CARNIVORE SCENT STATION SURVEY SUMMARY, 2021

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INTRODUCTION

Monitoring the distribution and abundance of carnivores can be important for understanding the effects of harvest, habitat change, and environmental variability on these populations. However, many carnivores are highly secretive, difficult to repeatedly capture, and naturally occur at low to moderate densities, making it difficult to annually estimate abundance over large areas using traditional methods (e.g., mark-recapture, distance sampling, etc.). Hence, indices of relative abundance are often used to monitor such populations over time (Sargeant et al. 1998, 2003, Hochachka et al. 2000, Wilson and Delahay 2001, Conn et al. 2004, Levi and Wilmers 2012).

In the early 1970's, the U.S. Fish and Wildlife Service initiated a carnivore survey designed primarily to monitor trends in coyote populations in the western U.S. (Linhart and Knowlton 1975). In 1975, the Minnesota DNR began to utilize similar survey methodology to monitor population trends for numerous terrestrial carnivores within the state. This year marks the 47th year of the carnivore scent station survey.

METHODS

Scent station survey routes are composed of tracking stations (0.9 m diameter circle) of sifted soil with a fatty-acid scent tablet placed in the middle. Scent stations are spaced at 0.5 km intervals on alternating sides of a road or trail. During the initial years (1975-82), survey routes were 23.7 km long, with 50 stations per route. Stations were checked for presence of tracks on 4 consecutive nights (old tracks removed each night), and the mean number of station visits per night was the basis for subsequent analysis. Starting in 1983, following suggestions by Roughton and Sweeny (1982), design changes were made whereby routes were shortened to 4.3 km, 10 stations/route (still with 0.5 km spacing between stations), and routes were surveyed only once on the day following route placement. The shorter routes and fewer checks allowed for an increase in the number and geographic distribution of survey routes. In either case, the design can be considered two-stage cluster sampling.

Survey routes were selected non-randomly, but with the intent of maintaining a minimum 5 km separation between routes and encompassing the variety of habitat conditions within the work area of each survey participant. Most survey routes are placed on secondary (unpaved) roads or trails and are completed from September through October. Survey results are currently stratified based on 3 habitat zones within the state (forest (FO), transition (TR), and farmland (FA); Figure 1).

Track presence is recorded at each station and track indices are computed as the percentage of scent stations visited by each species. Confidence intervals (95%) are computed using bootstrap methods (percentile method; Thompson et al. 1998). For each of 1000 replicates, survey routes are randomly re-sampled according to observed zone-specific route sample sizes, and station visitation rates are computed for each replicate sample of routes. Replicates are ranked according to the magnitude of the calculated index, and the 25th and 975th values constitute the lower and upper bounds of the confidence interval.

RESULTS AND DISCUSSION

A total of 198 routes and 1,769 stations were surveyed this year, the third fewest since the survey became fully operational in the early 1980's. Route density varied from 1 route per 754 km^2 in the Forest Zone to 1 route per 1,945 km^2 in the Farmland Zone (Figure 1).

Statewide, route visitation rates (% of routes with detection), in order of increasing magnitude, were opossums (6%), wolves (9%), bobcats (11%), domestic dogs (16%), domestic cats (27%), skunks (30%), red foxes and raccoons (34%), and coyotes (35%). Regionally, species-specific route visitation rates were as follows: red fox – FA 17%, TR 28%, FO 42%; coyote – FO 27%, TR 34%, FA 63%; skunk – TR 26%, FO 27%, FA 43%; raccoon – FO 15%, TR 42%, FA 80%; domestic cat – FO 15%, TR 42%, FA 46%; domestic dog – FO 11%, FA 17%, TR 26%; opossum - FO 0%, TR 6%, FA 17%; wolf - FA 0%, TR 2%, FO 15%; and bobcat - FA 0%, TR 9%, FO 15%.

Figures 2-5 show station visitation indices (% of stations visited) from the survey's inception through the current year. Although the survey is intended to document long-term trends in populations, confidence intervals (CI) improve interpretation of the significance of any annual changes. However, I refrain from formal significance testing (e.g., determination of whether a CI on the difference between means overlaps 0) and instead use more informal methods (i.e., degree of CI overlap; Cumming and Finch 2005) to highlight changes from last year that likely represent significant differences. Using this approach, the only notable changes this year were significant declines in striped skunk detections in the Farmland zone (Figure 2) and in wolf indices in the Forest Zone (Figure 5).

