Montana Fish, Wildlife & Parks' 2022 Chronic Wasting Disease Surveillance and Monitoring Report

PR Management Grant F22AF03233

Annual report, July 1st, 2023

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AGENCY:	***Fish, Wildlife & Parks***
GRANT:	***Montana Wildlife Disease Surveillance & Response Program***
MT TRACKING:	***F22AF03233***

Executive Summary

Montana Fish, Wildlife, and Parks (FWP) has been conducting surveillance for chronic wasting disease (CWD) since 1998, and first detected CWD in wild deer in 2017. In 2022, FWP prioritized sampling in northcentral, southwestern, southcentral, and east-central Montana. FWP continued CWD management in the Libby CWD Management Zone with the 4th annual Special Libby CWD Hunt and through agency trapping and removal of white-tailed deer within the town of Libby. Additionally, CWD management was conducted in southwest Montana through the 3rd consecutive special CWD hunt known as the Southwestern Montana CWD Management Hunt. FWP offered free state-wide testing. Hunters could submit samples via mail, at CWD sampling stations, and at all FWP regional offices in 2022.

During the 2022-2023 season, FWP tested 7247 samples from mule deer (n=2621), white-tailed deer (n=3320), elk (n=1256), and moose (n=50). Of these, 264 animals tested positive for CWD, including 68 mule deer, 195 white-tailed deer, and 1 elk. In 2022, CWD was detected in 3 new hunting districts: 304, 311, and 405. Among CWD-positive hunting districts across the state, prevalence estimated from hunter-harvested animals sampled from 2020-2023 ranged from <1% - 14% in mule deer and <1% - 28% in white-tailed deer. Within white-tailed deer, CWD prevalence was highest in hunting districts 322 (28%, 95%CI: 26-30%) and 340 (8%, 95%CI: 5-11%). Within mule deer, CWD prevalence was highest in hunting districts 600 (14%, 95%CI: 11-18%), 640 (10%, 95%CI: 7-14%), and 670 (8%, 95%CI: 6-11%). In the town of Libby, 9% (95%CI: 7-12%) of hunter-harvested or trapped white-tailed deer were positive for CWD, whereas only 5% (95%CI: 4-6%) were positive outside the town within the Libby CWD Management Zone. In the Southwestern Montana CWD Management Hunt Area, CWD prevalence among hunter-harvested white-tailed deer was 42% (95%CI: 39-45%). An analysis of all data collected during the general rifle season from 2017-2023 from hunter-harvested deer (n = 18628) in CWD-positive hunting districts suggested several state-wide patterns of infection across species, sex, and age class. Outside of the Libby CWD Management Zone and the Southwestern Montana CWD Management Hunt Area, but within CWD-positive hunting districts, we found no significant statewide difference in prevalence among adult male white-tailed deer and adult male mule deer, with an estimated 3% prevalence in both species. Among mule deer, adult males had 4.3 times the risk of infection as adult females across Montana's CWD-positive hunting districts. Among white-tailed deer, adult males had 1.6 times the risk of infection as adult females across Montana's CWD-positive hunting districts. Within age classes for both species, the risk of infection was greatest in adults, followed by yearlings and young of the year.

FWP continues to plan for long-term CWD management in positive areas. In 2023, FWP will continue to enforce proper carcass disposal requirements and provide educational materials and programs. FWP will continue to advertise CWD sampling station locations and hours of operation as well as distribute information for hunters who wish to collect and submit their own samples throughout the hunting season. Harvest management aimed at minimizing the spread and population effects of CWD is ongoing in various regions around the state. CWD management hunts are expected to continue in the Libby CWD Management Zone and Southwest Montana CWD Management Hunt Area. Trap and removal efforts in the town of Libby will also continue to be used to manage CWD prevalence and spread within the area. Additionally, FWP managers have drafted a proposal to implement a CWD management hunt in portions of Region 6 to address increasing CWD prevalence estimates within the mule deer population. This proposal was submitted through the biennial hunting season-setting process and is currently in review. In 2023, FWP will attempt surveillance in all hunting districts that intersect a 40-mile buffer on known positives, where CWD has not yet been found. FWP will target districts in southwestern, southeastern, northcentral, and eastern Montana for surveillance and monitoring to improve understanding of whether the prevalence and distribution of the disease is changing.

Background

Chronic Wasting Disease is a fatal neurologic disease of cervids (deer, elk, moose, and caribou) for which there is no known cure. CWD is caused by an infectious, mis-folded prion protein which is shed by infected individuals for much of their approximately 2-year course of infection. The CWD-associated prion is transmitted via direct animal-to-animal contact and indirectly through the ingestion of prion-contaminated materials in the environment. Since CWD was discovered in Colorado in 1967, it has been documented in captive or free-ranging cervid populations in 31 US states, four Canadian Provinces, Norway, Sweden, Finland, and South Korea. CWD is a relatively slow-moving disease, and if left unmanaged, may take decades to reach prevalences of 20-30%. Significant herd-level declines are predicted at such high prevalences (Gross and Miller 2001, Wasserberg et al. 2009, Almberg et al. 2011), and have been documented among mule deer and white-tailed deer in Wyoming (DeVivo 2015, Edmunds et al. 2016) and Colorado (Miller et al. 2008). Surveillance programs aimed at early detection of CWD are essential to providing the best options for managing the spread and prevalence of the disease. While CWD is not known to infect humans, public health authorities advise against consuming meat from a CWD-positive animal and recommend hunters have their deer, elk, or moose tested if it was harvested within a CWD-endemic area.

Introduction

Surveillance programs for CWD are essential for early detection of the disease in wild cervid populations. Detection of CWD while prevalence is still low is thought to be critical to the success of managing the disease. Nationally, surveillance efforts for CWD have varied over time and have fluctuated in response to funding and public interest. This has been true for Montana as well. More recently, renewed concerns over the potential risk to human health (Czub et al. 2017), the discovery of CWD in wild cervids in several new states, and renewed national legislative discussion on CWD have fueled interests to increase surveillance once again. With additional surveillance and concerted efforts at managing the disease, such as those outlined in the Western Association of Fish and Wildlife Agencies' 2017 Recommendations for Adaptive Management of CWD in the West, our goal is to effectively manage the disease in wild populations and stave off the worst of the predicted population declines.

Montana Fish, Wildlife, and Parks (FWP) has been conducting surveillance for CWD since 1998, with varying levels of intensity. In 2017, FWP renewed its CWD surveillance and management plans with the help of an internal CWD Action Team and a CWD Citizen's Advisory Panel. FWP's plan outlines a strategy to maximize our ability to detect CWD in high-priority areas where it is not known to exist. This entails (1) continuing to test any symptomatic deer, elk, or moose statewide, (2) focusing surveillance on mule deer and white-tailed deer, and (3) employing a weighted surveillance strategy aimed at detecting 1% CWD prevalence with 95% confidence (Walsh 2012) that rotates among high-priority CWD surveillance areas. High priority surveillance areas are defined as those hunting districts that intersect a 40-mile buffer on known CWD positive cases inside or adjacent to Montana. In addition, once an area is determined to be positive for CWD, FWP may set up special CWD hunts, or use hunter-harvest samples from the general season to monitor the distribution and prevalence of the disease.

In the fall of 2022, FWP conducted CWD surveillance and monitoring in northcentral, southwestern, southcentral, and east-central Montana (Figure 1). FWP organized the 3rd annual special CWD management hunt in southwestern Montana in 2022 in response to the high prevalence of CWD detected there. In addition, FWP conducted the 4th annual Special CWD Management Hunt in the Libby CWD Management Zone and continued to trap and euthanize white-tailed deer within the town of Libby as part of an effort to reduce deer

densities and help control CWD within the surrounding Libby CWD Management Zone. Lastly, FWP continued to provide free, state-wide CWD testing of hunter-harvested animals in 2022. Below, we report on the results and lessons learned from the 2022 CWD surveillance and monitoring efforts.

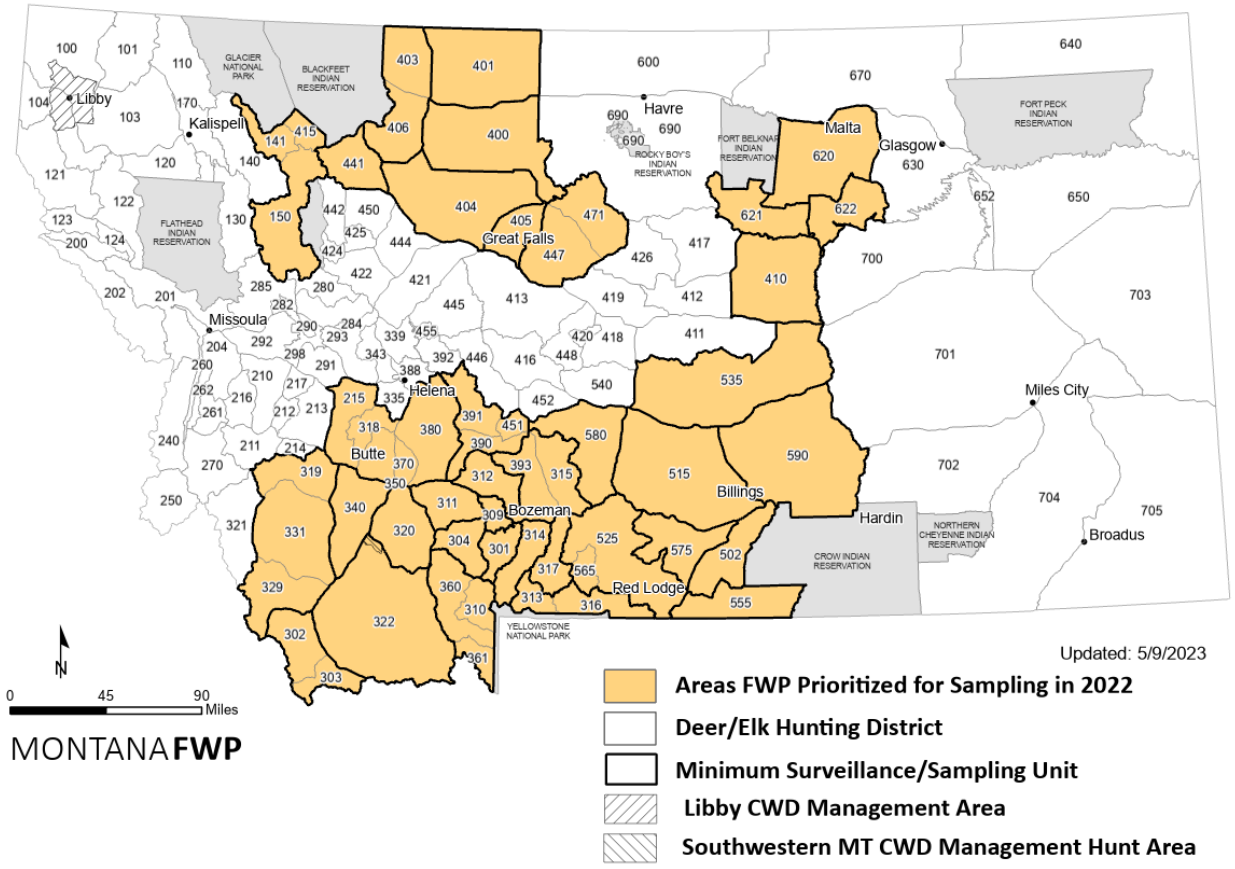


Figure 1. CWD priority sampling areas in Montana, 2022. CWD surveillance and monitoring areas included northcentral, southwestern, southcentral, and east-central Montana. Boundaries of the Libby CWD Management Area and the Southwestern Montana CWD Management Hunt Area (located in hunting district 322) are displayed in cross-hatch.

Methods

Surveillance

In 2022, FWP focused its surveillance efforts on districts where CWD had not yet been detected in northcentral, southwestern, southcentral, and east-central Montana. Priority sampling areas were divided into minimum surveillance units (Figure 1). Each minimum surveillance unit was defined as a portion of, or an aggregation of hunting districts meant to capture discrete and well-mixed population units of ≤15,000 mule deer. Within each minimum surveillance unit, we employed a weighted surveillance strategy aimed at detecting 1% CWD prevalence with 95% confidence (Walsh 2012). Under the weighted surveillance framework, different demographic groups (age, sex, or cause of death categories) of a species are assigned different point-values based on their relative risk of being infected (Table 1). A total of 300 points, spatially distributed across the unit, were necessary to meet our detection goals within each minimum surveillance unit. Sample size goals were specific to a single species within a minimum surveillance unit, and our efforts

prioritized the sampling of deer since they have the highest prevalences among the different cervid species where they overlap (Miller et al. 2000). Elk and moose were sampled opportunistically.

Table 1. Relative weights or "points" associated with each demographic group of deer and elk that count towards meeting a sample size goal using a weighted surveillance strategy based on data from mule deer and elk in CWD-positive areas in Colorado (Walsh and Otis 2012) and white-tailed deer in Wisconsin's CWD management zone (Jennelle et al. 2018).

	Weight/Points		
Demographic Group	**Mule Deer**	**White-tailed Deer**	**Elk**
Symptomatic female	13.6	9.09	18.75
Symptomatic male	11.5	9.09	8.57
Road-killed males/females	1.9	0.22	0.41
Other mortalities (predation, other unexplained in adults and yearlings)	1.9	7.32	0.41
Harvest-adult males	1	3.23	1.16
Harvest-adult females	0.56	1.30	1.00
Harvest-yearling females	0.33	0.85	0.23
Harvest-yearling males	0.19	1	NA
Harvest-fawns/calves	0.001	0.001	NA

FWP staff collected samples between July 1, 2022 – March 1, 2023, from mule deer, white-tailed deer, elk, and moose that were either hunter-harvested, road-killed, symptomatic and euthanized, or found dead. An animal was considered symptomatic if it appeared extremely sick and/or displayed symptoms consistent with CWD (emaciation, lack of coordination, drooping head/ears, excessive salivation, etc.). FWP used a variety of tools to obtain samples, including working with hunters at sampling stations, processors and taxidermists, outfitters, landowners, Montana Department of Transportation, and by sending letters to license holders notifying them of the surveillance effort. Field and laboratory staff collected retropharyngeal lymph nodes (Hibler et al. 2003) or an obex sample if lymph nodes were not available (both lymph nodes and obex were collected from moose), an incisor tooth for aging, and a small genetic sample (muscle tissue) from each cervid sampled as part of the CWD surveillance program. Field staff worked with hunters to gather precise location information on where the animal was harvested/found, as well as species, age, and sex information for each sampled animal. Lymph nodes and obex from deer and elk were frozen for subsequent enzyme-linked immunosorbent assay (ELISA) testing, whereas lymph nodes and obex from moose were fixed in 10% buffered formalin for immunohistochemistry (IHC) testing. Samples were submitted to Montana Veterinary Diagnostic Laboratory for ELISA testing. Samples requiring an IHC test (e.g., moose samples and confirmations of ELISA positives) were sent to Colorado State University Veterinary Diagnostic Laboratory, National Veterinary Services Laboratory, or Utah Veterinary Diagnostic Laboratory on a weekly basis. Testing costs were $15/sample for the ELISA, and $35/sample for IHC. Results from hunter-harvested animals were posted on FWP's website as soon as results were received from the lab. When a harvested animal tested positive for CWD on the ELISA (labeled a "suspect"), FWP directly contacted the associated hunter via email or phone to inform them of the test results, to let them know the meat could be legally disposed of, and to discuss proper disposal of the carcass parts. IHC confirmations were typically available 1-3 weeks later, so we did not require hunters to wait for that result before legally disposing of the carcass.

In addition to the focused sampling efforts in the 2022 priority sampling areas, FWP collected or received samples from symptomatic or hunter-harvested animals state-wide. Hunters that harvested an animal outside of the priority sampling areas and wanted to have their animal tested either brought their animal to a CWD sampling station, a regional headquarters/area office, or were instructed how to collect and mail in their

samples. Testing costs were paid by FWP. The video instructing hunters how to collect their own CWD sample can be found at fwp.mt.gov/conservation/chronic-wasting-disease under "Hunter Info."

Monitoring of prevalence and distribution within CWD Positive Areas

In 2022, FWP continued to prioritize sample collection from known positive areas in northcentral, southwestern, southcentral, and east-central Montana, and continued to test any hunter-submitted samples from other hunting districts around the state. In 2022, FWP held the 3rd annual special CWD management hunt in southwestern Montana. In addition, FWP held the 4th annual Special CWD Management Hunt within the Libby CWD Management Zone and continued to trap and euthanize white-tailed deer in the town of Libby to further reduce deer densities. Although CWD testing was not required, it was encouraged to improve our estimates of CWD prevalence and distribution in these areas (Figure 1). To reflect a more recent and current estimate, prevalence estimates in this report were calculated using only data from hunter-harvested, or agency trapped and euthanized animals (i.e., town of Libby), from 2020-2023.

