SCWDS BRIEFS

A Quarterly Newsletter from the

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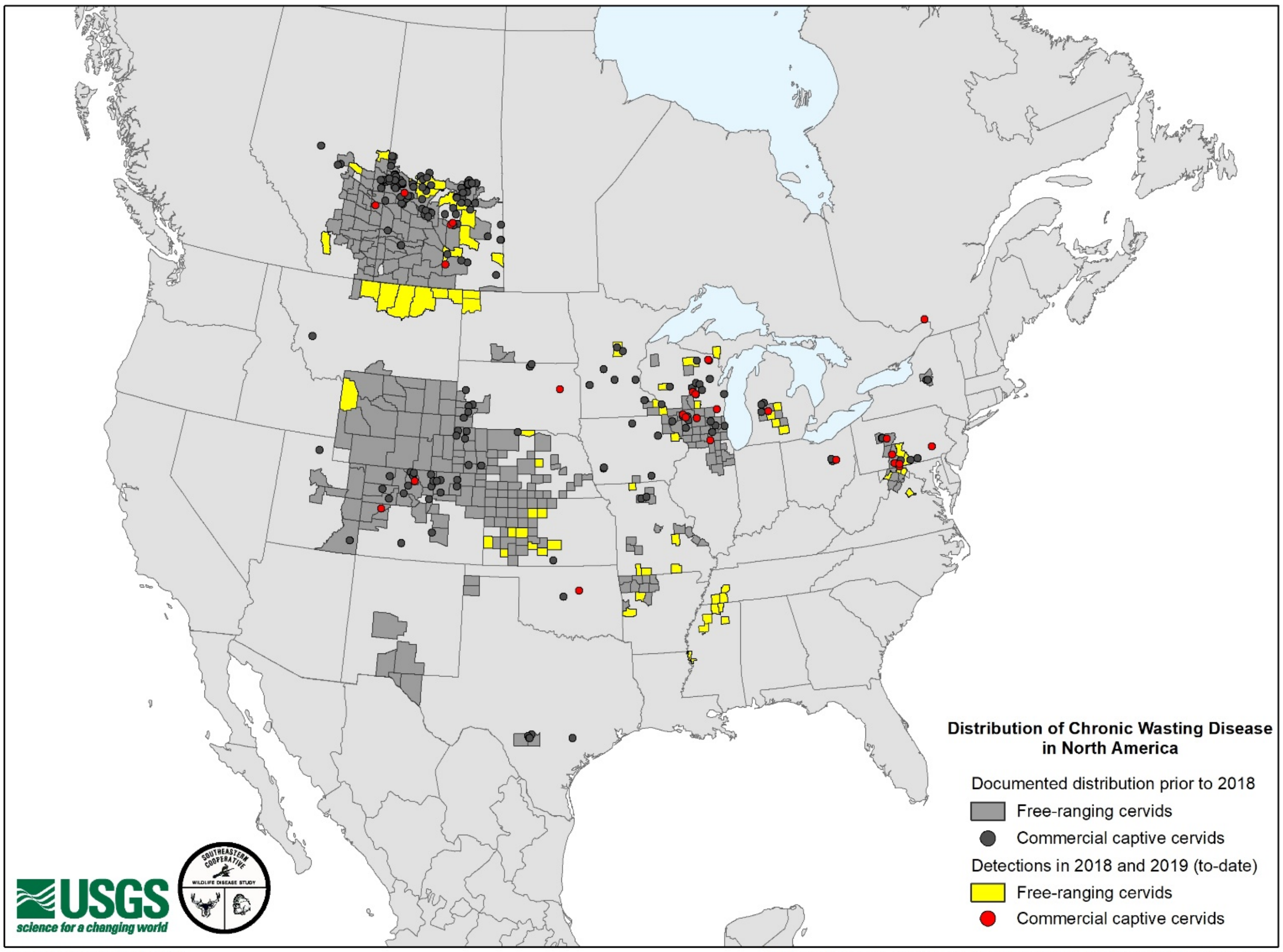

