

WILDLIFE MANAGEMENT AND RESEARCH NOTES

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	Title: Wild Turkey Summer Brood Production Indices – 2022	
2078		3/25/2023

Abstract: A total of 2,358 observation reports were received during the July and August 2022 survey period. This represents a 52% decrease from the 4,950 reports received in 2021 but very close to the 2,412 received in 2020. Brood observation reports were distributed across the state with ≥ 25 observations reported from 41 counties (-39% less than 67 in 2021) that were again highly associated with the distribution of forest cover in the state. In 2022, a total of 5,364 hens and 14,916 poult were reported that included 2,001 broods (at least 1 hen and 1 poult) and 357 hens without broods. The average size of the 2,001 broods was 9.7 (SE = 0.13) birds compared to 11.2 (SE = 0.10) birds for 4,435 broods in 2021 but greater than 8.5 (SE = 0.16) birds for 862 broods in 2020. The 2,001 broods reported in 2022 was 1,572 fewer (-44%) than the 3,573 reported in 2021, but 1.32 times more (+1,138) than the 862 broods reported in 2020. The 2022 PI was 2.8, with 83% of hens observed with at least one poult. The 2022 PI of 2.8 was 30% less than the 4.0 PI in 2021 but is equal to the 2.8 mean PI for the previous five years (2017-21) and slightly better than the 2.3 PI in 2020. The six regional PIs ranged from 2.1 to 3.5, with only the north region increasing slightly (+6%). The southern half of the state, in general, has experienced relatively lower production for almost two decades except for an increase in 2021. The regional poult to hen ratios and mean brood size were differed ($P < 0.01$) among regions, with the north region on the high end of the comparisons and southcentral on the low end. Poult to hen ratios were determined for 65 counties (71%) in 2022. These ratios ranged from 4.5 in Sullivan and Fountain counties to 0.9 in Martin County, with 33 counties showing PIs greater than the 2022 statewide average of 2.8. No observations were reported from Madison, Randolph, and Tipton counties.

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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. Initially, the brood survey was 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 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 2-month 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 website reporting form accessibility 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

After filtering and censoring data according to national brood survey criteria (National Wild Turkey Federation Technical Committee 2019), there were 2,358 observation reports received during the July and August 2022 survey period. This represents a 52% decrease from the 4,950 reports received during 2021 brood survey but very close to the 2,412 observations during the 2020 survey. Turkey production in summer 2021 was exceptionally high turkey production related to 17-yr cicada emergence (*Magicalcica spp.*; Brood X; Kritsky et al. 2005) and conducive weather during the critical early brood period of June (Bucks and McCallen 2021). Above normal turkey production related to the 17-yr cicada emergence was similarly observed in 2004 (Bucks 2005). In 2022, 2,358 usable observations (i.e., an observation with at least one hen, or at least one poult with at least one hen assumed) were used for the determining the wild turkey Production Index (PI; total poult/total hens) and related metrics (Table 1). The brood observation reports were distributed across the state with 41 counties reported ≥ 25 observations (-39% less than 67 in 2021) and were again highly associated with the distribution of forest cover in the state (Figures 1a and 1b.) In 2022, a total of 5,364 hens and 14,916 poult were reported that included 2,001 broods and 357 hens without broods. The average size of the 2,001 broods in 2022 was 9.7 ($SE = 0.13$) birds compared to 11.2 ($SE = 0.10$) birds for 4,435 broods in 2021 but greater than 8.5 ($SE = 0.16$) birds for 862 broods in 2020. The 2,001 broods reported in 2022 was 1,572 fewer (-44%) than the 3,573 reported in 2021, but more than 1.32 times more (1,138) than the 862 broods reported in 2020.

In 2022, the percent of hens with poults (Figure 2), the production index (Figure 3), and the number of observations were within the range of mean values ($P > 0.05$) observed the previous five years (Table 2). The 2022 PI was 2.8, with 83% of hens observed with at least one poult. Prior to 2021, the average PI had progressively declined ($P < 0.05$) in 28 years from an average 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 long-term decline in the PI got a significant lift with the 4.0 PI in 2021 (Figure 3) before dropping 30% to 2.8 in 2022, but it is still equal to the 2.8 mean PI for the previous five years (2017-21) and slightly better than the 2.3 PI in 2020.

