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TITLE: Wild turkey population and movement dynamics

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WORK LOCATION(S): Statewide

COOPERATING AGENCIES: Penn State University, University of Pennsylvania

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ABSTRACT Since the early 2000s turkey populations have remained steady in many Pennsylvania Wildlife Management Units (WMUs), while declining or increasing in others. To understand the mechanisms for these differences among areas and to provide the information necessary to successfully manage turkey populations moving forward, we are using GPS transmitters with accelerometers to track wild turkeys across 4 Pennsylvania WMUs. At the start of the 2024 nesting season (1 April 2024), 199 hens were active (36 juvenile and 163 adult). Throughout the 2024 nesting season, 193 nests were initiated (ranging from 0 - 3 incubation attempts per hen), 133 nests failed, 60 nests hatched, 26 hens had successful broods (broods survived to 4 weeks of age) and 113 poults were alive 4 weeks post-hatch. Nest results and poult survival varied by WMU. From December 2024 through March 2025, 143 female wild turkeys were captured and marked (46 juvenile and 97 adult). As of 12 June 2025, 124 females from the 2024 and 2025 capture seasons (33 juvenile and 91 adult) were still being monitored. The 2025 nesting season had not concluded at the time this report was prepared. In 2024, 137 female wild turkeys were tested for lymphoproliferative disease virus (LPDV) and Reticuloendotheliosis virus (REV). Of the samples, 74% showed prevalence of LPDV, no hens showed prevalence of REV, and prevalence varied by age and WMU. Intestinal parasite sampling was conducted for 113 females with a prevalence of 65% and varied by age and WMU. Coinfection (viruses + parasites) was prevalent in 45% of the 113 females sampled and varied by WMU but not by age.

OBJECTIVES

1. Improve our knowledge of hen turkey demographics, movements, and habitat use.

a. Assess impacts of weather on nesting rates, nest success, and 4-week poult survival in the 4 study areas.

b. Assess predation rates of hens and nests, and how they differ among landscapes (among the 4 study areas).

c. Assess how hen turkey habitat-use and movement behavior vary as a function of study area, weather pattern, and predator densities.

d. Assess the interactions of the above, and disease to develop turkey population management strategies to help improve turkey population trends where needed.

2. Improve and test the fall turkey season decision model.

    a. Improve understanding of hunters' attitudes regarding potentially other changes to fall turkey hunting seasons to structure the model with the greatest acceptance by hunters.

    b. Assess how other fall season options and human dimensions priorities, besides season length, can be incorporated into the fall decision model.

        i. Conduct choice modeling of hunters to assess the relative importance of different regulatory options (sporting arm used, season length).

        ii. Conduct choice modeling of hunters to assess the relative importance of fall hunting season length versus population size.

    c. Evaluate the decision model performance given the great annual variability of turkey populations.

    d. Build and simulate competing population models that can be evaluated by the decision model for setting fall hunting seasons.

INTRODUCTION

Wild turkey population management strategies in Pennsylvania have been based on maintaining a statewide spring turkey season that, on average, opens during the peak of nest incubation, such that spring season does not impact future turkey populations, while also maintaining a conservative fall harvest in Wildlife Management Units (WMUs) that can withstand harvest of hens (Casalena 2018). The fall management strategy includes competing objectives of maximizing spring male populations while maximizing fall hunting opportunities. Consequently, an optimization of these objectives is possible only by considering the population dynamics of turkeys and the relative value stakeholders place on male abundance and fall hunting season opportunity. A decision model for adjusting fall season harvest, by WMU, is nearly completed. The decision model identifies optimal season length to maximize both fall hunting season opportunity and spring harvests. The greatest uncertainty in the decision model is the relationship between reproduction rates and the size of the female population due to limited research available to inform critical parameters of this relationship. Developing competing models of this relationship

and monitoring turkey populations over time is the most efficient approach to identify the best performing model, which will improve the decision model. Additionally, in 2021, the Board of Commissioners introduced another method of changing fall harvest rates by eliminating rifles as a legal sporting arm. Currently, the fall decision model does not incorporate a combination of sporting arm and season length options. The importance of fall or spring turkey hunting and how fall harvest is managed involve the dynamics of the turkey population, stakeholder values, and the regulatory issues regarding that decision. The research study objectives were developed to understand the dynamics and limiting factors of wild turkey populations and understand and incorporate stakeholder values to set fall turkey seasons more effectively.

