

Surveillance for Lymphoproliferative Disease Virus in Hunter-Killed Eastern Wild Turkeys (*Meleagris gallopavo*)



Jesse M. Thomas^{1,2}, Michael J. Yabsley^{1,2}, and Justin D. Brown¹

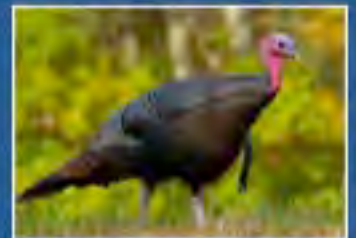
¹Southeastern Cooperative Wildlife Disease Study (SCWDS), College of Veterinary Medicine, University of Georgia, Athens, GA

²Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA



Viral-induced Tumors in Gallinaceous Birds

- Herpesvirus (Marek's Disease)
- Retroviruses
 - Avian leukosis/sarcoma viruses
 - Reticuloendotheliosis virus (REV)
 - Lymphoproliferative disease virus (LPDV)



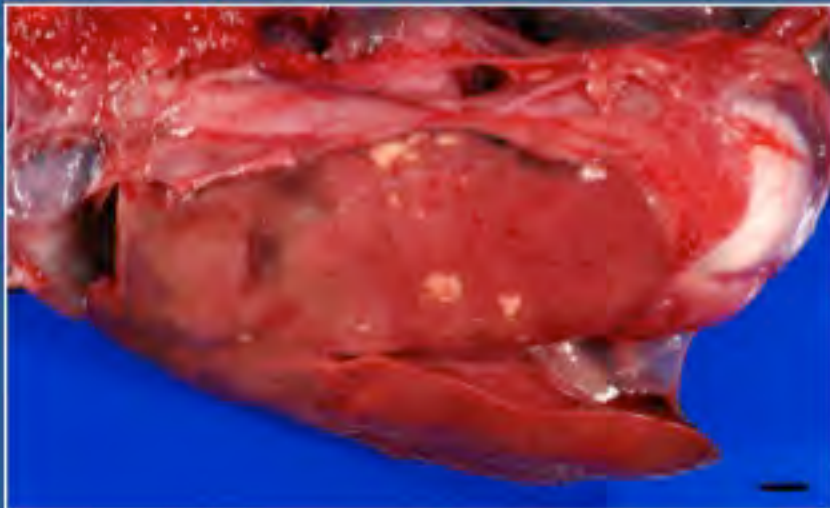
Historically, only REV was reported from wild upland game birds

History of LPDV

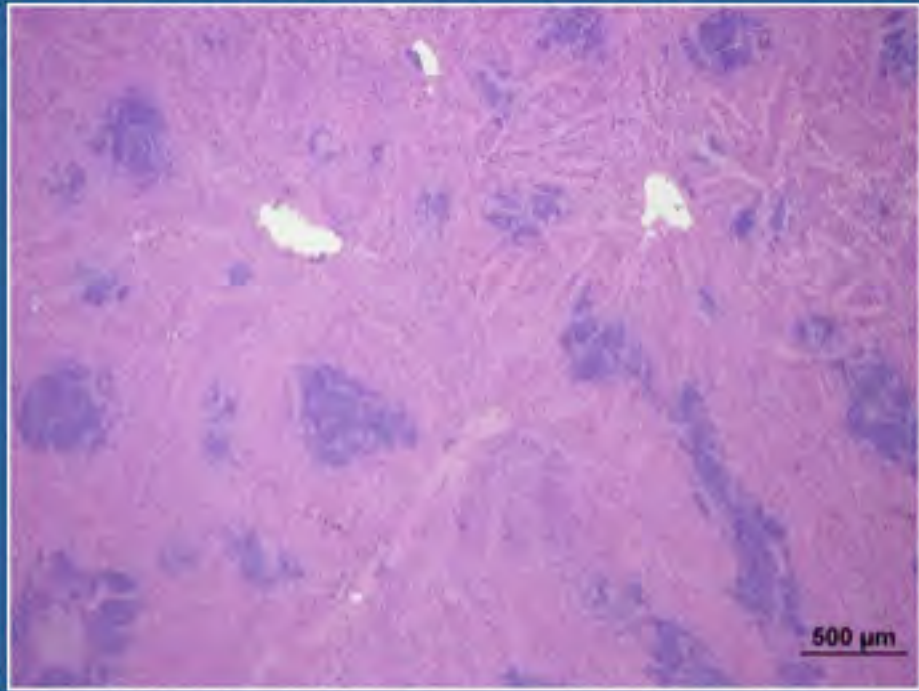
- First described in domestic turkeys in the United Kingdom in 1972
- Sporadic outbreaks reported in other European countries and Israel
- Apparently a restricted host range
 - Natural infection only reported in domestic turkeys
 - Turkeys and chickens have been infected experimentally
- Considered poultry pathogen of minor importance globally

