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QUAIL, PHEASANT, & TURKEY BROOD SURVEY - 2018

Performance Report

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QUAIL, PHEASANT, AND TURKEY BROOD SURVEY RESULTS – 2018

Prepared by Jeff Prendergast, Small Game Specialist

INTRODUCTION

The Kansas Department of Wildlife, Parks, and Tourism (KDWPT) collects reproductive data for quail (*Colinus virginianus and Callipepla squamata*), ring-necked pheasant (*Phasianus colchicus*), and wild turkey (*Meleagris gallopavo*) statewide. Northern bobwhites provide nearly all the quail data; however, scaled quail can be found in extreme southwestern Kansas and observations are included in quail estimates (< 1% of data). Summer brood surveys were initiated in 1986, focusing on pheasant and quail. Turkey data were not collected and reported until 2006. Results are used to forecast upcoming hunting seasons and to provide consistent monitoring of these important game species. Prairie chickens (greater and lesser; *Tympanuchus* spp.), though recorded opportunistically, cannot be easily assessed using the same methods because they generally do not associate with roads like quail, pheasants, and turkeys.

METHODS

Dates for the 2018 summer brood survey were from July 15 – August 25 (6 weeks). Survey protocol and methodology changed in 2012 to establish permanent brood routes averaging 35 miles (29-49 miles) in length in 74 randomly selected counties in Kansas (urban counties were removed from the original selection pool). Routes were positioned within each county to be representative of the average land cover (rangeland, crop, CRP, etc.) for that county. If public land (e.g., Wildlife Areas) occurred in the county, we attempted to place the route through or adjacent to the property. Routes were sampled ≥ 4 times during the survey period, beginning at sunrise, traveling at a maximum of 25 mph until the entire route was sampled. The 6-week sampling period was separated into 2, 3-week periods where at least 2 samples occurred in each 3-week period. Additionally, observers were asked to have at least one sample completed on a morning with wet vegetation (dew or after a rain the evening/night before). This sampling protocol provides a more stringent standardization of collected data. Indices are reported on a per mile basis (e.g., pheasant/mile, broods/mile, etc.). If a quail or pheasant brood was detected, observers attempted to flush the brood to get the most accurate count of chicks possible. Age of chicks was visually estimated based on aging criteria and recorded in weeks.

Historic brood surveys (1986 – 2011) were collected by KDPWT personnel on an opportunistic basis as field personnel spent days in the field (out of the office and off paved roads). Counts were standardized by birds/observer-day and hand recorded. In 2012, we began collecting data with the Cybertracker (http://cybertracker.org/) program using Trimble™ Juno SB units and mobile phones. This is a Windows™ Access database freeware which allows customized digital data capture and spatial referencing for all data. Data transfer occurs over the internet (FTP site), eliminating the need for paper copies and manual data entry.

This new protocol improved on historic data collection by:

1. Matching the survey time period with the time when game bird species are most active, during early morning periods, improving detection probabilities, while the old survey data was collected opportunistically throughout the day.
2. Standardizing the survey effort
3. Creating replication along a permanent route, resulting in more spatially comparable data for annual comparisons.
4. Providing a spatial reference for each count, allowing spatial analysis of the data.
5. Eliminating the need for manual data entry and associated errors.

Data Analysis

The indices to upland game bird densities were calculated as the mean number of birds observed per mile for each species along routes. Given that observations are recorded on permanently established routes, samples are not independent and thus a paired-sample t-test is used to make inter-annual comparisons. A two-tailed test with an alpha level of 0.10 was used to identify significant differences between years (current vs. previous year). Data was standardized by reporting counts per mile (e.g., pheasants/mile) for individual routes and Small Game Regions (Figure 1). Ratio data (chicks/hen and chicks/brood) can help indicate population productivity, but sample sizes per route are generally limited; as such, ratio data are pooled across each Small Game Region. In considering the brood to hen ratios, broods that are observed without hens are removed to remove bias from the percentage of hens that successfully hatched broods. While many factors influence these ratios, the broods/hen index is generally an indicator of nest success, while chicks/brood is an indicator of brood survival after hatching. Quail ratio data was reported per adult (male and female) because males also will incubate nests and brood young. Turkey Management Regions (Figure 2) differ from Small Game Regions and data were reported accordingly.

Spatial comparisons were made using an inverse weighted distance technique, which interpolates data across a landscape between known points. Inverse distance weighting was used for each species by assigning the route-specific index to the centroid of the county sampled. This provides a map showing probable densities which are spatially relative. This provides a statewide estimate of upland bird densities, but does not take into account localized populations and habitats.

RESULTS

Participants sampled all 76 established routes between July 13 and August 28. Only 3 routes did not complete the requested 4 samples during the survey period (Table1). Results are summarized by Kansas Small Game Regions (Figure 1) or Turkey Regions, respectively (Figure 2).

Pheasants

For 2018, there was a significant decrease in the statewide roadside index of pheasants (-25%) compared to 2017. Regionally, a statistically significant decrease occurred in the Northern High

Plains (-33%,Table 2). Pheasants per mile was highest in the Smoky Hills, with the highest index in Graham County (Table 2). Similar to 2017, few pheasants were detected in the Flint Hills or Glaciated Plains regions. Most notably no pheasants were observed in Dickinson County which held the highest numbers for these regions the past 2 years and marked improvements were observed in Marion County, where the index had remained depressed after large declines in 2015. No pheasants were detected in the Osage Cuestas.

Statewide production indices were reduced this year compared to 2017 (Table 3). All production indices were generally greatest in the Smoky Hills and South-Central Prairies (Table 3). The chick/hen and brood/hen ratios were improved in the Southern High Plains, suggesting higher nest success in this region (Table 3). Large increases were observed in production ratios in the Flint Hills. This region has few overall brood observations annually and are highly influenced by a few observations. No chicks were observed in the Glaciated Plains this year. Pheasant hatch peaked statewide in early to mid-June but the overall hatch was shifted later in the nesting season (Figure 3). Pheasant indices were generally highest in north-central and central Kansas with some areas of relatively high densities occurring in all remaining major pheasant regions (Figure 4).

Quail

There was a significant decrease in the statewide roadside index of quail (-39%) compared to 2017. Statistically significant decreases occurred in the Smoky Hills (-61%) and Southern High Plains (-33%, Table 4). While there were still some routes with observed increases, generally counts were declining from 2017. The exception to this was in the Osage Cuestas where there was a slight increase in the regional estimate. Quail densities were greatest in the Smoky Hills followed by the South-Central Prairie Region, with the highest index recorded in Hamilton County (Table 4). Scaled quail were recorded on 3 routes in the Southern High Plains, with the highest number recorded on the Hamilton County route.

