Iowa Spring Spotlight Survey: 2022 Summary

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ABSTRACT The Iowa Department of Natural Resources conducts nocturnal spotlight surveys from mid-March to mid-May, annually. Spotlight surveys are conducted in all 99 Iowa counties and total ~4,780 mi ($\bar{x}$ = ~50 mi/county) of surveyed rural roads. In 2022, a total of 24,492 wildlife observations were recorded, with white-tailed deer (*n* = 17,103), raccoon (*n* = 6,486), striped skunk (*n* = 270), opossum (*n* = 268), and house cat (*n* = 143) most frequently observed. Counts for deer, raccoon, coyote, opossum, and skunk increased, whereas counts for red fox, badger, bobcat, mink, and house cat were relatively stable.

INTRODUCTION

Data capable of estimating wildlife abundance are often difficult, expensive, and time consuming to collect, particularly for rare or elusive species, or species that exist across large geographic areas. Standardized sampling methods, however, may provide consistent indices of populations over time. Reliable indices are important for understanding population trends and the factors affecting populations, including environmental conditions (Progulske and Duerre 1964, Fujisaki et al. 2011), regulated harvest (Carrillo et al. 2000), and disease (Gehrt et al. 2006). One common method, the nocturnal spotlight survey, has been used since the mid-20th Century and provides wildlife managers a cost-effective and easily implemented option to sample wildlife populations (SDDGFP 1950; Anderson 1959). Spotlight counts have been used to produce indices for species such as opossum (*Didelphis virginiana*; Gehrt et al. 2006), raccoon (*Procyon lotor*; Gehrt et al. 2002), red fox (*Vulpes vulpes* ; Ruette et al. 2003), and white-tailed deer (*Odocoileus virginianus*; Rybarczyk 1978, Kaminski et al. 2019).

In 1978, the Iowa Department of Natural Resources (Iowa DNR; formerly the Iowa Conservation Commission) initiated the Spring Spotlight Survey because of concerns that all-time high raccoon pelt prices threatened an over-harvest and would negatively impact the sustainability of the population (Rybarczyk 1978). Spotlight routes were established along forested areas to survey for raccoon, although white-tailed deer were also included. In general, from 1978–1990, 85 spotlight routes were surveyed across the state, and from 1991–1995, 5 additional routes were added (Appendix A). Because forest cover may structure raccoon (Pedler et al. 1997, Beasley et al. 2007) and deer (Volk et al. 2007, Walter et al. 2009) populations in agricultural landscapes, statewide population counts using these data may be biased (McShea et al. 2011). Regardless, the trends resulting from this survey provided key insight into these growing populations since the 1970s (Appendix B–E).

In 2006, a new survey was developed to address deficiencies in the original design. Rather than using survey routes perpendicular to forest cover, routes were oriented longitudinally in an east–west direction to achieve a representative sample of the land cover types across the state. Several species were added to the survey, including badger (*Taxidea taxus*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), gray (*Urocyon cinereoargenteus*) and red fox, mink (*Mustela vison*), opossum, river otter (*Lontra canadensis*), striped (*Mephitis mephitis*) and spotted skunk (*Spilogale putorius*), weasels (*Mustela* sp.), white-tailed jackrabbit (*Lepus townsendii*), and woodchuck (*Marmota monax*). The new methodology was tested concurrently with the original survey and found to result in similar trends with less variability (Iowa DNR, unpublished data). Therefore, in 2012, the new survey routes were adopted in all 99 Iowa counties. The new survey design results in relatively large counts for deer, raccoon, opossum, striped skunk, coyote, and red fox. Observations for other species (e.g., gray fox, bobcat, river otter, mink), however, are more variable because of the secretive nature, low density, or low visibility for animals. Thus, a low count for these species does not necessarily imply low population abundance.

The goal of the Spring Spotlight Survey is to collect reliable, standardized, and long-term counts for select wildlife species that can be used to inform science-based management decisions in Iowa. The objectives of the survey are to 1) collect systematic observations for deer, raccoon, and select furbearer species as independent indices for populations or as

supplements to harvest and other survey data collected by the Iowa DNR and 2) monitor the long-term distribution and relative abundance of select wildlife species for population management and conservation efforts.

STUDY AREA

The Spring Spotlight Survey is conducted in each of 99 counties in the 56,239-mi^2 state of Iowa (Fig. 1). The climate is humid continental, characterized by hot, humid summers and cold winters. Average annual precipitation ranges from 24.4 inches in the northwest to 37.2 inches in the southeast (NOAA 2002a). Average annual temperatures ranges from 45.5° F in the northwest to 50.7° F in the southeast (NOAA 2002b). Land cover consists of agriculture (63%), grass and pastureland (22%), forest (10%), urban and other developed lands (2%), and wetlands, shallow lakes, and open water (2%; IA DNR 2015).

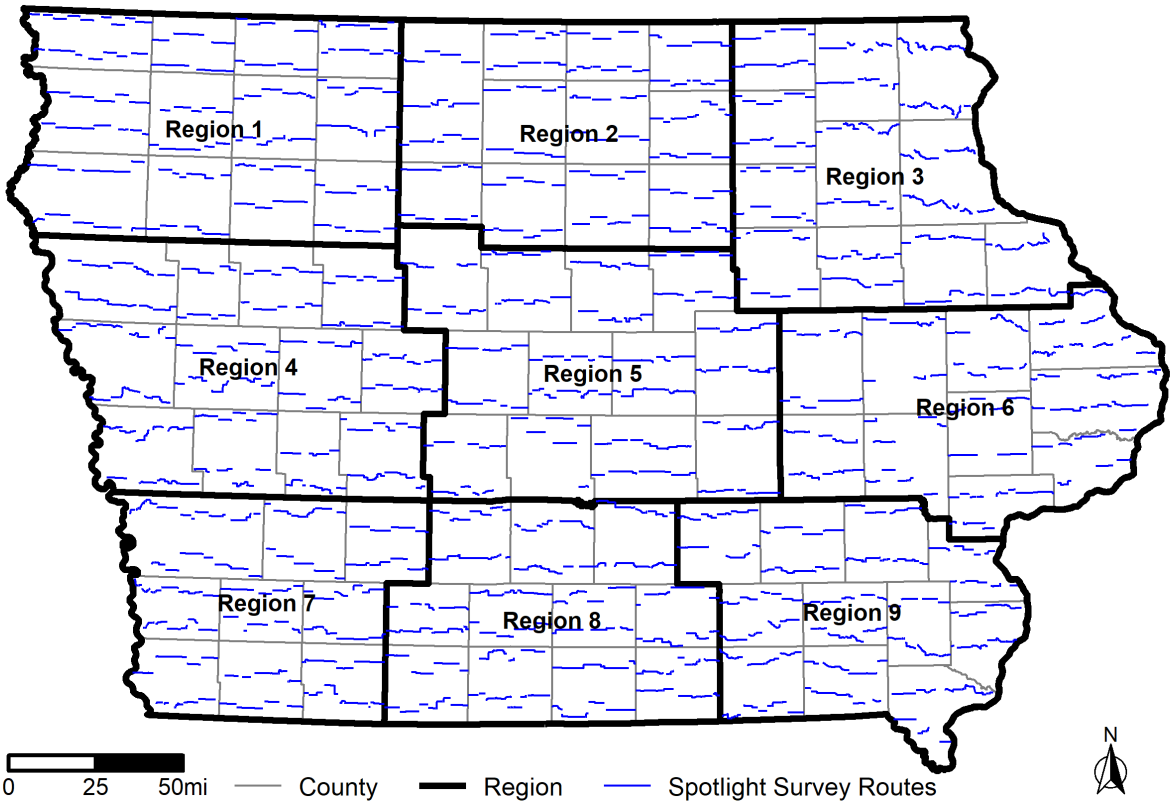

Figure 1. Spring Spotlight Survey routes (*n* = 199) in each county of Iowa and 9 regions of the state used for summarizing spotlight count data.

Table 1. Survey year, number of miles surveyed, and total number of animals observed for select species during the Spring Spotlight Survey in Iowa, 2006-present.

Year	Miles	Deer	Badger	Bobcat	Coyote	Mink	Opossum	Raccoon	Red fox	Skunk	House cat
2006[a]	4,317	9,279	9	4	56	9	136	2,417	41	133	15
2007	4,795	11,284	23	2	49	6	164	2,812	32	143	383
2008	4,793	13,329	22	5	51	13	118	3,143	46	148	511
2009	4,784	12,935	15	4	66	11	136	3,219	32	174	405
2010	4,787	10,888	16	4	53	10	86	3,621	43	217	392
2011	4,780	11,054	9	4	64	6	85	4,197	55	211	490
2012	4,788	9,324	9	3	92	11	114	3,282	37	171	599
2013	4,785	13,069	15	2	94	6	172	3,349	42	140	479
2014	4,800	11,401	12	3	65	3	88	3,791	28	116	391
2015	4,790	12,354	12	2	71	1	165	3,569	29	157	338
2016	4,799	12,522	16	1	110	13	273	3,672	27	144	252
2017	4,793	13,017	16	4	108	5	297	3,695	38	138	200
2018	4,790	15,102	18	0	99	2	295	4,683	46	181	209
2019	4,772	16,490	28	4	89	11	154	5,390	58	194	230
2020	4,781	15,746	26	8	86	8	179	4,454	24	173	161
2021	4,781	13,765	27	6	103	8	142	5,284	47	169	117
2022	4,783	17,103	27	4	119	7	268	6,486	48	270	143

[a]In 2006, species other than white-tailed deer and northern raccoon, particularly house cat, were not recorded in all counties and species counts may not be comparable to subsequent years.

METHODS

The Spring Spotlight Survey is conducted each year, usually after snow-melt and before spring green-up occurs, between mid-March and mid-May with the date of surveys dependent on local weather conditions and the latitudinal timing of vegetation leaf-out across the state. Surveys are standardized according to weather conditions (Rybarczyk 1978) and conducted during periods of no precipitation, wind speed <15 mph, relative humidity ≥40%, and temperature >32° F. Surveys consist of 2 east–west driving routes, one across each of the northern and southern halves of counties (except Kossuth County which has 3 routes; n = 199). Routes consist of rural unpaved roads totaling ~4,780 mi statewide ($\bar{x}$= 24.0 mi/route, 13.0–41.9 mi; SD=4.3 mi) and are sampled once each spring. Surveys begin 1 hour after sunset and are conducted at speeds ≤20 mi/hr. Surveys are conducted by 2 observers (1 driver and 1 passenger), both of whom search for wildlife using a spotlight along their respective side of the road. From 2006–2018, the number and location of animals was recorded at the observer location using a Global Positioning System (GPS) device. For deer, the distance and bearing to each group of deer (≥1 individual) were also recorded for estimating deer density across the state. Beginning in 2019, observations were recorded digitally (e.g., smart phones, tablets) in a geospatial database (ArcCollector; Environmental Systems Research Institute, Redlands, CA) which allowed for collection of more precise wildlife locations and increased survey efficiency.

We summarized long-term trends for spotlight counts across 9 regions of Iowa (Fig. 1) and statewide for species with typically ≥5 observations recorded per year. We standardized counts as the number of animals observed per 100 miles surveyed to account for annual differences in the number of miles surveyed (e.g., road closures). Because animal counts may vary annually, we further estimated the 5-year average relative distribution of counts to contextualize annual observations with recent trends and to map the relative distribution of species across the state. We interpolated the average distribution of counts for the most recent 5 years using inverse distance weighting (IDW; function gstat in Program R 3.6.1; R Core Team 2019) and 9 nearest neighbors. To determine the IDW power used to weight nearest neighbors for each species, we iteratively tested power values from 0.2–5.0 in 0.2 increments and estimated the root mean square error (RMSE) for each IDW estimate. We selected the power value from the IDW estimate with the lowest RMSE for producing the final IDW map. We further averaged the final IDW map using a focal analysis (function focal in Program R) and a 29.8-mi moving window to produce a smoother and more readily interpretable trend surface across Iowa.

RESULTS

In 2022, 4,783 mi of rural roads were surveyed across all 99 Iowa counties. A total of 24,494 animals were reported, marking an increase of 4,812 animals (23%) compared with 2021 (n = 19,952). Observations for all regularly reported species increased, except for bobcat and mink which are only incidentally observed (Table 1; Fig. 2–39). Two jackrabbit, two grey fox, and 6 weasels were also reported, whereas no otters or woodchucks were reported.

A total of 17,103 deer were observed in 2022, which was the highest count for deer since 2006 and 24% higher than the previous year, although comparable to counts in 2019 and 2020 (Fig. 2). Deer were observed at a rate of 3.6 deer/mi statewide, with the highest numbers across southern and eastern Iowa (Fig. 4). Deer counts increased in all regions except east-central, southwest, and south-central Iowa. Long-term deer observations have been relatively stable to increasing in all regions, except the southwest and south-central regions where counts have declined the past 3 to 5 years, respectively.

Raccoon observations increased 23% compared with 2021 and remained above their long-term average ($\bar{x}$ = 3,945; Fig. 24). All regions of the state recorded increased raccoon counts from 2021 and the statewide trend has increased by 423 animals per year since 2017 (R^2 = 0.69, P = 0.04; Fig. 24 & 26).

Opossum ($\bar{x}$ = 169; Fig. 20 & 22) and skunk ($\bar{x}$ = 169, Fig. 32 & 34) observations increased 88% and 66%, respectively, with increased counts reported for both species in all regions of the state, except the northeast where the skunk count was similar to last year. Badger observations have been stable the past four years (n = 27 in 2022) with most observations occurring in the western one-third of the state ($\bar{x}$ = 18; Fig. 7-10). In 2022, 119 coyote were observed, which is the highest count since 2006 and marks a 15% increase from 2021 ($\bar{x}$ = 76, Fig. 13). Despite observations fluctuating from 2006 to 2019, mink counts have remained stable the past 3 years with the most consistent observations in northern and east-central Iowa (Fig. 17 & 19). Bobcat observations (n = 4) were near their long-term average and generally low for this species ($\bar{x}$ = 3.5; Fig. 11). Overall, the total count for red fox (n = 48) was similar to last year, although counts increased in the northern two-thirds and decreased in the southern one-third of the state ($\bar{x}$ = 40; Fig. 28 & 30).

DISCUSSION

The total number of animals counted in 2022 was 23% higher than the previous year and represented increases for all species regularly observed on the survey (excluding bobcat and mink). To help explain this change we used a negative binomial regression model to estimate the effects of various winter and spring weather variables on spotlight counts (i.e., average number of precipitation events >1 inch and average daily temperature in the 28 days prior to each survey, average temperature and humidity across survey nights, and total accumulated winter season severity index [Boustead et al. 2015]). The relationship between observed and predicted animal counts for our model was moderately high (R^2 = 0.70, P < 0.001; Iowa DNR, unpublished data), indicating the model predicted total counts reasonably well. First, our model indicated that when the mean number of rain events greater than 1 inch changed by 1 event the number of animals counted changed by 3.29%. In 2021 and 2022, the mean number of these rain events was 2.27 and 6.53 for 2021 and 2022, respectively, for which the difference of 4.27 related to a 14.06% increase in the predicted number of animals counted in 2022. Second, deer are the most numerous species counted on the survey and their count was down 12% in 2021. Although the number of deer observed in 2022 was 24% higher than last year, the count was only 3.7% higher than in 2019, indicating that a portion of this year's increase was also due to inherent survey variability and a correction in what was an unusually low 2021 count. Overall, weather variability partially explains changes in annual species counts in our survey; however, the remainder of the

variability is likely explained by differences in forest or grassland cover across counties (Kaminski et al. 2019) as well as steadily increasing counts for the two most frequently observed species (deer and raccoon) during the past 5 years.

Deer counts have been stable or slightly increasing in all regions of the state, except in the southwest and south-central where counts have steadily decreased the past 3 and 4 years, respectively (Fig 4.). Despite decreasing counts in south-central Iowa, the region maintains some of the highest deer abundance in Iowa (Fig. 5).

Raccoon observations have remained relatively high during the past 5 years and in 2022 exceeded an average of 1 raccoon per mile for the third time in the past 4 years, even despite localized outbreaks of canine distemper virus this past year. Increased raccoon counts coincide with reduced furbearer trapping license sales in Iowa and low raccoon pelt values in international fur markets (Evelsizer 2019). It is likely statewide populations will remain high pending an increase in pelt values and local populations will continue to fluctuate with mechanisms such as disease in the coming years.

Spotlight observations for red fox are challenging to collect due to their small size and evasive behavior (Ruette et al. 2003) and as a result, some inherent variability exists in spotlight counts (Kaminski et al. 2021). Although counts often vary from year to year, red fox counts have remained stable during the past two years.

Badger observations remained stable in 2022 and near a four-year high. Most badger observations occur in western Iowa where models indicate the majority of suitable habitat exists in the state (Iowa DNR, unpublished data). Spotlight counts in northwest and southwest Iowa have fluctuated over time, whereas counts in east-central Iowa have steadily increased since the early 2010s.

Coyote observations increased the past two years following a marginal 5-year decline. The most notable regional changes occurred in the east-central where counts more than doubled and the southeast where counts were similar to their long-term average following a two-year low. Reported coyote harvest decreased 305% in 2021 (from 15,087 to 3,724) but it is unclear if this represents a true decrease in harvest or whether most furs were simply not sold due to a 50% drop in the average pelt value last year. It is possible that higher spotlight counts are a result of atypically low fall harvest last year and indicative of population growth. Ultimately, canids are difficult to survey using spotlighting and coyote observations are likely highly variable according to factors such as nighttime humidity, terrain, and road-avoidance behavior. Archery hunter observations likely provide a more reliable annual index for coyote and indicated relatively stable populations in all regions of the state (Harms et al. 2021). However, it is unknown whether hunters this fall will also report higher coyote numbers.

Although January and February temperatures were below normal across much of the state, the winter weather severity index was down 8% from 2021 due to below normal snowfall which likely contributed to increased opossum counts in all regions of the state. Opossums are sensitive to winter temperatures (Gillette 1980, Gehrt et al. 2006) and spring spotlight counts for opossum are negatively correlated with winter weather severity in Iowa (r = -0.60; Boustead et al. 2015). Opossum populations have the ability to rebound quickly following severe winters because females can produce two litters per year consisting of a large number of young (up to 13 joeys/litter; Gipson and Kamler 2001). February 2014, 2019, and 2021 all ranked within the top 16 coldest February's in recorded history and opossum counts subsequently declined 49%, 48%, and 21%, respectively, in the following springs (Glisan 2019, Glisan 2021*a*, Hillaker 2014). Alternatively, opossum counts increased 65% and 16% in 2016 and 2020, respectively, following warmer than normal winters. Overall, reported harvest for opossums has been at near all-time lows during the past 6 years; therefore, statewide population trends will likely be driven by winter severity, among other non-harvest related factors, in the coming years.

Similarly, skunk observations increased significantly statewide, with increased or stable counts in all regions of the state. Spotlight counts for skunks tend to fluctuate every 3–10 years similar to archery hunter observations (Harms et al. 2021). Spotlight surveys for skunks (as well as mustelids, e.g., badger, mink, weasel) are challenging because spotlighting is most effective for species that are readily detectable by eye shine (e.g., deer, raccoon). Skunks are rarely identified by eye shine and must be close to the observer for detection (Gehrt et al. 2006). Regardless, spotlighting likely works well for striped skunks in Iowa because of their tendency to be viewed in open areas at night, slower movements, and their distinct black and white markings. Therefore, this survey provides an independent and consistent indices for skunks and is an important component of furbearer management in the state.

The spotlight survey provides one of the only indices for mink in Iowa and indicated that populations typically fluctuated every 3–4 years, although statewide counts have been stable the past 3 years. Regionally, the most consistent mink observations occur in the northern one-third of the state and the east-central region. Mink observations are rare because surveys are not focused on riparian or wetland areas typical of mink habitat use. Reliable population trends for mink are possible using spotlight observations, however, annual counts may be highly variable (Waller 2010) and are typically low for our survey ($\bar{x}$ = 7.6).

Spotlight observations for bobcats are collected incidentally as spotlighting is less likely to detect forest obligates. However, the distribution of bobcat observations is consistent with other population indices in Iowa and suggests a population distributed primarily in the southern half and eastern one-third of the state.

For this survey house cats are defined as free-ranging domestic cats located in rural areas unconfined and away from farmsteads and human developments (e.g., feral cats). Observations for house cats have declined 76% since 2012. A similar pattern was observed for archery hunter observations, although the reason for these declines is unclear and may be related to several interacting factors (e.g., disease, predation, or declining rural human populations; Warner 1985). Predation by house cats on native fauna poses a serious conservation concern in North America, particularly for birds and small mammals (Dauphine and Cooper 2009). The effect of potentially declining rural cat populations on native fauna remains unknown, although declining cat populations is likely beneficial for several wildlife taxa across the state.

MANAGEMENT IMPLICATIONS

The Spring Spotlight Survey provides consistent long-term population indices for several wildlife species in Iowa. Population trends derived from the survey are critical for monitoring populations and informing science-based management decisions. When paired with long-term harvest and other survey data, the development of population abundance or growth models may be possible and provide more robust metrics for evaluating populations in the future.

ACKNOWLEDGMENTS

We thank all current and past Iowa DNR staff and volunteers who traveled thousands of miles of gravel roads across the state, often until early morning hours, to complete the Spring Spotlight Survey each year. We appreciate the opportunity to present these data on their behalf. W. J. Suchy (former Iowa DNR Wildlife Research Section supervisor) developed the current study design for the Spring Spotlight Survey; we appreciate his efforts to expand the survey statewide and across multiple species taxa to improve the quality of the data collected. J. E. Fredrickson, C. E. Ensminger, and J. M. Coffey provided editorial review.

