2024 MINNESOTA SPRUCE GROUSE SURVEY

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SUMMARY OF FINDINGS

The Minnesota Department of Natural Resources (MNDNR) initiated a spring (March-May) spruce grouse (*Canachites candadensis*) survey in 2018 with the help of dozens of cooperators and citizen volunteers. During 2018-2021, we used replicate surveys to quantify variation in the pellet detection process. Spruce grouse pellets were detected at an average of 32% of sites (range: 26 to 39) during initial visits. However, data from replicate surveys indicated that 57–66% of survey sites classified as "unused" in initial surveys may have had spruce grouse pellets present but they were missed (overlooked) or not available for detection (e.g., buried in the snow). Fortunately, the detection process appears to be relatively consistent over time. Therefore, although naïve site use is a biased estimate of true site use, it should serve as a reasonable monitoring metric in this case; especially given our monitoring goal is to be able to detect a relatively large decrease over a 10-yr interval. Beginning in 2022, we conducted single-visit surveys. The mean conditional pellet count in 2024 (25.6 pellets/used site) was almost double that observed in 2023 (14.2), whereas the proportion of used sites (39%) and used routes (64%) was similar to 2023 (33% and 62%, respectively). Furthermore, we did not find evidence of a statistically significant change in mean pellet counts rangewide during 2018-2024. However, at the ecosection level, count indices suggest a possible decrease in the Minnesota Drift and Lake Plains, which is the southern part of spruce grouse range in MN. We have relatively few routes (10) and survey sites (44) in this ecosection and the counts are dominated by zeros, which makes the observed changes more difficult to detect and interpret. Overall, the spruce grouse population appears to be reasonably stable in terms of our monitoring metrics and spatial extent, except possibly in the extreme southern part of their range in MN.

INTRODUCTION

Spruce grouse, *Canachites candadensis*, are a conifer-dependent gamebird in Minnesota and are expected to experience a range contraction due to climate change-induced habitat loss (Scheller and Mladenoff 2005, Prasad et al. 2007, Iverson et al. 2008). Thus, spruce grouse will likely have a more limited distribution in the southern portions of their range, which includes the Great Lakes region, in the future. The spruce grouse is considered a Species of Special Concern in Michigan (Michigan DNR 2005) and was listed as threatened in Wisconsin in 1997 (Wisconsin DNR 2004). Minnesota is unique among the Great Lakes states in that it still permits spruce grouse hunting, although they are a Species of Greatest Conservation Need because they are vulnerable to decline (Minnesota Department of Natural Resources, MNDNR 2015). Yet, the only data the MNDNR collected on spruce grouse before 2018 was estimated total harvest as part of the annual Small Game Harvest Mail Survey (Davros and Dexter 2020). Estimated total harvest of spruce grouse has been 7,000–19,000 birds/year since 2010 (Davros

and Dexter 2020). However, variation in spruce grouse harvest among years may be more reflective of the number of ruffed grouse (*Bonasa umbellus*) hunters; thus these harvest data cannot be used as a population index for spruce grouse (Gregg et al. 2004).

During 2014–2017, we developed survey methodology to provide an index of the spruce grouse population (Roy et al. 2014, 2015, 2016, 2017, 2020). We evaluated an auditory survey using playback of female cantus calls (Roy et al. 2020), which is the most common approach to survey spruce grouse (Fritz 1979, Boag and McKinnon 1982, Schroeder and Boag 1989, Whitcomb et al. 1996, Lycke et al. 2011), and also evaluated a fecal pellet survey (Roy et al. 2020) as a means to monitor the population. Fecal pellets are easily detected in late winter/early spring as the snow pack dissipates and pellets that have been deposited and frozen during winter become visible on the snow surface, indicating spruce grouse use of forest stands. The pellet survey was more efficient and had higher detection rates than the auditory survey. We also found road effects to be negligible in high-use cover types [e.g., jack pine (*Pinus banksiana*) and black spruce (*Picea mariana*)]. Thus, we designed a monitoring program based on a survey of sites centered on road-based points (hereafter, survey "sites") in spruce grouse cover types dispersed across their range in Minnesota.

In 2018, MNDNR launched the annual spruce grouse pellet survey with the cooperation of biologists from the Chippewa National Forest, Grand Portage Band of Lake Superior Chippewa, Leech Lake Band of Ojibwe, Minnesota Department of Natural Resources, Red Lake Band of Chippewa Indians, Superior National Forest, 1854 Treaty Authority, Vermilion Community College, and dozens of citizen volunteers. This survey is expected to be able to detect meaningful changes in the population over a 10-year period (i.e., >15% decline) and is intended to provide population information (i.e., status and distribution) that can be used to guide management decisions. In addition to collecting data on spruce grouse, we also count pellets from ruffed grouse and snowshoe hares (*Lepus americanus*), and report simple count-based monitoring metrics for these species.