Data summaries and analyses

Weighted surveillance points were calculated separately for mule deer, white-tailed deer, and elk (relative risk of infection data currently does not exist for moose) using data collected from 2020-2023. For each species, we tallied the number of samples collected within each of the age/sex/cause of death categories outlined in Table 1, multiplied this by their assigned point value, and summed all points within a minimum surveillance unit. We then modified the equation for the sample size (n) needed to establish freedom from disease at a specified prevalence level (P; proportion of the population that is positive), with a desired level of statistical confidence (α),

$$n = \frac{-\ln(1-a)}{P}$$

to calculate the threshold prevalence above which we would expect to detect at least one positive given our weighted surveillance points (n) and assuming 95% statistical confidence:

$$P = \frac{-\ln(1-a)}{n}$$

Following detection, we explored patterns of infection among hunter-harvested deer in CWD-positive hunting districts using logistic, generalized linear mixed models. We evaluated the odds of infection as a function of species, sex, age class, whether the animal was harvested in either the Libby CWD Management Zone or Southwestern MT CWD Management Hunt Area or outside of these areas, and relative timing of harvest within the general season (early-rut: Oct 23rd-Nov 14th; late-rut: Nov 15th-Nov 28th), while using hunting district as a random effect. Models with various permutations of these covariates were evaluated using Akaike's Information Criterion (AIC; Burnham and Anderson 2004), and unless otherwise noted, we report the estimated covariate effects from the best supported models (< 2 AIC units from the top model). Odds ratios (exponentiated logistic coefficients) were converted to estimates of relative risk to facilitate interpretation (relative risk = odds ratio/(1-p_0 + (p_0*odds ratio)), where p_0 is the prevalence within the baseline group; Grant 2014). All analyses were carried out in Program R (R Core Team 2017). We report prevalence at the scale of hunting districts, and the Libby CWD Management Zone or Southwestern MT CWD Management Hunt Area. We calculated 95% binomial confidence intervals using the Wilson method.

Results

Between July 1, 2022 – March 1, 2023, FWP submitted 7247 samples for testing, which was a 17% decrease from the number of samples collected in 2021 (n=8777) and a 9% decrease over the number of samples collected in 2020 (n=7974). Most of these samples were analyzed at Montana Veterinary Diagnostic Laboratory, with a much smaller number of IHC tests conducted at Colorado State University Veterinary Diagnostic Laboratory, National Veterinary Services Laboratory, and Utah Veterinary Diagnostic Laboratory. Of these samples, 2621 were collected from mule deer, 3320 from white-tailed deer, 1256 from elk, and 50 from moose. Fifty one percent (n=3706) of samples were collected from outside our priority sampling areas and hunters collected and submitted 622 of their own samples in 2022. Since FWP's renewed surveillance efforts in 2017, we have tested 34,964 samples statewide (Figure 2). FWP detected 264 CWD positive cervids during the 2022 sampling season, which included 68 mule deer, 195 white-tailed deer, and 1 elk. In the 2022 sampling season, we detected CWD in 3 new hunting districts, including: 304, 311, and 405 (Figure 2).

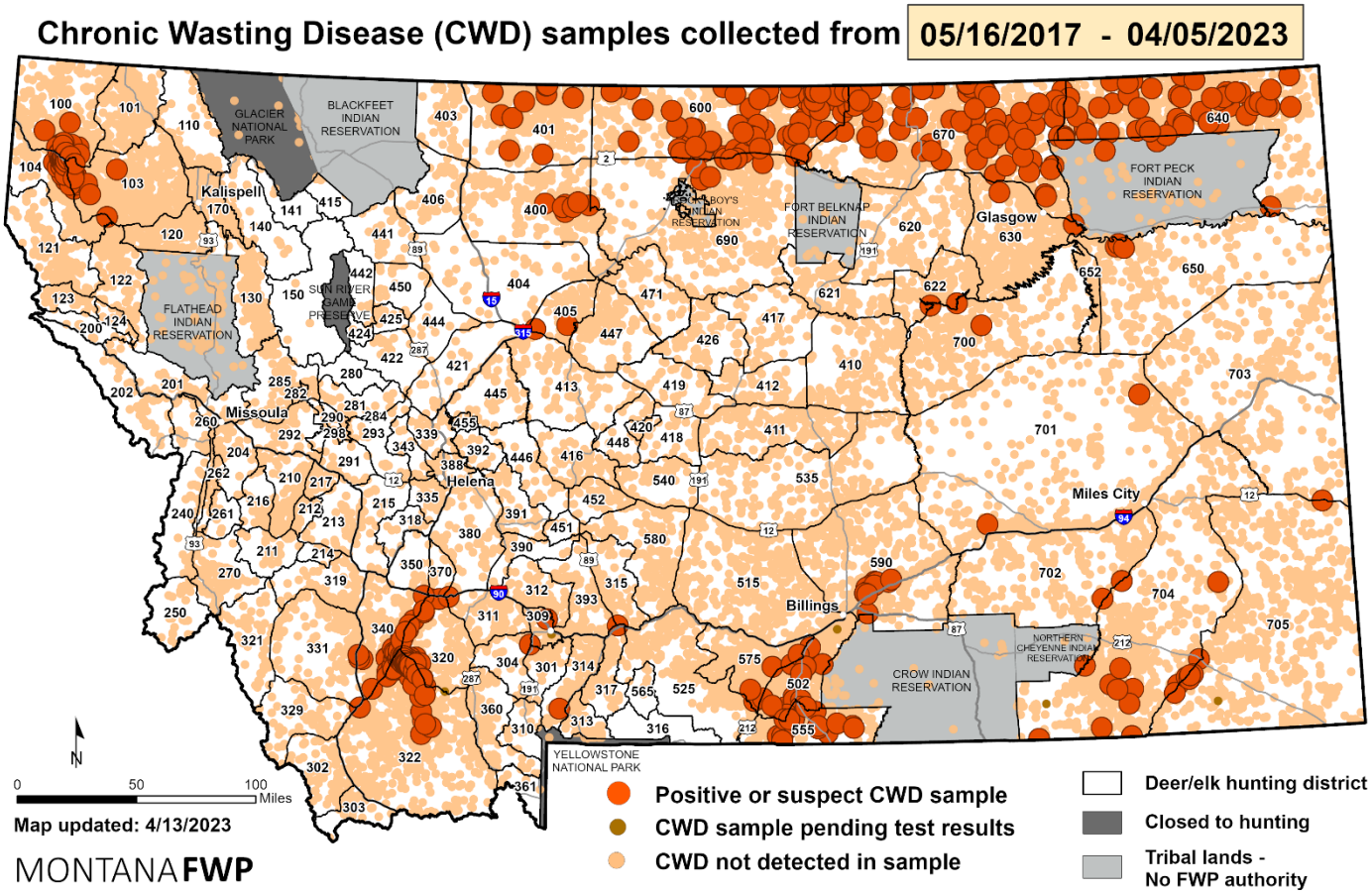


Figure 2. Map of sampling locations and CWD positives among deer, elk, and moose from 2017-2023.

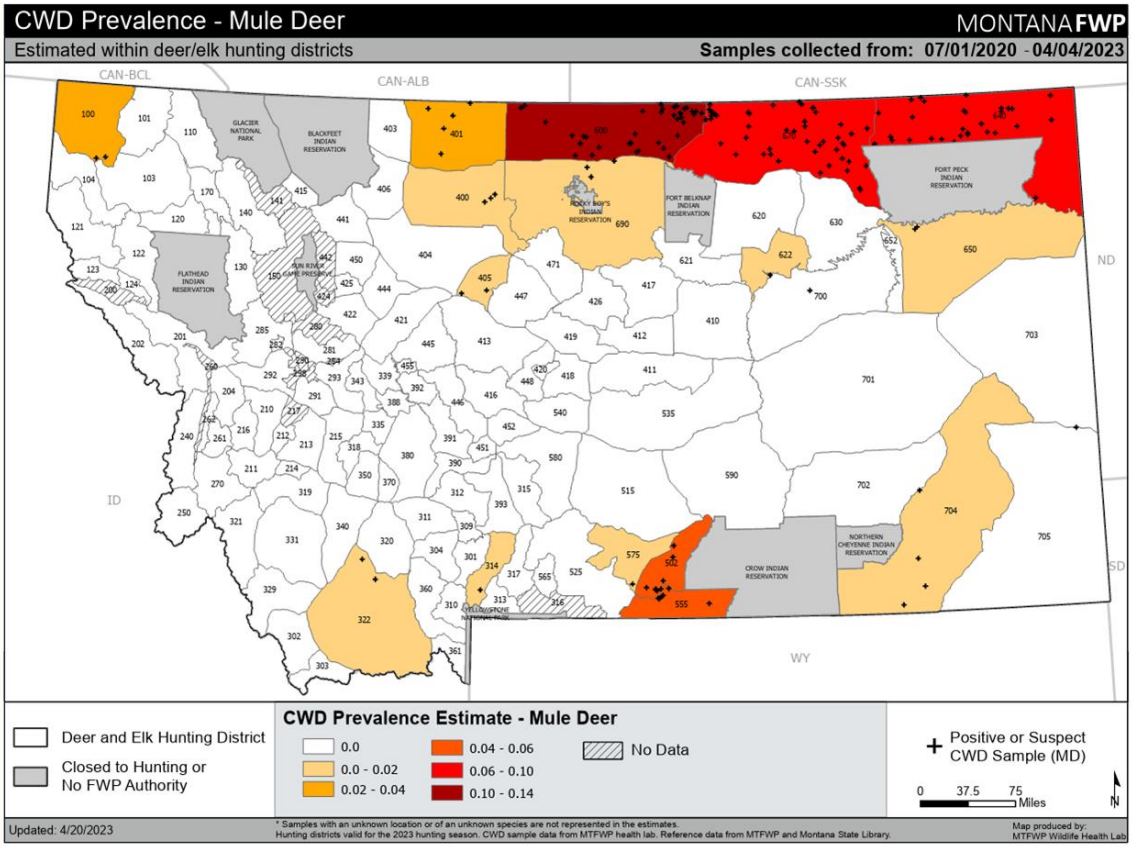
Within priority sampling areas in northcentral Montana (i.e., hunt districts 141, 150, 403, 404, 406, 415, 441, 447, 471), we failed to meet our surveillance points within each minimum surveillance unit. (Appendix I, Figure A1, A2). Additional sampling is warranted among these minimum surveillance units to achieve the necessary surveillance goals. Within priority sampling areas in southwest Montana (i.e., hunt districts 215, 318, 350, 370, 380, 301, 302, 303, 310, 360, 361, 312, 313, 316, 315, 393, 319, 329, 331, 390, 391, 451), we did not detect

CWD within any of the minimum surveillance units (Appendix I, Figure A1, A2). However, we fell short of the necessary surveillance points to rule out the possible presence of CWD in these areas, except for white-tailed deer in hunting district 312. Within priority sampling areas in southcentral and east-central Montana (i.e., hunt districts 410, 515, 525, 565, 535, 580, 620, 621), we did not meet the surveillance points within each minimum surveillance unit to detect the presence of CWD at <1% prevalence with 95% confidence except in hunting districts 525, 565, and 580 for white-tailed deer (Appendix I, Figure A1, A2). Overall, this suggests that if CWD were present among hunting districts 312, 525, 565, and 580, it is likely to only affect <1% of the white-tailed deer population. As of the 2022 sampling season, CWD was found to be present in priority surveillance hunting districts 304, 311, and 405 (Figure 2).

Among all CWD-positive hunt districts, prevalence estimated from hunter-harvested animals sampled from 2020-2023 ranged from <1% - 14% in mule deer and <1% - 28% in white-tailed deer (Figure 3 and 4; see Appendix II for prevalence estimates by hunting district), with varying levels of precision. Estimates of prevalence in east, central, southcentral, and southwest Montana were improved by another year of sampling and in most cases allowed the targeted range of precision of ± 3% margin of error to be exceeded (Figures 3 and 4). Between 2020-2023 in the town of Libby, 9% (95%CI: 7-12%) of hunter-harvested or trapped white-tailed deer were positive for CWD, whereas only 5% (95%CI: 4-6%) were positive outside the town within the Libby CWD Management Zone. Between 2020-2023 statewide, CWD prevalence among hunter-harvested white-tailed deer was highest in hunting districts 322 (28%, 95%CI: 26-30%) and 340 (8%, 95%CI: 5-11%). CWD prevalence among hunter-harvested mule deer during that time period was highest in hunting districts 600 (14%, 95%CI: 11-18%), 640 (10%, 95%CI: 7-14%), and 670 (8%, 95%CI: 6-11%).

An analysis of all data collected during the general rifle season (i.e., samples submitted between October 15 – December 5) between 2017-2023 from hunter-harvested deer in CWD-positive hunting districts (n=18,628) suggested several state-wide patterns of infection across species, sex, and age class. Our best supported model indicated that CWD prevalence differed by deer species, sex, age class, and within the Libby Management Zone or SW Montana CWD Management Area (see Appendix III for the list of evaluated models). Our best supported model identified white-tailed deer CWD hotspots in the Libby Management Zone and the SW Montana CWD management hunt area, where white-tailed deer prevalence was significantly higher than estimates from elsewhere around the state. Averaged across the two Management Areas, adult male and female white-tailed deer have 11.0 (95%CI: 8.5-13.8) and 11.9 (95%CI: 9.1-15.3) times the risk of infection, respectively, compared to adult male and female white-tailed deer from elsewhere in the state. Collectively, adult white-tailed deer prevalence inside the Libby Management Zone and SW Montana CWD Management Area is 15% among males and 16% among females, whereas outside of these areas it is 3% and 2%, respectively. Inside of the two Management Areas, male white-tailed deer have 1.5 times the relative risk of CWD as females (95%CI: 1.3-1.8).

Outside of the Libby Management Zone and Ruby CWD Management Area, we found no significant statewide difference in prevalence among adult male white-tailed deer and adult male mule deer (adult male mule deer have 1.0 times the relative risk as adult male white-tailed deer, 95%CI: 0.8-1.2; prevalence is 3% in both species). By contrast, the relative risk of CWD in adult female white-tailed deer is significantly higher than in female mule deer (female mule deer have 0.4 times the relative risk as adult female white-tailed deer, 95%CI: 0.2-0.6; prevalence is 1% in mule deer and 2% in white-tailed deer).



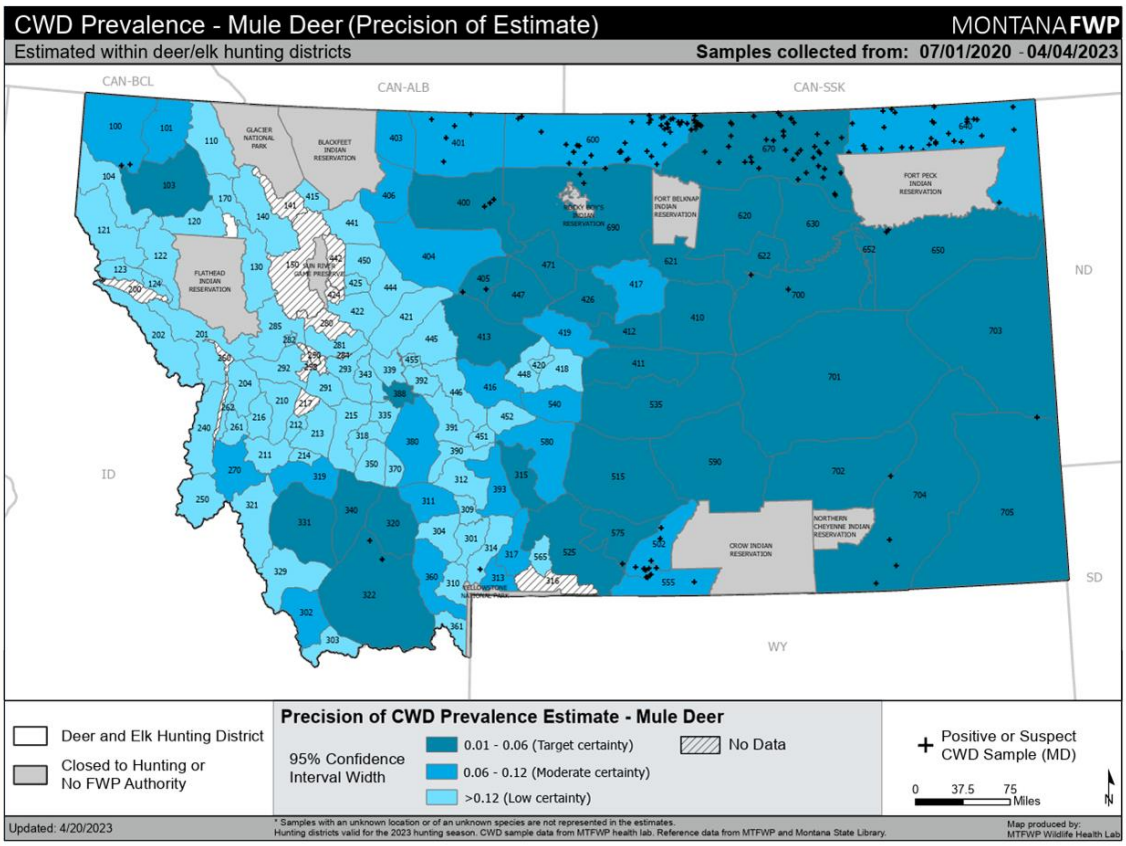
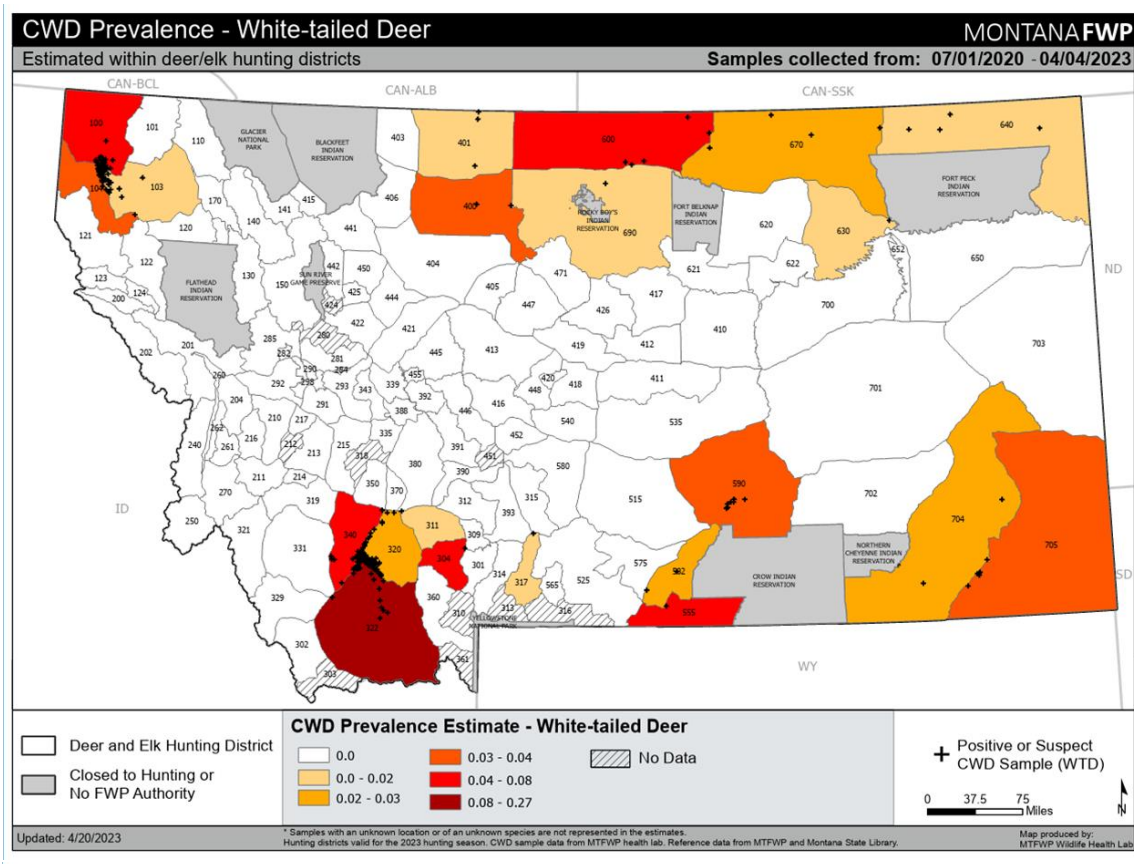


