MIDWEST FISH AND WILDLIFE HEALTH COMMITTEE

2019 STATUS REPORT - IOWA

IOWA DEPARTMENT OF NATURAL RESOURCES

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Hemorrhagic Disease

In 2019, there were 1,927 reported suspect cases of hemorrhagic disease (HD) in 60 counties with the majority of HD activity occurring in southcentral Iowa (Fig. 1). Nine neighboring counties accounted for nearly 80% of the reported mortalities, with Warren County alone accounting for 40% of the total. Tissue samples were sent to the NVSL to confirm epizootic hemorrhagic disease. Samples (n=3) came back positive for EHDV serotype 2. This was the second largest outbreak of HD in the state.

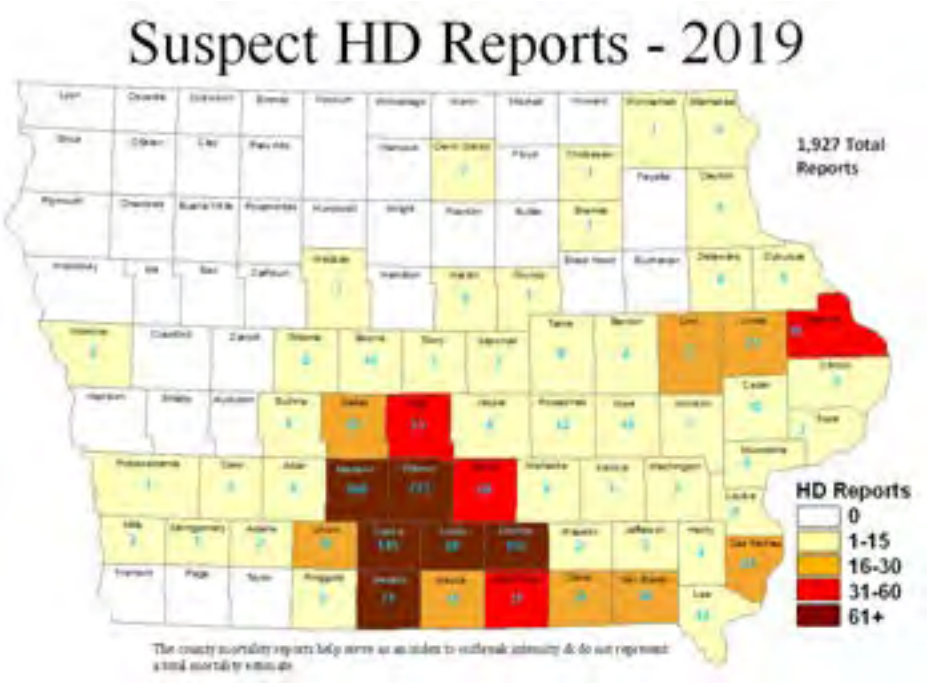


Figure 1. Reported suspect cases of hemorrhagic disease in Iowa Counties in 2019.

Bovine Tuberculosis

No white-tailed deer or other wildlife required testing for bovine tuberculosis in 2019.

Chronic Wasting Disease

Over the 2019/20 sampling season, Iowa Department of Natural Resources (IDNR) staff collected medial retropharyngeal lymph nodes from 7,362 (4,004 male, 3,336 female, 22 unknown) wild white-tailed deer (146 targeted, 1,039 roadkills, 5,610 hunter harvest, 271 taxidermist/locker, 294 city cull deer, 2 found dead; Fig. 2) for Chronic Wasting Disease (CWD) surveillance. In addition, 176 preserve deer were tested for CWD, as well as 3 free-roaming elk, 1 escaped elk, 1 one road-killed deer with ear tags, and 1 poached deer. IDNR also captured data on 56 deer tested through the hunter submission pathway that launched at Iowa State University's Veterinary Diagnostic Laboratory (VDL) in December 2019. Samples were either screened at Iowa State University's VDL and confirmed at the National Veterinary Services Laboratories (NVSL) or tested at Colorado State's VDL.

The greatest collection effort for wild deer in 2019/20 centered on the Harpers Ferry, Elkader, and Corydon Disease Management Zones (DMZ). Since 2002, Iowa has tested over 83,000 wild white-tailed deer (Fig. 3) and nearly 4,800 captive deer and elk. CWD was first detected in a hunter-harvested buck from Allamakee County in late 2013 and has since become endemic to parts of Allamakee, Clayton, and Wayne Counties delineated by DMZs (Fig. 4). This past year Iowa recorded a sharp uptick in positives, nearly doubling the number of historic positives in the state.

The 2019/20 sampling season started with 45 known CWD-positive deer from the endemic zones plus a single roadkill detection in Dubuque County dating to 2018. At its close, an additional 44 CWD-positive deer from 7 counties: Allamakee (22), Clayton (9), Decatur (1), Fayette (2), Wayne (5), Winneshiek (4), and Woodbury (1). Three of these new counties may reflect a natural expansion of the disease front in Iowa, as they are adjacent to or nearby existing DMZs.

Finally, in the fall of 2019, 2 deer from separate captive facilities in Van Buren County tested positive for CWD. Both originated from a breeding facility in Lee County. In early 2020, all three captive facilities in southeastern Iowa were depopulated by USDA-Wildlife Services on contract from Iowa Department of Agriculture and Land Stewardship. A total of 81 animals (white-tailed deer and hybrids) were removed, with an additional 4 deer testing positive from a single facility following the depopulation effort.

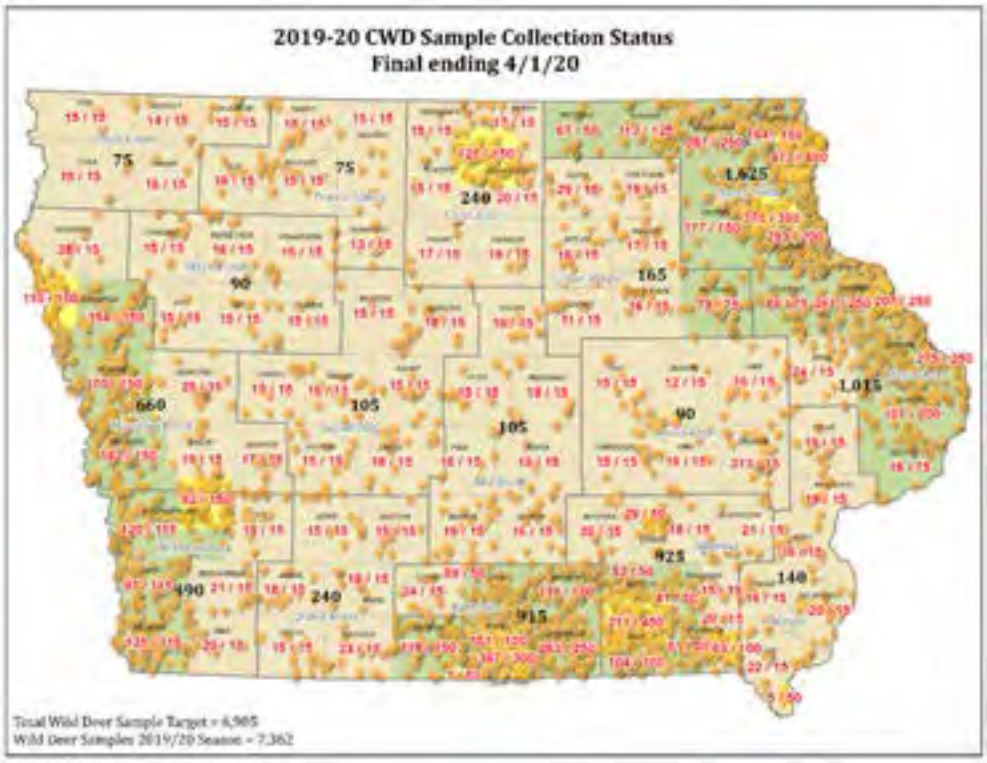


Figure 2. Iowa CWD sample location sites for wild deer, 2019/20. Johnson County quota includes a city cull effort.

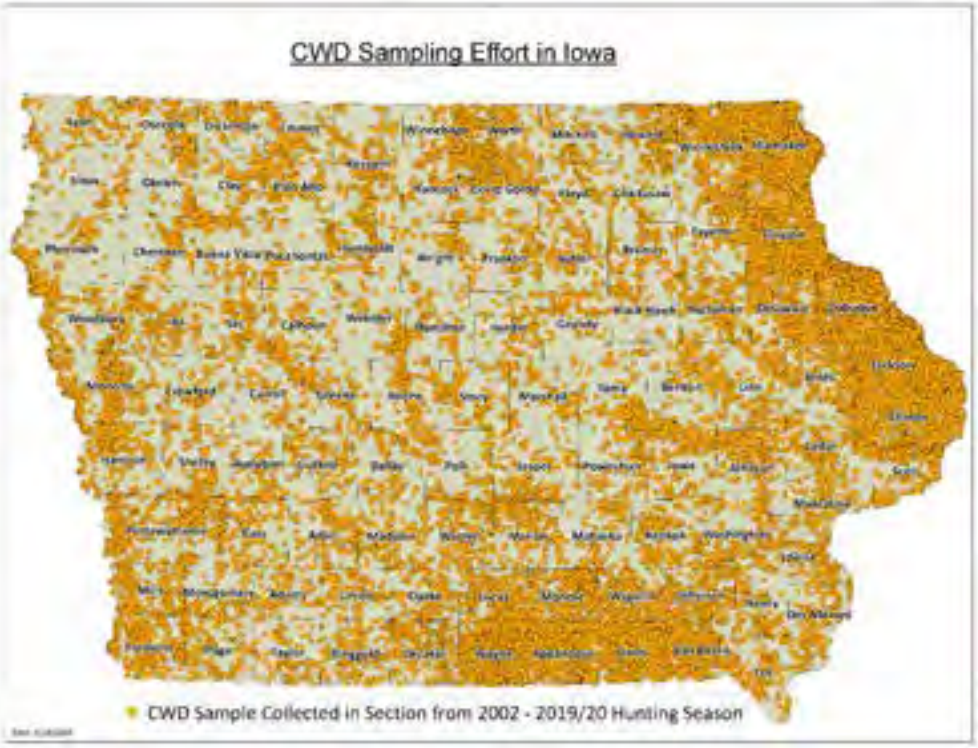


Figure 3. Iowa CWD sample location sites for wild deer, 2002-2019/20.

