WILDLIFE MANAGEMENT AND RESEARCH NOTES

Indiana Department of Natural Resources

No.	AUTHOR: Steven E. Backs, Wildlife Research Biologist and Emily McCallen, Biometrician	Date
2067	Title: Wild Turkey Summer Brood Production Indices – 2021.	9/23/2021

Abstract: *A total of 5,218 observation reports were received during the July and August survey period in 2021. After filtering and censoring data, 4,950 usable observations (330% increase over 2020) were used for the determine the 2021 wild turkey Production Index (PI; total poults/total hens) and related metrics. The brood observation reports were well distributed across the state with 67 counties reporting ≥ 25 observations. In 2021, a total of 10,212 hens and 40,576 poults were reported with 4,435 broods (at least 1 hen/1 poult) and 515 broodless hens (no poults observed with hens) reported. The number of broods reported in 2021 was 3,573 more than the 862 broods reported in 2020 (415% increase). The average brood size was 11.2 birds compared to 8.5 birds in 2020. The 2021 PI was 4.0 with 90% of the hens observed with at least one poult. The 2021 PI was 74% greater than the 2020 PI of 2.3. The production index, the percent of hens with poults, and the number of observations were greater in 2021 (P < 0.01) than the mean values observed during the previous five years. The substantially high increases in the Southcentral (+165%) and Southeast (+114%) regions were much needed boosts after more than a decade of decline in some of the better turkey habitat in Indiana. There were significant differences (P < 0.01) in the regional poult to hen ratios and mean brood sizes between the regions with higher values in the Southeast, Southcentral, and West-central regions than the Southwest, North, and East-central regions.*

Project ID/Activity: W51R/513

Since 1993, observations of eastern wild turkey (*Meleagris gallopavo sylvestris*) hens and poults, including hens without poults, were recorded during July and August in Indiana. The brood survey was initially conducted by agency wildlife biologists and conservation officers recording observations on brood survey cards. A wild turkey summer brood Production Index (PI) was calculated as the total number poults/the total number of adult hens observed in July and August. The PI is a more accurate index of production because it includes all hens, including those observed without poults (broodless hens). One chronic bias in brood observation data is the tendency for observers to report hens with poults more readily than those without poults resulting in a higher reported PI than actually occurred. The August production index is generally greater than in July due to "gang" brood behavior that occurs when several individual broods and hens without broods combine into brood flocks.

In 2016, the survey moved to an online data entry platform that allowed participation by both natural resource agency personnel and public volunteers. The objectives were to increase the survey coverage across the increasing range of wild turkeys in the state, to increase the number of observations received, and to enhance the robustness of the survey. Instructions for reporting wild turkey observations were posted on the DNR web page and included a link to an illustrative photo guide, "Introduction to documenting turkey broods". The online observation system was active only during the traditional brood reporting period (July and August).

In 2020, an assessment of volunteer participation and possible barriers to participation was conducted after the brood survey period (Middleton et al. 2021). Among the factors inhibiting volunteer observer participation were the pre-survey registration and difficulty with registering, volunteers forgetting usernames and passwords, and problems related to the accessibility of the website reporting form on mobile devices. Based on these findings, the survey form was simplified and moved to the ArcGIS Survey123 platform. Other changes included allowing the submission of geo-referenced observation locations, allowing the submission observation photos, and eliminating the pre-survey registration requirement and instead using volunteer observer's email address as the reporter identifier.

RESULTS AND DISCUSSION

Initially 5,218 observation reports were received during the July and August survey period. After filtering and censoring data according to nationally adopted brood survey protocol criteria (National Wild Turkey Federation Technical Committee 2019), 4,950 usable observations of at least one wild turkey were used for the determining the wild turkey Production Index (PI; total poults/total hens) and related metrics (Table 1). The brood observation reports were well distributed across the state with 67 counties reporting ≥ 25 observations and were highly associated with the distribution of forest cover in the state (Figure 1a and 1b.) The number of usable observations in 2021 was 330% greater than in 2020. In 2021, a total of 10,212 hens and 40,576 poults were reported with 4,435 broods (at least 1 hen/1 poult) and 515 broodless hens were reported. The average size of the 4,435 broods in 2021was 11.2 (*SE* =

0.10) birds compared to 8.5 (*SE* = 0.16) birds for 862 broods in 2020. The number of broods reported in 2021 was 3,573 (+415%) more than the number of broods reported in 2020.

In 2021, the percent of hens with poults (Figure 2), the production index (Figure 3), and the number of observations were greater ($P < 0.01$) than the mean values observed the previous five years (Table 2). The 2021 PI was 4.0, with 90% of hens observed with at least one poult. Prior to 2021, the average PI had progressively declined ($P < 0.05$) in 28 years from a mean of 3.6 (SE = 0.18; 1993-1999) to 2.4 (SE = 0.13; 2011-2020) before it began to stabilize in the last decade. The general decline in the PI (Figure 3) is indicative of a turkey population transitioning from a colonizing phase with geometric growth during restoration to an established one with stable annual production and growth rates that periodically and expectedly fluctuates above and below the long-term means (Porter et al. 2011, Casalena et al. 2015). The 2021 PI is the highest since 2004, when there was also a 17-yr cicada (*Magicicada spp.*; Brood X) emergence in the Southcentral and Southeast regions of the state (Backs 2005, Kritskey et al. 2005). The high 2004 PI was subsequently followed by a significant drop in 2005 (Backs 2006), and it did not rebound for about 10 years. The increase brood production in 2021 extended across the state, well beyond the range of influence of the Brood X cicada emergence in Indiana and was likely influenced by other factors (e.g., conducive warm and dry weather early in brood season post hatch).