In the Farmland Zone (Figure 2), red fox indices continue to remain stable but well below their long-term average as they have been for nearly 20 years. Conversely, coyote and raccoon indices remain at or near record levels. Low red fox numbers are likely related, in part, to increased coyote abundance (Levi and Wilmers 2012). No consistent long-term trends are evident for other species in the Farmland Zone, though domestic dog detections have remained below the long-term average for over a decade.

As in the Farmland, red fox and coyote indices have generally exhibited inverse patterns in the Transition Zone, with red fox indices remaining below average for nearly 2 decades and coyote indices steadily increasing during that same time (Figure 3). No consistent long-term trends are evident for other species in the Transition Zone. Wolves and bobcats continue to occur in the Transition Zone (Figure 5), but at low and sometimes erratic levels of detection compared to the Forest Zone.

Unlike in the Farmland and Transition Zones, the Forest Zone coyote index has not increased over time and, except for the past 3 years, has been below the long-term average for 2 decades (Figure 4), likely due to the presence and long-term increase of wolves in the Forest Zone (Levi and Wilmers 2012). Coyote point indices, however, have been above the long-term average the previous 3 years, as have wolf indices, but there was a significant decline in the Forest Zone wolf index this year. Red foxes, raccoons, and striped skunks have not exhibited consistent or notable trends over the past 20 years, and all are currently near their long-term averages. After remaining low for an extended period (1976 – 2000), bobcat indices increased for over a decade (~ 2000 – 2012) and have since fluctuated but remained well above average (Figure 4).

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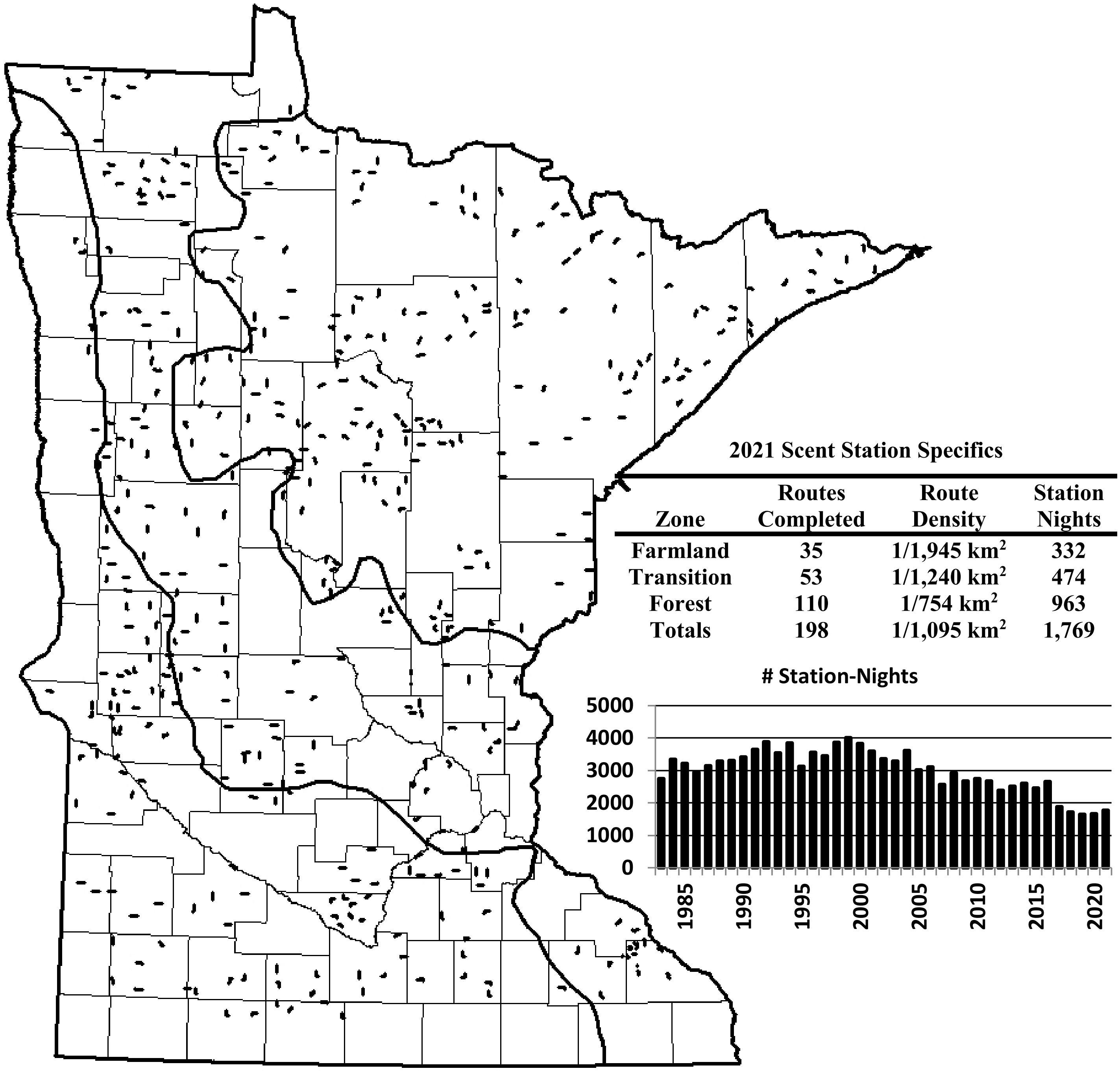

