SCWDS BRIEFS

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Sarcoptic Mange Research in Black Bears

For the last six years, SCWDS has been involved in collaborative research to understand more about the emergence and expansion of sarcoptic mange in black bears (*Ursus americanus*) in the northeastern and mid-Atlantic states (https://doi.org/10.1016/j.vprsr.2019.100303). A former Master's student at SCWDS, Sarah Knox Peltier, provided foundational research exploring genetic variation of the parasites in bears and showed that this emergence was not the result of a single, novel, highly-pathogenic mite strain (https://doi.org/10.1645/17-26). Additionally, her research showed that skin scraping was the diagnostic test that most likely resulted in a diagnosis of mange and the ability to identify the causative mite as compared to other more costly and labor-intensive tests (https://doi.org/10.7589/2017-06-148). More recently, a doctoral student, Dr. Kevin Niedringhaus, continued this work by exploring the ability of mites to survive off of the host, whether there are associations between sarcoptic mange and evidence of prior exposure to pathogens commonly present in bears, and if there is widespread exposure of bears to sarcoptic mange mites across the landscape. Results from Dr. Niedringhaus' recently completed research are highlighted below.

Our first objective was to estimate the extent of presumed exposure of bears to *S. scabiei* throughout Pennsylvania, the state currently experiencing the highest number of mange cases diagnosed in bears. There was anecdotal evidence that bears in Northeastern Pennsylvania, particularly in the Poconos, were relatively free of the disease while other parts of the state, namely the central area, were documented to have many cases of mange. Serology, a tool that indirectly measures whether an animal has been exposed to a pathogen by detecting circulating antibodies specific to that pathogen, can provide valuable information on the epidemiology of mange in bears in these regions. If antibodies to mites were widespread in both regions, it would suggest that bears in the central part of the state were predisposed, by some unknown factor, to developing disease associated with *S. scabiei* infection. However, if the overall antibody prevalence was low, we could speculate that all bears are inherently susceptible to developing mange after coming into contact with mites and that the presence of specific risk factors in some populations may be less likely explanations of the apparent variation in disease distribution.

Before research to explore these concepts could begin, a serological test had to be validated because no test was commercially developed for use in black bears. We evaluated a test designed to detect antibodies against *S. scabiei* in dogs. Initially, samples from bears with confirmed sarcoptic mange were used in conjunction with samples from cubs born to seronegative sows to ensure that the test could reliably detect antibodies in known positive cases and were reliably negative in presumed non-exposed cases. Additionally, serum samples collected sequentially from bears after they had received treatment for sarcoptic mange were supplied by collaborators at the Wildlife Center of Virginia to determine the extent that antibodies can still be detected after the disease resolves. This is an important concept because if antibodies were quickly depleted, we would expect our field prevalence estimates to be artificially low.

After confirming that the test was accurate to an acceptable level and understanding the persistence of antibodies over time, 437 samples were collected from harvested bears at check stations in Pennsylvania over two years. These

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samples were divided into two groups: samples from bears originating in high-mange areas and samples from bears in low-mange areas. The seroprevalence of non-diseased bears in the high- and low-mange area was 6.7% and 0%, respecitvely. These data not only show that there is presumably a lack of exposure to mites in the low-mange area but also that few bears in high-mange areas are being exposed without developing clinical disease.

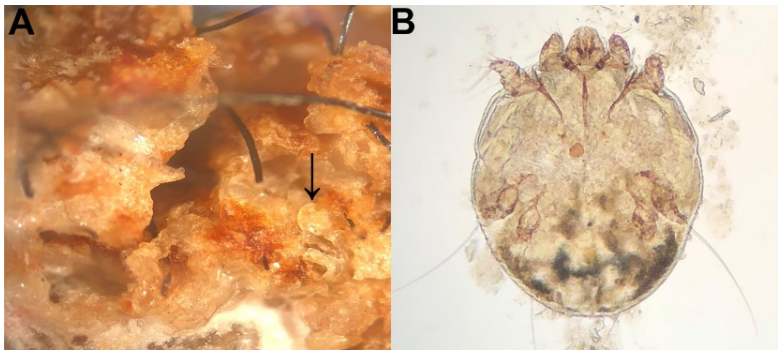

Figure A: Magnified view of crusts on the skin of a bear with severe sarcoptic mange showing an embedded mite (arrow).