Generally, statewide production indices were down but brood size remained high and similar to 2017 (Table 5). The chicks/adult and broods/adult ratios were highest in the Glaciated Plains, suggesting the region likely had the greatest nesting success this year (Table 5). Chicks/brood was highest in the Osage Cuestas, but remained good across many regions, indicating overall all good chick survival (Table 5). Quail hatch peaked in late June with a greater percentage of hatch occurring in July than average (Figure 5). The highest estimated quail densities are generally in the Smoky Hills (Figure 6).

Turkey

There was a non-significant increase in the statewide turkey index compared to 2017. There were no significant changes in the regional indices. However, the only region showing a decline was the Northwest. The Northeast had the highest regional index and Southwest had the lowest, remaining much lower than any of the other 5 regions with turkeys observed only on 2 of the 18 routes (Table 6). The Saline County route recorded the highest relative roadside estimate this year (Table 6).

The statewide broods/hen was better than 2017, with other production indices remaining relatively stable (Table 7). The Southcentral Region had the lowest poult/hen ratio but greatest

poults/brood ratio, suggesting lower nest success but higher poult survival (Table 7). While brood size was down in the Northcentral Region, the area had the highest poults/hen and broods/hen suggesting better nest success but lower poult survival (table 7). Poults were recorded in the Southwest Region this year—the first since 2015. Turkey hatch appeared to peak in mid to late June (Figure 7) which—similarly to pheasant and quail—was later than average. The highest estimated turkey densities were generally in northcentral and northeastern Kansas (Figure 8).

DISCUSSION

Conditions for upland game bird production within existing habitat has been ideal in recent years. Precipitation patterns and management over the past 5 years has altered vegetation, increasing both the quality and quantity of habitat. Upland bird response to these conditions has been generally good with some areas observing extraordinary responses. Last winter, Kansas received little winter precipitation and soil conditions were dry entering spring 2018. As such, much of the annual cover (e.g. winter wheat) was in poor condition entering nesting season. As spring/summer progressed, heavy precipitation occurred across much of the western half of the state—including many extreme events—while conditions remained dry across the eastern regions through much of the nesting and brood-rearing seasons. This resulted in a lush landscape and copious amounts of arthropods, creating excellent cover for nesting and brooding hens. However, the frequency and severity of precipitation events created challenging conditions for hens for nesting and raising young. Droughty conditions persisted through spring and summer in the eastern small game regions. In these regions, dry springs can be beneficial to nesting birds, as excessive rainfall can often limit nesting success. However, dry conditions can also limit the availability of arthropods, a critical food source for chicks. The extreme weather events across the state appear to have combined for declined overall abundances this fall. The same conditions that limited production resulted in high grain yields and increased cover. While this may challenge hunters, the additional winter food and escape cover should increase overwinter survival.

Pheasants are an important resource to Kansas. Within the last decade, estimated annual harvests have been at the high and low extremes. In response to better production conditions, harvest rates returned to approximately average during 2016 and 2017. While heavy precipitation improved nesting and brooding cover and delayed wheat harvest in 2018, the statewide index of pheasants declined. All major pheasant regions were subjected to extremely heavy rainfall throughout the production season. While the moisture greatly improved the quality of nesting cover and availability of arthropods, these extreme events can impact nest success and increase chick mortality. However, the habitat conditions and precipitation created conditions that favored a long nesting season. While the peak of hatching occurred in early to mid-June, a greater proportion of the hatch was shifted later in the summer. The broods that successfully hatched had quality resources available, thereby increasing odds of survival. Given that the roadside counts were down and the vegetation was greatly improved across the landscape, the 2018 hunting season will likely see reduced hunter success. The Smoky Hills had the highest regional estimate of pheasants in 2018, followed closely by the Northern High Plains despite both regions declining from the 2017 survey. The Southern High Plains estimates decreased but maintained relatively good numbers. (Figure 4).

In 2017, hunters in Kansas harvested more wild bobwhites than any other state in the country. Recent hunting seasons have seen high densities of quail across the Midwestern and Great Plains states, including Kansas. The early successional annual vegetation created across much of Kansas following weather-induced habitat changes has produced more quail than observed in several years. Spring whistle survey results were good, except in the South-Central Prairies, where declines were expected after poor production in 2017. Despite spring densities remaining high and plenty of moisture for production in western regions, statewide roadside indices for quail declined. Similar to pheasants, the frequent heavy rainfall events appear to have negatively impacted production across western regions. The eastern regions remained dry through the production season—which normally favors production in these areas. However, estimates were down from 2017 in all regions except the Osage Cuestas. Despite these observed declines, opportunity should remain relatively good given high densities in 2017. Some field reports contradict the results of the survey and it's possible with the later shift in the nesting season and the abundant cover that detection rates were been decreased. However, based on survey results, we expect considerably lower hunter success in the upcoming season. The Smoky Hills remained the highest regional roadside estimate this year (Figure 6).

While the roadside estimate for turkeys increased only slightly and there were no significant regional changes this year, observations were generally encouraging compared to recent years. Production estimates improved across most regions except the South-Central, albeit remaining lower than desired. Unlike pheasant and quail, turkey observations have not improved above what they were in the 2012-2013 years, when this survey was initiated, and populations of all gamebirds were in severe decline. However, regional estimates were generally positive or stable from last year. Given the earlier nesting chronology of turkeys and their susceptibility to riparian area flooding, it appears that heavy rainfall across western units was delayed enough to allow for improved production. Turkey densities in the Southwest remain extremely limited, but broods were recorded for the first time in 3 years (Table 4 & 7). The Northeast region had the highest roadside estimate this year (Figure 8).

Table 1. Upland game bird brood routes and observers in Kansas, 2018.

Route	Observer	Replicates	Route	Observer	Replicates
Allen	Justin Harbit	4	Marion	Jeff Rue	5
Atchison	Tim Urban	4	Marshall	Alex Thornburg	4
Barber	Kyle Austin	4	Meade	Aaron Andrews	4
Barton	Jeff Prendergast	4	Miami	Andy Friesen	5
Bourbon	Justin Harbit	4	Mitchell	Toby Marlier	4
Brown	Tyler Warner	4	Montgomery	Darin Porter	5
Cherokee	David Jenkins	1	Morris	Brent Konen	4
Cheyenne	Abigail Athen	4	Morton	Kraig Schultz	4
Cloud	Matt Farmer	4	Neosho	Logan Martin	4
Coffey	Kelly Newman	4	Ness	Andrew Nelson	4
Comanche	Matt Hanvey	4	Norton	Luke Winge	4
Cowley	Kurt Grimm	4	Osage	Alex Lyon	5
Decatur	Daniel Howard	4	Osborne	Chris Lecuyer	4
Dickinson	Clint Thornton	4	Pawnee	Kevin Wood	3
Doniphan	Hunter Ballie	4	Phillips	Michael Zajic	4
Elk	Viki Cikanek	4	Pottawatomie	Corey Alderson	4
Ellis	Megan Rohweder	4	Pratt	Jake George	4
Finney	Angie Reisch	4	Rawlins	Kevin Klag	4
Franklin	Ryan Twellmann	4	Reno	Kyle McDonald	4
Geary	Clint Thornton	4	Republic	Rob Unruh	4
Gove	Lynn Davigon	4	Rice	Steve Adams	4
Graham	Jake Brooke	4	Rooks	Eric Wiens	4
Gray	Manuel Torres	3	Rush	Jason Wagner	4
Greeley	Kurt Meier	4	Russell	James Svaty	4
Greenwood	Kent Fricke	5	Saline	Pat Riese	4
Hamilton	Kurt Meier	4	Scott	Lauren Angemayer	4
Harvey	Charlie Cope	4	Seward	Jason Vajnar	4
Haskell	Jeff Seim	4	Sheridan	Kevin Klag	4
Hodgeman	Dan Haneke	4	Sherman	Brittany Smith	4
Jackson	Tyler Warner	4	Smith	Kirk Andrews	4
Jefferson	Andrew Page	4	Stafford	Charlie Swank	4
Jewell	Luke Kramer	4	Stanton	Kraig Schultz	4
Kearney	Zerick Kuecker	4	Stevens	Kraig Schultz	4
Kingman	Troy Smith	4	Thomas	Jared Ireland	4
Kiowa	Charlie Swank	4	Trego	Kent Hensley	4
Labette	Rob Riggin	4	Wabaunsee	Brad Rueschhoff	4
Lane	Kurt Hudson	4	Wallace	Abigail Athen	4
Logan	Leonard Hopper	4	Wilson	Bob Funke	5