METHODS

The pellet survey is composed of 319 sites (waypoints) organized into 67 routes with 4-5 road-based sites per route spaced >400 m apart (Figure 1). Each route has >1 point with >30% black spruce or jack pine habitat. For the operational survey, sites are visited once during March-May, although we did conduct some revisit surveys during 2018-2021 to better understand the observation and detection process. Observers use a Global Positioning System (GPS) to walk a circular transect with a 100-m radius (i.e., 628-m length) centered on roadside sampling points. Observers record single grouse pellets and roost piles <1 m on either side of transects. Multiple pellets within a 30-cm diameter circle are considered a "roost" for the purpose of this survey. This standardization of the method is necessary because spruce grouse often roost in trees during winter and pellets fall to the ground in poorly defined roost piles. Ruffed grouse pellets tend to be shorter, thicker, and usually have a uric acid wash, whereas spruce grouse pellets are longer, thinner, and infrequently have a uric acid wash. Spruce grouse pellets are also darker green in color when spruce grouse are consuming conifer needles (during winter), but color changes depend on diet; spruce grouse pellets can have a similar color to ruffed grouse pellets later in the spring. At each site observers also record covariate data on major disturbances; access issues; the proportion of the 628-m transect that is located in spruce grouse cover types; days since last snow fall; whether snow cover is complete, partial, or gone; and survey conditions on a scale of 0-10, with 10 being the best conditions to detect pellets. Ruffed grouse and snowshoe hare pellets were recorded in a similar manner to spruce grouse pellets, but snowshoe hare pellets were reclassified in ordinal categories (0, 1-4, 5-11, 12-25, 25+) because the historic data contained inconsistent right-censored values and non-numeric data (e.g., "lots", "so many").

For the operational survey, we compute 3 annual count metrics for spruce grouse, ruffed

grouse, and snowshoe hare: 1) proportion of sites surveyed where at least 1 pellet was detected (index of site use), 2) mean conditional pellet count (index of pellet abundance at used sites), and 3) proportion of routes surveyed where at least 1 pellet was detected (route-level index). We computed 85% confidence intervals (CI) for these monitoring metrics by generating 500 bootstrap samples and then extracting the 0.075 and 0.925 quantiles of the bootstrapped estimates. We used revisit surveys and occupancy modeling during 2018-2021 to better understand the observation and detection process in spruce-grouse pellet surveys (see Roy et al. 2017), but maintaining this level of survey effort was not feasible (money or staff time) for the long-term operational survey. As a compromise, we used the information from our occupancy models to construct a model based on single-visit surveys. We examined whether a temporal trend in the mean annual spruce grouse pellet count was supported while adjusting for zero-inflation and annual variation in the sampling process (due to mean survey conditions and random year effects).

RESULTS AND DISCUSSION

Spruce Grouse

In 2024, 63 of 67 routes and 294 of 319 sites were surveyed by cooperating biologists (88% of surveys) and citizen volunteers (12% of surveys) between 4 March and 16 June (Table 1). Observers detected spruce grouse pellets at 115 (39%) sites in 2024, compared to an average of 30% of sites during initial visits in 2018-2023 (Figure 2). At the route level, spruce grouse pellets were detected on 40 routes (63%) in 2024 (Figure 3). Observers detected an average of 25.6 (range: 1–386) spruce grouse pellets (singles + roost piles) at used sites in 2024, compared to an average of 16.6 (annual range: 12.6-22.0) during initial visits in 2018-2023 (Figure 4). We failed to find evidence of a temporal trend (positive or negative) in mean spruce grouse pellet counts (log of estimated slope = -0.025; 85% CI: -0.153 to 0.102; Figure 5). Assuming pellet abundance is a good index of spruce grouse abundance, then the range-wide spruce grouse population in Minnesota appears to have been relatively stable during the 2018-2024 monitoring period (Figure 5). However, there are some indications that spruce grouse abundance in the Minnesota Drift & Lake Plains ecosection may have declined (see Figures 2, 3, and 4). Conversely, we have not observed any large, obvious changes in the spatial distribution of spruce grouse pellet detections over time (Figure 6). We have relatively few routes (n = 10) and sites (n = 44) in the Minnesota Drift & Lake Plains region because it is at the southern edge of the spruce grouse range. Thus, our ability to detect a meaningful population change is low for this subset of the population and it would be difficult to increase sample sizes given the paucity of good spruce grouse habitat in this area, which results in mostly zeros for pellet counts.