2021 Scent Station Specifics

Zone	Routes Completed	Route Density	Station Nights
Farmland	35	1/1,945 km^2	332
Transition	53	1/1,240 km^2	474
Forest	110	1/754 km^2	963
Totals	198	1/1,095 km^2	1,769

Figure 1. Locations of existing scent station routes (not all completed every year). Insets show 2021 route specifics and the number of station-nights per year since 1983.

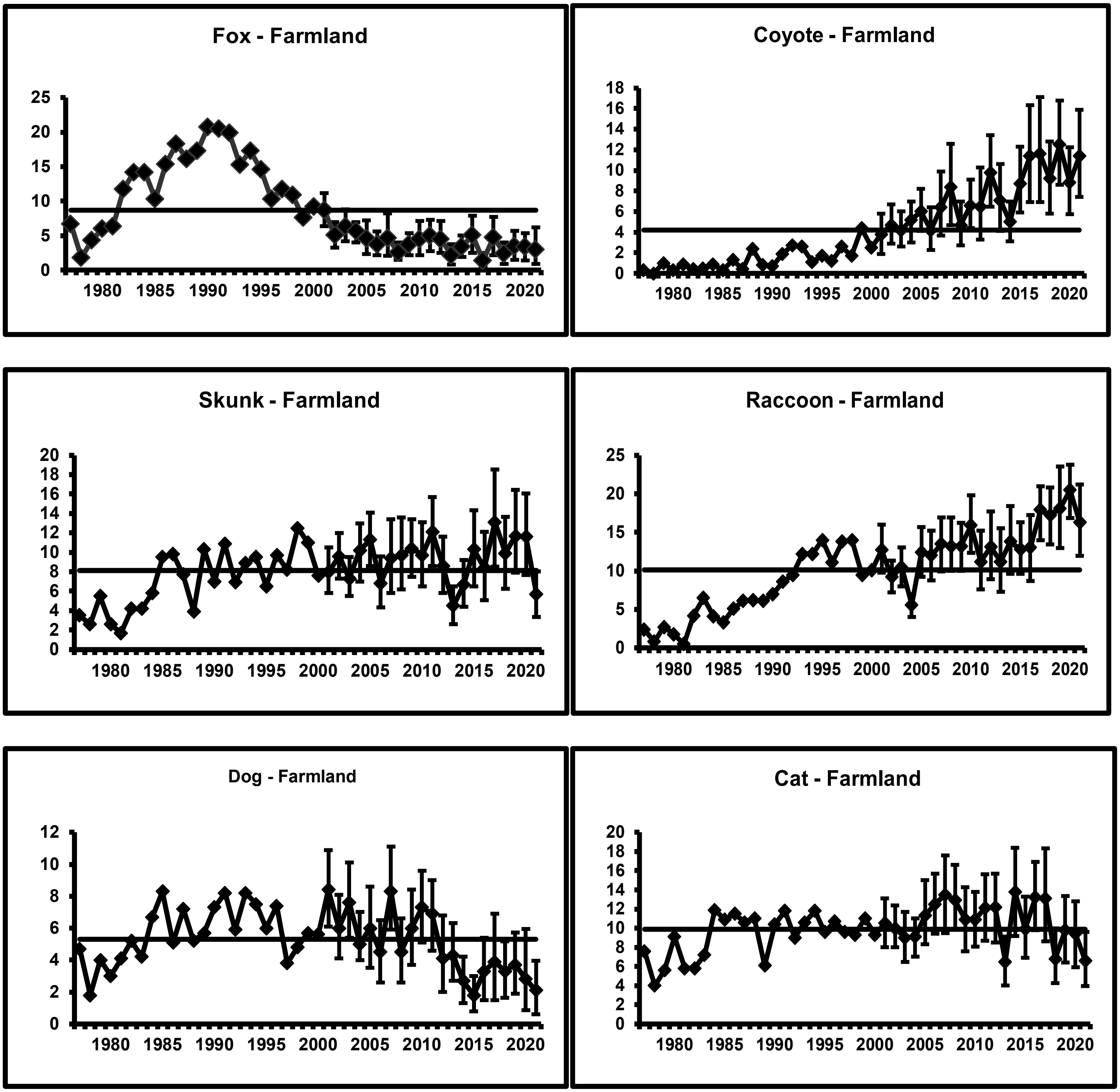

Figure 2. Percentage of scent stations visited by selected species in the Farmland Zone of Minnesota, 1977-2021. Horizontal lines represent long-term means.

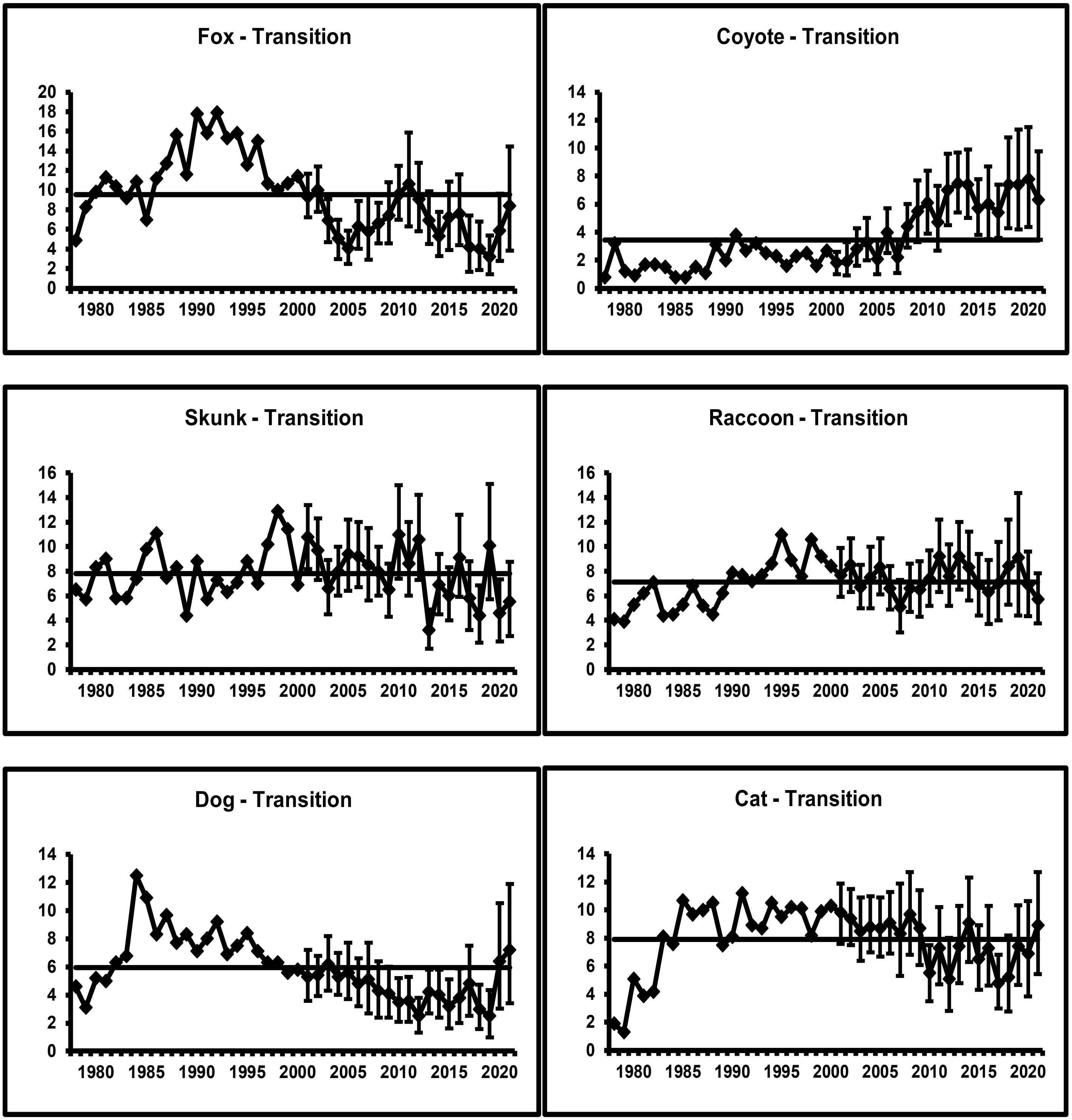

Figure 3. Percentage of scent stations visited by selected species in the Transition Zone of Minnesota, 1978-2021. Horizontal lines represent long-term means.