Table 2. Annual regional changes in mean pheasants per mile (P/M), 2018.

Route	2017 P/M	2018 P/M	% Δ
	Flint Hills		
Cowley	0.00	0.01	NE
Dickinson	0.11	0.00	-100
Elk	0.00	0.00	0
Geary	0.00	0.00	0
Greenwood	0.00	0.00	0
Marion	0.01	0.06	300
Morris	0.00	0.00	0
Pottawatomie	0.01	0.00	-100
Wabaunsee	0.00	0.00	0
Region	**0.01**	**0.01**	**-53**
	Glaciated Plains		
Atchison	0.01	0.00	-100
Brown	0.00	0.01	NE
Doniphan	0.00	0.00	0
Jackson	0.00	0.00	0
Jefferson	0.00	0.00	0
Marshall	0.00	0.01	NA
Region	**0.00**	**0.00**	**97**
	Smoky Hills		
Barton	0.32	0.60	89
Cloud	0.11	0.21	100
Ellis	0.27	0.13	-51
Hodgeman	0.85	0.34	-60
Jewell	0.21	0.46	117
Mitchell	0.74	0.26	-65
Ness	0.44	0.31	-30
Osborne	0.84	0.25	-70
Phillips	0.19	0.26	38
Republic	0.02	0.02	0
Rice	0.28	0.12	-56
Rooks	0.57	0.40	-29
Rush	0.30	0.49	62
Russell	0.30	0.13	-56
Saline	0.12	0.02	-86
Smith	0.53	0.53	0
Trego	0.48	0.23	-51
Region	**0.39**	**0.28**	**-27**

Route	2017 P/M	2018 P/M	% Δ
	Northern High Plains		
Cheyenne	0.42	0.31	-25
Decatur	0.74	0.35	-53
Gove	0.08	0.13	70
Graham	1.07	0.92	-14
Greeley	0.74	0.18	-75
Lane	0.28	0.12	-58
Logan	0.20	0.03	-85
Norton	0.12	0.21	81
Rawlins	0.23	0.22	-3
Scott	1.08	0.40	-63
Sheridan	0.20	0.20	-1
Sherman	0.18	0.52	188
Thomas	0.24	0.16	-32
Wallace	0.13	0.04	-67
Region	**0.41**	**0.27**	**-33***
	South-Central Prairies		
Barber	0.14	0.00	-100
Comanche	0.00	0.00	0
Harvey	0.01	0.00	-100
Kingman	0.06	0.00	-100
Kiowa	0.21	0.29	37
Pawnee	0.21	0.21	1
Pratt	0.22	0.16	-26
Reno	0.16	0.14	-14
Stafford	0.13	0.46	250
Region	**0.13**	**0.14**	**11**
	Southern High Plains		
Finney	0.07	0.07	0
Gray	0.38	0.19	-50
Hamilton	0.15	0.36	138
Haskell	0.34	0.39	13
Kearny	0.56	0.39	-30
Meade	0.13	0.14	6
Morton	0.25	0.33	31
Seward	0.57	0.27	-53
Stanton	0.16	0.14	-9
Stevens[a]	NA	0.36	NA
Region	**0.29**	**0.25**	**-13**
Statewide	**0.25**	**0.19**	**-25***

* = Significant difference ($p < 0.1$)

**The Osage Cuestas region is outside of the pheasant range and is removed for analysis.

[a]Route was not sampled in consecutive years and wasn't included in regional or statewide comparisions

Table 3. Annual regional changes in pheasant chicks per hen (C/H), chicks per brood (C/B), and broods per hen (B/H), 2018.

Region	2017 C/H	2018 C/H	%Δ	2017 C/B	2018 C/B	%Δ	2017 B/H	2018 B/H	%Δ
Flint Hills	1.8	8.00	344	4.5	4.0	-11	0.40	1.00	150
Glaciated Plains	0.0	0.00	0	0.0	0.0	0	0.00	0.00	0
Northern High Plains	6.1	3.67	-40	4.5	4.0	-12	0.61	0.60	-1
Osage Cuestas	0.0	0.00	0	0.0	0.0	0	0.00	0.00	0
Smoky Hills	7.8	4.07	-48	5.7	4.9	-14	0.84	0.50	-40
South-Central Prairies	6.3	4.11	-34	4.6	4.6	1	0.68	0.57	-16
Southern High Plains	3.2	4.02	27	4.3	3.3	-23	0.39	0.57	47
Statewide	6.0	4.0	-34	5.0	4.2	-16	0.64	0.56	-14

Table 4. Annual regional changes in mean quail per mile (Q/M), 2018.