The number of 2021 brood reports exceeded the goal of 3,000 brood observations, allowing meaningful comparisons among the six regions with >200 reports/region (Figure 4). The regional PIs ranged from 3.0 to 4.5, with all regions increasing (22% to 165%). The substantially high increases in the Southcentral (+165%) and Southeast (+114%) regions were much needed boosts after more than a decade of decline in what is considered some of the better turkey habitat in the Indiana. The southern half of the state, in general, experienced relatively high production for the first time in 15 years. Prior to 2021, southern Indiana had experienced 15 consecutive years of above normal precipitation during the critical two-week period of late May to early June of the early brood period extending through June. The values of regional poult to hen ratios were determined with the exclusion of broodless hens and thus are inherently higher values than the regional PI's (total poults/total hens). The regional poult to hen ratios ($F_{5, 4429} = 25.63$; Figure 5) and mean brood size ($F_{5,4429} = 33.82$; Figure 6) were different ($P < 0.01$) among the regions with the Southeast, Southcentral, and West-central higher than the Southwest, North, and East-central. Poult to hen ratios for 67 counties with ≥ 25 brood observations were calculated (Table 4). Poult to hen ratios ranged from a high of 5.9 in Fountain County to 2.5 in Lagrange County for the 67 counties examined.

Long-term trends in turkey populations are primarily influenced by availability of suitable habitat across the landscape with prevailing climatic conditions and other factors (e.g., cicada emergences) influencing annual fluctuations, although there is some indication that precipitation levels may be increasing during the early brood period of late May to early June in Indiana (Fredrick 2018). Changes in annual production are often reflected in the proportion of juvenile males (jakes) in the following fall and spring harvests and, two years later, in the pre-season gobbling surveys and spring harvest of two-year-old males who are the most active gobbling cohort and generally the most vulnerable to spring harvest. A 50-year examination of Indiana's spring harvests indicated that the proportion of two-year-old gobblers in the population was a principal driver in annual harvest levels (Backs and McCallen, *in press*). Based on the level of brood production observed in 2021, a substantial increase in the 2023 spring turkey harvest would be expected.

The substantial increase in observer participation the last three years increased the sensitivity of the survey to produce more accurate estimates of wild turkey production. A reality that affects public participation is that, in areas of low production, volunteer observers cannot "participate" if they do not observe any broods. Potential biases also include variable brood detection rates among regions due to differences in vegetation, road density, and topography. The objective to obtain a minimum goal of 3,000 brood reports evenly distributed across the regions of the state was surpassed, likely as result of an exceptional brood production year along with a more user-friendly web reporting system. Several volunteers commented on the ease of reporting under the new web platform and the straightforward observation form used.

LITERATURE CITED

Backs, S.E. 2005. Wild Turkey Brood Production - Summer 2004. Management and Research Note #891. Indiana Division of Fish and Wildlife, Indianapolis, Indiana.

Backs, S.E. 2006. Wild Turkey Brood Production - Summer 2005. Management and Research Note #910. Indiana Division of Fish and Wildlife, Indianapolis, Indiana.

Backs, S. E. and E. B. McCallen. *In Press.* Fifty years of spring wild turkey harvest in Indiana, 1970-2019. Wildlife Society Bulletin.

Casalena, M. J., M.V. Schiavone, A. C. Bowling, I. D. Gregg, and J. Brown. 2015. Understanding the new normal: wild turkeys in a changing Northeastern landscape. Proceedings of the National Wild Turkey Symposium. 11:45-57.

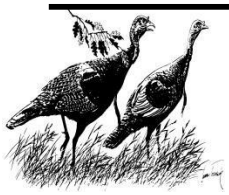
Fredrick, J.E. 2018. Daily temperature extreme and precipitation across Indiana for a 120-year period. Proceedings of the Indiana Academy of Science 127:140-152.

Kritsky, J. Webb, M. Folsom, and M. Pfiester. 2005. Observations of periodical cicadas (Brood X) in Indiana and Ohio in 2004 (Hemiptera: Cicadidae: *Magicicada spp*.). Proceedings of the Indiana Academy of Science 114:65-69.

Middleton, E., M. Sussman, and S.E. Backs. 2021. Audience, communication efforts, timing, and sequence: components of a volunteer monitoring engagement strategy for the Indiana wild turkey brood survey. Management and Research Note #2068. Indiana Division of Fish and Wildlife, Indianapolis, Indiana.

Porter, W. F., W. M. Healy, S. E. Backs, B. F. Wakeling, and D. E. Steffen. 2011. Managing wild turkeys in the face of uncertainty. Proceedings of the National Wild Turkey Symposium 10:1–9.

National Wild Turkey Federation Technical Committee 2019. A standardized protocol for conducting wild turkey brood surveys. National Wild Turkey Federation, Edgefield, SC. 13 pp.



These management and research notes are issued periodically to provide a quick source of information on wildlife surveys and investigations, and various wildlife programs prior to more formal reports. Any information provided is subject to further analysis and therefore is not for publication without permission.