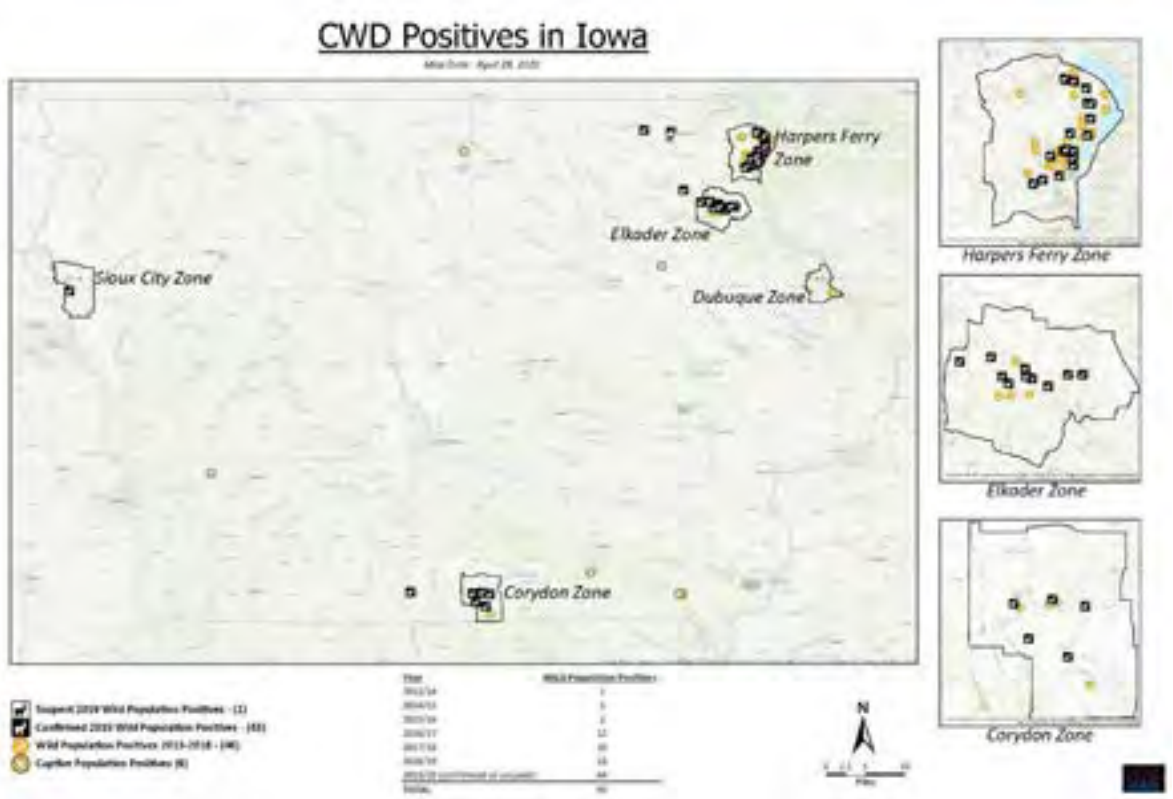


Figure 4. Locations of CWD positive deer in Iowa, 2013-2019/20.

Avian Influenza

In 2019, 20 wild turkeys (11 males, 9 females) were screened for avian influenza prior to transport to Texas. No birds tested positive.

Avian Poxvirus

Several severe cases of avian poxvirus were reported from across Iowa in wild turkeys and to a lesser extent mourning doves in 2019. In rare instances, individuals were target culled by IDNR due to a proliferation of nodules over the eyes and mouth. Samples were submitted to Iowa State University's Veterinary Diagnostic Lab for confirmation on histopathology, and legs were banked for the statewide lymphoproliferative disease virus (LPDV) study when possible.

Canine Distemper Virus

IDNR received reports of raccoons behaving abnormally (loss of fear, twitching, seizing) across the state in 2019, with focal outbreaks in Sioux City and Eldora. When possible, raccoons were submitted to Iowa State University's Veterinary Diagnostic Lab to confirm canine distemper virus (CDV) on polymerase chain reaction (PCR) and rule out rabies virus as needed (i.e. within an urban center). Additionally, a gray fox observed falling over and seizing within the city limits of Clear Lake tested positive for CDV.

White-Nose Syndrome

No new locations were discovered for WNS in 2019 and there were no reports from the public of bat mortality meeting criteria for priority samples as described in the USGS National Wildlife Health Center (NWHC), Bat Submission Guidelines for White-Nose Syndrome (WNS) Surveillance. Since 2011, 42 bats from Iowa have been collected and submitted to the USGS-National Wildlife Health Center in Madison for testing. WNS has been documented in seven counties (Clayton, Dubuque, Jackson, Des Moines, Van Buren, Jasper and Webster; Fig. 5). WNS has been documented in five species of North American bats that are known to occur in Iowa: Little brown bat (*Myotis lucifugus*), Tri-colored bat (*Perimyotis subflavus*), Northern long-eared bat (*Myotis septentrionalis*), Indiana bat (*Myotis sodalis*) and Big brown bat (*Eptesicus fuscus*). The causative fungus, *Pseudogymnoascus destructans* (Pd), has been detected on Eastern red bat (*Lasiurus borealis*) but no diagnostic sign of white-nose syndrome has been documented in this species to date.

Figure 5. Iowa counties where White-nose syndrome and *Pseudogymnoascus destructans* has been detected, 2011-2019.

Rabies

As of June 2019, only 2 bats from Cass and Hardin Counties had been tested and confirmed positive for rabies (Table 1; Fig. 6).

Table 1. Positive rabies cases in Iowa by species 2009 – 2019.

Species	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	06/2019	Total
Bat	11	10	12	17	6	10	7	12	6	9	2	**102**
Skunk	13	13	7	9	4	2	1	1	2	0	0	**52**
Feline	3	1	3	1	0	1	1	1	2	0	0	**13**
Bovine	5	1	3	4	2	2	0	1	0	1	0	**19**
Canine	2	1	0	0	0	0	3	3	0	0	0	**9**
Equine	0	0	0	0	0	0	0	1	0	0	0	**1**
Fox	0	1	0	0	0	0	0	0	0	0	0	**1**
Squirrel	1	0	0	0	0	0	0	0	0	0	0	**1**
Badger	0	0	0	0	0	0	0	0	0	0	0	**0**
TOTAL	35	27	25	31	12	15	12	19	10	10	2	198

Figure 6. Distribution of rabies cases in Iowa from January to June 2019.

Human Rabies in Iowa:
Iowa's most recent human rabies case occurred in 2002. The illness was caused by the bat strain. Prior to that, the last reported case occurred in 1951. While the exact number of people who receive rabies post-exposure prophylaxis each year in the United States is unknown, it is estimated to be about 40,000 people. Based upon Iowa's population, that would equate to approximately 390 Iowan's receiving preventative treatment each year.

West Nile Virus

The Iowa Department of Public Health has not released data on the incidence of WNV in 2019. However, according to the Centers for Disease Control and Prevention (CDC) website, Iowa experienced 0.1-0.24 cases per 100,000 people of neuroinvasive disease caused by WNV infection. This would equate to roughly 3-8 cases in 2019, compared to 59 reported cases in 2018. Moreover, a paper published by Dunphy et al. in 2019 (https://doi.org/10.1038/s41598-019-43246-y) evaluated a 15 year dataset on WNV in three host species in Iowa and found a gradient risk of infection that increased from east to west across the state (Fig. 7).