The high PI of 4.4 in 2004 (another Brood X 17-yr cicada emergence year) was followed by a significant drop in 2005 to 2.3 (Bucks 2006); thus, a drop in the 2022 PI following the high production of 2021 was expected. The number of 2022 brood reports fell short of the goal of 3,000 observations, but still allowed meaningful comparisons among the six regions with only the east-central region (106 observations) not reaching the goal of >200 reports/region (Figure 4). The regional PIs ranged from 2.1 to 3.5 with only the north region slightly increasing (+6%). The southern half of the state, in general, has experienced relatively lower production for almost two decades with the exception of an increase in 2021. Prior to 2021, southern Indiana had experienced at least 15 consecutive years of above normal precipitation during the critical early brood rearing period of late May to through June (Fredrick 2018, Bucks 2019).

The values of regional poult to hen ratios were determined with the exclusion of broodless hens to facilitate statistical comparisons of relative differences or similarities among regions and are inherently higher values than the actual regional PI's (total poult/total hens). The regional poult to hen ratios ($F_{5,1995} = 14.14$; Tables 3; Figure 5) and mean brood size ($F_{5,1995} = 8.92$; Table 3; Figure 6) differed ($P < 0.01$) among regions, with the north region on the high end of the comparisons and southcentral on the low end. By reducing observation benchmark from ≥ 25 observations (used in 2021) to ≥ 15 observations in 2022, poult to hen ratios were determined for 65 counties (71%) in 2022 (Table 5). These ratios ranged from 4.5 in Sullivan and Fountain counties to 0.9 in Martin County, with 33 counties showing PI's greater than the 2022 statewide average of 2.8. No observations were reported from Madison, Randolph, and Tipton counties.

Long-term trends in turkey populations are primarily influenced by availability of suitable habitat across the landscape with prevailing climatic conditions and other periodic but temporary factors (e.g., cicada emergences) influencing annual fluctuations, although there is some indication that precipitation amounts 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 thus, generally the most vulnerable to spring harvest. A 50-year examination of Indiana's spring harvests found the proportion of two-year-old gobblers in the population was a principal driver in annual harvest levels (Bucks and McCallen, 2022). Based on the level of brood production observed in 2021, a substantial increase in the 2023 spring turkey harvest can be expected.

The substantial increase in observer participation the last four years has 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 is still valid, but an objective of securing a minimum of 25 observations for at least 75% (70 or more) of the counties is reasonable. To achieve this objective, it is critical to continue public outreach and survey publicity to maintain the current level of participants and recruit new participants in areas where it is low or lacking.

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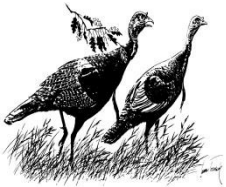


Table 1. Indiana wild turkey brood production - Summer 2022.


Jul-22	Adult Hens	No. of Poults	Brood Size *	Poults/Hen **	
Total	2,846	7,652		2.7	Percent hens with broods 81%
No. Observations	1,259	1,259	1,043		Mean No. "barren" hens in a group 2.5
Mean	2.3	5.8	9.5		Observations of "barrens" hens 216
SE	0.07	0.14	0.18		
Aug-22	Adult Hens	No. of Poults	Brood Size *	Poults/Hen **	
Total	2,518	7,264		2.9	Percent hens with broods 84%
No. Observations	1,009	1,099	958		Mean No. "barren" hens in a group 2.8
Mean	2.3	6.6	9.8		Observations of "barrens" hens 141
SE	0.05	0.16	0.19		
July & August Combined	Adult Hens	No. of Poults	Brood Size *	Poults/Hen **	
Total	5,364	14,916		2.8	Percent hens with broods 83%
No. Observations	2,268	2,358	2,001		Mean No. "barren" hens in a group 2.6
Mean	2.3	6.2	9.7		Observations of "barrens" hens 357
SE	0.02	0.09	0.13		
* 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 = 2,258) for July and August 2022.