LPDV in the U.S.

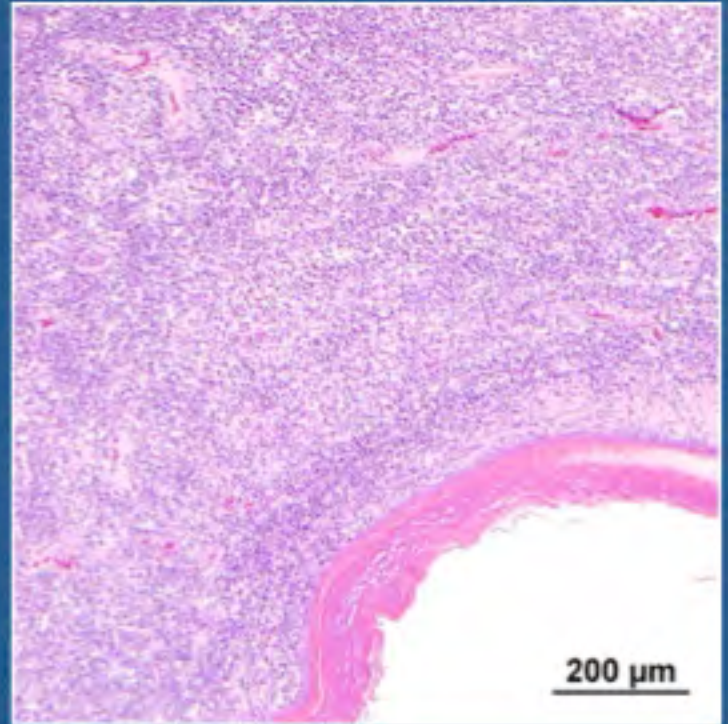
- First recognized in the United States in 2009
 - 3 adult Eastern wild turkeys with lymphoid tumors
 - 2 from West Virginia, 1 from Arkansas
 - Negative for REV, pox
 - Positive for LPDV



Histopathology



Liver (cc12-09)