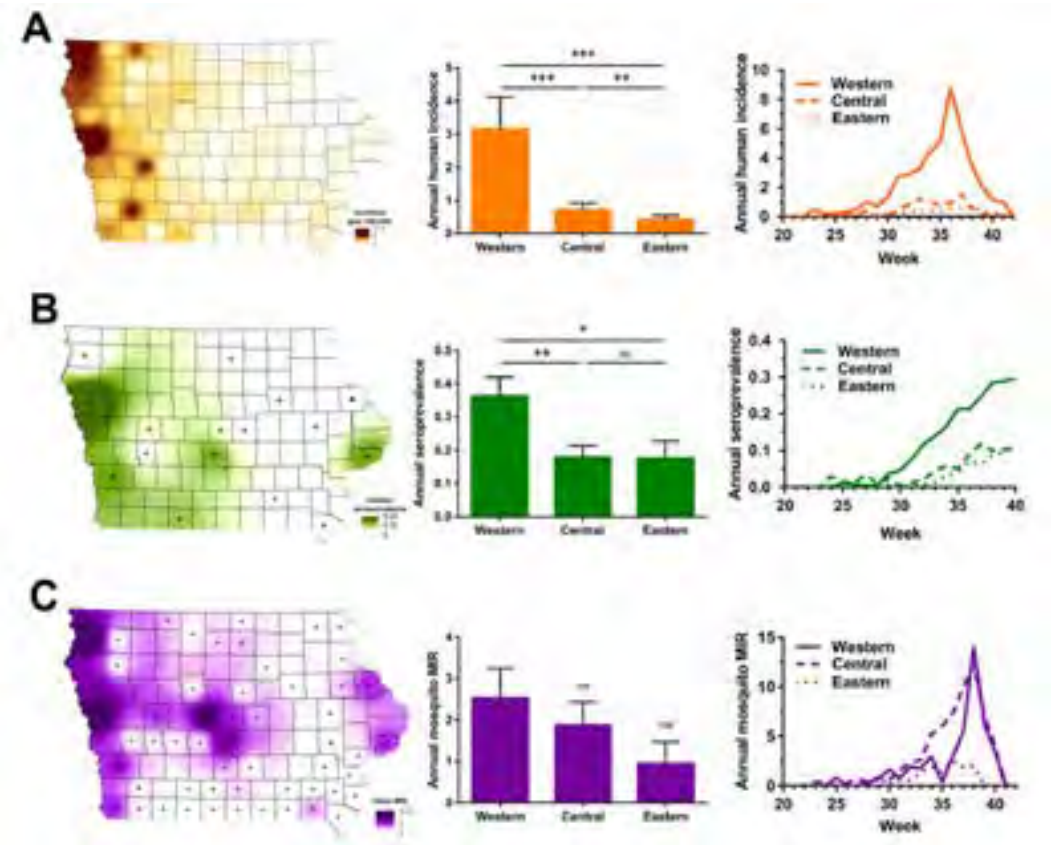


Figure 7. From Dunphy et al. (2019), with (a) reflecting human incidence, (b) reflecting seroprevalence in sentinel chickens, and (c) reflecting *Culex* mosquito minimum infection rates (MIR).

Feral Swine

In 2019, USDA-Wildlife Services responded to 9 reports of feral swine involving a total of 15 hogs. Of those, 8 hogs were removed and all were sampled for genetics. Viable blood samples were collected from 2 and screened for Classical Swine Fever, Pseudorabies, and Swine Brucellosis. Both samples tested negative for all diseases. Since fall 2004, 261 feral swine have been eradicated with 123 tested for various diseases including Classical Swine Fever, Pseudorabies Virus, Swine Brucellosis, Influenza A Virus, Leptospirosis, Toxoplasmosis, Trichinosis, Porcine Reproductive and Respiratory Syndrome, Porcine Epidemic Diarrhea Virus, Tuberculosis, and Seneca Valley Virus. In 2017, 1 feral swine tested positive for swine brucellosis. While hogs have been observed in numerous counties since 2003, the aggressive effort has resulted in no known established populations in the state.

The IDNR, USDA-WS and Iowa State University Agricultural Extension have continued to educate the citizens of Iowa by doing press releases, presentations and radio programs. We continue to send a consistent message to completely eradicate feral hogs in the state. We are working one-on-one with landowners when needed and are not encouraging hunting. Legislation passed in 2007 helps prohibit any further movement or release of feral swine.

Wildlife Disease Research In Iowa

Acoustic transect monitoring in preparation for White Nose Syndrome in Iowa bats
Dr. Julie Blanchong, Department of Natural Resource Ecology and Management, Iowa State University

Knowledge of the abundance and distribution of bat species in Iowa is critically needed to understand the potential ramifications of White Nose Syndrome (WNS) to Iowa. For the past 4 years, we have conducted acoustic surveys along drive transects in eastern, central, and southern Iowa to document bat echolocation activity. As in previous years, in 2018, bat activity was consistently higher on transects in eastern Iowa compared to those in central and southern Iowa. Higher bat activity in eastern Iowa may be because eastern Iowa is the more forested area surveyed. In the central and southern regions of Iowa, low frequency bats, consisting of big brown, hoary, and silver-haired bats, were most frequently recorded while in the eastern region, high frequency bats, consisting of Eastern red, evening, Indiana, little brown, northern long-eared, and tricolored bats, were most frequently recorded. The difference in the distribution of low vs high frequency bats may be of importance with respect to potential regional differences in future impacts of WNS as bat species in the high frequency group tend to suffer greater impacts from WNS than do bats in the low frequency group. The acoustic monitoring program will continue in summer 2019. In summer 2018, we also continued an acoustic monitoring project in fixed location sites in several counties in central Iowa that will also contribute to our understanding of bat distribution and monitoring of potential impacts of WNS in Iowa. These monitoring projects have expanded to incorporate formal extension efforts to communicate with Iowa citizens, particularly private landowners, about the ecological importance of bats and methods for managing forests in bat-friendly ways.

Occurrence and risk factors associated with turkey lymphoproliferative disease virus in Iowa
Dr. Julie Blanchong, Department of Natural Resource Ecology and Management, Iowa State University

A new project began spring 2019 using hunter-harvested turkeys to document the prevalence of turkey lymphoproliferative disease virus (LPDV) in Iowa, examine spatial patterns of LPDV distribution, and identify risk factors associated with its occurrence. LPDV has been successfully detected using bone marrow from the tarsometatarsus.

Development of genetic tools to inform CWD management
Dr. Julie Blanchong, Department of Natural Resource Ecology and Management, Iowa State University

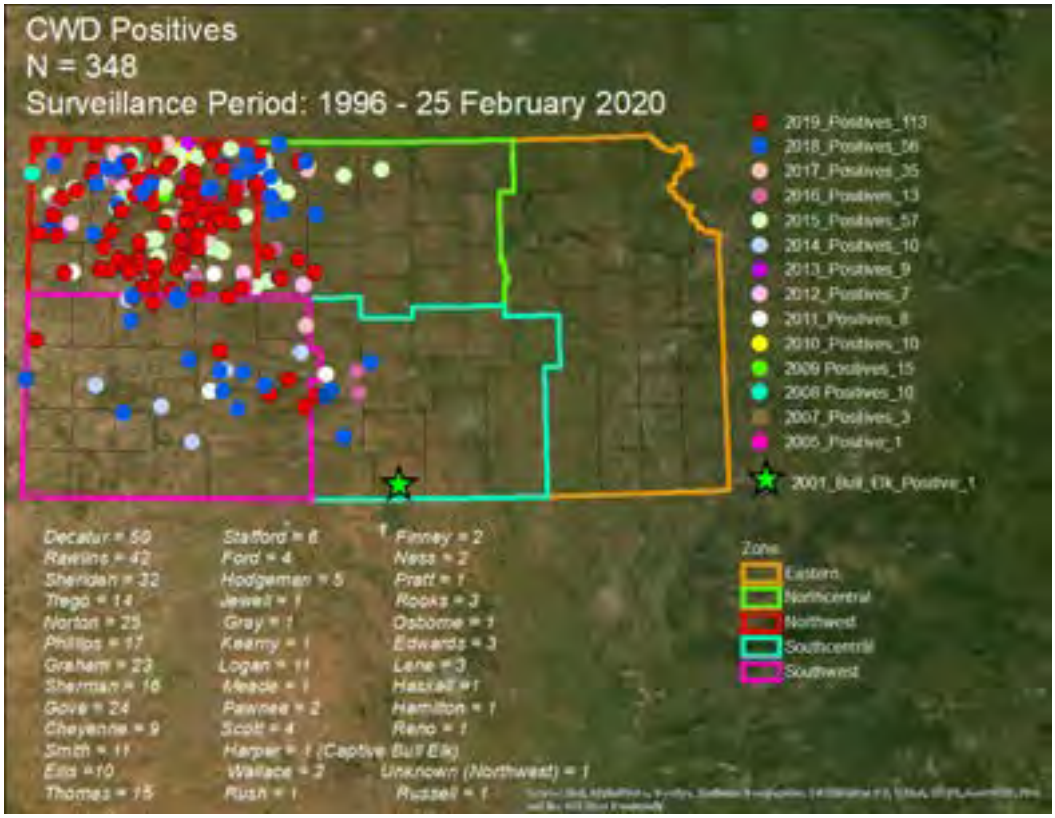
In collaboration with colleagues at other universities and several state natural resource agencies we are working toward developing a set of genetic tools for white-tailed deer that will facilitate improved CWD management by identifying genes associated with susceptibility, determining origin of CWD-positive deer, resolving relationships among CWD-positives, and determining how landscape features impact population connectivity and disease spread. Thus far, genome resequencing data for deer from three populations across the white-tailed deer range have been sequenced to identify genomic variability and genes of particular interest (i.e., PRNP). Proposals are pending that will support development of a set of single-nucleotide polymorphism (SNP) panels that states and researchers can use to address questions related to CWD and generate data that can be shared and pooled across labs/agencies.