Figure 3. CWD prevalence in mule deer (top figure), estimated by hunting district across Montana, 2020-2023. Prevalence is calculated by dividing the number of test-positives by the total number of animals sampled. Only data from hunter-harvested or agency removal/trapping were used to calculate prevalence. The corresponding precision of these estimates is displayed in the bottom figure. Small 95% confidence interval widths (dark blue) indicate higher certainty in prevalence estimates; large 95% confidence interval widths (light blue) indicate low certainty in the estimates. Where CWD has not been detected (i.e., prevalence = 0 in top figure), additional sampling may still be necessary to declare the area free from disease, or below 0.01 prevalence, with 95% confidence.



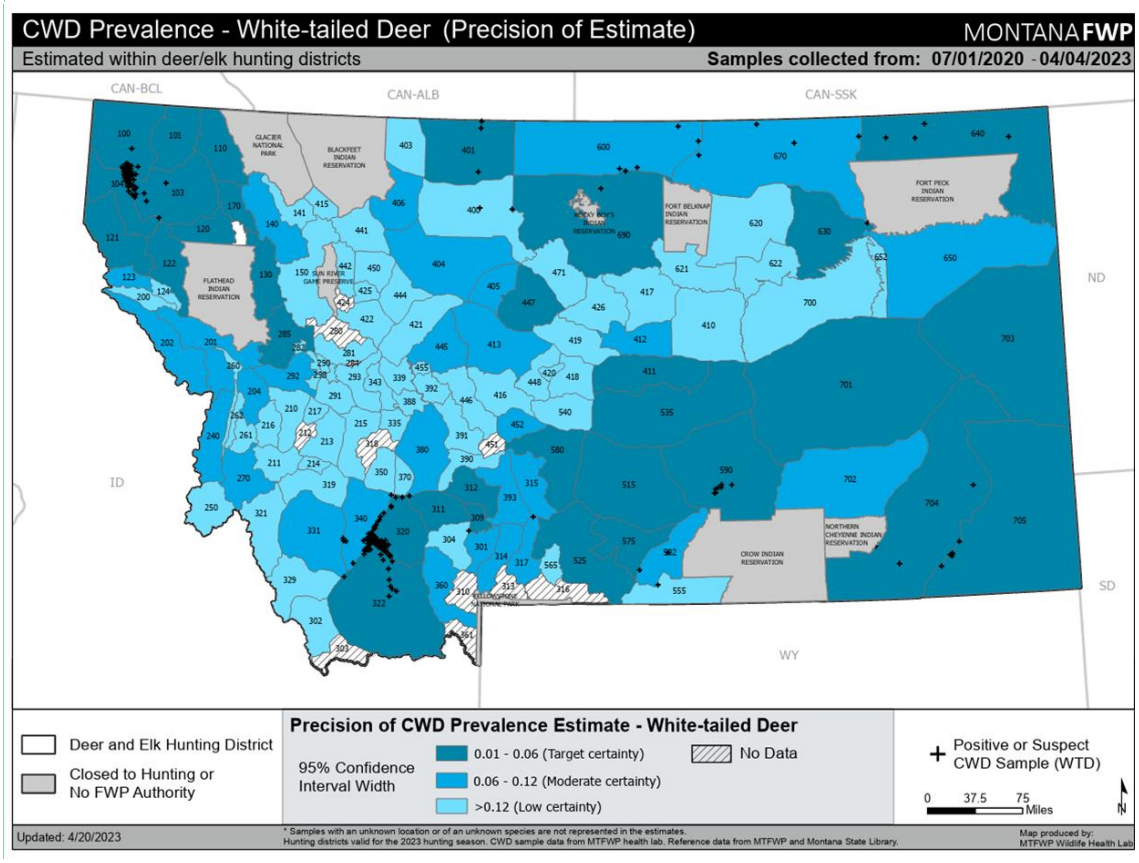


Figure 4. CWD prevalence in white-tailed deer (top figure), estimated by hunting district across Montana, from hunter-harvested or agency removal/trapped deer from 2020-2023. Prevalence is calculated by dividing the number of test-positives by the total number of animals sampled. The corresponding precision of these estimates is displayed in the figure below. Small 95% confidence interval widths (dark blue) indicate higher certainty in prevalence estimates; large 95% confidence interval widths (light blue) indicate low certainty in the estimates. Where CWD has not been detected (i.e., prevalence = 0 in top figure), additional sampling may still be necessary to declare the area free from disease, or below 0.01 prevalence, with 95% confidence.

Among mule deer, adult males had 4.3 times the risk of infection as adult females (95%CI: 2.8 – 6.6), and adult male mule deer prevalence was 3% while adult female prevalence was 1.0%. Among white-tailed deer outside of the Management Areas, adult males had 1.6 times the relative risk as females (95%CI: 1.3 – 2.1; adult white-tailed deer female prevalence = 2%, adult white-tailed deer male prevalence = 3%). Across deer species in CWD-positive hunting districts, young of the year and yearlings had 0.1 times (95%CI: 0.03 – 0.1) and 0.4 times (95%CI: 0.3 – 0.6), the risk of infection as adults, respectively (outside of the management areas: young of the year prevalence = 0%, yearling prevalence = 1%, and adult prevalence = 3%).

During the general rifle season (October 23rd – November 28th), deer harvested during the "rut" (November 15th – November 28th) were no more likely to be infected than those deer harvested before the "rut" (October 23rd – November 14th) (prevalence before the rut: 2%; prevalence during rut: 3%; relative risk late:early = 1.1, 95%CI: 0.9 – 1.3; Appendix III, Table A1).

CWD Management Hunts:

Southwestern Montana CWD Management Hunt

FWP ran the Southwestern Montana CWD Management Hunt from December 10, 2022 – February 15, 2023, in a portion of hunting district 322 (Figure 2). The 2022 CWD management hunt boundary was reduced by comparison to the hunt boundaries of the 2020 and 2021 CWD management hunts which included all or portions of hunting districts 320, 322, 324, 325, 326, 329, 330, 331, and 340. The hunt area was decreased to focus hunter harvest and reduce the white-tailed deer population, within an area of known high CWD prevalence, to the lowest extent possible through hunter harvest of all sex and age classes. Hunters were allowed to use any unused 2022 general deer licenses, 003-00 white-tailed deer B-licenses, and 399-00 white-tailed deer B-licenses to be valid for harvest of antlered or antlerless white-tailed deer. White-tailed deer B-licenses 003-00 and 399-00 were also available for purchase throughout the hunt. There were no testing or reporting requirements associated with the hunt, however, 96 white-tailed deer harvested during the 2022 hunt were submitted for testing. Of these, 43 were CWD positive. Collectively, during the 2022 sampling season, the estimated prevalence of white-tailed deer was 48% (95%CI: 41-54%) within the CWD Management Hunt boundary. At the hunting district level for the 2022 sampling season, prevalence of white-tailed deer in hunting districts 322, 340, and 320 was 31% (95%CI: 26-36%), 22% (95%CI: 14-32%), and 3% (95%CI: 1-8%) respectively. (Figure A2).

Libby

FWP offered 2,000 either-sex white-tailed deer licenses (199-20 B-licenses) during the 2022 season as part of the ongoing effort to increase harvest within the Libby CWD Management Area. During only the general hunting season, hunters submitted samples from 242 white-tailed deer from this area for testing, of which 14 were positive for CWD. From January 15, 2023 through March 5, 2023, FWP trapped, euthanized, and tested an additional 75 white-tailed deer within the Libby Surveillance Area (i.e., town of Libby), of which 8 were positive. Using only data from hunter-harvested or trapped and euthanized white-tailed deer during the 2022 sampling season, the estimated prevalence was 7% (95%CI: 5-10%) in the entire Libby CWD Management Zone, a figure slightly higher than estimates from previous years' data. Within this zone, the core "Libby Surveillance Area" had a prevalence of 9% (95%CI: 5-16%), whereas the remaining outer ring of the Libby Management Zone had a prevalence of 6% (95%CI: 4-10%). Within the Libby CWD Management Zone for the 2022 sampling season, only 19 mule deer, 8 elk, and 2 moose were harvested and CWD sampled, and CWD was not detected in any of these samples.

Testing and reporting turn-around time

On average, it took 8 calendar days (sd = 3 days) from the day a sample was collected to the day the ELISA test result was posted online. This was an improvement in turnaround time from 2021, when our average was 11 days and a significant improvement in turnaround time from 2019, when our average was 19 days. Of this time, it took on average 3 days (sd = 2 days) from the time the sample was collected until shipment to Montana Veterinary Diagnostic Laboratory, and an average of 5 days (sd = 2 days) from the day of shipment until results were received, which includes 1-2 days of transit time. Using three diagnostic laboratories (Colorado State University Veterinary Diagnostic Laboratory, National Veterinary Services Laboratory, and Utah Veterinary Diagnostic Laboratory), the IHC testing confirmations of ELISA positive samples and the IHC testing of moose samples also took an average of 9 days.

When a suspect CWD test result was received, FWP staff emailed and/or called hunters to notify them and to inquire about the processing and disposal of the meat/carcass. If meat had gone to a processor, the Department of Public Health and Human Services contacted the processor and followed up with any hunters who may have received meat that was batch-processed with the positive animal. Most hunters with positive animals had either waited for their test result prior to processing or processed their animal at home.

Discussion

To date, targeted CWD surveillance has confirmed our predictions of CWD presence within the northcentral, northeastern, southcentral, and southeastern borders of our state. However, we have also detected CWD in places where we did not expect to find it, including Libby, Great Falls, Sheridan, Bozeman, and Livingston. These detections indicate the disease is more widely distributed than we initially expected, consistent with Montana's mostly intact landscape and widely connected state-wide deer populations. State-wide testing that is offered free-of-charge to hunters, while requiring a significant amount of time and resources, continues to be successful at detecting positives in new areas outside of those targeted for annual surveillance. We plan to continue offering free state-wide testing to meet hunter interest, to improve our surveillance and monitoring across the state, and to inform future CWD management.

During the 2022 sampling season, we met our surveillance and monitoring goals in several units in southwestern and southcentral Montana but fell short of the target sample sizes and distribution of sampling in most of the other priority sampling areas. Therefore, districts still in need of additional samples are incorporated into priority areas for the 2023 sampling season.

Our state-wide analysis suggests that outside of the CWD hotspots among white-tailed deer in the Libby CWD Management Zone and SW CWD Management Area, there is little difference in risk of infection or prevalence between white-tailed deer and mule deer among CWD-positive hunting districts. Based on data collected from 2020 – 2023, the HD 322 and Libby areas that are dominated by white-tailed deer have the highest measured local CWD prevalences in the state (28% in HD 322 and 9% within the town of Libby). In other areas of the state where both mule deer and white-tailed deer are abundant, prevalences tend to be relatively similar between the species (Figures 3 & 4). Other western states and provinces have reported that mule deer have higher prevalences than white-tailed deer where they overlap (Miller et al. 2000, DeVivo 2017, Nobert et al. 2016), and indeed Montana's CWD surveillance plan prioritizes mule deer for CWD detection. However, white-tailed deer populations should remain a priority for surveillance and monitoring in Montana, particularly when they are abundant or the dominant species in an area. The fact that the patterns in Montana diverge from those reported elsewhere, at least currently, may relate to the more liberal harvest management

and lower buck:doe ratios that exist in Montana compared to the more restrictive harvest management and higher buck:doe ratios among other states and provinces, the relative timing of disease introduction across the two species or local differences in the ecology, movement, and population dynamics of the two species in Montana, all of which may result in differences in transmission dynamics within or between the species. It is important to note that the similarities among mule deer and white-tailed deer reported here reflects the average pattern across all CWD positive hunting districts, and we would expect (and do see) deviations from this pattern at a finer scale where obvious differences in disease introduction between the two species or local differences in the ecology, movement, and population dynamics exist.

We also found that adult male mule deer and white-tailed deer are more likely to be infected than adult females for both species. This was previously true within mule deer but is a new finding in white-tailed deer in Montana. Male mule deer have been found to have higher prevalences than females in other western states and provinces (Miller et al. 2000, DeVivo 2017, Nobert et al. 2016), and reported patterns among the sexes in white-tailed deer have been more variable, including evidence for a female bias (Edmunds et al. 2016), a male bias (Grear et al. 2006, Nobert et al. 2016), and no detectable differences in prevalence between the sexes (Miller et al. 2000). Our data suggests that we should continue to clearly emphasize the sampling of adult male mule deer over females for surveillance, and a slight shift in emphasis should be placed on adult male white-tailed deer as well in areas where our goal is to first detect CWD. Currently, with the CWD sampling dataset for Montana becoming larger and more robust for each species and demographic group, the development of Montana specific estimates of weighted surveillance point values (Table 1) has begun. Next steps will include investigating any estimate biases represented by sampling methods before possibly incorporating Montana-specific weighted surveillance points into surveillance efforts and results reporting.

Conner et al. (2000) found that the risk of harvesting CWD positive mule deer, particularly mule deer bucks, increased over the harvest season. One hypothesis is that older-aged animals, which are more likely to be positive, are more susceptible to harvest during the rut, which could bias the estimate of prevalence upwards in late vs. early season. Another hypothesis is that CWD-infected deer may be less aware or responsive to hunters, particularly when they are already distracted by the rut. We found no support for a general pattern where hunters were more likely to harvest a CWD-positive mule deer and white-tailed deer later in the rut (after November 15th) than earlier. Differences observed between the Montana dataset and the Conner et al. (2000) study may be related to differences in deer management among states. The Conner et al. (2000) pattern is based on Colorado data, where there is statewide limited-entry hunting, producing higher buck ratios and older age structures. By contrast, Montana has much more liberal buck harvest, producing lower buck ratios and younger buck age structures. This may result in a higher likelihood that hunters harvest an older (and more likely positive) buck as the rut progresses in Colorado than in Montana.

In 2023, we will conduct surveillance in all hunting districts that intersect a 40-mile buffer on known positives where CWD has not yet been found (Figure 5). In addition, FWP will target districts in southwestern, southcentral, northcentral, and central Montana for monitoring to improve our understanding of whether the prevalence and distribution of the disease is changing.