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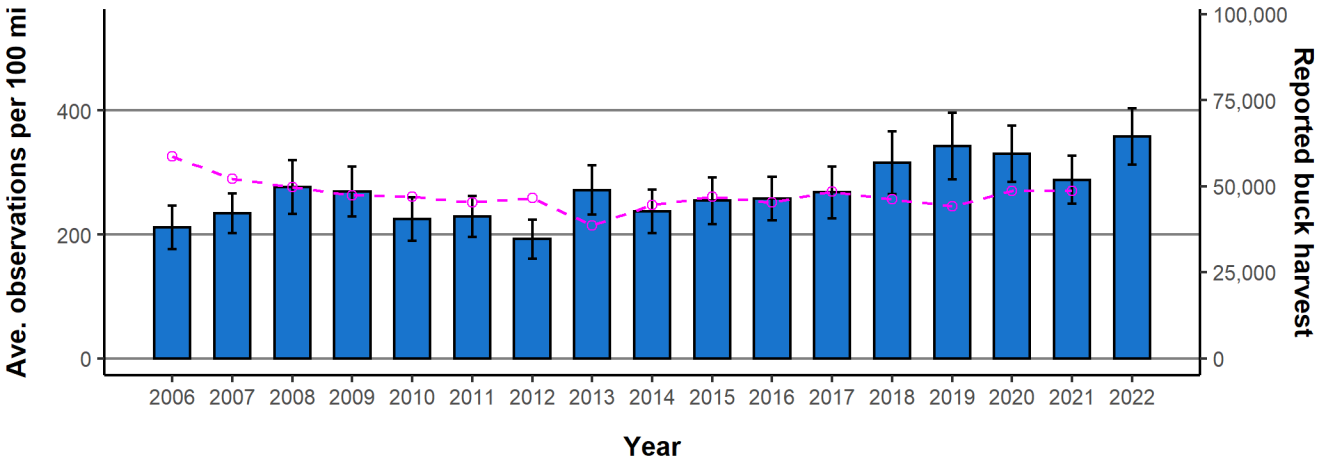


Figure 2. Average white-tailed deer observations per 100 miles surveyed during the Iowa Spring Spotlight Survey, 2006–2022. Error bars indicate 95% confidence intervals. Dashed line indicates the reported statewide buck deer harvest.

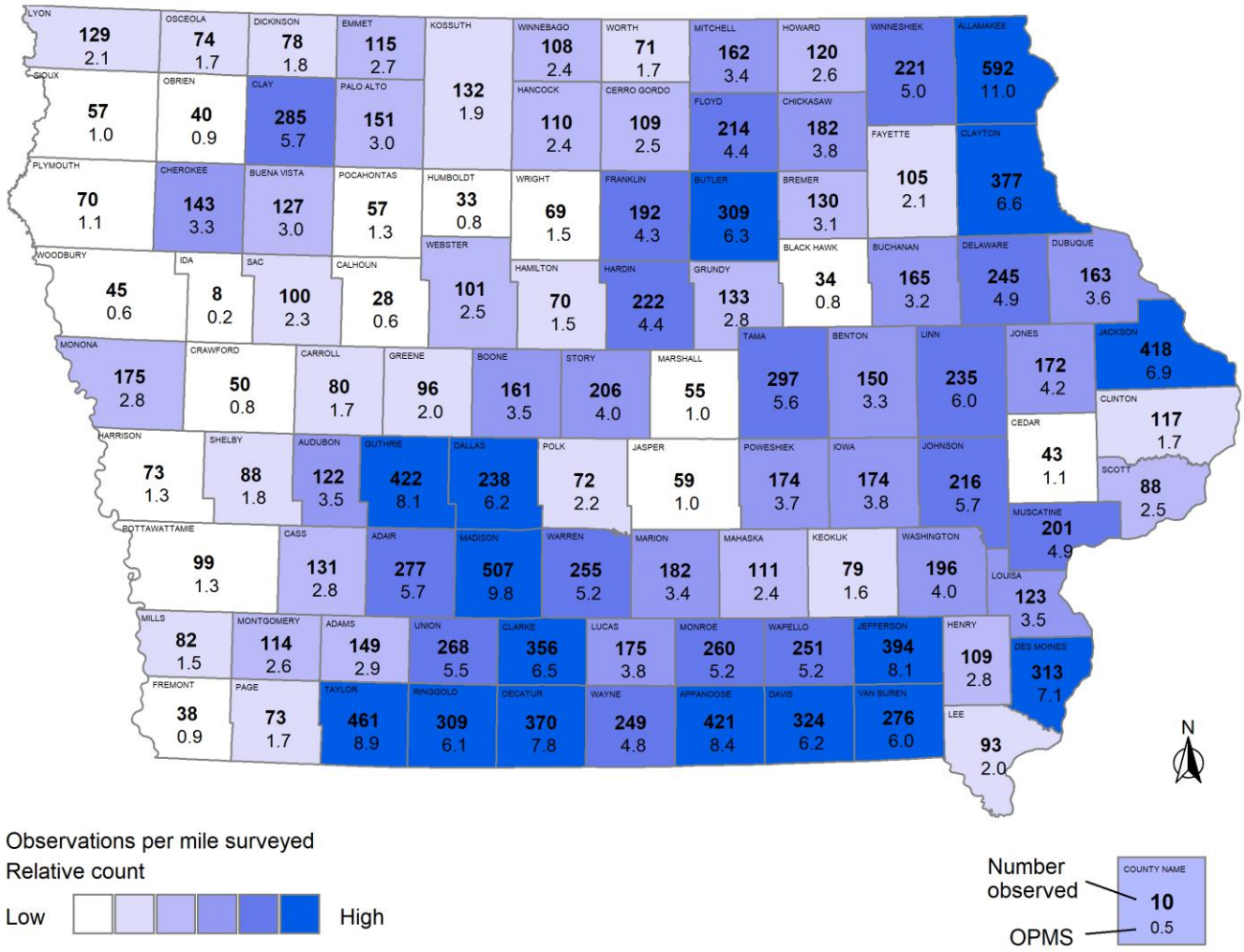


Figure 3. Total number of white-tailed deer observations per county during the Iowa Spring Spotlight Survey, 2022. Color shading indicates the number of animals counted per mile surveyed (OPMS).

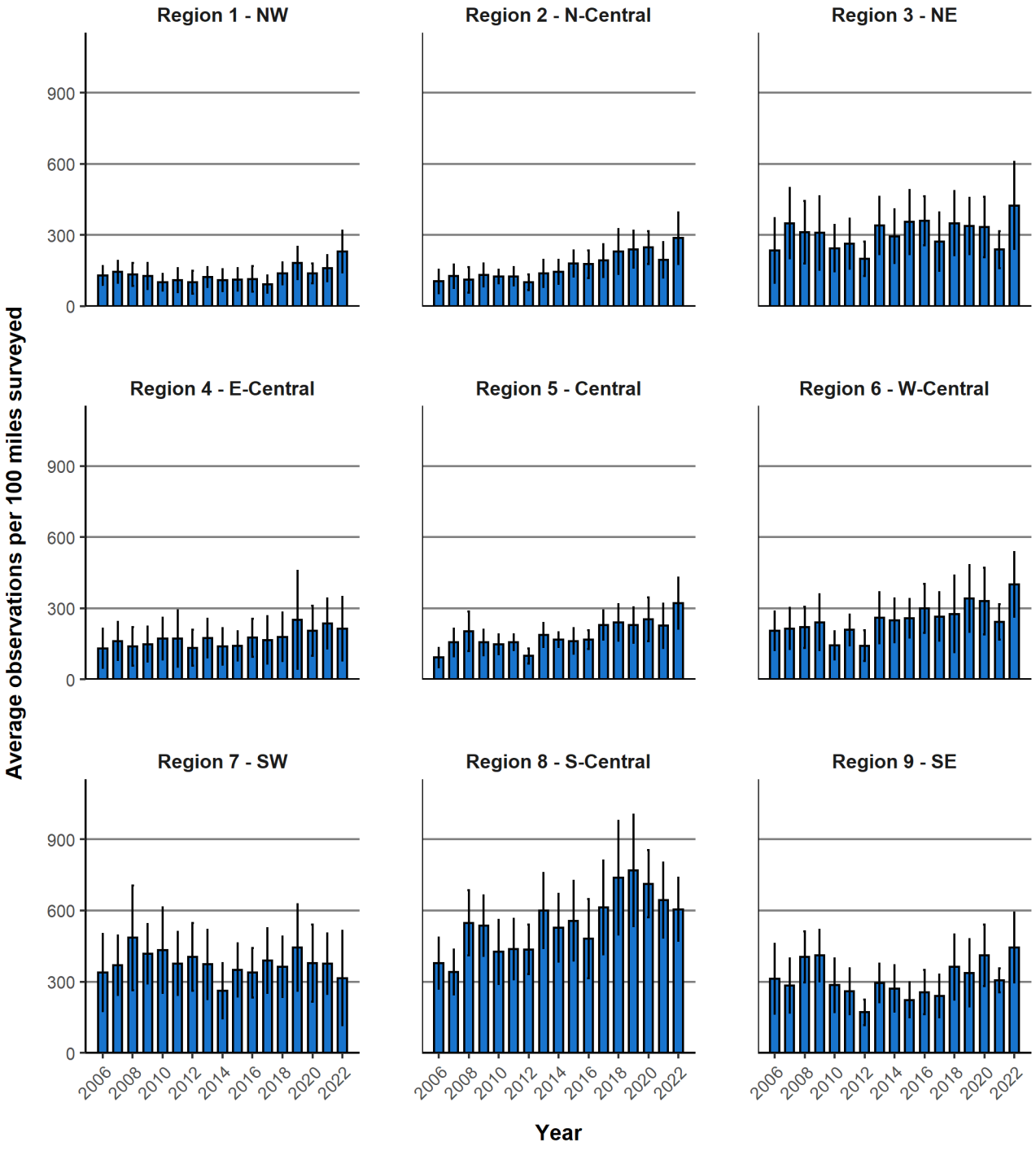


Figure 4. Average white-tailed deer observations per 100 miles surveyed during the Spring Spotlight Survey for nine regions of Iowa, 2006–2022. Error bars indicate 95% confidence intervals.

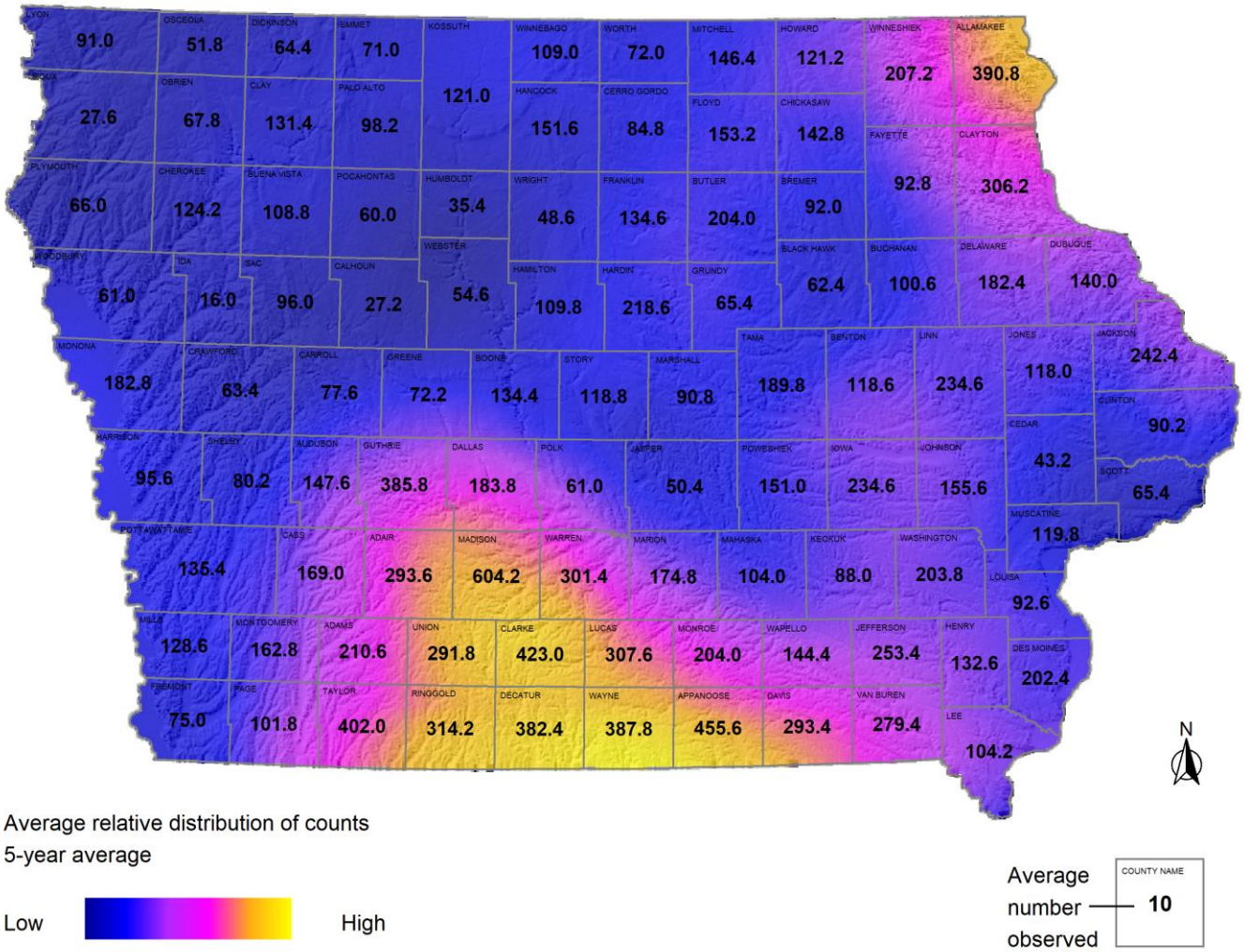


Figure 5. Average relative distribution of spring spotlight observations for white-tailed deer during the past 5 years in Iowa. The number of observations per county is relative to the highest and lowest number of observations across all counties during the survey and may not represent an over- or under-abundance of the species (i.e., high counts are considered high relative to those observed in all other counties).

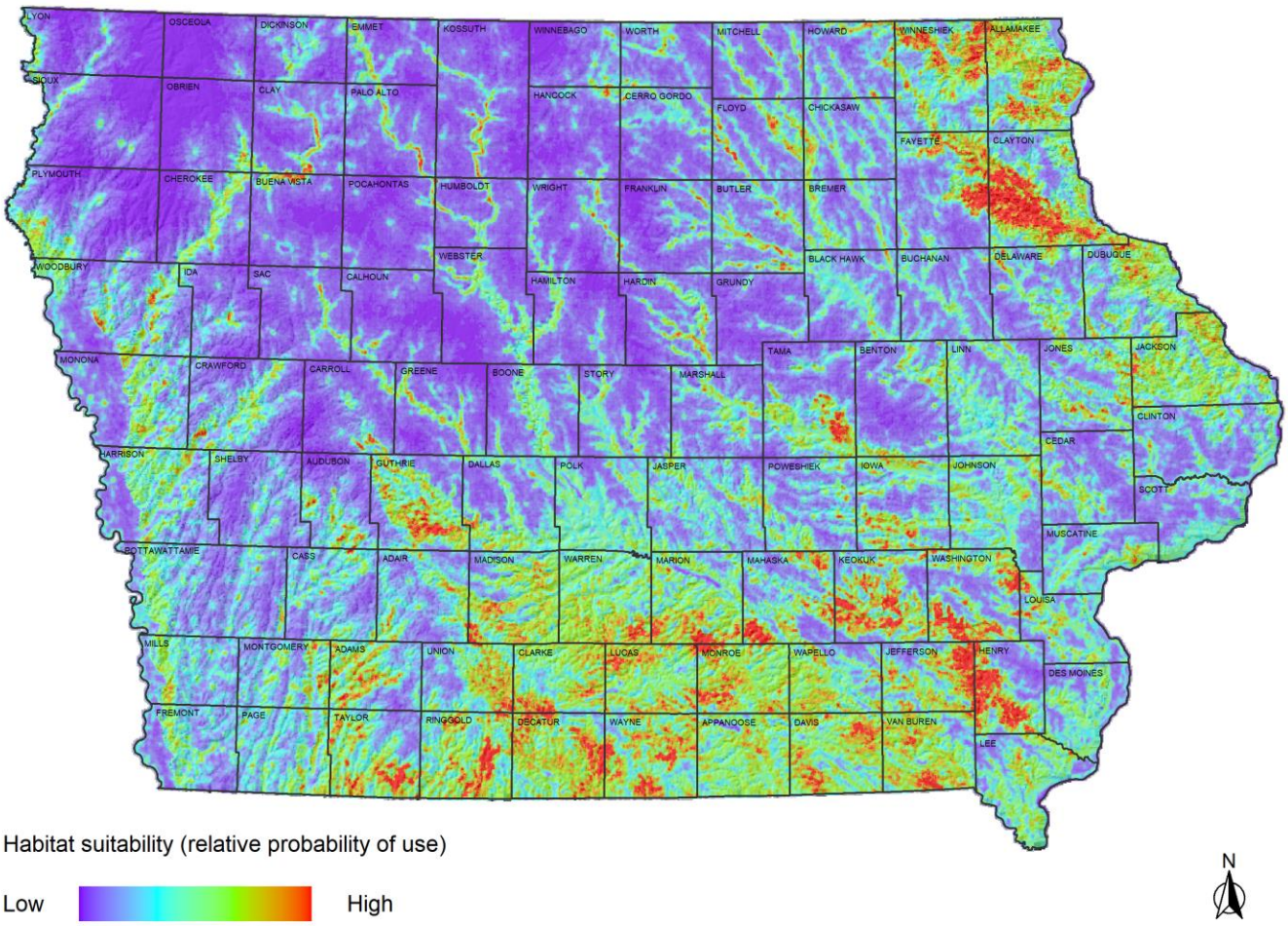


Figure 6. Habitat suitability (i.e., relative probability of use) for white-tailed deer in Iowa based on a resource selection function (RSF; see Kaminski et al. [2019] for details). The RSF model was predicted using spotlight observations for deer from 2012–2016 and the accuracy of the model was tested using 2017 observations (R^2 = 0.95). High values indicate areas of higher relative habitat quality for deer and low values indicate lower habitat quality.

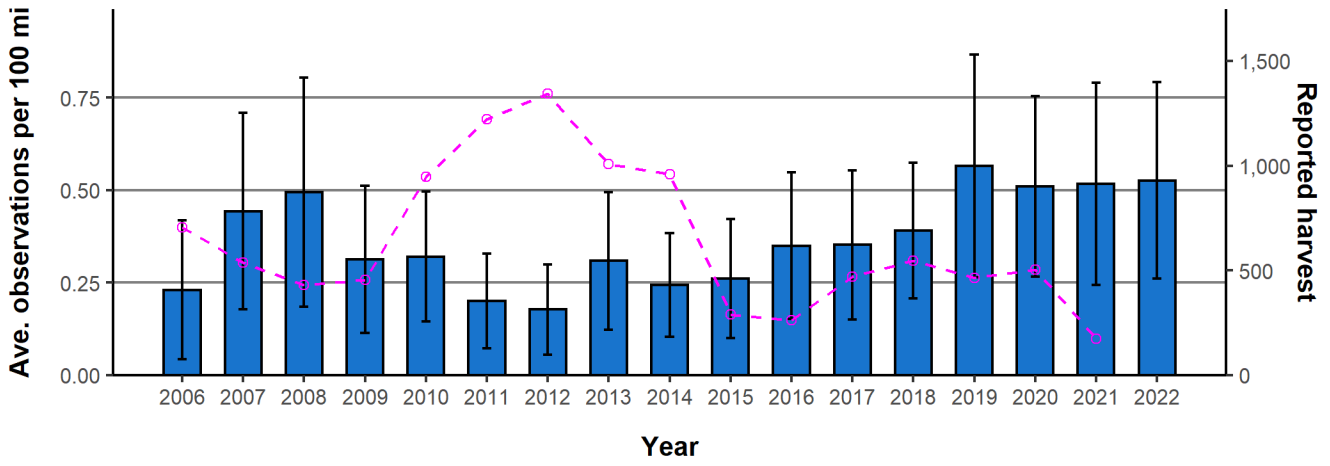


Figure 7. Average badger observations per 100 miles surveyed during the Iowa Spring Spotlight Survey, 2006–2022. Error bars indicate 95% confidence intervals. Dashed line indicates the reported statewide harvest.

