

CWD Harvest Modeling

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One of the limited number of tools that can be employed by State Game Agencies in their efforts to maximize the efficacy of efforts to contain the spread and prevalence rate of CWD, in areas where it has become established, are harvest regulations.

The most effective means of limiting the spread and prevalence of CWD is to remove as many infected animals from the herd as possible. This has a two-fold impact, it reduces the potential frequency of contacts between infected and uninfected animals and it also lowers prevalence rates by diluting the percentage of infected animals in the herd.

Targeted removal has been demonstrated as an effective means of limiting the spread and prevalence of CWD and any effective mitigation plan should include those efforts but for the purposes of this monograph we will focus on regulations related to hunter harvests.

Harvest regulations can influence the type of deer, both in terms of gender and age, that hunters remove from the herd on an annual basis. To paraphrase George Orwell, "All animals are equal, but some animals are more equal than others". In the case of deer infected with CWD, data shows us that there is an observed inequality, in terms of which deer are more likely to spread the disease and which deer are most likely to be infected with CWD. In that sense, all deer are most decidedly not created equal.

Most of the data gathered from other Midwestern states indicates a bias based both on gender and on age, regarding CWD prevalence rates. The state that has the largest sampling data base is Wisconsin and that data shows that adult bucks ($2.5 \geq$) tend to have approx. double the prevalence rate for CWD, when compared to adult does and that yearling bucks and does have similar rates, that tend to be slightly lower than what is found in adult does. While prevalence rates have increased in the core areas in Wisconsin over time, the ratio between the age and gender classes has remained fairly steady.

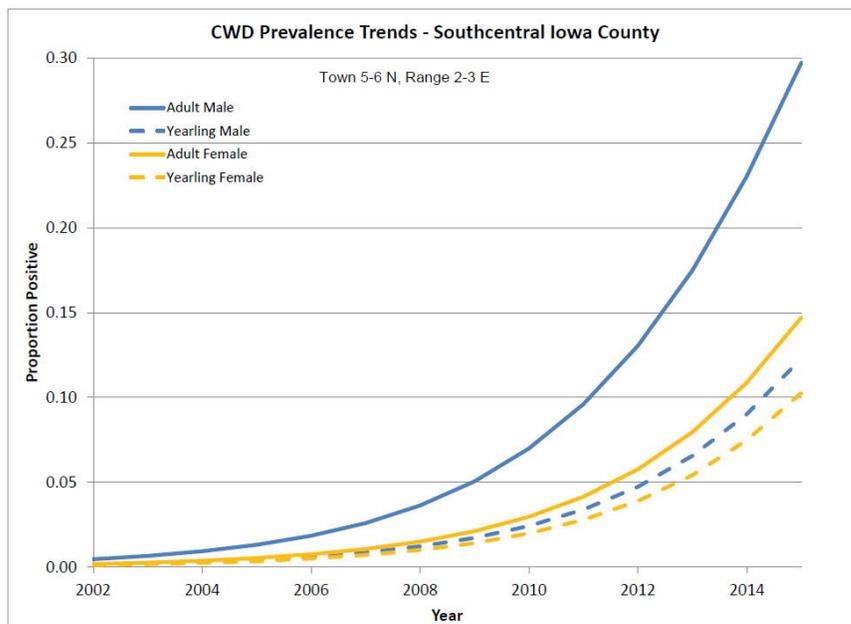


Figure 1 - Source WI DNR

CWD sampling data gathered by the Michigan DNR in 2017, from Montcalm County, shows a similar bias, although not quite as pronounced, indicating that adult bucks ($2.5 \geq$) have the highest prevalence rate for CWD in the sample tested.