Map updated April 2019

All locations are approximations based on best-available information

Chronic Wasting Disease Update: 2018-19

Our *SCWDS BRIEFS* updates on chronic wasting disease (CWD) in free-ranging and captive cervids are becoming increasingly complicated, concerning, and lengthy. In fact, since our last update on CWD in free-ranging cervids in January 2018, CWD has been detected in so many new areas that we cannot concisely provide details on all the new cases. The map shows historical documentation of CWD in free-ranging and commercial captive cervids, as well as new detections since January 2018. It is easy to get lulled to sleep by the mosaic of dots and polygons, but the map reveals two concerning trends: 1) the continued expansion of known CWD foci, and 2) the detection of CWD in new areas. The sheer number of CWD detections in some areas is also disconcerting. For example, in Wisconsin where CWD was first detected in 2002, surveillance efforts by the Wisconsin Department of Natural Resources yielded over

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1,050 CWD-positive deer during their 2018 sampling year (out of 17,300 samples tested). Although frustrating to wildlife managers, the above trends, likely related to a combination of factors including increased surveillance, increasing local CWD prevalence, natural geographic spread by infected cervids, and human-assisted movements of infected cervids or contaminated materials, are not unexpected and are likely to continue.

The map highlights changes in known CWD distribution over the last 16 months (beginning January 2018); however, it is important to keep in mind this does not necessarily equate to the *spread* of CWD during this timeframe. Although, these "new" positive counties reflect recent detections, CWD may have been present in these populations for many months or even years prior. Rarely does the first case of any disease detected by surveillance efforts equate to the *first* case in a population, and this is likely true of CWD. Although CWD prion transmission among cervids is efficient, this disease can be cryptic due to its long incubation period and slow disease course. These factors, as well as the clustering of positive animals on the landscape can make surveillance for early detection challenging. Accordingly, surveillance efforts and strategies should be considered when evaluating CWD distribution maps.

Since the beginning of calendar year 2018 (i.e., the past 16 months), CWD has been detected in free-ranging cervids in 54 new counties (out of 274 total positive counties) in 16 states. Of these 54 counties, 39 were adjacent to counties with prior detections of CWD in free-ranging cervids and likely represent expansion of known CWD foci. However, 15 of the counties were not adjacent to other counties with prior CWD detections in free-ranging cervids and represent newly recognized foci of CWD on the landscape. CWD had previously been detected in captive cervids in two of these 15 counties.

Among the 18 SCWDS member states, CWD has now been detected in 11 states in free-ranging cervids (Arkansas, Maryland, Mississippi, Tennessee, Virginia, and West Virginia,), commercial captive cervids (Oklahoma), or both free-ranging and captive cervids (Kansas, Missouri, Nebraska, and Pennsylvania). Mississippi and Tennessee are the 23rd and 24th states nationally and the most recent SCWDS member states to confirm CWD in free-ranging cervids. Over the last few months, it has become clear that these disease foci in Mississippi and Tennessee are not distinct, but likely represent another substantial endemic focus of CWD in the Southeast. The first documented case of CWD in Mississippi was in a buck from Issaquena County in February 2018. Since that time, increased surveillance by Mississippi Department of Wildlife, Fisheries, and Parks has documented CWD in 18 additional deer. To date, CWD has been confirmed in 19 free-ranging white-tailed deer in the following counties: Issaquena (2), Pontotoc (1), Benton (7), Marshall (7), Panola (1), and Tallahatchie (1). Just to the north, CWD has now been confirmed in 186 free-ranging white-tailed deer in Tennessee since their initial detection in December 2018. The vast majority of positive deer (185) have been from Fayette and Hardeman Counties along the Mississippi border, with a single positive deer coming from Madison County just to the north.

On the commercial captive cervid front, new cases of CWD also have been reported. According to information compiled by the United States Department of Agriculture (USDA), CWD has been detected in 21 new captive cervid facilities in the United States since January 2018. This includes 14 facilities (9 breeder, 3 shooter, 1 exhibition, 1 hobby) in Colorado (2), Illinois (1), Ohio (1), Pennsylvania (3), and Wisconsin (7), during 2018, and 7 facilities (3 breeder, 2 shooter, 1 mixed, 1 hobby) in Michigan (1), Oklahoma (1) Pennsylvania (3), South Dakota (1), and Wisconsin (1), from January through April 2019. One of the many notable detections was a 2-year-old bull elk from a captive elk breeding facility in Lincoln County, Oklahoma. This represents the first CWD detection in Oklahoma since 1998, when CWD was originally detected in a captive elk from Oklahoma County. Of the 21 facilities with CWD detections mentioned above, nine were enrolled in the USDA Herd Certification Program (HCP) and all nine of these herds were certified as low risk for having CWD at the time of detection. Four of these facilities have been depopulated, while the remainder are under quarantine. Chronic wasting disease has now been detected in 111 commercial captive cervid herds in 17 states since 1997.

