

## West Nile Virus

### PA Game Commission Research Summary

#### WNV Overview

- WNV is an arbovirus most commonly transmitted by mosquitoes.
- 70-80% of infected people show no symptoms. 1 in 5 will show flu-like symptoms. <1% may develop serious neurological illness such as meningitis, which may be fatal.
- WNV is known from Europe, Africa and Asia. It was first detected in North America in 1999 (NY). Human and wildlife infections have been documented in all 48 contiguous states.

#### Impacts of WNV on Wildlife

- WNV has been detected in over 300 avian species in the United States. Populations of some species are not impacted. Some experience steep declines followed by population recovery. Others experience steep declines followed by continued population suppression.
- WNV has been shown to have dramatic impacts on sage grouse, reducing juvenile, yearling and adult survival.

#### Historic Impacts of WNV on Ruffed Grouse

- In 2000, NY DEC received nearly 150 grouse carcasses found on the landscape by residents. Eighteen percent of these tested positive for WNV using the tests available at the time.
- PA's largest grouse propagator (flock= 30 birds) lost 80% of his flock in a two week period in September 2003. WNV was confirmed as cause of death in the single carcass submitted for testing from this outbreak.
- The nation's largest grouse propagator (in Idaho) lost 25% of his ruffed grouse in 4 days in 2013 (n=10 of 40 grouse). WNV was not lab-confirmed, but since beginning an annual vaccination program losses have been minimal (n=3 deaths in 2014).
- 118 hunter-harvested birds were tested for WNV antibodies during the National Grouse and Woodcock Hunt in MN in 2005. One bird was found to have antibodies to WNV (suggesting previous exposure). This study confirmed that grouse contract the disease and can survive. The low number of antibody-positive birds suggested either that WNV prevalence was low in MN in 2005 or that grouse mortality was high (i.e. birds were not living to time of harvest). Researchers called for a follow-up experimental study of grouse and WNV at that time, but resources were unavailable.
- Eastern/Mid-Atlantic states with Cooperator programs exhibited a multi-state grouse population decline in the years 2001-2005 (Figure 1). Population recovery has varied from state to state since that time. It is likely that the severity of WNV impacts will vary from state to state and year to year depending upon habitat quantity and quality, annual WNV prevalence, and individual- and population-level recovery.
- PA grouse populations (as indicated by hunter flush rates) showed steep declines in the initial years of the PA outbreak (2001-2005), followed by weak recovery (Figure 2). When WNV prevalence increased again in 2009-2014, grouse populations again showed steep declines. When corrected for hunter effort (harvest/100 days), grouse harvest declined 45% (2001-2005) and 28% (2009-2014).

## Current Impacts of WNV on Ruffed Grouse

- The PA Game Commission (PGC) is working to better understand the impact of WNV. Colorado State University, Guelph University (Ontario), Ruffed Grouse Society and Woodcock Limited have been partners in this effort. We are fortunate to be working with some of the top WNV researchers in the country on this project.
- The two main early objectives of this research are 1) to determine the susceptibility of grouse to WNV, and 2) to measure statewide exposure to WNV in grouse.
- For Objective 1, PGC and collaborators used chicks hatched from wild-collected eggs to conduct an experimental infection trial in 2015. Results indicated that WNV affects multiple critical organs in grouse, including brain, heart, muscle, and kidneys. Some birds had rapidly fatal infections (within 8 days of infection) while others survived to the end of the 2-week trial, but had WNV-associated damage to heart and brain tissue. In all, 80% of the inoculated grouse died or had significant lesions due to WNV.
- PGC, with RGS support, tested hunter-harvested grouse for antibodies (exposure) to WNV in the 2015-16 season. This revealed that in every region of PA, some wild grouse are exposed to WNV and some proportion survive until the hunting season. Sampling will continue in the 2016-17 season.

