Background

- The ruffed grouse (Bonasa umbellus) is an important gamebird species and the state bird of Pennsylvania (PA).
- West Nile virus (WNV) was introduced to the northeastern U.S. in 1999, and occurred statewide in PA by 2002.
- Grouse populations in PA declined precipitously from 2002-2005. Robust recovery has not occurred.
- Grouse populations show a strong inverse correlation with WNV prevalence (r = -0.74; p=0.02) (Fig 1).
- 7 of 9 years of the lowest flush rates in 50 years of monitoring have occurred since 2002.
- Summer productivity/survival indices are in decline; July 2016 values were the lowest in 36 years of monitoring.
- A 2015 challenge study indicated that WNV may cause significant mortality in infected wild grouse.
- To assess WNV antibody prevalence in wild grouse, blood sampling of hunter-harvested birds was implemented.

Methods

- Blood sampling of hunter-harvested ruffed grouse via Nobuto filter strips began in PA in the 2015 grouse season.
- Participating hunters were selected by recent success in harvesting grouse and region/county of harvest(s) to ensure broad geographic representation.
- Participating hunters received a blood sampling kit (i.e., instructions, Nobuto strips, ziplock bags and postage-paid envelopes).
- Hunters added blood of freshly-harvested birds (<30 minutes of harvest) to Nobuto filter strips, which were air dried and returned by mail.
- Successful hunters submitted blood and feather samples (2 central tail feathers, 5-10 rump feathers, complete wing or 3 outer primary feathers) for each harvested grouse.
- Samples were labeled with name and date, county, township and wildlife management unit of harvest.

Results

- 202 Nobuto filter strips from 32 counties were received in 2015-16.
- 14% of samples were positive for antibodies to WNV. These represent grouse that survived WNV infection.
- Juveniles accounted for 39% of WNV+ birds; adults accounted for 57%. Males accounted for 54% of WNV+ birds; females accounted for 46%.
- WNV antibody prevalence ranged from 29% to 7% and varied by PA Game Commission geographic region (Fig 2).
- Seroprevalence was higher in areas of the state characterized by high-quality and abundant habitat (the ‘core’ of the PA grouse range) (Fig 2).

Conclusions

- Estimated WNV-associated morbidity and mortality in ruffed grouse, based on experimental infection, is 40% mortality in the short-term (i.e., within 1 week following infection)
- An additional 50% may have compromised longer-term survival (i.e., > 2 weeks post-infection) based on the severity of histologic lesions in the heart and brain.
- Field-collected serologic data reveal variation in the distribution and extent of WNV antibody seroprevalence.
- Preliminary findings suggest grouse populations occupying high-quality and abundant habitat recover more quickly between WNV prevalence peaks than populations in lower-quality habitat (Fig 3).
- Nobuto filter strips are a reliable method for detecting the presence of antibodies to WNV in hunter-harvested grouse. Strips are relatively cheap and easy for hunters to use.
- Focusing habitat restoration efforts in areas where grouse populations are most able to respond can improve cost-benefit returns as well as outcomes for grouse populations.

Acknowledgments

We thank all hunters that contributed samples and the Ruffed Grouse Society & Loyal Order of Dedicated Grouse Hunters for partnering on this project.