SCWDS BRIEFS

A Quarterly Newsletter from the
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Working Together: The 40th Anniversary of the National Hemorrhagic Disease Survey

In the last two issues of *SCWDS BRIEFS*, we provided examples of how data from this long-term collaborative survey has been used to document the northern expansion of hemorrhagic disease (HD) in North America and how such data can provide a map of HD risk across broad landscapes. Understanding why the range of HD is expanding or why we observe these spatial patterns, however, is an ongoing challenge and our overall goal is not only to document HD occurrence but to understand the mechanisms that drive the observed spatial and temporal patterns. In part three of this series we provide a recent example of how the data from the HD survey have been used to investigate some of the mechanisms that drive regional HD outbreaks.

Part 3: The role of drought as a driver of HD in the eastern United States.

We recently had the privilege to work with a team of researchers at the Department of Fisheries and Wildlife at Michigan State University to investigate the role of drought in the epidemiology of HD. The study was led by Dr. Sonja Christensen, and the results were recently published (See: Christensen SA, Ruder MG, Williams DM, Porter WF, Stallknecht DE. The role of drought as a determinant of hemorrhagic disease in the eastern U.S. *Global Change Biology* 2020;26(7):3799-3808. https://onlinelibrary.wiley.com/doi/abs/10.1111/gcb.15095).

Understanding the drivers of HD is a complicated process as there are many potential environmental, host, and viral factors that interact to produce and drive an HD outbreak. For example, climate factors such as temperature not only influence vector population dynamics but can also affect the ability of EHDV and BTV to replicate in these vectors. Drought, which is often correlated with high temperature along with low seasonal rainfall events, is another example of a potential risk factor that may not only affect *Culicoides* development but may also have host related implications such as increasing host density around water sources and wetland areas where *Culicoides* vectors breed.

During 2007 and 2012, widespread HD outbreaks occurred in the eastern and midwestern United States, and there was a spatial correlation between areas affected by severe drought and areas where HD occurred. Previous research also has identified drought like conditions, such as high temperatures and low precipitation, as risk factors for HD. To further investigate this potential relationship, we focused on 23 states in the eastern United States that have reported HD related mortality during the period 2000-2014. These included states where HD has historically occurred since 1980 and states such as Michigan, Pennsylvania, and Wisconsin where HD reports have been recently documented or are increasing. The period 2000-2014 was selected based on the availability of data from the Drought Monitor (http://droughtmonitor.unl.edu/). Archived drought data from this site are available at a county level and include intensity estimates based on objective and well-known indicators of drought. We selected data from the last week of August to include in the analysis as this time point reflects drought conditions at a time when most HD outbreaks are occurring. In addition to HD mortality and drought data, other potentially relevant drivers and factors were included in the analysis; these included, wetland cover, physiographic region, latitude, longitude, year, and state. The analysis was done using a generalized linear mixed model to explain HD occurrence based on these potential spatiotemporal predictors. Results indicated that drought severity was a significant predictor of HD presence. This relationship, however, was highly dependent on latitude and only was significant at northern latitudes.

The findings improve our understanding of the epidemiology of HD and help to inform deer management. However, in both cases there is a need for thoughtful and informed interpretation of study results. The observed relationship between increasing significance of drought with increasing latitude provides

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a relevant example. In this analysis, latitude likely served as a proxy to herd immunity which increases in deer populations at lower latitudes and is low to absent in deer herds in northern latitudes. Herd immunity, as provided by previous infections with EHDV or BTV, serves to decrease both mortality and the severity of disease. Because herd immunity can fluctuate and even become cyclic over time, it represents an important and additional factor in endemic southern areas that likely reduce potential effects of climate related drivers such as drought. From an epidemiologic standpoint, the lesson relates to fully recognizing the complexity of HD and the epidemiologic variation that can occur over broad landscapes. From a management standpoint the lesson is the same, as the importance of individual risk factors may or may not apply equally to all areas.