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Slowing the expansion of CWD will require significant effort and will continue to tax resources and disease management options. Missouri is a particularly good example of this, with a sprawling and somewhat disconnected CWD Management Zone that stretches across a significant portion of the state. In order to slow the spread and control the prevalence of CWD, the Missouri Department of Conservation (MDC) works closely with landowners and other partners to conduct post-season targeted removal operations around sites of recent detections. This disease control strategy, when enacted early in the outbreak when CWD prevalence is low, holds the best promise for successfully managing this disease. However, this important management tool is challenging and costly to perform at even a single location and MDC is annually performing these operations at multiple locations across the state. CWD management in Missouri highlights one of the many challenges associated with this disease.

There is no indication that the rate of new CWD detections observed during the last 16 months will abate; altering CWD's current trajectory will take coordinated action by everyone involved, including wildlife and agricultural professionals, hunters, captive cervid operators, staff at non-profit and private corporations, wildlife enthusiasts, politicians, and many others. (Prepared by Mark Ruder, SCWDS; and Bryan Richards, U.S. Geological Survey – National Wildlife Health Center)

Living with CWD: Colorado Revises CWD Response Plan

In January 2019, Colorado Parks and Wildlife (CPW) Commission adopted the Colorado Chronic Wasting Disease (CWD) Response Plan (accessible at: https://cpw.state.co.us/Documents/Hunting/BigGame/CWD/PDF/ColoradoChronicWastingDiseaseResponsePlan.pdf). The plan generally follows the 2018 Western Association of Fish and Wildlife Agencies (WAFWA) Recommendations for Adaptive Management of CWD in the West.

It is well-documented that once CWD becomes established in an area, without management the prevalence and distribution increase. In Colorado, the CPW Commission was concerned by the CWD prevalence trends observed in some of its deer herds over the past 15 years. As of July 2018, at least 31 of 54 (57%) deer herds and 16 of 43 (37%) elk herds in Colorado were known to be infected with CWD. Of particular concern to the CPW Commission, some mule deer herds have experienced a 10-fold increase in estimated CWD prevalence since the early 2000s and CWD is now negatively impacting these herds. Accordingly, the CPW Commission established a CWD Advisory Group comprised of representatives from diverse stakeholder groups to help provide public input to CPW. This public input was important to the development of a publicly approved CWD Response Plan.

The purpose of the Response Plan is to provide herd managers with guidance for managing CWD prevalence within Colorado's deer herds and strives to suppress individual herd-level CWD prevalence below a realistic management threshold (5%). Central to the plan is the recognition that not much happens fast with CWD and a sustained, measured, long-term approach is needed. The plan will initiate a 15-year monitoring plan that relies on mandatory testing of adult, male deer in a 5-year testing rotation schedule. This will allow sufficient time to show a meaningful change in CWD prevalence in a particular herd after different management actions have been attempted.

Within the plan, a 5% adult, male prevalence was selected as the threshold for management intervention, as this was considered the lowest rate of adult male prevalence that is realistic to manage in order to minimize annual CWD mortality in adult does. The resulting management actions will be tailored to each herd management plan and may include reducing population or density, reducing male/female ratios, lowering age structure, targeted removals, reducing artificial congregations, carcass disposal and transport regulations, among other actions. For those herds with less than 5% CWD prevalence, management actions to maintain prevalence below 5% will be recommended. With the obvious emphasis on understanding prevalence in herds, central to Colorado's CWD Response Plan is a consistent monitoring program to generate reliable CWD prevalence estimates in

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herds across the state. Thus, the mandatory testing of harvested animals in some herds or management units on a 5-year rotation is needed. Continued public support will be critical to the success of the program, therefore, CPW has developed a public education and communications strategy to complement the plan.