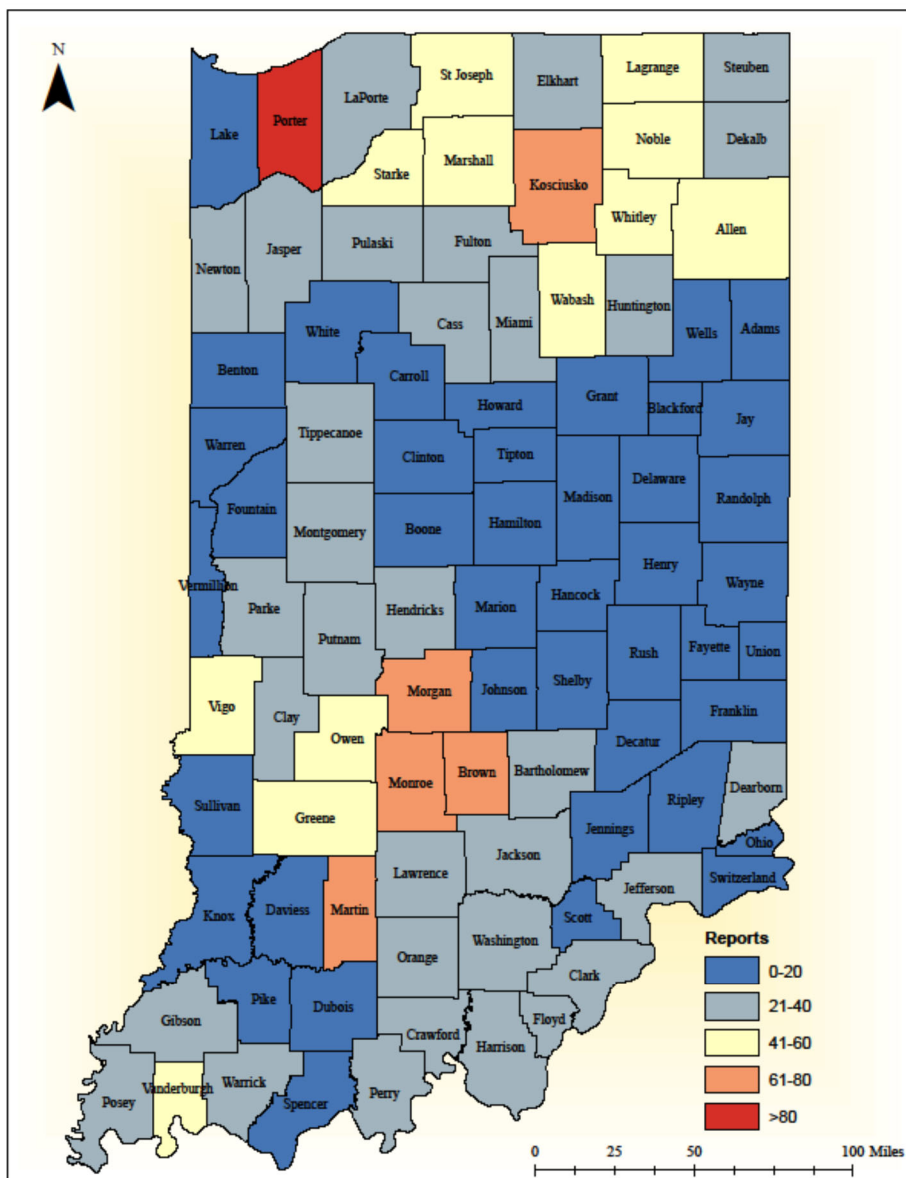


Figure 1b. Distribution of wild turkey observation reports by forest cover distribution (n = 2,258) for July and August 2022.