There is an observation not associated with this study that also deserves attention and provides an important perspective on risk factors. Following this analysis and the identification of drought as a driver of HD outbreaks, we documented a substantial outbreak of HD in 2017 that occurred in the Appalachian Plateau. This outbreak, which affected a large land area and resulted in substantial white-tailed deer mortality, occurred in the absence of drought and in the absence of high levels of herd immunity. This example demonstrates that a risk factor such as drought only indicates that an event or outbreak is *more likely* to occur, not that it will. It is possible that drought is not a needed prerequisite for HD and only intensifies an outbreak rather than starting it.

What does all this mean to management? At present our “management” for HD is centered on risk communication, and this is generally started after HD is detected during late summer. This is not the perfect early warning that we want, but knowing that a problem is coming, knowing what to expect in the way of potential outcomes and population effects, and having the information to communicate to the public are of value. Identifying drought as an important risk factor in HD outbreaks helps us refine our ability to provide insight into possible outcomes, improve risk communication, and with additional work, to possibly predict HD outbreaks earlier and more reliably. This will be especially important in northern areas where the range of HD is expanding into naïve white-tailed deer populations.

As always, we want to thank the agencies and wildlife professionals who contribute the HD data we used in this study. This work was additionally supported by the Michigan Department of Natural Resources and the Boone and Crockett Quantitative Wildlife Center. (Prepared by Dave Stallknecht, Mark Ruder and Sonja Christensen, Michigan State University)

An Update on the COVID-19 Pandemic

Impact on SCWDS Activities

When our last *SCWDS BRIEFS* issue was released in April, the United States was just beginning to grapple with the COVID-19 pandemic and a nationwide State of Emergency. As human cases and deaths continue to increase in the Southeast and many other locations around the world, the pandemic shows no signs of slowing down.

This unprecedented situation has resulted in significant changes at SCWDS. In mid-March, the University of Georgia adopted numerous important disease mitigation strategies to protect public health, many of which impacted SCWDS research, service, and instructional activities. Non-essential travel remains restricted while field and laboratory research activities are now resuming but with added preventive measures. Many SCWDS staff and faculty have been primarily working from home since mid-March, and UGA’s summer semester courses were conducted exclusively online, and UGA College of Veterinary Medicine student clinical rotations were cancelled (including the SCWDS externship program). UGA is now undergoing a multi-phased reopening strategy for a safe and gradual return to normal services and instruction by mid-August. During this time, SCWDS remains available to assist our member agencies with wildlife mortality investigations. The SCWDS Diagnostic Services Section continues to operate under new practices to limit human interaction. Please contact us if you need assistance.

North American Wildlife and SARS-CoV-2

In late 2019, the novel coronavirus classified as severe acute respiratory syndrome (SARS)-CoV-2 first emerged in humans. SARS-CoV-2 is believed to have a wildlife origin and although the exact source remains undetermined, molecular studies suggest that a bat species served as the original host of the virus. The virus also may have amplified in a second animal species (such as a pangolin) before ultimately transmitting to humans.

In recent months, much attention has been given to further understanding the SARS-CoV-2 host range. To date, natural infections with this virus have been documented in tigers and lions in zoos, farmed mink, and domestic cats and dogs. Though apparently rare, these infections occurred in animals that were under human care, not in free-ranging wildlife. In some cases, the source of infection was traced back to one or more infected humans in close proximity to the affected animal(s), such as an infected pet’s owner or a zoo

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animal keeper. This suggests reverse zoonosis is a possible route of infection for animals. Human-to-animal transmission is of particular concern in scenarios in which close and extended human-animal contact occurs, such as with wildlife rehabilitation, education, exhibition, production settings, research, or live trapping and handling.

Several studies are currently underway to determine susceptibility to SARS-CoV-2 infection in rodents, non-human primates, bats, and other non-domestic species considered to be at relatively high-risk for infection. While it is too early to fully understand the impact of SARS-CoV-2 on animals, there is currently no evidence that the virus can be transmitted or maintained in free-ranging North American wildlife populations.

