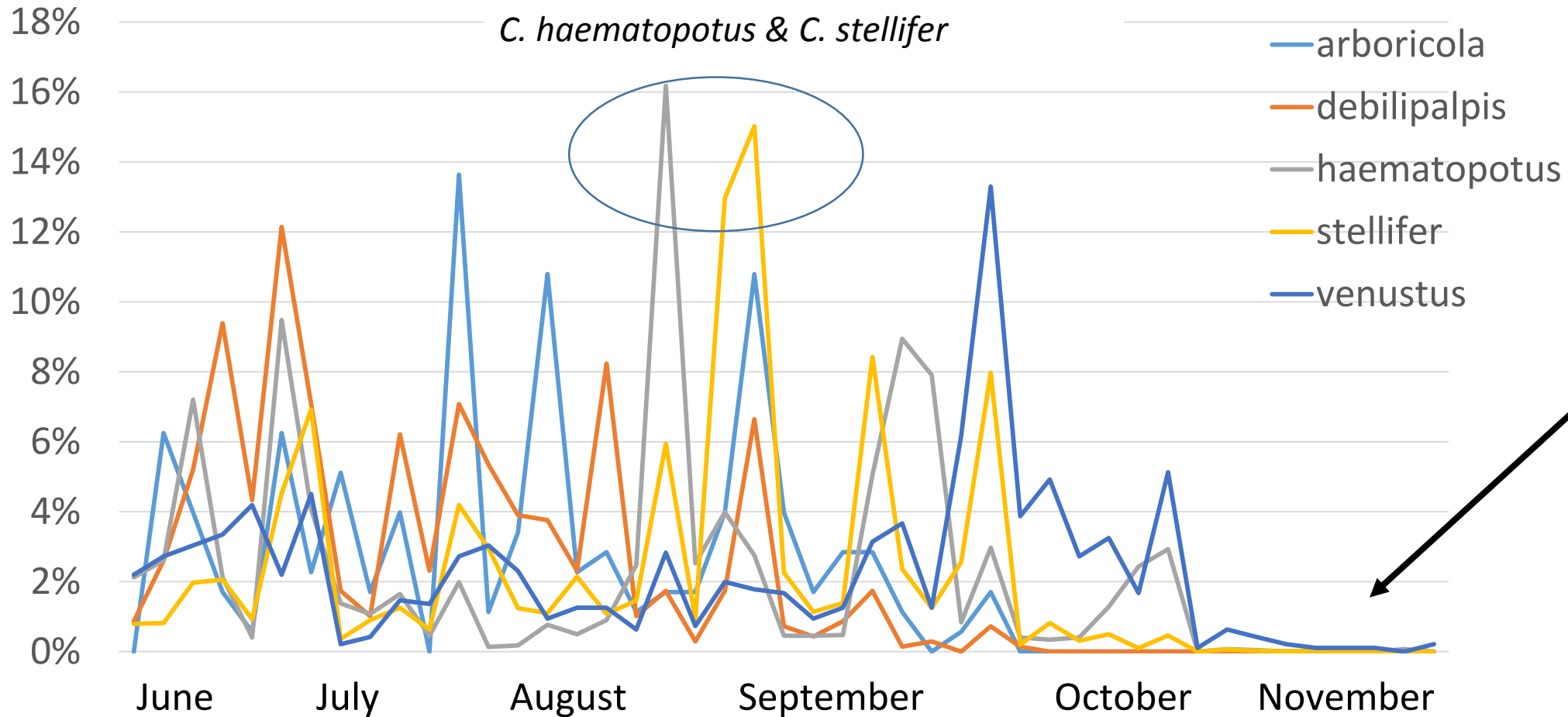
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# Hemorrhagic Disease: EHD and Bluetongue

- Vectored by biting midges
- *Culicoides*-dependent system
- No other known vectors- ticks, mosquitoes, ect.