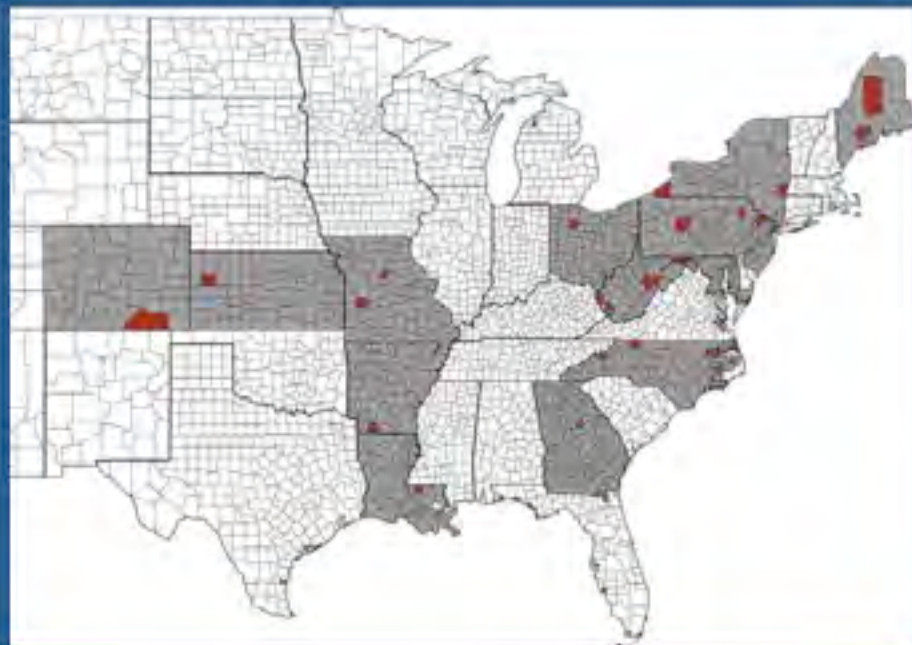


Skin (cc152-11)

Tumors composed of neoplastic lymphoid cells

Eastern Wild Turkey Clinical Cases '09-'12

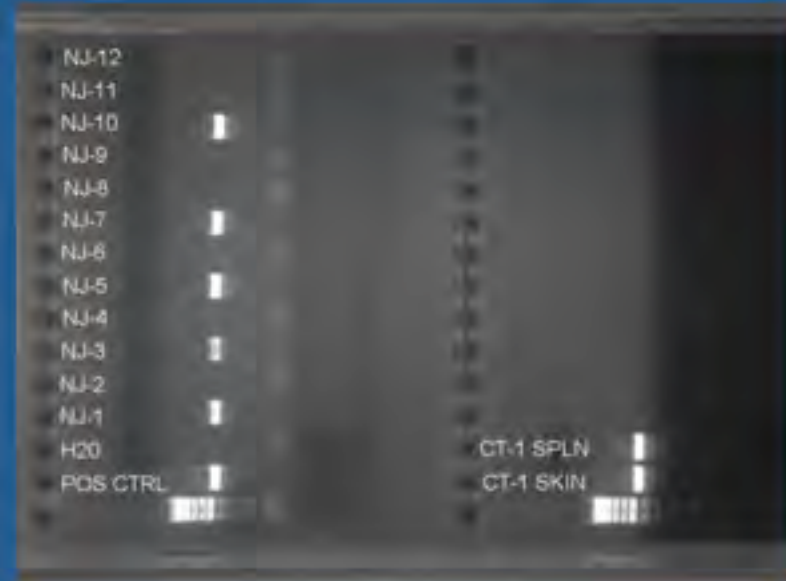
SCWDS ID	M/F	Location	Date
cc12-09	F	Columbia, AR	1/8/09
cc122-09	F	Randolph, WV	1/23/09
cc286-09	M	Upshur, WV	8/20/09
cc47-10	F	Upshur, WV	2/23/10
cc183-10	F	Wayne, WV	7/16/10
cc32-11	F	Yancey, NC	1/21/11
cc90-11	M	Logan, WV	3/14/11
cc152-11	M	Putnam, GA	5/16/12
cc12-141	M	Las animas, CO	4/15/12
cc12-71	M	St. Clair, MO	10/4/12
cc12-95	F	Morgan, WV	11/1/12
cc12-165A	Unk	Piscataquis, ME	5/3/12
cc12-165B	Unk	Kennebec, ME	5/3/12
cc12-163A	M	Columbia, NY	5/4/12
cc12-163B	M	Columbia, NY	3/13/12
cc12-196	M	Bertie, NC	6/18/12
cc12-159	F	Clearfield, PA	4/16/12
cc12-169	F	Allegany, MD	5/29/12
cc12-216	M	Lackawanna, PA	5/20/12
cc12-205	M	Howard, MO	4/29/12
cc12-217	F	East Feliciana, LA	7/2/2012
cc3-09-C	F	Logan, KS	1/4/2009
cc12-388	F	Chautauqua, NY	5/15/12
cC12-428	M	Surry, NC	9/14/2012
cc12-453	F	Lafayette, NJ	9/13/2012
cc12-514	M	Hancock, OH	05/2012



26 LPDV positive clinical cases from 14 states

Testing for LPDV

- Method of *in vitro* culture not currently known
- Diagnostics rely on histopathology and PCR
 - Lesions not specific to LPDV
 - Lesions may not always be present
- PCR testing
 - Primers that target a 457 bp portion of the gag gene