Figure B: High-magnification view of an adult female S. scabiei as seen from a skin scrape from a bear with severe mange.

These data provide evidence that bears are inherently susceptible to disease after exposure. This finding has important implications for bear populations in other regions, as there is evidence of the continued disease expansion, including recent confirmed cases in Oklahoma and Arkansas. Additionally, the validation of the serological assay can be used by SCWDS and others to continue research on the epidemiology of mange in bears.

The research that SCWDS students conducted on this subject, as well as a general overview of mange in wildlife, was recently presented at the Eastern Black Bear Workshop in Potosi, Missouri, on April 23, 2019. The presentation was designed to inform biologists and other agency personnel of our current knowledge of the disease, theories on its emergence, and potential implications for bears in the future. Also, for those interested in learning more about sarcoptic mange, we recently published an open access peer-reviewed review of the disease in wildlife in North America (https://doi.org/10.1016/j.ijppaw.2019.06.003).
(Prepared by Kevin Niedringhaus and Michael Yabsley)

Research into the Effects of West Nile Virus on Gamebirds

Since its introduction to the United States in 1999, West Nile virus (WNV) has spread rapidly and is now considered endemic throughout much of North America. WNV is a vector-borne flavivirus that is most commonly transmitted by mosquitoes in the *Culex* genus and circulates between mosquitoes, birds, and mammalian hosts (including humans). Numerous bird species can be infected with WNV but clinical outcome can vary significantly between species, ranging from inapparent infection to death. This varied clinical spectrum appears to occur between galliform species. For example, results from early WNV research indicate that some domesticated galliforms (e.g., chickens and domestic turkeys) are resistant to WNV-associated disease. In contrast, greater sage grouse (*Centrocercus urophasianus*) and more recently, ruffed grouse (*Bonasa umbellus*), are highly susceptible to WNV-associated morbidity and mortality. The potential impacts of WNV on other upland game bird species such as wild turkey (*Meleagris gallopavo silvestris*) and bobwhite quail (*Colinus virginianus*) are largely unknown.

Recently, SCWDS researchers have begun collaborating with wildlife biologists and veterinarians from multiple state agencies across the eastern United States as well as central and eastern Canada to test hunter-harvested, ruffed grouse blood samples for antibodies to WNV. These findings will ultimately be used to develop a multi-year, WNV antibody prevalence data set on ruffed grouse populations across part of their range in eastern North America. The detection of antibodies to WNV in the blood of wild birds generally indicates either prior WNV infection (most likely via mosquito bite) or maternally-derived antibodies (antibodies passed from mother to egg and chick that wane over time). This project developed in response to concerns among numerous state wildlife agencies over ruffed grouse population declines and the current research supporting the potential for WNV to impact ruffed grouse health.

In response to similar concerns regarding depressed population numbers and low recruitment rates in eastern wild turkey and northern bobwhite quail in some areas, SCWDS researchers are also exploring the potential impact of WNV on these species. During the summer and

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fall of 2019, eastern wild turkey poults and juvenile northern bobwhite quail will be experimentally infected with WNV. Groups of turkey and quail will be inoculated with WNV at 6 and 16 weeks post-hatch and monitored for two weeks following inoculation for signs of clinical disease, viral shedding (oropharyngeal and cloacal), and virus in blood (viremia). Postmortem evaluations will assess for pathology and evidence of virus persistence in tissues. Results of this research will provide critical insight into the potential for WNV to impact these upland game bird species and will be useful in interpreting field data. State agencies will be able to consider these data in future management strategies of upland game birds.

