QUAIL, PHEASANT, & TURKEY BROOD SURVEY - 2019

Performance Report

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QUAIL, PHEASANT, AND TURKEY BROOD SURVEY RESULTS – 2019

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% data). Summer brood surveys were initiated in 1986 focusing on pheasant and quail. Turkey data were not collected and reported until 2006. These summer brood surveys 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 2019 summer brood survey were from July 21 – August 31 (6 weeks). Survey protocol and methodology changed in 2012 to establish permanent brood routes averaging 35 miles (29-49 miles) 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 beginning at sunrise, driving the route 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, 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. 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. Eliminates 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 routes and regions. 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 (Figure 1). In considering the brood to hen ratios, broods that are observed without hens are removed to remove bias from the % 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 ARC GIS Inverse Weighted Distance technique, which interpolates data across a landscape between known points. Inverse Distance Weighting was used per species by assigning the route-specific index to the centroid of the county sampled. This provides a unique 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 74 of 76 established routes between July 20 and September 2. There were eight of the remaining routes that were not completed the requested 4 runs during the survey period (Table1). This was largely attributed to flooding and road conditions associated with heavy rainfall throughout the survey period. Results are summarized by Kansas Small Game Regions (Figure 1) or Turkey Regions accordingly (Figure 2).

Pheasants

For 2019, there was a non-significant decrease in the statewide roadside index of pheasants (-9%) compared to 2018. No statistically significant changes occurred in any regional estimate this year. Pheasants per mile was highest in the Northern High Plains, with the highest index in Decatur County (Table 2). Similar to last year, few pheasants were detected in the Flint Hills or Glaciated plains regions. Most notably, pheasants were observed in Dickinson County again after none being observed in 2018, and Marion county decreased after a marked improvement last year. No pheasants were detected in the Osage Cuestas of southeastern Kansas.

Statewide production indices were all increased this year compared to 2018 (Table 3). Production indices were generally greatest in the South-Central Prairies this year, however similar across all major pheasant regions (Table 3). The production indices generally increased across all regions except the Flint Hills (Table 3). The Flint Hills region has few overall brood observations annually and are highly influenced by a few observations. Only 2 broods and no hens were observed in the Glaciated Plains this year. Pheasant hatch peaked statewide in early to mid-June, but the nesting season was overall longer with the wet conditions (Figure 3). Pheasant indices were generally highest in the Northern high plains and on the eastern portions of the High Plains regions (Figure 4).

Quail

There was a non-significant increase in the statewide roadside index of quail (+7%) compared to 2018. A statistically significant increase occurred in the Smoky Hills (+46%, Table 4). No other statistically significant regional changes were observed this year, however apparent large changes were recorded in the Osage Cuestas (-43%) and Northern High Plains (+49%). While some regional patterns emerge, many regional changes were obscured by large offsetting changes on routes within the regions. Quail densities were greatest in the Smoky Hills followed by South-Central Prairie Region, with the highest index recorded in Rooks County (Table 4). Scaled quail were recorded on 2 routes this year in the Southern High Plains, with the highest number recorded on the Hamilton County route.

Statewide production indices were all increased this year compared to 2018 (Table 5). Despite fewer overall observations, production indices were generally highest in the south-central prairies; indicating that the region likely had the greatest % nesting success this year (Table 5). However, broods per adult was greatest in the smoky hills greatly improving from 2018 (Table 5). Quail hatch peaked in late June early July, however there was a robust distribution of hatch throughout the summer months (Figure 5). The highest estimated quail densities are generally in the Smoky Hills (Figure 6).

Turkey

There was a significant decrease in the statewide roadside index of turkey (-35%) compared to 2018. A statistically significant decrease occurred in the Northeast refion (-42%, Table 6). No other statistically significant decreases were observed however the all other regions except the Southwest were generally trending down (Table 6). Despite an apparent large increase in the southwest region, turkeys were only observed on 2 routes in the region with the Trego County route recording the highest relative roadside estimate this year (Table 6).

The statewide turkey production indices all decreased this as turkey populations continue to struggle (Table 7). The southwestern region had the highest production indices however turkeys were only observed on 2 routes and poults only observed on 1 route this year. Production had remained fair in the Northcentral region the last several years, however this year they had some of the worst poults per hen and broods per hen rates recorded (table 7). Turkey hatch peaked between mid-May to mid-June (Figure 7). The highest estimated turkey densities will generally be found in northeastern Kansas (Figure 8).

DISCUSSION

Kansas entered the fall of 2018 relatively dry however this did not last long. Heavy precipitation began in October and was maintained throughout much of the winter. Much of this came as winter showers instead of snow. This led to tough overall hunting conditions as many areas were inaccessible through much of the season. Snowfall that we did receive was intense at times but relatively short-lived minimizing potential for impacts to survival. No overwinter impacts were recorded for pheasant, however there were some localized survival impacts on quail, particularly in the far south western part of the state. This winter precipitation provided for an excellent soil moisture profile which stimulated growth of native grasses and winter wheat fields. This translated into some of the best nesting cover that we have observed in almost a decade. The heavy precipitation continued throughout much of the nesting season with rainfall amounts in May being above average across the entire state with most of the state receiving 300-400% above average rainfall in May (Figure 9). The heavy precipitation maintained ample cover through the summer, slowed harvest, and produced ample arthropods, but also created challenging conditions for nesting birds. Flooding was common across the state and likely impacted survival as well as displacing birds from normal habitat.

Pheasants are an important resource to Kansas. Within the last decade, estimated annual harvests have been at both extreme highs and lows. Harvest rates had returned to approximately average in response to better production conditions, however were just below average last season. Despite heavy precipitation improving nesting and brooding cover and a lengthy wheat harvest in 2019, the statewide index of pheasants did not improve. Typically, we expect pheasant densities to go up in wet years, however this year was extremely wet. Production tends to be best in years when the precipitation is near average. While the moisture greatly improves the quality of nesting cover and availability of arthropods, extreme events can cause low nest success and increased chick mortality. The far NW region, that has been the slowest to recover from the drought, appears to have had the best production this year. This is probably because this area is typically very dry, so above average rainfalls still improved conditions above what they had been. Researchers at Kansas State University working with pheasants recorded high rates of nest abandonment this year during the heavy precipitation events. Despite this, statewide estimates were similar to last years. The cover conditions appear to have been good enough that despite lower nest success, brood survival was increased, resulting in fewer but larger broods. Given that the roadside index was similar and the vegetation was greatly improved across the landscape, the 2019 hunting season will likely see slightly below average hunter success again. The Northern High Plains had the highest regional estimate of pheasants in 2019 trending up from 2018, followed closely by the Southern High Plains. The roadside index for the Smoky Hills region trended down (Figure 4).