METHODS

Four WMUs were selected to represent 4 different landscape level habitat types and turkey population and harvest densities (Fig. 1). Wildlife Management Unit 2D, in the Game Commission's Northwest and Southwest regions, represents some of the most diversity among Pennsylvania's landscape, with high interspersion of habitats suitable for wild turkeys, an increasing long-term population trend, one of the highest 2020-2022 average spring harvest per 100 hunters (6.0 birds harvested/100 hunters), high hunter density (4.7 hunters/mi^2) and hunter success (25%), but below average poult to hen ratio (2.7 poults/hen). Wildlife Management Unit 3D, in the Game Commission's Northeast Region, represents large expanses of publicly owned wooded landscapes surrounded by human developments, a decreasing long-term turkey population trend represented by a low 2020-2022 average spring harvest per 100 hunters (2.5 birds/100 hunters), low hunter density (3.1 hunters/mi^2), hunter success (12%) and poult to hen ratio (2.6 poults/hen). Wildlife Management Unit 4D, in the Game Commission's Northcentral and Southcentral Regions, represents large expanses of publicly- and privately-owned wooded habitat surrounded by large expanses of agriculture, with a stable long-term turkey population trend but a low 2020-2022 average spring harvest per 100 hunters (2.9 birds harvested/100 hunters), average hunter density (3.9 hunters/mi^2), and hunter success (14%), but above-average poult to hen ratios (3.6 poults/hen). Wildlife Management Unit 5C, in Game Commission's Southeast and Northeast Regions, represents a mix of urban and large agricultural landscapes, with a stable long-term turkey population trend but a low 2020-2022 average spring harvest per 100 hunters (2.9 birds harvested/100 hunters), the second-lowest average hunter density (1.9 hunters/mi^2) and poult to hen ratio (2.1 poults/hen), and below-average hunter success (12%).

In each of the 4 study areas, field crews trap wild turkeys using rocket nets (Eriksen et al. undated) each winter (December – March, 2021-2025). Each turkey is sexed, aged (juvenile or adult; Brenneman undated, Delahunt et al. 2011) and banded with a locking rivet-style leg band (National Band and Tag Co., Louisville, Kentucky). Diefenbach et al. (2009) concluded that locking style bands, such as rivet bands, should be used for mark-recapture studies because retention of butt-end style bands on turkeys is <50% 15 months after banding, whereas rivet-style band retention was 100%. Leg bands are stamped with a number unique to the bird, and a toll-free number and email address or web link to report the band number. A minimum of 25 hen turkeys per study area per year are equipped with transmitters that collect GPS and accelerometer data for tracking movement (e-obs digital telemetry, Gruenwald, Germany). Additionally, 30 adult male and 30 juvenile male turkeys are trapped and banded per year in each study area.

Blood samples from either the jugular, brachial, or metatarsal vein (150-200 microliters) and cloacal and nasopharyngeal/choanal swabs are taken from each transmittered turkey for pathogen analysis. When possible, fecal samples are collected to facilitate parasitological sampling. Samples are stored in dry ice as soon as possible and transported to the New Bolton Center, University of Pennsylvania School of Veterinary Medicine (PennVet), Kennett Square, Pennsylvania, USA. They are then stored in a -80°F freezer until testing. Samples are tested for lymphoproliferative disease (LPDV), Reticuloendotheliosis virus (REV), and avian pox. If any skin lesions are detected, samples are collected from affected tissue. Avian pox is tested only if clinical sign exists, as the lesions are needed to collect diagnostic sample, as well as for the bacterial infections of bacterial pox lesions and *Mycoplasma gallisepticum* (*Mycoplasma*). Occurrence of three gastrointestinal focal parasites were tested from fecal samples: nematodes such as *Capillaria* sp. (i.e., threadworms) and Ascarids (i.e., roundworms), as well as coccidian infection caused by *Eimeria* sp. (i.e., protozoans). Intestinal parasites are tested by the PennVet Parasitological Services as funds permit. These diseases are a threat to poultry and occur at the domestic-wildlife interface, infect (or have the potential to infect) other wild birds, have been found to be immunosuppressive and/or their pathogenicity is increased with stress or secondary infection, and there is a knowledge gap regarding their impact on wild turkeys at the individual and population level.