Until more is understood about the risk of zoonosis or reverse-zoonosis of SARS-CoV-2, it is prudent to minimize these risks by following current recommendations established to prevent coronavirus infections between humans. These include avoiding contact with wildlife species when ill, minimizing non-essential management or research associated with species of concern, and wearing basic personal protective equipment (e.g., gloves, face masks) when handling or in close contact with wildlife. Reverse zoonosis concerns continue to emphasize bats, mustelids, canids, and felids based on current knowledge of host range but this could rapidly change as we learn more.

Several resources provide guidance on handling wildlife, and many are continuously updated to reflect new findings and current knowledge. Among these, the Food and Agriculture Organization of the United Nations (FAO) released a qualitative exposure assessment of exposure to SARS-CoV-2 from animals (http://www.fao.org/3/ca9959en/ca9959en.pdf), and the United States Geological Survey (USGS) and U.S. Fish and Wildlife Service (USFWS) performed a risk assessment of the transmission of SARS-CoV-2 from humans to bats (https://pubs.usgs.gov/of/2020/1060/ofr20201060.pdf). The Centers for Disease Control and Prevention has provided guidance for testing of wildlife for SARS-CoV-2 (https://www.cdc.gov/coronavirus/2019-ncov/animals/pets-other-animals/wildlife-testing.html) and the Fish and Wildlife Health Committee of the Association of Fish and Wildlife Agencies summarized current knowledge of SARS-CoV-2 in mustelids, canids, and felids (https://www.fishwildlife.org/application/files/2415/9230/2533/AFWA_Statement_on_COVID-19_and_Mustelids_Felids_and_Canids_June_9_2020.pdf). Finally, a collaborative document by the Zoo and Aquarium All Hazards Preparedness, Response, and Recovery (ZAHP) Fusion Center provided guidance for the handling of non-domestic animals in human care (https://zahp.aza.org/covid-19-animal-care/). (Prepared by Natalie Stilwell and Mark Ruder).

Anticoagulant Rodenticide Toxicosis in a Black Bear

Black bears are adaptable and are capable of utilizing habitats with varying land-use patterns and frequently use diverse den sites. Accordingly, this may put them in close proximity to humans. Such a scenario occurred last winter when an adult, female black bear and her three cubs denned under a private citizen's deck in Pickens County, Georgia. In March 2019, the homeowner observed the sow emerge from the den for the first time – unfortunately, she then rolled around on the ground and subsequently died. Georgia Department of Natural Resources personnel captured the three cubs and placed them in zoos and submitted the bear carcass to SCWDS for necropsy and diagnostic testing.

On necropsy, the sow was in excellent nutritional condition. The thoracic cavity was filled with approximately 2 liters of non-clotted blood and a small amount of clotted blood (Figure 1).

Figure 1. Unclotted blood filling the chest cavity of a black bear with anticoagulant rodenticide toxicosis

Numerous hemorrhages were observed along the right side of the neck and both hindquarters. All lung lobes and the retroperitoneal spaces were filled with non-clotted blood, and a small amount of non-clotted blood was also observed in the abdominal cavity. Pinpoint hemorrhages were scattered along the outer surface of the small intestines, stomach, and urinary bladder. Microscopic examination supported gross necropsy findings. Overall, postmortem findings suggested the bear died acutely from coagulopathy (i.e., uncontrolled bleeding due to poor clotting ability).

A sample of liver from the bear was submitted to the California Animal Health and Food Safety Laboratories

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(CAHFSL) in Davis, CA, for anticoagulant rodenticide screening. Brodifacoum and bromadiolone were both detected at extremely high levels (6200 parts per billion and 2000 parts per billion, respectively). A trace amount of difenacoum was also detected, which indicates that difenacoum was present in the sample, but at a concentration below the stated reporting limit. Brodifacoum, bromadiolone, and difenacoum are all second-generation anticoagulant rodenticides, which are highly toxic to non-target hosts, such as many wildlife species. Second generation anticoagulant rodenticides, which are vitamin K-antagonists, disrupt the body's ability to recycle vitamin K. Vitamin K plays a significant role in forming blood clots, and when its activity is disrupted, vitamin K-dependent clotting factors are no longer produced, resulting in the inability to adequately clot blood (i.e., coagulopathy). Second generation rodenticides have a longer half-life than first generation rodenticides and therefore, are capable of affecting the body for a longer period of time with more significant effects. Non-target animals that consume sufficient quantities of these toxic chemicals often bleed out internally and present in a similar manner as this bear. Although there is some evidence for anticoagulant rodenticide passage through the milk, the cubs in this case appeared unaffected.