Kansas continues to have one of the strongest quail populations in the country. Recent years have seen improved densities across many of the Great Plains states, including Kansas. This initial boom was caused by habitat changes associated with recovery from the extreme and expansive drought. While the benefits of these habitat changes have largely waned and some states have seen populations decline again, Kansas has largely maintained these higher densities thus far. Spring whistle surveys were trending down across many regions of the state, all regions except the far eastern regions, remained at or above the long-term averages. The heavy and continuous rainfall had an apparent effect on bobwhite production in our eastern regions, which had already declined back below their long-term averages. This was most apparent in the Osage Cuestas of southeast Kansas. The remaining regions remained similar or trended back up this year with the Smoky Hills making a significant increase, after decreasing last year. The southern high plains showed a slight decrease, but field reports suggest that this may be an artifact of quail habitat being more restricted and difficult to sample in that region. The Smoky Hills remained the highest regional roadside estimate this year (Figure 6). Based on roadside survey estimates we expect hunters to find a similar density to the last few years and have good hunter success.

Roadside estimates for turkeys significantly decreased this year, with all major turkey regions declining. The state-wide production indices declined again and remained very low, particularly in the measure of chicks per hen. This continues the trend that we have seen in recent years with our turkeys struggling to recruit young into the population. Given the earlier nesting chronology of turkeys and their susceptibility to riparian area flooding, it appears that very little production occurred this year. Turkey densities in the Southwest region made an apparent increase however remain extremely limited with almost all observations coming from a single route. The Northeast region had the highest roadside estimate this year, however it significantly declined from 2018 (Figure 8).

Table 1. Upland game bird brood routes and observers in Kansas, 2019.

Route	Observer	Replicates	Route	Observer	Replicates
Allen	Justin Harbit	4	Marion	Jeff Rue	4
Atchison	Tim Urban	4	Marshall	Alex Thornburg	5
Barber	Kyle Austin	4	Meade	Aaron Andrews	4
Barton	Jeff Prendergast	4	Miami	Andy Friesen	4
Bourbon	Justin Harbit	4	Mitchell	Toby Marlier	4
Brown	Tyler Warner	4	Montgomery	Darin Porter	6
Cherokee	David Jenkins	3	Morris	Brent Konen	4
Cheyenne	Abigail Athen	4	Morton	Kraig Schultz	4
Cloud	Matt Farmer	1	Neosho	Logan Martin	4
Coffey	Kelly Newman	4	Ness	Andrew Nelson	5
Comanche	Matt Hanvey	0	Norton	Luke Winge	4
Cowley	Kurt Grimm	0	Osage	Alex Lyon	4
Decatur	Daniel Howard	4	Osborne	Chris Lecuyer	4
Dickinson	Clint Thornton	4	Pawnee	Kevin Wood	4
Doniphan	Jesse Morland	4	Phillips	Michael Zajic	4
Elk	Vickie Cikanek	4	Pottawatomie	Corey Alderson	4
Ellis	Megan Rohweder	3	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	3
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	Vickie Cikanek	5	Saline	Pat Riese	3
Hamilton	Kraig Schultz	4	Scott	Brent Clark	4
Harvey	Charlie Cope	4	Seward	Jason Vajnar	4
Haskell	Kelly Lazar	4	Sheridan	Kevin Klag	4
Hodgeman	Dan Haneke	4	Sherman	Abigail Athen	4
Jackson	Tyler Warner	4	Smith	Kirk Andrews	4
Jefferson	Andrew Page	3	Stafford	Logan Shoup	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	Logan Shoup	4	Trego	Kent Hensley	4
Labette	Rob Riggin	4	Wabaunsee	Brad Rueschhoff	4
Lane	Sean Coleman	3	Wallace	Abigail Athen	4
Logan	Leonard Hopper	4	Wilson	Bob Funke	5

Table 2. Annual regional changes in mean pheasants per mile (P/M), 2019.

Route	2018 P/M	2019 P/M	% Δ
	Flint Hills		
Cowley	0.01	NA	NA
Dickinson	0.00	0.09	NE
Elk	0.00	0.00	0
Geary	0.00	0.00	0
Greenwood	0.00	0.00	0
Marion	0.06	0.01	-88
Morris	0.00	0.00	0
Pottawatomie	0.00	0.00	0
Wabaunsee	0.00	0.00	0
Region	**0.01**	**0.01**	**67**
	Glaciated Plains		
Atchison	0.00	0.00	0
Brown	0.01	0.00	-100
Doniphan	0.00	0.00	0
Jackson	0.00	0.00	0
Jefferson	0.00	0.00	0
Marshall	0.01	0.02	220
Region	**0.00**	**0.00**	**57**
	Smoky Hills		
Barton	0.60	0.26	-57
Cloud	0.21	0.23	7
Ellis	0.13	0.21	60
Hodgeman	0.34	0.72	112
Jewell	0.46	0.11	-77
Mitchell	0.26	0.04	-86
Ness	0.31	0.12	-62
Osborne	0.25	0.11	-54
Phillips	0.26	0.10	-61
Republic	0.02	0.02	33
Rice	0.12	0.31	153
Rooks	0.40	0.29	-27
Rush	0.49	0.24	-51
Russell	0.13	0.18	35
Saline	0.02	0.02	33
Smith	0.53	0.17	-68
Trego	0.23	0.36	53
Region	**0.28**	**0.20**	**-27**