Table 1. Indiana wild turkey brood production - Summer 2021.

Jul-21	Adult Hens	No. of Poults	Brood Size *	Poults/ Hen **		
Total	5,989	24,663		**4.1**	Percent hens with broods	88%
No. Observations	3,067	2,706	2,706		Mean No. "barren" hens in a group	2.1
Mean	2.0	9.1	11.1		Observations of "barrens" hens	361
SE	0.02	0.12	0.13			

Aug-21	Adult Hens	No. of Poults	Brood Size *	Poults/ Hen **		
Total	4,223	15,913		**3.8**	Percent hens with broods	92%
No. Observations	1,883	1,729	1,729		Mean No. "barren" hens in a group	2.3
Mean	2.2	9.2	11.4		Observations of "barrens" hens	154
SE	0.03	0.14	0.16			

July & August Combined	Adult Hens	No. of Poults	Brood Size *	Poults/ Hen **		
Total	10,212	40,576		**4.0**	Percent hens with broods	90%
No. Observations	4,950	4,435	4,435		Mean No. "barren" hens in a group	2.1
Mean	2.1	9.1	11.2		Observations of "barrens" hens	515
SE	0.02	0.09	0.16			

* Brood size = all hens + all poults observed as a group at one time.
** The total poults/total hens.
The total poults/total hens observed each month; July + August combined = annual Production Index (PI).

Figure 1a. Distribution of wild turkey observation reports by counties, (n = 4,950) for July and August 2021.

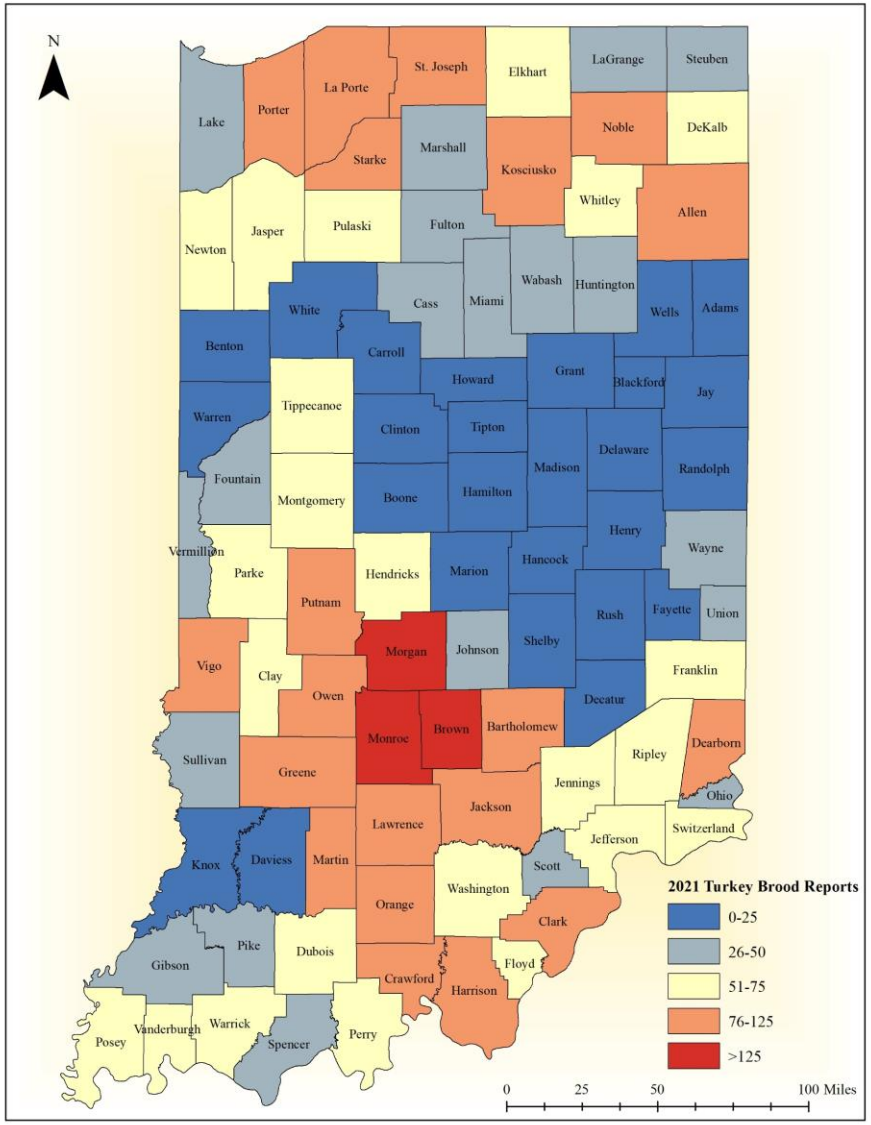


Figure 1b. Distribution of wild turkey observation reports by forest cover distribution (n = 4,950) for July and August 2021.