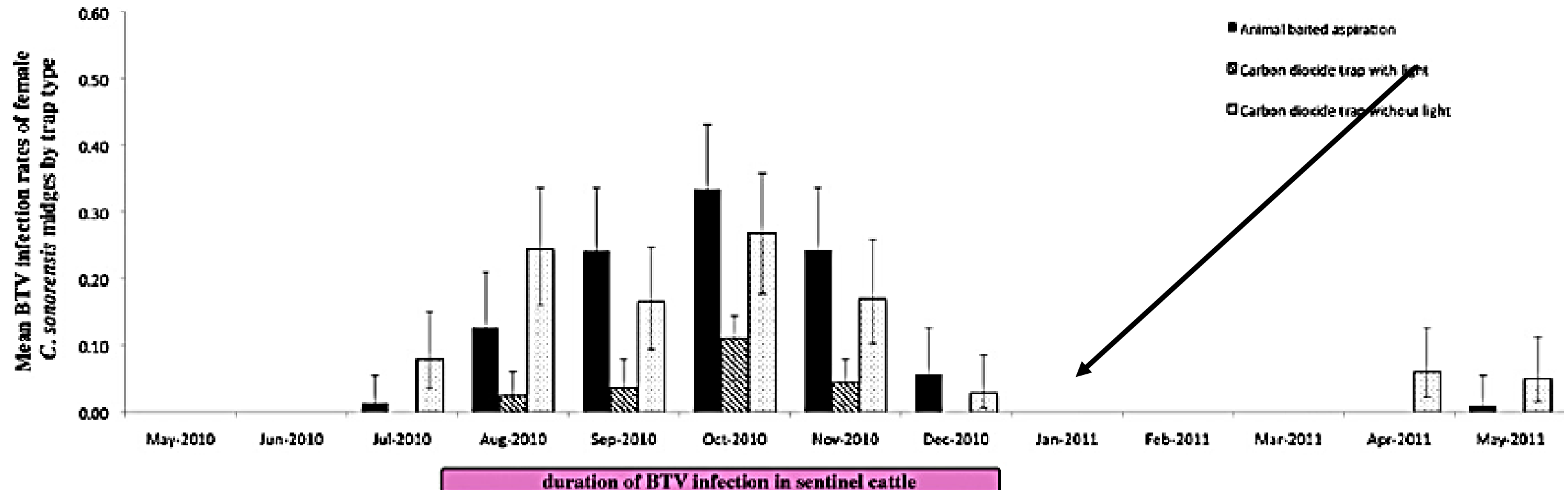


# Species Abundance by Date- Single Farm



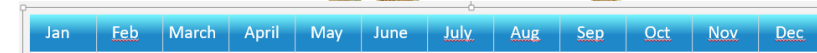
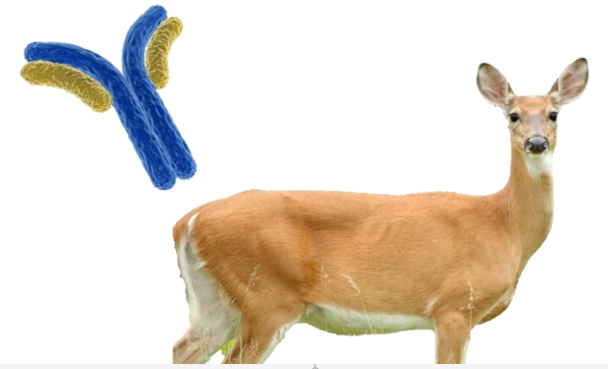