Ruffed Grouse and Snowshoe Hare

We detected ruffed grouse pellets (single pellets and roost piles) at 238 (81%) sites in 2024 (Table 1, Figures 2 and 3), with a mean count of 14.7 (range: 1-181) pellets per used site (Figure 4). Observers detected pellets of both spruce grouse and ruffed grouse at 100 sites (34%), whereas we failed to detect pellets of either species at 41 sites (14%).

We detected snowshoe hare pellets at 256 (90%) sites in 2024 (Table 1, Figures 2 and 3). Most (49%) pellet counts were in the 25+ count bin (Figure 4). Snowshoe hares may be declining at the site level in the Northern Minnesota Drift and Lake Plains ecological region since the survey began.

Observers detected pellets of both spruce grouse and snowshoe hares at 107 sites (36%). Pellets of spruce grouse, snowshoe hare, and ruffed grouse were detected at 94 sites (32%).

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Table 1. Spruce grouse (SPGR) routes and sites surveyed in northern Minnesota in 2024 by Department of Natural Resources (DNR) staff, cooperators, and volunteers, and the proportion of sites where observers detected spruce grouse, ruffed grouse (RUGR), and/or snowshoe hare (SNHA) pellets (singles and roosts per used site) during initial visits.

Cooperator	Ecosection	Routes	Sites	SPGR	RUGR	SNHA
Aurora Superior National Forest (SNF)	212N	3	15	0.07	0.93	0.93
Baudette DNR	212M	4	19	0.21	0.37	0.89
Bemidji DNR	212N	2	10	0.10	0.50	0.10
Chippewa National Forest	212N	4	19	0.00	0.63	0.63
Cook SNF	212L	4	20	0.40	0.70	0.80
Duluth DNR	212L	2	9	0.00	0.78	1.00
Ely Superior National Forest	212L	4	17	0.35	1.00	1.00
Grand Marais DNR	212L	2	8	0.25	0.75	1.00
Grand Marais SNF	212L	3	14	0.57	0.64	1.00
Grand Portage Reservation	212L	3	15	0.00	0.93	1.00
Grand Rapids Area (DNR)	212L	1	4	0.25	0.75	1.00
International Falls Area (DNR)	212M	3	13	0.77	0.92	1.00
Orr DNR	212L	4	18	0.67	0.94	0.83
Red Lake Reservation	212N	3	13	0.00	0.77	0.92
Red Lake DNR	212M	5	23	0.96	0.91	1.00
1854 Treaty Authority	212L	4	20	0.50	1.00	0.85
Tofte SNF	212L	6	29	0.76	0.83	1.00
Two Harbors DNR	212L	3	14	0.00	1.00	1.00
Tower DNR	212L	3	14	0.57	0.86	1.00
Not Surveyed	NA	4	25	NA	NA	NA
Total	NA	63	294	0.39	0.81	0.90

212L = Northern Superior Uplands
212M = Northern Minnesota & Ontario Peatlands
212N = Northern Minnesota Drift & Lake Plains