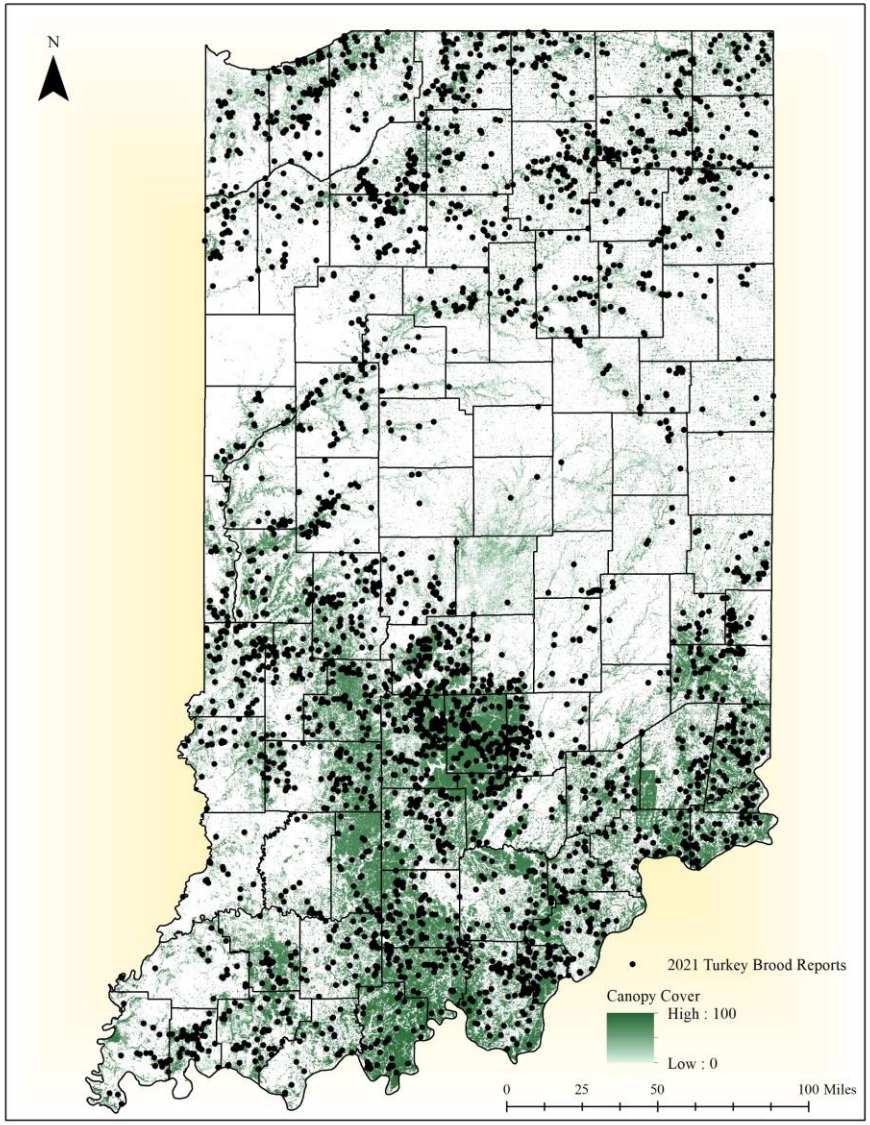


Table 2. Indiana wild turkey production indices, 1993-2021.

Year	Poults/Hen [a] (PI)	Lower 95% CI	Upper 95% CI	% Hens with poults	No. Observations
1993	4.0	3.4	4.6	88%	117
1994	3.9	3.4	4.3	78%	175
1995	3.5	3.1	4.0	80%	121
1996	3.4	3.0	3.8	75%	142
1997	3.2	2.7	3.6	79%	126
1998	2.8	2.5	3.2	79%	134
1999	4.2	3.8	4.7	80%	229
2000	3.1	2.9	3.4	78%	227
2001	3.3	3.0	3.6	78%	313
2002	3.2	2.9	3.5	79%	338
2003	2.4	2.2	2.7	68%	312
2004	4.4	4.1	4.7	89%	597
2005	2.3	2.1	2.5	74%	240
2006	2.6	2.5	2.8	82%	477
2007	2.6	2.4	2.8	82%	364
2008	2.6	2.3	2.8	80%	328
2009	2.4	2.2	2.6	86%	311
2010	2.1	1.9	2.3	71%	320
2011	1.5	1.3	1.6	60%	320
2012	2.5	2.3	2.7	79%	318
2013	2.0	1.9	2.2	66%	394
2014	2.9	2.7	3.2	81%	363
2015	2.8	2.6	3.0	79%	302
2016	2.4	2.1	2.6	89%	323
2017	2.7	2.6	2.8	78%	522
2018	2.8	2.6	2.9	75%	527
2019	2.2	2.1	2.3	71%	899
2020	2.3	2.2	2.4	71%	862
2015-2020 Mean	*2.5*	*2.3*	*2.6*	*77%*	*627*
2021	4.0	3.9	4.1	90%	4435

[a] Production index (PI) is the total poults/total hens observed in July and August.