Objectives

- Determine the prevalence and distribution of LPDV in apparently asymptomatic hunter-killed Eastern wild turkeys.
 - Analyze differences among different age and sex classes.
- Determine best tissue for LPDV detection in asymptomatic turkeys.
 - Spleen, bone marrow, liver

Sample Collection and Testing

- Liver, spleen, and bone marrow collected from hunter-killed wild turkeys
 - Tissues selected based on
 - Literature (LPDV and REV in domestic turkeys)
 - Experience (LPDV in wild turkey clinical cases)
 - Availability and compliance (Infrastructure and trained personnel)
- To date, 285 samples have been collected from 5 states
 - Spring 2011: South Carolina (n=68)
 - Spring 2012: West Virginia (n=42)
 - Fall 2012: New York (n=107)
 - Missouri (n=33)
 - New Jersey (n=35)
- Testing by PCR as previously described



Results

State	Tissue Type	Number Sampled	# Positive (%)
Missouri	Liver	33	8 (24%) ^a
New Jersey	Bone Marrow	35	13 (37%) ^a
New York	Bone Marrow	107	44 (41%) ^{a,b}
South Carolina	Liver	68	33 (49%) ^{b,c}
West Virginia	Liver	42	68 (50%) ^{b,c}

*Numbers with the same letter are not significantly different from each other

**No significant difference between tissue type tested

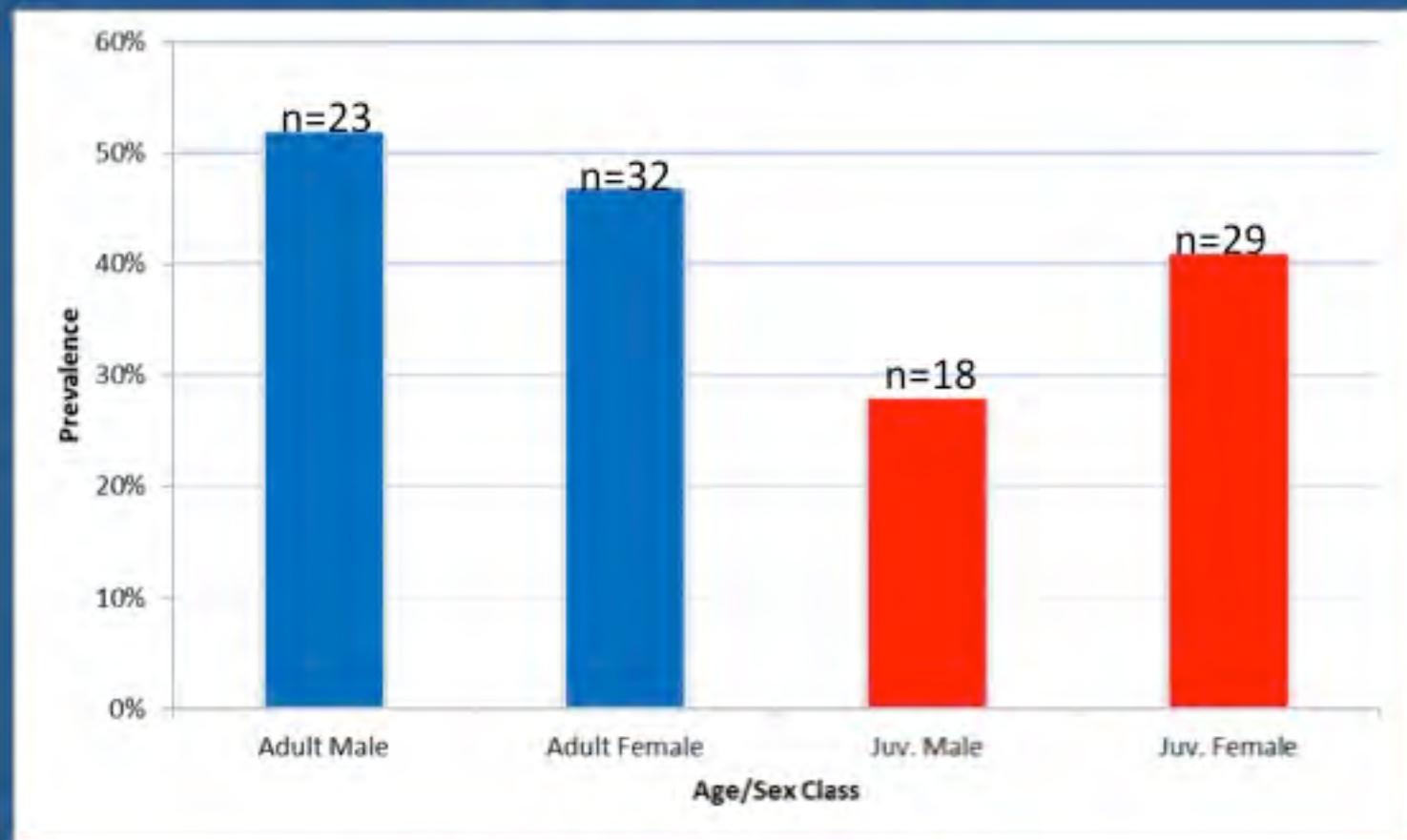
A map of Virginia divided into its constituent counties. The majority of the counties are shaded in red, while a smaller number of counties, primarily in the western and northwestern parts of the state, are shaded in black. This visual representation corresponds to the data presented in the accompanying table regarding the percentage of the population aged 65 and over living alone.