Many wildlife species, as well as domestic animals, suffer from anticoagulant rodenticide exposure and toxicosis from either direct ingestion of the poison or secondarily by scavenging exposed prey (such as rodents). Mortality events are not uncommon and can occur as a result of accidental exposure or malicious intent. Raptors, such as bald eagles, are thought to be more frequently exposed to these compounds than many other wild animals; however, any wild animal could potentially be exposed. The source of exposure in this bear is unknown. Anticoagulant rodenticide bait, as well as carcasses of animals that die from ingestion of rodenticides, also are considered potentially hazardous to humans. Label instructions should always be followed when distributing rodenticides to ensure that domestic and non-target, wild animals cannot access these compounds. Further, animals that may have been exposed to these rodenticides should not be consumed by humans. SCWDS thanks the Georgia Department of Natural Resources for submission of this interesting case. (Prepared by Armaghan Nasim, Virginia-Maryland College of Veterinary Medicine, Melanie Kunkel, and Nicole Nemeth).

RHDV2 Testing Capacity

Rabbit hemorrhagic disease virus 2 (RHDV2) continues to spread across the western US in both domestic and wild rabbit populations. In collaboration with the United States Department of Agriculture (USDA), SCWDS has been approved to serve as a laboratory available for testing wild lagomorphs for RHDV2. The RHDV2 real-time reverse transcription polymerase chain reaction assay used at SCWDS follows the same protocol used by the Foreign Animal Disease Diagnostic Laboratory (National Veterinary Services Laboratories, USDA). The National Wildlife Health Center (U.S. Geological Survey) also has RHDV2 diagnostic capacity for wild lagomorphs. If a positive result is obtained in a new species or new state, the sample will be forwarded to FADDL for confirmation. SCWDS will continue to collaborate closely with state and federal agriculture agencies regarding RHDV2 testing. We encourage wildlife agencies to remain vigilant and investigate wild rabbit and hare mortality events. To submit a carcass to SCWDS for testing, please work with our Diagnostic Service to coordinate shipment. (Prepared by Mark Ruder and Becky Poulson)

A Note to Our Readers

We thank you for your sustained interest in our quarterly newsletter, the *SCWDS BRIEFS*. We continue to receive positive feedback from many readers, which lets us know that we are still providing items of interest to you in each issue.

One difficult aspect of putting out a publication such as the *BRIEFS* is maintaining the distribution list. We want to reach as many of you as we can, but can do so only if you let us know you want to be included on the distribution list, notify us of any mailing address or email address changes, or inform us of someone else you know who would like to be added. Of course, we encourage you to choose to opt for the email list-serve if you want to reduce the volume of mail coming into your home or office. Please contact us if you wish to be removed from the regular mailing list and have your name added to our email list to be informed when each new issue is posted on our website. This way, you usually can read the newsletter at least 10 days before a mailed copy would arrive. As always, if you have suggestions for improvement of the *BRIEFS*, please let us hear from you. Our goal is to provide information of interest to you.

Recent SCWDS Publications Available

Below are some recent publications authored or co-authored by SCWDS staff. Many of these can be accessed online from the web pages of the various journals. If you do not have access to this service and would like to have a copy of any of these papers, let us know. Many can be sent to you electronically with minimum effort; others will be mailed to you. For your convenience, please indicate requested publications, fill out the form on page 7, and check the appropriate box

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to receive either an electronic copy or a hard copy and return it to us: SCWDS, College of Veterinary Medicine, University of Georgia, Athens, GA 30602 or email at brewton@uga.edu.

____Adams, H., M.H. Murray, C. Welch, A. Kidd-Weaver, T. Ellison, S. Curry, J. Hepinstall-Cymerman, and S.M. Hernandez. 2019. Capturing American white ibises in urban South Florida using two novel techniques. *Journal of Field Ornithology* doi: 10.1111/jofo.12311.