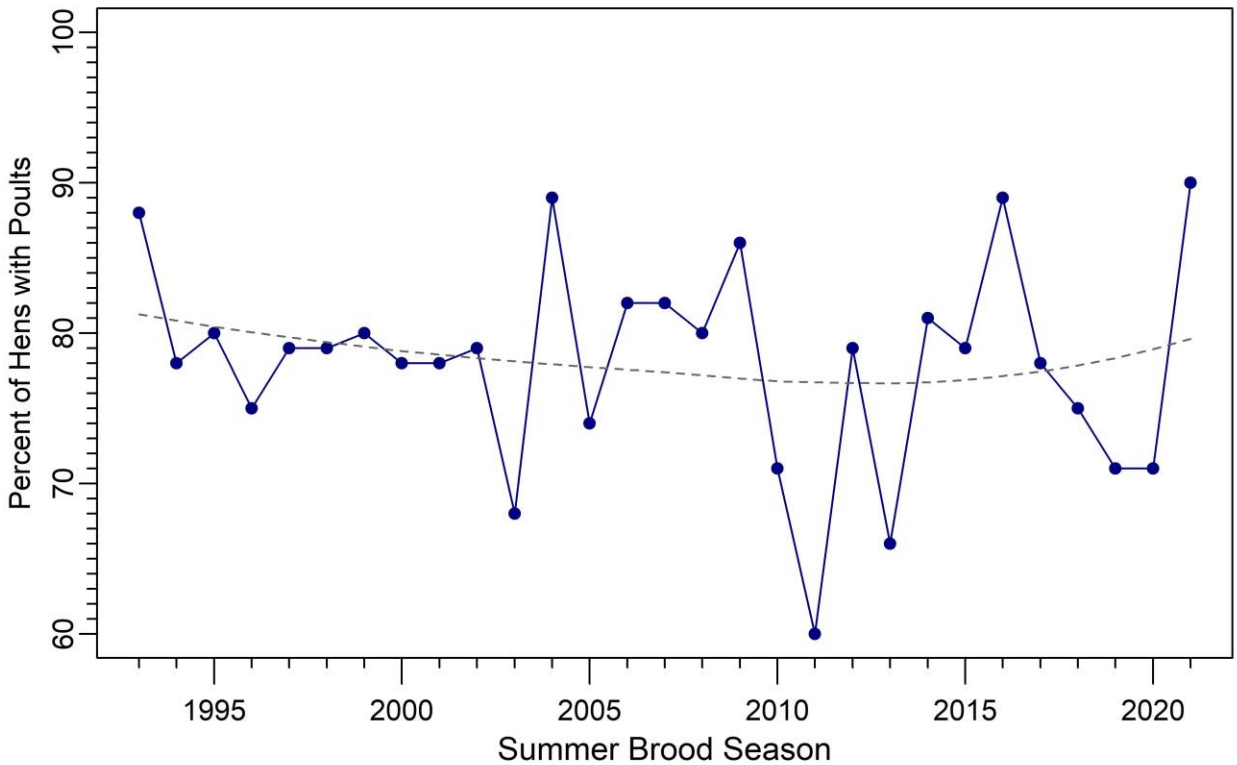


Figure 2. Percent of turkey hens with poults in Indiana 1993-2021. Dashed trendline was fitted using locally weighted polynomial regression.