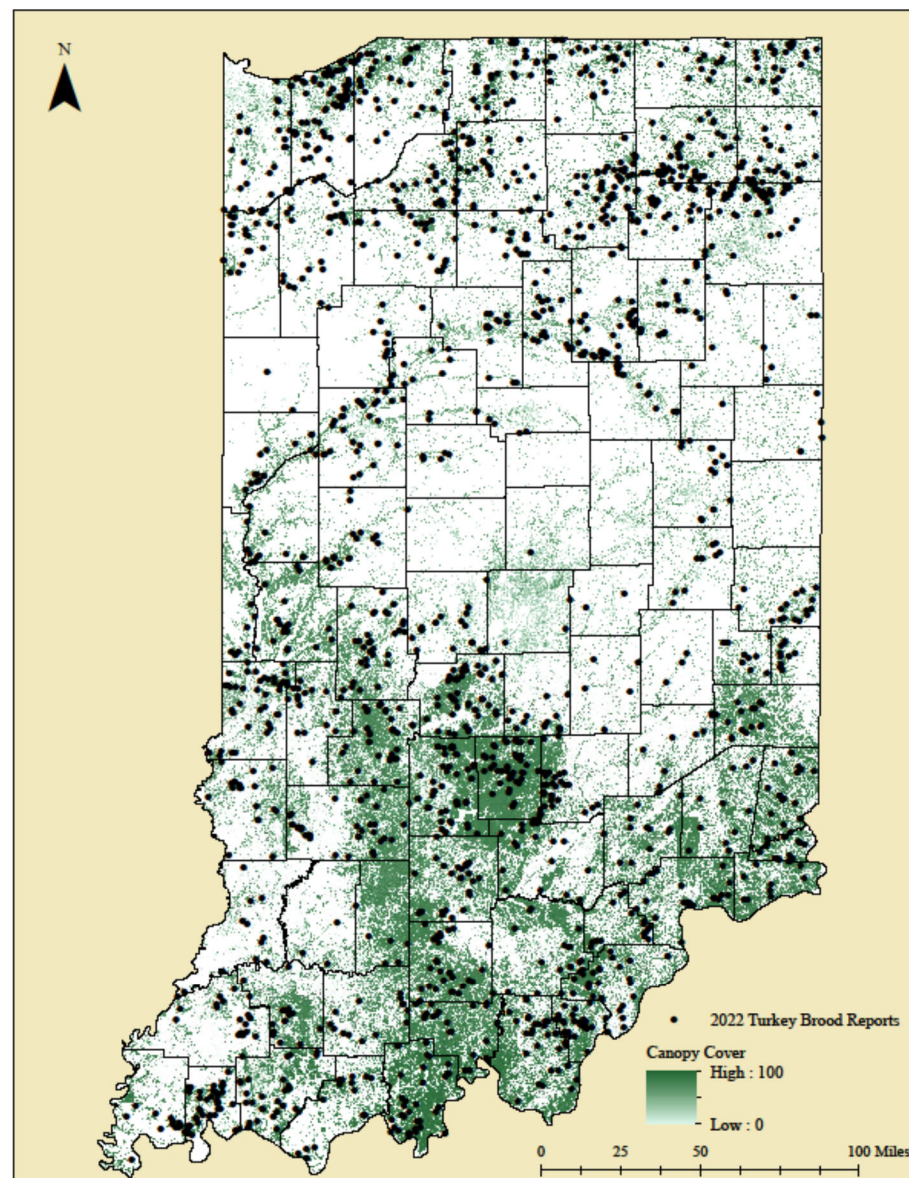


Table 2. Wild turkey production indices in Indiana, 1993-2022.

Year	Poults/Hen ^a (PI)	% Hens with poults	No. Observations
1993	4.0	88%	101
1994	3.9	78%	175
1995	3.5	80%	121
1996	3.4	75%	142
1997	3.2	79%	126
1998	2.8	79%	134
1999	4.2	80%	229
2000	3.1	78%	227
2001	3.3	78%	313
2002	3.2	79%	338
2003	2.4	68%	312
2004 ^b	4.4	89%	597
2005	2.3	74%	240
2006	2.6	82%	477
2007	2.6	81%	364
2008	2.6	80%	328
2009	2.4	86%	311
2010	2.1	71%	320
2011	1.5	60%	320
2012	2.5	79%	318
2013	2.0	66%	394
2014	2.9	81%	363
2015	2.8	79%	302
2016	2.3	89%	323
2017	2.7	78%	522
2018	2.8	75%	527
2019	2.2	71%	899
2020	2.3	71%	862
2021 ^b	4.0	90%	4,435
2017-2021 Mean (SE)	2.8 (0.32)	77% (4.0%)	1,449 (750.8)
2022	2.8	83%	2,358

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

^b 2004 and 2021 summers of 17-yr periodic cicada (*Magicicada spp.*; Brood X) emergence (Kritskey et al. 2005)