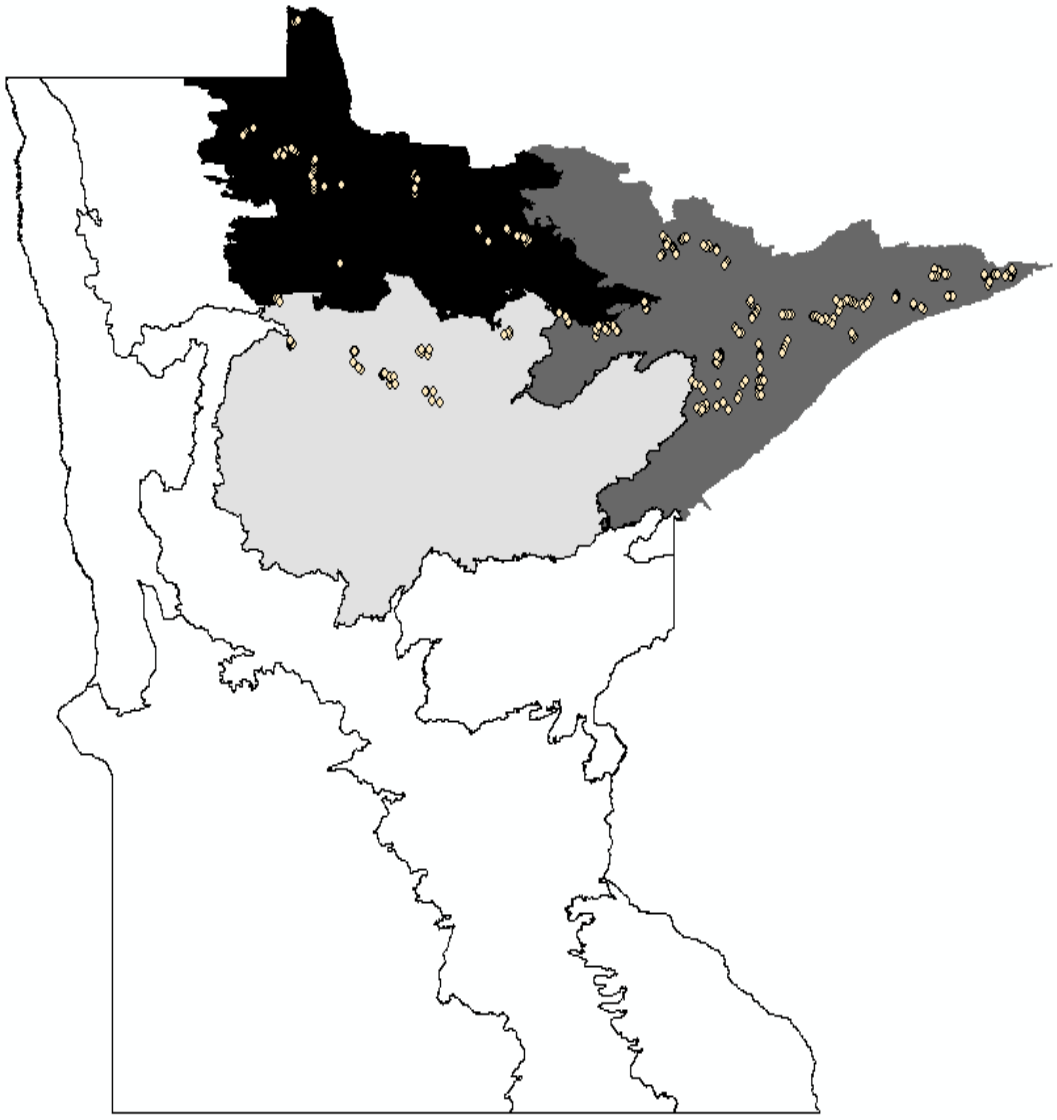

Figure 1. Distribution of sampling sites in northern Minnesota during 2018-2024. Ecological Classification System sections included the Northern Minnesota and Ontario Peatlands (n = 17 routes and 85 sites) in the northwest, the Northern Superior Uplands (n = 40 routes and 190 sites) in the east, and the Northern Minnesota Drift and Lake Plains (n = 10 routes and 44 sites) in the southcentral survey region.