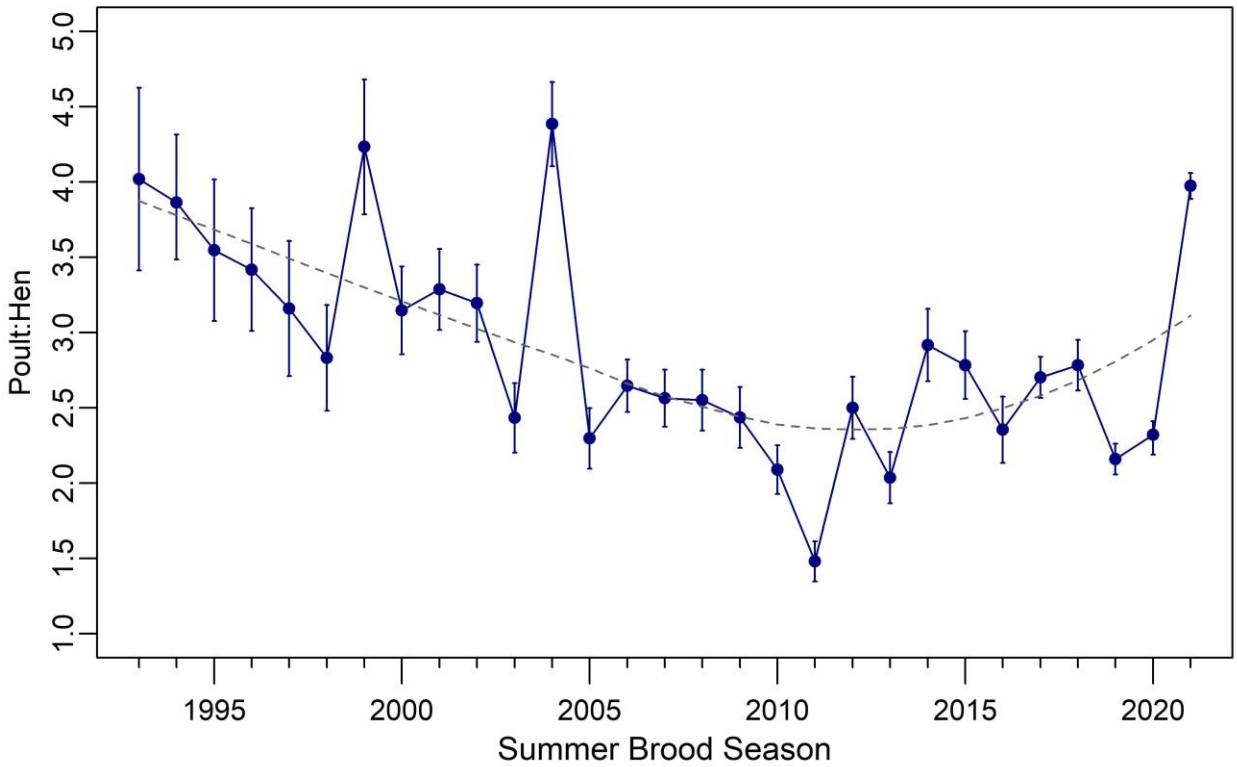
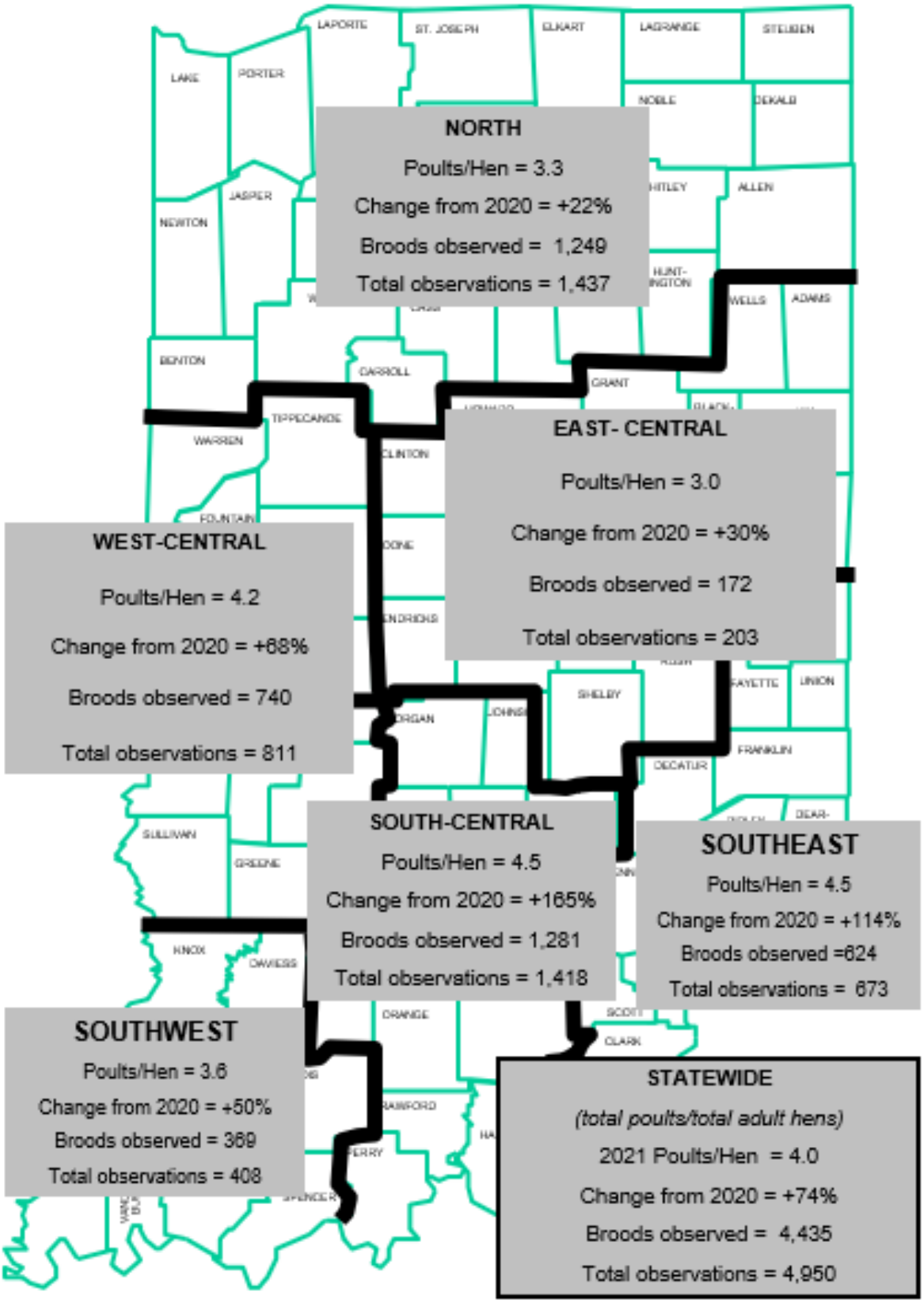


Figure 3. Annual wild turkey production (95% CI) in Indiana 1993-2021. Dashed trendline was fitted using locally weighted polynomial regression.

Figure 4. Regional wild turkey production for July and August 2021.