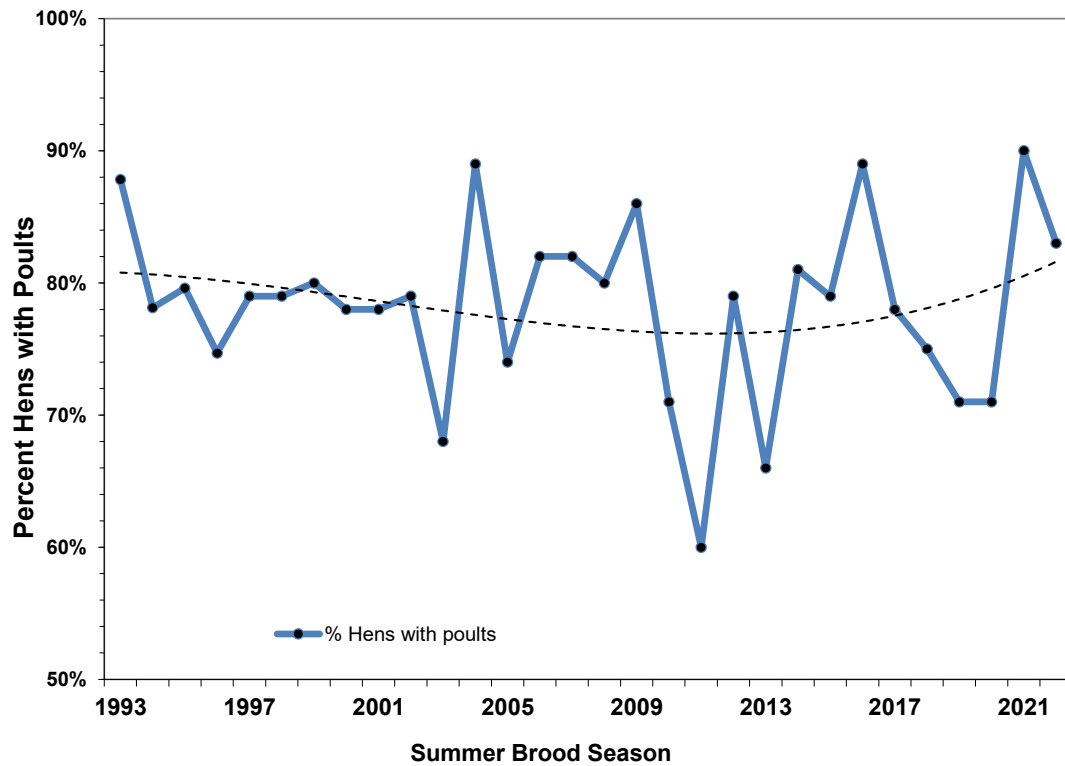


Figure 2. Percent of turkey hens with poults in Indiana 1993-2022. Dashed trendline was fitted using locally weighted polynomial regression.

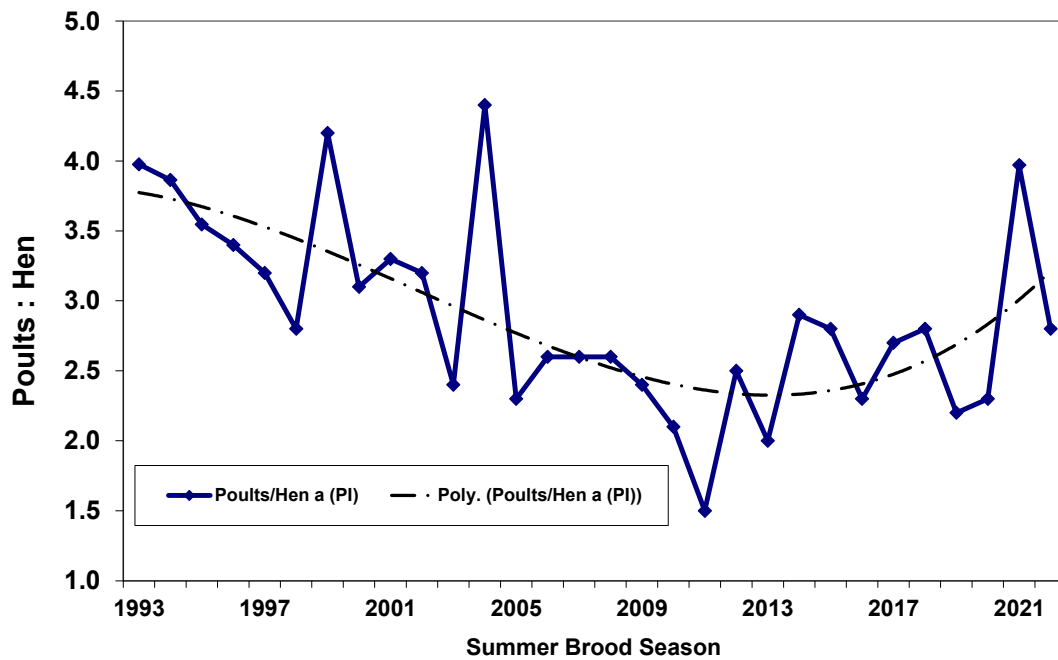


Figure 3. Annual wild turkey production in Indiana 193-2022. Dashed trendline fitted using locally weighted polynomial regression.

Figure 4. Regional wild turkey production for July and August 2022.