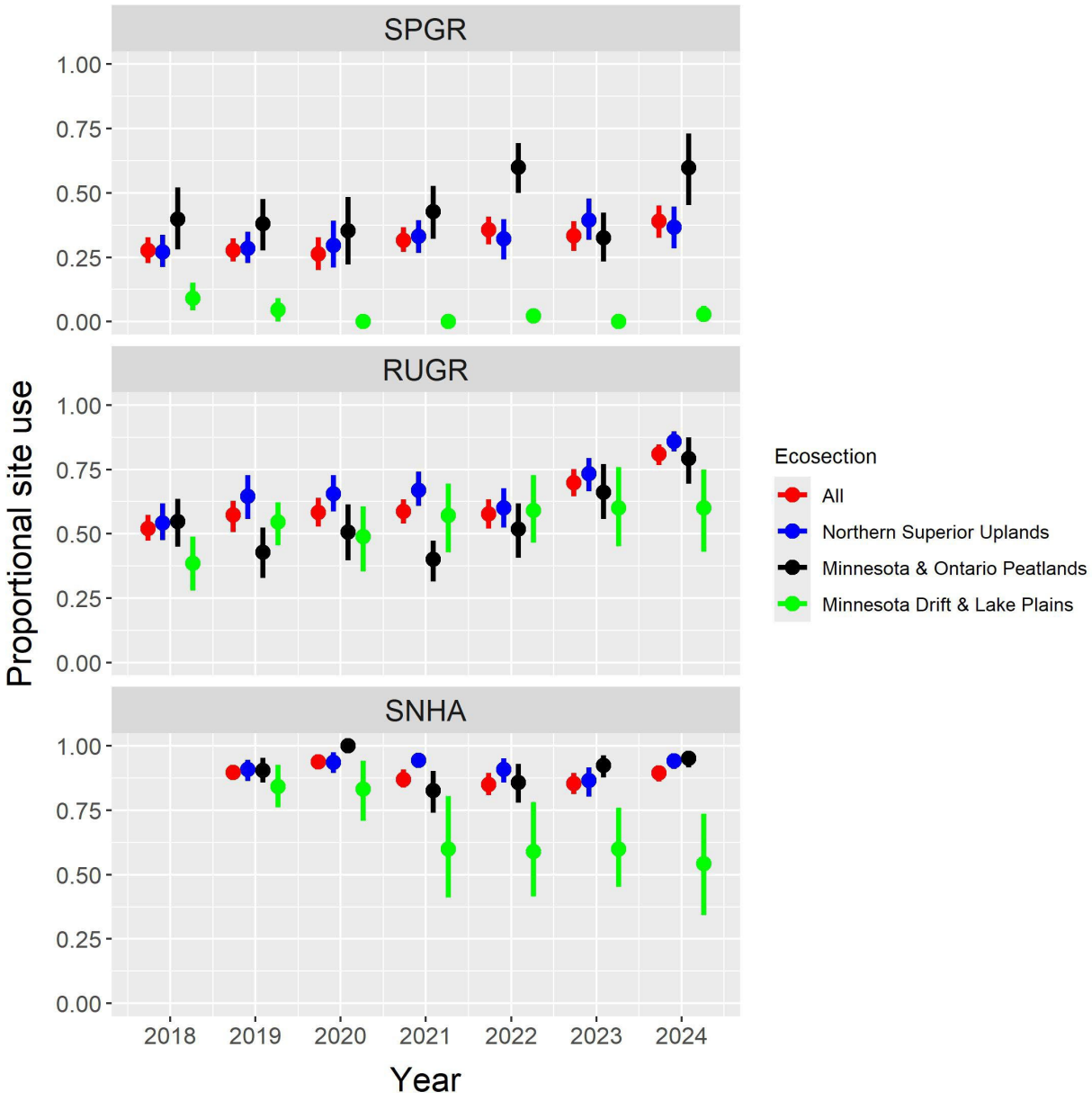

Figure 2. Index of site use in northern Minnesota during 2018-2024 based on the proportion of sites surveyed where at least 1 pellet was detected for spruce grouse (SPGR), ruffed grouse (RUGR), or snowshoe hare (SNHA). Error bars are bootstrapped 85% confidence intervals.