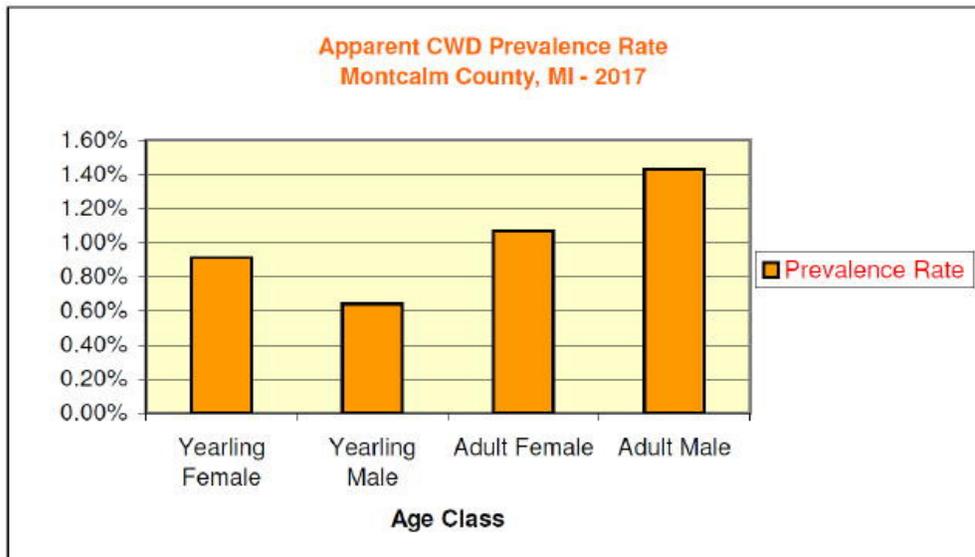


Figure 2 - Data Source MDNR

2017 CWD testing in Montcalm County indicated a yearling female prevalence rate of .91%, a yearling male prevalence rate of .64%, an adult female ($2.5 \geq$) prevalence rate of 1.07% and an adult male ($2.5 \geq$) prevalence rate of 1.43%. The total sample size was 3,705 with 34 total CWD positives. Fawns of both genders were excluded from this graphic, as both have very low incidence of CWD, as were deer of indeterminate age.

Using this data, we can employ harvest modeling to estimate what the potential impact of regulation changes may be on increasing or decreasing the relative number of diseased animals from the herd on an annual basis. Please note that the available data is based on a relatively small sample size and there is no way to predict whether the bias in prevalence rates that is currently indicated by the available data will continue or whether it will change, as testing increases and sampling becomes more robust. Should such changes occur, then management approaches should be adapted to reflect those demographic changes.

MDNR harvest survey and check station data from Montcalm/Mecosta Counties, from 2016, was used to populate the demographic distribution and the gender ratio of the harvest, for this model. Montcalm and Mecosta data was combined by the DNR for that year, so there was no way to select just the data from Montcalm county for modeling purposes.

The check station data provides us with the age class distribution for each gender within the harvest. In this case, the age distribution among antlerless deer was 11% female fawns, 12% male fawns, 20% yearling females and 56% adult females 2.5 or older. The antlered distribution was 60% yearling males and 40% adult males 2.5 or older.

The hunter survey data provides us with the total harvest numbers and the gender ratio within the harvest. In 2016 in the subject DMU, the harvest sample was composed of 43% antlerless deer (7,674) and 57% antlered deer (10,123) for a total harvest of 17,847.

CWD Modeling					
County	Year				Total
Montcalm/Mecosta	2016				
Check Station Data - source MDNR					
Antlerless	Fawn -F	Fawn - M	Yearling	2.5 ≥	
Sample composition	15	16	27	75	133
Distribution	11%	12%	20%	56%	
Prevalance	0	0	0.009	0.011	
Antlered	Yearling	2.5 ≥			
Sample composition	100	68			168
Distribution	60%	40%			
Prevalance	0.006	0.014			
Harvest Data - source MDNR					
Harvest Actual	Antlerless	Antlered	Combined		
	7,674	10,173	17,847		
Harvest ratio	0.43	0.57			
Percentage increase	1.00	1.00			
	7,674	10,173			
Yearlings	1,558	6,055			
Diseased Yearlings	14	36			
Adults	4,328	4,118			
Diseased Adults	48	58			
Total DD	62	94	156		
Prevalance rates based on 2017 Montcalm County sample -source MDNR					

Figure 3 - Base model

This model estimates that there would be 156 CWD positive deer (DD) included in a total harvest of 17,847. The model allows for changing the harvest ratio, to estimate what the impact of regulations which may change that ratio, might have on increasing or decreasing the number of diseased deer removed from the herd.

There have been a number of suggestions made for adopting harvest regulations designed to increase the number of antlerless deer harvested, under the assumption that because there are more adult antlerless deer in the herd, that the majority of the diseased animals in the herd must be females.

Critics of current MDNR policy also suggest that we need to adopt harvest regulations that would balance the harvest between antlered and antlerless deer, in order to increase the number of antlerless deer harvested, under the misguided belief that doing so will result in greater numbers of diseased deer being removed from the herd.

That premise is not supported by the available data. In Figure 4, we change the harvest ratio from the actual ratio that occurred in 2016 of 43%/57% antlerless/antlered, to 50% antlerless / 50% antlered bucks.