Route	2018 P/M	2019 P/M	% Δ
	Northern High Plains		
Cheyenne	0.31	0.36	16
Decatur	0.35	0.68	96
Gove	0.13	0.28	112
Graham	0.92	0.63	-31
Greeley	0.18	0.53	192
Lane	0.12	0.05	-58
Logan	0.03	0.11	275
Norton	0.21	0.49	131
Rawlins	0.22	0.28	26
Scott	0.40	0.23	-42
Sheridan	0.20	0.08	-60
Sherman	0.52	0.42	-19
Thomas	0.16	0.16	0
Wallace	0.04	0.08	83
Region	**0.27**	**0.31**	**16**
	South-Central Prairies		
Barber	0.00	0.10	NE
Comanche	0.00	NA	NA
Harvey	0.00	0.00	0
Kingman	0.00	0.00	0
Kiowa	0.29	0.09	-71
Pawnee	0.21	0.26	23
Pratt	0.16	0.34	104
Reno	0.14	0.08	-42
Stafford	0.46	0.06	-87
Region	**0.16**	**0.11**	**-27**
	Southern High Plains		
Finney	0.07	0.07	0
Gray	0.19	0.27	46
Hamilton	0.36	0.22	-38
Haskell	0.39	0.41	6
Kearny	0.39	0.07	-81
Meade	0.14	0.32	128
Morton	0.33	0.10	-70
Seward	0.27	0.24	-9
Stanton	0.14	0.16	10
Stevens[a]	0.36	0.64	NA
Region	**0.26**	**0.25**	**-5**
Statewide	**0.20**	**0.18**	**-9**

* = 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), 2019.

Region	2018 C/H	2019 C/H	%Δ	2018 C/B	2019 C/B	%Δ	2018 B/H	2019 B/H	%Δ
Flint Hills	8.00	2.00	-75	4.0	6.0	50	1.00	0.33	-67
Glaciated Plains	0.00	0.00	0	0.0	2.0	NE	0.00	0.00	0
Northern High Plains	3.67	5.59	52	4.0	4.5	15	0.60	0.62	3
Osage Cuestas	0.00	0.00	0	0.0	0.0	0	0.00	0.00	0
Smoky Hills	4.07	4.94	21	4.9	4.7	-3	0.50	0.65	29
South-Central Prairies	4.11	5.47	33	4.6	5.5	19	0.57	0.65	13
Southern High Plains	4.02	5.11	27	3.3	3.5	7	0.57	0.62	8
Statewide	4.0	5.6	42	4.2	4.6	10	0.56	0.62	11

Table 4. Annual regional changes in mean quail per mile (Q/M), 2019.

Route	2018 Q/M	2019 Q/M	% Δ	Route	2018 Q/M	2019 Q/M	% Δ
	Flint Hills				Smoky Hills		
Cowley	0.08	NA	NA	Barton	0.19	0.18	-7
Dickinson	0.33	0.31	-7	Cloud	0.22	0.46	106
Elk	0.19	0.13	-31	Ellis	0.41	0.50	23
Geary	0.05	0.04	-25	Hodgeman	0.27	0.26	-3
Greenwood	0.16	0.16	-1	Jewell	0.35	0.21	-41
Marion	0.12	0.13	2	Mitchell	0.26	0.36	40
Morris	0.01	0.06	300	Ness	0.13	0.21	69
Pottawatomie	0.22	0.11	-50	Osborne	0.25	0.36	43
Wabaunsee	0.02	0.14	533	Phillips	0.12	0.18	56
Region	**0.14**	**0.13**	**-4**	Republic	0.02	0.03	100
	Glaciated Plains			Rice	0.16	0.23	45
Atchison	0.04	0.02	-50	Rooks	0.10	0.65	529
Brown	0.13	0.09	-29	Rush	0.06	0.28	333
Doniphan	0.01	0.07	900	Russell	0.17	0.09	-50
Jackson	0.24	0.24	0	Saline	0.01	0.09	967
Jefferson	0.09	0.04	-56	Smith	0.38	0.13	-67
Marshall	0.23	0.13	-45	Trego	0.01	0.34	4200
Region	**0.12**	**0.10**	**-20**	**Region**	**0.18**	**0.27**	**46***
	Northern High Plains				Southern High Plains		
Cheyenne	0.01	0.00	-100	Finney	0.10	0.01	-86
Decatur	0.04	0.21	460	Gray	0.16	0.04	-72
Gove	0.11	0.00	-100	Hamilton	0.49	0.33	-33
Graham	0.05	0.07	50	Haskell	0.00	0.00	0
Greeley	0.00	0.00	0	Kearny	0.07	0.00	-100
Lane	0.03	0.20	567	Meade	0.05	0.30	457
Logan	0.00	0.00	0	Morton	0.04	0.03	-33
Norton	0.21	0.04	-82	Seward	0.05	0.12	167
Rawlins	0.01	0.19	1200	Stanton	0.01	0.06	300
Scott	0.02	0.01	-50	Stevens	0.43	0.26	-38
Sheridan	0.02	0.00	-100	**Region**	**0.14**	**0.12**	**-17**
Sherman	0.00	0.02	NE		Osage Cuestas		
Thomas	0.00	0.00	0	Allen	0.19	0.10	-46
Wallace	0.00	0.00	0	Bourbon	0.01	0.03	300
Region	**0.03**	**0.05**	**49**	Cherokee	0.00	0.00	0
	South-Central Prairies			Coffey	0.36	0.10	-73
Barber	0.17	0.04	-76	Franklin	0.01	0.04	400
Comanche	0.01	NA	NA	Labette	0.03	0.02	-50
Harvey	0.12	0.01	-88	Miami	0.21	0.04	-81
Kingman	0.13	0.15	17	Montgomery	0.19	0.08	-57
Kiowa	0.19	0.43	131	Neosho	0.11	0.19	68
Pawnee	0.03	0.04	50	Osage	0.12	0.14	12
Pratt	0.18	0.17	-4	Wilson	0.09	0.03	-67
Reno	0.13	0.24	89	**Region**	**0.12**	**0.07**	**-43**
Stafford	0.33	0.14	-58				
Region	**0.16**	**0.15**	**-3**	**Statewide**	**0.13**	**0.14**	**7**

*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, 2019.