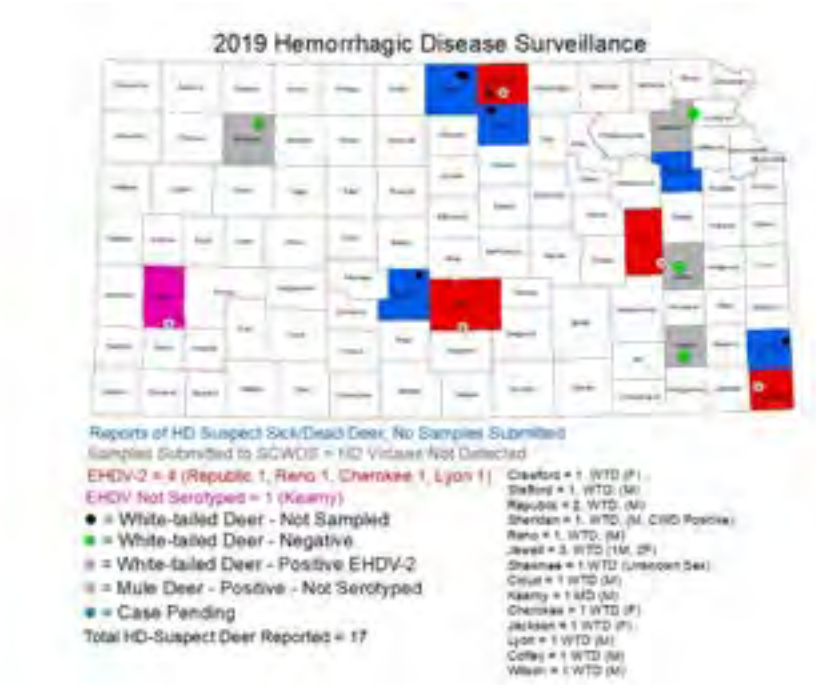
Snake fungal disease in Iowa
Matt Stephenson, Department of Natural Resource Ecology and Management, Iowa State University
Dr. Rachel Ruden, Iowa DNR

Snake Fungal Disease (SFD) is an emerging fungal disease of snakes caused by the pathogen *Ophidiomyces ophiodiicola*. In 2018 and 2019, skin swabs were collected from snakes during Science-based Trials of Rowcrops Integrated with Prairie Strips (STRIPS) surveys in 7 central Iowa counties to evaluate for the presence of the pathogen via quantitative PCR. Clinical signs consistent with SFD infection were observed in many snakes and *O. ophiodiicola* DNA was detected on several individuals, from multiple counties and species for which the disease has not yet been reported. Snake Fungal Disease is an emerging threat to snake populations in the Midwest and should be considered by wildlife managers, particularly for Iowa's three SGCN rattlesnake species which are particularly susceptible to the disease.

Offshoots of this project will include incorporating SFD monitoring into the Multiple Species Inventory Monitoring (MSIM) program coordinated through IDNR and Iowa State, as well as a collaborating on a longitudinal study with Dr. Bob Brodman of Buena Vista University to evaluate individual infection outcomes.

KANSAS WILDLIFE HEALTH REPORT 2019-2020





Kentucky's Midwest Wildlife Health Technical Group Update 2020

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Deer and Elk:

Chronic Wasting Disease (CWD)

- Kentucky Department of Fish and Wildlife Resources (KDFWR) has tested more than 30,000 free-ranging deer and elk for CWD since 2002; and to date; has not detected CWD within the state of Kentucky.
    - In 2020, Kentucky tested at total 2,000 samples from white-tailed deer and elk. On average, approximately 70 samples are from elk annually.
- CWD has been detected in 6 out of 7 states bordering Kentucky.
    - The nearest detections of CWD to Kentucky are 59 miles from Jackson, Tennessee (wild deer), 65 miles from Perry County, Missouri (wild deer), 135 miles from Millersburg, Ohio (captive deer), and 194 miles from Pruitt, Arkansas (wild deer and elk).

- Current regulations enacted by the KDFWR and KY Department of Agriculture (KDA) include a ban on importation of live cervids from CWD positive states, including Ohio.
    - Currently KDA permits the importation of captive cervids from herds in enrolled in the USDA's herd certification program from AK, AL, NC, IN, ME, and Manitoba.
- KDFWR proposed an amendment to the previous high risk parts carcass ban to change "allow quarters" to "meat must be deboned".
- KDFWR is exploring possible double fencing requirements for all new captive facilities and expansions on pre-existing facilities.

CWD sampling Effort

- Implemented a new data collection app, Survey123
    - Improve data quality and management
- Increased collection efforts
    - As of 1/21/2020 we have collected 2,780 samples
        - Testing 2,000 samples based on funding availability
- Samples were submitted to Wisconsin Veterinary Diagnostic Laboratory
    - Results from IHC are pending
        - So far of the 192 tested, all were negative as of 04/24/20
- Future of sample efforts
    - Implement a weighted sample design
    - Samples will be sent to the Breathitt Veterinary Center
    - Switch from IHC to ELISA for CWD surveillance
    - Submit samples on a quarterly base rather than annual
- Update CWD Response Plan as surveillance, management, and response plans evolve

Table. Summary of CWD sample data from Kentucky, 2009-2017.

Species	Sex	Age	2009	2010	2011	2012	2013	2014	2015	2016	2017
Deer	F	Fawns	154	149	98	2	14	0	0	1	1
	F	Yearlings	213	203	150	6	34	26	39	76	61
	F	2 year olds	251	205	179	39	143	105	90	205	198
	F	Mature adults	117	186	92	220	114	137	186	198	178
	M	Fawns	128	138	115	1	19	2	1	1	0
	M	Yearlings	450	361	323	8	106	112	98	137	159
	M	2 year olds	428	411	337	99	325	266	254	401	474
	M	Mature adults	190	232	159	264	237	235	311	379	436
Total	deer		1,931	1,885	1,453	639	1,036	885	979	1398	1511
Elk	F	Calves	5	5	0	1	1	4	1	2	3
	F	Yearlings	2	4	2	12	4	6	5	1	7
	F	Adults	6	4	1	29	21	19	14	24	21
	M	Calves	3	1	0	1	3	4	2	0	0
	M	Yearlings	7	4	3	6	8	8	7	7	6
	M	Adults	6	9	7	34	22	33	27	27	51
Total	elk		29	27	13	83	58	74	56	61	88
Clinical samples (elk and deer):			9	13	16	32	47	49	20	25	76
Road killed samples:			348	256	287	107	213	221	207	199	260
Total samples:*			**2,179**	**2,107**	**1,625**	**722**	**1,094**	**959**	**1039**	**1,469**	**1,599**

Meningeal Worm (*Parelaphostrongylus tenuis*) in Elk

- Approximately 4-6% of elk in Kentucky contract the parasite.
    - In 2019, 18 animals were submitted to SCWDS as suspect P. tenuis cases
        - Majority had a copper deficiency comorbidity
            - Copper deficiency was often seen with an elevated thiosulfate level detected from ocular fluid
            - The role of a potential sulfur toxicity is still being teased out
- Active surveillance by KDFWR for suspect P. tenuis elk
    - Developed standard field necropsy protocol
        - Includes trace mineral analysis
    - The public is strongly encouraged to report any sick or dead elk to the local biologists so they can respond and collect samples for the appropriate tests.
- While, symptoms of meningeal worm can appear similar to those caused by Chronic Wasting Disease (CWD), they are not the same.
    - These similarities highlight the importance of performing diagnostic tests to distinguish between these diseases.

Furbearers:

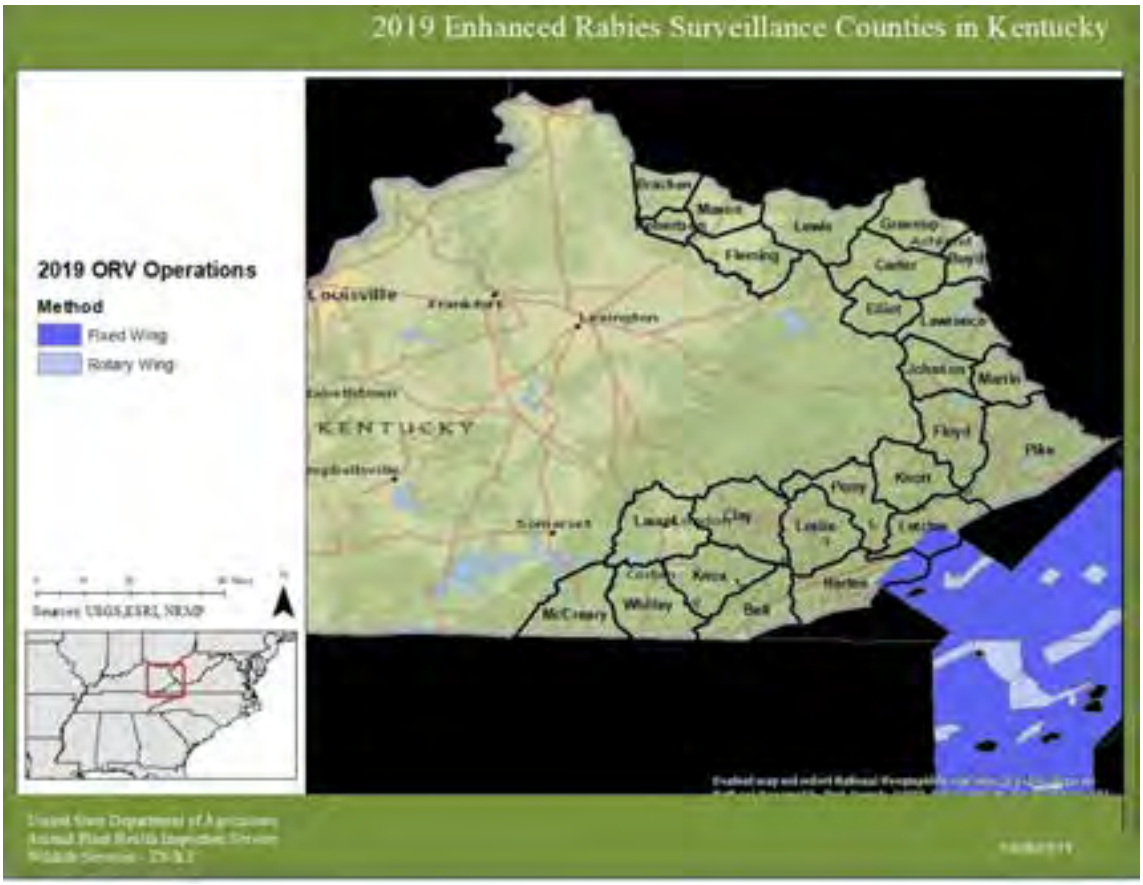
Raccoon Rabies Control Program

- To date, raccoon-variant rabies has not been detected in Kentucky, with state and federal agencies working to control spread east of the state border.
    - However, in May 2017 USDA Wildlife Services confirmed the detection of raccoon-variant rabies 7 miles east of Kentucky border which was 9 miles west of the Oral Rabies Vaccination Zone.
    - The USDA-WS continues to maintain enhanced surveillance in areas where raccoon variant rabies may emerge and currently maintains a 25-county enhanced rabies surveillance zone in Eastern Kentucky (map below).
    - The Oral Rabies Vaccination Zone was expanded to address the 2017 breach and now includes two eastern counties in Kentucky.
- To prevent the introduction of raccoon-variant rabies through the inadvertent translocation or movement of rabies vectors species (raccoons, skunks, foxes, coyotes), in July of 2017, the KDFWR Commission voted to approve a proposed regulatory amendment to prohibit movement of rabies vector species in and out and within the 25-county USDA enhanced rabies surveillance zone in eastern Kentucky.
    - This amendment is awaiting a vote in the house but expected to pass

Rabies Testing and Prevention in Kentucky

Kentucky's Public Health Rabies Laboratory sees approximately 15.6 positive cases per year out of 800-900 tests. In 2016, the Kentucky Department of Public Health in partnership with the University of Kentucky developed an interactive webmap, which includes rabies submission data from 1989-2015. The data is now stored and maintained at the University of Kentucky Veterinary Diagnostic Lab in the Epidemiology section. Kentucky Fish & Wildlife has also submitted their data from **1976-2019** to include.