Route	2017 Q/M	2018 Q/M	% Δ	Route	2017 Q/M	2018 Q/M	% Δ
	Flint Hills				Smoky Hills		
Cowley	0.40	0.08	-80	Barton	0.46	0.19	-58
Dickinson	0.15	0.33	119	Cloud	0.49	0.22	-55
Elk	0.54	0.19	-65	Ellis	0.53	0.41	-23
Geary	0.07	0.05	-20	Hodgeman	0.38	0.27	-29
Greenwood	0.27	0.16	-42	Jewell	0.39	0.35	-9
Marion	0.12	0.12	4	Mitchell	0.41	0.26	-38
Morris	0.05	0.01	-71	Ness	0.34	0.13	-63
Pottawatomie	0.03	0.22	700	Osborne	0.58	0.25	-57
Wabaunsee	0.06	0.02	-63	Phillips	0.22	0.12	-47
Region	**0.18**	**0.13**	**-29**	Republic	0.31	0.02	-95
	Glaciated Plains			Rice	0.06	0.16	144
Atchison	0.26	0.04	-83	Rooks	0.63	0.10	-84
Brown	0.21	0.13	-39	Rush	0.46	0.06	-86
Doniphan	0.14	0.01	-95	Russell	0.05	0.17	225
Jackson	0.15	0.24	59	Saline	0.03	0.01	-75
Jefferson	0.03	0.09	200	Smith	1.44	0.38	-73
Marshall	0.09	0.23	146	Trego	0.13	0.01	-94
Region	**0.15**	**0.12**	**-16**	**Region**	**0.47**	**0.18**	**-61***
	Northern High Plains				Southern High Plains		
Cheyenne	0.00	0.01	NE	Finney	0.14	0.10	-30
Decatur	0.22	0.04	-83	Gray	0.17	0.16	-7
Gove	0.01	0.11	1300	Hamilton	0.53	0.49	-7
Graham	0.14	0.05	-67	Haskell	0.01	0.00	-100
Greeley	0.00	0.00	0	Kearny	0.00	0.07	NE
Lane	0.06	0.03	-50	Meade	0.15	0.05	-63
Logan	0.00	0.00	0	Morton	0.10	0.04	-57
Norton	0.30	0.21	-32	Seward	0.27	0.05	-83
Rawlins	0.01	0.01	50	Stanton	0.08	0.01	-82
Scott	0.00	0.02	NE	Stevens[a]	0.00	0.43	NA
Sheridan	0.02	0.02	-25	**Region**	**0.16**	**0.11**	**-33***
Sherman	0.00	0.00	0		Osage Cuestas		
Thomas	0.00	0.00	0	Allen	0.07	0.19	180
Wallace	0.00	0.00	0	Bourbon	0.09	0.01	-93
Region	**0.05**	**0.03**	**-36**	Cherokee	0.00	0.00	0
	South-Central Prairies			Coffey	0.18	0.36	105
Barber	0.24	0.17	-31	Franklin	0.01	0.01	-50
Comanche	0.16	0.01	-91	Labette	0.01	0.03	200
Harvey	0.05	0.12	143	Miami	0.10	0.21	112
Kingman	0.32	0.13	-60	Montgomery	0.31	0.19	-40
Kiowa	0.11	0.19	63	Neosho	0.12	0.11	-8
Pawnee	0.01	0.03	300	Osage	0.19	0.12	-36
Pratt	0.12	0.18	47	Wilson	0.05	0.09	71
Reno	0.63	0.13	-80	**Region**	**0.10**	**0.12**	**16**
Stafford	0.43	0.33	-23				
Region	**0.23**	**0.14**	**-38**	**Statewide**	**0.20**	**0.12**	**-39***

*Values are significant at a $P < 0.10$.

[a]Route was not sampled in consecutive years and wasn't included in regional or statewide comparisions

Table 5. Annual regional changes in quail chick per adult (C/A), chicks per brood (C/B), and broods/adult, 2018.

Region	2017 C/A	2018 C/A	%Δ	2017 C/B	2018 C/B	%Δ	2017 B/A	2018 B/A	%Δ
Flint Hills	1.7	1.1	-36	6.7	7.9	18	0.23	0.12	-49
Glaciated Plains	3.4	2.5	-26	5.8	8.0	38	0.08	0.28	231
Northern High Plains	2.5	1.1	-57	7.7	8.0	4	0.29	0.13	-53
Osage Cuestas	1.3	1.3	3	9.3	11.0	18	0.11	0.09	-17
Smoky Hills	3.0	1.5	-50	9.5	8.4	-11	0.22	0.11	-47
South-Central Prairies	1.8	0.9	-46	8.6	8.9	3	0.18	0.10	-46
Southern High Plains	1.7	1.2	-31	8.2	6.5	-20	0.03	0.09	181
Statewide	2.2	1.3	-41	8.5	8.4	-1	0.18	0.11	-36

Table 6. Annual regional changes in mean turkey per mile (T/M), 2018.

Route	2017 T/M	2018 T/M	[a]% Δ	Route	2017 T/M	2018 T/M	% Δ
	Northeast				Northcentral		
Atchison	0.05	0.05	0	Barton	0.04	0.31	650
Brown	0.21	0.14	-34	Cloud	0.30	0.11	-64
Dickinson	0.07	0.37	400	Ellis	0.27	0.03	-90
Doniphan	0.00	0.02	NE	Jewell	0.23	0.53	131
Franklin	0.12	0.49	306	Mitchell	0.26	0.05	-80
Geary	0.60	0.38	-37	Osborne	0.21	0.34	65
Jackson	0.95	0.80	-16	Phillips	0.10	0.12	23
Jefferson	0.47	0.81	73	Republic	0.05	0.23	343
Marshall	0.23	0.22	-3	Rooks	0.07	0.00	-100
Morris	0.86	0.50	-42	Rush	0.11	0.02	-80
Osage	0.46	0.69	50	Russell	0.13	0.15	15
Pottawatomie	0.47	0.14	-70	Saline	0.56	1.15	105
Wabaunsee	0.26	0.43	67	Smith	0.00	0.22	NA
Region	**0.37**	**0.39**	**6**	**Region**	**0.18**	**0.25**	**40**
	Northwest				Southcentral		
Cheyenne	0.35	0.14	-60	Barber	0.37	0.00	-100
Decatur	0.36	0.09	-76	Comanche	0.00	0.00	0
Graham	0.00	0.00	0	Harvey	0.33	0.18	-46
Norton	0.06	0.15	150	Kingman	0.29	0.21	-25
Rawlins	0.01	0.04	275	Kiowa	0.00	0.00	0
Sheridan	0.15	0.09	-41	Meade	0.00	0.00	0
Sherman	0.00	0.00	0	Pawnee	0.16	0.30	88
Thomas	0.05	0.22	320	Pratt	0.00	0.00	0
Region	**0.12**	**0.09**	**-27**	Reno	0.31	0.37	21
	Southwest			Rice	0.11	0.08	-27
Finney	0.00	0.00	0	Stafford	0.49	0.91	85
Gove	0.00	0.00	0	**Region**	**0.19**	**0.19**	**0**
Gray	0.00	0.00	0		Southeast		
Greeley	0.00	0.00	0	Allen	0.17	0.03	-79
Hamilton	0.00	0.00	0	Bourbon	0.01	0.30	4500
Haskell	0.00	0.00	0	Cherokee	0.00	0.00	0
Hodgeman	0.08	0.00	-100	Coffey	0.03	0.09	175
Kearny	0.00	0.00	0	Cowley	0.76	0.49	-36
Lane	0.00	0.00	0	Elk	0.18	0.09	-51
Logan	0.00	0.00	0	Greenwood	0.20	0.18	-12
Morton	0.00	0.00	0	Labette	0.12	0.19	57
Ness	0.09	0.27	208	Marion	0.08	0.16	93
Scott	0.00	0.00	0	Miami	0.43	0.39	-11
Seward	0.04	0.00	-100	Montgomery	0.08	0.30	294
Stanton	0.00	0.00	0	Neosho	0.33	0.24	-28
Stevens[a]	NA	0.00	NA	Wilson	0.30	0.21	-31
Trego	0.00	0.00	0	**Region**	**0.21**	**0.21**	**-1**
Wallace	0.06	0.09	38				
Region	**0.02**	**0.13**	**725**	**Statewide**	**0.17**	**0.19**	**8**

*Values are significant at a $P < 0.10$.

