

CHRONIC WASTING DISEASE IN A MINNESOTA WILD DEER HERD: FIRST DETECTION IN FILLMORE COUNTY

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SUMMARY OF FINDINGS

In fall 2016, the Minnesota Department of Natural Resources (MNDNR) sampled 2,966 hunterharvested white-tailed deer (*Odocoileus virginianus*) for chronic wasting disease (CWD) in southeastern Minnesota. The surveillance effort focused on testing deer within deer permit areas (DPA) in the 300 series zone, in response to increased incidence of CWD in wild deer in both southwest Wisconsin and northeast Iowa. Three deer tested positive for the disease in Fillmore County (DPA 348) and MNDNR enacted its CWD Response Plan which called for an immediate ban on recreational deer feeding, a formal survey of the area CWD was found, creation of a disease management zone (DPA 603), and additional sampling efforts to better understand the prevalence and spatial extent of the outbreak. During a winter (January-March 2017) supplemental surveillance effort, an additional 1,179 samples were tested through 3 operational phases; a special late hunt, landowner shooting permits, and a contract with United States Department of Agriculture–Wildlife Services (USDA-WS) for targeted deer removals. As a result, 8 more CWD positive deer were found. Surveillance efforts for CWD will be intensified in southeastern MN in fall 2017 and also expanded into 2 other areas of the state (Crow Wing and Meeker Counties) where the disease was recently discovered in captive cervid farms.

INTRODUCTION

Chronic wasting disease is a transmissible spongiform encephalopathy (TSE) that affects elk *(Cervus canadensis)*, mule deer *(Odocoileus hemionus)*, white-tailed deer, and moose *(Alces alces)*. TSEs are infectious diseases that alter the morphology of the central nervous system, resulting in a "sponge-like" appearance of this tissue. The etiological agent of CWD is an infectious protein, called a prion. Incubation time of the disease can range from 1.5 to nearly 3 years, although infected animals have been shown to shed prions in their feces up to a year before showing signs of illness (Tamguney et al. 2009, Haley et al. 2011). Clinical signs are non-specific and may include a loss of body condition and weight, excessive salivation, ataxia, and behavioral changes. There is no known treatment or vaccine for the disease and it is always fatal. Experimental and circumstantial evidence suggest that transmission of the disease is primarily through direct contact with infected animals or their infective saliva or excrement (Mathiason et al. 2006, Safar et al. 2008). However, persistence of prions in the environment and resulting indirect transmission has been shown to occur (Miller et al. 2004, Johnson et al. 2007, and Maluquer de Motes et al. 2008).

The Center for Disease Control (CDC) and other public health agencies have concluded there is no known link between CWD and any neurological disease in humans (MaWhinney et al. 2006, Sandberg et al. 2010). However, both the CDC and the World Health Organization (WHO) recommend that no part of a known positive animal should be consumed by humans. Additionally, there is no evidence that CWD can be naturally transmitted to species other than deer, elk, or moose. However, new research conducted by the Canadian Food Inspection Agency has demonstrated that by orally administering muscle under experimental conditions from cervids (deer and elk) naturally infected with CWD, the disease can be transmitted to macaques. This finding has sparked renewed concerns about potential human health risks to eating CWD-contaminated venison (Czub, S. 2017, May).

In December 2016, 2 captive white-tailed deer from a mixed white-tail and mule deer herd in Crow Wing County tested positive for CWD through routine slaughter surveillance. Four other captive facilities in Minnesota received deer within the past 5 years from this CWD-infected herd, these exposed animals were euthanized and tested for the disease. One of these traceout herds was located in Meeker County and the deer linked to the Crow Wing County farm tested positive for CWD; following whole herd depopulation, 30% of the deer on this farm were infected. The remaining 3 trace out facilities tested negative for CWD.

Currently, Minnesota has approximately 460 captive cervid facilities (Minnesota Board of Animal Health). As the current statewide population estimate of wild deer approaches one million, there is an element of inherent disease transmission risk between captive and wild cervids. Overall, risk is difficult to quantify because deer populations are unevenly distributed over the landscape ranging in densities from < 1-15 deer/km² (i.e., 1–40 deer/mi²), facility fences vary in construction quality, and direct/indirect contact rates between captive and wild cervids are unknown. In addition, captive cervid facilities are sporadically distributed on the landscape and are independent of wild deer densities.