Region	2018 C/A	2019 C/A	%Δ	2018 C/B	2019 C/B	%Δ	2018 B/A	2019 B/A	%Δ
Flint Hills	1.1	1.4	22	7.9	8.7	10	0.12	0.08	-34
Glaciated Plains	2.5	0.8	-68	8.0	8.3	3	0.28	0.05	-82
Northern High Plains	1.1	3.2	204	8.0	8.5	6	0.13	0.14	7
Osage Cuestas	1.3	0.6	-51	11.0	7.1	-35	0.09	0.06	-26
Smoky Hills	1.5	2.9	98	8.4	8.8	5	0.11	0.23	108
South-Central Prairies	0.9	3.4	260	8.9	11.1	25	0.10	0.10	7
Southern High Plains	1.2	2.5	107	6.5	8.0	23	0.09	0.14	55
Statewide	1.3	2.1	60	8.4	8.8	5	0.11	0.14	21

Table 6. Annual regional changes in mean turkey per mile (T/M), 2019

Route	2018 T/M	2019 T/M	[a]% Δ	Route	2018 T/M	2019 T/M	% Δ
	Northeast				Northcentral		
Atchison	0.05	0.22	329	Barton	0.31	0.06	-80
Brown	0.14	0.05	-63	Cloud	0.11	0.11	7
Dickinson	0.37	0.00	-100	Ellis	0.03	0.13	400
Doniphan	0.02	0.07	233	Jewell	0.53	0.52	-1
Franklin	0.49	0.26	-48	Mitchell	0.05	0.02	-57
Geary	0.38	0.08	-79	Osborne	0.34	0.34	-2
Jackson	0.80	0.68	-15	Phillips	0.12	0.15	25
Jefferson	0.81	0.21	-74	Republic	0.23	0.00	-100
Marshall	0.22	0.29	29	Rooks	0.00	0.03	NE
Morris	0.50	0.15	-69	Rush	0.02	0.01	-33
Osage	0.69	0.48	-31	Russell	0.15	0.28	87
Pottawatomie	0.14	0.24	71	Saline	1.15	0.18	-84
Wabaunsee	0.43	0.19	-57	Smith	0.22	0.04	-83
Region	**0.39**	**0.22**	**-42***	**Region**	**0.25**	**0.14**	**-42**
	Northwest				Southcentral		
Cheyenne	0.14	0.47	235	Barber	0.00	0.06	NE
Decatur	0.09	0.11	25	Comanche	0.00	NA	NA
Graham	0.00	0.00	0	Harvey	0.18	0.45	150
Norton	0.15	0.09	-40	Kingman	0.21	0.06	-73
Rawlins	0.04	0.00	-100	Kiowa	0.00	0.00	0
Sheridan	0.09	0.00	-100	Meade	0.00	0.00	0
Sherman	0.00	0.00	0	Pawnee	0.30	0.14	-52
Thomas	0.22	0.00	-100	Pratt	0.00	0.00	0
Region	**0.09**	**0.08**	**-7**	Reno	0.37	0.32	-13
	Southwest			Rice	0.08	0.00	-100
Finney	0.00	0.00	0	Stafford	0.91	0.03	-97
Gove	0.00	0.00	0	**Region**	**0.21**	**0.11**	**-48**
Gray	0.00	0.00	0		Southeast		
Greeley	0.00	0.00	0	Allen	0.03	0.06	80
Hamilton	0.00	0.00	0	Bourbon	0.30	0.05	-85
Haskell	0.00	0.00	0	Cherokee	0.00	0.08	NE
Hodgeman	0.00	0.00	0	Coffey	0.09	0.00	-100
Kearny	0.00	0.00	0	Cowley	0.49	NA	NA
Lane	0.00	0.00	0	Elk	0.09	0.09	0
Logan	0.00	0.00	0	Greenwood	0.18	0.10	-43
Morton	0.00	0.00	0	Labette	0.19	0.00	-100
Ness	0.27	0.00	-100	Marion	0.16	0.04	-74
Scott	0.00	0.00	0	Miami	0.39	0.69	76
Seward	0.00	0.00	0	Montgomery	0.30	0.14	-52
Stanton	0.00	0.00	0	Neosho	0.24	0.04	-85
Stevens[a]	0.00	0.00	0	Wilson	0.21	0.21	3
Trego	0.00	0.91	NE	**Region**	**0.18**	**0.13**	**-31**
Wallace	0.09	0.01	-84				
Region	**0.03**	**0.05**	**88**	**Statewide**	**0.19**	**0.12**	**-35***

*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), 2019.

Region	2018 P/H	2019 P/H	%Δ	2018 P/B	2019 P/B	%Δ	2018 B/H	2019 B/H	%Δ
Northcentral	2.4	0.3	-86	4.5	4.0	-12	0.52	0.08	-86
Northeast	1.7	1.9	15	5.2	5.0	-4	0.32	0.32	-1
Northwest	1.8	1.4	-19	3.5	3.5	0	0.50	0.34	-31
Southcentral	0.6	1.7	207	6.1	4.2	-30	0.09	0.40	339
Southeast	1.7	0.6	-65	5.5	4.5	-17	0.30	0.13	-57
Southwest	0.5	2.4	384	2.6	5.4	106	0.15	0.45	194
Statewide	1.5	1.1	-23	5.0	4.6	-9	0.29	0.23	-21