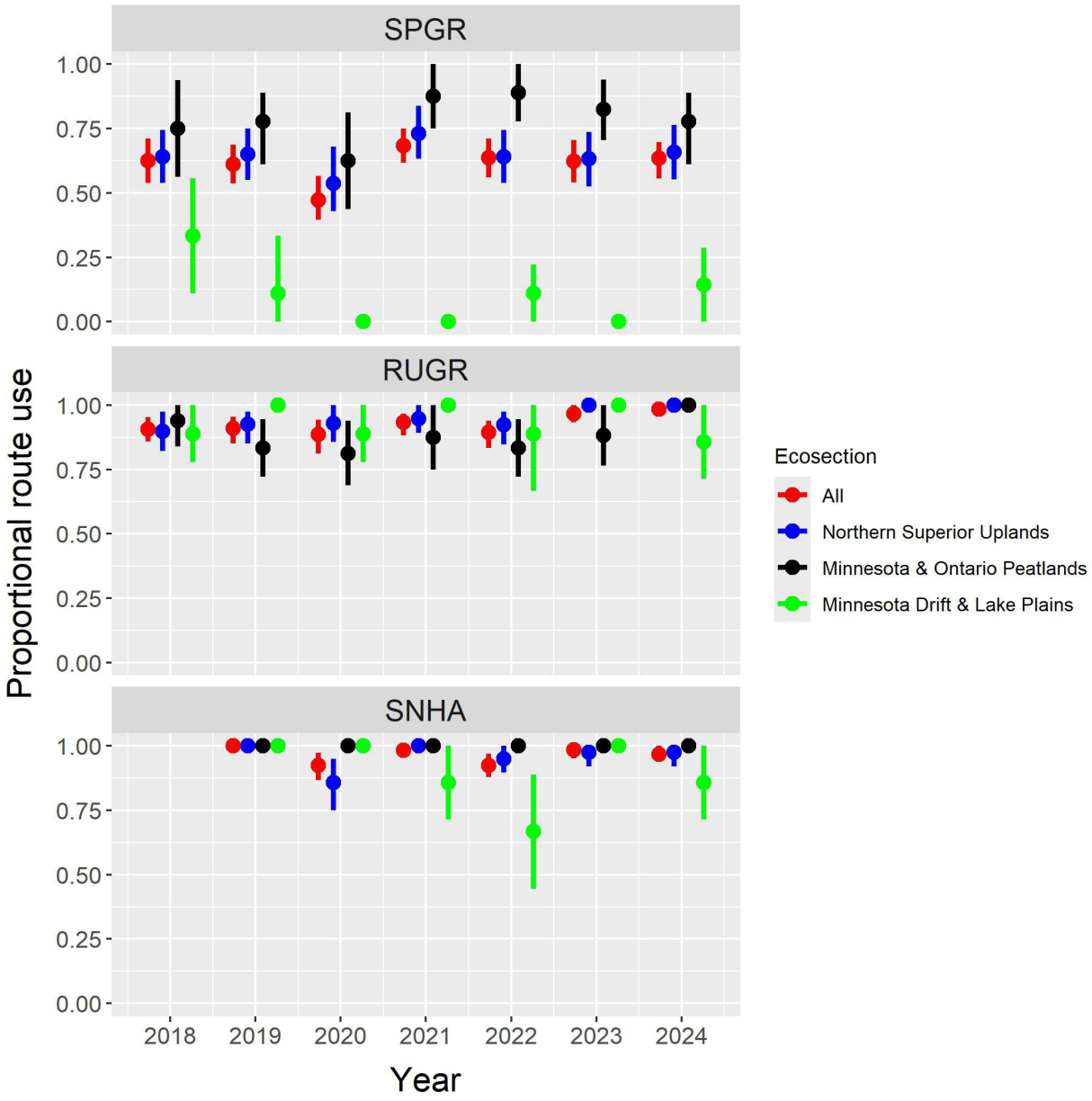

Figure 3. Index of route use in northern Minnesota during 2018-2024 based the proportion of routes surveyed where at least 1 pellet was detected for spruce grouse (SPGR), ruffed grouse (RUGR), or snowshoe hare (SNHA). Error bars are bootstrapped 85% confidence intervals.