Since 2002, MNDNR has conducted CWD surveillance and sampled >50,000 wild deer. The first occurrence of this disease in wild deer was in 2011, when a wild deer was found with CWD near an infected captive elk facility in Pine Island. Aggressive surveillance efforts from 2011-2013 tested an additional >4,000 deer in the surrounding area, and failed to detect another case of CWD in the wild. Since that time, MNDNR has been closely monitoring disease spread in the neighboring states and conducting additional surveillance efforts to ensure early detection of the disease, if present in Minnesota.

METHODS

Hunter-harvested surveillance was conducted at deer registration stations during the first 3 weekends and first week (only a subset of stations) of the 2016 regular firearm hunting season in southeastern Minnesota. Selected stations were staffed with MNDNR personnel and students, trained in lymph node collection. Stations were selected based on deer volume and distribution throughout the surveillance zone to meet sampling goals. Eight taxidermists were trained and collected samples throughout the entire archery season from trophy bucks harvested within our surveillance DPAs. Hunters were asked to voluntarily submit medial retropharyngeal lymph node samples from deer ≥1.5 years of age to be tested for CWD. All samples were inventoried, entered into a database, and sent to Colorado State University (CSU) for enzyme-linked immunosorbent assay (ELISA) testing. Any presumptive positive deer from ELISA testing would be confirmed using immunohistochemistry (IHC) testing at CSU.

At the time when deer were sampled, hunter information was recorded, including the hunter's name, a telephone number, MNDNR number, and location of harvest. Maps were provided to assist the hunters in identifying the location (Township, Range, and Section) of the harvest site. Cooperating hunters were given a cooperator's patch and entered into a raffle to win one of two, .50 caliber muzzleloaders or a compound bow package donated by Minnesota Deer Hunters Association (MDHA) and The Bluffland Whitetails Association. Hunters were not notified of their testing result unless it was positive.

Following detection of the disease near Preston, the public was invited to receive information about the CWD response plan, and to have questions answered by MNDNR. On the evening of December 15, 2016, >700 local landowners, hunters, media personnel, and general public attended a meeting held at the Preston Elementary School to better understand MNDNR's plans going forward regarding the response to CWD in their local community.

A disease management zone, called DPA 603, was created to encompass a 10-mile radius

around 2 CWD-infected deer and used enforceable boundaries such as county highways and township roads (Figure 1). An aerial survey was conducted in DPA 603 to better understand overall deer densities, local concentrations of deer, and locations of artificial feeding sites. From December 14 – 21, a helicopter was used to complete the survey. Towards the end of the survey, confirmation of the 3rd CWD-positive deer required an expansion of the flight area to include a northern "bump out", which encompassed an additional 10 mi radius around this case. The survey design included 104 plots in a 1317.5-km² (508.7-mi²) area. Following the survey, a census was flown around each of the known positive deer. To prevent further disease transmission, MNDNR banned recreational feeding and use of attractants for deer in a 5-county area in southeastern Minnesota (Figure 2). During winter (Jan-March 2017) effort was made to collect additional samples from DPA 603 and the northern "bump out" to help understand disease prevalence, and geographic extent. This was obtained through 3 operational phases; a special late season hunt, landowner shooting permits, and a contract with the United States Department of Agriculture-Wildlife Services (USDA-WS) to remove additional deer using sharpshooting.

First, during the special late season hunt 31 December 2016 to 15 January 2017, any person who had possession of either an unused 2016 deer license or a special disease management license (available for a reduce cost of \$2.50 and unlimited bag) could harvest deer only inside DPA 603. Harvested deer were brought to one of 4 registration check stations, where CWD sampling of all deer >1 year old was required, and all deer received a special carcass tag from MNDNR staff. Carcass movement restrictions required the carcass remains could not leave the DPA 603 until a test negative result was received. However, meat that was boned out or cut and wrapped either commercially or privately, and quarters or other portions of meat with no part of the spinal column or head attached were allowed to leave the surveillance boundaries immediately. A MNDNR-leased refrigerated semi-trailer was provided for hunters to use, along with a lined dumpster to dispose of carcass remains; both items provided hunters viable options after harvesting deer to keep carcasses inside the zone until a test negative result was reported. Hunters checked their results on the MNDNR website using either their MNDNR number or the special carcass tag number assigned to their deer.