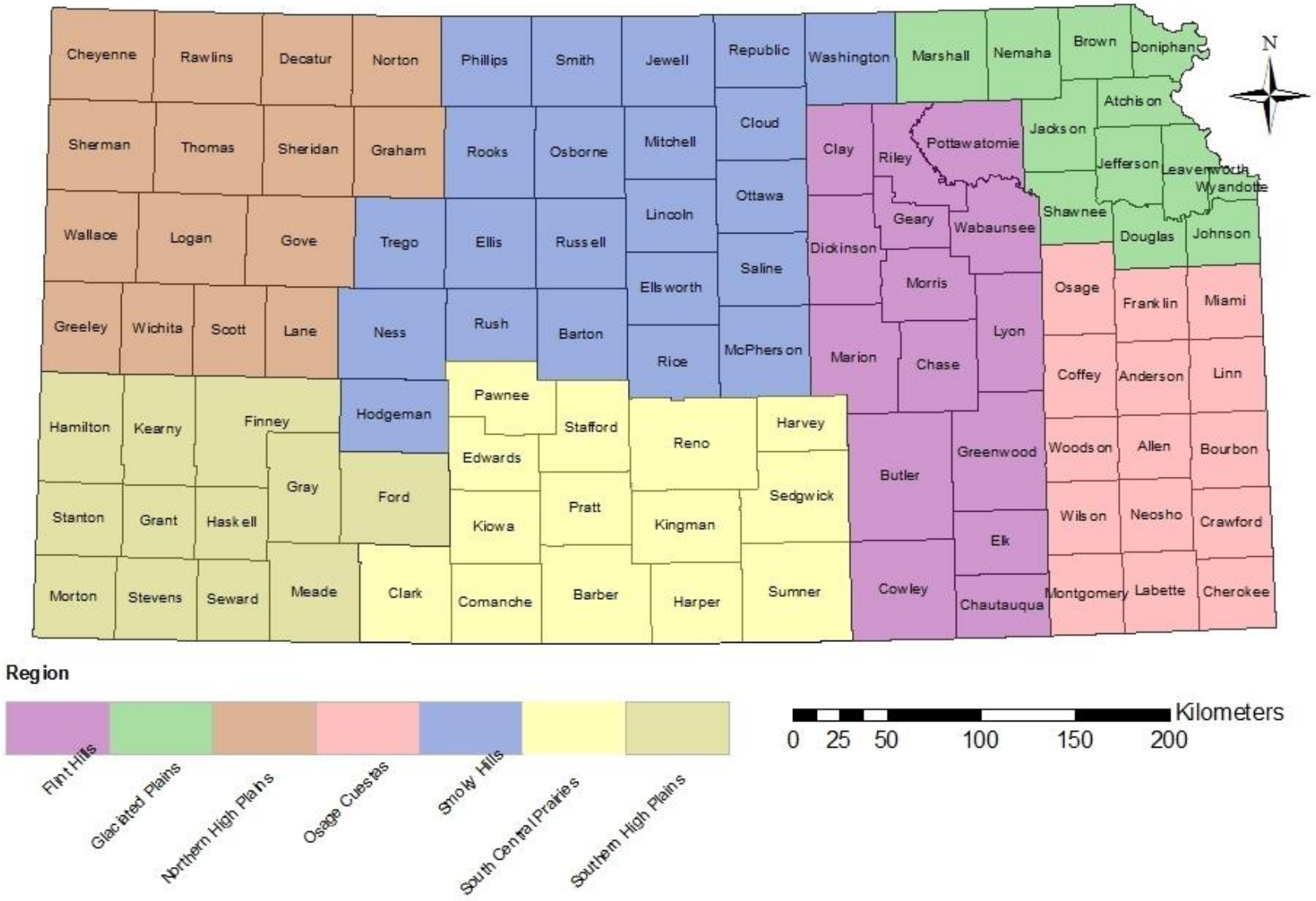

Figure 1. Kansas Small Game Regions.

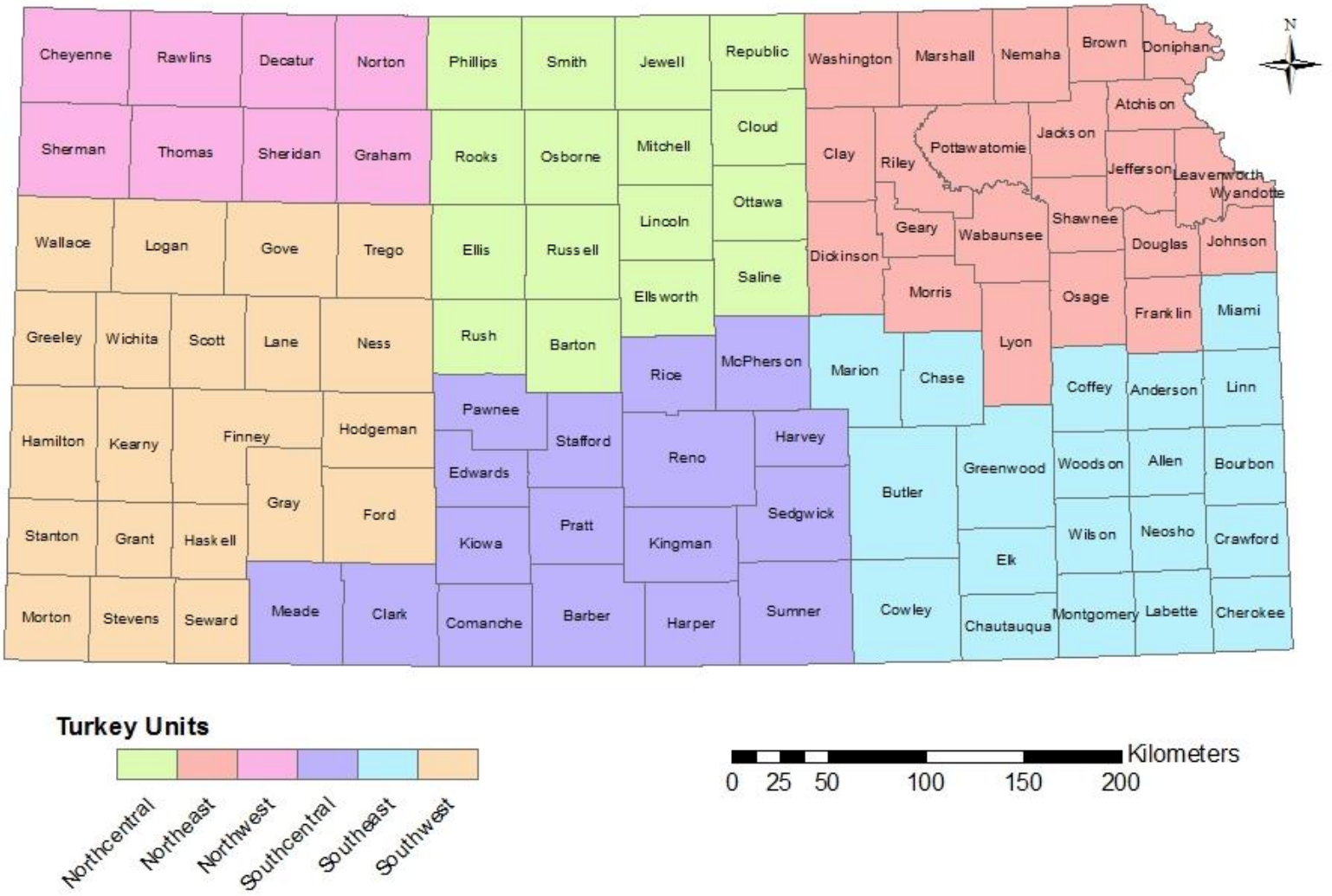

Figure 2. Kansas Turkey Management Regions.