A map of Georgia with its counties outlined. Several counties are shaded in black and others in red. The black-shaded counties are: Spalding, Walton, Wilkes, Jasper, Hancock, and Burke. The red-shaded counties are: DeKalb, Douglas, Cobb, Clayton, and Chatham.

A map of Illinois with county boundaries. The counties of Cook, DuPage, Kane, Kendall, and Lake are colored black. The counties of Adams, Alexander, Bond, Boone, Brown, Calhoun, Cass, Carroll, Champaign, Clark, Clinton, Coles, Crawford, DeKalb, DeWitt, Douglas, Edwards, Effingham, Hancock, Hardin, Jasper, Johnson, Joazeur, Madison, Macoupin, Menard, Mercer, Morgan, Moultrie, Newton, Norman, Oglethorpe, Pope, Pulaski, Richland, Sangamon, Shelby, St. Clair, St. Louis, Taylor, Tazewell, Union, Vermilion, Warren, Washington, Wayne, White, Woodford, and York are colored red.

Not Tested
 Positive
 Negative

LPDV Detection Among Different Age/Sex Groups in New York



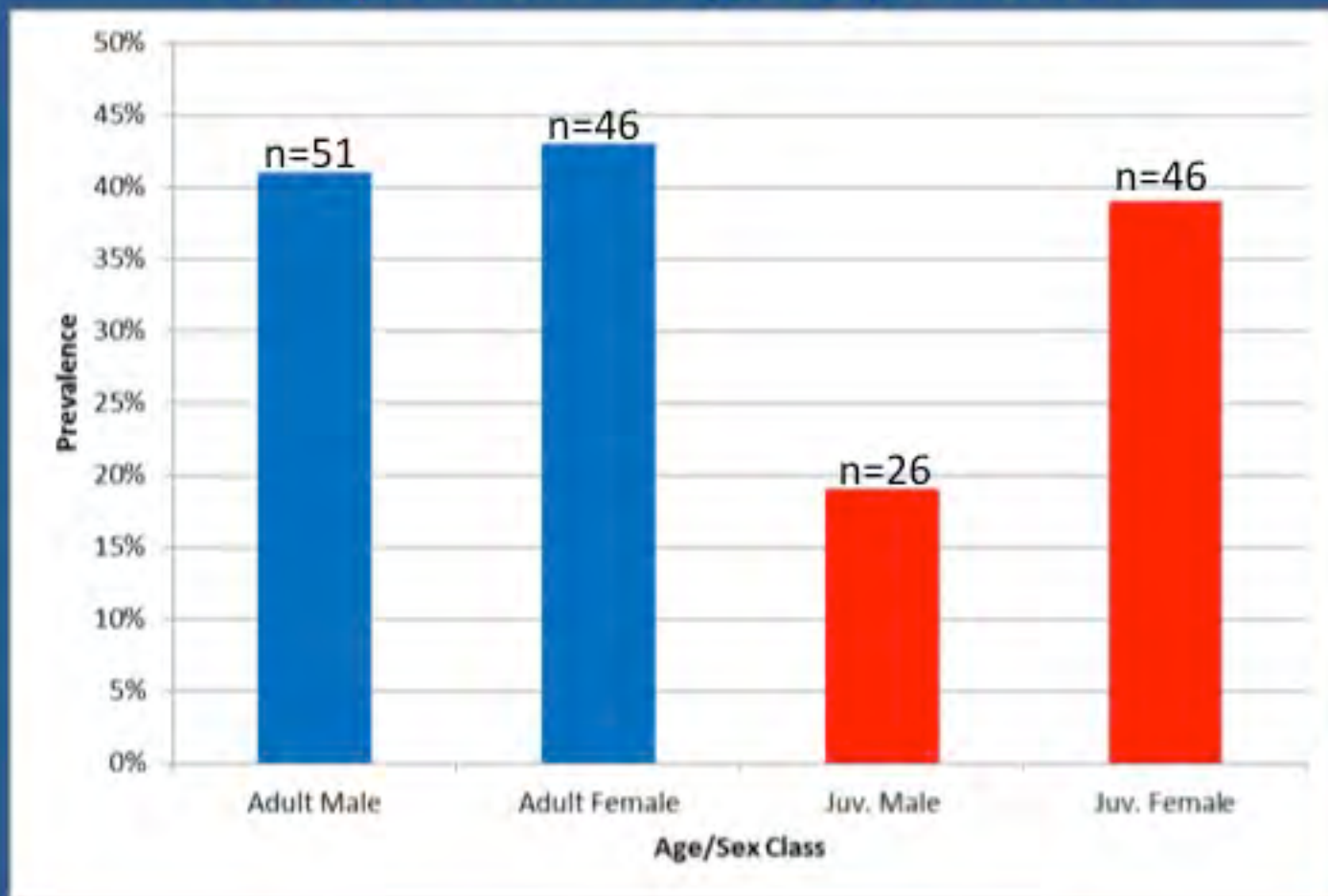
Adult Males vs. Adult females ($p=0.79$)

Juv. Males vs. Juv. Females ($p=0.53$)

Adults vs. Juveniles ($p=0.23$)

Males vs. Females ($p=0.84$)

LPDV Detection Among Different Age/Sex Groups from NY, MO, and NJ



Adult Male vs. Adult Female ($p=0.84$)

Juv. Male vs. Juv. Female ($p=0.12$)

Adults vs. Juveniles ($p=0.2$)

Males vs. Females ($p=0.34$)