____Allen, S.E., N.A. Vogt, B. Stevens, M.G. Ruder, C.N. Jardine, and N.N. Nemeth. 2020. A retrospective summary of cervid morbidity and mortality in Ontario and Nunavut regions of Canada (1991-2017). *Journal of Wildlife Diseases* 56(4); doi: 10.7589/JWD-D-19-00018.

____Ayala, A.J., S.M. Hernandez, T.L. Olivier, C.N. Welch, K.M. Dimitrov, I.V. Goraichuk, C.L. Afonso, and P.J. Miller. 2019. Experimental infection and transmission of Newcastle disease vaccine virus in four wild passerines. *Avian Diseases* 63(3): 389-399.

____Bahnson, C.S., S.M. Hernandez, R.L. Poulson, R.E. Cooper, S.E. Curry, T.J. Ellison, H.D. Adams, C.N. Welch, and D.E. Stallknecht. 2020. Experimental infections and serology indicate that American white ibis (*Eudociumus albus*) are competent reservoirs for type A influenza virus. *Journal of Wildlife Diseases* doi: 10.7589/2019-05-136.

____Bahnson, C.S., R.L. Poulson, L.P. Hollander, J.C. Bradley, and D.E. Stallknecht. 2020. Susceptibility of laughing gulls (*Leucophaeus atricilla*) and mallards (*Anas platyrhynchos*) to ruddy turnstone (*Arenaria interpres morinella*) origin type A influenza viruses. *Journal of Wildlife Diseases* 56(1): 167-174.

____Bloodgood, J.C.G., S.M. Hernandez, A. Isaiah, J.S. Suchodolski, L.A. Hoopes, P.M. Thompson, T.B. Waltzek, and T.M. Norton. 2020. The effect of diet on the gastrointestinal microbiome of juvenile rehabilitating green turtles (*Chelonia mydas*). *PloS One* 15(1): e0227060.

____Calvente, E., N. Chinnici, J.D. Brown, J.E. Banfield, J.W. Brooks, and M.J. Yabsley. 2020. Winter tick (*Dermacentor albipictus*)-associated dermatitis in a wild elk (*Cervus canadensis*) in Pennsylvania, USA. *Journal of Wildlife Diseases* 56(1): 247-250.

____Chambouvet, A., V. Smilansky, M. Jirku, M. Isidora-Ayza, S. Itoiz, E. Derrelle, A. Monier, D.J. Gower, M. Wilkinson, M.J. Yabsley, J. Lukes, and T.A. Richards. 2020. Diverse alveolate infections of tadpoles, a new threat to frogs? *PloS Pathogens* 16(2): e1008107.

____Christensen, S.A., M.G. Ruder, D.M. Williams, W.F. Porter, and D.E. Stallknecht. 2020. The role of drought as a determinant of hemorrhagic disease in the eastern United States. *Global Change Biology* 26(7): 3799-3808.

____Cleveland, C.A., K.B. Garrett, E.K. Box, Z. Eure, A.A. Majewska, J.A. Wilson, and M.J. Yabsley. 2020. Cooking copepods; the survival of cyclopoid copepods (Crustacea; Copepoda) in simulated provisioned water containers and implications for the Guinea Worm Eradication Program in Chad, Africa. *International Journal of Infectious Diseases* 95: 216-220; doi: 10.1016/j.ijid.2020.03.016.

____Cleveland, C.A., L. Swanepoel, J.D. Brown, M.J. Casalena, L. Williams, and M.J. Yabsley. 2020. Surveillance for *Borrelia* spp. in upland game birds in Pennsylvania, USA. *Veterinary Sciences* 7(3), 82.

____Cozad, R.A., S.M. Hernandez, T.M. Norton, T.D. Tuberville, N.I. Stacy, N.L. Stedman, and M.J. Aresco. 2020. Epidemiological investigation of a mortality event in a translocated gopher tortoise (*Gopherus polyphemus*) population in northwest Florida. *Frontiers in Veterinary Science* https://doi.org/10.3389/fvets.2020.00120.