Link: https://ukvdlmap.carto.com/viz/66a6cffa-4f37-11e6-98da-0ee66e2c9693/embed_map



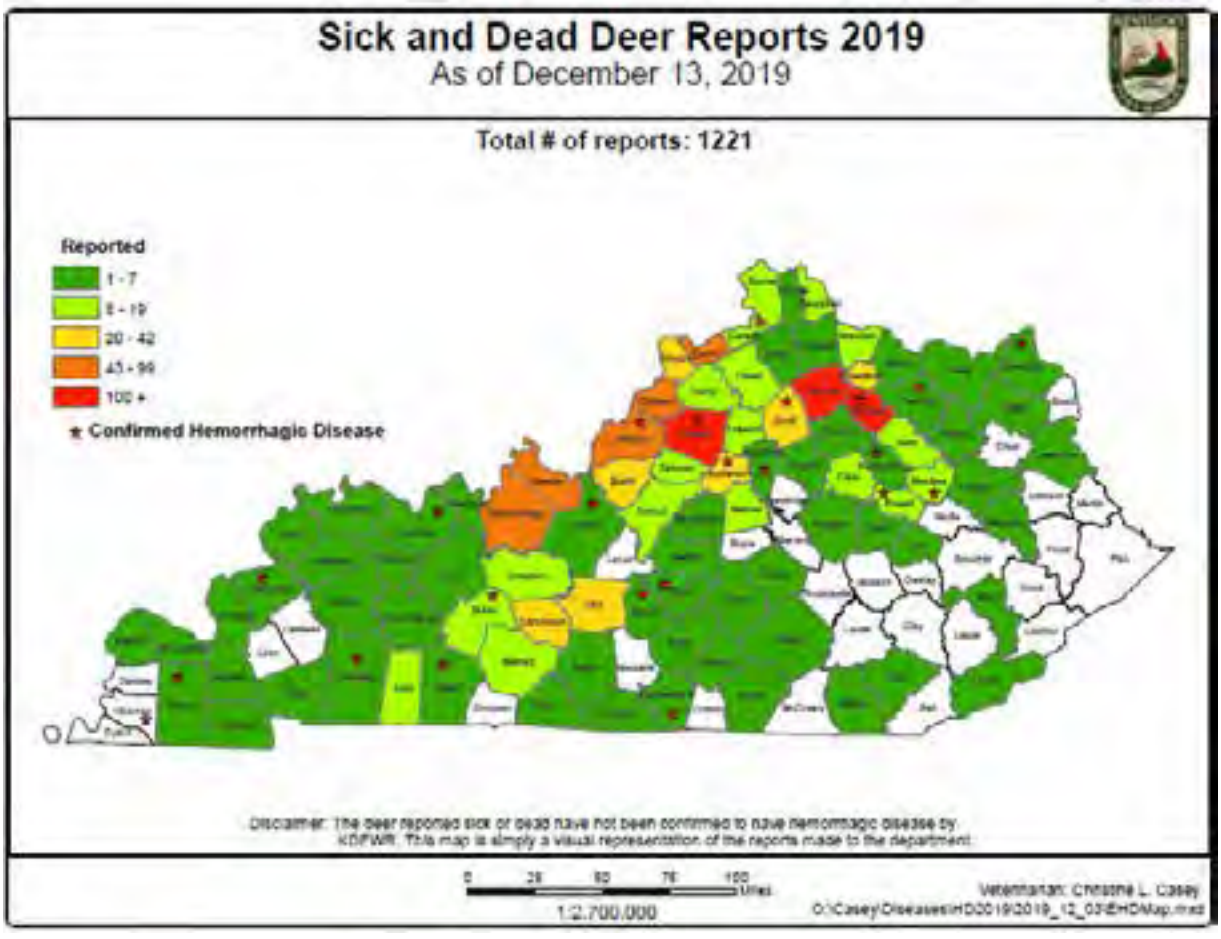
<u>Upland Game Birds:</u>

First Confirmed Detections in KY

- Case of Histomoniasis in a Wild Turkey from Breckinridge Co. (October 2019)
- Clinical case of LPDV in a Wild Turkey from Jackson Co. (November 2019)

Hemorrhagic Disease - 2019 Outbreak

- In the late summer through December of 2019, KDFWR received reports of 1,221 sick or found dead white-tailed deer suspected of having hemorrhagic disease (HD).
- This is considerable more than the previous year's number of sick or dead deer, 35, but significantly less than the 2017 with 4625 deer reported.
- In 2019, over 50 samples from suspect cases were submitted for diagnostic testing. Epizootic hemorrhagic disease virus (EHDV) was confirmed by PCR in deer from 24 counties in KY.
    - All isolates were identified as Serotype EHDV-2 via virus isolation.
- The Bluegrass Region and the Green River region had the highest number of reports in 2019.
- Additionally, 25 hunter-harvested blood samples were collected during a fall quota hunt at Clay WMA in northeast KY. These samples were submitted for serology and will be compared to results from samples collected in previous years.
    - The hope is to use this data to demonstrate to hunters that deer due survive infection with EHDV and produce antibodies.



Eastern Wild Turkey Health Assessment

The goal of the study was to examine hunter-harvested wild turkey from 2018 to further investigate a perceived localized decline in wild turkey populations. The wild turkeys examined were in apparent good health with no significant gross abnormalities detected.

- A total of 36 frozen hunter-harvested turkey carcasses were submitted to the Southeastern Cooperative Wildlife Disease Study (SCWDS) for gross necropsies and diagnostic evaluations.
- The majority of birds were from the populations of concern in Livingston County (n=13) and Crittenden County (n=17), designated the study population.
    - An additional, six birds were collected from other areas, including Allen County (n=2), Anderson County (n=2), Woodford County (n=1), and Pulaski County (n=1) and represent the control population.
- Microscopic examination revealed no evidence of any significant underlying disease processes.
- Although all birds had variable burdens of intestinal parasites (i.e., coccidia, cestodes and nematodes) and hemoparasites (i.e., H. meleagridis and L. smithi), these infections are likely not significant to the health of adult birds (see table below).
    - All the parasites detected are commonly reported in wild turkeys and are not typically associated with disease in adult birds.
- No clinical disease was observed in association with lymphoproliferative disease virus (LPDV) or Reticuloendotheliosis virus (REV) infection.

Overall, this diagnostic survey of hunter-harvested, adult male wild turkey did not identify potential explanations for the apparent turkey declines in the area. The significance of cause-specific mortality factors among wild turkeys may vary between age classes. In the future, KDFWR would like to explore the potential of submitting poults to assess age related mortality factors.

Table 1: Prevalence of selected microbes detected in hunter-harvested wild turkeys from KY

Observed Prevalence of Selected Pathogens			
Pathogen	Study Population	Control Population	Overall
Borrelia spp.	4/30 (13%)	0/6 (0%)	4/36 (11%)
LPDV	12/30 (40%)	2/6 (33%)	14/36 (39%)
REV	4/30 (13%)	0/6 (0%)	4/36 (11%)
Histomonas/Tetratrichomonas spp.	2/30 (7%)	1/6 (17%)	3/36 (8%)
Haemoproteus meleargridis	26/30 (87%)	4/6 (67%)	30/36 (83%)
Leucocytozoon smithi	1/30 (3%)	0/6 (0%)	1/36 (2.8%)

Bobwhite Quail Health Assessment

While there are no current widespread disease issues for quail in the state, an ongoing study in collaboration with researchers at Lincoln Memorial University is attempting to assess the overall health of quail populations in Kentucky.

- To date, 51 hunter-harvested bobwhite from the western and northeastern portions of the state have been collected and analyzed.
- To date, no eyeworms have been detected from quail in KY.
- The main intestinal worm detected, *Aulenocephalus pennula*, was present in 89% of the samples submitted for testing.
- To get a more comprehensive understanding of the diversity and prevalence of parasites in quail the future goals of this study are to include samples collected from different times points throughout the year.

Small Game:

Tularemia

- In August 2019, a rabbit was reported by a landowner in Louisville as lethargic and died shortly after.
    - The carcass was collected by KDFWR and submitted for diagnostic testing, it came back positive for the causative agent of Tularemia.
- In spring of 2018, KDFWR personnel responded to a rabbit testing positive for tularemia in Butler County.
    - The Department tested several other animals in the immediate area and is continuing to monitor the site for years to come to track the occurrence of this disease. Most of the rabbits in the immediate area died very quickly and impacts to the surrounding rabbit population appear to be minimal.
- Penned rabbits and their current lack of regulation poses a serious health concern for humans as well as wildlife.