# Documented in California

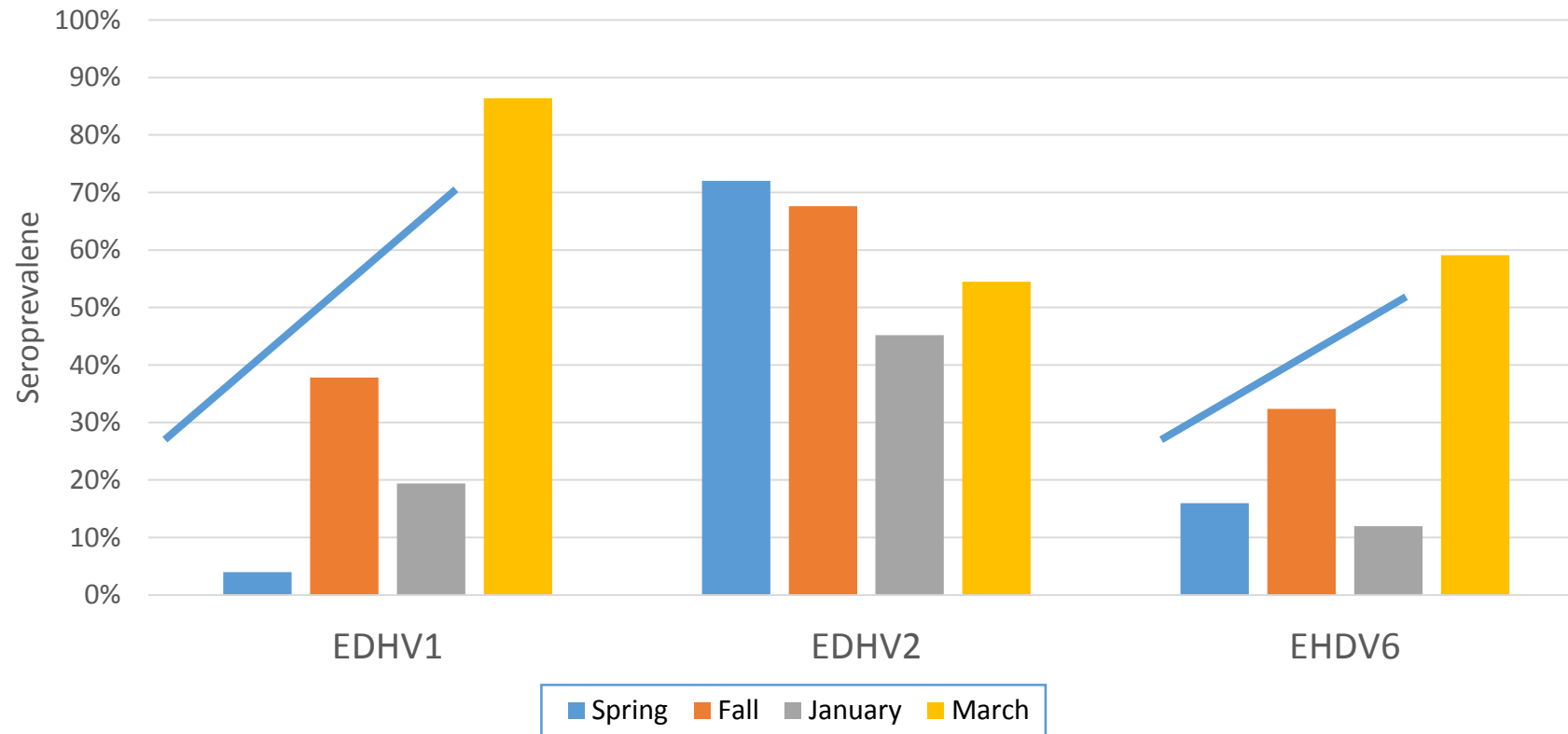


Mayo et al. 2012

# Serial Serology: Patterns of Exposure

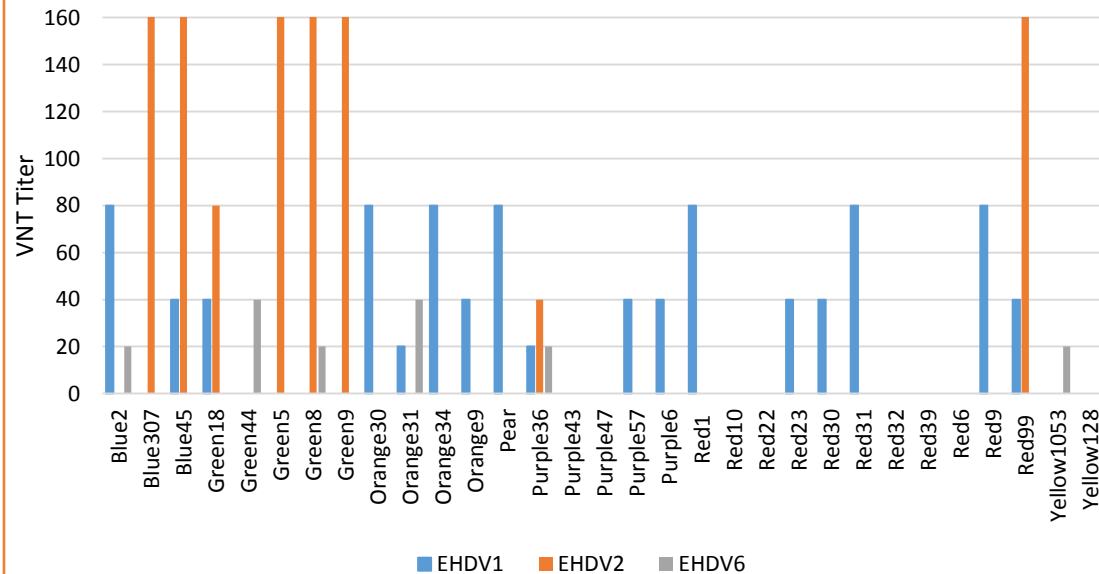


Seroprevalence by Serotype

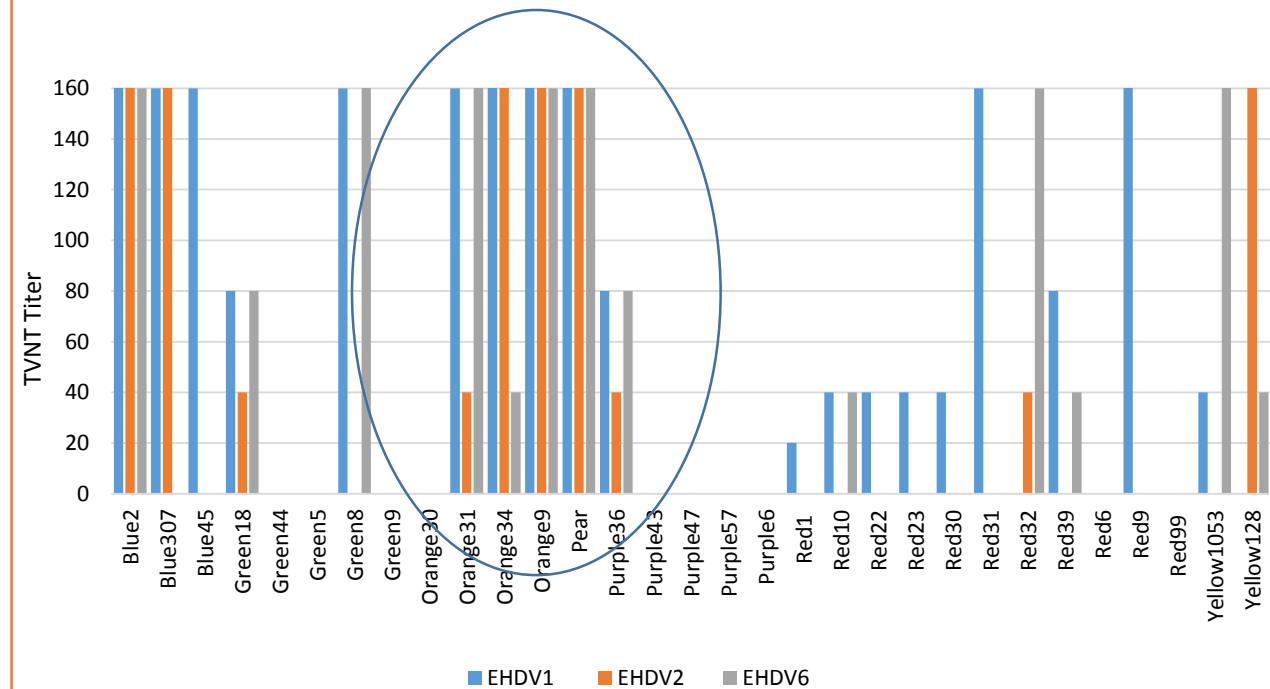