The second operational phase offered special shooting permits to landowners in DPA 603 as well as the northern "bump out", from 16 January 2017 to 12 February 2017. Landowners inside this area didn't have to own a minimum amount of acreage to qualify for a shooting permit, but did have to abide by city and state ordinances for discharging firearms. There were no limit to the number or sex of deer that could be harvested from the owner's property and they could designate as many shooters under their permit as desired. The use of high powered center-fire rifles under this permit was allowed and since this area was historically regulated as a shotgun-only zone during the firearm season, the ability to use rifles during this sampling effort was viewed as a unique opportunity by many landowners. The landowner was required to contact MNDNR staff within 24 hours of harvesting by calling a MNDNR CWD hotline and trained staff either traveled to the landowner's site to collect samples or deer were brought into the Preston Forestry Office for sampling. Each carcass was given a unique identification tag, and landowners were directed not to transport carcasses outside the surveillance area until a test negative result was received. Meat that was boned out or cut and wrapped either commercially or privately, and quarters or other portions of meat with no part of the spinal column or head attached were allowed to leave the surveillance boundaries immediately.

The third operational phase was a contract with USDA-WS to use sharpshooting at bait piles from mid-February through mid-March to obtain additional samples surrounding areas where infected deer were harvested. By this time in our efforts, we had identified 2 core areas of concern, a 31-km2 (12-mi2) area surrounding the first 2 positive deer and a 23-km2 (9-mi2) area around the third positive deer, and sharpshooting efforts were focused in these areas. USDA-WS obtained permissions from private landowners to access their properties, place bait if

needed, and target deer during evening and overnight hours. Intact carcasses were transported to the Preston Forestry office where a processing facility was set up. Here the deer were eviscerated immediately upon delivery, and samples were collected including medial retropharyngeal lymph nodes, a central incisor for aging, muscle tissue for genetic signatures, and blood collected from the heart for arbovirus screening. Data was also collected which included deer harvest location, age class and sex, pregnancy status of females and number and sex of fetuses. A unique carcass tag was issued to each individual animal by MNDNR staff. Entrails were deposited in a lined dumpster and all carcasses were held in a MNDNR-leased refrigerated trailer at 33-38 °F until test-negative results were reported (typically within 4 business days). All test negative deer went to a recipient from a venison donation list that contained more than 400 people or were given back to the landowner from where the deer was harvested. Any CWD-positive deer carcasses were disposed of by alkaline digestion at the University of Minnesota, Veterinary Diagnostic Laboratory in St. Paul, MN.

While MNDNR staff were working inside DPA 603 through each operational phase of winter sampling, opportunistic deer such as vehicle-kills, and found dead or opportunistic sick deer that were reported by the public were also collected and sampled for disease

Across all of MN, MNDNR routinely samples any cervid exhibiting clinical symptoms of CWD infection (opportunistic surveillance). We have disseminated information to wildlife staff regarding clinical signs of infection for symptomatic deer. These staff were also provided with the necessary equipment and training for lymph node removal and data recording. The number of samples expected through opportunistic statewide surveillance is estimated to be less than 100 animals annually, since few reports of deer with clinical signs are received.

RESULTS AND DISCUSSION

A total of 2,966 samples were collected in southeastern Minnesota from hunter-harvested deer during fall 2016; 200 of these were collected through participating taxidermists. Three deer tested positive for CWD, 2 of these deer were sampled at check stations and 1 deer was sampled by a taxidermist. All 3 deer were located in a relatively small geographic area near Preston, MN (Figure 3). Our CWD Response Plan was enacted shortly after the initial detection of disease was confirmed in December 2016.

The aerial survey estimated the deer population in DPA 603 and the northern "bump out" to be 11,656 deer, equating to an estimated deer density of 61 deer/km2 (23.6 deer/mi2) (Figure 4). Deer densities were highest within a 31-km2 (12-mi2) area surrounding the first 2 positive deer and within a 23-km2 (9-mi2) area around the third positive deer, with an average of 90 deer/km2 (35 deer/mi2).

A total of 626 deer were sampled for CWD during the special late hunt, with 3 testing positive for disease. A total of 411 permits were issued to landowners during the landowner shooting permit phase and 269 deer were sampled for CWD. Only 133 (32%) of the landowners that received shooting permits removed at least 1 deer, and of those, 71 (53%) landowners took only 1 deer and 10 (7%) landowners took 5 or more deer. Two deer tested positive for CWD through this operational phase. Finally, during the sharpshooting contract with USDA-WS, 238 additional deer were removed and tested; 2 were found positive for CWD.