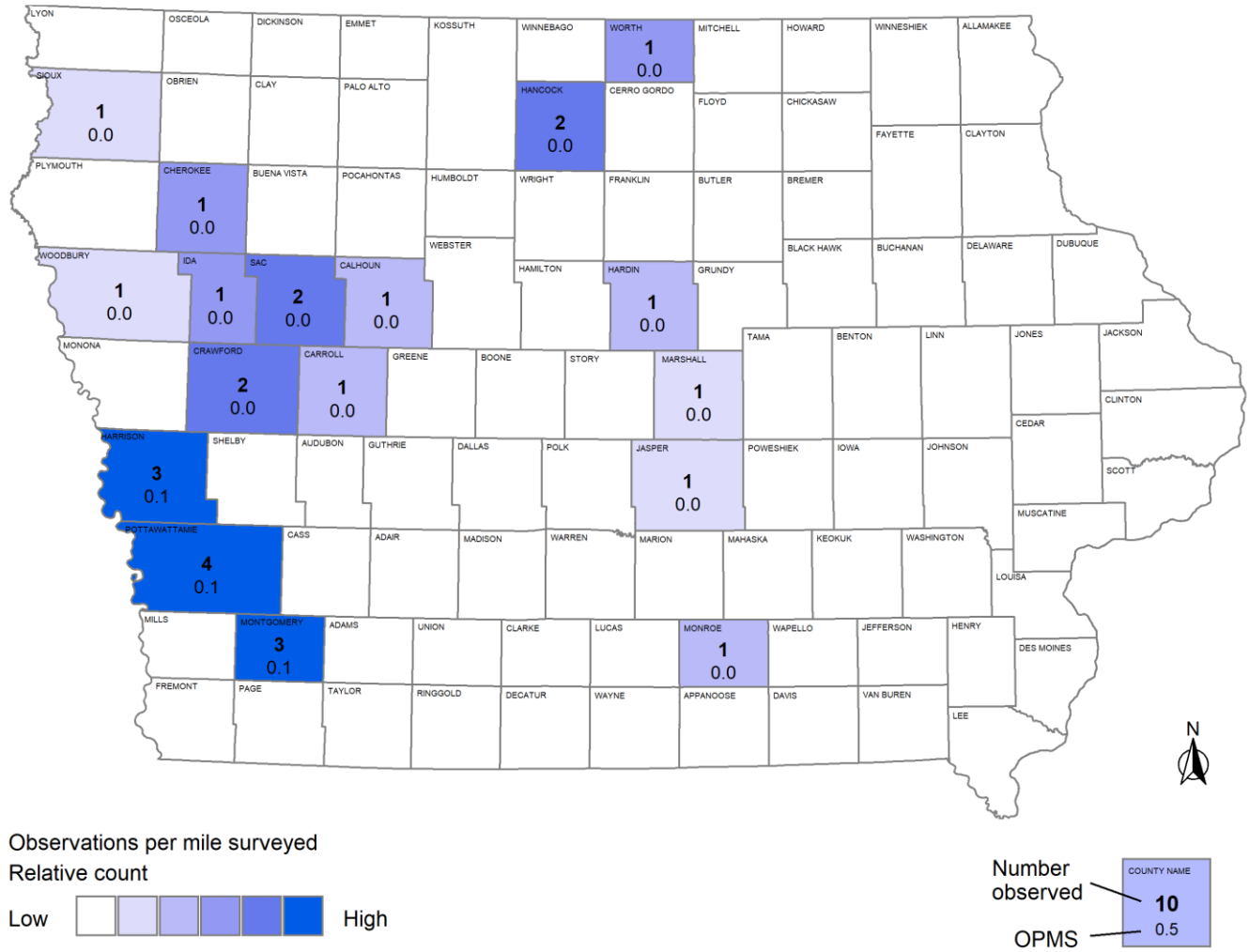


Figure 8. Total number of badger observations per county during the Iowa Spring Spotlight Survey, 2022. Color shading indicates the number of animals counted per mile surveyed (OPMS).

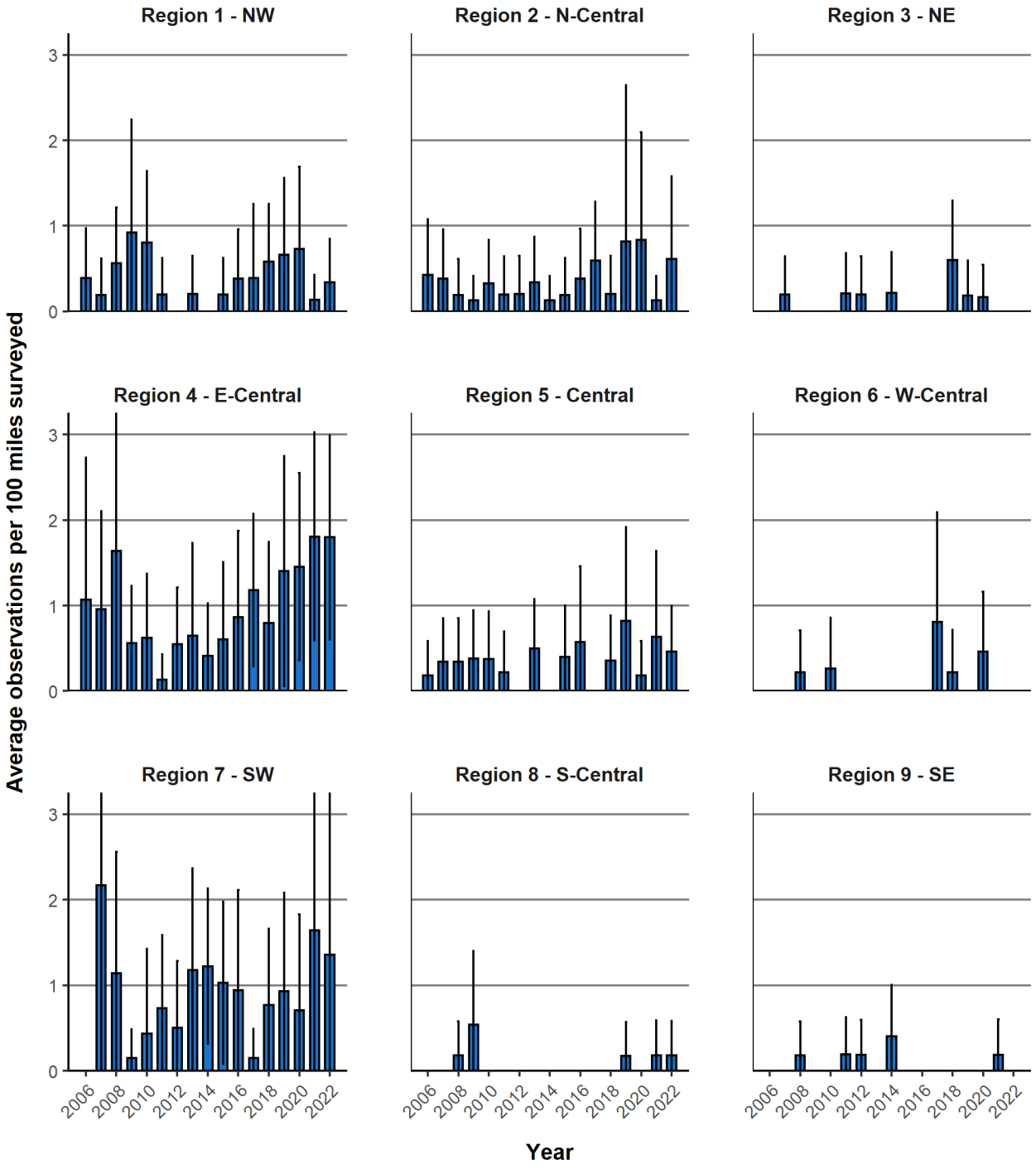


Figure 9. Average badger observations per 100 miles surveyed during the Spring Spotlight Survey for nine regions of Iowa, 2006–2022. Error bars indicate 95% confidence intervals.

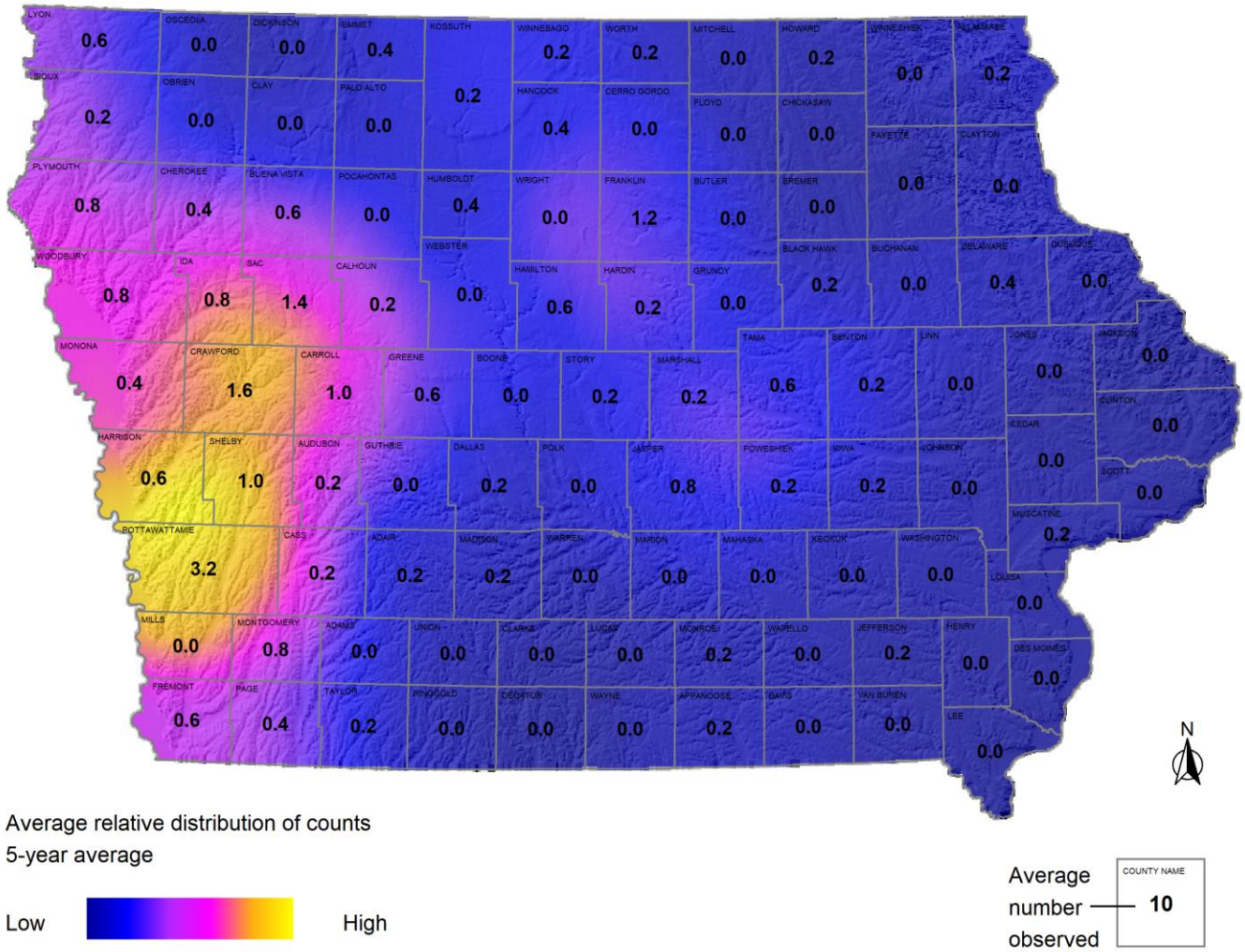


Figure 10. Average relative distribution of spring spotlight observations for badger during the past 5 years in Iowa. The number of observations per county is relative to the highest and lowest number of observations across all counties during the survey and may not represent an over- or under-abundance of the species (i.e., high counts are considered high relative to those observed in all other counties).

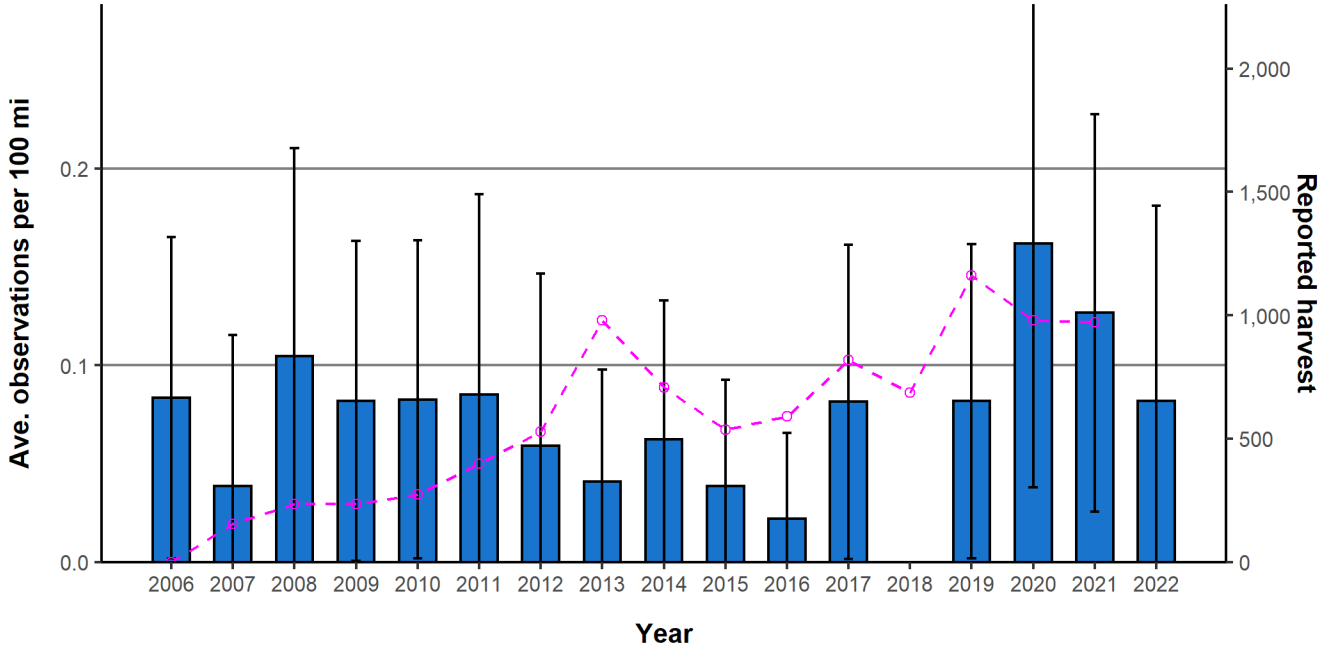


Figure 11. Average bobcat observations per 100 miles surveyed during the Iowa Spring Spotlight Survey, 2006–2022. Error bars indicate 95% confidence intervals. Dashed line indicates the reported statewide harvest.

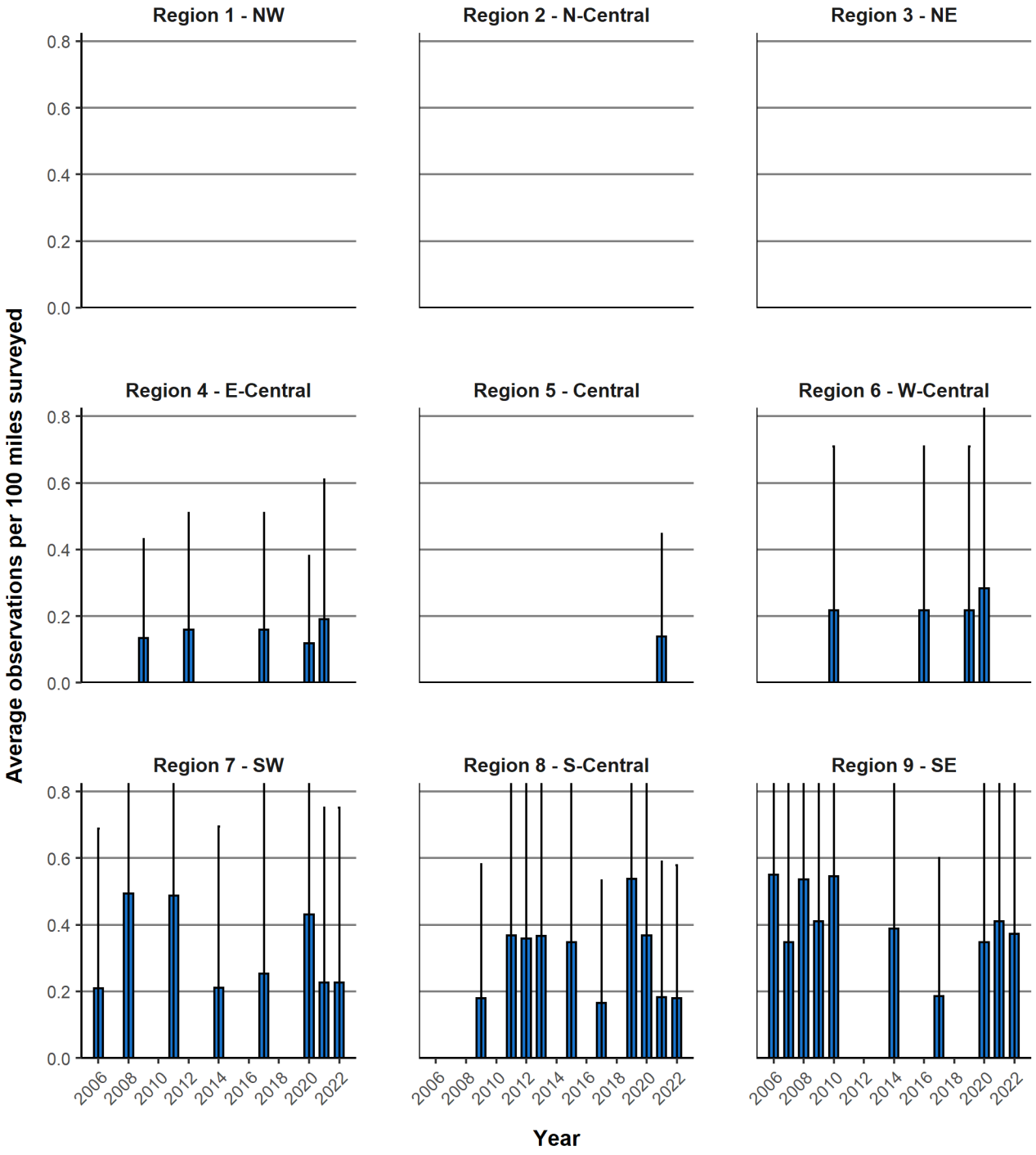


Figure 12. Average bobcat observations per 100 miles surveyed during the Spring Spotlight Survey for nine regions of Iowa, 2006–2022. Error bars indicate 95% confidence intervals.

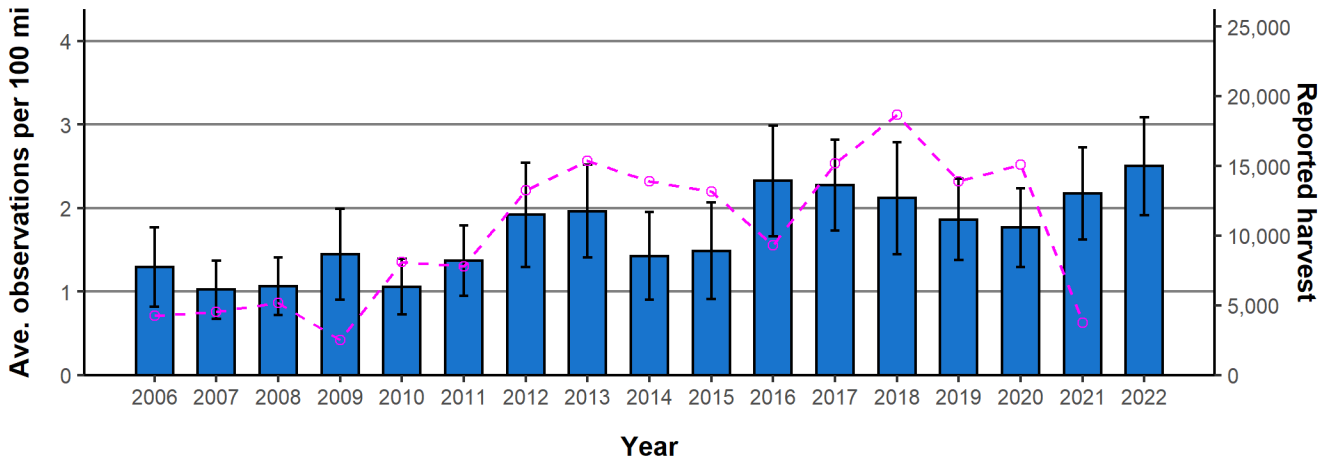


Figure 13. Average coyote observations per 100 miles surveyed during the Iowa Spring Spotlight Survey, 2006–2022. Error bars indicate 95% confidence intervals. Dashed line indicates the reported statewide harvest.

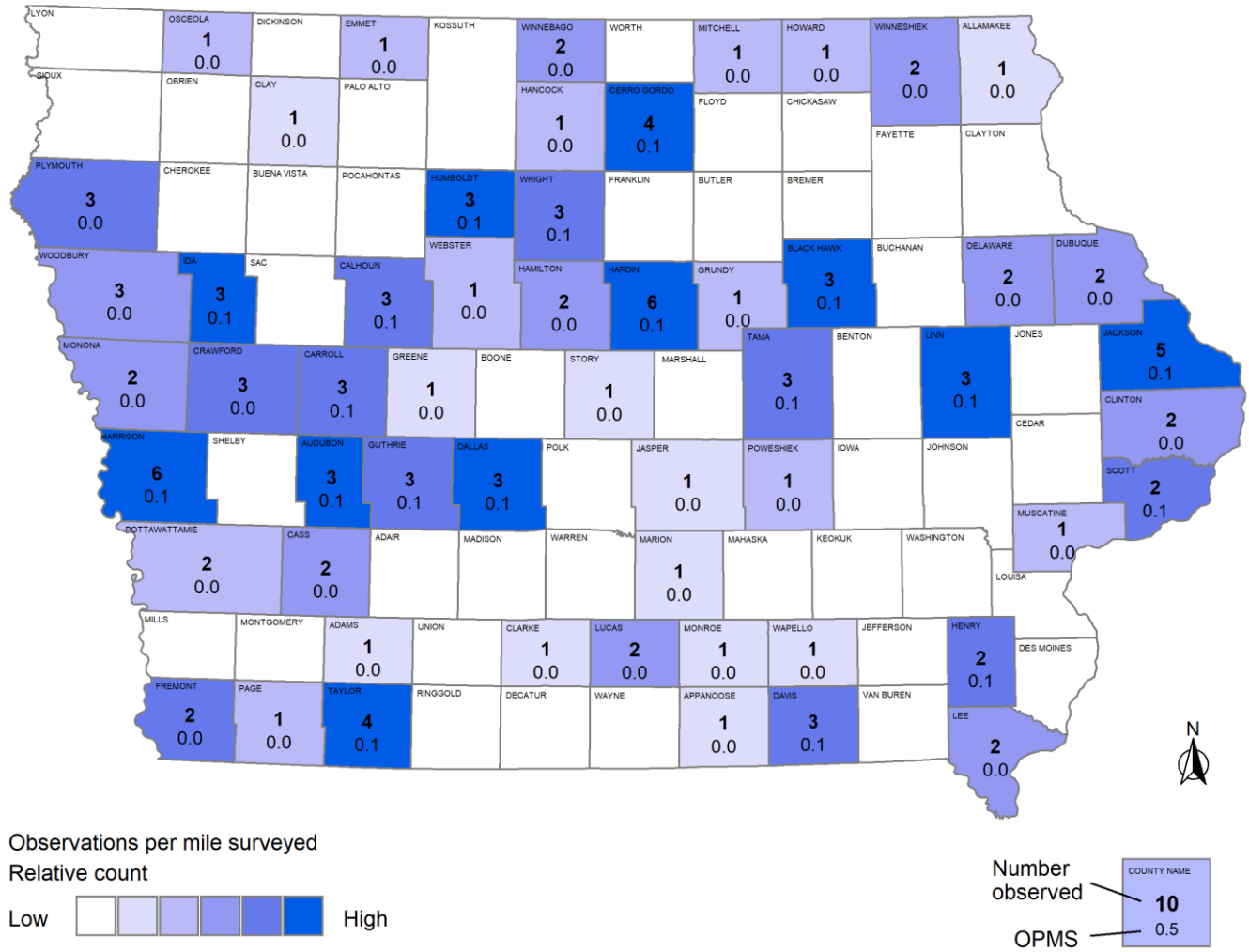


Figure 14. Total number of coyote observations per county during the Iowa Spring Spotlight Survey, 2022. Color shading indicates the number of animals counted per mile surveyed (OPMS).