Bats:

White-Nose Syndrome (WNS)

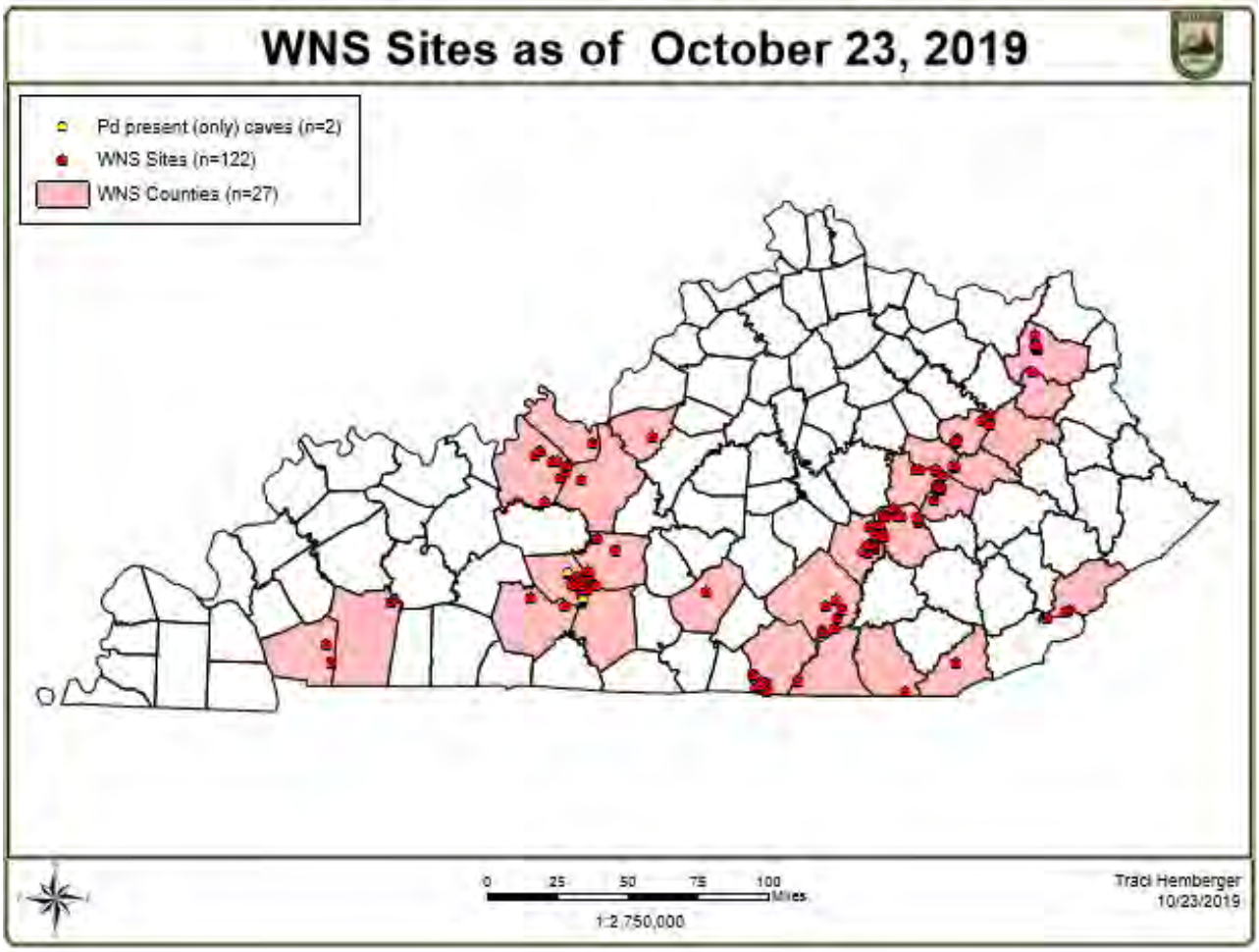
- Eleven of Kentucky's 15 bat species will utilize caves during the winter, and WNS has had an impact on several of them.
    - The 2014 and 2015 winter surveys revealed the first major declines in three historically common species: little brown bat, northern long-eared bat, and tricolored bat (see table).

- Overall, there have been less visibly infected and/or dead bats observed during winter surveys the last several years but populations for all of these continue to decline.
    - Looking at a subset of caves, these species have all suffered >88% declines from their peak populations observed in 2012 and 2013 (see Table 2).
    - Looking at the same subset of caves, the Indiana bat population has shown only a small decrease in numbers; however, looking at all the Indiana bat cave populations shows a decrease of about 21% now.
- A few important populations of this endangered bat have suffered significant declines (e.g., three P2 cave populations have decreased >=80%.) and lesser caves have suffered up to 100% loss.
- On the other hand, there have been only a total of 13 symptomatic and/or dead big brown and small-footed bats combined since 2011, the fungus Pd has been detected on only one Rafinesque's big-eared bat, and only two endangered gray bats have been observed as visually-infected.
- Since 2015, the KDFWR scaled down surveillance to primarily hibernacula known to harbor federally endangered or threatened species as required to be monitored by federal regulations.
    - Department biologists have made an effort to get caves back on a two-year schedule to reduce disturbance to hibernating bats.
    - The most important bat caves will be surveyed again in 2021, and WNS-related impacts to Indiana bats in particular can be reassessed then.

Table 2 Population size for P1 (n=6) and P2 (n=15) Indiana bat hibernacula.

Year*	MYLU	MYSE	MYSO	PESU
2008 + 2009	7091	43	52908	1283
2010 + 2011	9021	16	66607	1462
2012 + 2013	13958	168	58013	2507
2014 + 2015	4401	63	60482	714
2016 + 2017	1734	24	55573	368
2018 + 2019	1232	15	52733	273
% change from peak (2012+2013) to 2018/2019	-91.17	-91.07	-9.10	-89.11
overall % change [preWNS (2008+2009) compared to 2018/2019]	-82.63	-65.12	-0.33	-78.72

*Each cave is normally surveyed every two years on odd (n=15) or even (n=6) year rotation but there are some gaps in the data.



Reptiles and Amphibians:

Snake Fungal Disease

- In July 2014, snake fungal disease was first confirmed in a queen snake from central Kentucky.
- Since then, skin lesions have been detected on a variety of species in Kentucky including copperheads, milk snakes, king snakes, water snakes, worm snakes, and black racers.
- Preliminary data (Dr. Steven Price, University of Kentucky) have detected *Ophidiomyces ophiodiicola* in several species including kingsnake, copperhead, garter snake, milksnake, ringneck, racer, northern watersnake, ringneck, timber rattlesnake, queensnake.
    - The fungus was detected (RT-PCR) in 102/222 (46%) snakes sampled and in 102/125 (82%) snakes with skin lesions. The fungus was detected in 12/14 species sampled.

- The KDFWR is working with other agencies and researchers to investigate the potential role of this emergent disease and population level impacts on snakes in the Commonwealth.

Amphibian Disease Surveillance

From 2016 to 2018, KDFWR conducted a statewide disease surveillance in partnership with the USGS - National Wildlife Health Center and Eastern Kentucky University to determine the geographic distribution of ranavirus and chytrid fungus, early detection of salamander chytrid fungus, and impact on populations of amphibians in the Commonwealth.

Results:

- Based on 2016-2017 data, the salamander chytrid fungus (Bsal) was not detected.
- It appears that *Batrachochytrium dendrobatitis* (Bd) is widespread across the state, and present in a large proportion of animals sampled in wetlands where the fungus has been detected.
    - Bd was detected in Eastern newts at 88% (44/50) wetland sites sampled, and in 66.2% of newts and 11.7% of ranid frog tadpoles tested.
- Ranavirus was detected in 17% (8/47) of wetland sites and 2.4% of tadpoles tested.
- Genetic sequencing is still pending.

Wild Swine:

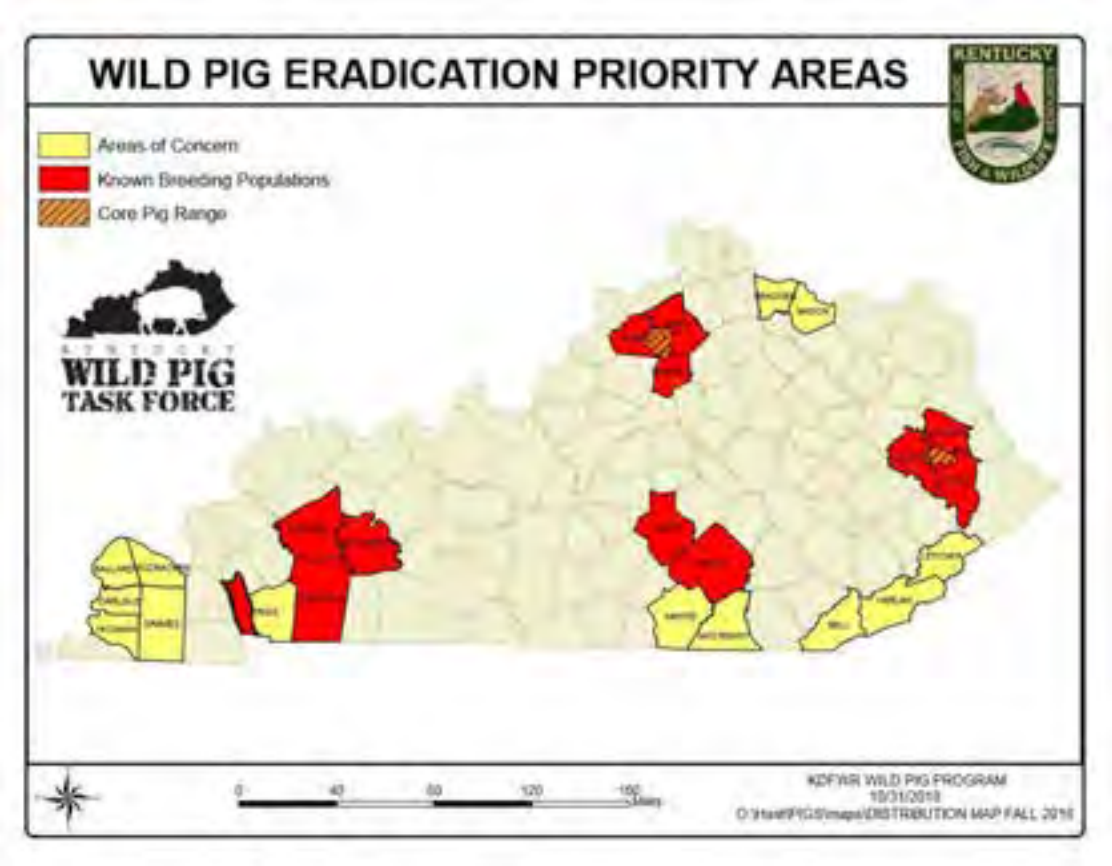
Eradication and Disease Concerns

The Kentucky Department of Fish and Wildlife Resources in partnership with USDA Wildlife Services has made great strides in wild pig eradication over the last few years.

- Wild pig numbers are at the lowest level in the last decade.
- All breeding populations of pigs in KY have been significantly reduced.
- Eradication numbers in 2019 were less than a third that of 2018 which is indicative of shrinking populations due to the success of trapping efforts and an aggressive campaign that includes monitoring, communication, and increased public support for wild pig removal.
    - The largest population of wild pigs, located in Henry County, has been almost entirely eradicated.
    - Since 2018, 128 wild pigs have been removed from Henry County. Crop damage has not been reported since 2018.
- Efforts are underway to find any remaining pigs on the landscape.

Wild pig control efforts in Kentucky, 2009-2019

	2009	2010	2011	2012	2013	2014*	2015	2016	2017	2018	2019
# Removed	91	178	312	167	101	100	326	323	407	171	51
# Sampled	27	50	94	12	11	11	25	19	56	19	20
PRV Positive	5	8	0	0	0	0	0	0	0	1	0
SB Positive	3	1	0	0	1	0	0	0	0	0	0



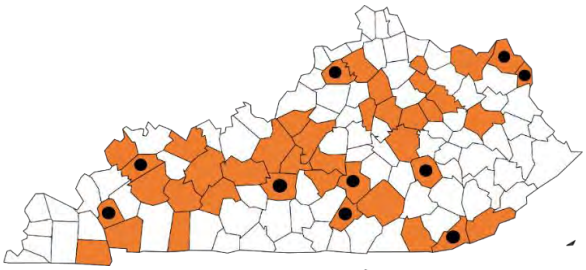
Tick Surveillance

In response to the expansion of tick vector species into Kentucky, in partnership with SCWDS, in 2015, the KDFWR initiated a statewide tick surveillance program which is ongoing.

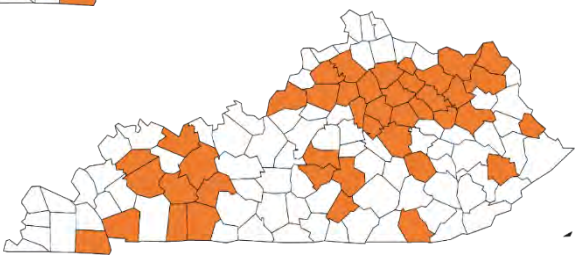
- Additionally, KDFWR has partnered with the KY Department of Public Health to continue long-term surveillance of tick populations in Kentucky.
- Since the Asian longhorned tick's initial detection it has been confirmed in 10 states, including KY.
    - The tick was recovered from an elk in Martin county in July 2018.

- **However, this past year a positive HL detection was confirmed from a black bear collected in June 2017.**

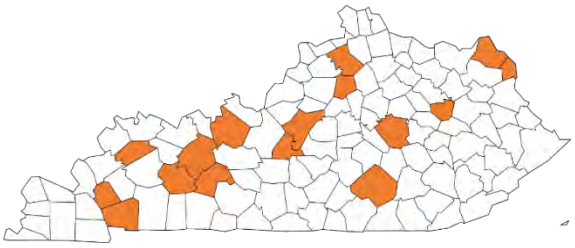
- To date, no pathogens have been detected with HL tick samples from KY.



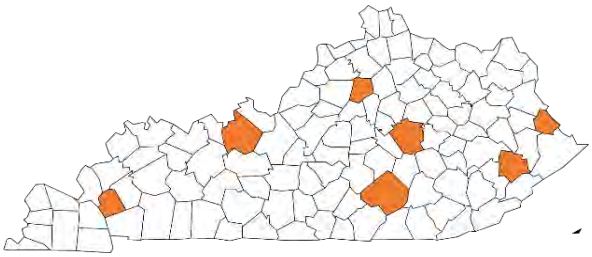
Lyme disease detections in *Ixodes scapularis* (dots) overlaying the currently known *I. scapularis* distribution in Kentucky (orange counties).



The winter tick (*Dermacentor albipictus*) distribution in Kentucky, by county.



The lone star tick (*Amblyomma americanum*) distribution in Kentucky, by county.



The Gulf Coast tick (*Amblyomma maculatum*) distribution in Kentucky, by county.

Asian longhorned tick (*Haemaphysalis longicornis*) distribution in Kentucky, by county.

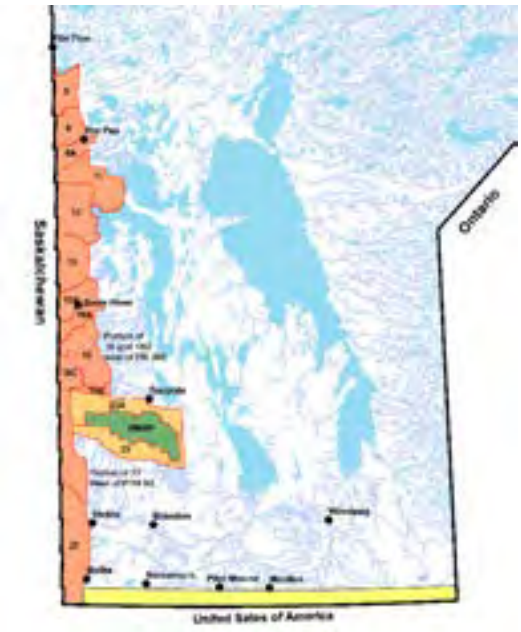
Manitoba
Sustainable Development

Midwest Association of Fish and Wildlife Agencies Health Committee Meeting
April 29th, 2020

Manitoba Wildlife Health Program Update

A bit of background on Big Game Health:

- Baiting cervids for the purpose of hunting is illegal for licensed hunters' province wide.
- Mule deer are considered extirpated in MB – no hunting allowed.



- Feeding of cervids is illegal in the Bovine TB Eradication and CWD Surveillance Zones (see map).
- All licensed hunters must submit the entire head and lungs in the Bovine TB Zone (orange on map) and the entire head in the CWD Zone along the MB-SK border (pink) of any deer or elk harvested.
- 2019, submission of deer and elk samples voluntary along MB-US border (yellow)

←---------- 449km ----------→

- Multiple areas of MB closed to moose hunting – low populations. Moose Recovery Program underway since 2014. Some populations appear to be recovering. Slow recovery rate and overall issues with moose still not understood.
- Biggest concerns for the Big Game Health Program are CWD and bovine TB.
    - Regulations (under the Wildlife Act) put in place to address these:
        - Prohibition on import of live native or exotic cervids (excludes farmed elk)
        - *Wildlife Protection Regulation*
            - Mandatory sample submissions
            - Prohibition on possession of cervid bodily fluids (urine)
            - Restrictions on carcass importation
            - Authority to order removal of any thing acting as an attractant to cervids
        - *Cervid Protection Regulation*
            - Feeding of cervids for any purpose prohibited in disease control zones

Bovine Tuberculosis

Species	Male	Female	Total	Average Total
White-tailed deer	244	30	274	300
Elk	14	20	34	100
Moose	0	1	1	5
Total			309	405

Table 1. Sample submissions from hunter-harvested cervids in the Riding Mountain Eradication Area for 2019-20.

All samples **negative**, only one with GVLs (actinobacillus).

Bovine TB is below detectable levels in wildlife and has been declared eradicated in domestic livestock in the Riding Mountain Eradication Area. Following recommendations from the Scientific Review Committee, MB's Big Game Health Program will be conducting bovine TB surveillance of wild deer and elk harvested by hunters for a minimum of two (2) more years.

Chronic Wasting Disease

Species	Male	Female	Total	Average Total
White-tailed deer	415	76	491	300
Elk	29	19	48	100
Moose	3	3	6	10
Mule Deer	2	7	9	6
Total	449	105	554	416

Table 2. Sample submissions from hunter-harvested cervids in the CWD Surveillance Zone 2019-20.

All samples **negative**.

- Received word from AB on five (5) CWD positive mule deer harvested by MB residents. Collected and destroyed all parts and meat from these.
- Expanding program includes mandatory sample submission along MB-US border, expanding feeding ban (province-wide?), prohibiting importation of **all** cervid parts, all hunter-harvested cervids (including moose) mandatory sample submissions.

Parelaphostrongylus tenuis

Figure 1. Moose tracks showing probable P tenuis symptoms.