[a]Route was not sampled in consecutive years and wasn't included in regional or statewide comparisions

Table 7. Annual regional changes in turkey poults per hen (P/H), poults per brood (P/B), and broods per hen (B/H), 2018.

Region	2017 P/H	2018 P/H	%Δ	2017 P/B	2018 P/B	%Δ	2017 B/H	2018 B/H	%Δ
Northcentral	2.2	2.4	8	5.7	4.5	-21	0.36	0.52	46
Northeast	1.2	1.7	40	5.4	5.2	-3	0.19	0.32	68
Northwest	1.6	1.8	12	4.2	3.5	-15	0.29	0.50	70
Southcentral	1.8	0.6	-68	6.0	6.1	0	0.29	0.09	-69
Southeast	1.3	1.7	28	5.2	5.5	5	0.26	0.30	18
Southwest	0.0	0.5	0	0.0	2.6	0	0.00	0.15	NE
Statewide	1.4	1.5	1	5.4	5.0	-8	0.25	0.29	17

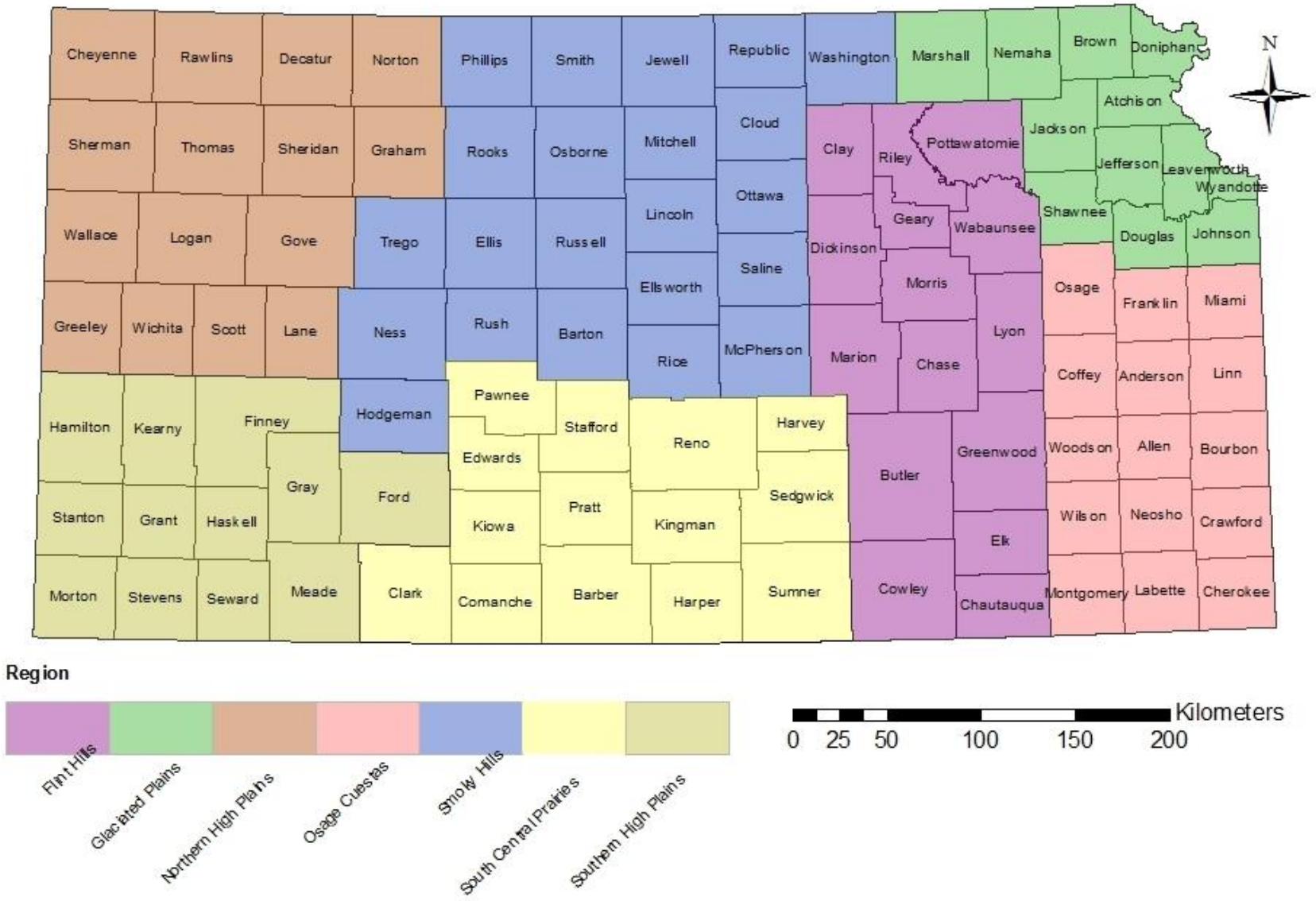

Figure 1. Kansas Small Game Regions.