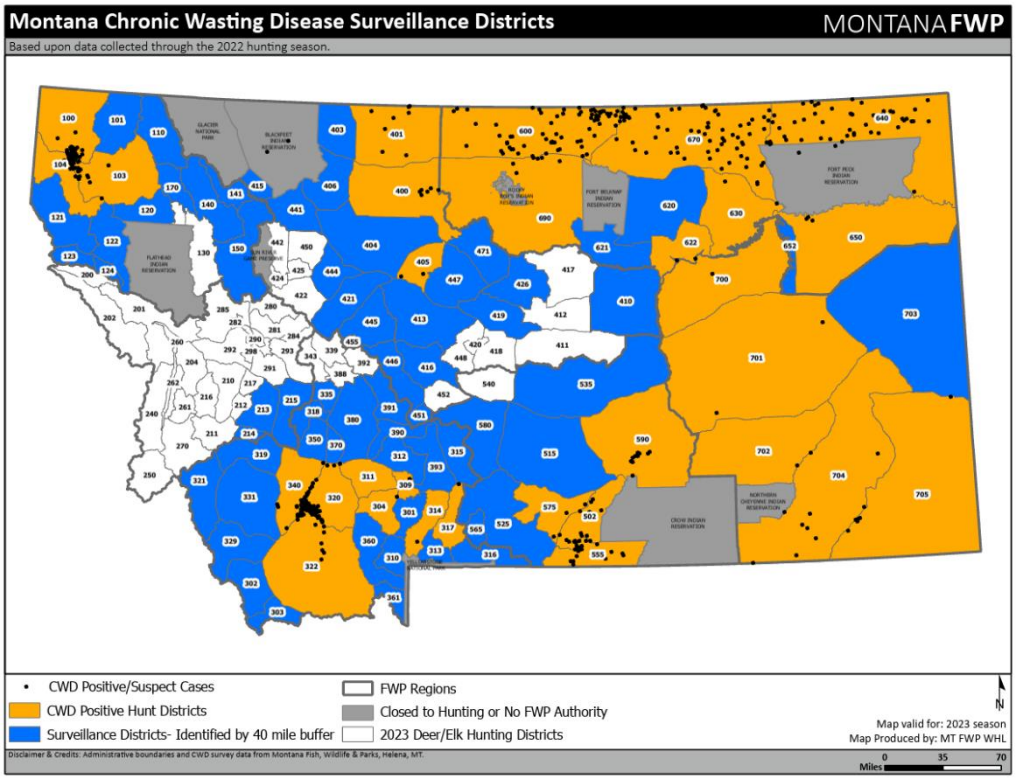


Figure 5. Map of future priority CWD surveillance districts (blue) that are within 40 miles of known CWD positives. CWD-positive hunting districts are in orange.

Management updates

FWP is committed to managing CWD to minimize its spread and to keep prevalences below 5%. Management has been changed in response to CWD in the following areas:

- Region 1: Following the detection of CWD in Libby, the region focused on increasing the accuracy and precision of prevalence estimates. Efforts were made to increase signage and/or public messaging throughout the Libby CWD Management Zone about 1) not feeding/aggregating deer, 2) discouraging carcass dumping, and 3) informing hunters of proper carcass disposal. FWP has worked with the Libby City Council in drafting an Urban Deer Management Plan, which was completed in 2021. Lastly, the Fish & Wildlife Commission approved another either-sex B-license with a quota of 2,000 valid within the Libby CWD Management Zone.

- Region 2: FWP offered 8 strategically placed carcass disposal dumpster stations during the hunting season to facilitate FWP's carcass disposal policy aimed at reducing the human-assisted spread of CWD to new areas of the state. Of the 8 dumpster stations, 7 dumpster stations were in R2 for the 2022-2023 season.

- Region 3: FWP ran the Southwestern Montana CWD Management Hunt from December 10, 2022 – February 15, 2023 in a portion of hunting district 322 (Figure 2). Hunters were allowed to use any unused 2022 general deer licenses, 003-00 white-tailed deer B-licenses, and 399-00 white-tailed deer B-licenses to be valid for harvest of antlered or antlerless white-tailed deer. White-tailed deer B-licenses 003-00 and 399-00 were also available for purchase throughout the hunt. The goals of the

hunt were to continue ongoing priority CWD surveillance; to reduce the number of CWD positive animals, reduce CWD prevalence, and slow the spread of CWD among white-tailed deer populations; to measurably reduce white-tailed deer populations where CWD currently occurs; reduce white-tailed deer populations and CWD prevalence to levels that can be more effectively managed through general hunting season harvest; and to reduce probability of CWD spreading to overlapping mule deer, elk, and moose.

- Region 4: Based on CWD surveillance findings in 2019, FWP Region 4 managers proposed a change from a 3-week general deer season to a 5-week general deer season in HD's 400, 401, 403, and 406. Due to significant public resistance and direction from the Fish & Wildlife Commission, the Department proposed an alternative of limited species-specific antlered buck permits valid for 2 weeks after the 3-week general season in these 4 hunting districts. This change was approved by the Commission on February 13, 2020 and is still in effect.

- Region 5: 2019 was the first year of CWD-related season changes in south-central Montana (previously hunting districts 510, 502, 520, and 575) designed to liberalize both mule deer and white-tailed deer harvest, particularly of bucks. In 2022, consolidation of hunting districts and adjustments to hunting district boundaries were implemented that affected south-central Montana (now hunting districts 555, 502, 525, and 575). HD 502 was changed from a buck-only mule deer to an either-sex harvest, and additional antlerless mule deer B-licenses were made available. HD 555 was changed from an unlimited mule deer buck permit to an either-sex general season hunt. HD 525 is an antlered buck mule deer season type, with additional antlerless mule deer B-licenses available. HD 575 maintained the antlered buck mule deer season type but doubled the number of antlerless B-licenses issued compared to 2018.

  Harvest estimates for 2022 suggest:
  - In HD 502, white-tailed and mule deer buck and doe harvest was similar to the 5-year average.
  - In HDs 525 and 555, the 2022 season was the first year with the new hunt district boundaries. Although a crude comparison when compared to the previous boundary of HD 510 to 555 and HD 520 to 525, harvest estimates were similar to the previous lows recorded, especially for mule deer buck harvest. Harvest of both sexes of white-tailed deer was similar to the previous 5-year averages found in previous HDs 510 and 520.
  - In HD 575, mule deer buck harvest was the second lowest recorded since 1996, and doe harvest was low but slightly above average for the previous 5 years. Among white-tailed deer, buck harvest was at its lowest since 1992, and doe harvest was slightly below the 5-year average.
  - These harvest numbers reflect that deer numbers of both species are at or near the lowest levels in observed in the last 40 years.

- Region 6: Managers have actively increased antlerless B-licenses in recent years for both mule deer and white-tailed deer in response to the presence of CWD and increasing deer populations. In 2022, 8,400 mule deer antlerless B-licenses were issued region-wide, which was a 158% increase since 2017 (3,300) and up to four unlimited region-wide white-tailed deer B-licenses were available per hunter. The number of permits in the regions sole permitted mule deer buck hunting district (HD 652) stayed at 200, as compared to 100 in 2017. This was also in response to an increasing deer population, high buck ratios, and detection of CWD in neighboring HD 650. Additionally, one carcass disposal dumpster was placed in R6 for the 2022 sampling season to facilitate FWP's carcass disposal policy aimed at reducing the human-assisted spread of CWD to new areas of the state.

- Region 7: Management in 2022 was fairly liberal, similar to the previous few decades, and included offering either-sex, either-species opportunity on the general deer license across the entire region. However, population declines related to prolonged drought conditions and to a lesser extent disease (i.e., bluetongue, epizootic hemorrhage disease viruses) resulted in fewer B-licenses available regionally. The region-wide mule deer B-license were quota was set at 5,500, which was down from 11,000 in 2021. Region-wide white-tailed deer B-license quota was set at 5,500, which is less opportunity than offered in previous years, when it was available over-the-counter, 1 per hunter. Additionally, there were previously 2,000 licenses available for residents to purchase as a 2nd white-tailed deer B-license, valid region-wide, which were discontinued for the 2022 season.

Acknowledgements

CWD surveillance required significant involvement from FWP regional enforcement staff, biologists, communication and education staff, administrative staff, the Wildlife Health Lab, and hired technicians. A special thank you to all the coordinators and technicians that worked sampling stations and regional offices during the general season. We greatly appreciate their help for making this effort a success. We would like to extend a special thank you to the staff at the Montana Veterinary Diagnostic Laboratory, Colorado State University's Veterinary Diagnostic Laboratory, National Veterinary Services Laboratory, and Utah Veterinary Diagnostic Laboratory for analyzing all our samples as quickly as possible. We would also like to thank hunters, landowners, supportive residents and communities, vigilant wildlife watchers, and State, Federal and Tribal agency partners. Funding for this project came from deer and elk auction license sales, PR Management Grant to Montana Fish, Wildlife and Parks, and generous donations from the Rocky Mountain Elk Foundation and the Mule Deer Foundation.

Appendix I. Additional Figures

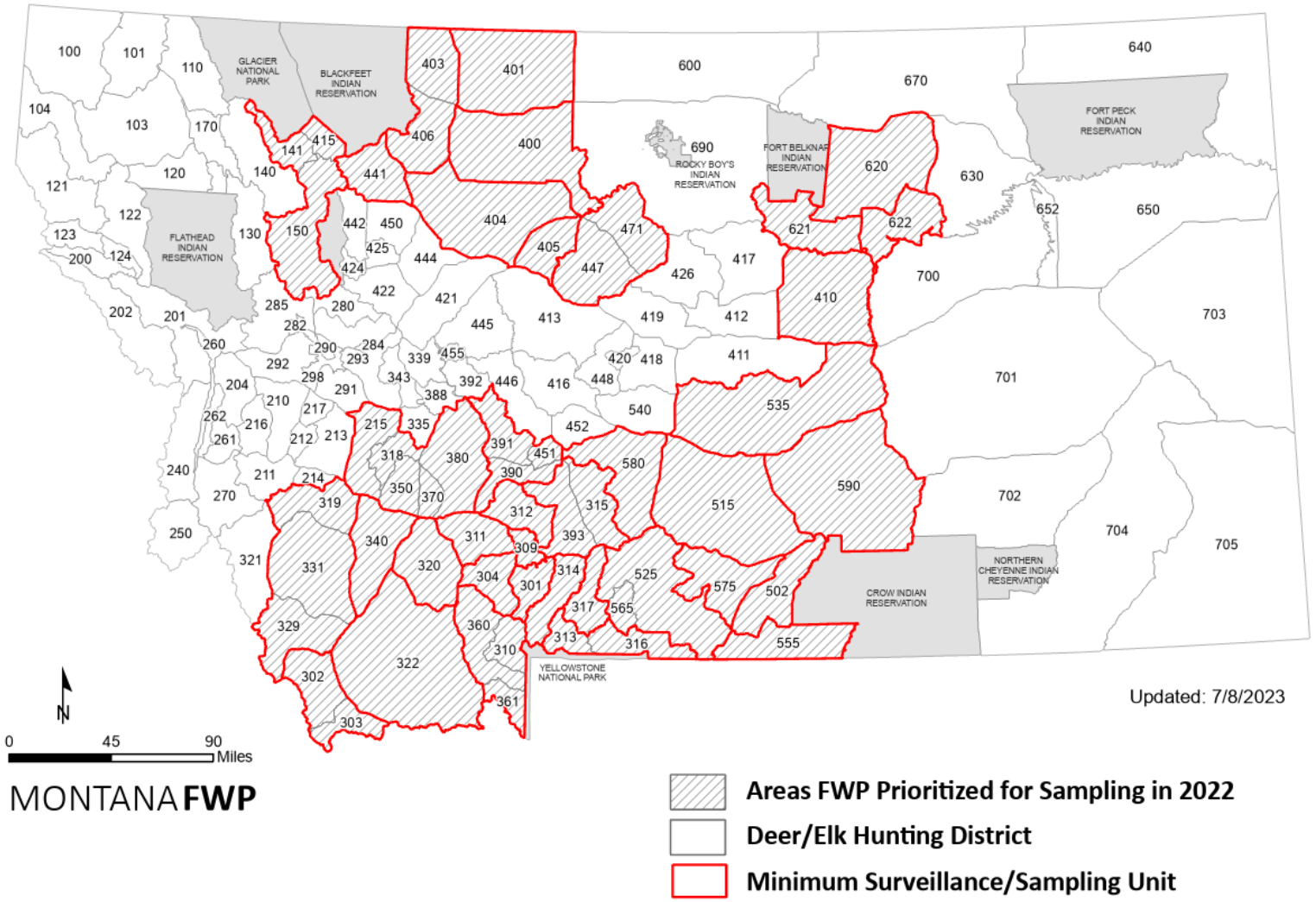


Figure A1. CWD priority sampling areas and Minimum Surveillance/Sampling Units in Montana, 2022. CWD surveillance and monitoring areas included northcentral, southwestern, southcentral, and east-central Montana.

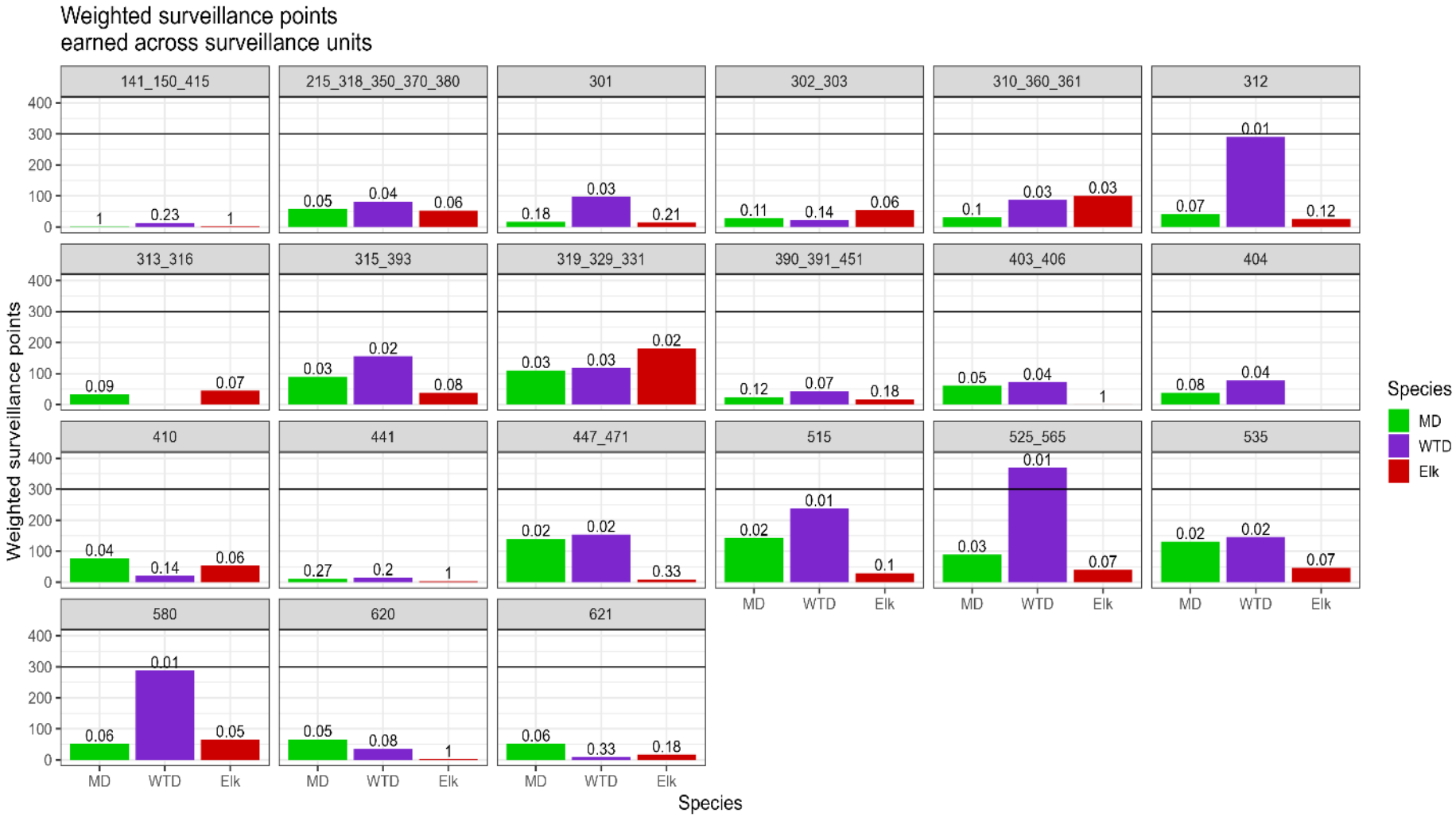


Figure A2. Weighted surveillance points earned for mule deer (MD), white-tailed deer (WTD), and elk within the 2022 minimum surveillance units in Montana, using data collected from 2020-2023. Under the weighted surveillance framework, different demographic groups (age, sex, or cause of death categories) of a species are assigned different point-values based on their relative risk of being infected and summed to a total point value. Our goal was to reach 300 weighted surveillance points in mule deer and/or white-tailed deer to detect ≥ 1% prevalence with 95% confidence. Above each bar, we have displayed the threshold prevalence, above which we would expect to detect at least 1 positive if the disease were present, given the number of surveillance points earned.