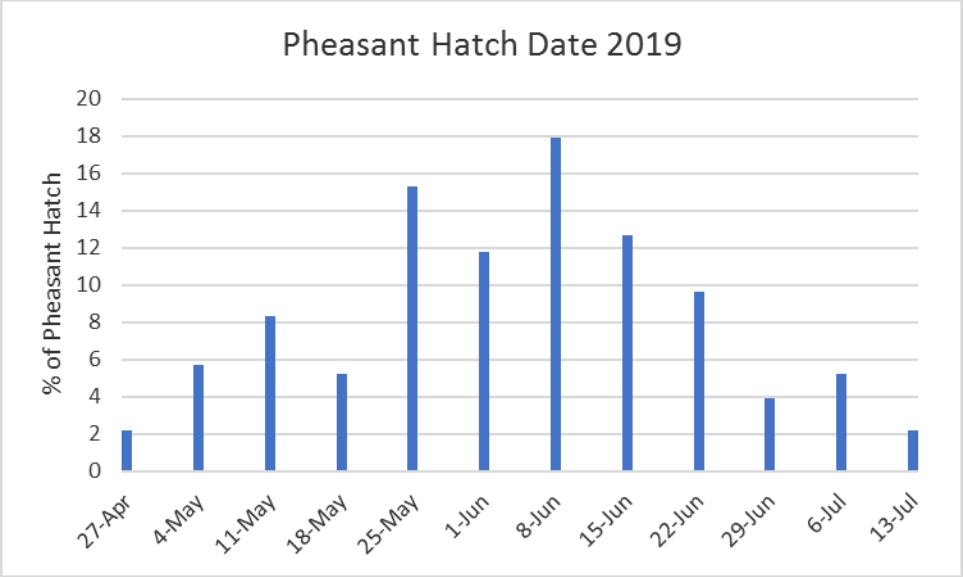

Figure 3. Weekly hatch dates of pheasant broods estimated from age at detection.

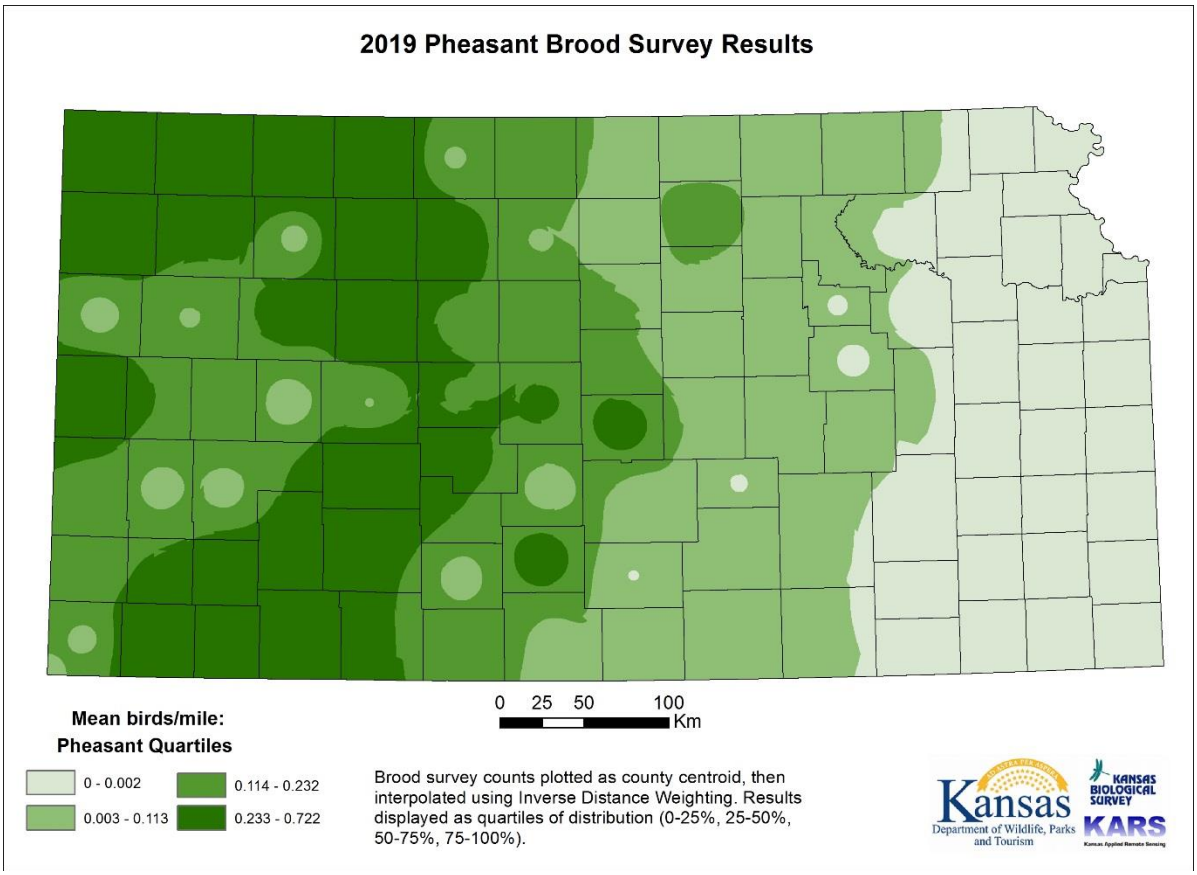

Figure 4. Relative pheasant densities estimated from brood survey routes in Kansas, 2019.