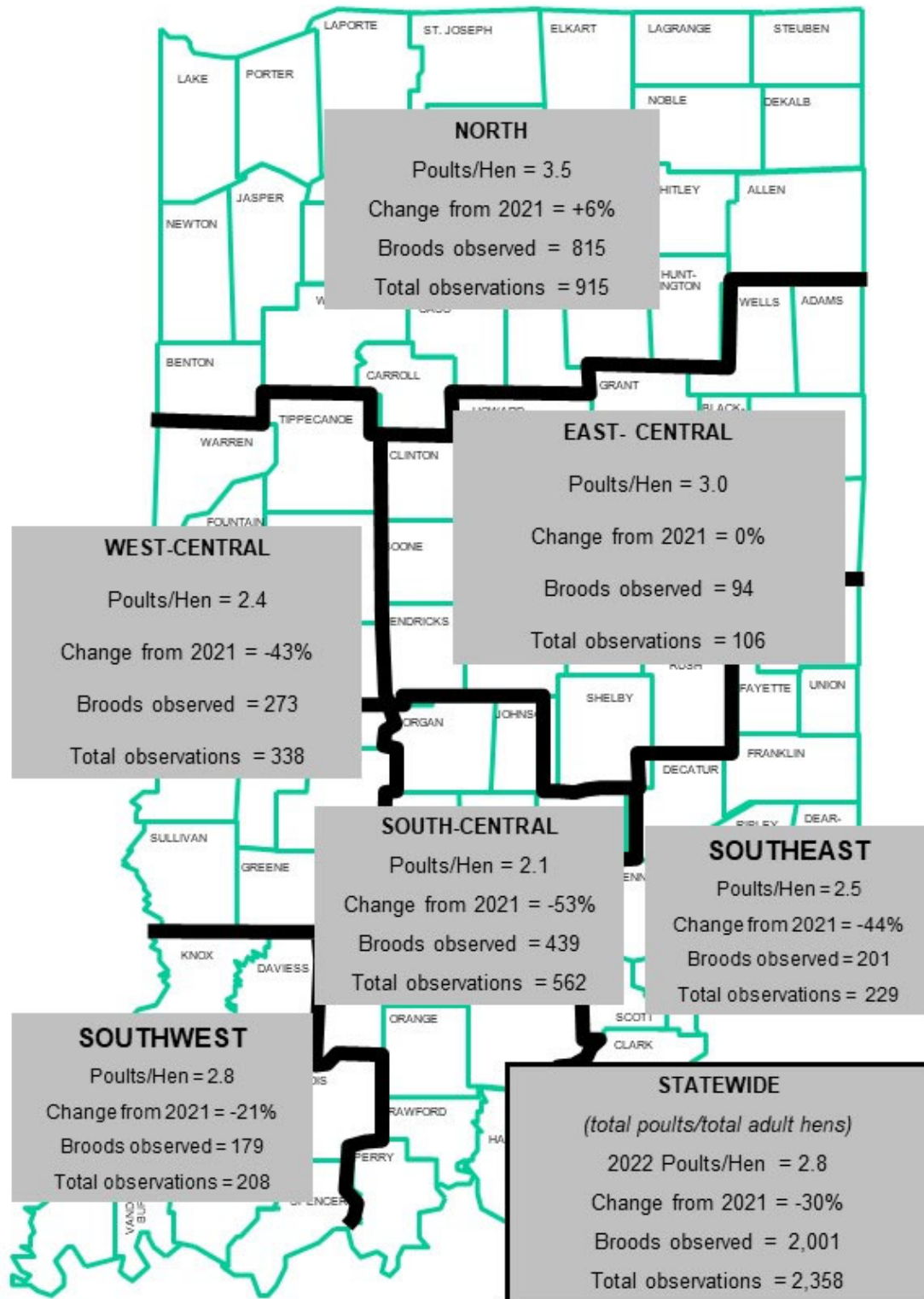


Table 3. Poult to hen ratio and brood sizes, by region, for July/August 2022.

Poult to Hen ratios (Broodless Hens excluded)					
	N	Mean	SE	% Hens with Broods	ANOVA ^a
Region					$F_{5,1995} = 14.14$ $P < 0.01$
East-central	94	4.1	0.25	88%	AB
North	815	4.6	0.09	87%	A
South-central	439	3.5	0.12	78%	C
Southeast	201	3.7	0.17	84%	BC
Southwest	179	3.9	0.18	84%	BC
West-central	273	3.9	0.15	75%	B

Brood Size (Hens + poults; broodless hens excluded)					
	N	Mean	SE	% Hens with Broods	ANOVA ^b
Region					$F_{5,1995} = 8.92$; $P < 0.01$
East-central	94	8.5	0.59	88%	B
North	815	10.7	0.20	87%	A
South-central	439	9.2	0.27	78%	B
Southeast	201	8.5	0.41	84%	B
Southwest	179	9.3	0.43	84%	B
West-central	273	8.9	0.35	75%	B

^b The ANOVA comparison to determined differences among regions. Broodless hen observations removed to facilitate statiistical comparisons of poult to hen ratios by regions. Regional mean ranked in descending order A to C relative to other means; Regions with same letters are statistically similar ($P > 0.05$; Least Significant Difference comparisons).

