Evaluation Of Deer Population Parameter Estimates and Implications for CWD Management

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Deer hunters account for the largest portion of the hunting public in the United States. This distinction is important because deer-hunting related expenditures and license sales generate many conservation dollars—not only for the benefit of game species, but for non-game too. Therefore, wildlife managers must assure the health of deer populations to sustain the overall economic well-being of wildlife conservation. However, Michigan has an emerging problem on their hands—chronic wasting disease (CWD).

Chronic wasting disease affects species in the deer family, and once a deer is infected, there is no recovery—it is always fatal. Deer can become infected with CWD through animal-to-animal contact or through contaminants in the environment (e.g., feces). Since first identified in Michigan's free-ranging deer in 2015, CWD has been detected in 3 primary areas (southwest Upper Peninsula, and south-central and southeast Lower Peninsula) across the state—with most positive animals detected in a designated 5-county Core CWD Area (Ionia, Kent, Mecosta, Montcalm, and Newaygo counties). As CWD continues to be detected in new areas, it is becoming more relevant every day.

From what we learned from other states that have experienced CWD, the disease spreads slowly through a population. We also know that mature bucks are more likely to be infected than any other sex or age deer. An approach to try to reduce transmission and maintain low levels of prevalence in a population is to target deer that are more likely to be infected, and to also reduce deer abundance. It is generally believed that deer hunting regulations that limit hunter harvest to specific sex and age deer can achieve this, but this is untested in free-ranging deer populations. Mandatory antler point restrictions, or APRs, is a common deer harvest regulation meant to target mature bucks based on antler size. Because APRs reduce the number of bucks in a population available for hunters to harvest (e.g., younger bucks with smaller antlers are protected) it is also believed that hunters will harvest more does—and removing more does from a population may reduce deer abundance. However, there is a limited understanding how APRs change populations and how those changes interact with CWD. So, the APR Study was developed to address the first research question, "how do APRs change relative abundance and sex and age composition of deer populations?"

The APR Study is supported in part by funds provided through Public Act 207 of 2018, which appropriated $5.3 million to the Michigan Department of Natural Resources (MDNR) for CWD research and response. To address the first question, the APR Study utilizes remote infrared cameras in the Core CWD Area to monitor potential change in relative abundance and composition of deer populations following an APR regulation change. With answers from question one, researchers will address a second research question, "can antler

point restrictions be used to influence prevalence and spread of CWD"? To answer this question, a collaborative team of researchers from the MDNR and Michigan State University (MSU) are applying innovative methods and cutting-edge technologies to connect population estimates to possible outcomes for CWD prevalence and spread. This approach includes using data from the APR Study and a computer-simulation model.

Today's vast amount of CWD information and high-performance computing present the research team with an opportunity to open new doors to better understanding the disease. Fortunate for the research team, a previous MDNR–MSU research project developed a computer model designed to simulate CWD spread and prevalence in south-central Michigan. Essentially, this model takes everything we have learned about CWD and packages it into a single, powerful tool—equipping the research team with an environment where they can test out different what-if scenarios. For example, what if we protect a certain sex and age class of deer from harvest? Or, what if we increase harvest of a certain sex of deer? And how will these scenarios likely affect CWD spread and prevalence? This simulation model is invaluable because it can help researchers understand things they could never know in the wild, like unobservable disease processes—and they equip the research team to work towards answering the big question, "can antler point restrictions limit spread and prevalence of CWD?" So, what the research team is doing, is taking results from the APR Study (relative abundance and sex and age composition estimates) and incorporating them directly into the computer model to simulate spread and prevalence of CWD under APR harvest scenarios.

Understanding how deer harvest regulations influence relative abundance and sex and age composition are important for understanding CWD dynamics. So, before any CWD modeling occurs, the research team is doing some deep analytical dives to make sure they are informing the model with the best information possible. To accomplish this, the researchers are leveraging a high volume of camera images from the APR Study to conduct a methodological assessment. The purpose of this assessment is twofold and includes identifying strategies that maximize precision of relative abundance estimates and identifying ways to minimize resources for future camera-based data collection. To analyze their large, complex datasets, the researchers are utilizing the supercomputer at MSU's High Performance Computing Center. Once the best relative abundance and composition estimates are identified, the research team will use the data to inform and parameterize the computer-simulation model.

The team anticipates immediate benefits from their research in a variety of forms. First, they will identify ways to save resources in the future, which can help wildlife agencies be more impactful across the board. Next, the development of better techniques for trail-camera based population estimation. It is anticipated that these techniques will allow stronger inferences about wild populations and their responses to management and conservation actions. Lastly, by linking potential change in relative abundance and composition resulting from APR harvest scenarios to possible outcomes for CWD spread and prevalence, the researchers can inform the deer harvest regulations setting process in Michigan. Outcomes from this project will also add to our knowledge about how CWD could spread throughout the Midwest—which in turn can help push the needle of conservation in a productive direction.