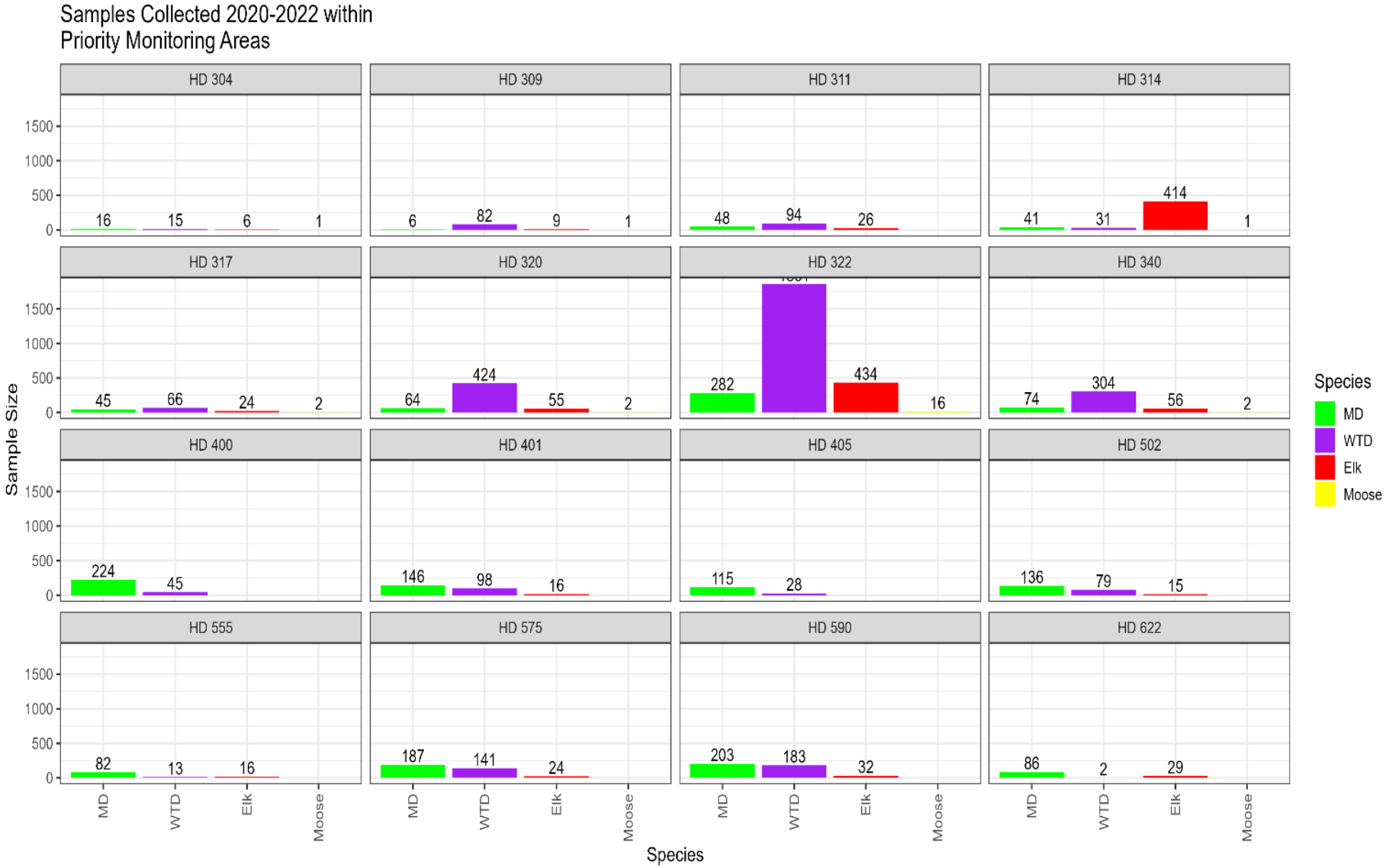


Figure A3. Samples collected from mule deer (MD), white-tailed deer (WTD), elk, and moose within the 2022 priority monitoring areas in Montana, using data collected from 2020-2023. We are typically aiming for at least 200 samples distributed across the population, to achieve a prevalence estimate with a margin of error ≤3%. Above each bar, we have displayed the total number of individuals sampled.

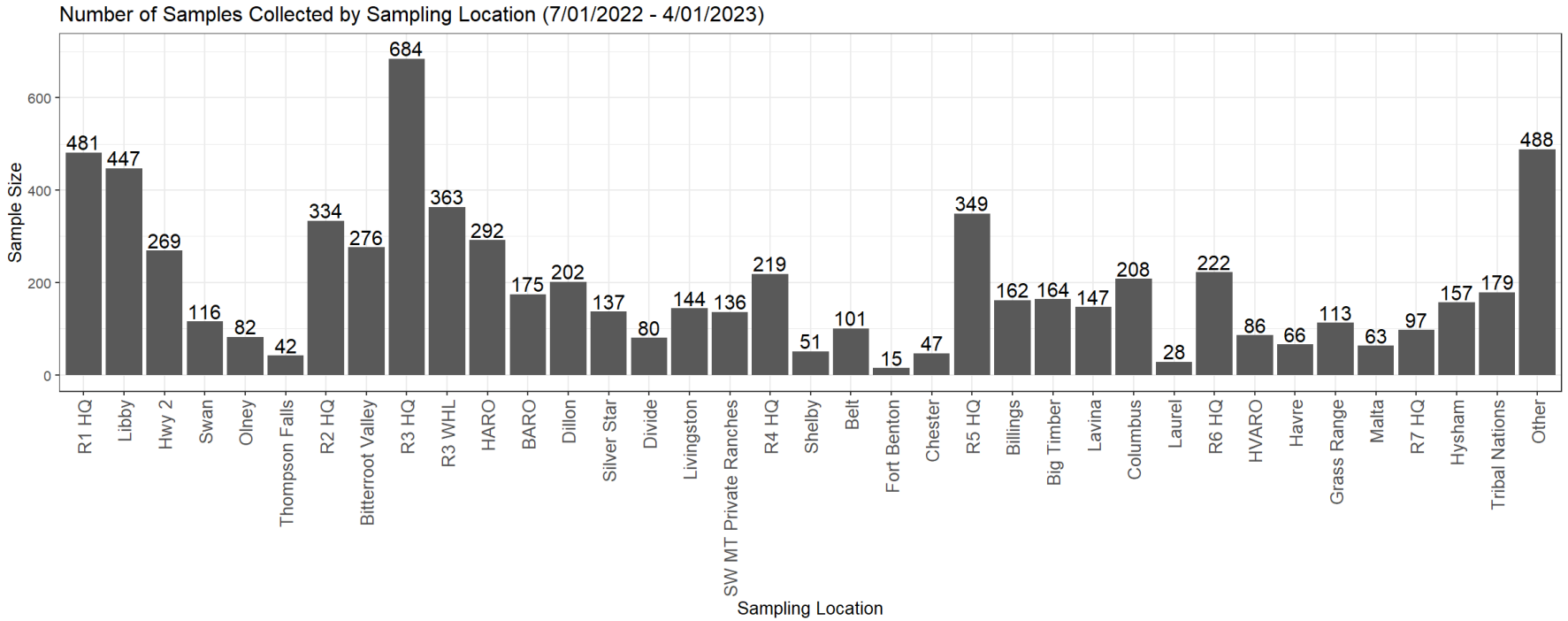


Figure A4. Number of samples collected at various CWD sampling locations around the state during the 2022 hunting season. "Hunter submitted" is the number of samples collected and submitted by hunters. "HQ" stands for headquarters and "R3 WHL" stands for the Region 3 Wildlife Health Lab. "HVARO", "HARO", and "BARO" stand for Havre Area Resource Office, Helena Area Resource Office, and Butte Area Resource Office, respectively. "Tribal Nations" includes all the reservations that collected and submitted samples for testing. "Other" includes all the additional locations that samples were collected (e.g. private property, trailheads, BMA, etc.,).

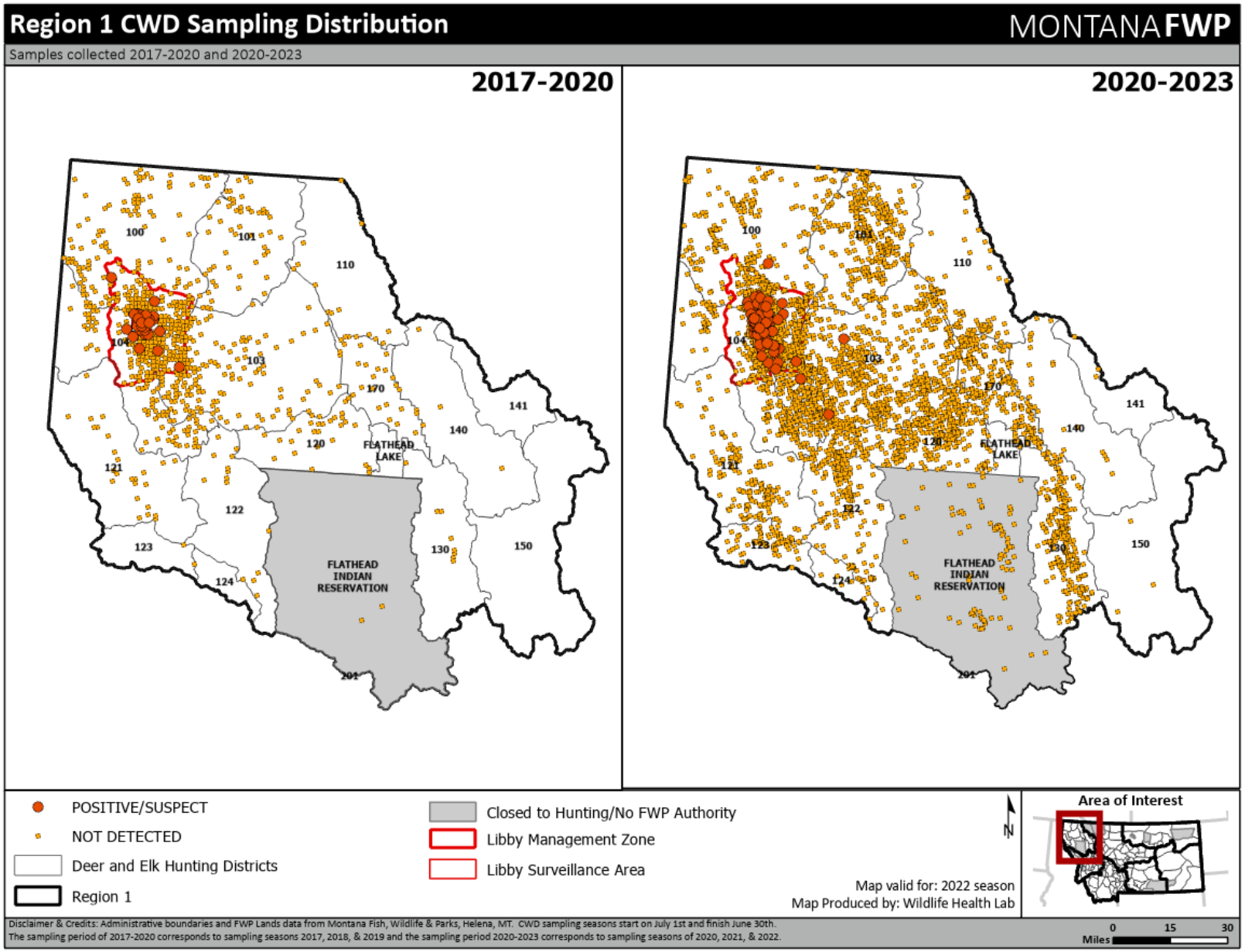


Figure A5. Map of sampling locations and positive/suspect white-tailed deer, mule deer, elk, and moose in Region 1 from 2017-2023.

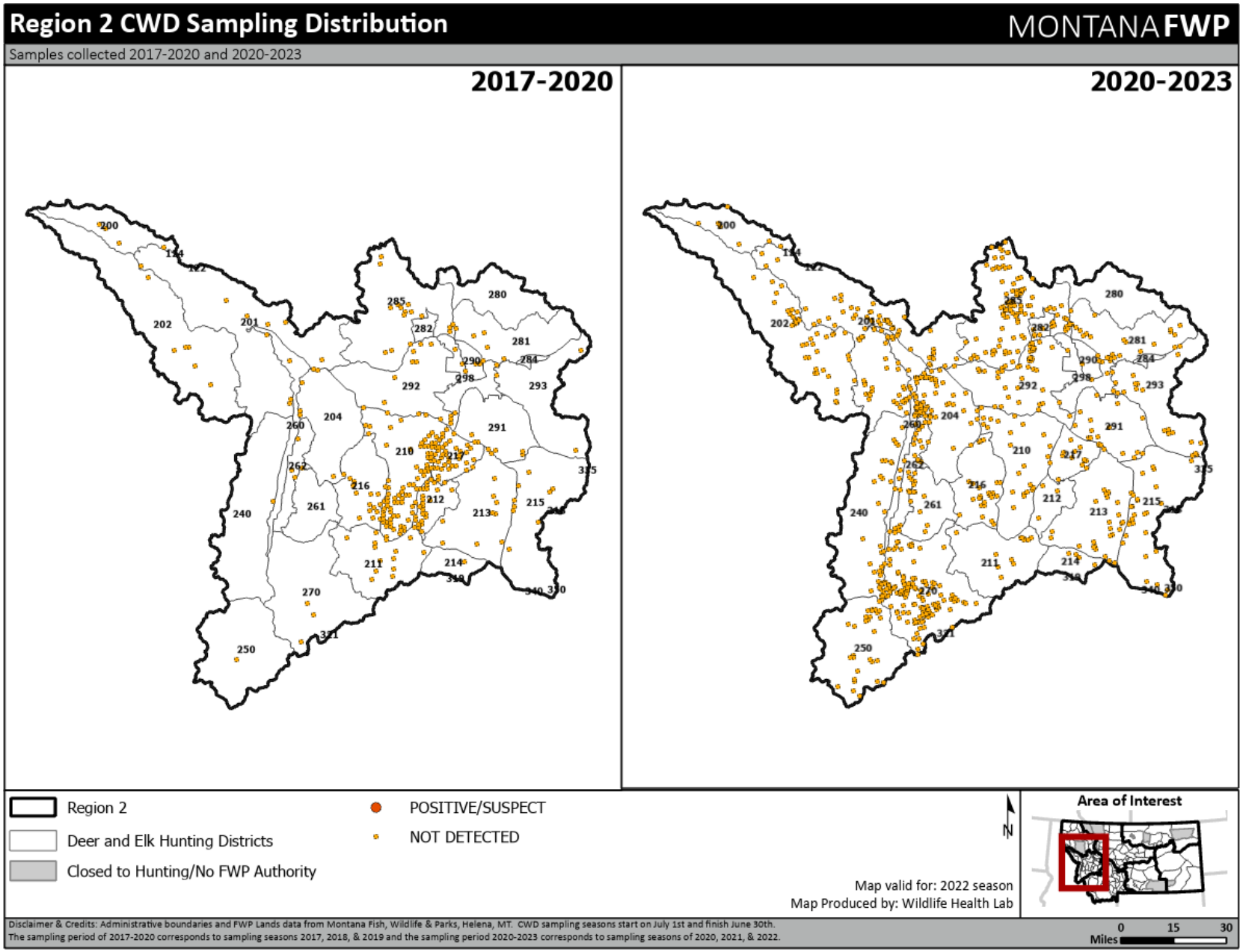


Figure A6. Map of sampling locations and positive/suspect white-tailed deer, mule deer, elk, and moose in Region 2 from 2017-2023.