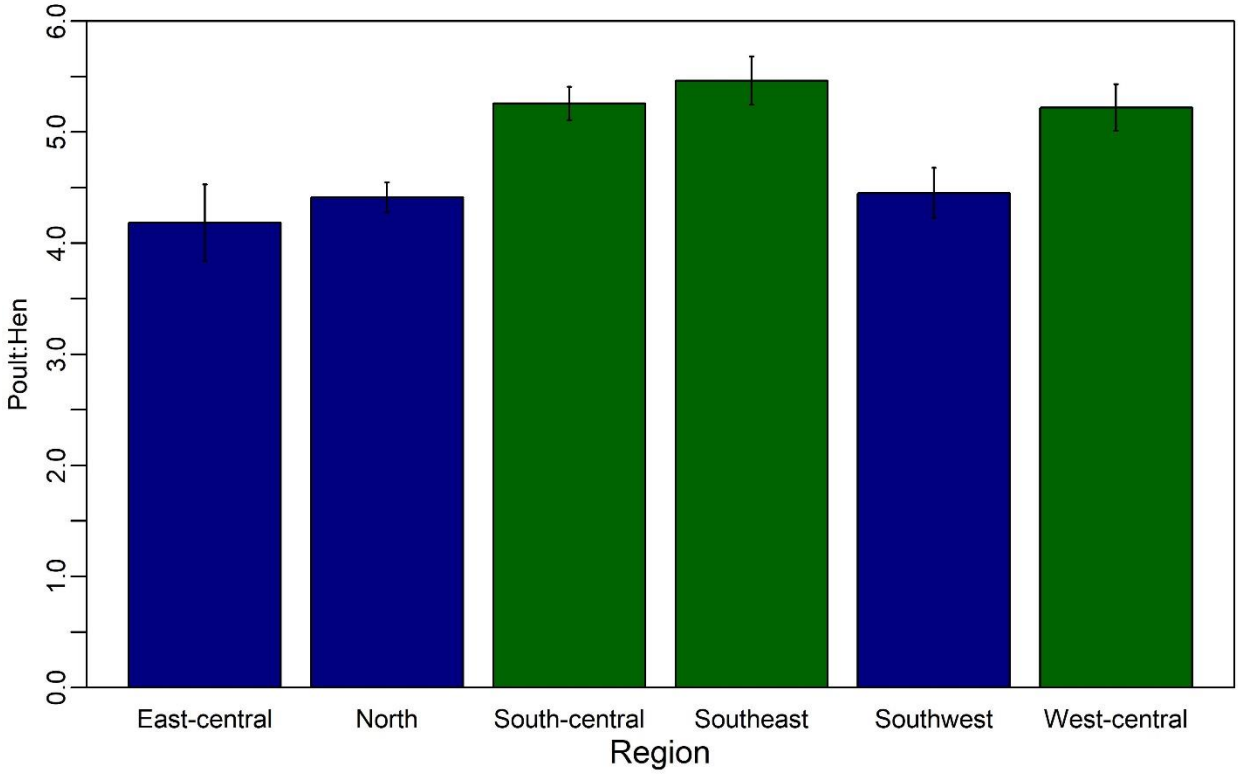


Figure 5. Wild turkey production (95% CI) during the 2021 summer brood season in Indiana by region.

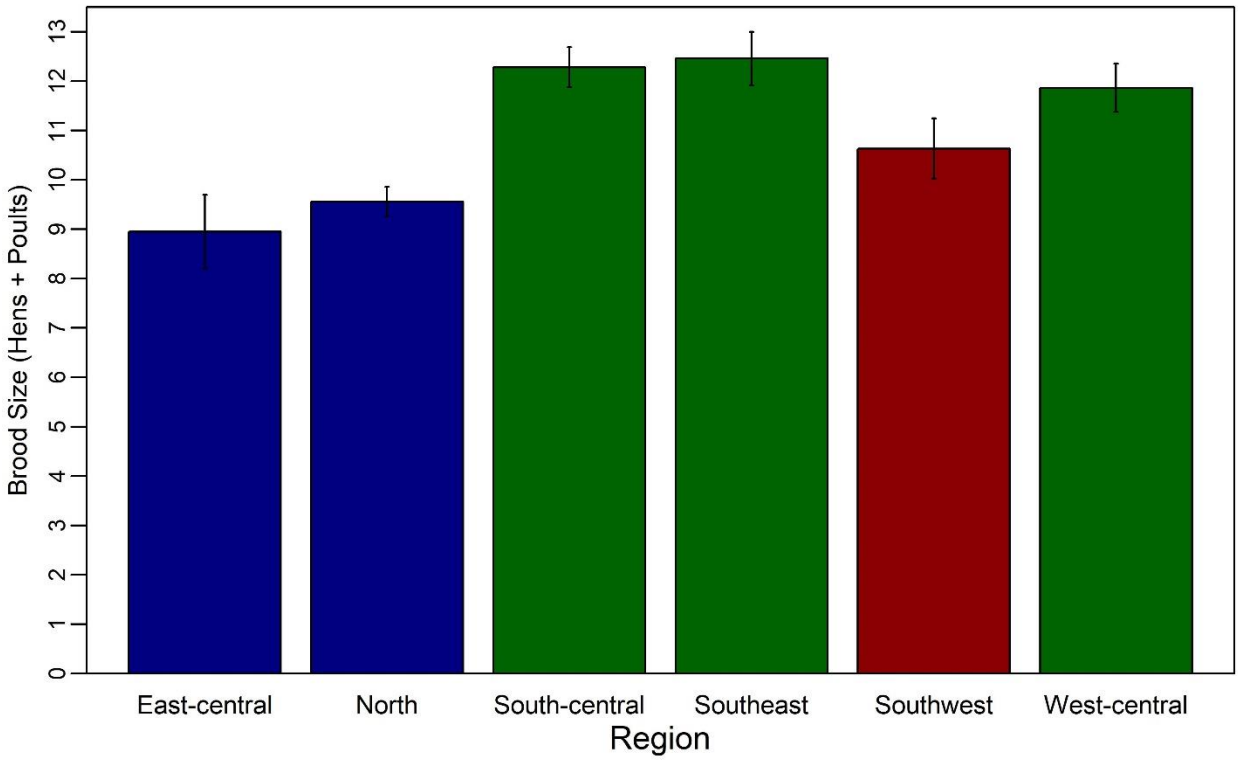


Figure 6. Wild turkey brood size (95% CI) during the 2021 summer brood season in Indiana by region.