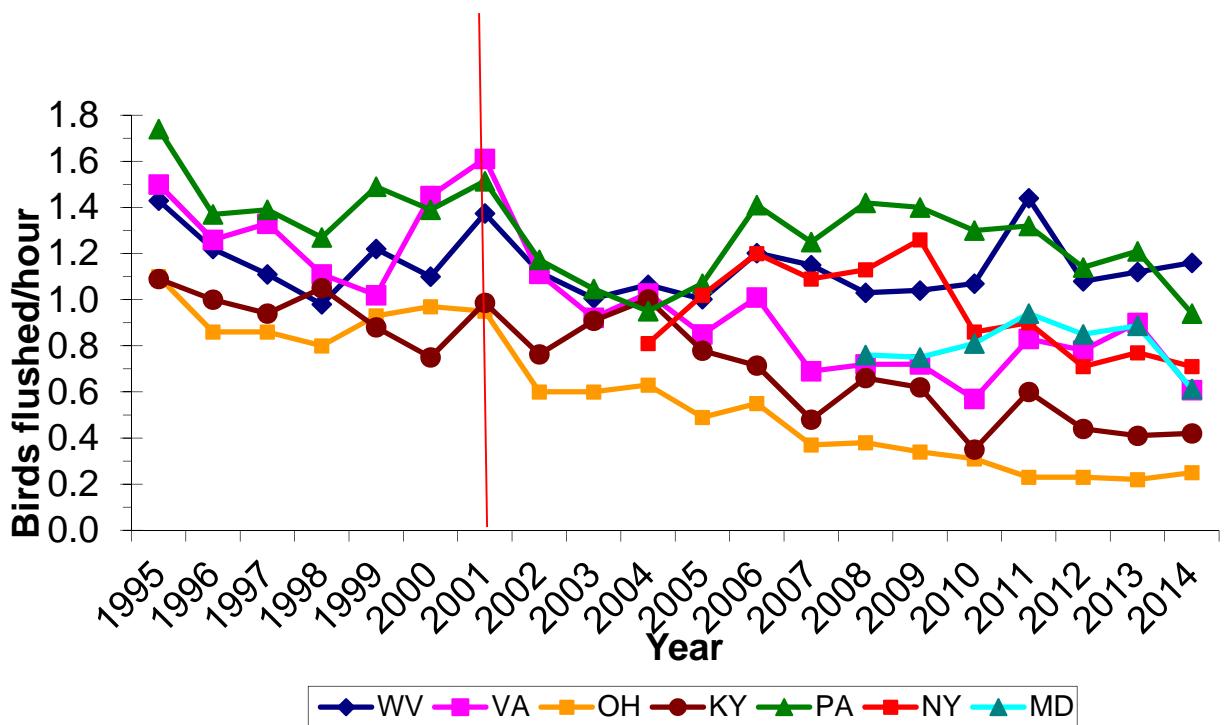
## The Habitat Connection

- WNV does not apply annual and steady pressure on grouse populations throughout their range. Rather, prevalence (and risk to grouse) rises and falls over time. In PA, dramatic WNV peaks occurred in 2001-2004 and 2012-2014. WNV peak years are most likely triggered by weather, so the timing of peak years will vary in other states, regions and time periods.
- PA's population monitoring (based on hunter flushes/hour) indicates that regions with high-quality and abundant habitat appear to show a strong grouse population recovery between peaks of WNV (i.e. grouse populations recover between WNV peaks) (Figure 3).
- PA's population monitoring also shows that in regions with lower-quality, less abundant and more fragmented habitat, grouse numbers show only an anemic recovery and continue to decline below long term average (i.e. populations do not recover between WNV peaks) (Figure 3).
- Preliminary results indicate that regions with high-quality and abundant habitat may also be producing more individuals that survive WNV than regions with poor habitat (i.e. individual birds exposed to WNV may have a higher rate of survival in high quality habitat than they do in low quality habitat). This could be due to better 'baseline' health, easier access to high-quality forage, better protective cover from predators or some other benefit associated with high-quality habitat.
- These are early observations and additional samples/results will help further support or refute these trends, and may reveal other factors involved in grouse population dynamics.