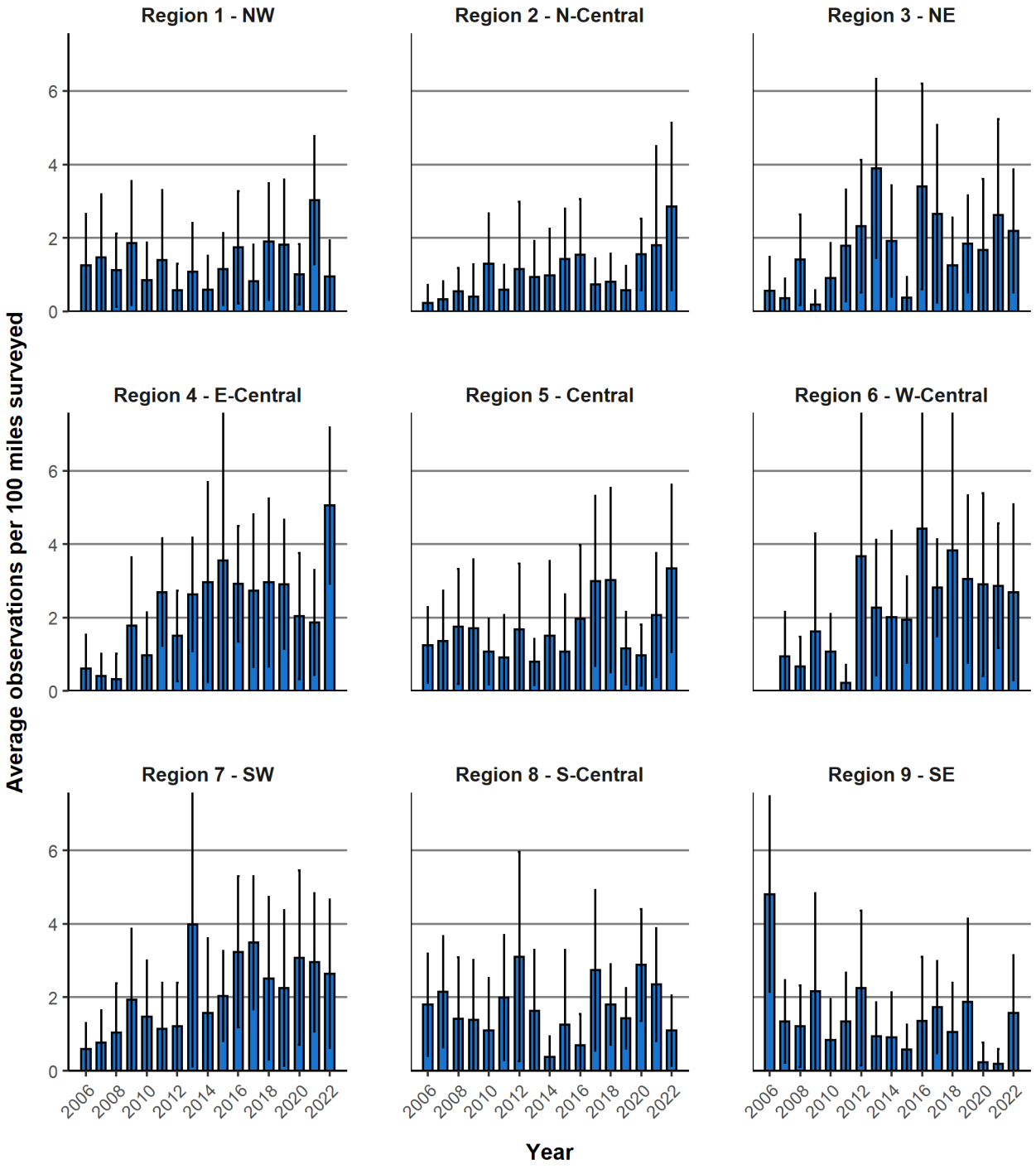


Figure 15. Average coyote observations per 100 miles surveyed during the Spring Spotlight Survey for nine regions of Iowa, 2006–2022. Error bars indicate 95% confidence intervals.

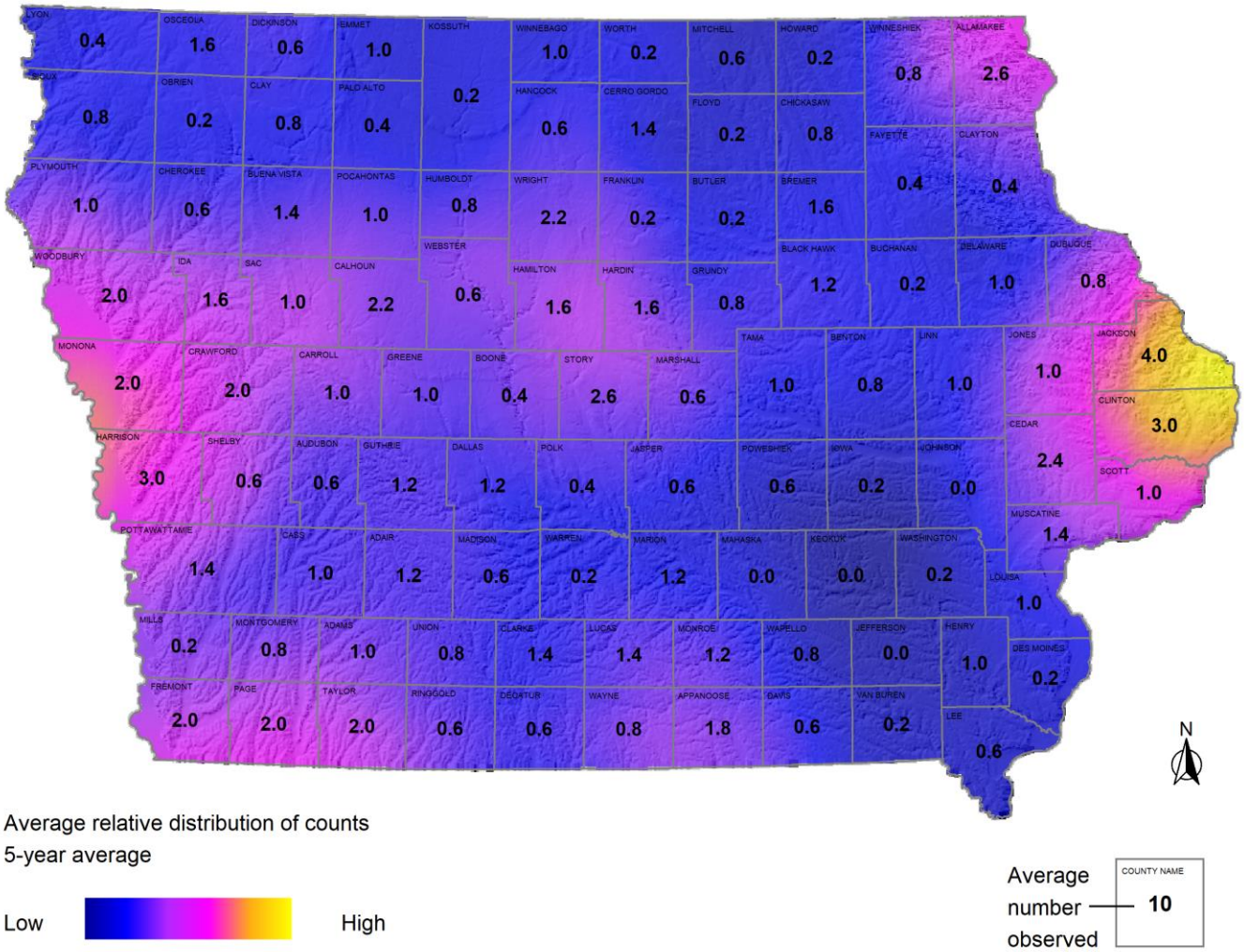


Figure 16. Average relative distribution of spring spotlight observations for coyote during the past 5 years in Iowa. The number of observations per county is relative to the highest and lowest number of observations across all counties during the survey and may not represent an over- or under-abundance of the species (i.e., high counts are considered high relative to those observed in all other counties).

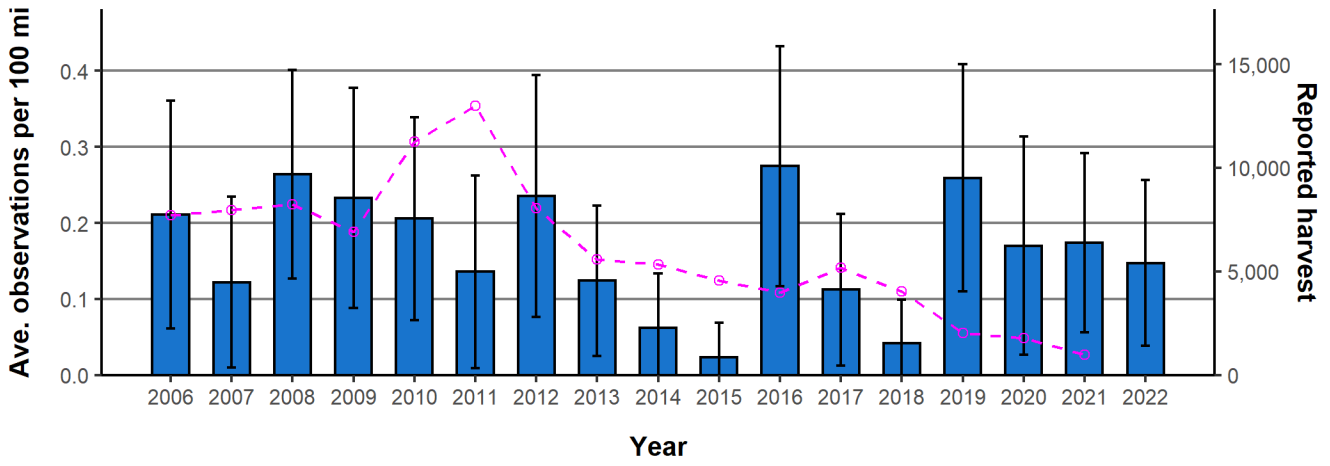


Figure 17. Average mink observations per 100 miles surveyed during the Iowa Spring Spotlight Survey, 2006–2022. Error bars indicate 95% confidence intervals. Dashed line indicates the reported statewide harvest.

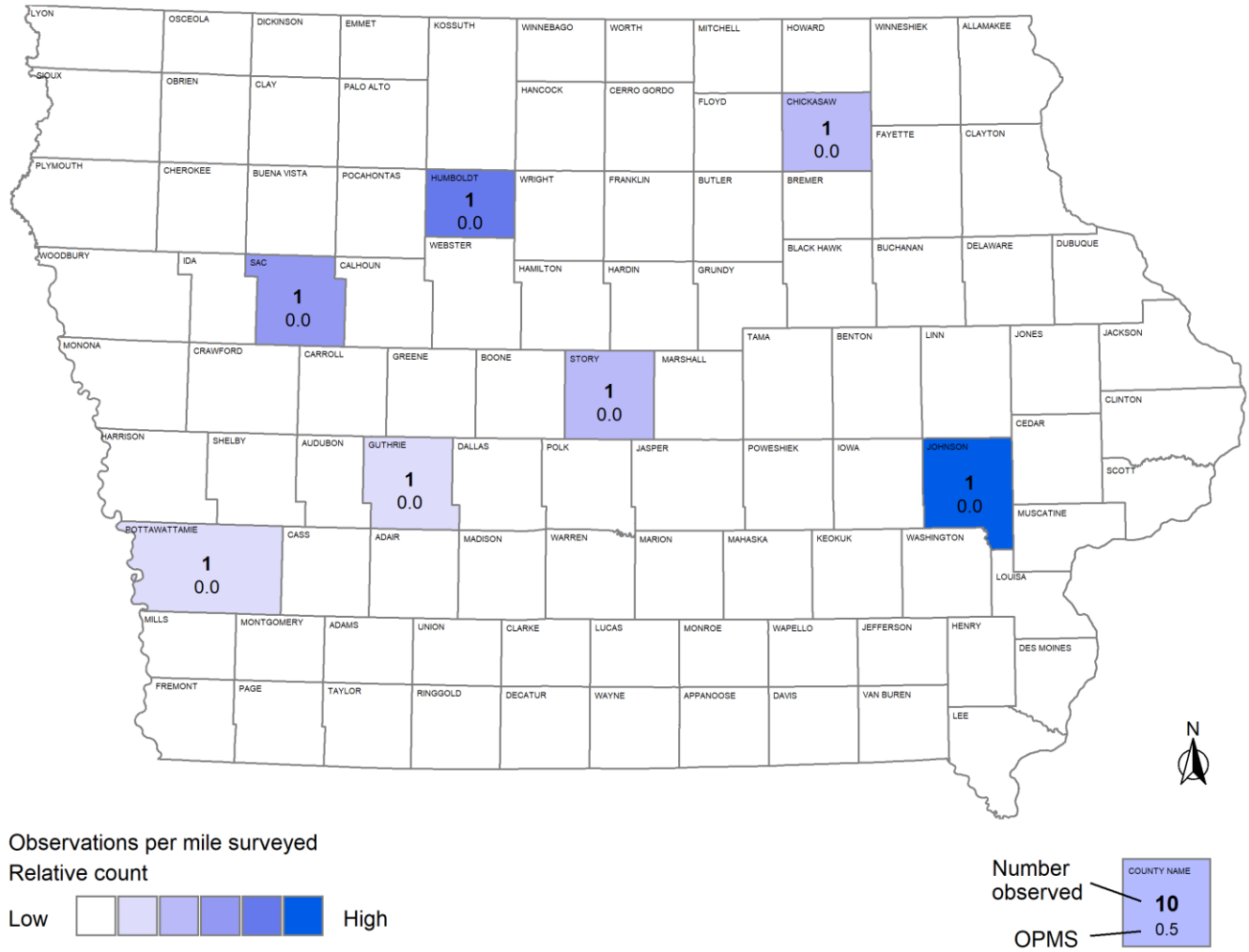


Figure 18. Total number of mink observations per county during the Iowa Spring Spotlight Survey, 2022. Color shading indicates the number of animals counted per mile surveyed (OPMS).

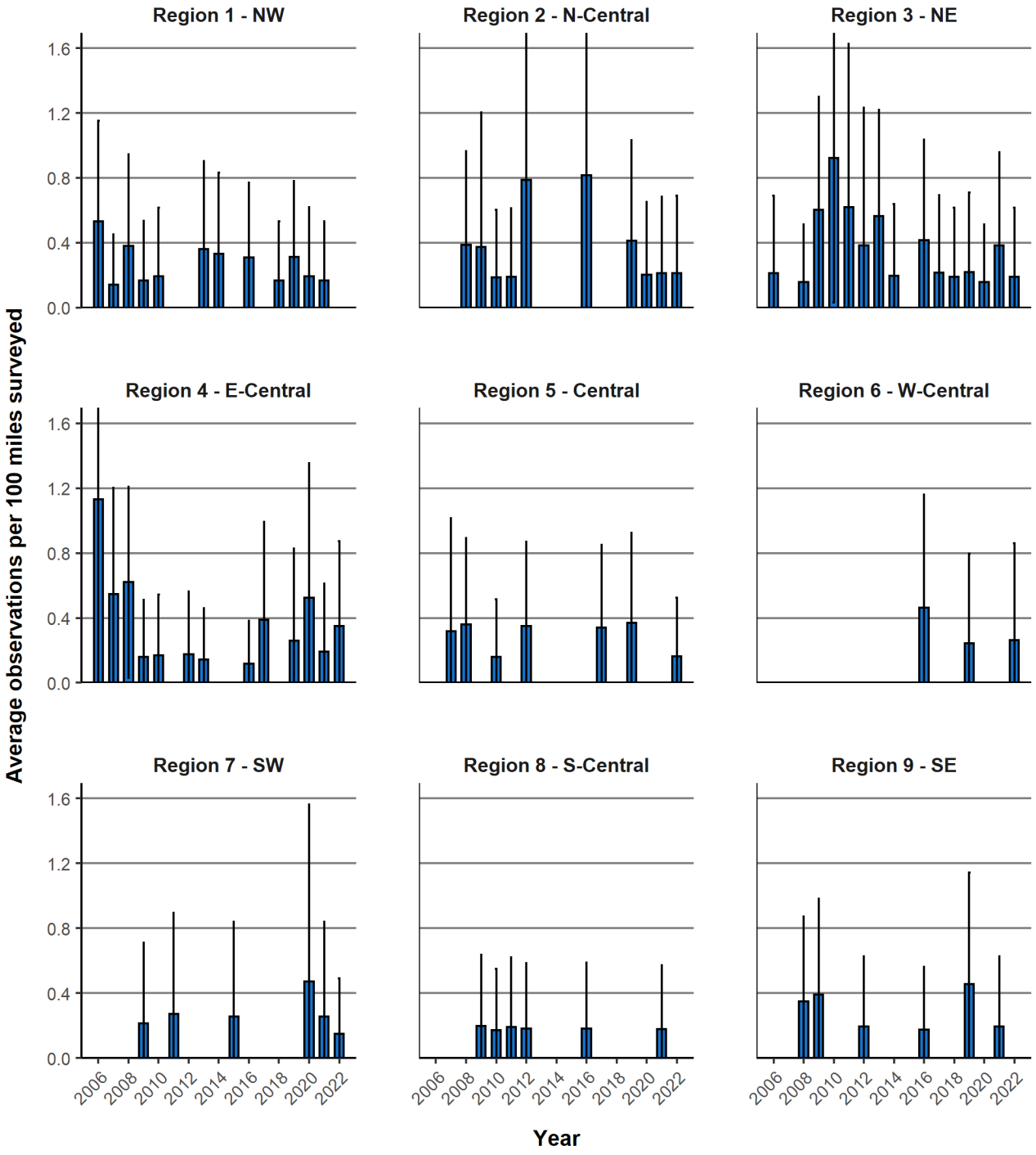


Figure 19. Average mink observations per 100 miles surveyed during the Spring Spotlight Survey for nine regions of Iowa, 2006–2022. Error bars indicate 95% confidence intervals.

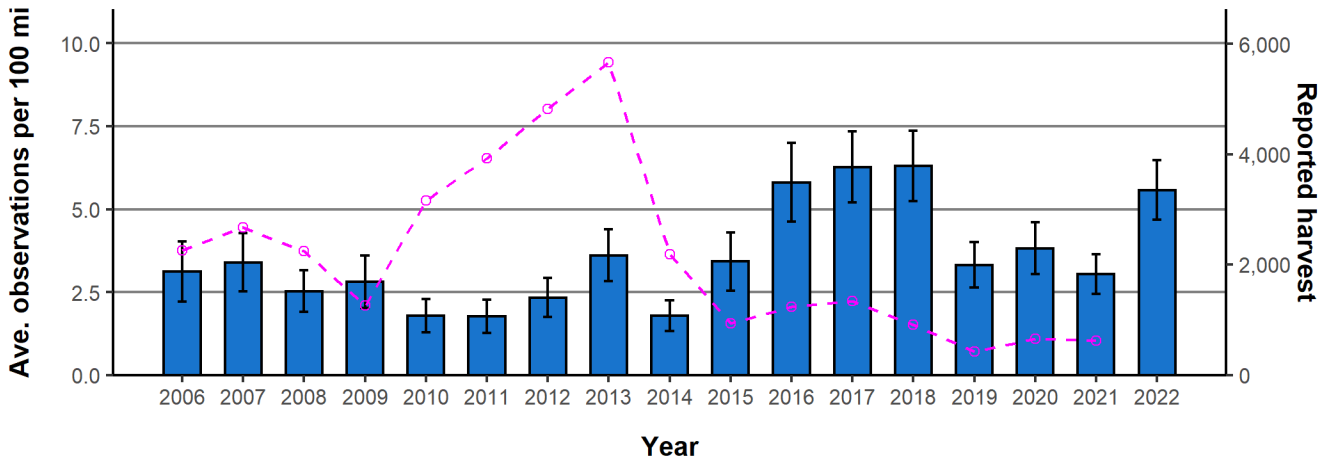


Figure 20. Average opossum observations per 100 miles surveyed during the Iowa Spring Spotlight Survey, 2006–2022. Error bars indicate 95% confidence intervals. Dashed line indicates the reported statewide harvest.