# Following cohort through “over winter” period

January 2016- Titers in Serially Bleed Individuals



March 2016- Titers in Serially Bleed Individuals

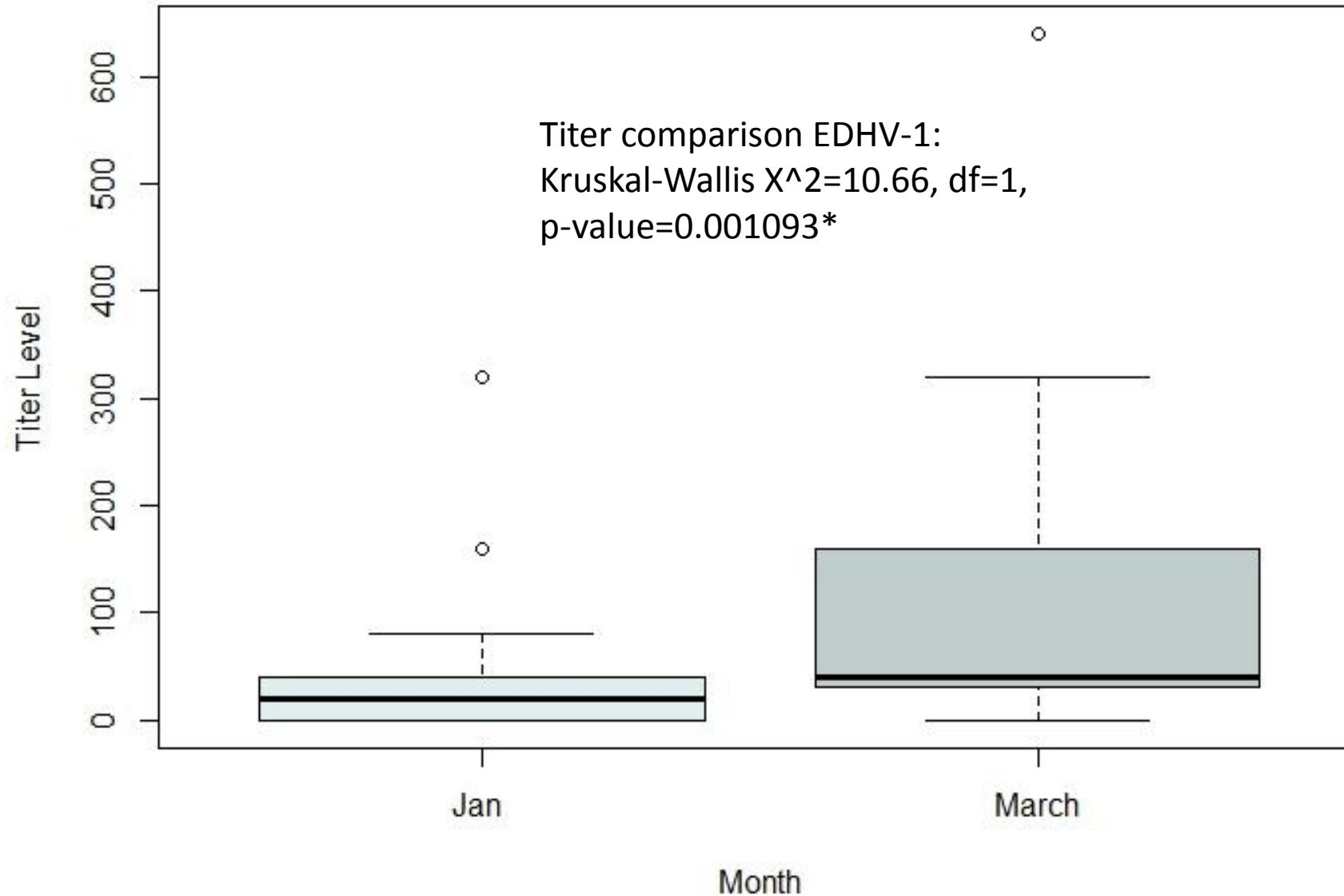


# Data Snapshot- 6 year old doe

Tag	Date	Event	EDHV1 Titer	EDHV2 Titer	EHDV6 Titer
Blue45	22-Sep-15	Sorting Does & Fawns 2015	40	>1280	20
Blue45	18-Jan-16	Sorting Does 2016	40	1280	0
Blue45	3-Mar-16	Vaccine_Baseline	160	>1280	0
Blue45	28-Mar-16	Vaccine_Booster	640	1280	0