Through this combined winter surveillance effort, a total of 1,179 deer (1,142 adults, 37 fawns) were sampled in our CWD surveillance area; 8 deer tested positive for the disease (Figure 5). Sampling included deer taken through the special late hunt (n = 626), landowner shooting permits (n = 269), contract with USDA-WS deer removal (n = 238), vehicle-kills (n = 30), found dead deer (n = 13), and opportunistic sick deer (n = 3) (Figure 6).

In total, 246 deer were issued to recipients that were on the venison donation list. The MNDNRleased refrigerated trailer was utilized for the duration of the winter surveillance effort and 521 deer were held; 188 deer during the special late hunt, 91 deer in the landowner shooting permit phase, and 242 deer during the contract with USDA-WS.

We estimated the fall 2016 surveillance effort cost \$364,000. The estimated total cost of the winter sampling effort was \$557,800. This can be broken down into staff salary (\$235,800), fleet (\$35,200), travel expenses (\$60,700), equipment leases or rentals (\$14,100), USDA-WS contract (\$144,000), and diagnostic testing (\$19,200) By operation phase, we spent \$136,000, \$162,800, and \$259,000 for the special hunt, landowner shooting permits, and sharpshooting, respectively.

From July 2016 to June 2017, MNDNR collected a total of 60 samples through opportunistic surveillance efforts. This included samples from 2 escaped captive deer, 1 possible escaped captive mule deer, 1 elk that was mistakenly shot by a deer hunter outside of MN's elk range, head and carcass remains from 1 elk that was found dumped in a gravel pit outside of elk range, 8 vehicle-killed deer, and 46 free-ranging deer with clinical signs; all samples were negative for CWD.

Future Surveillance Plans

CWD surveillance will take place inside DPA 603 for all deer harvested in fall 2017. Mandatory sampling of adult (\geq 1.5 years of age) deer and restricted whole-carcass movements inside DPA 603 will continue to be in effect. The MNDNR plans to sample 7,200 hunter-harvested deer for CWD during the opening weekend of firearm season through a mandatory sampling framework for hunters in DPAs: 343, 345, 346, 347, 348, 349, 155, 171, 172, 242, 246, 247, 248, 249, 218, 219, 229, 277, 283, and 285. This effort is in response to the recent detection of CWD in 2 captive cervid farms (Crow Wing and Meeker counties) and in wild deer (Fillmore County). Targeted CWD surveillance of deer exhibiting clinical signs of illness will continue statewide.

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Figure 1. Chronic wasting disease (CWD) management zone, deer permit area (DPA) 603 boundaries in southeast Minnesota winter, 2017.



Figure 2. Five-county area in southeastern Minnesota where recreational feeding of wild whitetailed deer was banned in December 31, 2016, following the discovery of chronic wasting disease in Fillmore County.



Figure 3. Sampling distribution for all hunter-harvested white-tailed deer (n=2,966) tested for chronic wasting disease (CWD) in southeastern Minnesota, fall 2016. Three tested positive for CWD near Preston, Minnesota.



Figure 4. Helicopter, aerial survey results for 1317.5-km² (508.7-mi²) area surrounding the location of the white-tailed deer that tested positive for chronic wasting disease (CWD), southeastern Minnesota, December 2016.



Figure 5. Sampling distribution of deer (*n*=1,179) sampled for chronic wasting disease (CWD) in southeast Minnesota's CWD surveillance area winter, 2017.

Sample type	Samples	Negative	Pending	Suspect	Positive
Landowner shooting permit zone January 16 – February 12, 2017	269	267	0	0	2
Special hunt zone 603 December 31, 2016 – January 15, 2017	626	623	0	0	3
USDA-WS deer removal February 20 – March 20, 2017	238	236	0	0	2
Road kill	30	30	0	0	0
Found dead	13	12	0	0	1
Sick/injured/ euthanized	3	3	0	0	0
Totals	1,179	1,171	0	0	8
** 873 deer were harvested during the special hunt. Fawns were not tested. ***3 positive deer collected during fall 2016 for 11 total positives					

Figure 6. Breakdown by method of total white-tailed deer tested for chronic wasting disease (CWD) by MNDNR in the CWD surveillance area during winter, 2017.