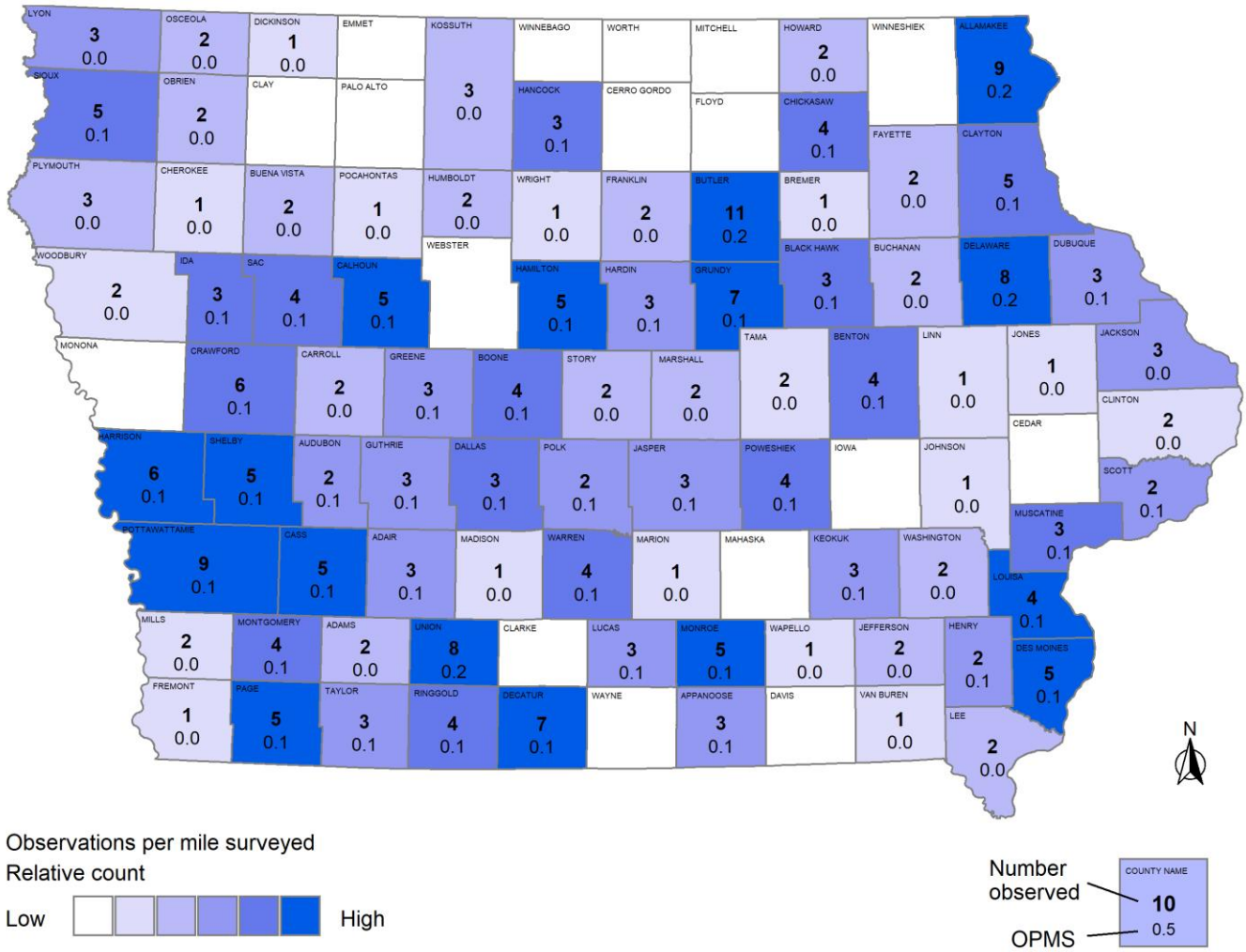


Figure 21. Total number of opossum observations per county during the Iowa Spring Spotlight Survey, 2022. Color shading indicates the number of animals counted per mile surveyed (OPMS).

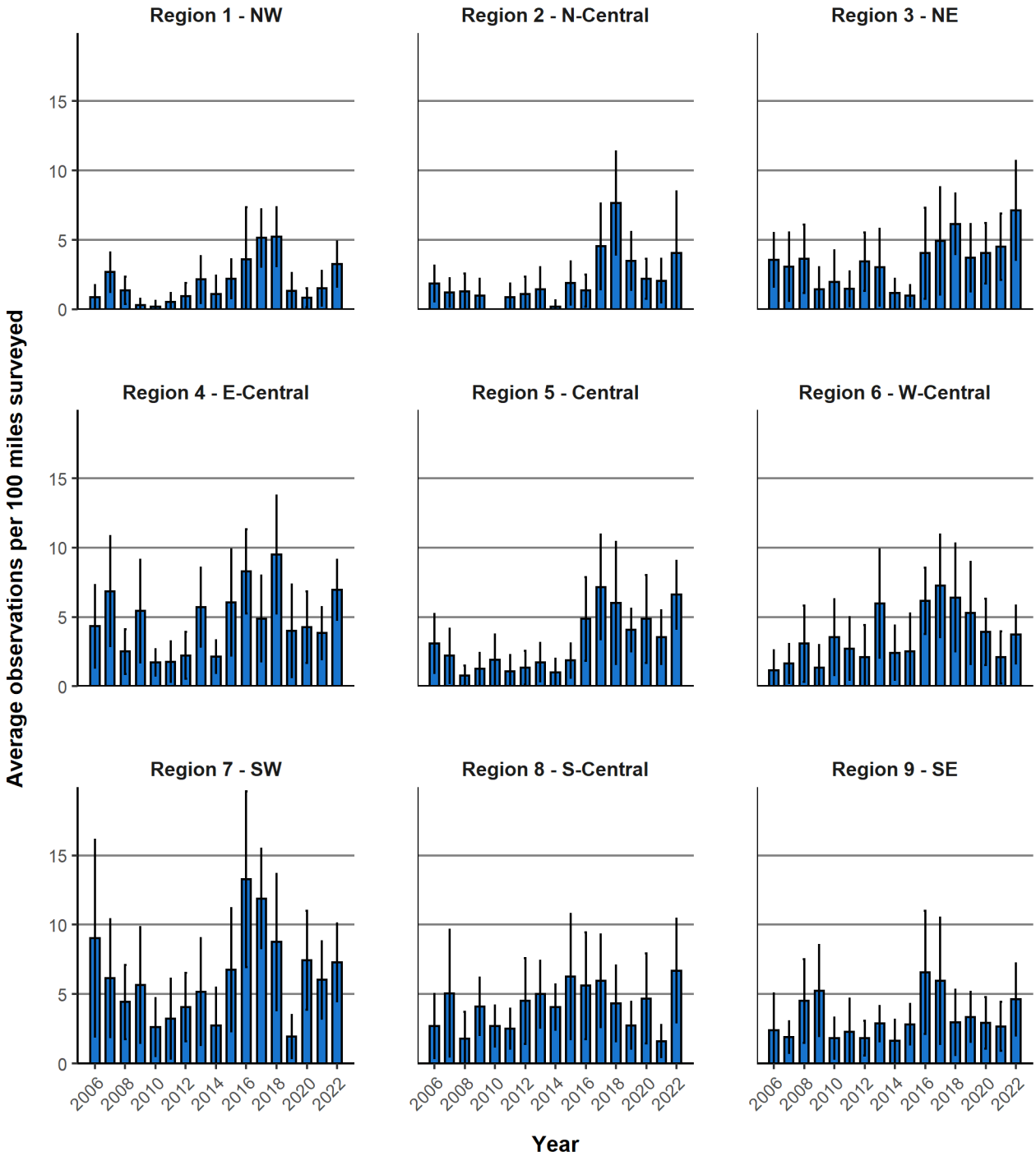


Figure 22. Average opossum observations per 100 miles surveyed during the Spring Spotlight Survey for nine regions of Iowa, 2006–2022. Error bars indicate 95% confidence intervals.

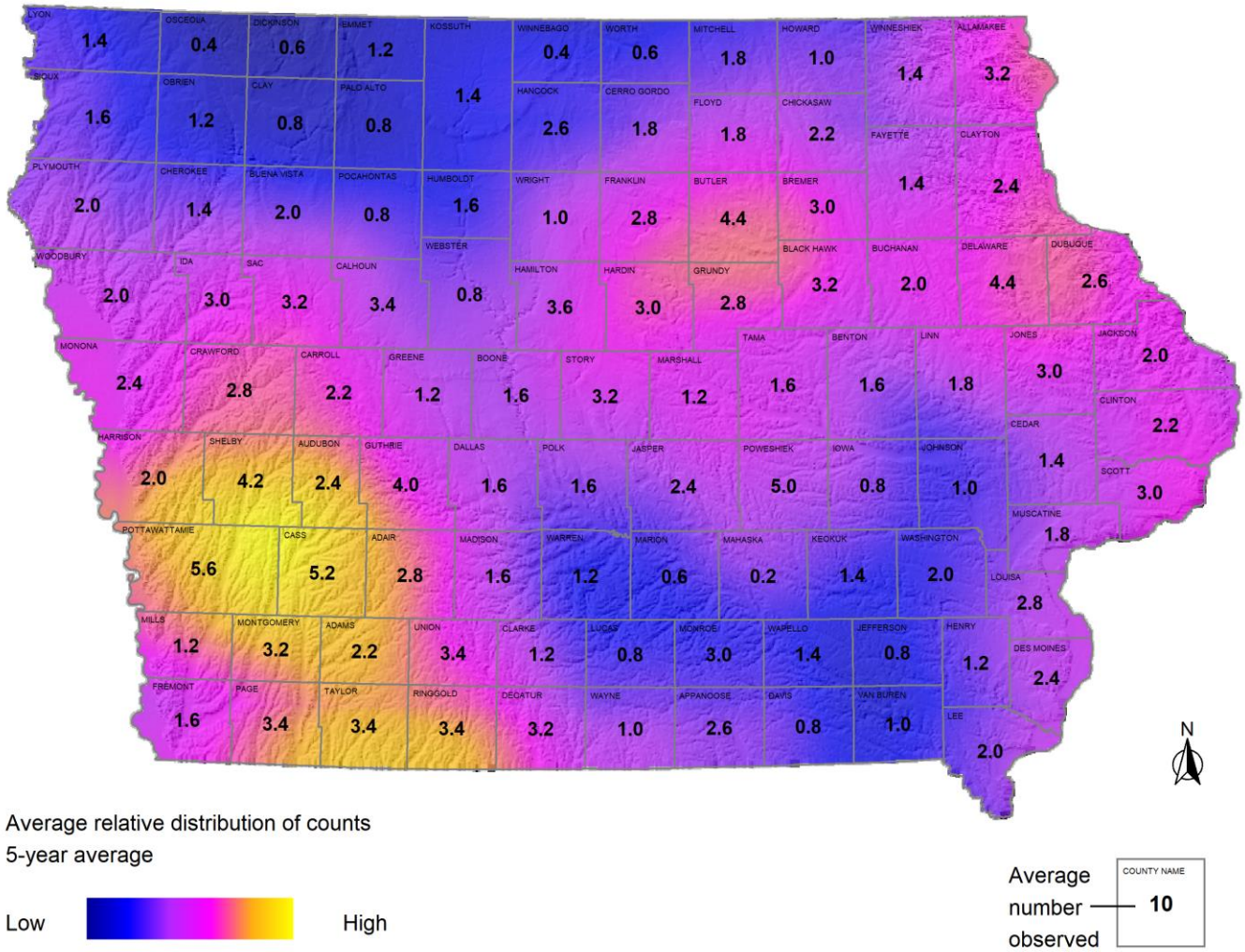


Figure 23. Average relative distribution of spring spotlight observations for opossum during the past 5 years in Iowa. The number of observations per county is relative to the highest and lowest number of observations across all counties during the survey and may not represent an over- or under-abundance of the species (i.e., high counts are considered high relative to those observed in all other counties).

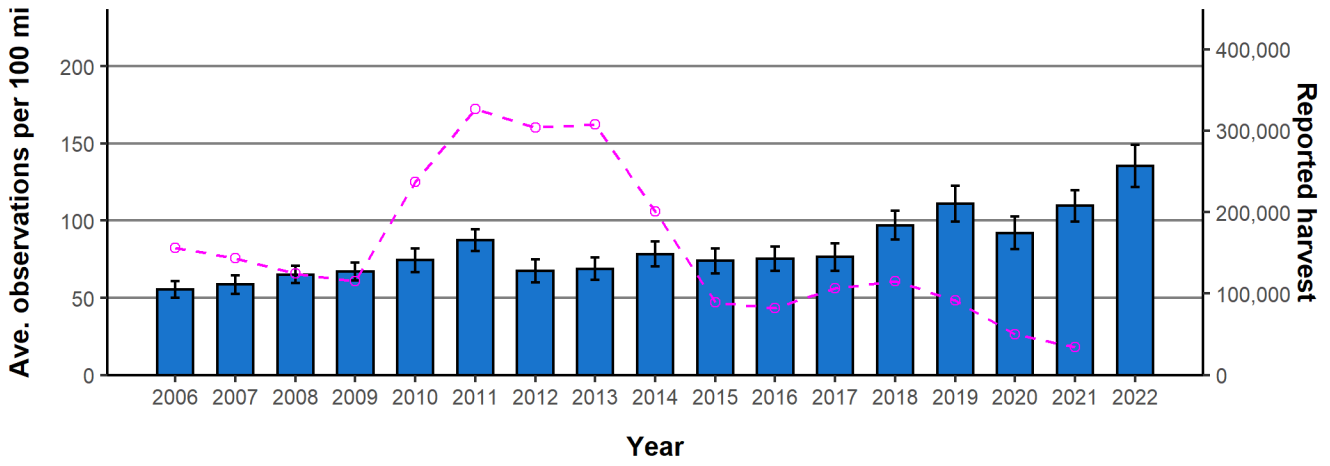


Figure 24. Average raccoon observations per 100 miles surveyed during the Iowa Spring Spotlight Survey, 2006–2022. Error bars indicate 95% confidence intervals. Dashed line indicates the reported statewide harvest.

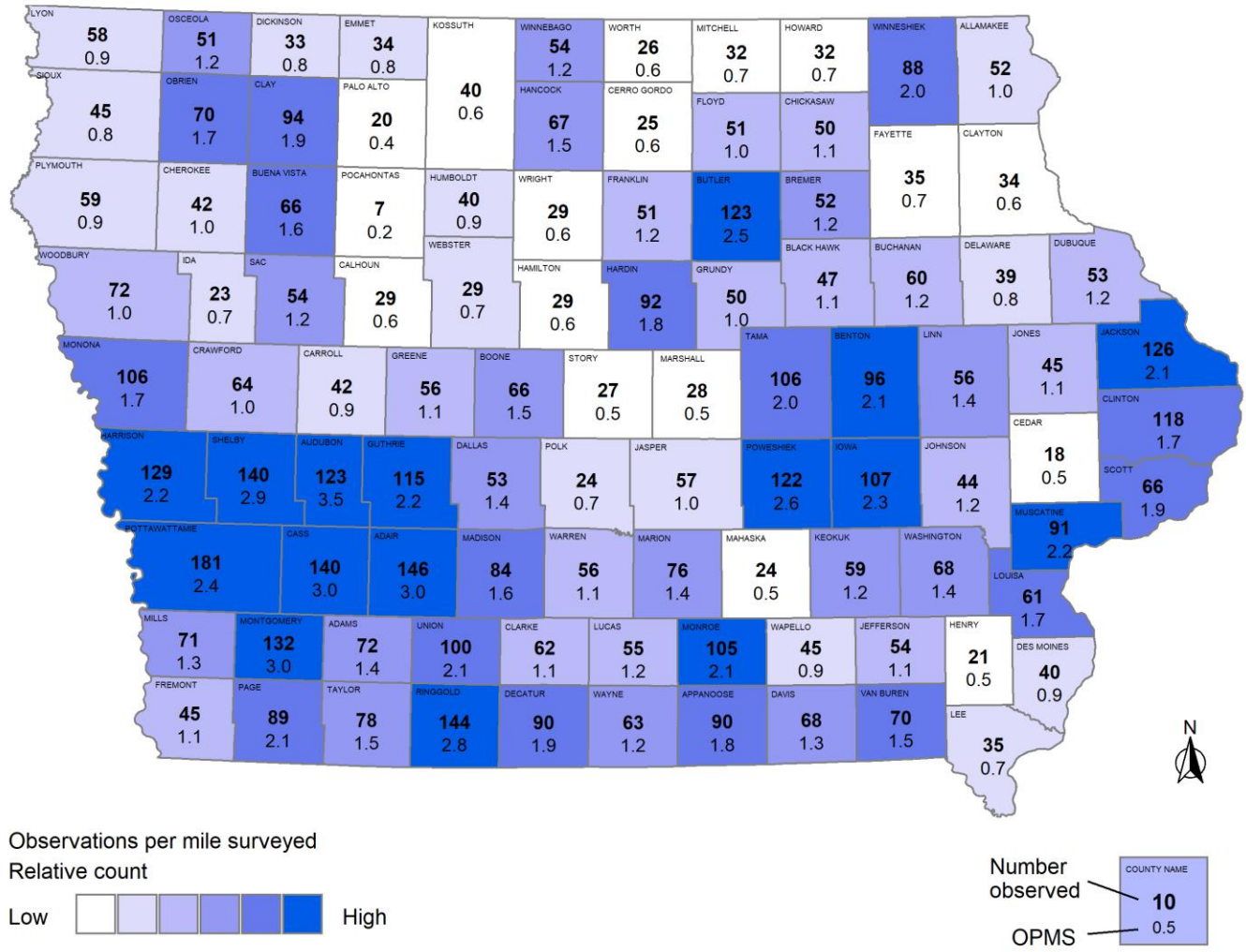


Figure 25. Total number of raccoon observations per county during the Iowa Spring Spotlight Survey, 2022. Color shading indicates the number of animals counted per mile surveyed (OPMS).

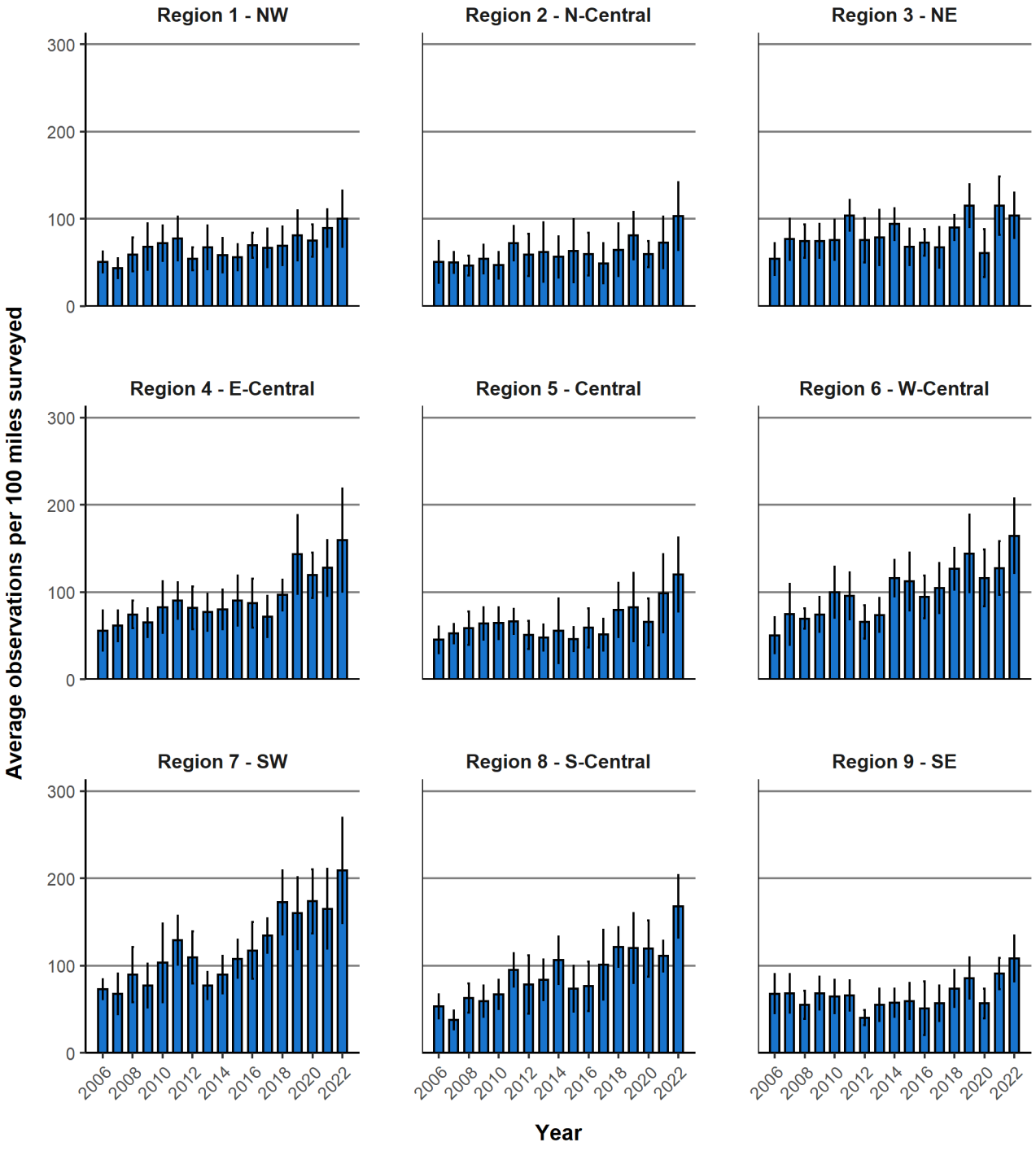


Figure 26. Average raccoon observations per 100 miles surveyed during the Spring Spotlight Survey for nine regions of Iowa, 2006–2022. Error bars indicate 95% confidence intervals.