Effectively, CPW is embarking on a long-term, real world experiment on how to live with CWD - to manage deer in a manner that keeps prevalence at or below a level to minimize impact on the population. Reading the Colorado CWD Response Plan drives home the inevitable truth that responsible management of CWD requires long-term commitment by the agency and close cooperation with the public. The full Colorado CWD Response Plan can be accessed at the above link. (Prepared by Mark Ruder)

Avian Influenza: A Decade of Surveillance at Two Ends of a Flyway

Annually, in the fall, ducks in North America congregate in high densities around lakes in the northern USA and Canada. This combination of susceptible hosts (many birds are immunologically naïve, hatch year individuals) in high concentration provides a perfect scenario for transmission of low pathogenicity (LP) avian influenza virus (AIV); it is at this time of year (late summer – early fall), that peak prevalence of AIV has been consistently reported. As birds leave their staging areas and migrate towards wintering grounds, the prevalence of AIV decreases throughout the remainder of the year and remains low throughout the spring.

Funded through the NIH *Centers for Excellence in Influenza Research and Surveillance*, we have carried out over a decade of AIV surveillance in Anseriformes species (ducks and geese) at two ends of the Mississippi Flyway, in two different seasons. Fall surveillance has been carried out in northwestern Minnesota, primarily in mallards (*Anas platyrhynchos*). In the Gulf Coast states of Louisiana and Texas (at the southern end of this same flyway), we have surveyed ducks (primarily blue and green-winged teal, *Spatula discors* and *Anas crecca*, respectively) during both fall migration, as they are moving south towards overwintering grounds throughout the southern USA and into Central and South America, and in the spring, as they are travelling northward to breeding sites.

As is consistent with historical reports from the northern USA and Canada, prevalence of AIV in mallards in Minnesota in late summer/early fall across these years of surveillance (2007 - 2016) averaged 19.4% (1,768 AIV isolated from over 13,000 swabs collected). While AIV prevalence and subtype diversity were variable across years, the most common AIV subtypes were H3 and H4, which accounted for over 65% of the observed subtype diversity. From mallards at these autumn sampling sites, we identified 67 unique subtype combinations, indicative of the diversity of AIV circulating in ducks this time of year.

As collection efforts moved south annually, during the month of September (2007 - 2017), the average prevalence of AIV was 6.8% (650 AIV isolated from over 9,000 swabs collected). Consistent with previous reports, including our work in Minnesota, H3 and H4 were the most common subtypes isolated from blue-winged teal in the autumn. Spring collections in these southern sites revealed different patterns in prevalence and subtype diversity, however. From over 7,500 teal sampled in March - April, from 2012 - 2017, we isolated 266 AIV, for an overall prevalence of 3.5%. At this time of year LP H7 and H10 viruses were the most common, making up over 85% of all AIV recovered, while H3 and H4 viruses were rarely and inconsistently reported.

The mechanisms driving these consistent and seasonal patterns of prevalence, subtype diversity, and predominance are not understood, but likely include factors at the host, population, and virus level. These results highlight the need for additional research regarding potential drivers of spatiotemporal patterns of infection such as population immunity. Further, this work underscores the importance of consistent, long-term and broad-scale AIV surveillance to better understand the ecology and natural history of AIV in waterfowl hosts, and the potential risk of spillover into human and domestic animals.

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Results of both surveillance projects were recently published in *Avian Diseases*: Carter et al. 2019. *Influenza A prevalence and subtype diversity in migrating teal sampled along the United States Gulf Coast*. doi.org/10.1637/11850-041918-Reg.1 and Hollander et al. 2019. *Prevalence of influenza A viruses in ducks sampled in Northwestern Minnesota and evidence for predominance of H3N8 and H4N6 subtypes in mallards, 2007–2016*. doi.org/10.1637/11851-041918-Reg.1 (Prepared by Rebecca Poulson and David Stallknecht)

PFAS in Michigan Deer

In October 2018, the Michigan Department of Health and Human Services (MDHHS) issued a "Do Not Eat" advisory on deer acquired within a five-mile radius of Clark's Marsh, near the former Wurtsmith Air Force Base, an area known for severely elevated levels of per- and polyfluoroalkyl substances (PFAS). PFAS are a category of human-made chemicals used in various consumer products such as carpet, clothing treatments, food packaging, and firefighting foams. These substances have strong carbon-fluorine bonds, allowing them to be extremely persistent in the environment and bioaccumulate in animal tissues. These characteristics have led the U.S. Environmental Protection Agency (EPA) to classify PFAS compounds as emerging contaminants**.** The most well-known and prevalent PFAS compounds are perfluorooctane sulfonate (PFOS) and perfluorooctanic acid (PFOA). In 2006, the EPA prompted major manufacturers to limit the production of PFOS/PFOA; however, decades of prior use of PFOS/PFOA and continued use of other PFAS make these compounds a continued environmental health threat. Additionally, the bioaccumulation potential of PFOS/PFOA has led to public health concerns.