____Cozad, R.A., T.M. Norton, M.J. Aresco, M.C. Allender, and S.M. Hernandez. 2020. Pathogen surveillance and detection of ranavirus (*Frog virus 3*) in translocated gopher tortoises (*Gopherus polyphemus*). *Journal of Wildlife Diseases* doi: 10.7589/2019-02.053.

____Diskin, E.R., K. Friedman, S. Krauss, J.M. Nolting, R.L. Poulson, R.D. Slemons, D.E. Stallknecht, R.G. Webster, and A.S. Bowman. 2020. Subtype diversity of influenza A virus in North American waterfowl; a multidecade study. *Journal of Virology* 94(11) e02022-19.

____Ford, A.K., K.D. Niedringhaus, A.N. Anderson, J.M. LaCour, and N.M. Nemeth. 2020. Disseminated *Mycobacterium kansasii* infection in a white-tailed deer and implications for public and livestock health. *Journal of Veterinary Diagnostic Investigation* 32(1): 147-151.

____Ganoe, L.S., J.D. Brown, M.J. Yabsley, M.J. Lavallo, and W.D. Walter. 2020. A review of pathogens, diseases, and contaminants of muskrats (*Ondatra zibethicus*) in North America. *Frontiers in Veterinary Science* 7: 233.

____Garrett, K.B., E.K. Box, C.A. Cleveland, A.A. Majewska, and M.J. Yabsley. 2020. Dogs and the classic route of Guinea Worm transmission: an

Continued…

evaluation of copepod ingestion. *Scientific Reports* 10(1): 1430.

____Gettings, J.R., S.C. Self, C.S. McMahan, D.A. Brown, S.K. Nordone, and M.J. Yabsley. 2020. Local and regional temporal trends (2013-2019) of canine *Ehrlichia* spp. seroprevalence in the USA. *Parasites & Vectors* 13: 153; doi: 10.1186/s13071-020-04022-4.

____Gibson, D.J., N.M. Nemeth, H. Beaufrère, C. Varga, D. Ojkic, A. Marom, and L. Susta. 2019. Development and use of a triplex real-time PCR assay for detection of three DNA viruses in psittacine birds. *Journal of Veterinary Diagnostic Investigation* 31(5): 719-725.

____Greenawalt, D., P. Dunn, J.D. Brown, M.J. Yabsley, L. Williams, M.J. Casalena, R. Boyd, E. Debelak, H. Wildicka, E. Phillips, and E. Wallner-Pendleton. 2020. Surveillance for *Heterakis* spp. in game birds and cage-free, floor-raised poultry in Pennsylvania, USA. *Avian Diseases* 64(2): 210-215; doi.org/10.1637/aviandiseases-D-19-00164.

____Groves, B.A., M.J. Yabsley, L. Swanepoel, and M. Garner. 2020. Lungworm (*Crenosoma goblel*) infection in unweaned free-ranging raccoons (*Procyon lotor*) in Washington State, USA. *Journal of Wildlife Diseases* doi: 10.7589/2019-03-060.

____Huckins, G.L., D. Eschar, D. Schwarz, M. Morton, B.H. Herrin, A. Cerezo, M.J. Yabsley, and S.M. Schneider. 2019. *Trypanosoma cruzi* infection in zoo-housed red panda in Kansas. *Journal of Veterinary Diagnostic Investigation* 31(5): 752-755.

____Jia, B., A. Colling, D.E. Stallknecht, D. Biehert, J. Bingham, B. Crossley, D. Eagles, and I.A. Gardner. 2020. Validation of laboratory tests for infectious diseases in wild mammals: review and recommendations. *Journal of Veterinary Diag. Investigation* doi: 10.1177/1040638720920346.

____Kidd-Weaver, A., J. Hepinstall-Cymerman, C.N. Welch, M.H. Murray, H.C. Adams, T.J. Ellison, M.J. Yabsley, and S.M. Hernandez. 2020. The movements of a recently urbanized wading bird reveal changes in season timing and length related to resource use. *PLoS One* 15(3): e0230158.