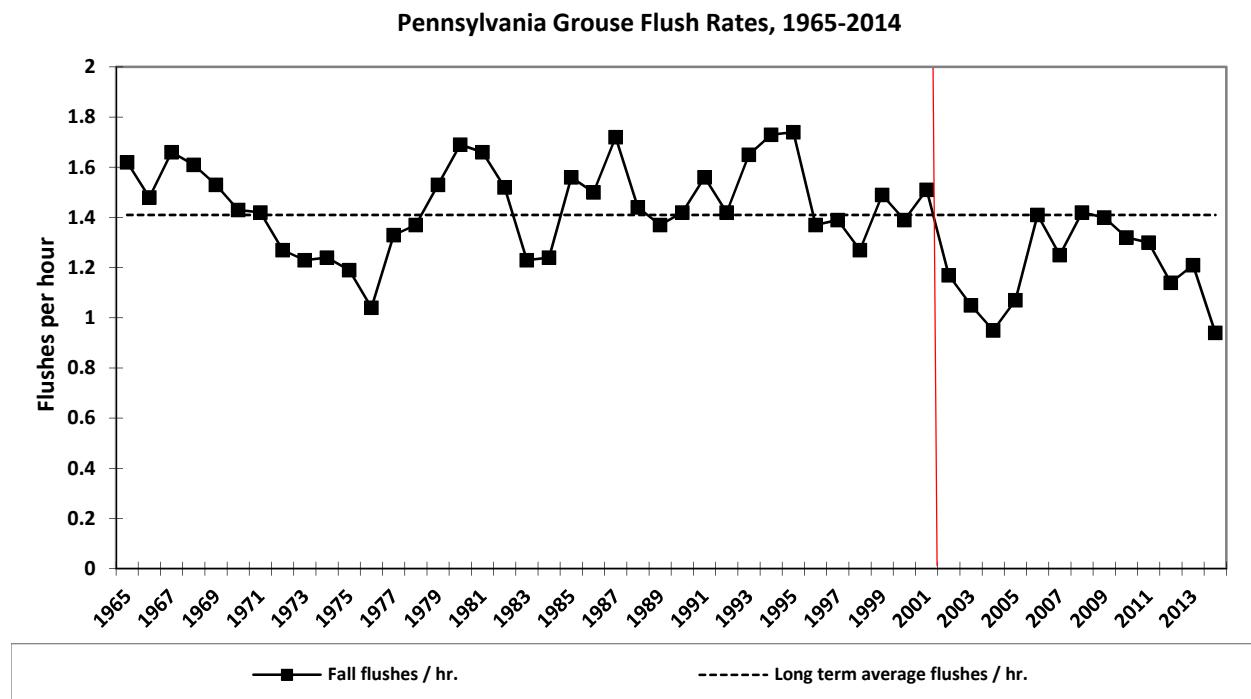
## WHAT CAN WE DO?

- WNV is a Call to Action to create more high-quality habitat at a landscape scale. This has always been a priority for many of our conservation partners, but with the onset of this additional mortality factor and its potential role in grouse declines, urgent action is needed. PA's preliminary data suggests that habitat quality may affect the recovery of grouse populations.
- Until the protective mechanism of high-quality habitat is defined, managers should focus on creating areas with diverse native food sources and thick protective cover to support birds if and when they are exposed to WNV.

**Figure 1: State Hunter Flush Rates (flushes/hour) observed in states that maintain a Hunter Cooperator program.**



**Figure 2: Long term grouse population trends, as reported by PA Grouse Cooperators, 1965 – 2015.**  
WNV was found in PA in 2000 and occurred statewide by 2002.



**Figure 3: Grouse population trends in PA, showing robust recovery between WNV peaks in a region with high-quality and abundant habitat (represented by the NW region) and weak recovery in a region with less-abundant, fragmented habitat (represented by the SW region). Periods indicated in red represent peak WNV activity years, based on PA DEP surveillance data.**