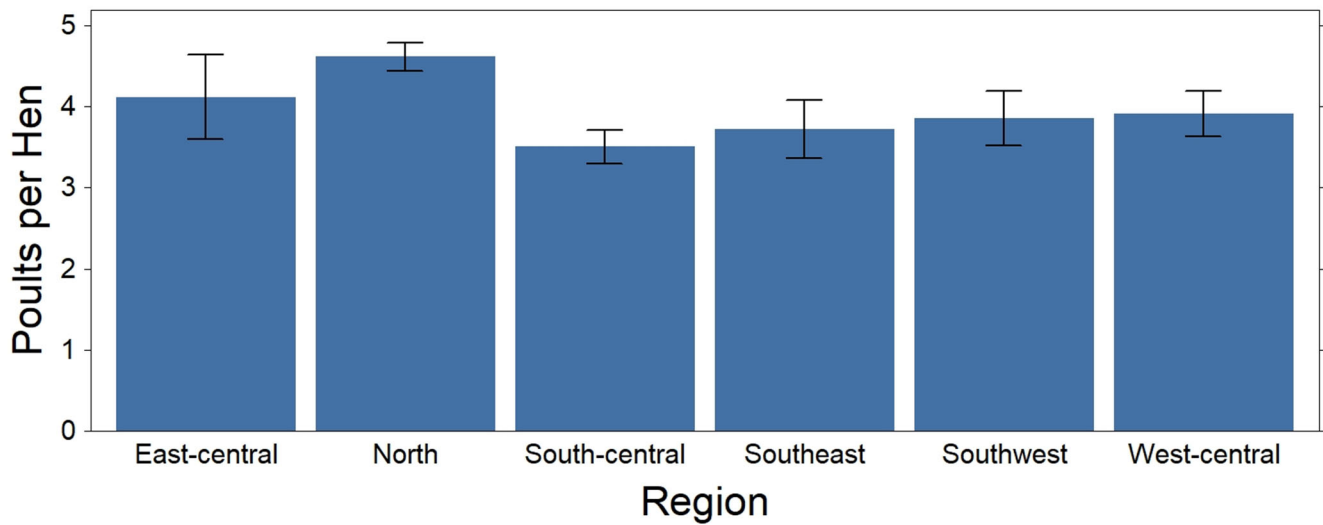


Figure 5. Wild turkey production (95% CI) during the 2022 summer brood season in Indiana by region.

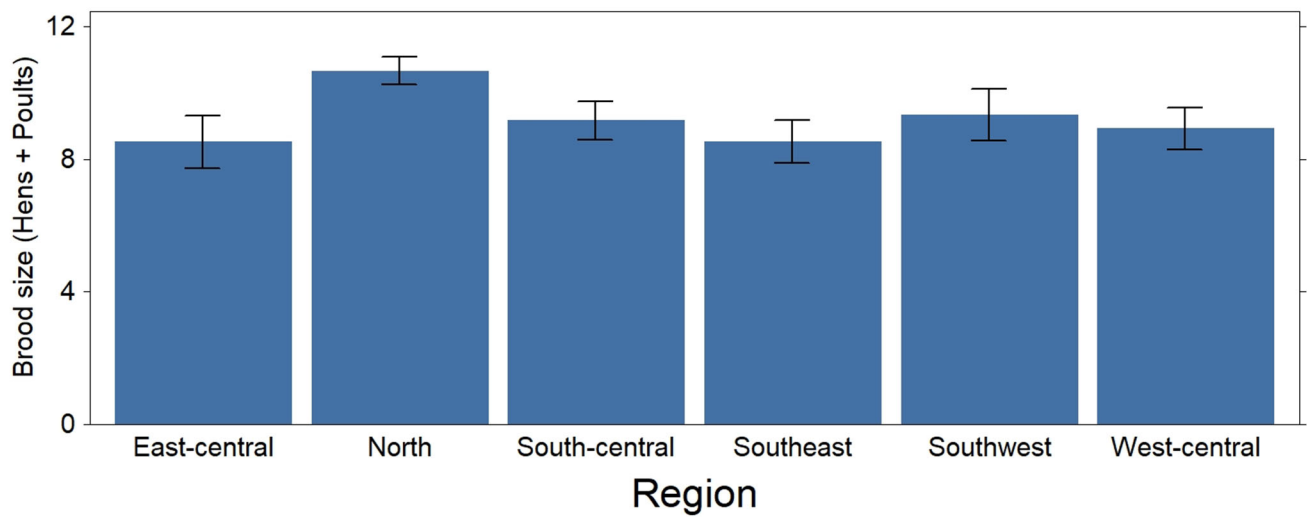


Figure 6. Wild turkey brood sizes (95% CI) during the 2022 summer brood season in Indiana by region.

Table 5. Indiana wild turkey brood production by county, July and August 2022.