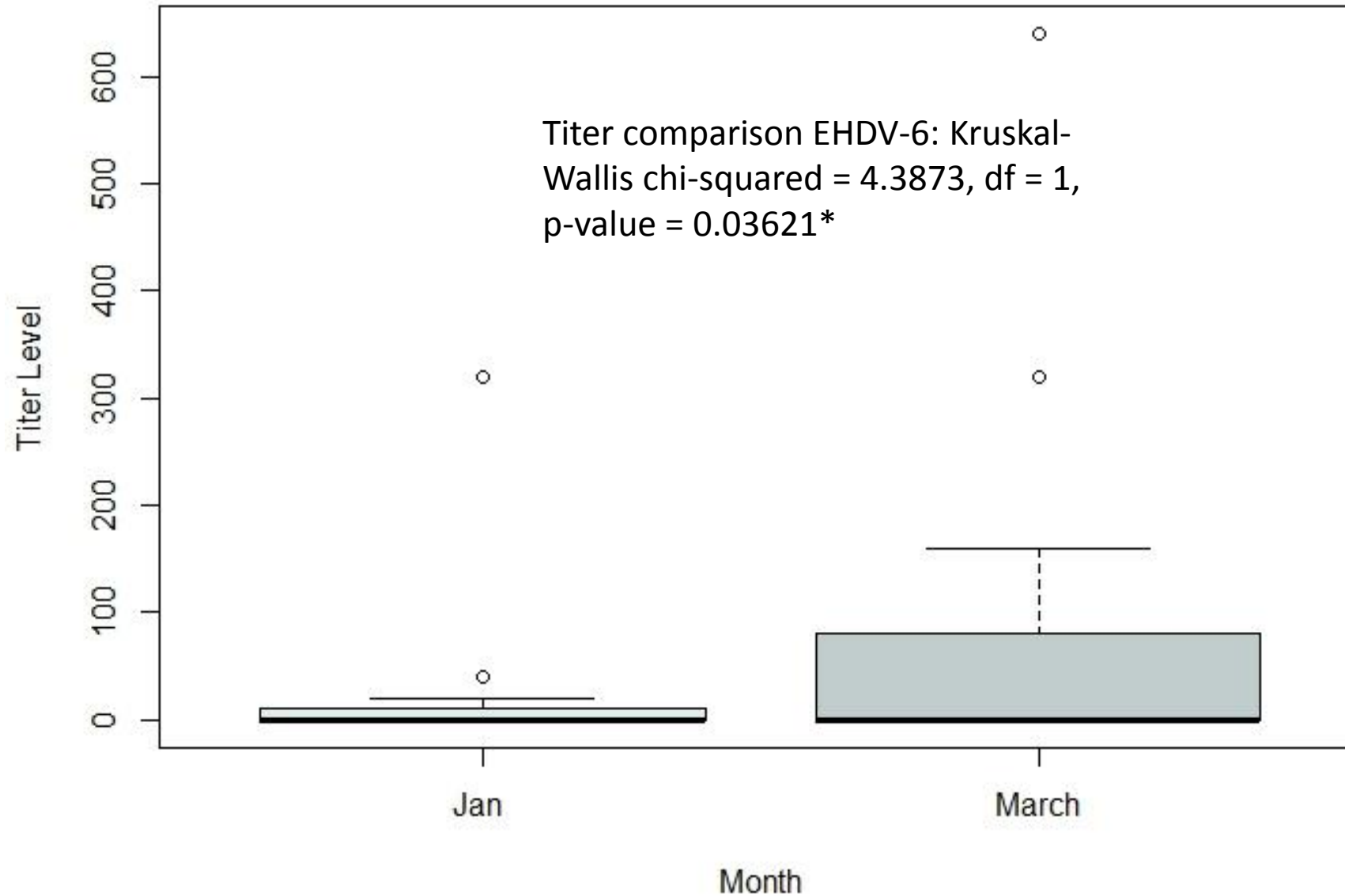


## Further Quantitative Evidence: EHDV-1





## Further Quantitative Evidence: EHDV-6



# Molecular Methods: Patterns of Exposure

Sample Date	Total Positive/Total Sampled	% Prevalence
January 2016	6/64	9.4%
January 2017	35/72	48.6%