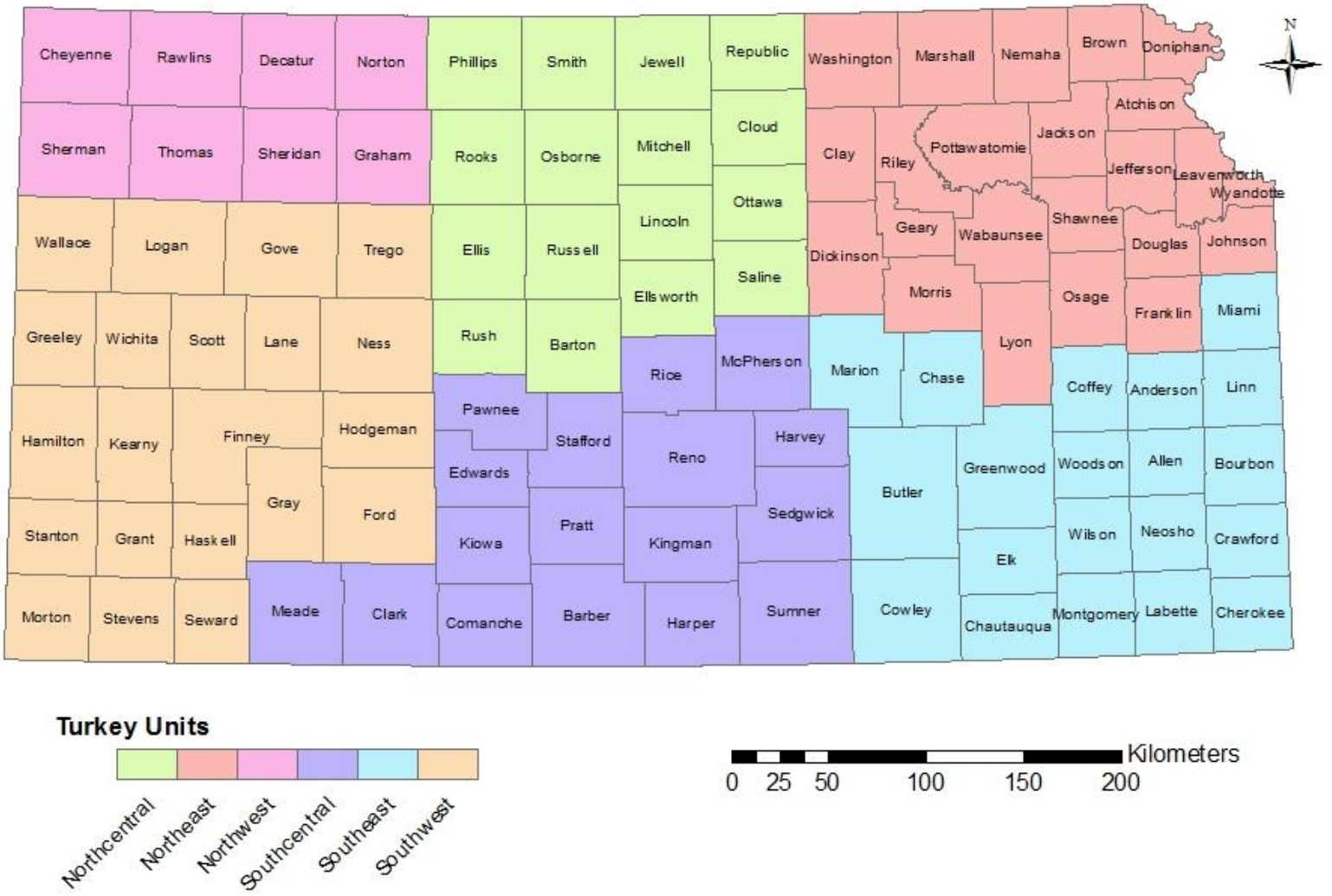

Figure 2. Kansas Turkey Management Regions.

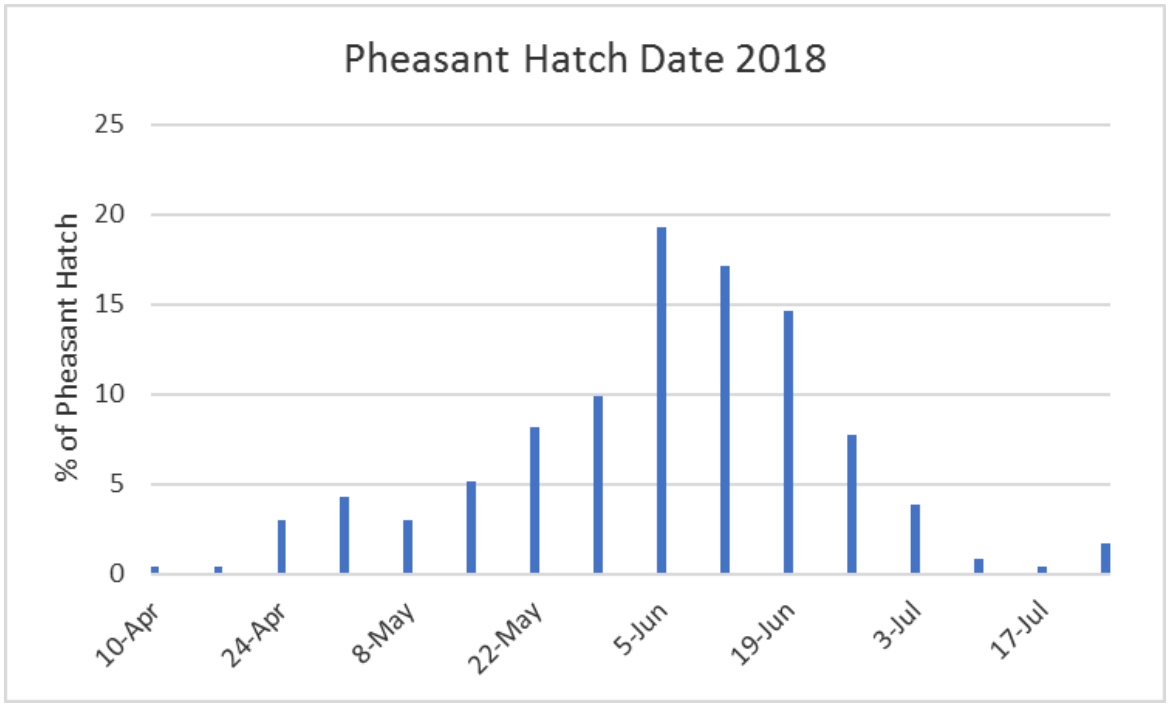

Figure 3. Weekly hatch dates of pheasant broods estimated from age at detection.