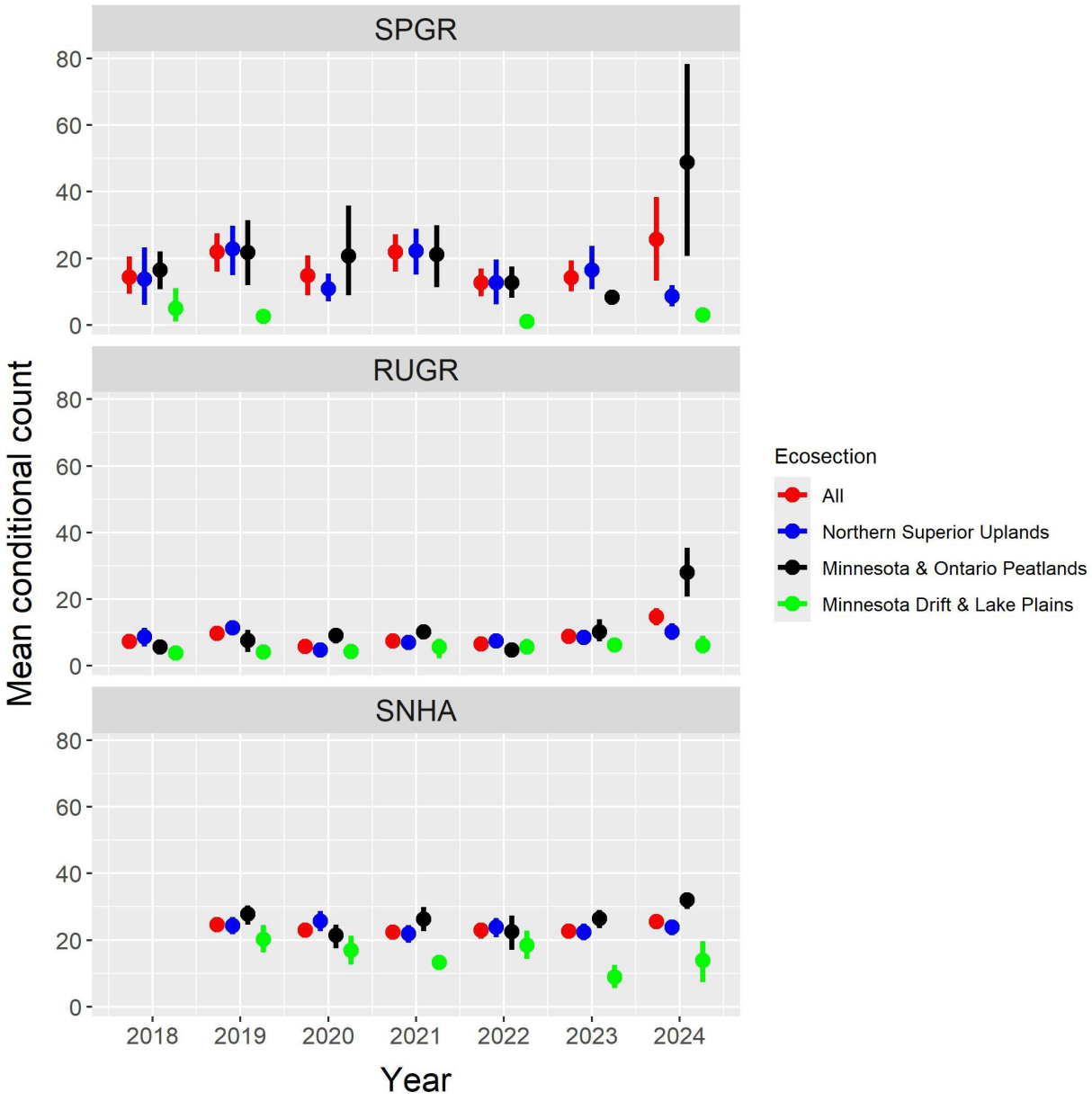

Figure 4. Index of pellet abundance at used sites for spruce grouse (SPGR), ruffed grouse (RUGR), and snowshoe hare (SNHA) in northern Minnesota during 2018-2024. Error bars are bootstrapped 85% confidence intervals. Note: missing data points for spruce grouse in 2020, 2021, and 2023 in the Minnesota Drift and Lake Plains region indicate there were no survey points where pellets were detected, whereas missing data points for snowshoe hare in 2018 are because we did not start systematically counting hare pellets until 2019.

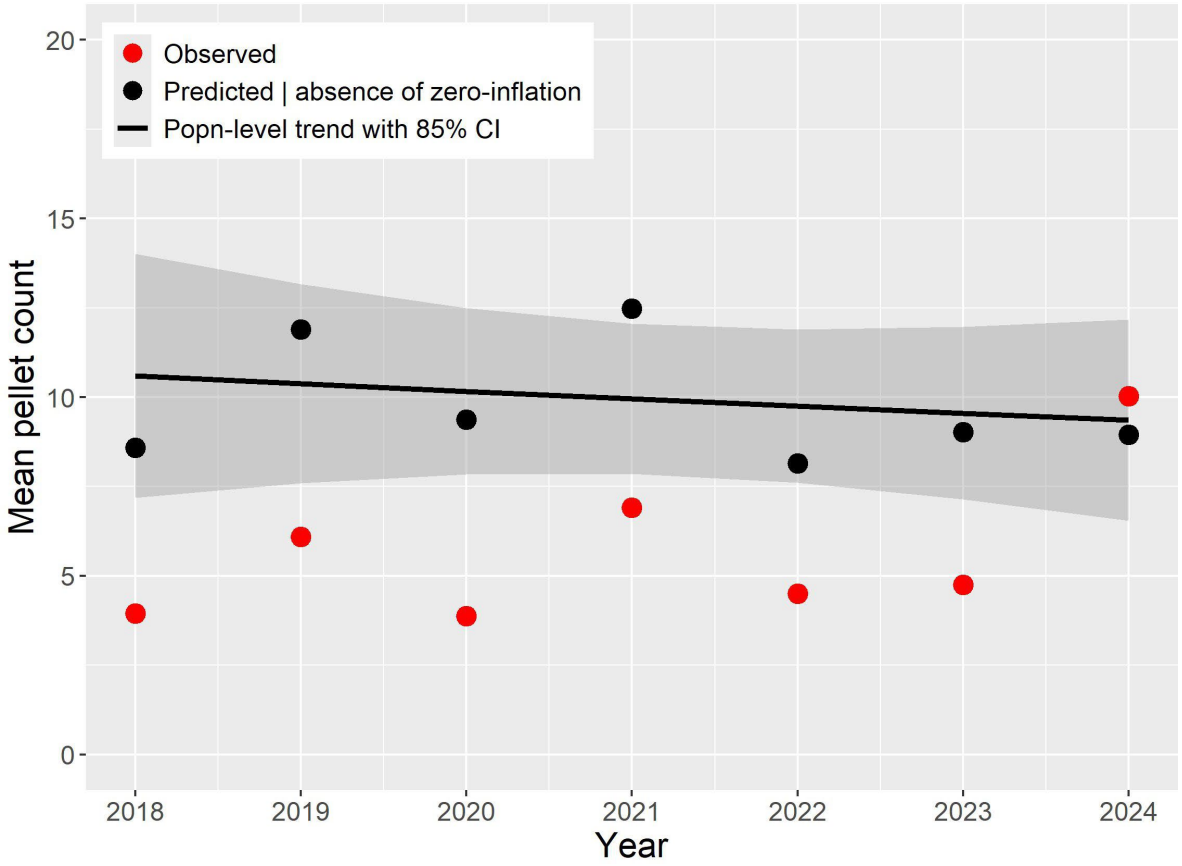

Figure 5. Predicted mean spruce grouse pellet counts in northern Minnesota during 2018-2024 and the estimated temporal population-level (popn-level) trend with 85% confidence intervals (CI) from the model.