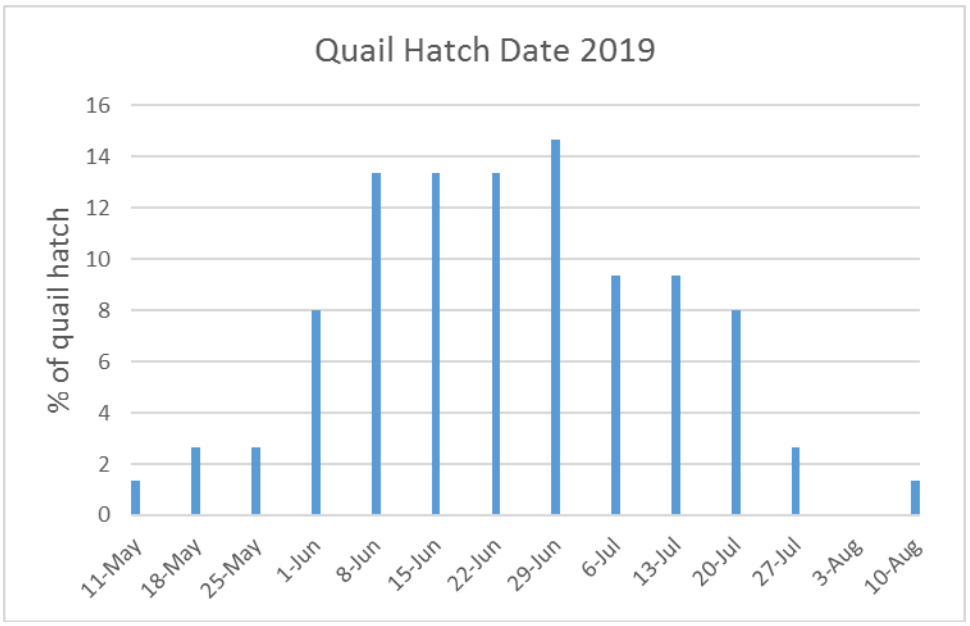

Figure 5. Weekly hatch dates of quail broods estimated from age at detection.

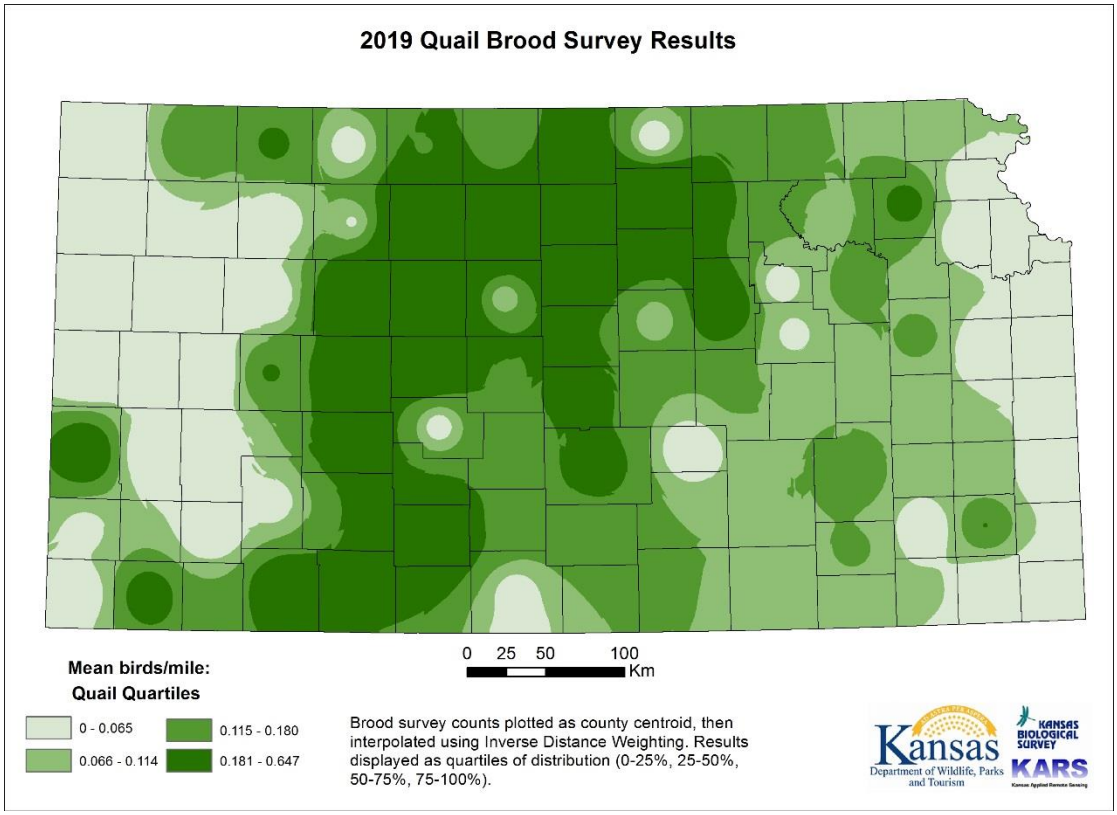

Figure 6. Relative quail densities estimated from brood survey routes in Kansas, 2019.

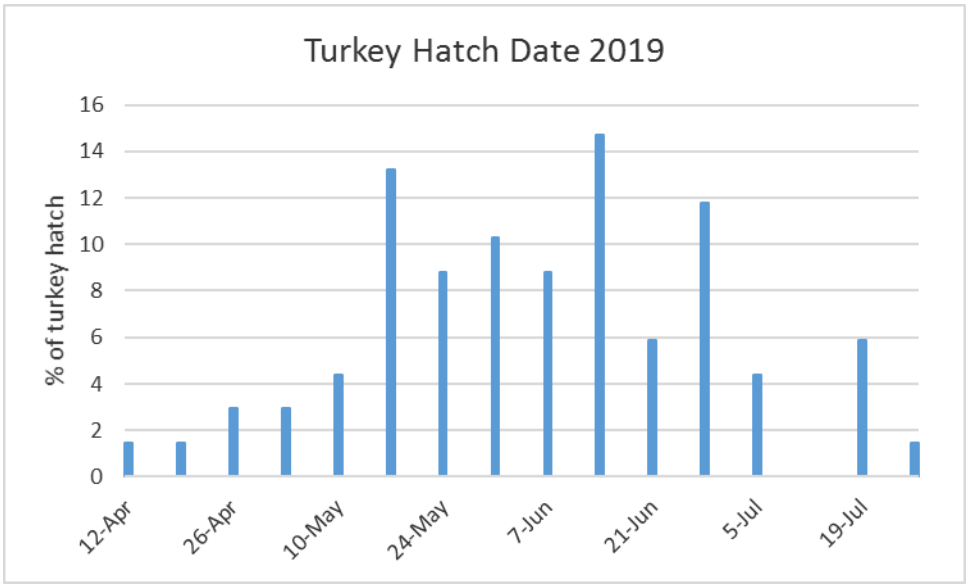

Figure 7. Weekly hatch dates of turkey broods estimated from age at detection.