We thank the Multistate Conservation Grant Program for funding this study as well as the Pennsylvania Game Commission (PGC) for providing the eastern wild turkey eggs. (Prepared by Melanie Kunkel and Nicole Nemeth)

Snow Geese Mortality Event in Kansas

During March 2019, the morning light revealed a grisly scene on a northwestern Kansas prairie-wetland. Approximately 140 dead and dying snow and Ross's geese (*Chen caerulescens* and *C. rossii*, respectively) were observed near a pond in Norton County, Kansas (Figure 1). Ninety percent of the geese had blood discharging from the ears (Figure 2) and about 25% of these had obvious skull fractures, blood on the feathers of the head, and bulging eyes; others had severed heads. The night before, severe thunderstorms with lightning moved through the area, including strong wind gusts, up to 60 mph. The carcasses of five geese were submitted to SCWDS by the Kansas Department of Wildlife, Parks, and Tourism (KDWPT) for further examination.

Postmortem examination confirmed the field findings of acute skull fractures with hemorrhage, and also revealed blood in the oral cavity, eyes, and ear canals as well as acute spinal fractures with hemorrhage. Examination revealed that all birds were in good nutritional condition and had recently eaten based on digestive tract contents. Microscopic examination revealed hemorrhage in the lung of one bird, but otherwise normal tissues in all five geese. There was no evidence of an infectious process, including avian cholera (caused by *Pasteurella multocida*), which was ruled out by laboratory tests.

Based primarily on the detailed history and field findings provided by KDWPT personnel, gross findings, and lack of other evidence of disease, these geese were diagnosed with severe, acute blunt-force trauma, primarily to the head, as the cause of death. Violent storms in the area the night prior to finding the geese was deemed the likely source of trauma, possibly through strong wind gusts or lightning strike during flight which may have caused confusion and disorientation of the flock leading to collision with each other and the ground. These sources cannot be confirmed, but the gross presentation suggests severe, blunt-force (and high velocity) head trauma, strong enough to cause decapitation in some cases.

Figure 1.

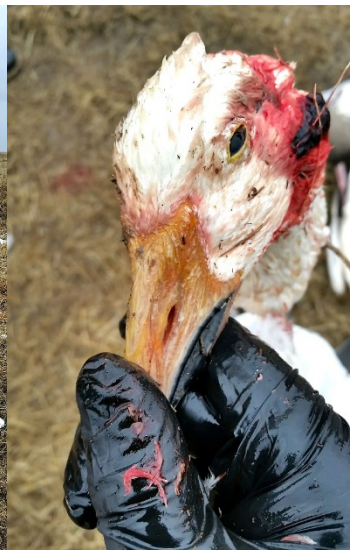

Figure 2.

Snow geese often travel in flocks of dozens of birds or more, which can be joined by smaller numbers of Ross's geese, especially during migration when they often fly at high altitude during the night. This makes them susceptible to large mortality events when they encounter large-scale trauma-inducing factors, toxins, or a highly contagious, infectious pathogen. In the present case, the number of affected birds was between 100 and 200, which were all found within relatively close proximity on the landscape. There have been anecdotal reports of single, dead birds falling from the sky due to lightning strike, which remains an alternative possibility as to the cause of death in these geese in Kansas. Birds may have fallen at high speeds and hit the ground, which could have caused the observed gross findings. Further, the high numbers of affected geese may arise due to confusion and disorientation within the night-flying flock following

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the lightning storm. Strong and unpredictable wind gusts would also likely contribute.

Population numbers of both snow and Ross's geese across their range from Mexico north to the Arctic have steadily increased since the 1950s, believed to be facilitated by warming climates in their northern breeding grounds, allowing for increased access to the vegetation they eat, as well as a lengthened growing season. Concurrent eastward range expansion of Ross's geese has led to increased geographic overlap of the two species, resulting in hybridization. Both species are federally protected game bird species with annual hunting seasons that vary by region.

SCWDS would like to thank the KDWPT for submission of this case, and participation in the case summary and BRIEFS article. (Prepared by Nicole Nemeth, SCWDS; Shane Hesting, and Luke Winge, KDWPT.)

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 mailing 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 mailing list, notify us of any address changes, or inform us of someone else you know who would like to be added to the mailing list. Of course, if you want to reduce the volume of mail coming into your home or office, you may opt 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 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.

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