Brainworm still causing us issues. Initiated a couple of studies including collaboration with the Canadian Wildlife Health Cooperative (CWHC) in Saskatoon, SK. In 2018/19 sent 214 skulls from hunter-harvested white-tailed deer for brainworm necropsy. Part of a Masters student's research.

P. tenuis Result	Total Worms	Olfactory bulb	Cerebrum	Cerebellum	Transverse	Sagittal	Cavernous
# Positive	54	3	39	17	9	0	0
% Positive	24.766	5.556	72.222	31.481	16.667		
Ave # Worms	2.426	1.333	2.091	1.353	2.222		

Table 3. P tenuis results from n=214 white-tailed deer samples, western part of Manitoba, 2018-19.

Study is on-going, over 400 heads sent to Saskatoon last month. Results pending. Note in 1997, ~20% positive and, in 2013/14, ~48% of white-tailed deer in same geographic area had P tenuis infection.

Another study initiated in 2019, collaboration with University of Manitoba researchers on P tenuis host distribution and abundance. Study will begin this summer.

Moose Health Initiative

In 2018 we started a project to look at the general health of moose in Manitoba with an eye towards determining if there were other causes to moose declines in some areas of the province. We provided kits for hunters and included instructions on what and how to collect samples from animals harvested. We weren't sure what samples we could reliably receive nor what condition they would be in. In 2018 we provided these kits to outfitters and other hunters, no charge, and asked them to send us samples. Appendix 1 includes summary results from 2018-19 sampling and instructions given to hunters for sampling methods.

	Total	Blood	Hair	Fecal	Hide	Liver	Jaw	Kidney	Testicle	Abnormality
2018/19	39	29	33	28	29	31	22	29	29	10
2019/20	25	19	22	17	21	16	23	21	14	5

Table 4. Preliminary samples from hunter harvested moose – Moose Health Initiative.

Appendix 1. Information provided to moose hunters for Moose Health Initiative.

Dear Moose Hunter(s),

Thank you so much for your interest in and help with investigating Manitoba's moose health/disease status. The main goal of this project to establish baseline values for moose health parameters in our province as well as potentially identify any health abnormalities in hunter harvested moose populations. This data has value in its own right but also in its utility as comparison data for moose samples collected in parts of the province where moose populations may be declining or in cases in which ill moose are identified.

The first moose hunting season in which full health kits were sent out to hunters as part of this project in Manitoba was 2018-2019 with the majority of samples collected in September and October. During the 2018-2019 hunting season we had a total of 39 kits collected and returned with varying numbers of samples returned with each kit. The following samples were collected from these kits: 29 blood samples, 33 hair samples, 28 fecal samples, 29 hide samples, 31 liver samples, 22 jaw samples, 29 kidney samples, 29 testicle samples and 10 abnormalities. Almost all samples came from male moose.

Analysis of these samples has largely been completed or will be soon, although some of it is ongoing as we are still developing techniques to perform the type of analysis needed.

The hair samples have been analyzed for cortisol concentrations (which can be a measure of chronic stress). The cortisol concentrations ranged from 2.33 to 22.0 pg/mg with an average of 7.4 pg/mg. This average is comparable to values observed in moose in other studies in North America but we plan to compare these values, especially those on the extreme ends of the range, to other parameters within the individual moose moving forward as well as comparing these values between regions and between ill animals and healthy hunter harvested animals.

The fecal samples have been examined for internal parasites and cortisol. A type of roundworm (*Nematodirus* sp.) and a type of tapeworm (*Monezia* sp.) were found in the fecal samples. No evidence of fecal nematodes or tapeworms were found in ~43% of individual moose samples but ~57% of fecal samples had evidence, and in a couple of cases high numbers, of eggs from these two types of parasites. Fecal trematodes (*Paramphistoumum* sp.) were also found in ~21% of samples. Fecal cortisol concentrations averaged 47.48 ng/g and ranged from 14.22 to 110.02 ng/g. Comparison of these results as well as the others will be examined on an individual animal level and over time results will be compared amongst various regions of the province. The hide samples have been examined for levels of the early stages of winter tick with early stages observed on ~45% of hide samples.

The liver samples have been analyzed for various trace minerals including selenium, molybdenum, iron, copper, zinc, etc. Mineral deficiencies and elevations have been found to cause a range of conditions in moose and have been associated with population declines in some parts of the world. The evaluation of these results is ongoing.

Of the abnormalities/extra tissues submitted by hunters, four were confirmed to be hydatid cysts in the lungs. Although these cysts are not infectious to people, they are infectious to dogs and wild canids. Two abnormalities were reactive lymph nodes and two were inflamed sections of lining from the chest cavity (the cause of which was not determined). In addition two sections of spinal cord were submitted which appeared to be within normal limits (no evidence of brainworm, etc).

We plan to extract a portion of the blood called the serum from the blood filter paper strips for blood tests looking for evidence of brainworm (*P. tenuis*) infection as well as potentially other diseases such as those that can contribute to abortions (eg. Neosporosis and Toxoplasmosis). An incisor from the collected jaw samples has been submitted to Matson's Lab in Montana and the results are pending. Analysis of the reproductive organs (testicles or ovaries) will be performed to assess reproductive functioning in the near future. Kidney and bone marrow samples may also be analyzed for toxins, diseases and/or fat stores in the future.

Thank you so much for collecting and contributing samples to this ongoing project! With time we expect to accumulate more and more valuable information. A few very important factors in this data/sample collection include: 1) the location were the moose was harvested, as we are attempting to sample moose all over the province to look for trends/abnormalities amongst regions of the province (we have put pencils all of this year's kits so you can record this information) 2) it is very valuable for rump fat measurements to be made so that we are able to assess what kind of body condition the moose are in at the time of sampling and 3) please provide your contact information so that we are able to provide you with your individual moose's results in the future.

Moose Health Monitoring 2019 Moose ID #: _____

Hunter name: _____ Date of Kill:_____

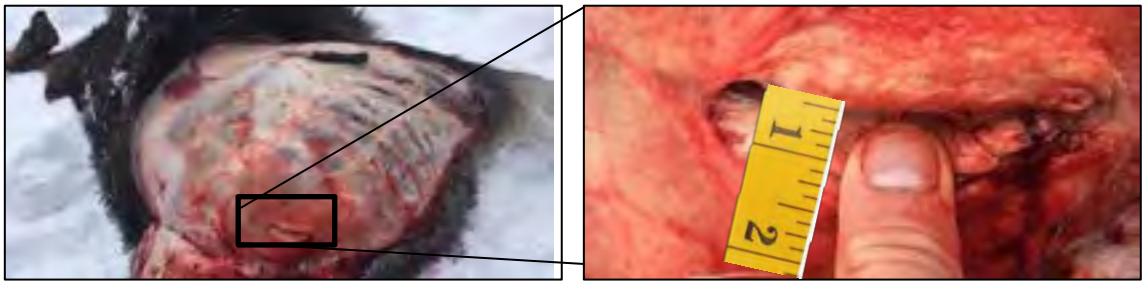
Kill location description and GPS coordinates:_____

Hunter phone number: _____ Email: _____

Mailing address: _____
(Contact info will only be used to provide hunter with results of biological sample tests)

1. Sex (√): ☐ Bull ☐ Calf ☐ Cow If a cow, was it: ☐ With a calf ☐ Pregnant ☐ Unknown

2. Amount of rump fat: _____ inches - Please take a photo with the measurement tap found on Ziploc bag



3. Animal's behavior (√): ☐ Normal ☐ Circling, head tilt, falling ☐ Other:_____

Please collect the following priority samples:
****Put data sheet in plastic bag with samples****

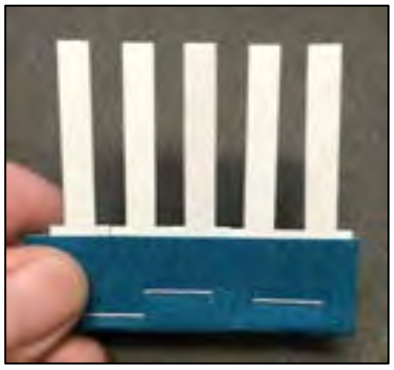
☐ **Blood** - As soon as the animal is killed, soak all 15 strips with blood (e.g. by cutting heart open and placing s
followed by labelled bag.

☐ **Fecal sample** - Collect 10 moose pellets from anus or by cutting end of intestine once gutted and place in lal

☐ **Hair** - Pull hairs from hide (do not cut them) and place a handful of hair in labelled bag.

Blood strips Blood strips

Image borrowed from CircumArctic Rangifer Monitoring + Assessment (CARMA)



Blood strips

Hair

Fecal sample

Any abnormalities noted?

Meat ☐ Normal ☐ Cysts ☐ Other

Liver ☐ Normal ☐ Cysts ☐ Other

Lungs ☐ Normal ☐ Cysts ☐ Other

Skin over shoulders ☐ Normal ☐ Ticks ☐ Hair loss

Skin over rump ☐ Normal ☐ Ticks ☐ Hair loss

Please take the following photos of the moose:

☐ Full body side view ☐ Area with hair loss ☐ All organs together in chest cavity ☐ Liver ☐ Lungs ☐ Abnorm

Other abnormalities or comments (please describe):

_____

_____

If you are able to collect additional samples and keep samples frozen, please place the following in labelled bag
Note hide samples and hair samples are different. Hide samples will be used for winter tick counts. Hair sample

☐ Liver (3 by 3 inch piece) ☐ Left kidney with fat ☐ Any abnormalities (e.g. cysts)

☐ Jaw ☐ Testicle ☐ Hide over shoulders and rump (8 by 8

Liver

Kidney with fat

Kidney without fat

Jaw

Testicle

Hide over shoulders and rump (8” b

Hydatid cysts on lungs

Hydatid cyst in liver