Conclusion

- High prevalence of LPDV proviral DNA among Eastern Wild Turkeys
 - Clinical disease is uncommon
 - We currently do not know whether these positives represent whole virus or segments of viral DNA
- Widespread across the eastern United States
- Appears that the virus has been in the U.S. for a long period of time
 - Misdiagnosed and not looked for until now

Future directions

- Increase sample size
 - Expecting samples from at least 11 more states
 - More samples from 5 states presented today
- Collection of multiple samples from individual turkeys to evaluate best tissue for diagnostics
- Targeted surveillance of additional wild turkey subspecies and wild galliform species



LPDV Future Studies

- Genetically characterize the North American wild turkey LPDV
 - Allison (Cornell Univ.)
- Characterize epidemiology in wild turkeys
 - Brown (UGA)
- Determine how to culture virus
 - Zavala (PDRC), Fadley (USDA-ARS)
- Characterize pathobiology
 - Zavala (PDRC)

Acknowledgements

- Numerous wildlife biologists and veterinarians
 - James Crum (WVDNR), Elizabeth Bunting (Cornell Univ.), Kevin Hynes (NYS DEC), Tony McBride (NJDFW), Jason Isabelle (MDC), and SCDNR
- Funding provided through the continued support of SCWDS by member states and federal agencies.



Questions?