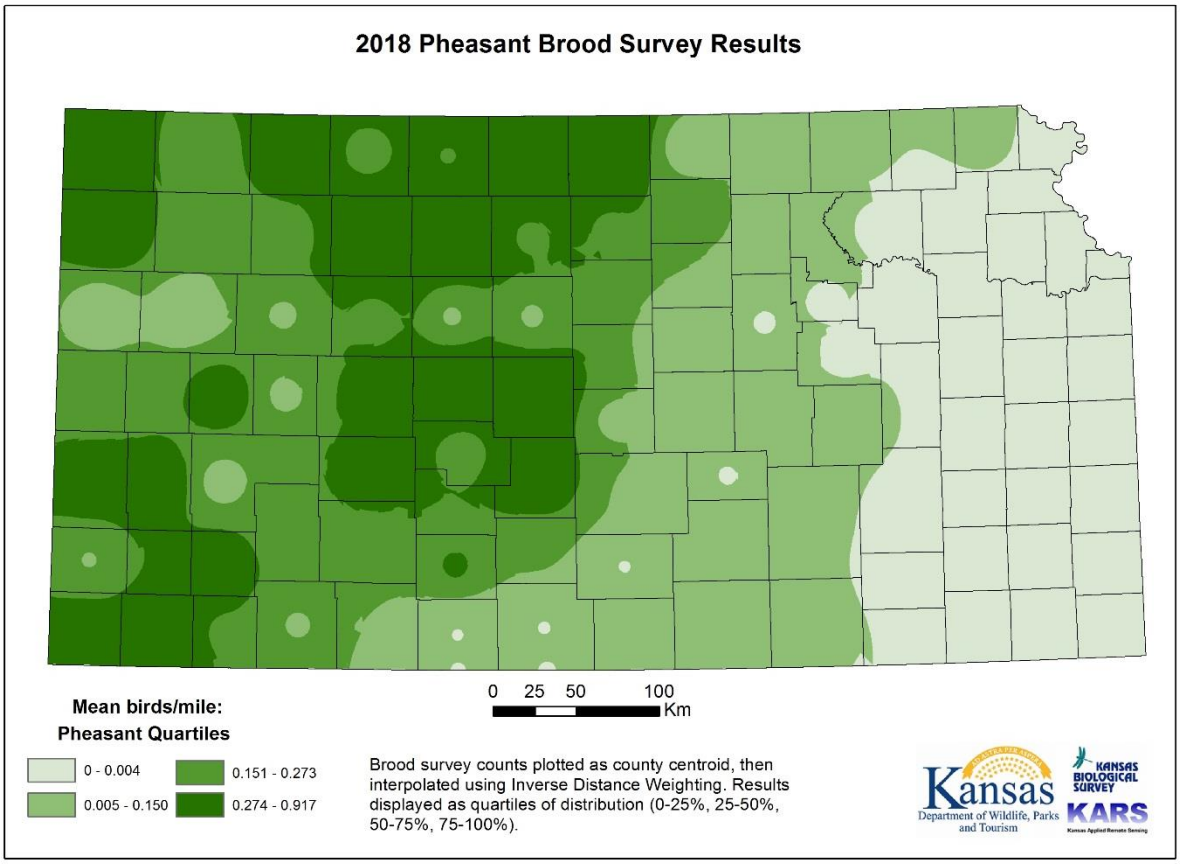

Figure 4. Relative pheasant densities estimated from brood survey routes in Kansas, 2018.

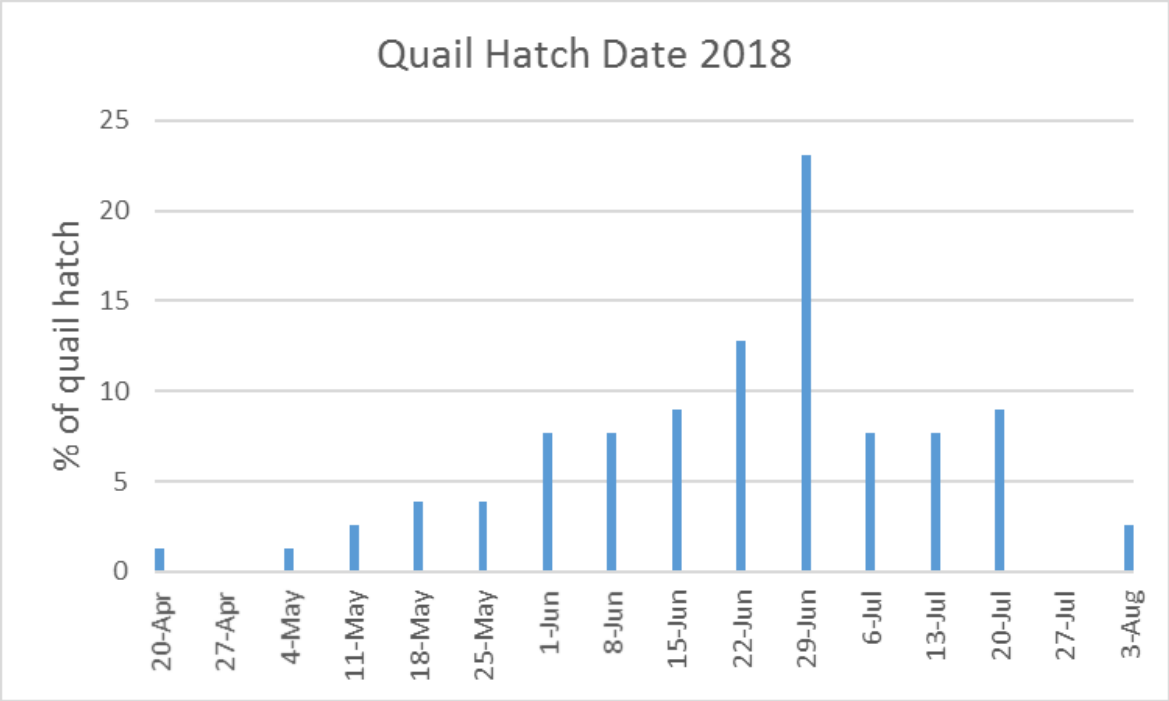

Figure 5. Weekly hatch dates of quail broods estimated from age at detection.