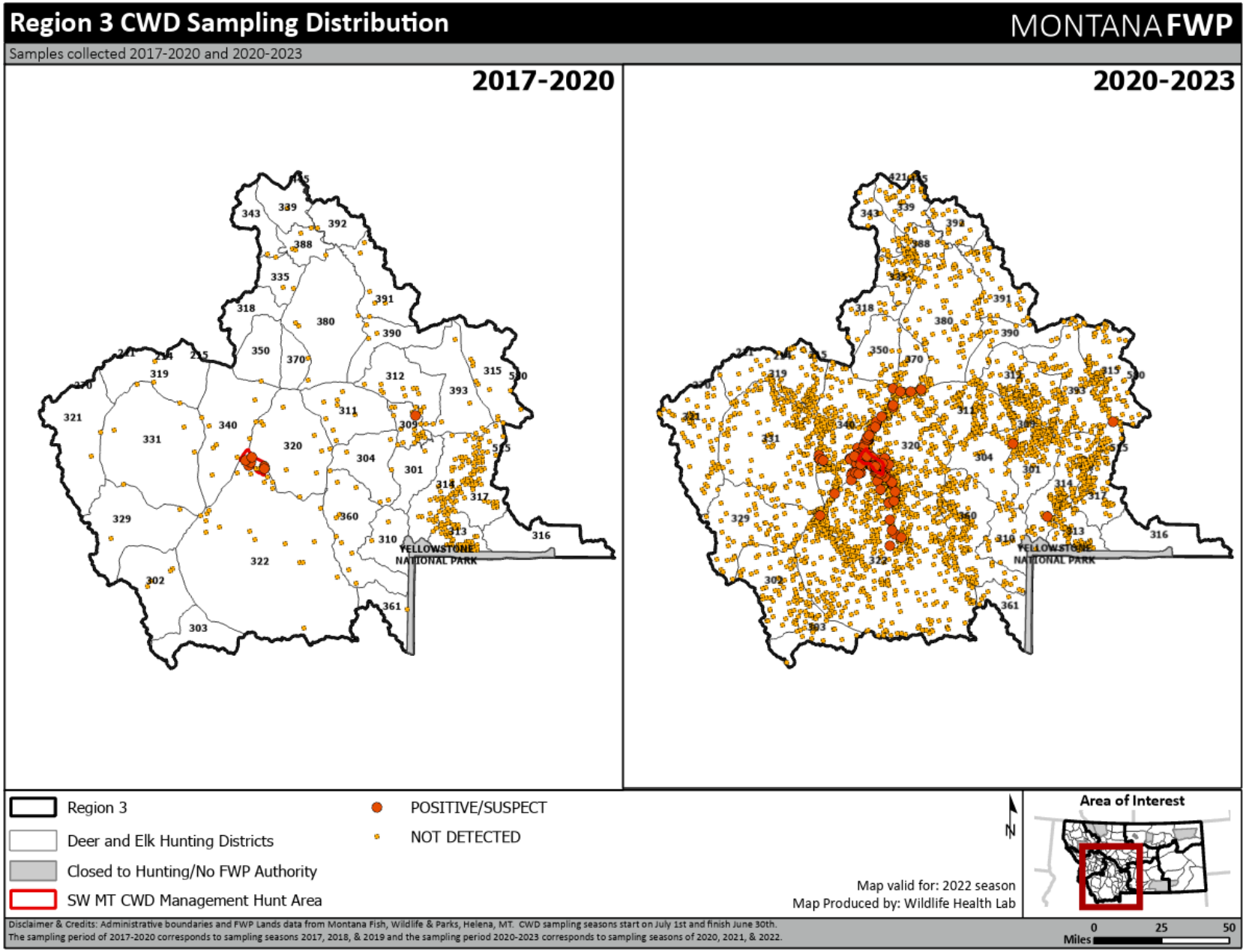


Figure A7. Map of sampling locations and positive/suspect white-tailed deer, mule deer, elk, and moose in Region 3 from 2017-2023.

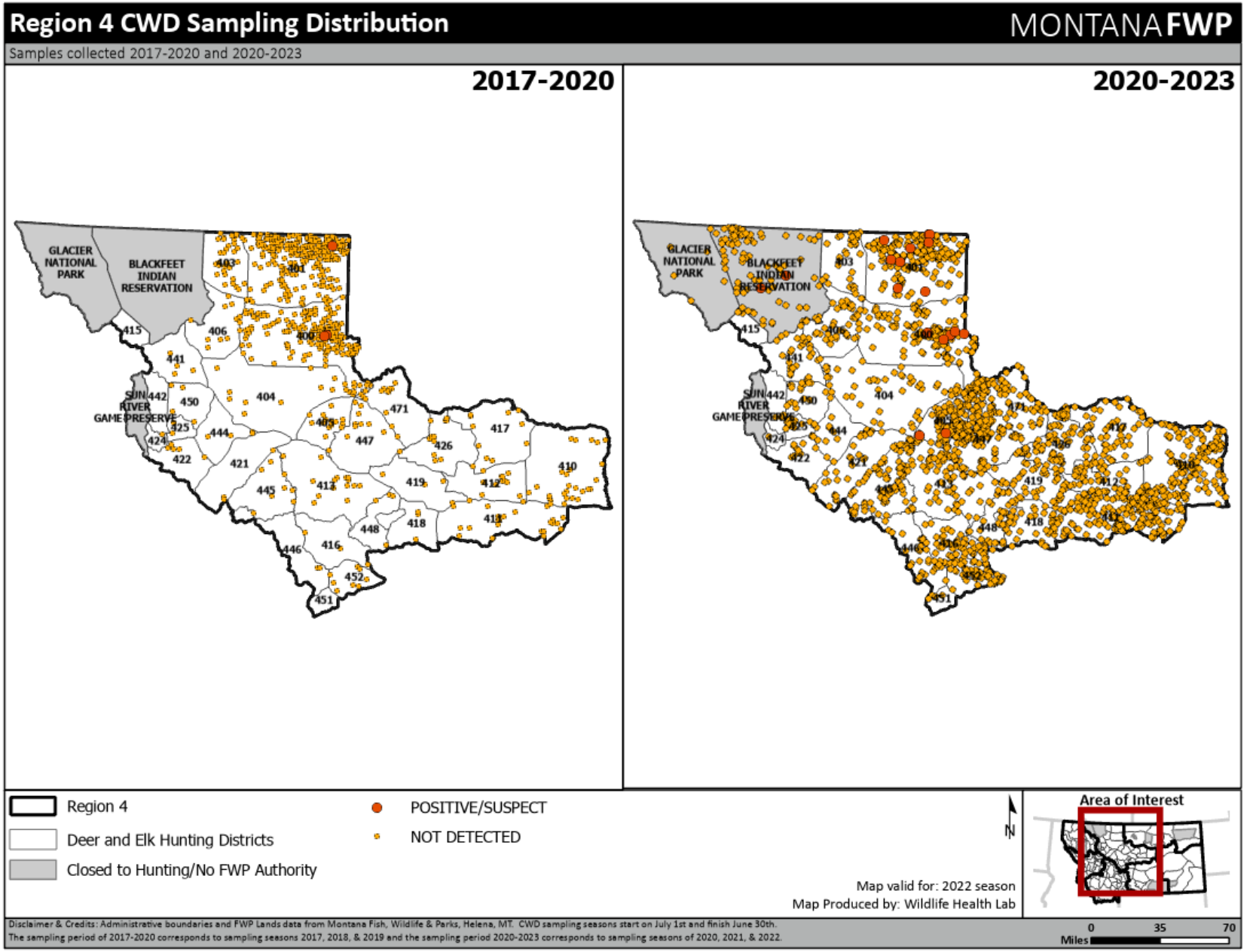


Figure A8. Map of sampling locations and positive/suspect white-tailed deer, mule deer, elk, and moose in Region 4 from 2017-2023.

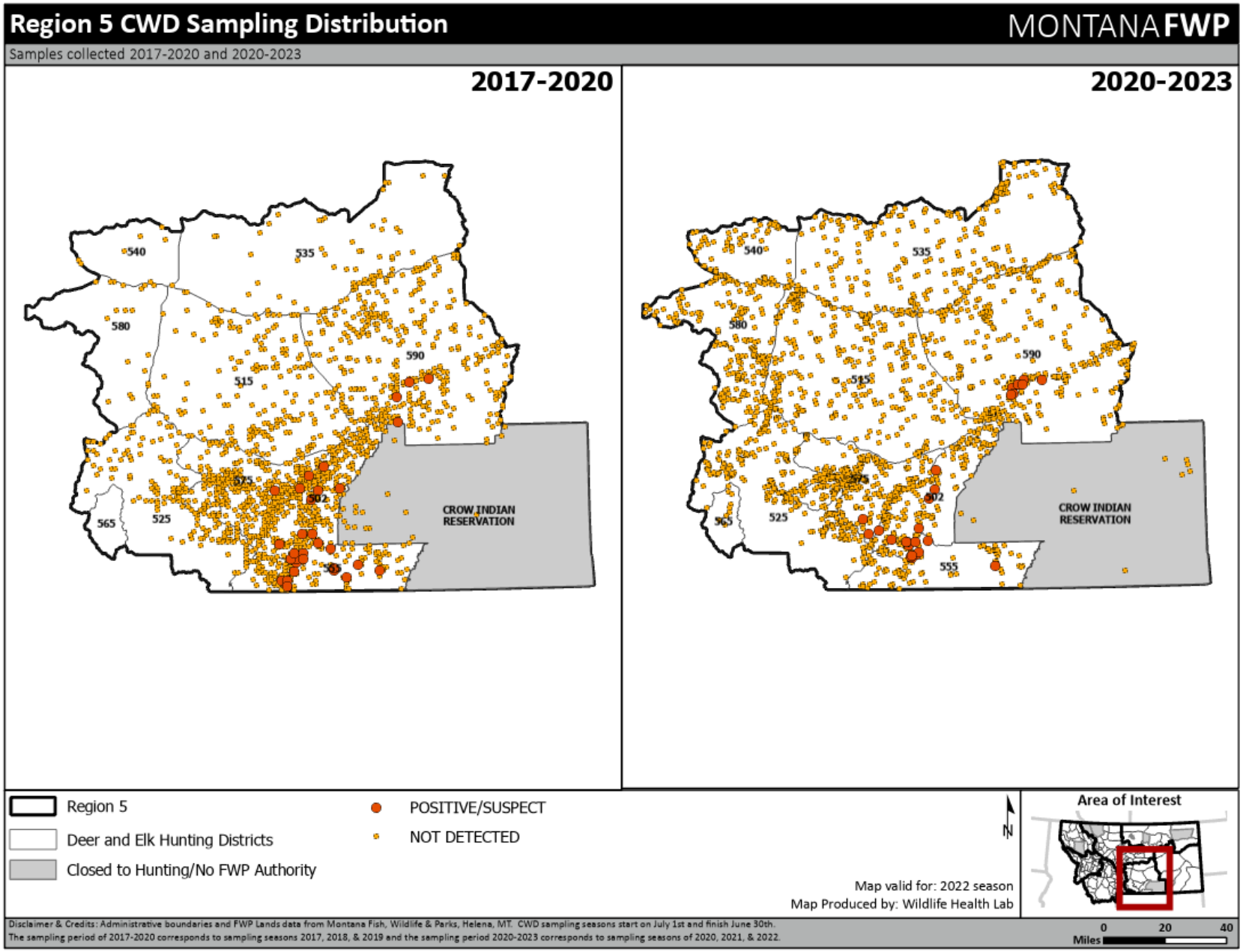


Figure A9. Map of sampling locations and positive/suspect white-tailed deer, mule deer, elk, and moose in Region 5 from 2017-2023.

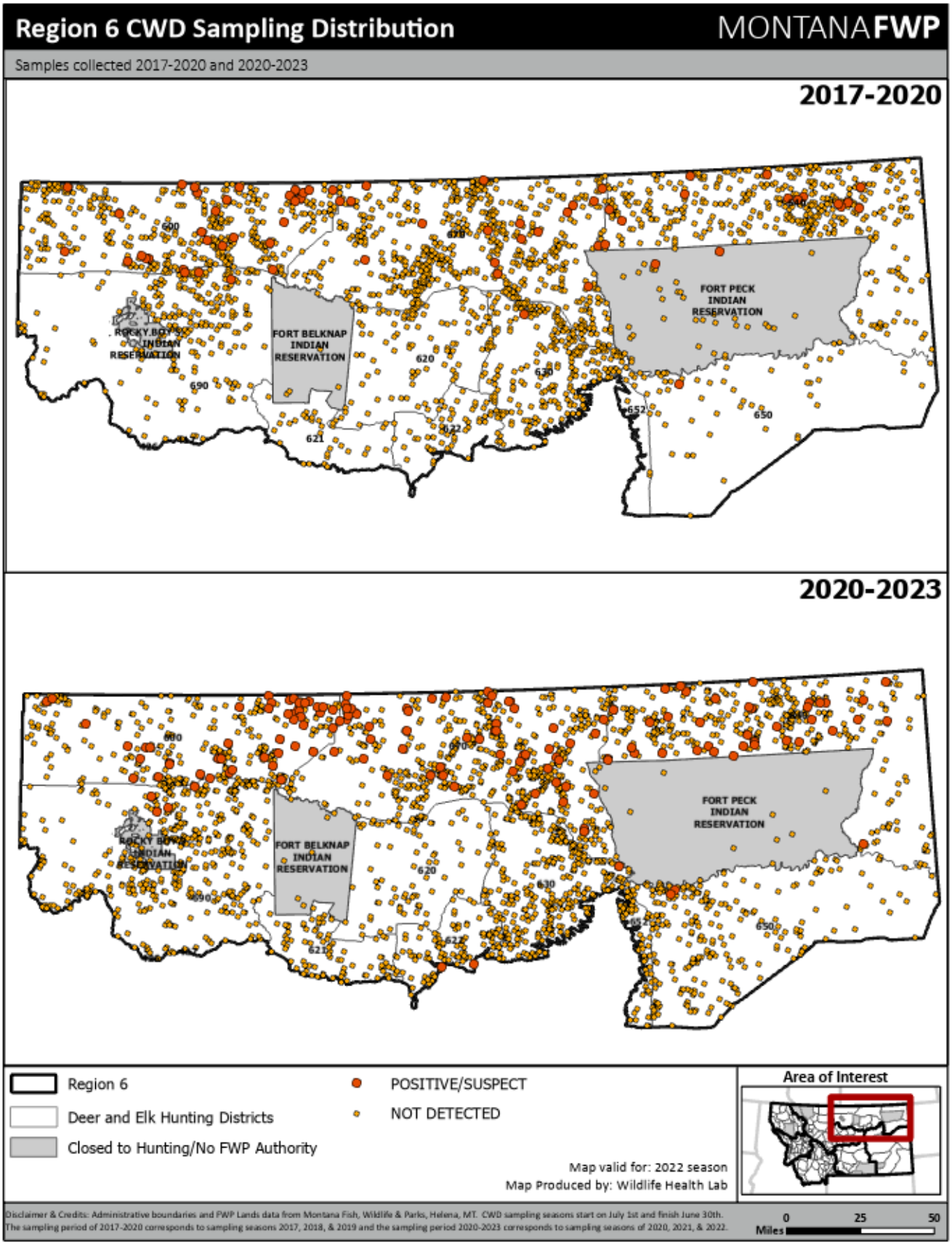


Figure A10. Map of sampling locations and positive/suspect white-tailed deer, mule deer, elk, and moose in Region 6 from 2017-2023.

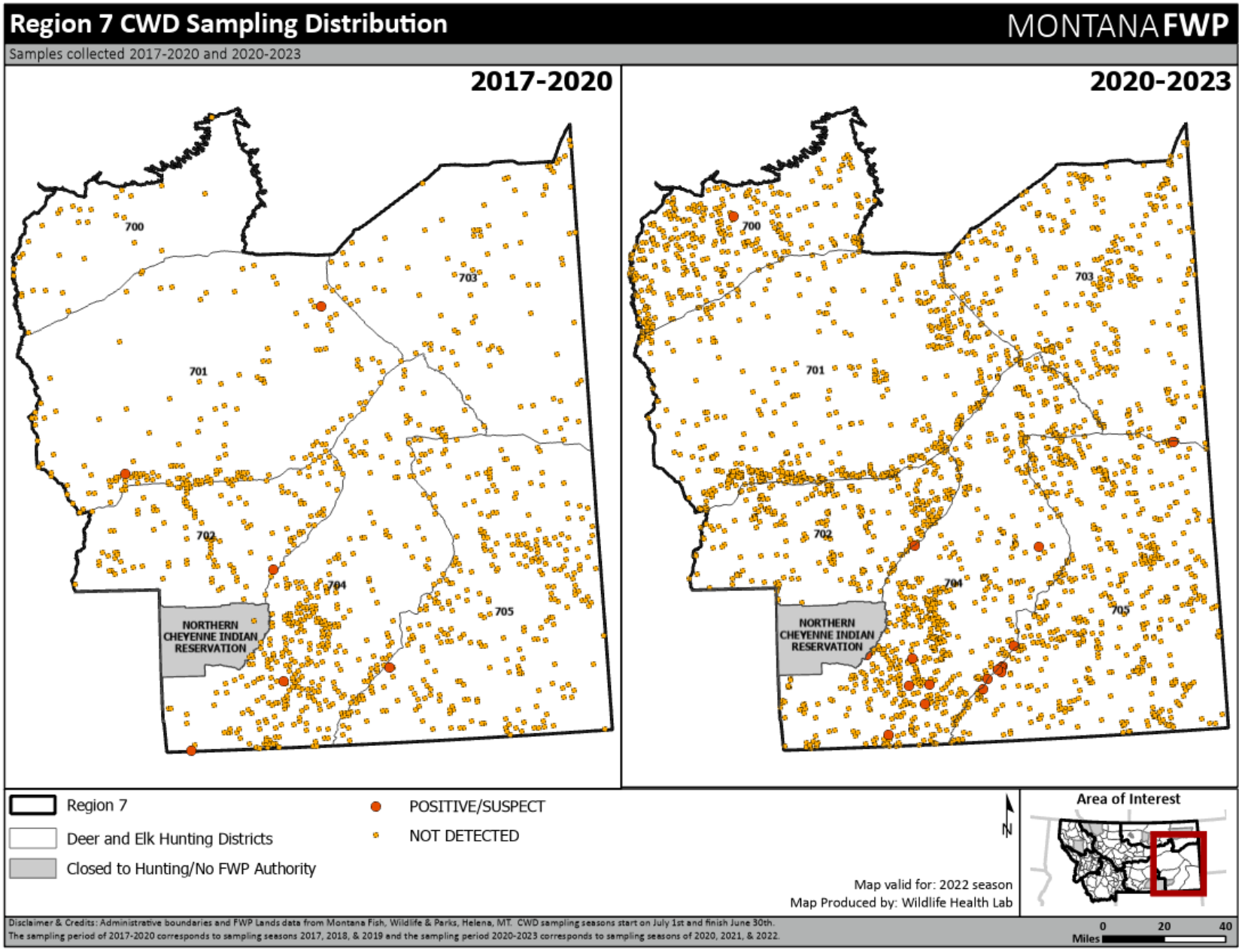


Figure A11. Map of sampling locations and positive/suspect white-tailed deer, mule deer, elk, and moose in Region 7 from 2017-2023.