____Larouche, C., H. Beaufrere, C. Mosley, N. Nemeth, and C. Dutton. 2019. Evaluation of the effects of midazolam and flumazenil in the ball python (*Python regius*). *Journal of Zoo and Wildlife Medicine* 50(3): 579-588.

____Larouche, C, J. Beeler-Marfisi, L. Attard, N. Nemeth, and H. Beaufrere. 2019. Hemolymph cytology, hemocyte count, and electrolyte reference values in 93 Cameroon red tarantulas (*Hysterocrates gigas*). *Veterinary Clinical Pathology* 48(3): 461-468.

____MacDonald, A.M., J.R. Barta, M. McKay, S. Lair, R. Le Net, F. Baldwin, N. Pople, and N.M. Nemeth. 2019. Lymphoproliferative disease virus in wild turkeys (*Meleagris gallopavo*) from Manitoba and Quebec, Canada. *Avian Diseases* 63(3): 506-510.

____MacDonald, A.M., D.J. Gibson, J.R. Barta, R. Poulson, J.D. Brown, A.B. Allison, and N.M. Nemeth. 2019. Bayesian phylogenetic analysis of avipoxviruses from North American wild birds demonstrates new insights into host specificity and interspecies transmission. *Avian Diseases* 63(3): 427-432.

____Niedringhaus, K.D., J.D. Brown, M.A. Ternent, C.A. Cleveland, and M.J. Yabsley. 2019. A serosurvey of multiple pathogens in American black bears (*Ursus americanus*) in Pennsylvania, USA, indicates a lack of association with sarcoptic mange. *Veterinary Science* 6(4): 75.

____Niedringhaus, K.D., J.D. Brown, M.A. Ternent, S.K. Peltier, P. Van Wick, and M.J. Yabsley. 2020. Serology as a tool to investigate sarcoptic mange in American black bears (*Ursus americanus*). *Journal of Wildlife Diseases* doi: 7589/2019-04-086.

____Niedringhaus, K.D., J.D. Brown, M.A. Ternent, S.K. Peltier, and M.J. Yabsley. 2019. Effects of temperature on the survival of *Sarcoptes scabiei* of black bear (*Ursus americanus*) origin. *Parasitology Research* 118(10): 2767-2772.

____Niedringhaus, K.D., N.M. Nemeth, H.S. Sellers, J.D. Brown, and H.M.A. Fenton. 2019. Multicentric round cell neoplasms and their viral associations in wild turkeys (*Meleagris gallopavo*) in the Southeastern United States. *Veterinary Pathology* 56(6): 915-920.

____Oakes, V.J., M.J. Yabsley, D. Schwartz, T. LeRoith, C. Bissett, C. Broaddus, J.L. Schlater, S.M. Todd, K.M. Boes, M. Brookhart, and K.K. Lahmers. 2019. *Theileria orientalis* Ikeda genotype in cattle, Virginia USA. *Emerging Infectious Diseases* 25(9): 1653-1659.

____Poulson, R.L., and J.D. Brown. 2020. Wild bird surveillance for avian influenza virus. *Methods Mol Biol.* 2020;2123:93-112. doi: 10.1007/978-1-0716-0346-8_8.

____Reeves, A.B., A.M. Ramey, J.C. Koch, R.L. Poulson, and D.E. Stallknecht. 2020. Field-based method for assessing duration of infectivity for influenza A viruses in the environment. *Journal of Virology Methods* doi: 10.1016/j.jviromet.2020.113818.

Continued…

____Rothenburger, J.L., C.G. Himsworth, N.M. Nemeth, D.L. Pearl, P. M. Treuting, and C.M. Jardine. 2019. The devil is in the details-Host disease and co-infections are associated with zoonotic pathogen carriage in Norway rats (*Rattus norvegicus*). *Zoonoses and Public Health* 66(6): 622-635.

____Self, S.C., Y. Liu, S.K. Nordone, M.J. Yabsley, H.S. Walden, R.B. Lund, D.D. Bowman, C. Carpenter, C.S. McMahan, and J.R. Gettings. 2019. Canine vector-borne disease: mapping and the accuracy of forecasting using big data from the veterinary community. *Animal Health Research Reviews* 20(1): 47-60.