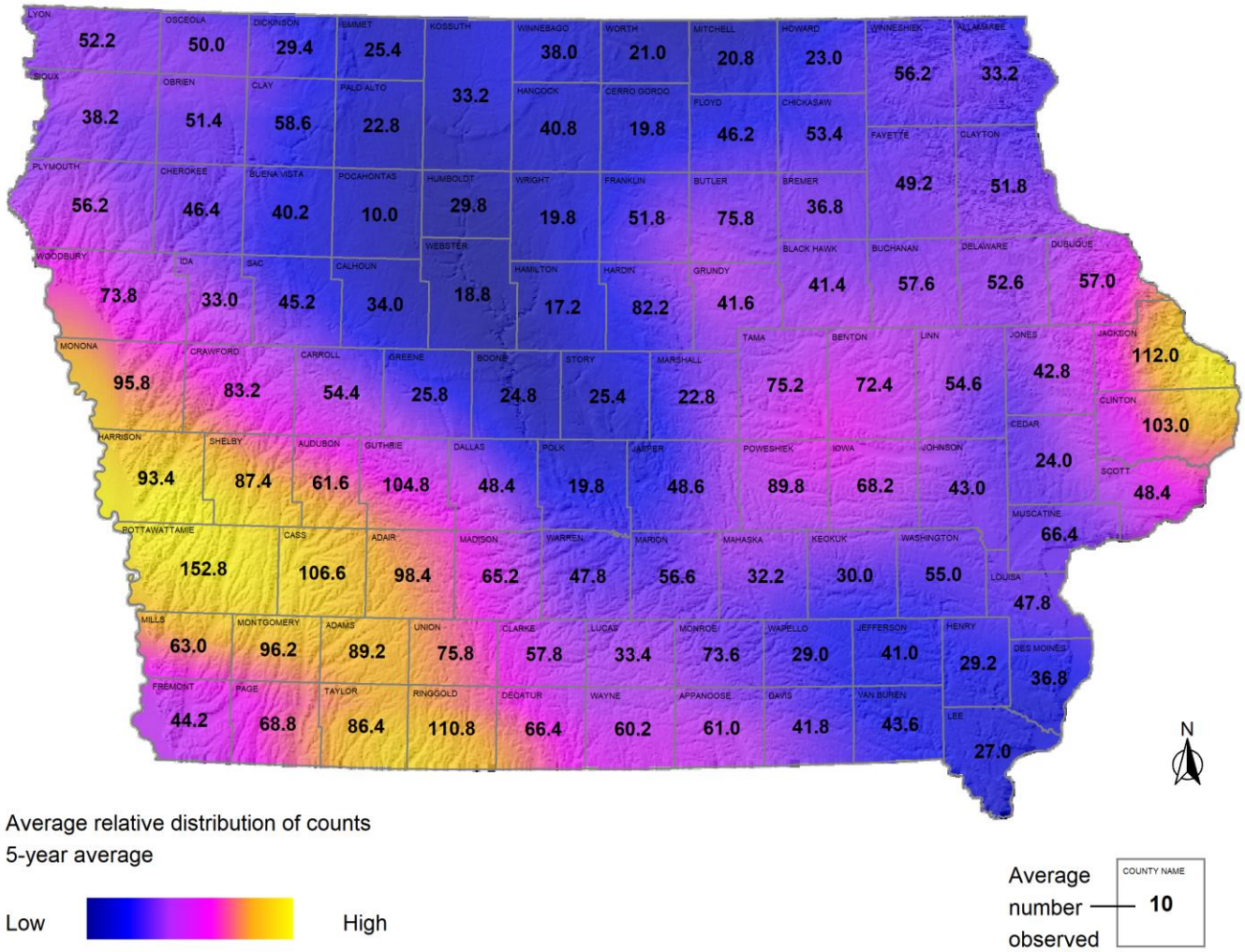


Figure 27. Average relative distribution of spring spotlight observations for raccoon during the past 5 years in Iowa. The number of observations per county is relative to the highest and lowest number of observations across all counties during the survey and may not represent an over- or under-abundance of the species (i.e., high counts are considered high relative to those observed in all other counties).

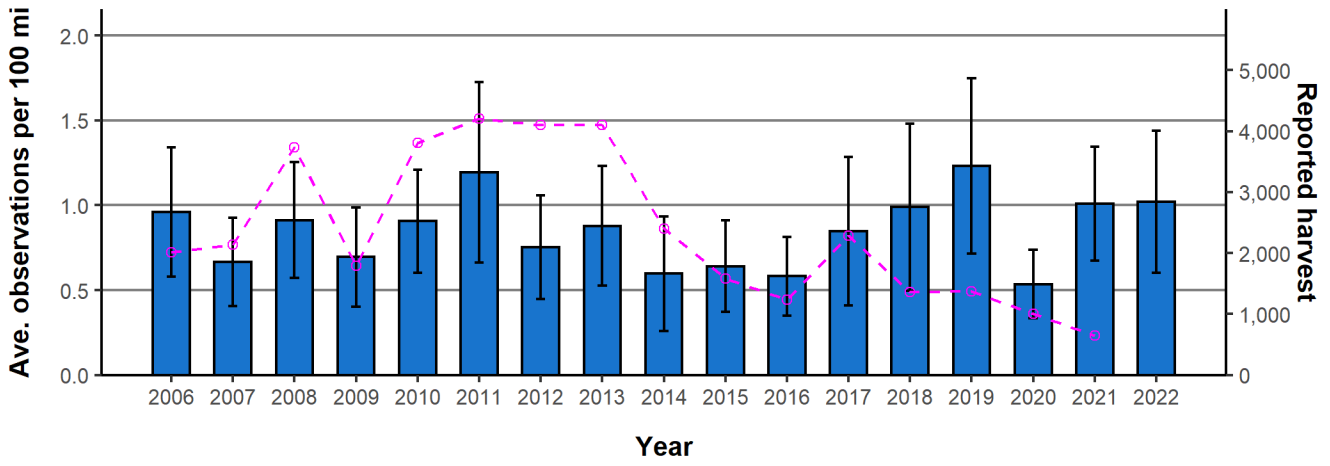


Figure 28. Average red fox observations per 100 miles surveyed during the Iowa Spring Spotlight Survey, 2006–2022. Error bars indicate 95% confidence intervals. Dashed line indicates the reported statewide harvest.

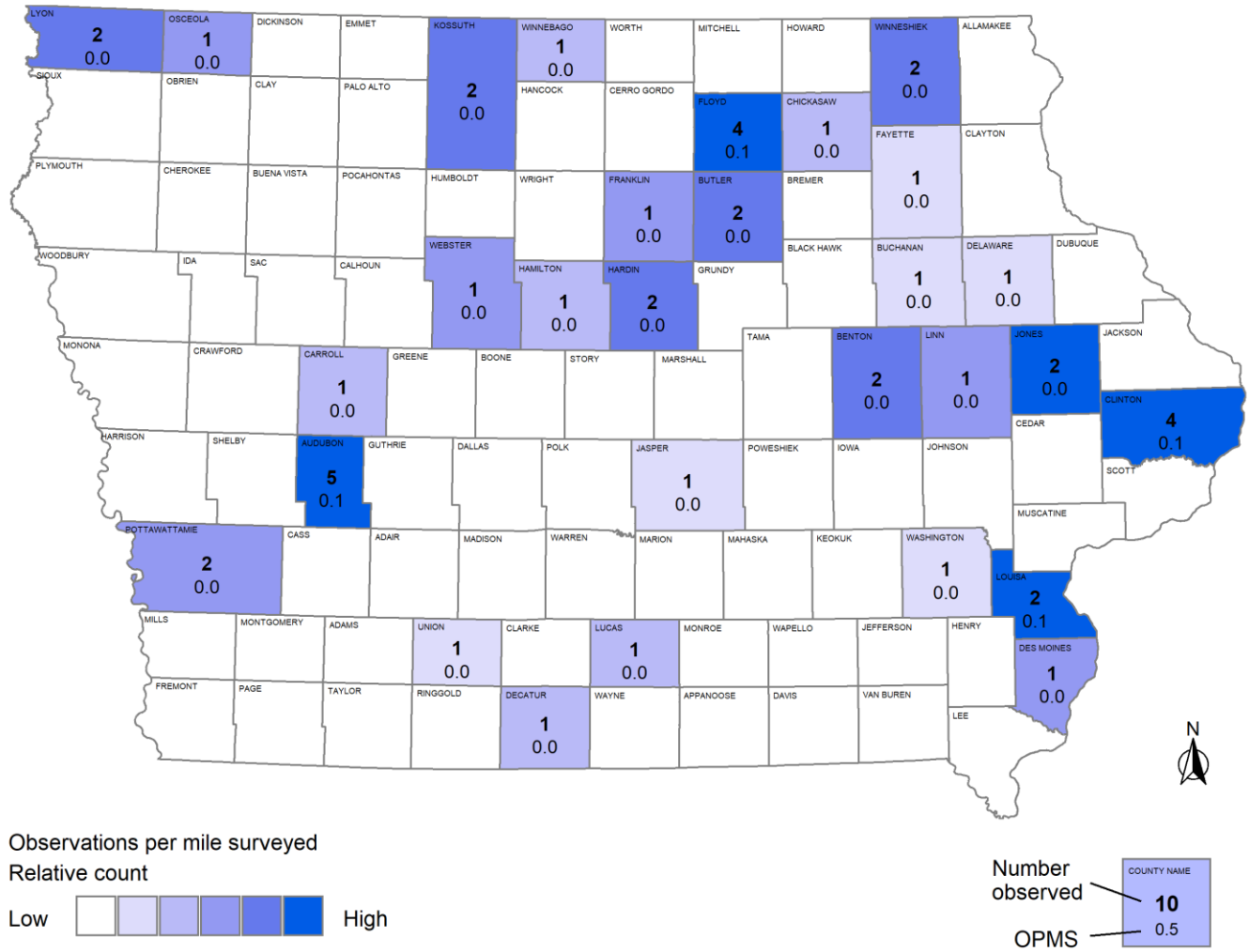


Figure 29. Total number of red fox observations per county during the Iowa Spring Spotlight Survey, 2022. Color shading indicates the number of animals counted per mile surveyed (OPMS).

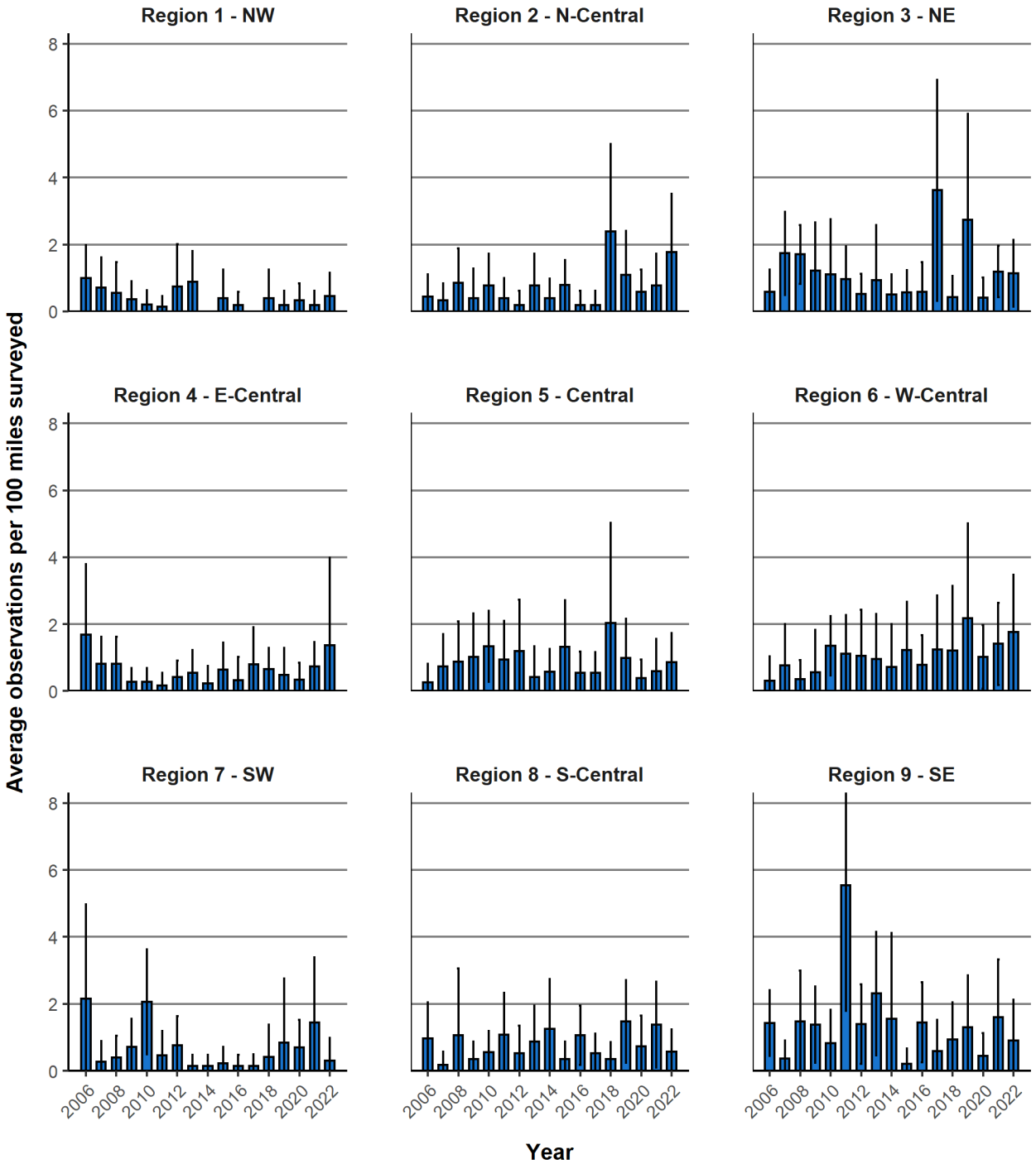


Figure 30. Average red fox observations per 100 miles surveyed during the Spring Spotlight Survey for nine regions of Iowa, 2006–2022. Error bars indicate 95% confidence intervals. Red fox includes observations listed as “fox” due to the rarity of gray fox in the state.

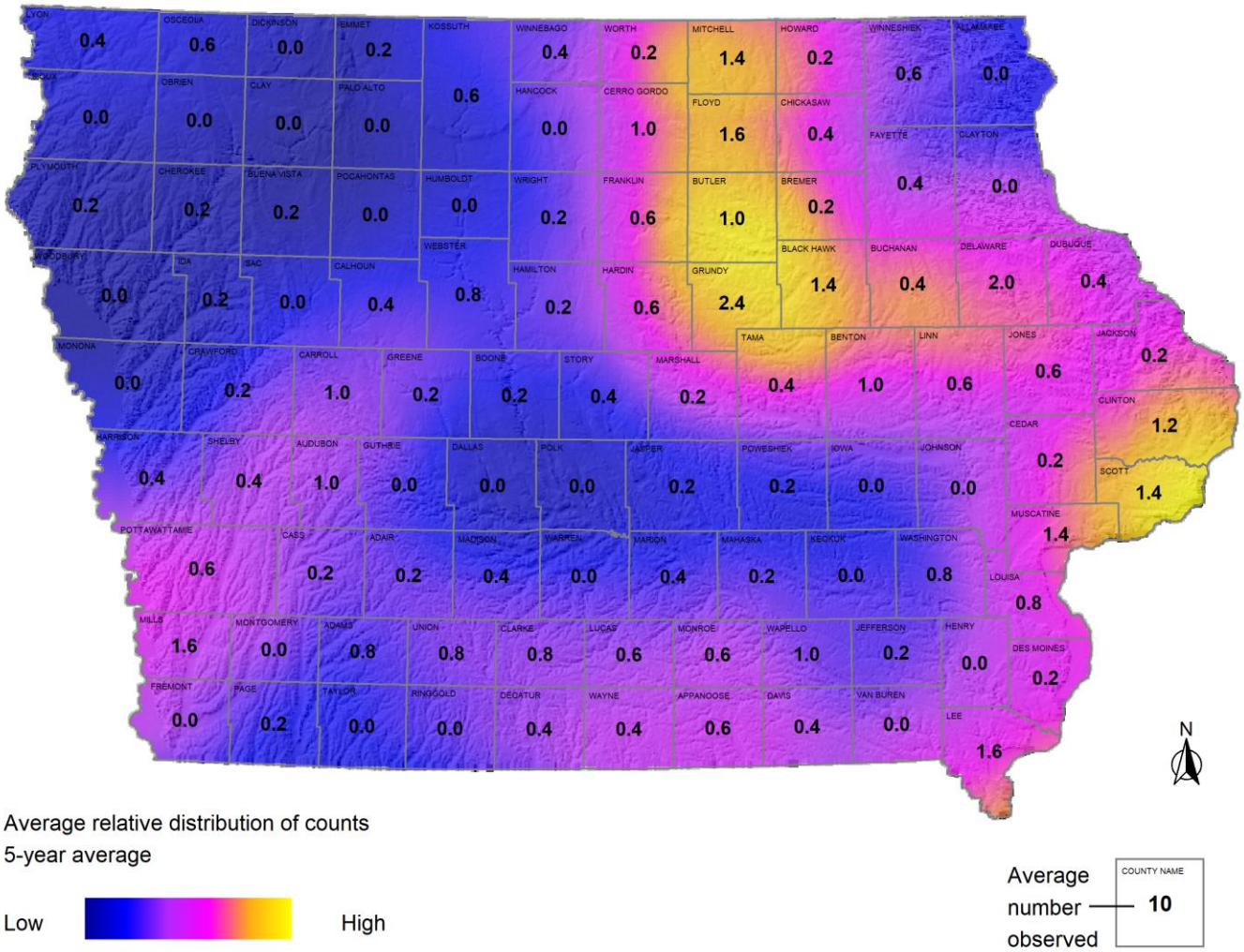


Figure 31. Average relative distribution of spring spotlight observations for red fox during the past 5 years in Iowa. The number of observations per county is relative to the highest and lowest number of observations across all counties during the survey and may not represent an over- or under-abundance of the species (i.e., high counts are considered high relative to those observed in all other counties).

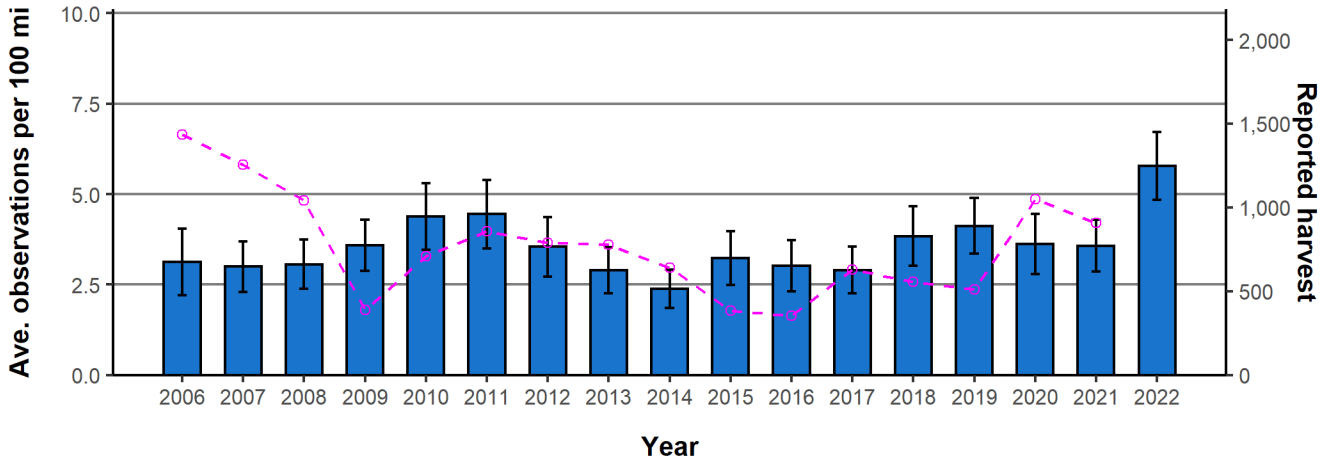


Figure 32. Average striped skunk observations per 100 miles surveyed during the Iowa Spring Spotlight Survey, 2006–2022. Error bars indicate 95% confidence intervals. Dashed line indicates the reported statewide harvest.