Appendix II. Prevalence Estimates

Table A1. Estimated CWD prevalence by hunting district (HD) and species, using data from All-time Sampling (2017-2022) and 2019-2022 Sampling from hunter-harvested or agency removed (i.e. in Libby) animals. The lower (LB) and upper (UB) 95% confidence intervals are provided along with sample size (N) and total number of positives by species in each HD.

		All-time Sampling					2020-2023 Sampling				
HD	**Species**	**N**	**Positives/ Suspects**	**Prevalence**	**LB 95% CI**	**UB 95% CI**	**N**	**Positives/ Suspects**	**Prevalence**	**LB 95% CI**	**UB 95% CI**
100	Elk	35	0	0	0	0.1	18	0	0	0	0.18
100	MD	123	3	0.02	0.01	0.07	67	2	0.03	0.01	0.1
100	Moose	23	1	0.04	0.01	0.21	12	0	0	0	0.24
100	WTD	1151	70	0.06	0.05	0.08	752	44	0.06	0.04	0.08
101	Elk	16	0	0	0	0.19	15	0	0	0	0.2
101	MD	41	0	0	0	0.09	32	0	0	0	0.11
101	Moose	5	0	0	0	0.43	5	0	0	0	0.43
101	WTD	354	0	0	0	0.01	313	0	0	0	0.01
103	Elk	47	0	0	0	0.08	39	0	0	0	0.09
103	MD	196	0	0	0	0.02	143	0	0	0	0.03
103	Moose	23	1	0.04	0.01	0.21	20	0	0	0	0.16
103	WTD	1594	25	0.02	0.01	0.02	1193	21	0.02	0.01	0.03
104	Elk	17	0	0	0	0.18	11	0	0	0	0.26
104	MD	31	0	0	0	0.11	18	0	0	0	0.18
104	Moose	5	0	0	0	0.43	5	0	0	0	0.43
104	WTD	866	39	0.05	0.03	0.06	565	24	0.04	0.03	0.06
110	Elk	6	0	0	0	0.39	5	0	0	0	0.43
110	MD	2	0	0	0	0.66	2	0	0	0	0.66
110	Moose	4	0	0	0	0.49	3	0	0	0	0.56
110	WTD	73	0	0	0	0.05	66	0	0	0	0.06
120	Elk	12	0	0	0	0.24	10	0	0	0	0.28
120	MD	17	0	0	0	0.18	17	0	0	0	0.18
120	Moose	1	0	0	0	0.79	1	0	0	0	0.79
120	WTD	355	0	0	0	0.01	327	0	0	0	0.01

		All-time Sampling					2020-2023 Sampling				
HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
121	Elk	27	0	0	0	0.12	25	0	0	0	0.13
121	MD	20	0	0	0	0.16	17	0	0	0	0.18
121	Moose	2	0	0	0	0.66	2	0	0	0	0.66
121	WTD	151	0	0	0	0.02	131	0	0	0	0.03
122	Elk	22	0	0	0	0.15	21	0	0	0	0.15
122	MD	28	0	0	0	0.12	26	0	0	0	0.13
122	Moose	2	0	0	0	0.66	2	0	0	0	0.66
122	WTD	195	0	0	0	0.02	182	0	0	0	0.02
123	Elk	14	0	0	0	0.22	14	0	0	0	0.22
123	MD	8	0	0	0	0.32	8	0	0	0	0.32
123	WTD	33	0	0	0	0.1	32	0	0	0	0.11
124	Elk	8	0	0	0	0.32	8	0	0	0	0.32
124	MD	2	0	0	0	0.66	2	0	0	0	0.66
124	WTD	7	0	0	0	0.35	7	0	0	0	0.35
130	Elk	5	0	0	0	0.43	5	0	0	0	0.43
130	MD	2	0	0	0	0.66	2	0	0	0	0.66
130	WTD	285	0	0	0	0.01	277	0	0	0	0.01
140	Elk	6	0	0	0	0.39	6	0	0	0	0.39
140	MD	2	0	0	0	0.66	2	0	0	0	0.66
140	Moose	1	0	0	0	0.79	1	0	0	0	0.79
140	WTD	34	0	0	0	0.1	29	0	0	0	0.12
141	WTD	2	0	0	0	0.66	2	0	0	0	0.66
150	WTD	3	0	0	0	0.56	3	0	0	0	0.56
170	Elk	17	0	0	0	0.18	17	0	0	0	0.18
170	MD	1	0	0	0	0.79	1	0	0	0	0.79
170	WTD	220	0	0	0	0.02	199	0	0	0	0.02
200	WTD	9	0	0	0	0.3	6	0	0	0	0.39
201	Elk	16	0	0	0	0.19	14	0	0	0	0.22
201	MD	18	0	0	0	0.18	18	0	0	0	0.18
201	WTD	58	0	0	0	0.06	50	0	0	0	0.07
202	Elk	3	0	0	0	0.56	3	0	0	0	0.56

		All-time Sampling					2020-2023 Sampling				
HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
202	MD	7	0	0	0	0.35	7	0	0	0	0.35
202	Moose	2	0	0	0	0.66	2	0	0	0	0.66
202	WTD	34	0	0	0	0.1	28	0	0	0	0.12
204	Elk	27	0	0	0	0.12	27	0	0	0	0.12
204	MD	3	0	0	0	0.56	3	0	0	0	0.56
204	Moose	1	0	0	0	0.79	1	0	0	0	0.79
204	WTD	40	0	0	0	0.09	39	0	0	0	0.09
210	Elk	39	0	0	0	0.09	6	0	0	0	0.39
210	MD	28	0	0	0	0.12	3	0	0	0	0.56
210	WTD	79	0	0	0	0.05	14	0	0	0	0.22
211	Elk	13	0	0	0	0.23	8	0	0	0	0.32
211	MD	6	0	0	0	0.39	2	0	0	0	0.66
211	WTD	8	0	0	0	0.32	2	0	0	0	0.66
212	Elk	9	0	0	0	0.3	NA	NA	NA	NA	NA
212	MD	20	0	0	0	0.16	3	0	0	0	0.56
212	WTD	11	0	0	0	0.26	NA	NA	NA	NA	NA
213	Elk	20	0	0	0	0.16	15	0	0	0	0.2
213	MD	9	0	0	0	0.3	8	0	0	0	0.32
213	WTD	13	0	0	0	0.23	9	0	0	0	0.3
214	MD	2	0	0	0	0.66	2	0	0	0	0.66
214	WTD	3	0	0	0	0.56	2	0	0	0	0.66
215	Elk	14	0	0	0	0.22	8	0	0	0	0.32
215	MD	10	0	0	0	0.28	10	0	0	0	0.28
215	WTD	5	0	0	0	0.43	5	0	0	0	0.43
216	Elk	6	0	0	0	0.39	3	0	0	0	0.56
216	MD	18	0	0	0	0.18	13	0	0	0	0.23
216	Moose	1	0	0	0	0.79	1	0	0	0	0.79
216	WTD	20	0	0	0	0.16	9	0	0	0	0.3
217	Elk	17	0	0	0	0.18	9	0	0	0	0.3
217	MD	18	0	0	0	0.18	NA	NA	NA	NA	NA
217	WTD	31	0	0	0	0.11	7	0	0	0	0.35

		All-time Sampling					2020-2023 Sampling				
HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
240	Elk	11	0	0	0	0.26	11	0	0	0	0.26
240	MD	5	0	0	0	0.43	5	0	0	0	0.43
240	WTD	30	0	0	0	0.11	29	0	0	0	0.12
250	Elk	8	0	0	0	0.32	8	0	0	0	0.32
250	MD	3	0	0	0	0.56	3	0	0	0	0.56
250	WTD	19	0	0	0	0.17	18	0	0	0	0.18
260	Elk	2	0	0	0	0.66	2	0	0	0	0.66
260	WTD	11	0	0	0	0.26	10	0	0	0	0.28
261	Elk	4	0	0	0	0.49	4	0	0	0	0.49
261	MD	2	0	0	0	0.66	2	0	0	0	0.66
261	WTD	5	0	0	0	0.43	5	0	0	0	0.43
262	Elk	1	0	0	0	0.79	1	0	0	0	0.79
262	MD	6	0	0	0	0.39	4	0	0	0	0.49
262	WTD	19	0	0	0	0.17	18	0	0	0	0.18
270	Elk	60	0	0	0	0.06	60	0	0	0	0.06
270	MD	40	0	0	0	0.09	39	0	0	0	0.09
270	WTD	35	0	0	0	0.1	33	0	0	0	0.1
281	Elk	6	0	0	0	0.39	6	0	0	0	0.39
281	MD	3	0	0	0	0.56	2	0	0	0	0.66
281	WTD	20	0	0	0	0.16	15	0	0	0	0.2
282	Elk	1	0	0	0	0.79	1	0	0	0	0.79
282	MD	1	0	0	0	0.79	1	0	0	0	0.79
282	WTD	4	0	0	0	0.49	4	0	0	0	0.49
285	Elk	9	0	0	0	0.3	8	0	0	0	0.32
285	MD	15	0	0	0	0.2	13	0	0	0	0.23
285	WTD	92	0	0	0	0.04	83	0	0	0	0.04
290	Elk	2	0	0	0	0.66	1	0	0	0	0.79
290	WTD	6	0	0	0	0.39	2	0	0	0	0.66
291	Elk	6	0	0	0	0.39	6	0	0	0	0.39
291	MD	10	0	0	0	0.28	6	0	0	0	0.39
291	WTD	3	0	0	0	0.56	3	0	0	0	0.56

		All-time Sampling					2020-2023 Sampling				
HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
292	Elk	8	0	0	0	0.32	8	0	0	0	0.32
292	MD	8	0	0	0	0.32	5	0	0	0	0.43
292	WTD	44	0	0	0	0.08	35	0	0	0	0.1
293	Elk	6	0	0	0	0.39	6	0	0	0	0.39
293	MD	8	0	0	0	0.32	4	0	0	0	0.49
293	WTD	8	0	0	0	0.32	8	0	0	0	0.32
298	Elk	3	0	0	0	0.56	1	0	0	0	0.79
298	WTD	7	0	0	0	0.35	5	0	0	0	0.43
301	Elk	14	0	0	0	0.22	14	0	0	0	0.22
301	MD	19	0	0	0	0.17	18	0	0	0	0.18
301	Moose	2	0	0	0	0.66	2	0	0	0	0.66
301	WTD	33	0	0	0	0.1	33	0	0	0	0.1
302	Elk	38	0	0	0	0.09	37	0	0	0	0.09
302	MD	33	0	0	0	0.1	29	0	0	0	0.12
302	Moose	1	0	0	0	0.79	1	0	0	0	0.79
302	WTD	8	0	0	0	0.32	8	0	0	0	0.32
303	Elk	21	0	0	0	0.15	21	0	0	0	0.15
303	MD	8	0	0	0	0.32	8	0	0	0	0.32
304	Elk	8	0	0	0	0.32	6	0	0	0	0.39
304	MD	16	0	0	0	0.19	16	0	0	0	0.19
304	Moose	1	0	0	0	0.79	1	0	0	0	0.79
304	WTD	15	1	0.07	0.01	0.3	15	1	0.07	0.01	0.3
309	Elk	10	0	0	0	0.28	9	0	0	0	0.3
309	MD	6	0	0	0	0.39	6	0	0	0	0.39
309	Moose	1	0	0	0	0.79	1	0	0	0	0.79
309	WTD	91	0	0	0	0.04	82	0	0	0	0.04
310	Elk	13	0	0	0	0.23	12	0	0	0	0.24
310	MD	5	0	0	0	0.43	4	0	0	0	0.49
310	Moose	1	0	0	0	0.79	1	0	0	0	0.79
311	Elk	30	0	0	0	0.11	26	0	0	0	0.13
311	MD	49	0	0	0	0.07	48	0	0	0	0.07

		All-time Sampling					2020-2023 Sampling				
HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
311	WTD	100	1	0.01	0	0.05	94	1	0.01	0	0.06
312	Elk	28	0	0	0	0.12	26	0	0	0	0.13
312	MD	22	0	0	0	0.15	19	0	0	0	0.17
312	Moose	3	0	0	0	0.56	3	0	0	0	0.56
312	WTD	119	0	0	0	0.03	110	0	0	0	0.03
313	Elk	79	0	0	0	0.05	45	0	0	0	0.08
313	MD	93	0	0	0	0.04	40	0	0	0	0.09
313	WTD	3	0	0	0	0.56	NA	NA	NA	NA	NA
314	Elk	433	0	0	0	0.01	414	0	0	0	0.01
314	MD	62	1	0.02	0	0.09	41	1	0.02	0	0.13
314	Moose	1	0	0	0	0.79	1	0	0	0	0.79
314	WTD	51	0	0	0	0.07	31	0	0	0	0.11
315	Elk	21	0	0	0	0.15	20	0	0	0	0.16
315	MD	61	0	0	0	0.06	57	0	0	0	0.06
315	Moose	1	0	0	0	0.79	1	0	0	0	0.79
315	WTD	57	0	0	0	0.06	49	0	0	0	0.07
317	Elk	31	0	0	0	0.11	24	0	0	0	0.14
317	MD	71	0	0	0	0.05	45	0	0	0	0.08
317	Moose	2	0	0	0	0.66	2	0	0	0	0.66
317	WTD	87	1	0.01	0	0.06	66	1	0.02	0	0.08
318	Elk	9	0	0	0	0.3	9	0	0	0	0.3
318	MD	2	0	0	0	0.66	2	0	0	0	0.66
319	Elk	58	0	0	0	0.06	58	0	0	0	0.06
319	MD	47	0	0	0	0.08	45	0	0	0	0.08
319	Moose	2	0	0	0	0.66	1	0	0	0	0.79
319	WTD	8	0	0	0	0.32	8	0	0	0	0.32
320	Elk	55	0	0	0	0.07	55	0	0	0	0.07
320	MD	69	0	0	0	0.05	64	0	0	0	0.06
320	Moose	2	0	0	0	0.66	2	0	0	0	0.66
320	WTD	428	12	0.03	0.02	0.05	424	12	0.03	0.02	0.05
321	Elk	43	0	0	0	0.08	43	0	0	0	0.08

		All-time Sampling					2020-2023 Sampling				
HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
321	MD	8	0	0	0	0.32	8	0	0	0	0.32
321	Moose	6	0	0	0	0.39	5	0	0	0	0.43
321	WTD	5	0	0	0	0.43	5	0	0	0	0.43
322	Elk	444	0	0	0	0.01	434	0	0	0	0.01
322	MD	287	2	0.01	0	0.03	282	2	0.01	0	0.03
322	Moose	16	1	0.06	0.01	0.28	16	1	0.06	0.01	0.28
322	WTD	1879	516	0.27	0.25	0.3	1861	512	0.28	0.26	0.3
329	Elk	36	0	0	0	0.1	35	0	0	0	0.1
329	MD	24	0	0	0	0.14	23	0	0	0	0.14
329	Moose	1	0	0	0	0.79	1	0	0	0	0.79
329	WTD	10	0	0	0	0.28	10	0	0	0	0.28
331	Elk	85	0	0	0	0.04	83	0	0	0	0.04
331	MD	93	0	0	0	0.04	93	0	0	0	0.04
331	WTD	49	0	0	0	0.07	49	0	0	0	0.07
335	Elk	8	0	0	0	0.32	8	0	0	0	0.32
335	MD	26	0	0	0	0.13	25	0	0	0	0.13
335	Moose	1	0	0	0	0.79	1	0	0	0	0.79
335	WTD	3	0	0	0	0.56	3	0	0	0	0.56
339	Elk	4	0	0	0	0.49	3	0	0	0	0.56
339	MD	20	0	0	0	0.16	20	0	0	0	0.16
339	WTD	8	0	0	0	0.32	8	0	0	0	0.32
340	Elk	56	0	0	0	0.06	56	0	0	0	0.06
340	MD	76	0	0	0	0.05	74	0	0	0	0.05
340	Moose	2	0	0	0	0.66	2	0	0	0	0.66
340	WTD	307	24	0.08	0.05	0.11	304	24	0.08	0.05	0.11
343	Elk	2	0	0	0	0.66	2	0	0	0	0.66
343	MD	10	0	0	0	0.28	8	0	0	0	0.32
343	WTD	5	0	0	0	0.43	5	0	0	0	0.43
350	Elk	2	0	0	0	0.66	2	0	0	0	0.66
350	MD	11	0	0	0	0.26	11	0	0	0	0.26
350	WTD	5	0	0	0	0.43	5	0	0	0	0.43