____Stallknecht, D.E., C. Kienzle-Dean, N. Davis-Fields, C.S. Jennelle, A.S. Bowman, J.M. Nolting, W.M. Boyce, J.M. Crum, J.J.S. Santos, J.D. Brown, D.J. Prosser, S.E.W. De La Cruz, J.T. Ackerman, M.L. Casazza, S. Krauss, D.R. Perez, A.M. Ramey, and R.L. Poulson. 2020. Limited detection of antibodies to clade 2.3.4.4 A/goose/Guangdong/1/1996 lineage highly pathogenic H5 avian influenza virus in North American waterfowl. *Journal of Wildlife Diseases* 56(1): 47-57.

____Swenson, S.L., D.G. Mead, and D.R. Kinker. 2019. Rhabdoviruses; rabies virus and vesicular stomatitis viruses. In: Diseases of Swine, 11th Edition. pp. 733-739. J.J. Zimmerman, L.A. Karriker, A. Ramirez, K.J. Schwartz, G.W. Stevenson, and J. Zhang (eds). Wiley-Blackwell Publishing, Ames, IA.

____Taylor, K.Y., M.G. Ruder, D.G. Mead, and D.E. Stallknecht. 2020. An embryonated egg transmission model for epizootic hemorrhagic disease virus. *Vector Borne and Zoonotic Diseases* doi: 10.1089/vbz.2019.2590.

____Thompson, A.T., C.A. Cleveland, T.M. Koser, S.T. Wyckoff, and M.J. Yabsley. 2019. The occurrence of *Physaloptera hispida* and a *Mastophorus* sp. in pulmonary vessels of hispid cotton rats (*Sigmodon hispidus*) from Georgia, USA. *Journal of Parasitology* 105(5): 718-723.

____Thompson, A.T., K. Dominguez, C.A. Cleveland, S.J. Dergousoff, K. Doi, R.C. Falco, T. Greay, P. Irwin, L. Robbin Lindsay, J. Liu, T.N. Mather, C. Oskam, R.I. Rodriquez-Vivas, M.G. Ruder, D. Shaw, S.L. Vigil, S. White, and M.J. Yabsley. 2020. Molecular characterization of *Haemaphysalis* species and a molecular genetic key for the identification of *Haemaphysalis* of North America. *Frontiers in Veterinary Science* 7:141; doi: 10.3389/fvets.2020.00141.

____Thompson, A.T., S. White, D. Shaw, A. Egizi, K. Lahmers, M.G. Ruder, and M.J. Yabsley. 2020. Theileria *orientalis* Ikeda in host-seeking *Haemaphysalis longicornis* in Virginia, U.S.A. *Ticks and Tick-Borne Diseases* 11 101450; doi.org/10.1016/j.ttbdis.2020.101450.

____Verhagen, J.H., M. Poen, D.E. Stallknecht, S. van der Vliet, P. Lexmond, S. Sreevatsan, R.L. Poulson, R.A. Fouchier, and C. Lebarbenchon. 2020. Phylogeography and antigenic diversity of low pathogenic avian influenza H13 and H16 viruses. *Journal of Virology* doi: 10.1128/JVI.00537.20.

____Vincent, E.C., M.G. Ruder, M.J. Yabsley, V.S. Hesting, M.K. Keel, J.D. Brown, and N.M. Nemeth. 2020. A *Baylisascaris* outbreak in fox squirrels (*Sciurus niger)* and subsequent detection of *Francisella tularensis* in Kansas, USA. *Journal of Wildlife Diseases* 56(2): 457-461.

____White, S.A., S.N. Bevins, M.G. Ruder, S.L. Vigil, D. Shaw, A. Randall, T. Deliberto, K. Dominquez, A.T. Thompson, J.W. Mertins, J. Alfred, and M.J. Yabsley. 2020. Surveys for ticks on wildlife hosts and in the environment at Asian longhorned tick (*Haemaphysalis longicornis*)-positive sites in Virginia and New Jersey. *Transboundary and Emerging Diseases*.

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