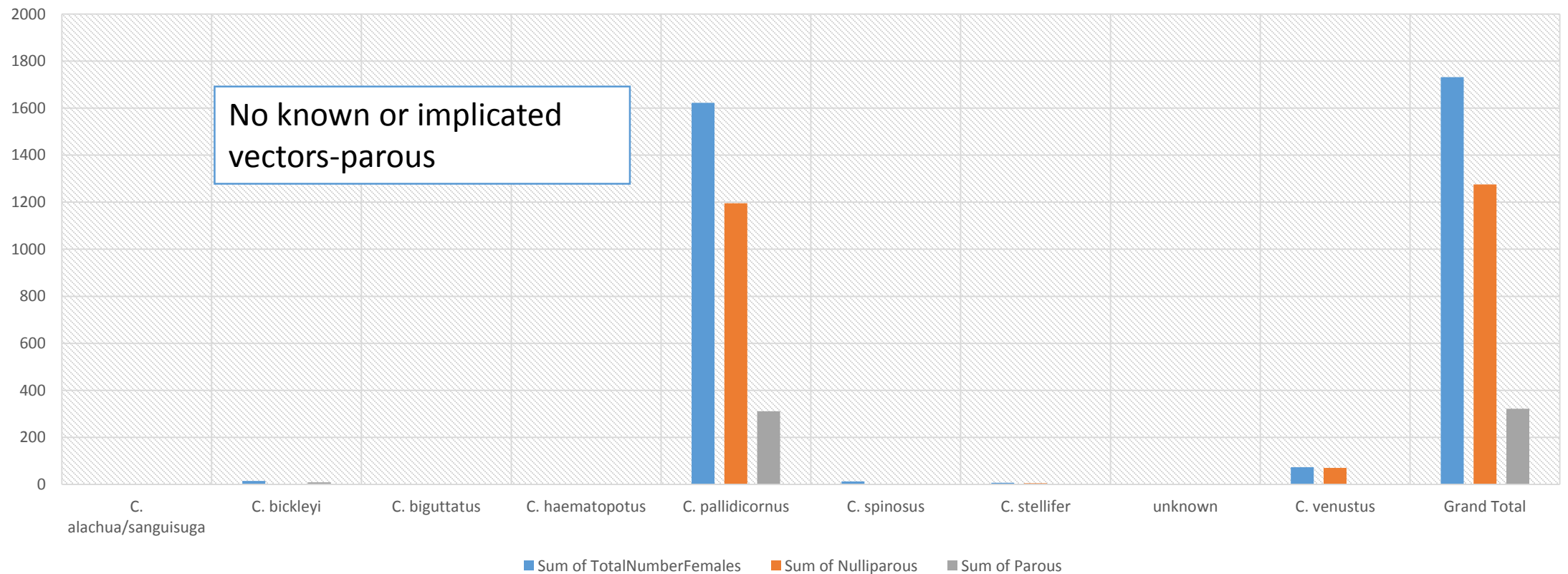
Alli Cauvin and Carisa Boyce  
processing blood samples in the field

February 14<sup>th</sup>- OV446, 2.5 year old buck RT-qPCR positive

# Vector Data-2016



# by Reproductive Status



# Surviving Infection: 2016/2017

- 15/77 RT-qPCR positive white-tails in September, 2016 (19.5%)
- 35/72 RT-qPCR positive white-tails in January 2017 (48.6%)
- 8 positive at both times- without any signs of infection



Yearling buck- PCR positive Sept., again in January. Recovered from acute, clinical EHD.

# Acute infection difficult to predict



## Blue27

- 7Sept2016-Weaning
- ↓
- RT-qPCR neg., Seronegative to all types
- Mixed genetics, unvaccinated
- Died 28Sept2017, Cq=34

## Blue39

- 7Sept2016-Weaning
- ↓
- RT-qPCR neg., Seronegative to all types
- Northern genetics, vaccinated
- Died 28Sept2017, Cq=32



# Findings

Data Snapshot- 6 year old doe

Tag	Date	Event	EDHV1 Titer	EDHV2 Titer	EHDV6 Titer
Blue45	22-Sep-15	Sorting Does & Fawns 2015	40	>1280	20
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- Some animals are exposed beyond “peak” vector time
- Nearly year-round exposure is occurring
- Some animals in same herd survive infection, others do not
  - Vaccine status of fawn nor dam significant
  - Other factors need to be identified
- Understanding WHEN and WHY disease occurs- better management

# Next Steps



- 1. Use Microsat → SNP data look for genetic markers of survival, MHC-associated traits (Collaboration with Weeks/Gezan Labs)
- 2. Examine Jan-March 2017 vector data (Collaboration with Burkett-Cadena Lab)
- 3. Genetically compare EHDVs from moribund animals/those surviving infection (Collaboration with Waltzek/Lednicky Labs)

# Questions/Comments?



# “Seasonal” Disease

HD-related deaths, 2015 & 2016