		All-time Sampling					2020-2023 Sampling				
HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
360	Elk	104	0	0	0	0.04	96	0	0	0	0.04
360	MD	34	0	0	0	0.1	33	0	0	0	0.1
360	WTD	43	0	0	0	0.08	41	0	0	0	0.09
361	Elk	3	0	0	0	0.56	3	0	0	0	0.56
361	MD	2	0	0	0	0.66	2	0	0	0	0.66
361	Moose	1	0	0	0	0.79	NA	NA	NA	NA	NA
370	Elk	5	0	0	0	0.43	5	0	0	0	0.43
370	MD	7	0	0	0	0.35	6	0	0	0	0.39
370	WTD	2	0	0	0	0.66	2	0	0	0	0.66
380	Elk	38	0	0	0	0.09	34	0	0	0	0.1
380	MD	42	0	0	0	0.08	42	0	0	0	0.08
380	WTD	28	0	0	0	0.12	28	0	0	0	0.12
388	Elk	6	0	0	0	0.39	6	0	0	0	0.39
388	MD	95	0	0	0	0.04	95	0	0	0	0.04
388	WTD	12	0	0	0	0.24	11	0	0	0	0.26
390	Elk	6	0	0	0	0.39	6	0	0	0	0.39
390	MD	5	0	0	0	0.43	4	0	0	0	0.49
390	WTD	7	0	0	0	0.35	7	0	0	0	0.35
391	Elk	15	0	0	0	0.2	13	0	0	0	0.23
391	MD	22	0	0	0	0.15	22	0	0	0	0.15
391	Moose	1	0	0	0	0.79	1	0	0	0	0.79
391	WTD	12	0	0	0	0.24	12	0	0	0	0.24
392	Elk	1	0	0	0	0.79	1	0	0	0	0.79
392	MD	14	0	0	0	0.22	13	0	0	0	0.23
392	WTD	2	0	0	0	0.66	2	0	0	0	0.66
393	Elk	26	0	0	0	0.13	23	0	0	0	0.14
393	MD	58	0	0	0	0.06	55	0	0	0	0.07
393	WTD	47	0	0	0	0.08	46	0	0	0	0.08
400	Elk	1	0	0	0	0.79	NA	NA	NA	NA	NA
400	MD	553	4	0.01	0	0.02	224	3	0.01	0	0.04
400	WTD	92	3	0.03	0.01	0.09	45	2	0.04	0.01	0.15

		All-time Sampling					2020-2023 Sampling				
HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
401	Elk	65	0	0	0	0.06	16	0	0	0	0.19
401	MD	498	7	0.01	0.01	0.03	146	6	0.04	0.02	0.09
401	Moose	1	0	0	0	0.79	NA	NA	NA	NA	NA
401	WTD	261	2	0.01	0	0.03	98	2	0.02	0.01	0.07
403	MD	58	0	0	0	0.06	29	0	0	0	0.12
403	WTD	11	0	0	0	0.26	5	0	0	0	0.43
404	MD	41	0	0	0	0.09	31	0	0	0	0.11
404	WTD	38	0	0	0	0.09	35	0	0	0	0.1
405	MD	127	1	0.01	0	0.04	115	1	0.01	0	0.05
405	WTD	33	0	0	0	0.1	28	0	0	0	0.12
406	Elk	3	0	0	0	0.56	1	0	0	0	0.79
406	MD	41	0	0	0	0.09	30	0	0	0	0.11
406	WTD	33	0	0	0	0.1	27	0	0	0	0.12
410	Elk	56	0	0	0	0.06	55	0	0	0	0.07
410	MD	129	0	0	0	0.03	98	0	0	0	0.04
410	WTD	9	0	0	0	0.3	9	0	0	0	0.3
411	Elk	43	0	0	0	0.08	40	0	0	0	0.09
411	MD	103	0	0	0	0.04	85	0	0	0	0.04
411	WTD	104	0	0	0	0.04	92	0	0	0	0.04
412	Elk	10	0	0	0	0.28	5	0	0	0	0.43
412	MD	65	0	0	0	0.06	59	0	0	0	0.06
412	WTD	45	0	0	0	0.08	42	0	0	0	0.08
413	Elk	11	0	0	0	0.26	9	0	0	0	0.3
413	MD	67	0	0	0	0.05	58	0	0	0	0.06
413	WTD	50	0	0	0	0.07	46	0	0	0	0.08
415	Elk	2	0	0	0	0.66	2	0	0	0	0.66
415	MD	1	0	0	0	0.79	1	0	0	0	0.79
415	WTD	1	0	0	0	0.79	1	0	0	0	0.79
416	Elk	31	0	0	0	0.11	29	0	0	0	0.12
416	MD	29	0	0	0	0.12	29	0	0	0	0.12
416	WTD	15	0	0	0	0.2	15	0	0	0	0.2

		All-time Sampling					2020-2023 Sampling				
HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
417	Elk	25	0	0	0	0.13	20	0	0	0	0.16
417	MD	56	0	0	0	0.06	49	0	0	0	0.07
417	WTD	4	0	0	0	0.49	4	0	0	0	0.49
418	Elk	3	0	0	0	0.56	3	0	0	0	0.56
418	MD	14	0	0	0	0.22	12	0	0	0	0.24
418	WTD	24	0	0	0	0.14	22	0	0	0	0.15
419	Elk	2	0	0	0	0.66	2	0	0	0	0.66
419	MD	30	0	0	0	0.11	27	0	0	0	0.12
419	WTD	18	0	0	0	0.18	18	0	0	0	0.18
420	Elk	8	0	0	0	0.32	8	0	0	0	0.32
420	MD	2	0	0	0	0.66	2	0	0	0	0.66
420	WTD	1	0	0	0	0.79	1	0	0	0	0.79
421	MD	24	0	0	0	0.14	22	0	0	0	0.15
421	WTD	10	0	0	0	0.28	10	0	0	0	0.28
422	Elk	2	0	0	0	0.66	2	0	0	0	0.66
422	MD	6	0	0	0	0.39	4	0	0	0	0.49
422	WTD	6	0	0	0	0.39	6	0	0	0	0.39
425	MD	7	0	0	0	0.35	6	0	0	0	0.39
425	WTD	10	0	0	0	0.28	10	0	0	0	0.28
426	Elk	1	0	0	0	0.79	1	0	0	0	0.79
426	MD	107	0	0	0	0.03	95	0	0	0	0.04
426	WTD	12	0	0	0	0.24	11	0	0	0	0.26
441	Elk	5	0	0	0	0.43	4	0	0	0	0.49
441	MD	14	0	0	0	0.22	12	0	0	0	0.24
441	Moose	1	0	0	0	0.79	1	0	0	0	0.79
441	WTD	12	0	0	0	0.24	10	0	0	0	0.28
442	Elk	1	0	0	0	0.79	1	0	0	0	0.79
442	WTD	7	0	0	0	0.35	7	0	0	0	0.35
444	MD	4	0	0	0	0.49	4	0	0	0	0.49
444	WTD	32	0	0	0	0.11	25	0	0	0	0.13
445	Elk	11	0	0	0	0.26	10	0	0	0	0.28

		All-time Sampling					2020-2023 Sampling				
HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
445	MD	30	0	0	0	0.11	24	0	0	0	0.14
445	WTD	45	0	0	0	0.08	40	0	0	0	0.09
446	Elk	8	0	0	0	0.32	8	0	0	0	0.32
446	MD	8	0	0	0	0.32	8	0	0	0	0.32
446	Moose	1	0	0	0	0.79	1	0	0	0	0.79
446	WTD	22	0	0	0	0.15	20	0	0	0	0.16
447	Elk	9	0	0	0	0.3	8	0	0	0	0.32
447	MD	107	0	0	0	0.03	97	0	0	0	0.04
447	WTD	63	0	0	0	0.06	59	0	0	0	0.06
448	Elk	7	0	0	0	0.35	6	0	0	0	0.39
448	MD	16	0	0	0	0.19	15	0	0	0	0.2
448	WTD	9	0	0	0	0.3	8	0	0	0	0.32
450	Elk	8	0	0	0	0.32	7	0	0	0	0.35
450	MD	9	0	0	0	0.3	7	0	0	0	0.35
450	WTD	6	0	0	0	0.39	6	0	0	0	0.39
451	MD	4	0	0	0	0.49	4	0	0	0	0.49
452	Elk	19	0	0	0	0.17	18	0	0	0	0.18
452	MD	30	0	0	0	0.11	26	0	0	0	0.13
452	WTD	31	0	0	0	0.11	28	0	0	0	0.12
454	MD	1	0	0	0	0.79	1	0	0	0	0.79
455	Elk	2	0	0	0	0.66	2	0	0	0	0.66
455	MD	3	0	0	0	0.56	3	0	0	0	0.56
455	WTD	1	0	0	0	0.79	1	0	0	0	0.79
471	Elk	1	0	0	0	0.79	NA	NA	NA	NA	NA
471	MD	74	0	0	0	0.05	61	0	0	0	0.06
471	WTD	7	0	0	0	0.35	7	0	0	0	0.35
502	Elk	26	1	0.04	0.01	0.19	15	0	0	0	0.2
502	MD	504	14	0.03	0.02	0.05	136	8	0.06	0.03	0.11
502	WTD	308	6	0.02	0.01	0.04	79	2	0.03	0.01	0.09
515	Elk	34	0	0	0	0.1	29	0	0	0	0.12
515	MD	400	0	0	0	0.01	198	0	0	0	0.02

		All-time Sampling					2020-2023 Sampling				
HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
515	WTD	136	0	0	0	0.03	116	0	0	0	0.03
525	Elk	60	0	0	0	0.06	43	0	0	0	0.08
525	MD	178	0	0	0	0.02	93	0	0	0	0.04
525	Moose	4	0	0	0	0.49	1	0	0	0	0.79
525	WTD	307	0	0	0	0.01	195	0	0	0	0.02
535	Elk	25	0	0	0	0.13	22	0	0	0	0.15
535	MD	205	0	0	0	0.02	159	0	0	0	0.02
535	WTD	75	0	0	0	0.05	63	0	0	0	0.06
540	Elk	19	0	0	0	0.17	16	0	0	0	0.19
540	MD	30	0	0	0	0.11	29	0	0	0	0.12
540	WTD	27	0	0	0	0.12	20	0	0	0	0.16
555	Elk	35	0	0	0	0.1	16	0	0	0	0.19
555	MD	347	17	0.05	0.03	0.08	82	5	0.06	0.03	0.13
555	WTD	68	3	0.04	0.02	0.12	13	1	0.08	0.01	0.33
565	Elk	3	0	0	0	0.56	3	0	0	0	0.56
565	MD	1	0	0	0	0.79	1	0	0	0	0.79
565	WTD	5	0	0	0	0.43	5	0	0	0	0.43
575	Elk	31	0	0	0	0.11	24	0	0	0	0.14
575	MD	548	4	0.01	0	0.02	187	2	0.01	0	0.04
575	WTD	324	0	0	0	0.01	141	0	0	0	0.03
580	Elk	68	0	0	0	0.05	64	0	0	0	0.06
580	MD	58	0	0	0	0.06	53	0	0	0	0.07
580	WTD	135	0	0	0	0.03	125	0	0	0	0.03
590	Elk	56	0	0	0	0.06	32	0	0	0	0.11
590	MD	556	0	0	0	0.01	203	0	0	0	0.02
590	WTD	306	12	0.04	0.02	0.07	183	8	0.04	0.02	0.08
600	Elk	7	0	0	0	0.35	5	0	0	0	0.43
600	MD	815	71	0.09	0.07	0.11	327	46	0.14	0.11	0.18
600	Moose	1	0	0	0	0.79	1	0	0	0	0.79
600	WTD	188	9	0.05	0.03	0.09	72	4	0.06	0.02	0.13
620	Elk	5	0	0	0	0.43	2	0	0	0	0.66

		All-time Sampling					2020-2023 Sampling				
HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
620	MD	190	0	0	0	0.02	75	0	0	0	0.05
620	Moose	1	0	0	0	0.79	1	0	0	0	0.79
620	WTD	43	0	0	0	0.08	15	0	0	0	0.2
621	Elk	24	0	0	0	0.14	20	0	0	0	0.16
621	MD	105	0	0	0	0.04	70	0	0	0	0.05
621	WTD	7	0	0	0	0.35	4	0	0	0	0.49
622	Elk	39	1	0.03	0	0.13	29	1	0.03	0.01	0.17
622	MD	139	1	0.01	0	0.04	86	1	0.01	0	0.06
622	WTD	4	0	0	0	0.49	2	0	0	0	0.66
630	Elk	14	0	0	0	0.22	11	0	0	0	0.26
630	MD	508	1	0	0	0.01	273	0	0	0	0.01
630	Moose	2	0	0	0	0.66	1	0	0	0	0.79
630	WTD	195	1	0.01	0	0.03	113	1	0.01	0	0.05
640	Elk	2	0	0	0	0.66	1	0	0	0	0.79
640	MD	749	50	0.07	0.05	0.09	351	35	0.1	0.07	0.14
640	WTD	277	4	0.01	0.01	0.04	125	3	0.02	0.01	0.07
650	MD	295	3	0.01	0	0.03	240	2	0.01	0	0.03
650	WTD	63	0	0	0	0.06	49	0	0	0	0.07
652	MD	69	0	0	0	0.05	65	0	0	0	0.06
652	WTD	4	0	0	0	0.49	4	0	0	0	0.49
670	Elk	2	0	0	0	0.66	NA	NA	NA	NA	NA
670	MD	1331	67	0.05	0.04	0.06	626	52	0.08	0.06	0.11
670	WTD	260	6	0.02	0.01	0.05	125	4	0.03	0.01	0.08
690	Elk	23	0	0	0	0.14	20	0	0	0	0.16
690	MD	701	5	0.01	0	0.02	443	3	0.01	0	0.02
690	WTD	160	1	0.01	0	0.03	100	1	0.01	0	0.05
700	Elk	77	0	0	0	0.05	69	0	0	0	0.05
700	MD	274	1	0	0	0.02	253	1	0	0	0.02
700	WTD	27	0	0	0	0.12	23	0	0	0	0.14
701	Elk	20	0	0	0	0.16	14	0	0	0	0.22
701	MD	415	1	0	0	0.01	327	0	0	0	0.01

		All-time Sampling					2020-2023 Sampling				
HD	Species	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI	N	Positives/ Suspects	Prevalence	LB 95% CI	UB 95% CI
701	WTD	291	1	0	0	0.02	220	0	0	0	0.02
702	Elk	18	0	0	0	0.18	13	0	0	0	0.23
702	MD	306	0	0	0	0.01	205	0	0	0	0.02
702	WTD	59	1	0.02	0	0.09	40	0	0	0	0.09
703	Elk	9	0	0	0	0.3	7	0	0	0	0.35
703	MD	320	0	0	0	0.01	250	0	0	0	0.02
703	WTD	141	0	0	0	0.03	97	0	0	0	0.04
704	Elk	100	0	0	0	0.04	62	0	0	0	0.06
704	MD	847	8	0.01	0	0.02	487	7	0.01	0.01	0.03
704	WTD	177	5	0.03	0.01	0.06	133	4	0.03	0.01	0.07
705	Elk	31	0	0	0	0.11	22	0	0	0	0.15
705	MD	748	0	0	0	0.01	448	0	0	0	0.01
705	WTD	273	7	0.03	0.01	0.05	164	6	0.04	0.02	0.08

Appendix III. Models and Montana Surveillance Relative Weights

Table A1. Logistic generalized linear mixed models used to evaluate the odds of infection as a function of species (mule deer vs. white-tailed deer), sex, age class (young of the year, yearlings, adults), timing of harvest (early-rut vs. late-rut), and whether the animal was from the Libby or Ruby CWD Management Area (ManagementArea=1) or from outside these areas (ManagementArea =0). Models are ranked from best supported to least supported. All complete deer records from the general season (collected between October 15 - December 5) were included in this analysis (n = 18628*).*

Model	**AICc**	**Delta AICc**	**Relative model likelihood**	**AICc weight**
Infected~ 1+ Species + Sex + Species*Sex + AgeClass + ManagementArea + ManagementArea*Species + (1|HD)	4655.86	0	1.00	0.4
Infected~ 1+ Species + Sex + Species*Sex + AgeClass + ManagementArea + ManagementArea*Species + HarvestTiming + (1|HD)	4656.87	1.01	0.60	0.24
Infected~ 1+ Species + Sex + Species*Sex + AgeClass + ManagementArea + ManagementArea*Species + HarvestTiming + HarvestTiming*Sex + (1|HD)	4657.15	1.29	0.52	0.21
Infected~ 1+ Species + Sex + Species*Sex + AgeClass + ManagementArea + ManagementArea*Species + HarvestTiming + HarvestTiming*Sex + HarvestTiming*Species + (1|HD)	4658.15	2.29	0.32	0.13
Infected~ 1+ Species + Sex + Species*Sex + AgeClass + ManagementArea + (1|HD)	4662.45	6.59	0.04	0.01
Infected~ 1+ Species + Sex + AgeClass + ManagementArea + ManagementArea*Species + (1|HD)	4670.81	14.95	0	0
Infected~ 1+ Species + Sex + Species*Sex + AgeClass + (1|HD)	5005.17	349.31	0	0
Infected~ 1+ Species + Sex + AgeClass + (1|HD)	5042.47	386.61	0	0
Infected~ 1+ Species + Sex + Species*Sex + (1|HD)	5093.83	437.97	0	0
Infected~ 1+ Species + Sex + (1|HD)	5130.28	474.42	0	0
Infected~ 1+ Species + (1|HD)	5158.44	502.58	0	0

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