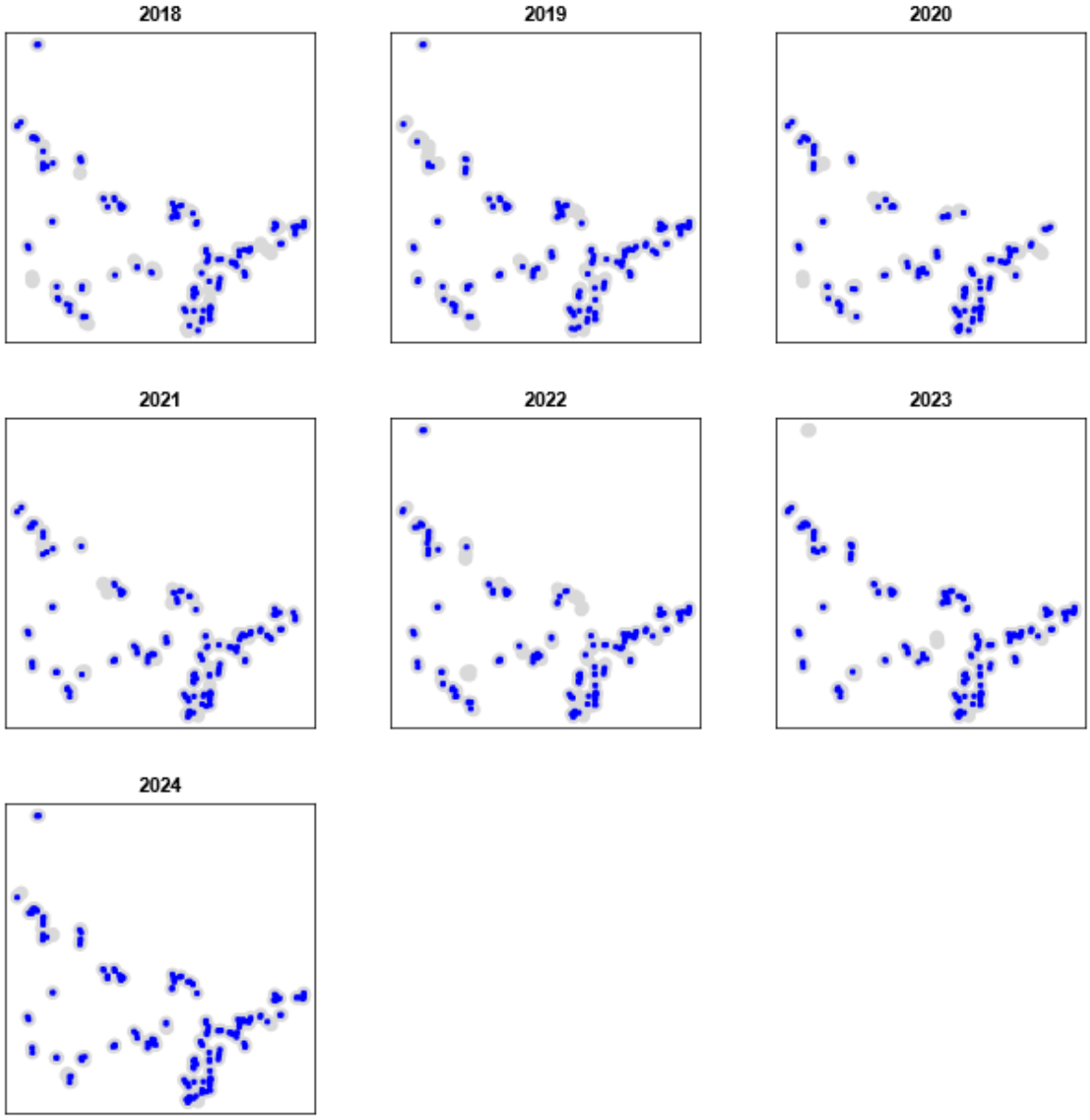

Figure 6. Spatial distribution of sampling effort and spruce grouse pellet detections by year in northern Minnesota during 2018-2024.