Although more research is needed, a limited number of studies suggest PFAS may negatively impact human health. PFOA has been the most widely studied compound and a variety of potential disease associations have been identified, including cancer (kidney and testicular), pregnancy-induced hypertension, thyroid disease, negative effects on neonatal development, and chronically elevated cholesterol. These potential negative health effects, paired with results of National Health and Nutrition Examination Surveys by the Centers for Disease Control and Prevention (CDC) documenting PFAS exposure in the general U.S. population, highlight the need for further study.

Michigan has taken such actions to investigate the presence of PFAS in the environment. In 2010, the Michigan Department of Environmental Quality (MDEQ) became aware of PFAS contamination at the decommissioned Wurtsmith Air Force Base and at the neighboring Clark's Marsh in Oscoda, Michigan. Groundwater levels were 10,000 times higher than the EPA lifetime health advisory level (70 parts per trillion) for PFOS and PFOA combined. Subsequently, MDEQ began testing for PFAS in fish from Clark's Marsh and in 2012, the MDHHS issued a "Do Not Eat" advisory for these fish due to elevated levels of PFOS in fish filets. Rising concerns for PFAS in the state led to the establishment of the Michigan PFAS Action Response Team (MPART) in 2017. To investigate the potential for bioaccumulation in a game species, the Michigan Department of Natural Resources (MDNR) and MDHHS began testing deer originating from four specific areas with known PFAS water contamination. In October 2018, another "Do Not Eat" advisory was issued, this time in deer, after the discovery of a deer that had a PFOS concentration of 547 parts per billion (ppb) in muscle, as well as elevated concentrations in liver and kidney. The MDHHS currently recommends that deer meat exceeding a PFAS concentration of 300 ppb should not be consumed. The other 19 deer collected at this site had very low (2 deer < 1.2 ppb) to non-detectable (17 deer) concentrations of PFAS in the muscle.

Samples were collected from an additional 60 deer from three other sites in Michigan with known surface water PFAS contamination and muscle samples were collected from 48 deer heads submitted to the MDNR during the fall 2017 hunting season. All 108 additional muscle samples had very low to no detectable levels of PFOS. In 21 of 108 samples, PFOS was only detected (levels < 4.9 ppb) in liver and kidney samples. Further, in deer with detectable PFOS, liver and kidney typically had higher concentrations than muscle. Specifically, liver and kidney PFOS levels were 11-50 times and 3-6 times higher than muscle levels,

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respectively. This finding is consistent with previous work in caribou, cattle, sheep, and wild boar. The mechanism behind this variation in tissue PFAS levels is unknown, but exposure concentration and metabolism of PFAS may play a role. Although the current Clark's Marsh "Do Not Eat" deer advisory is still active, no additional advisories have been implemented. However, MDHHS continues to recommend not consuming kidneys or liver from any deer in Michigan, a recommendation in place prior to the detection of PFAS in deer.

Globally, biomonitoring studies indicate PFOS is commonly found in terrestrial and aquatic wildlife, even in remote regions, like the Arctic. The presence of these compounds in a game species in Michigan raises significant public health concerns. The Michigan PFAS Action Response Team continues its interagency work to better understand and respond to this problem. The MDNR continues to work closely with MDHHS to educate the public and evaluate PFAS in deer and other game species. (Prepared by Steph Kurth, University of Wisconsin-Madison, Lana Wolfe, University of Georgia, and Mark Ruder)

Sonia Hernandez Promoted to Professor

Dr. Sonia Hernandez joined SCWDS faculty in 2008 and was recently promoted to full professor! Sonia has a joint position at the Warnell School of Forestry & Natural Resources and SCWDS in the College of Veterinary Medicine. She holds a DVM from Louisiana State University, a PhD in Ecology from UGA, and is a Diplomate of the American College of Zoological Medicine. As a wildlife veterinarian and disease ecologist, Sonia leads an outstanding wildlife health research program dedicated to investigating wildlife diseases and how human activities affect the health of wildlife populations. Sonia is also a dedicated teacher and mentor. Her courses include Wildlife Disease Ecology and Management for graduate students, Ornithology for undergraduate and graduate students, Wildlife Diseases for veterinary students, and a study abroad Conservation Medicine & Biology course in Costa Rica which is open to all student levels. Her excellence in teaching has been recognized numerous times: Warnell's Outstanding Teaching Award (2013), University-wide Richard B. Russell Award for Excellence in Teaching (2017), and Professor of the Year at Warnell (2018). She is the proud mother of Paxton, and twins, Ashton and Maya. Congratulations, Sonia!