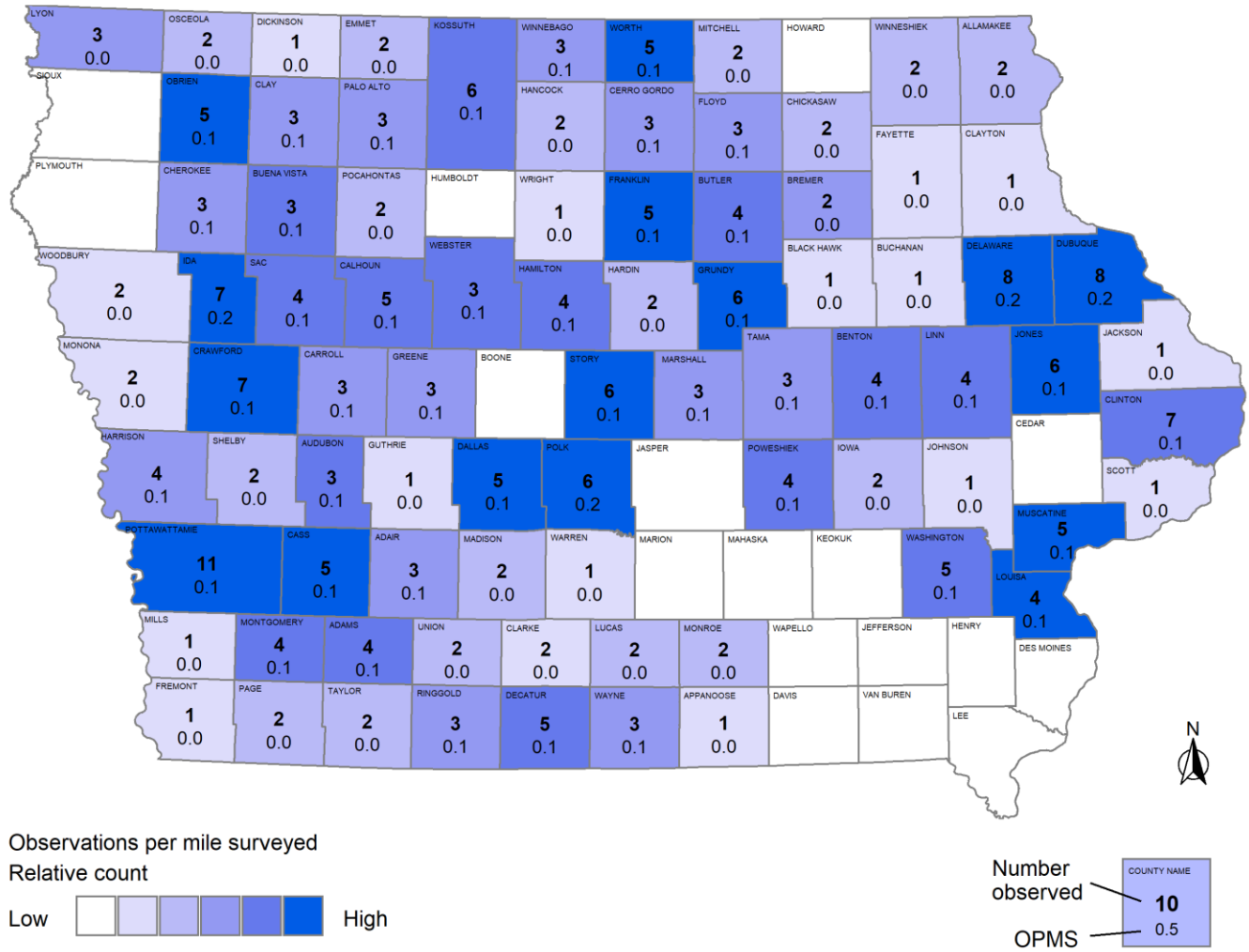


Figure 33. Total number of striped skunk observations per county during the Iowa Spring Spotlight Survey, 2022. Color shading indicates the number of animals counted per mile surveyed (OPMS). Counts likely include few or no spotted skunk.

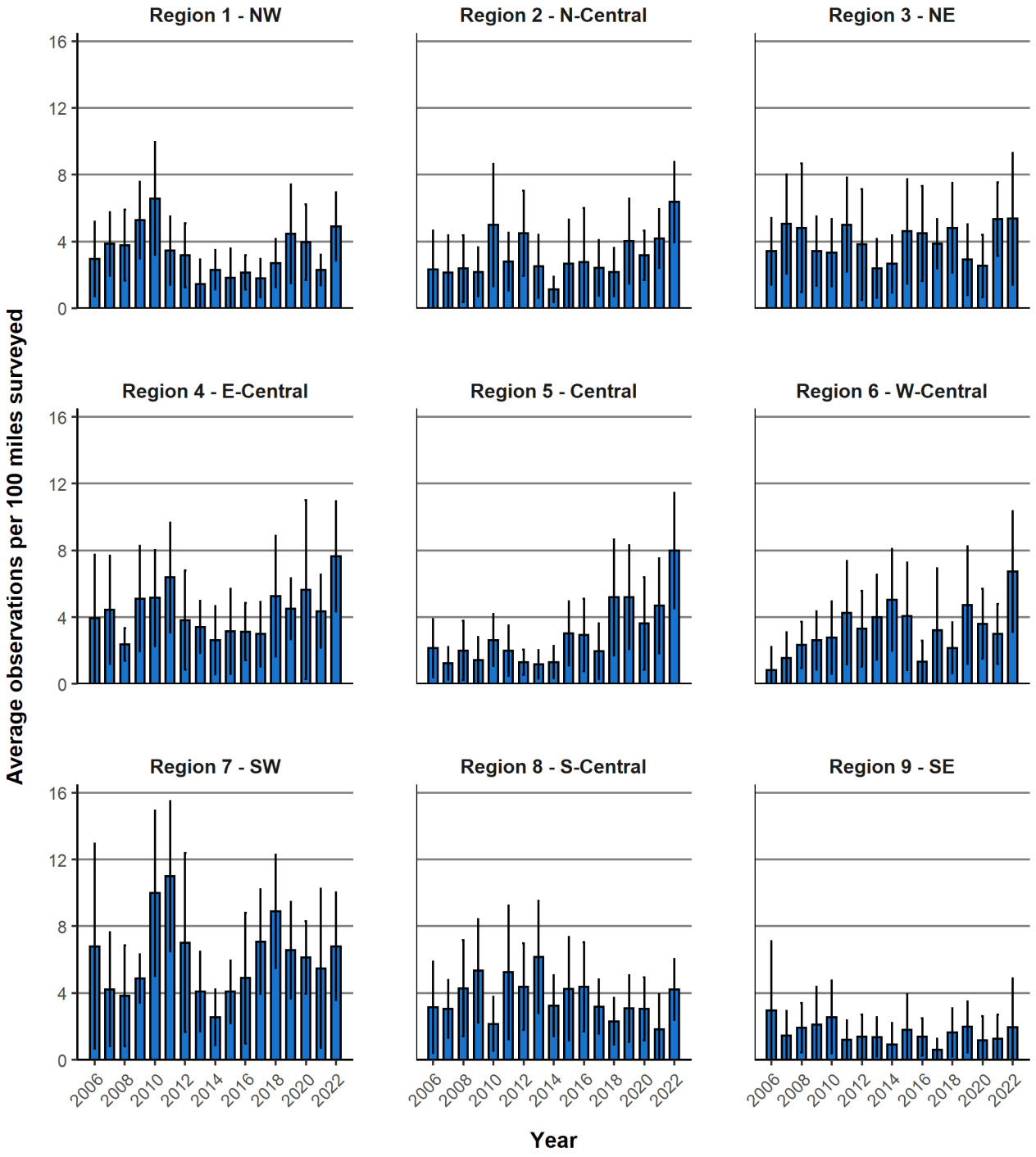


Figure 34. Average skunk observations per 100 miles surveyed during the Spring Spotlight Survey for nine regions of Iowa, 2006–2022. Error bars indicate 95% confidence intervals. Skunk includes all observations recorded as “striped skunk” and “skunk” and likely includes none or few spotted skunk observations due to the rarity of the species in the state.

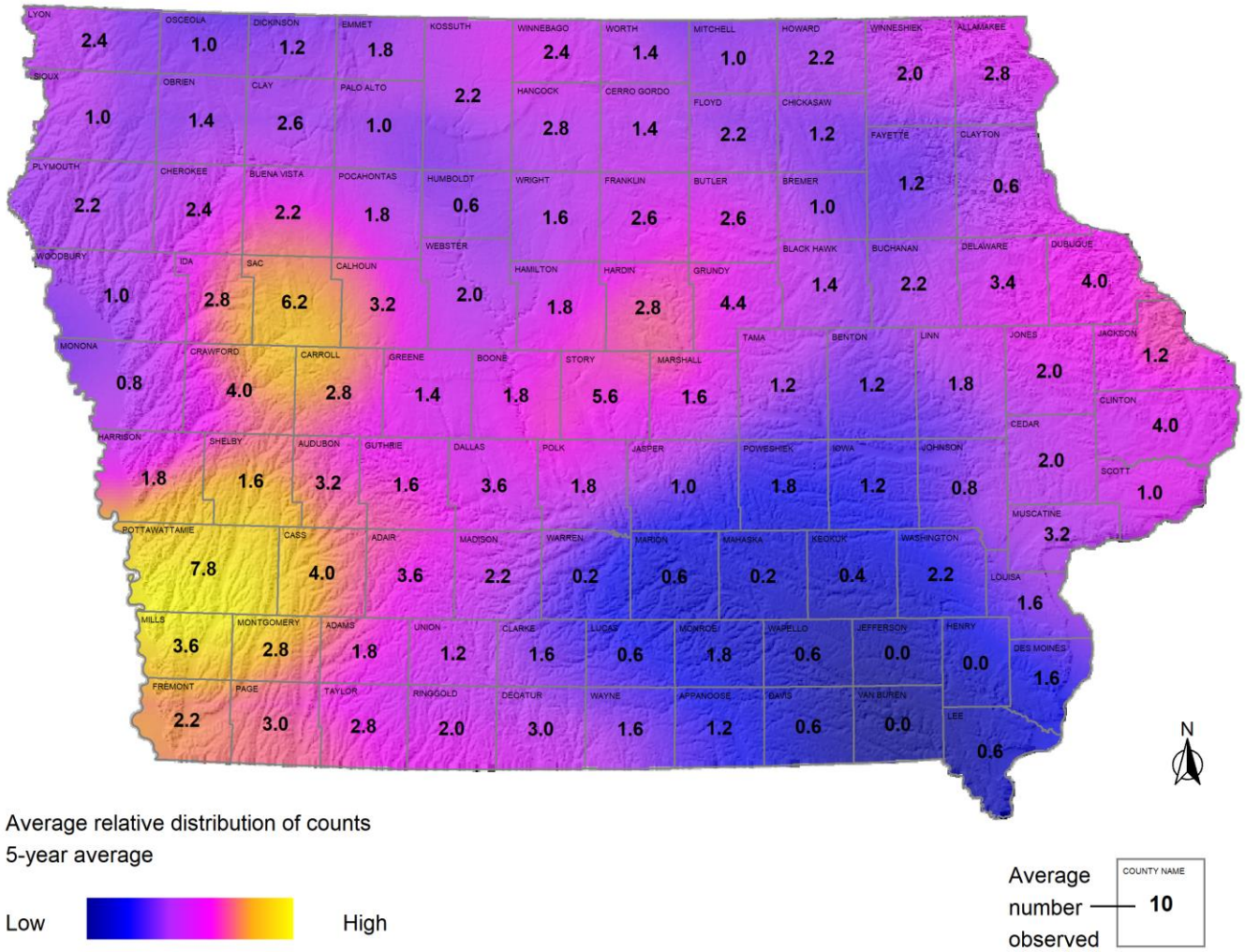


Figure 35. Average relative distribution of spring spotlight observations for skunk during the past 5 years in Iowa. The number of observations per county is relative to the highest and lowest number of observations across all counties during the survey and may not represent an over- or under-abundance of the species (i.e., high counts are considered high relative to those observed in all other counties). Counts likely include few or no spotted skunk observations due to their rarity in the state.

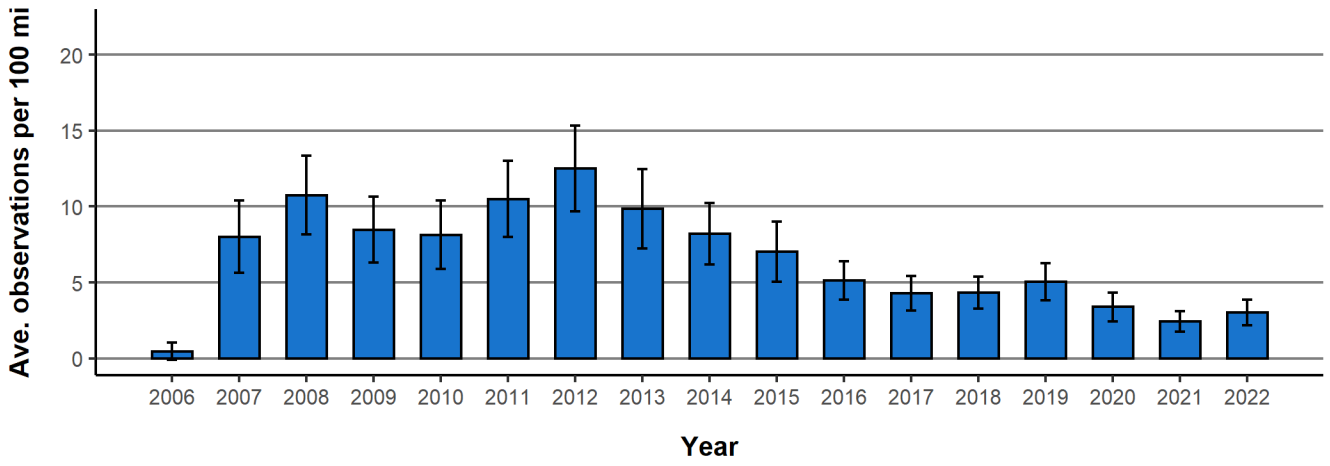


Figure 36. Average free-ranging house cat observations per 100 miles surveyed during the Iowa Spring Spotlight Survey, 2006–2022. Error bars indicate 95% confidence intervals. Observations were not recorded in most counties during 2006.

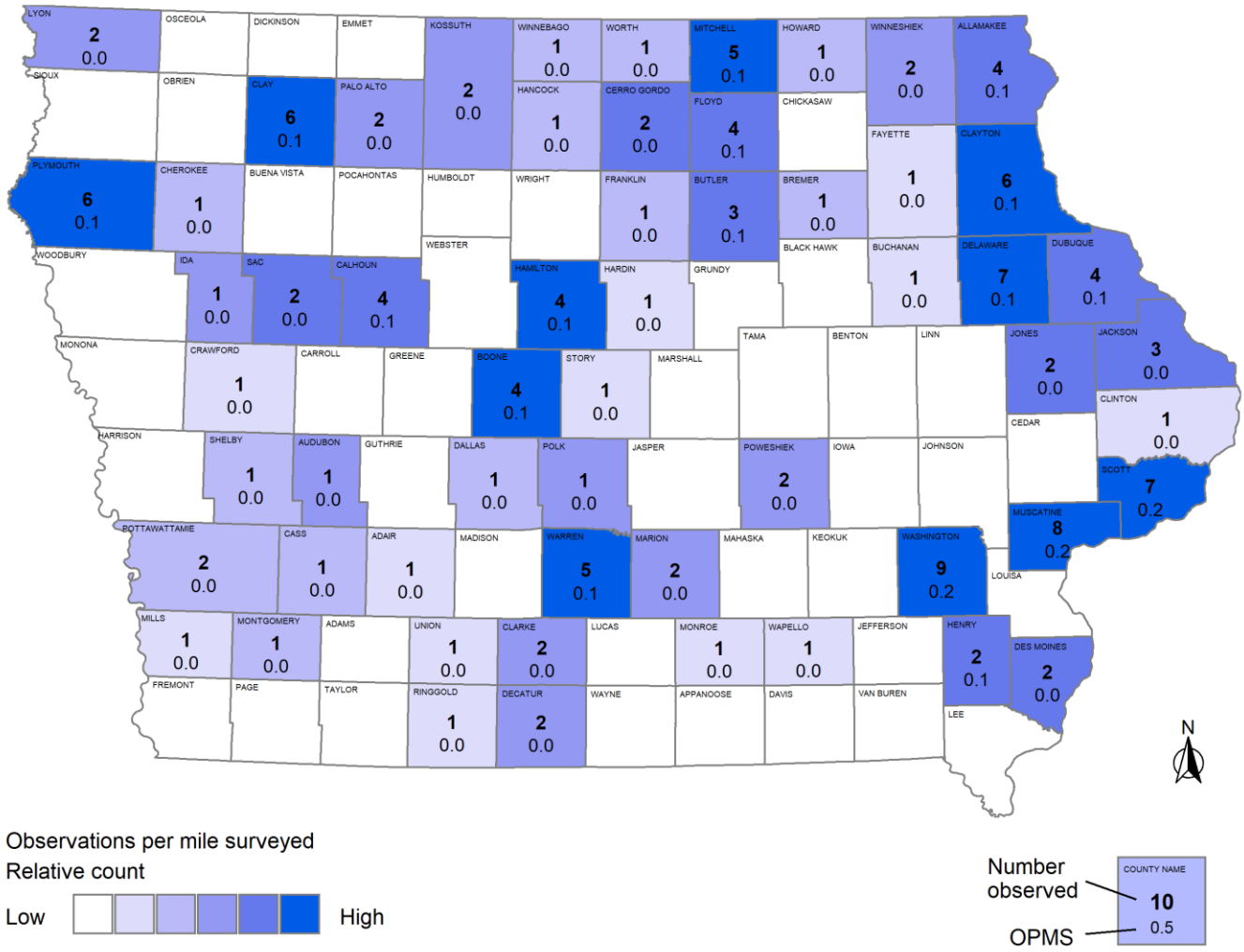


Figure 37. Total number of free-ranging house cat observations per county during the Iowa Spring Spotlight Survey, 2020. Cats located at farmsteads not included in counts. Color shading indicates the number counted per mile surveyed (OPMS).

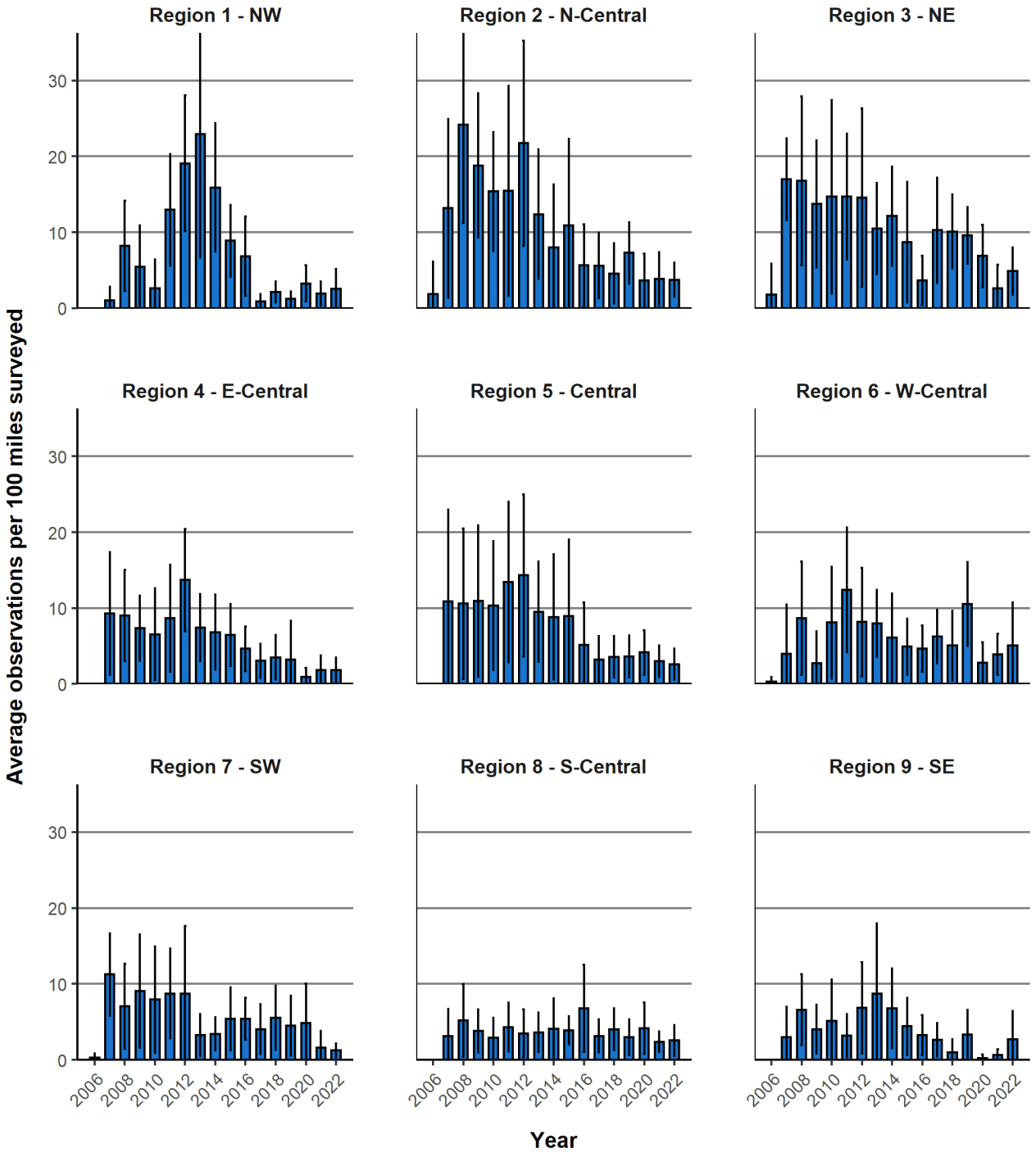


Figure 38. Average free-ranging house cat observations per 100 miles surveyed during the Spring Spotlight Survey for nine regions of Iowa, 2006–2022. Error bars indicate 95% confidence intervals. Cats located at farmsteads or human developments were not included in counts. Observations were not recorded in most counties during 2006.