Transmitters collect GPS data every hour from capture until 1 April when the duty cycle is changed by field crews to collect GPS data every 30 minutes. After nesting season, the duty cycle is changed back to collect GPS data every hour to allow battery life of 2 nesting seasons. Accelerometer data are collected every 2 minutes year-round. Brood survival is determined by conducting brood flush surveys when broods of transmittered hens are approximately 2 weeks and the final brood count at 4 weeks old (Chamberlain et al. 2020).

Cause of death of transmittered hens is determined as soon as possible after a mortality is detected and predation rates will be calculated for each study area. Fate of each nest also is determined via field checks after hens vacate the nest. Any whole birds found dead will be necropsied and tested for pathogens.

To assess impacts of weather on nesting rates, nest success and 4-week poult survival in the 4 study areas, remote sensed weather data will be acquired within 1 km of each nest (daymet.ornl.gov). Data will include daily minimum and maximum temperature, precipitation, vapor pressure, snow water equivalent, and day length.

A survey of Pennsylvania turkey hunters will be used to evaluate the tradeoffs of different fall turkey hunting season regulations. The survey will be conducted by the Pennsylvania Game Commission and anonymized data will be provided to Penn State researchers for analysis.

RESULTS

In 2024, 199 hens (36 juveniles which are first year hens, 163 adults) were being monitored at the beginning of nesting season which is defined as 1 April each year (Table 1). Monitored hens were those that were alive plus those missing but searches were being conducted via ground and air. Field crews documented 193 nests incubated (29 from juveniles, 164 from adults), ranging

from 0 - 3 incubation attempts per hen, 133 nests failed (16 juvenile, 117 adult), 47 nests hatched (13 juvenile, 47 adult), with 26 broods surviving to 4 weeks old (3 from juvenile hens, 23 from adult hens), which is the age at which poult mortality decreases significantly, totaling 113 poults alive 4 weeks post-hatch (14 from juvenile hens, 99 from adult hens). Survival and nest results varied by age of hen and study area. The 2025 nesting season had not concluded when this report was prepared.

From December 2024 through March 2025, 143 female wild turkeys were captured and marked (46 juvenile and 97 adult), of which 89 were being monitored on 12 June 2025 (33 juvenile and 56 adult; Table 2). As of 12 June 2025, all hens captured during 2022 (Cohort 1) and 2023 (Cohort 2) had either died or were censored due to the transmitter reaching the end of battery life. Of hens captured in 2024 (Cohort 3), 35 adults were alive as of 12 June 2025. Total hens being monitored on 12 June 2025 were 124 (33 juvenile and 91 adult).

In 2024, 137 female wild turkeys were tested for LPDV and REV (Table 3). Of the samples, 74% showed prevalence of LPDV, but none showed prevalence of REV. Virus prevalence varied by age with adults having higher prevalence (82%) than juvenile females (53%). Prevalence also varied by WMU. LPDV prevalence was lowest in 4D (69%) and highest in 5C (81%). Intestinal parasite infection (i.e., positive for at least one of the parasites tested) sampling was conducted for 113 females, with a prevalence of 65% and varied by age, being higher in juveniles (84%) than in adults (57%). Parasite prevalence also varied by WMU; lowest in 2D (35%) and highest in 5C (86%). Coinfection (viruses + parasites) was prevalent in 45% of the 113 females sampled, and was similar by age, 46% in adults and 44% in juveniles. Coinfection prevalence varied by WMU and was lowest in 2D (32%) and highest in 5C (64%).

RECOMMENDATION

Continue the study and complete final reports by 30 September 2026 from PSU and June 2027 from UPenn, as per the study proposals, and strategies 1.5. 1.11, 1.12, 1.13, 1.15, 1.17 and 1.19 in the Pennsylvania Wild Turkey Management Plan, 2018-2027 (Casalena 2018).

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Figure 1. Pennsylvania Wildlife Management Units, as revised April 2023.

Table 1. Wild turkey nesting summary for hens during the 2024 nesting season in 4 Pennsylvania study areas (Wildlife Management Units), by age (Juvenile [J], Adult [A]).