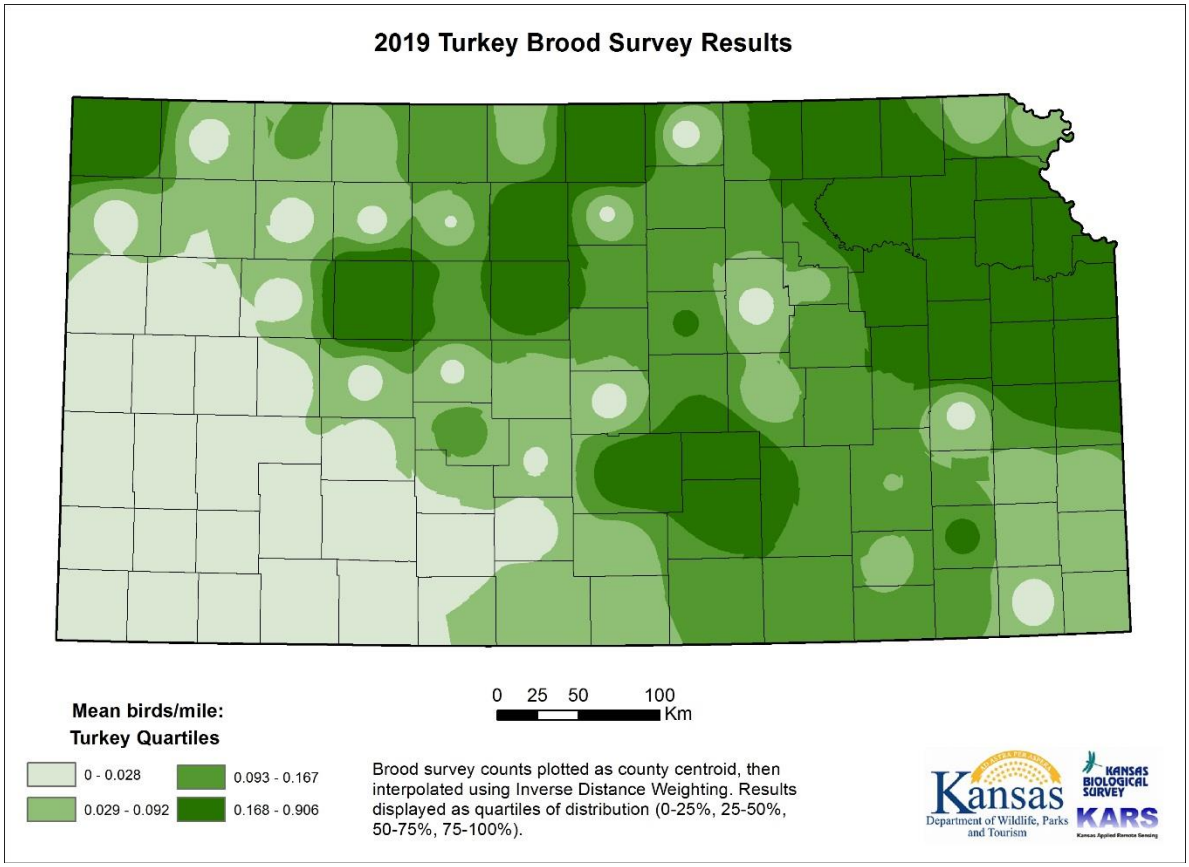

Figure 8. Relative turkey densities estimated from brood survey routes in Kansas, 2019.

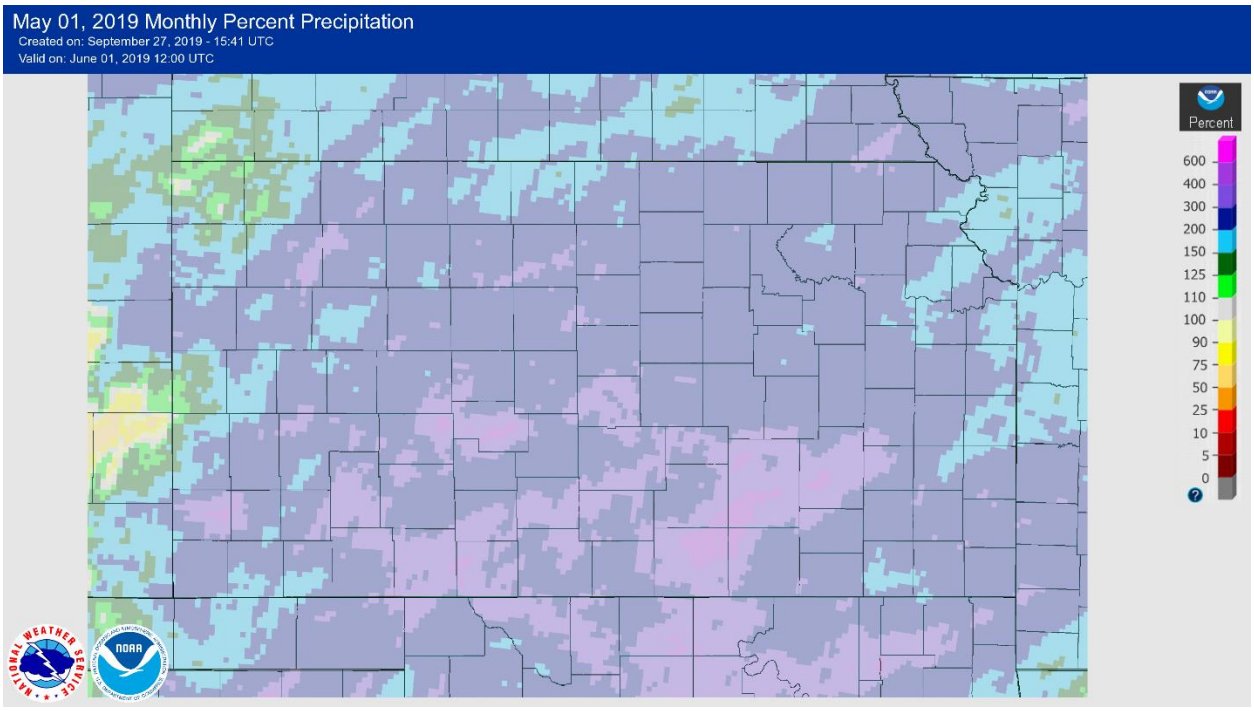

Figure 9. National Oceanic and Atmospheric Administration's Predicted monthly rainfall departure from normal in Kansas for the month of May 2019.