County	No. Observations	No. Broods	Hens	% with Broods	Poults	Poults/Hen [*]
Adams	5	5	8	100%	34	N/A
Allen	53	44	118	76%	323	2.7
Bartholomew	34	31	72	86%	212	2.9
Benton	2	1	2	50%	5	N/A
Blackford	1	1	1	100%	7	N/A
Boone	1	1	3	100%	3	N/A
Brown	65	51	164	75%	314	1.9
Carroll	13	11	26	85%	88	N/A
Cass	29	28	57	98%	247	4.3
Clark	34	33	83	98%	188	2.3
Clay	22	18	49	63%	130	2.7
Clinton	5	4	17	94%	32	N/A
Crawford	26	18	67	69%	107	1.6
Daviess	3	3	4	100%	23	N/A
Dearborn	24	19	63	73%	122	1.9
Decatur	19	16	34	79%	98	2.9
DeKalb	37	29	84	76%	184	2.2
Delaware	15	14	25	92%	84	3.4
Dubois	14	12	29	93%	51	1.8
Elkhart	34	31	77	88%	298	3.9
Fayette	10	9	13	92%	62	N/A
Floyd	32	31	74	95%	270	3.6
Fountain	18	15	29	83%	131	4.5
Franklin	18	14	33	76%	105	3.2
Fulton	24	22	50	82%	208	4.2
Gibson	25	20	58	79%	168	2.9
Grant	15	15	31	100%	99	N/A
Greene	49	38	123	74%	209	1.7
Hamilton	1	1	1	100%	5	N/A
Hancock	1	1	2	100%	8	N/A
Harrison	36	30	80	75%	223	2.8
Hendricks	25	21	47	83%	166	3.5
Henry	13	11	26	77%	63	N/A
Howard	4	2	4	50%	9	N/A
Huntington	28	27	63	98%	171	2.7
Jackson	27	21	60	75%	168	2.8
Jasper	30	27	68	79%	225	3.3
Jay	6	6	12	100%	36	N/A
Jefferson	23	22	44	95%	107	2.4
Jennings	16	14	46	83%	100	2.2
Johnson	18	18	38	100%	120	3.2
Knox	13	2	53	100%	71	N/A
Kosciusko	66	64	147	98%	629	4.3
Lagrange	19	19	45	100%	149	3.3
Lake	33	30	61	93%	243	4.0
LaPorte	48	8	325	100%	443	N/A
Lawrence	32	29	165	94%	196	1.2

Table 5 continued next page

Table 5 *con't.* Indiana wild turkey brood production by county, July and August 2022.

County	No. Observations	No. Broods	Hens	% with Broods	Poults	Poults/Hen*
Madison	0	N/A	N/A	N/A	N/A	N/A
Marion	2	2	4	100%	12	N/A
Marshall	42	40	101	91%	391	3.9
Martin	66	27	138	48%	121	0.9
Miami	36	30	85	78%	294	3.5
Monroe	61	49	132	75%	299	2.3
Montgomery	23	19	55	76%	141	2.6
Morgan	66	49	184	72%	343	1.9
Newton	26	22	57	81%	221	3.9
Noble	60	55	133	88%	488	3.7
Ohio	18	17	44	89%	127	2.9
Orange	36	31	95	85%	198	2.1
Owen	44	35	123	76%	215	1.7
Parke	23	12	78	51%	82	1.1
Perry	39	35	93	88%	200	2.2
Pike	17	16	33	88%	77	2.3
Porter	93	81	177	85%	661	3.7
Posey	39	36	92	95%	339	3.7
Pulaski	28	26	55	95%	240	4.4
Putnam	37	33	80	83%	239	3.0
Randolph	0	N/A	N/A	N/A	N/A	N/A
Ripley	11	7	29	55%	42	N/A
Rush	2	1	7	100%	10	N/A
Saint Joseph	41	38	80	90%	337	4.2
Scott	15	3	89	100%	115	1.3
Shelby	5	4	8	88%	26	N/A
Spencer	18	15	41	76%	108	2.6
Starke	41	36	85	88%	347	4.1
Steuben	27	23	49	78%	162	3.3
Sullivan	20	17	37	81%	165	4.5
Switzerland	9	7	23	87%	31	N/A
Tippecanoe	35	29	57	79%	156	2.7
Tipton	0	N/A	N/A	N/A	N/A	N/A
Union	13	13	29	100%	105	N/A
Vanderburg	48	40	101	79%	284	2.8
Vermillion	10	1	50	100%	66	N/A
Vigo	41	36	88	88%	221	2.5
Wabash	48	43	131	90%	386	2.9
Warren	16	12	40	70%	115	2.9
Warrick	31	26	70	81%	189	2.7
Washington	24	19	61	74%	148	2.4
Wayne	19	18	39	95%	100	2.6
Wells	5	5	9	100%	29	N/A
White	12	8	19	58%	49	N/A
Whitley	45	40	87	89%	284	3.3
Statewide	2,358	2,001	5,364	83%	14,916	2.8

* Poult/Hen ratio determined only for counties with ≥15 observations.