Study Area	Age	Number of Hens Active Beginning of Nest Season [a]	Nests Initiated[b]	Nests Failed	Nests Hatched[c]	Number of Poults Alive 4 Weeks Post-Hatch	Number of Broods Alive at 4 Weeks Post-Hatch
2D	J	7	4	2	2	6	1
2D	A	42	50	35	15	29	6
3D	J	13	9	4	5	3	1
3D	A	52	46	30	16	51	10
4D	J	6	7	4	3	0	0
4D	A	34	29	20	9	15	3
5C	J	10	9	6	3	5	1
5C	A	35	39	32	7	4	4
Total	J	36	29	16	13	14	3
Total	A	163	164	117	47	99	23
Study	**Total**	**199**	**193**	**133**	**60**	**113**	**26**

[a] Beginning of nesting season is defined as 04/01 each year.

[b] A nest is identified as "initiated" due to a hen displaying laying or incubation behavior via the transmitter's accelerometer and GPS data.

[c] A nest with at least 1 hatched egg is considered hatched.

Table 2. Female wild turkey sample sizes, mortalities, censors and number on air at the end of the reporting period for 3 cohorts in the 4 Pennsylvania study areas (Wildlife Management Units) by age (Juvenile, Adult). Cohort 2 was hens captured in 2023. Cohort 3 was hens captured in 2024. Cohort 4 was hens captured in 2025.

		Cohort 2			**Cohort 3**				**Cohort 4**				**All Cohorts**
Study Area	**Age**	Number on Air 01/02/2025	Censors	Number on Air 06/12/2025	Number on Air 01/02/2025	Mortalities	Censors	Number on Air 06/12/2025	Number Captured 2025	Mortalities	Censors	Number on Air 06/12/2025	Number on Air 06/12/2025
2D	J	NA	NA	NA	NA	NA	NA	NA	11	1	0	10	**10**
2D	A	2	2	0	19	3	2	14	20	5	3	12	**26**
3D	J	NA	NA	NA	NA	NA	NA	NA	10	4	1	5	**5**
3D	A	0	0	0	22	3	8	11	28	7	3	18	**29**
4D	J	NA	NA	NA	NA	NA	NA	NA	10	2	0	8	**8**
4D	A	0	0	0	14	2	8	4	25	9	4	12	**16**
5C	J	NA	NA	NA	NA	NA	NA	NA	15	5	0	10	**10**
5C	A	0	0	0	15	3	6	6	24	8	2	14	**20**
Total	Juv.	NA	NA	NA	NA	NA	NA	NA	46	12	1	33	**33**
Total	Adult	2	2	0	70	11	24	35	97	29	12	56	**91**
Study	**Total**	**2**	**2**	**0**	**68**	**11**	**24**	**35**	**143**	**41**	**13**	**89**	**124**

Table 3. Sample size (*n*) of female wild turkeys captured during 2024 and able to be tested for viruses (Lymphoproliferative disease virus, LPDV, and Reticuloendotheliosis virus, REV), parasites and coinfections by age (Adult, Juvenile) study area (Wildlife Management Unit, WMU) and state total, and prevalence rates (%) of each.

WMU, Hen Age	Number Sampled, Viruses	LPDV Positive	LPDV Prevalence (%)	REV Positive	REV Prevalence (%)	Number Sampled, Parasites Coinfection	Parasite Positive	Parasite Prevalence (%)	Coinfection Positive	Coinfection Prevalence (%)
2D	*36*	*26*	*72%*	*0*	*0%*	*31*	*11*	*35%*	*10*	*32%*
A	29	22	76%	0	0%	24	7	29%	7	29%
J	7	4	57%	0	0%	7	4	57%	3	43%
3D	*38*	*28*	*74%*	*0*	*0%*	*34*	*25*	*74%*	*16*	*47%*
A	24	21	88%	0	0%	22	15	68%	12	55%
J	14	7	50%	0	0%	12	10	83%	4	33%
4D	*32*	*22*	*69%*	*0*	*0%*	*20*	*13*	*65%*	*7*	*35%*
A	26	19	73%	0	0%	17	10	59%	5	29%
J	6	3	50%	0	0%	3	3	100%	2	67%
5C	*31*	*25*	*81%*	*0*	*0%*	*28*	*24*	*86%*	*18*	*64%*
A	20	19	95%	0	0%	18	14	78%	13	72%
J	11	6	55%	0	0%	10	10	100%	5	50%
Total A	99	81	82%	0	0%	81	46	57%	37	46%
Total J	38	20	53%	0	0%	32	27	84%	14	44%
Study Total	***137***	***101***	***74%***	***0***	***0%***	**113**	**73**	**65%**	**51**	**45%**