Harvest Actual	Antlerless	Antlered	Combined
	8,924	8,924	17,847
Harvest ratio	0.50	0.50	
Percentage increase	1.00	1.00	
	8,924	8,924	
Yearlings	1,812	5,312	
Diseased Yearlings	16	32	
Adults	5,032	3,612	
Diseased Adults	55	51	
Total DD	72	82	154

Prevalence rates based on 2017 Montcalm County sample -source MDNR

Figure 4 - Model 50% - 50% harvest ratio

From these results, we can see that balancing harvest ratios between antlerless and antlered deer, actually slightly decreases the number of diseased deer (DD) removed from the herd. Such a change would also hypothetically increase the number of diseased yearling bucks which would survive either pre or post dispersal, to continue to spread CWD geographically outside of established areas, in Figure 4, the number of diseased yearling bucks harvested decreases from 36 to 32, a reduction of 11%.

Because of higher prevalence rates among adult antlered bucks and the fact that both male & female fawns, which have extremely low prevalence rates are harvested as part of the antlerless cohort, balancing harvest ratios is an inefficient method for removing diseased animals from the herd.

This model also has the capability of estimating what impact increased levels of harvest of either or both antlerless / antlered deer will have on the overall number of diseased deer removed from the herd.

Figure 5 shows the estimated impact that would occur from a management policy that resulted in a 10% increase in the number of antlerless deer harvested. The impact, in terms of removing diseased deer, is relatively small, with the total number of diseased deer being removed changing from 156 to 162, a net increase of 6 deer, which is a 4% overall increase. In order to accomplish that, hunters in Montcalm County would have to harvest an additional 768 antlerless deer.

Harvest Actual	Antlerless	Antlered	Combined
	7,674	10,173	17,847
Harvest ratio	0.43	0.57	
Percentage increase	1.10	1.00	
	8,442	10,173	
Yearlings	1,714	6,055	
Diseased Yearlings	15	36	
Adults	4,760	4,118	
Diseased Adults	52	58	
Total DD	68	94	162

Prevalence rates based on 2017 Montcalm County sample -source MDNR

Figure 5 - model plus 10% antlerless harvest increase

Due to harvest efficiency resulting from increased average prevalence rates found in antlered males, in order to obtain the same 4% increase in the number of diseased deer removed from the herd, a management policy which increased the number of antlered bucks harvested, would require a smaller increase, to obtain the same outcome.

Harvest Actual	Antlerless	Antlered	Combined
	7,674	10,173	17,847
Harvest ratio	0.43	0.57	
Percentage increase	1.00	1.06	
	7,674	10,814	
Yearlings	1,558	6,437	
Diseased Yearlings	14	39	
Adults	4,328	4,377	
Diseased Adults	48	61	
Total DD	62	100	162

Prevalence rates based on 2017 Montcalm County sample -source MDNR

Figure 6 - model plus 6% increase in antlered buck harvest

Figure 6 indicates that to remove the same number of diseased deer resulting from a 10% increase in antlerless harvest, only a 6% increase in antlered harvest would be required. An additional 641 antlered bucks would need to be harvested to result in the 4% increase. This strategy would also result in an 8% increase in the number of infected yearling bucks harvested, which could help limit the geographic spread of the disease.

Management implications

Successfully encouraging hunters to harvest additional antlerless deer has been a chronic issue in Michigan for decades. Encouraging hunters to shoot additional antlered bucks seems like it would be a much more obtainable goal to accomplish from a regulatory standpoint and would have the added benefit of decreasing the threat of yearling buck dispersal spreading CWD geographically.

As part of the discussion that will be occurring at the May NRC meetings, a number of different solutions will be proposed and a lot of data will be thrown out in support of those varying solutions. I would encourage Commissioners to look at each of those varying proposals through the lens of disease elimination, I.E., will a given proposal increase or decrease the number of diseased animals removed from the herd and if so, is it the most efficient way of removing animals utilizing the tool of hunter harvest.

My opinion is that the best regulatory policy that fits the criteria for most efficiently removing the greatest number of diseased animals from the herd is the one that is currently being employed by the MDNR in CWD zones, which is to remove any APR's from both of the combo tags and allow hunters to focus on killing antlered bucks. Efforts to manipulate harvest practices in a manner designed to increase antlerless harvest would be both inefficient and have the potential for interfering with the removal of antlered bucks, the deer most likely to be carrying and transmitting CWD.