Table 4. Indiana wild turkey brood production by county for July and August 2021.

County	No. Observations	No. Broods	Hens	% with Broods	Poults	Poults/Hen*
Adams	7	7	13	100%	43	N/A
Allen	89	70	171	78%	557	3.3
Bartholomew	96	87	188	94%	789	4.2
Benton	0	---	---	---	---	---
Blackford	16	12	30	80%	95	N/A
Boone	5	5	20	100%	31	N/A
Brown	137	129	246	96%	1,266	5.1
Carroll	23	21	40	93%	142	N/A
Cass	32	30	77	92%	214	2.8
Clark	84	76	193	90%	810	4.2
Clay	53	49	122	93%	565	4.6
Clinton	11	10	23	87%	67	N/A
Crawford	92	88	194	97%	929	4.8
Daviess	19	17	30	93%	118	N/A
Dearborn	90	84	196	91%	901	4.6
Decatur	19	18	34	97%	188	N/A
DeKalb	55	49	112	94%	356	3.2
Delaware	11	9	24	79%	59	N/A
Dubois	69	61	144	88%	525	3.6
Elkhart	69	63	130	91%	560	4.3
Fayette	21	21	32	100%	148	N/A
Floyd	77	75	197	99%	1,016	5.2
Fountain	28	27	55	96%	325	5.9
Franklin	71	68	142	96%	624	4.4
Fulton	35	32	64	95%	237	3.7
Gibson	30	27	66	89%	193	2.9
Grant	17	16	38	97%	133	N/A
Greene	119	111	271	92%	1,149	4.2
Hamilton	3	3	6	100%	31	N/A
Hancock	10	8	18	89%	57	N/A
Harrison	108	97	233	91%	790	3.4
Hendricks	58	49	101	85%	357	3.5
Henry	10	8	14	79%	56	N/A
Howard	1	0	7	0%	0	N/A
Huntington	32	29	62	90%	191	3.1
Jackson	90	79	198	88%	808	4.1
Jasper	51	45	105	84%	356	3.4
Jay	7	5	13	62%	40	N/A
Jefferson	64	56	127	87%	599	4.7
Jennings	64	60	147	93%	710	4.8
Johnson	39	36	80	93%	359	4.5
Knox	20	17	42	88%	110	N/A
Kosciusko	102	99	214	95%	808	3.8
Lagrange	47	34	87	69%	219	2.5
Lake	46	38	92	80%	279	3.0
LaPorte	81	72	146	90%	494	3.4
Lawrence	99	88	174	90%	770	4.4

Table 4 continued next page

Table 4 *con't.* Indiana wild turkey brood production by county for July and August 2021.

County	No. Observations	No. Broods	Hens	% with Broods	Poults	Poults/Hen*
Madison	1	1	2	100%	4	N/A
Marion	2	0	2	0%	0	N/A
Marshall	50	47	95	94%	329	3.5
Martin	109	71	184	72%	578	3.1
Miami	40	35	97	86%	271	2.8
Monroe	193	182	370	94%	1,741	4.7
Montgomery	64	59	140	88%	471	3.4
Morgan	151	143	315	95%	1,528	4.9
Newton	51	42	112	78%	400	3.6
Noble	85	76	163	83%	497	3.0
Ohio	30	26	75	87%	221	2.9
Orange	99	92	225	93%	1,110	4.9
Owen	107	98	248	92%	1,026	4.1
Parke	58	54	118	93%	618	5.2
Perry	68	62	186	95%	846	4.5
Pike	38	34	73	88%	243	3.3
Porter	115	98	205	85%	673	3.3
Posey	64	61	150	92%	573	3.8
Pulaski	73	58	158	78%	507	3.2
Putnam	114	106	215	89%	974	4.5
Randolph	4	3	8	88%	17	N/A
Ripley	54	49	119	85%	544	4.6
Rush	10	10	22	100%	70	N/A
Saint Joseph	104	86	173	81%	657	3.8
Scott	50	47	129	96%	572	4.4
Shelby	21	18	44	73%	100	N/A
Spencer	28	27	65	95%	223	3.4
Starke	78	63	184	77%	501	2.7
Steuben	46	44	84	94%	360	4.3
Sullivan	43	37	84	88%	286	3.4
Switzerland	57	54	120	97%	584	4.9
Tippecanoe	60	42	122	63%	318	2.6
Tipton	1	1	1	100%	1	N/A
Union	35	33	68	91%	307	4.5
Vanderburg	69	62	143	91%	586	4.1
Vermillion	31	31	63	100%	297	4.7
Vigo	109	102	229	94%	950	4.1
Wabash	47	39	96	78%	290	3.0
Warren	25	24	54	93%	254	4.7
Warrick	71	63	168	82%	570	3.4
Washington	60	52	117	91%	519	4.4
Wayne	34	32	61	95%	238	3.9
Wells	8	7	12	92%	43	N/A
White	24	22	52	81%	152	N/A
Whitley	62	57	143	90%	453	3.2
Total	4,950	4,435	10,212		40,576	

* Poult/Hen ratio determined only for counties with ≥25 observations.