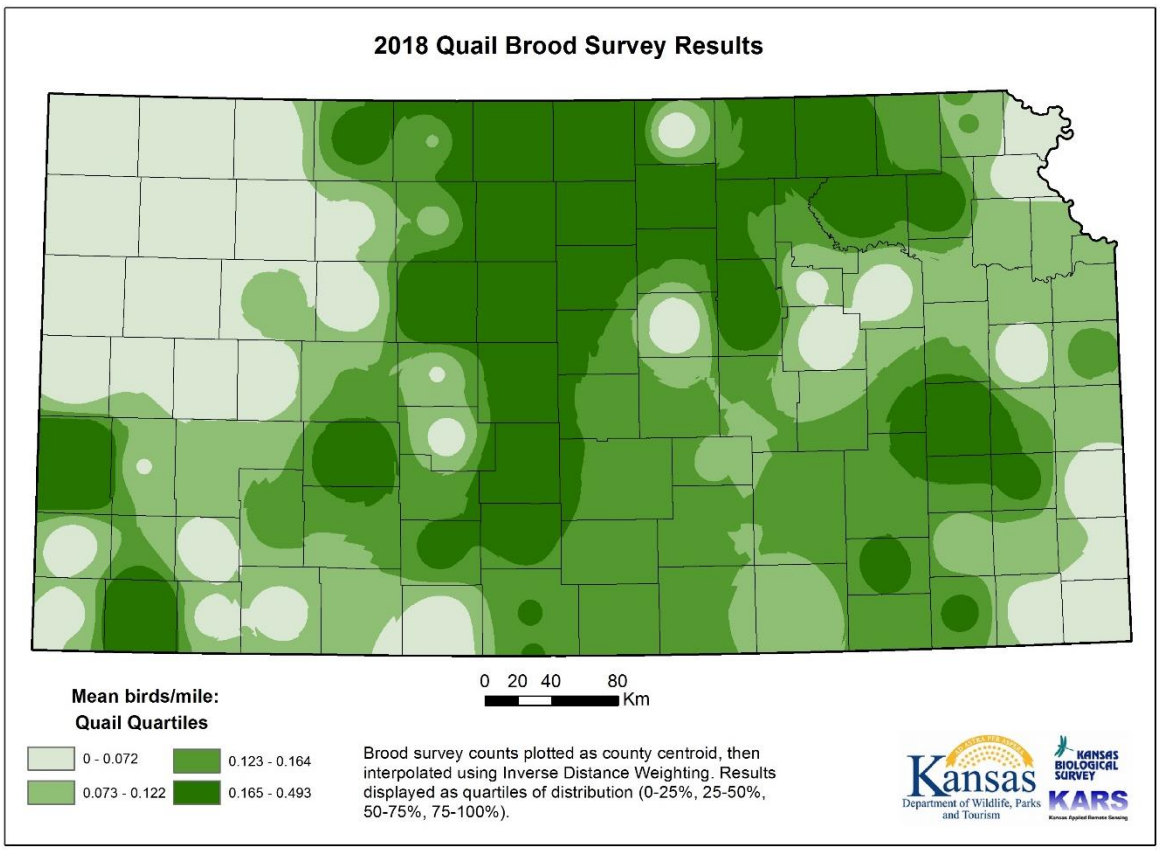

Figure 6. Relative quail densities estimated from brood survey routes in Kansas, 2018.

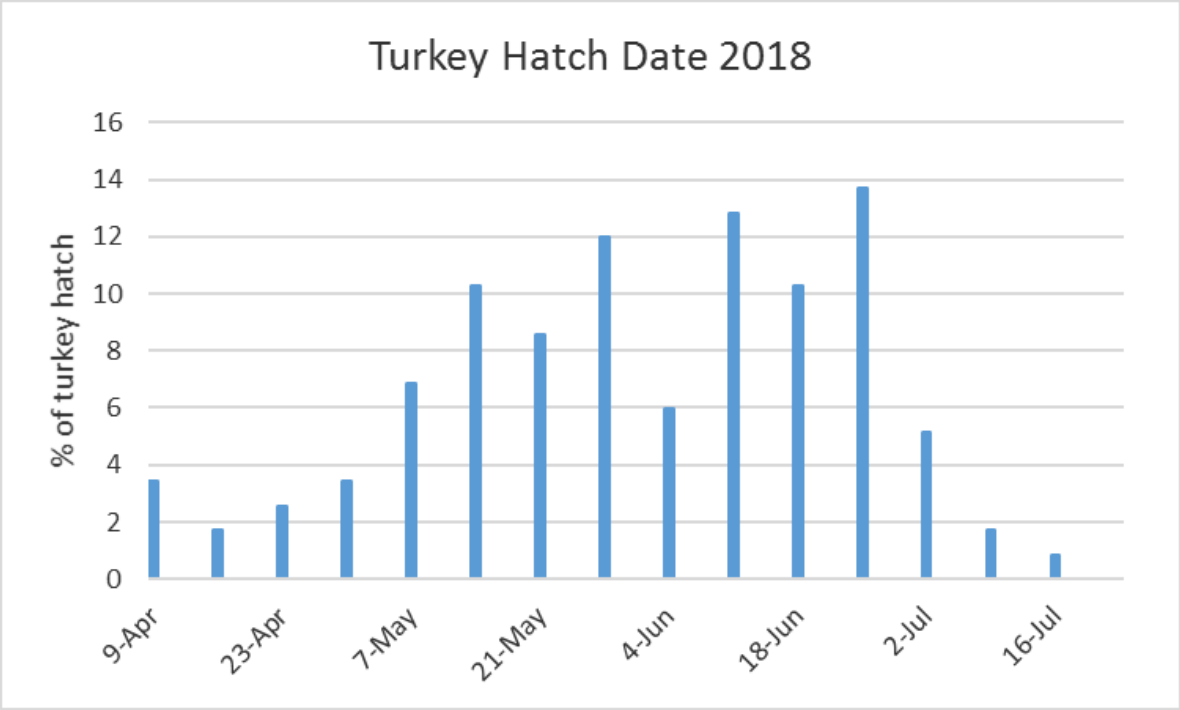

Figure 7. Weekly hatch dates of turkey broods estimated from age at detection.

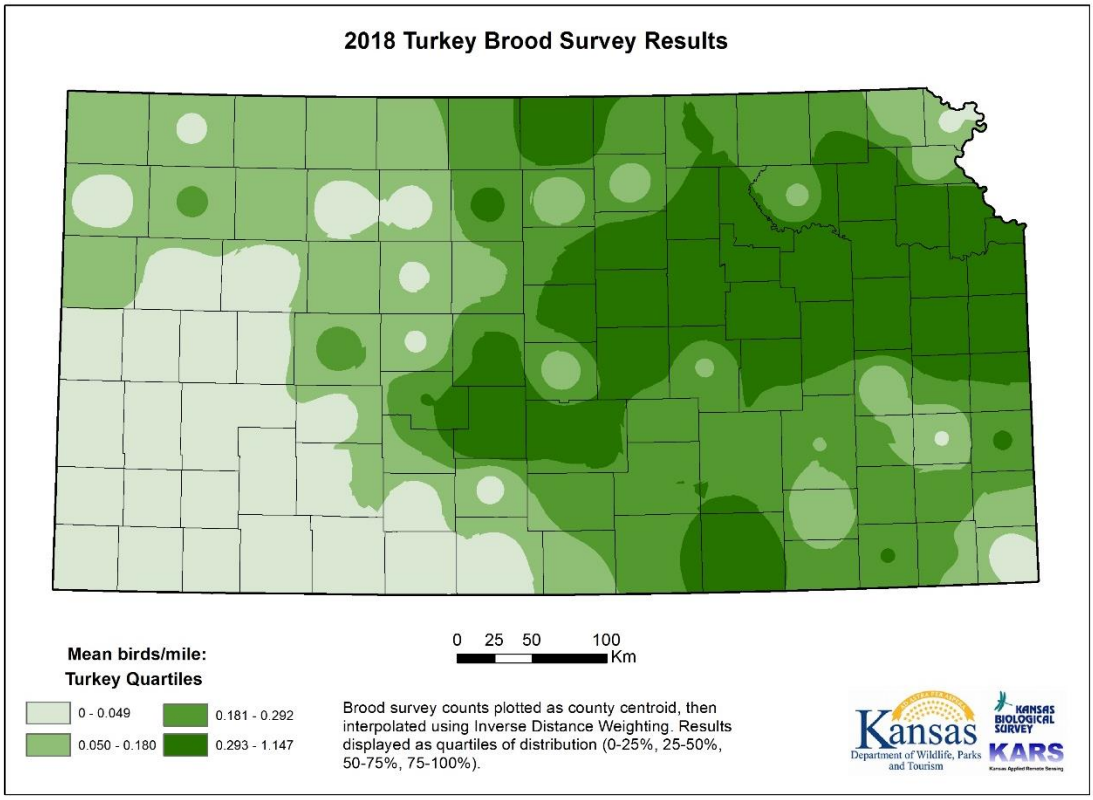

Figure 8. Relative turkey densities estimated from brood survey routes in Kansas, 2018.