Hypertrophic Osteopathy in a Deer

An emaciated white-tailed deer was observed multiple times by a landowner in Westmoreland County, Pennsylvania, during late July 2018. The animal was dispatched and necropsied by Pennsylvania Game Commission personnel. Necropsy revealed the distal extremities of all four limbs were swollen and hard (Figure 1A).

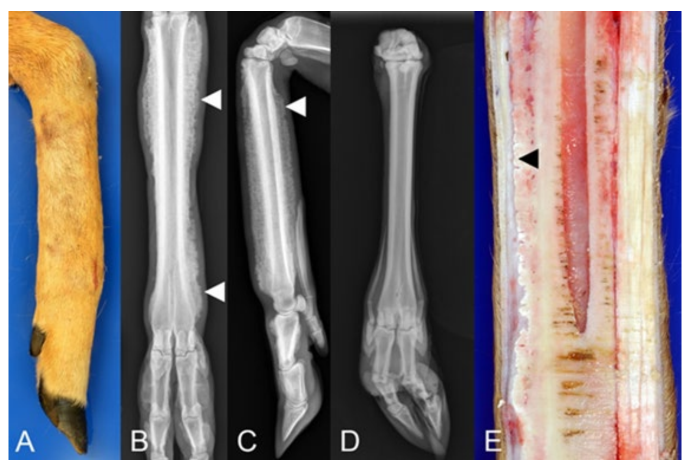

Figure 1A-E.

The swollen limbs likely interfered with the deer's ability to freely move and forage, resulting in the poor nutritional condition. There was no evidence of traumatic injury or infection to explain the cause of the lesions. The four limbs were submitted to SCWDS for further examination. Additionally, samples were submitted to another laboratory for chronic wasting disease testing.

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Upon arrival to SCWDS, x-rays were taken of the legs prior to necropsy examination. The x-ray images revealed that the firm, swollen material was proliferating bone, which resulted in irregular, expanded edges as compared to normal bone (Figure 1B and 1C are affected; Figure 1D is a normal bone for comparison). Thin sections of bone were obtained (Figure 1E) and decalcified to enable examination of the lesions under the microscope. Microscopically, the outer surface of the bone (periosteum) was expanded by fibrous connective tissue and unmineralized bone (osteoid) and was surrounded by dense collagen. These findings are consistent with a diagnosis of hypertrophic osteopathy (HPO) or abnormal proliferation of the cells that form bone.

Hypertrophic osteopathy, also referred to as "Marie's disease," is an uncommon, but well-described, lesion in multiple domestic animals including horses and dogs, as well as humans. The lesions in the leg bones most often are secondary to a primary disease process in the thoracic cavity, such as severe inflammation or cancer. Less common findings in domestic animals with HPO include heart inflammation, heartworm infection, cancer of the urinary bladder in large breed dogs, and ovarian cancer in mares. While the mechanism of lesion development has not been confirmed, the most commonly accepted theory between these seemingly unrelated lesions is that the body's response to disease in the thorax results in increased blood flow to the distal extremities via stimulation of the vagus nerve. When the inciting cause (e.g. thoracic disease) is removed or the vagus nerve is cut, the boney lesions in the legs typically resolve.

Hypertrophic osteopathy has been reported in multiple cervid species including roe deer, elk, and white-tailed deer. In these species, the syndrome is most often associated with granulomas in the lungs that contain fungi such as *Aspergillus* spp. and *Conidiobolus* spp., or the fungal-like organism *Pythium insidiosum*. *Mycobacterium* spp. also have been associated with this syndrome in some animals. Despite extensive examination, no lung or thoracic lesions were observed in this particular deer during necropsy, and it is unknown if the leg lesions are a primary or secondary process in this case. The lack of lung lesions in this deer further emphasizes our lack of complete understanding of this disease process. However, because HPO most commonly is a secondary lesion, it is important to perform a complete necropsy and submit representative tissue samples from major organs when similar distal leg lesions are observed. SCWDS thanks the Pennsylvania Game Commission for submission of this interesting case. (Prepared by Kevin Niedringhaus and Nicole Nemeth).

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