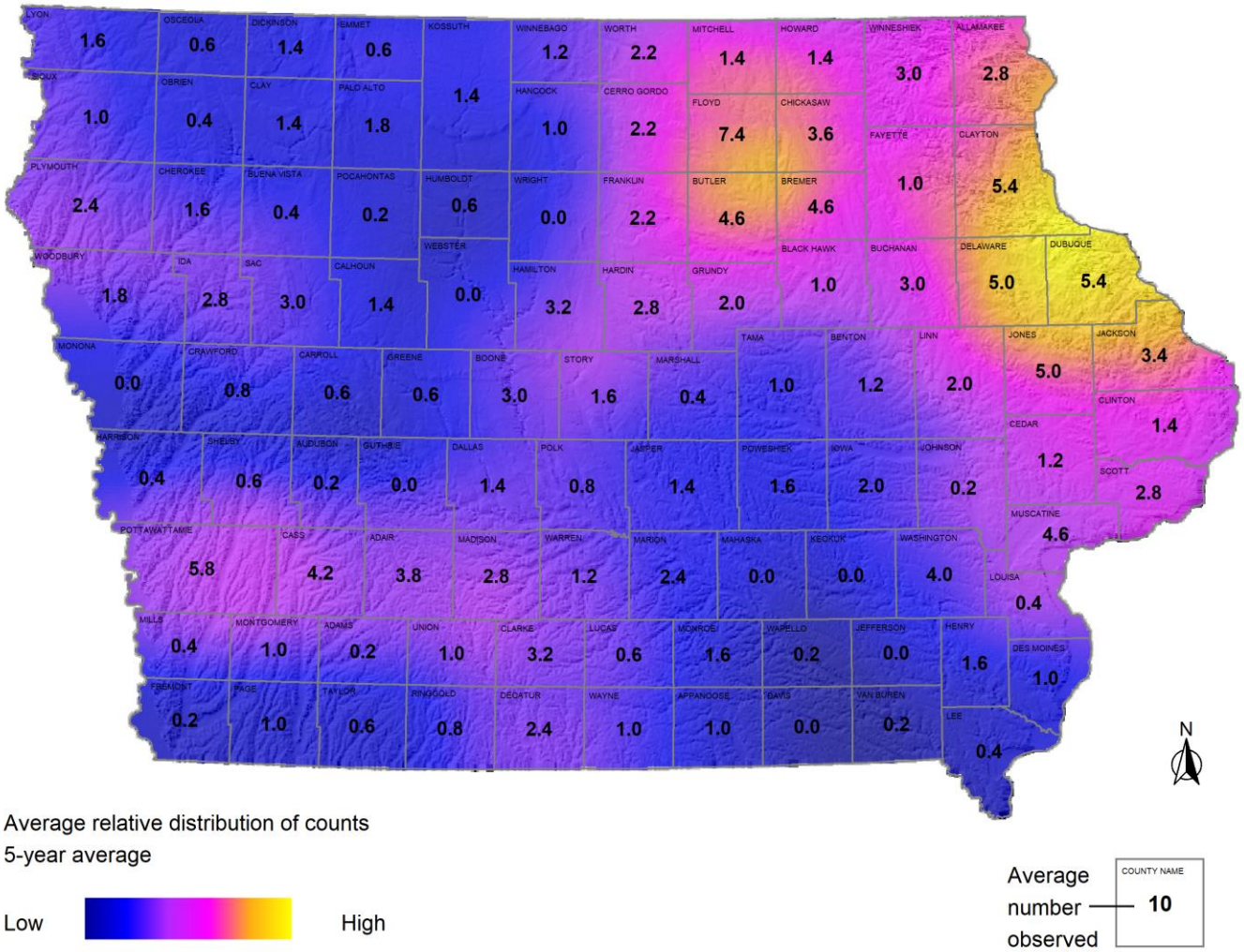
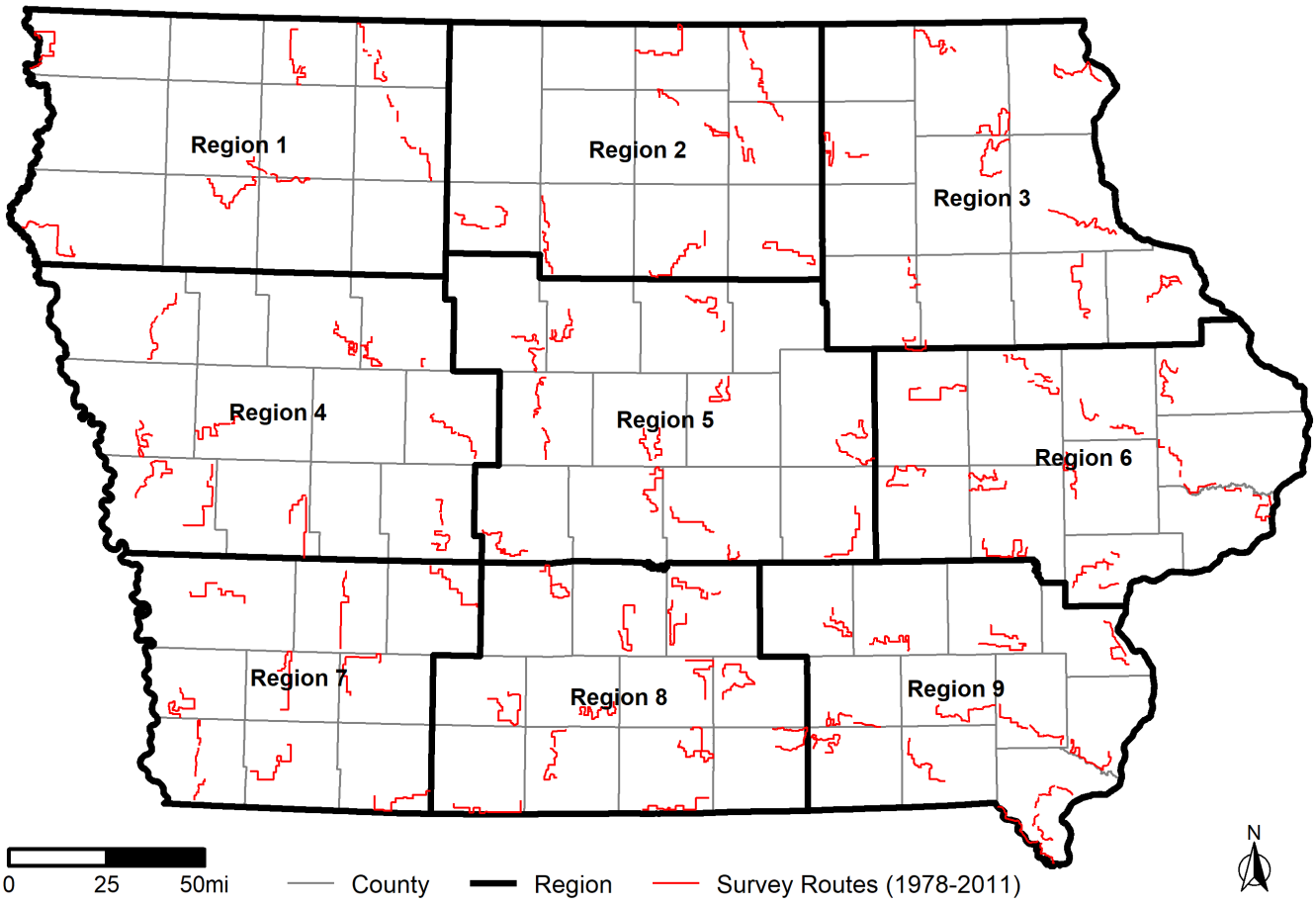


Figure 39. Average relative distribution of spring spotlight observations for house cat during the past 5 years in Iowa. The number of observations per county is relative to the highest and lowest number of observations across all counties during the survey and may not represent an over- or under-abundance of the species (i.e., high counts are considered high relative to those observed in all other counties). House cats located at farmsteads or human developments were not included in counts.

APPENDICES

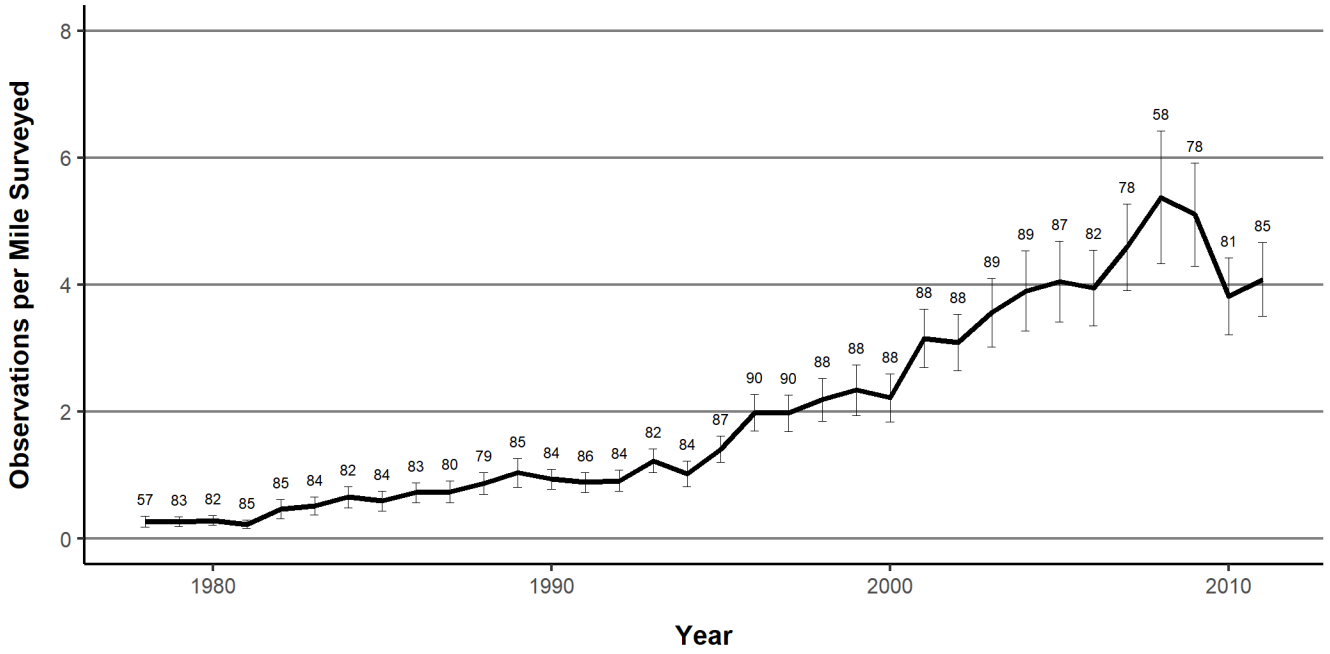
IOWA SPRING SPOTLIGHT SURVEY RESULTS FOR WHITE-TAILED DEER AND NORTHERN RACCOON, 1978–2011

APPENDIX A



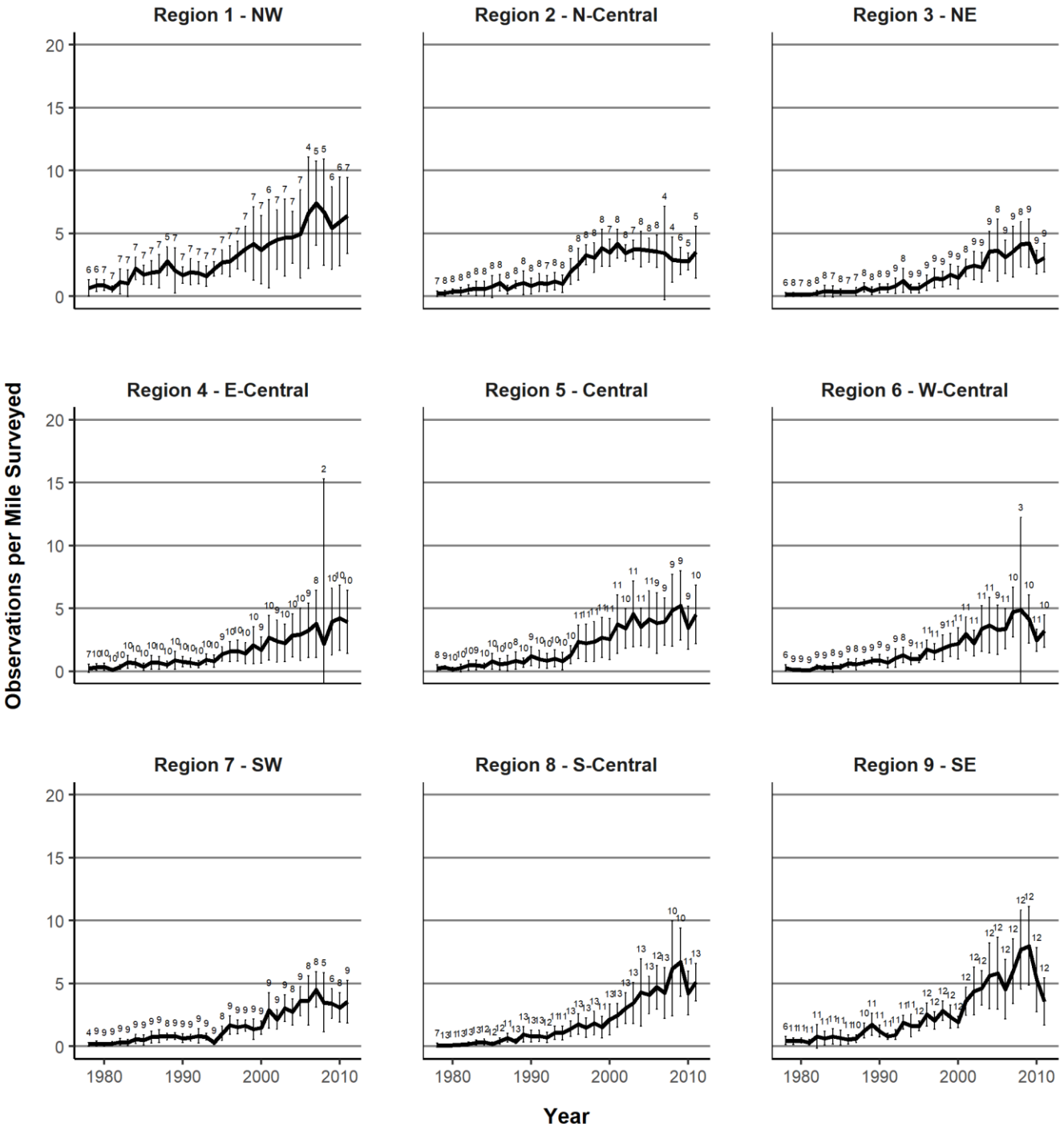
Appendix A. Regions used for summarizing Spring Spotlight Survey observations in Iowa and historical Spring Spotlight Survey routes sampled from 1978–2011.

APPENDIX B



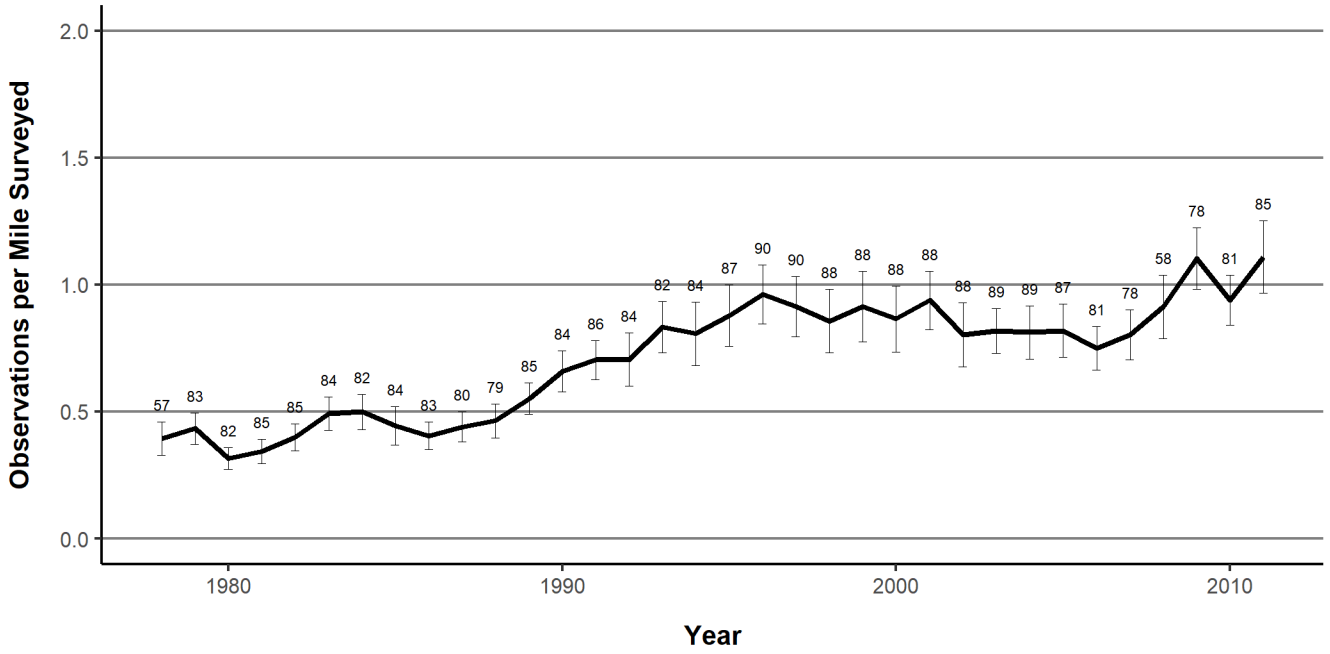
Appendix B. Statewide average white-tailed deer observations per mile surveyed during the Iowa Spring Spotlight Survey, 1978–2011. Observations were standardized by mile surveyed to account for regions in which counties were not surveyed. Error bars indicate 95% confidence intervals. Numbers above error bars indicate the number of transects surveyed each year.

APPENDIX C



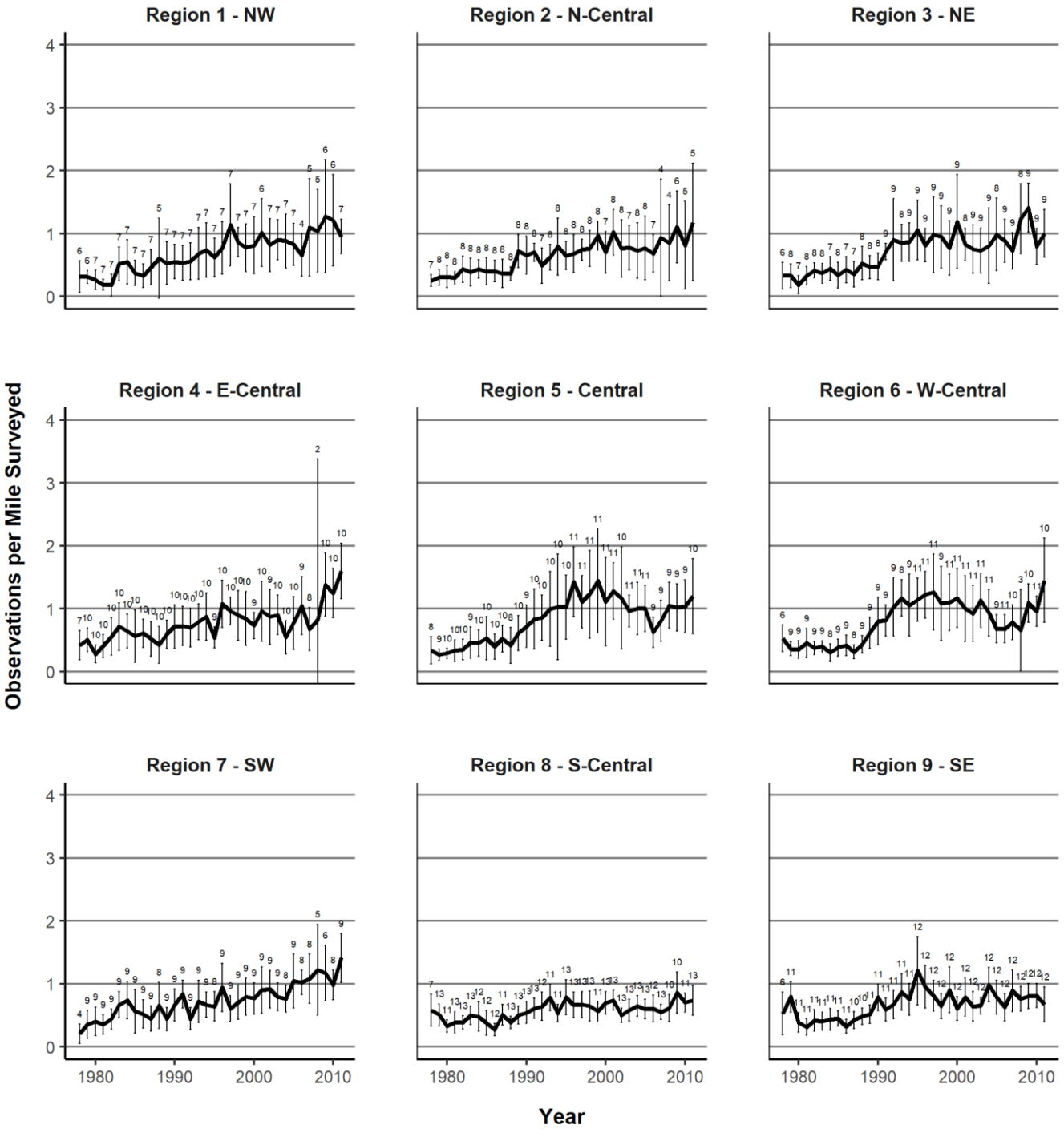
Appendix C. Average white-tailed deer observations per mile surveyed during the Iowa Spring Spotlight Survey, 1978–2011. Observations were standardized by mile surveyed to account for regions in which counties were not surveyed. Error bars indicate 95% confidence intervals. Numbers above error bars indicate the number of transects surveyed each year. Note, surveys were conducted linearly along forested habitats and not standardized by amount of available habitat in each region; thus, cross-regional comparisons should be considered with caution as data represents the relative change in species abundance within each region.

APPENDIX D



Appendix D. Average raccoon observations per mile surveyed during the Iowa Spring Spotlight Survey, 1978–2011. Observations were standardized by mile surveyed to account for variable number of transects surveyed each year. Error bars indicate 95% confidence intervals. Numbers above error bars indicate the number of transects surveyed each year.

APPENDIX E



Appendix E. Average raccoon observations per mile surveyed during the Iowa Spring Spotlight Survey, 1978–2011. Observations were standardized by mile surveyed to account for regions in which counties were not surveyed. Error bars indicate 95% confidence intervals. Numbers above error bars indicate the number of transects surveyed each year. Note, surveys were conducted linearly along forested habitats and not standardized by amount of available habitat in each region; thus, cross-regional comparisons should be considered with caution as data represents the relative change in species abundance within each region.