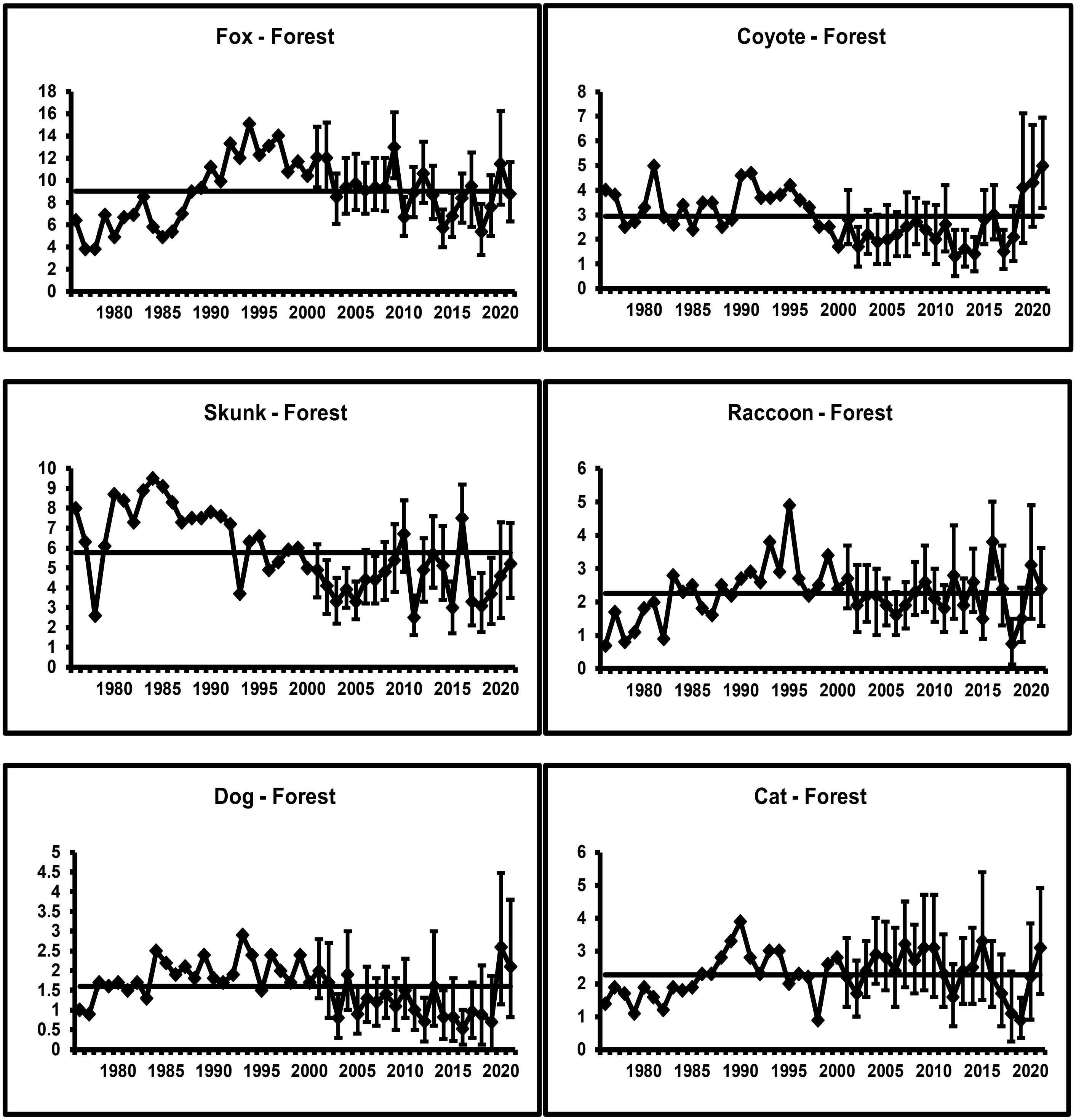

Figure 4. Percentage of scent stations visited by selected species in the Forest Zone of Minnesota, 1976-2021. Horizontal lines represent long-term means.

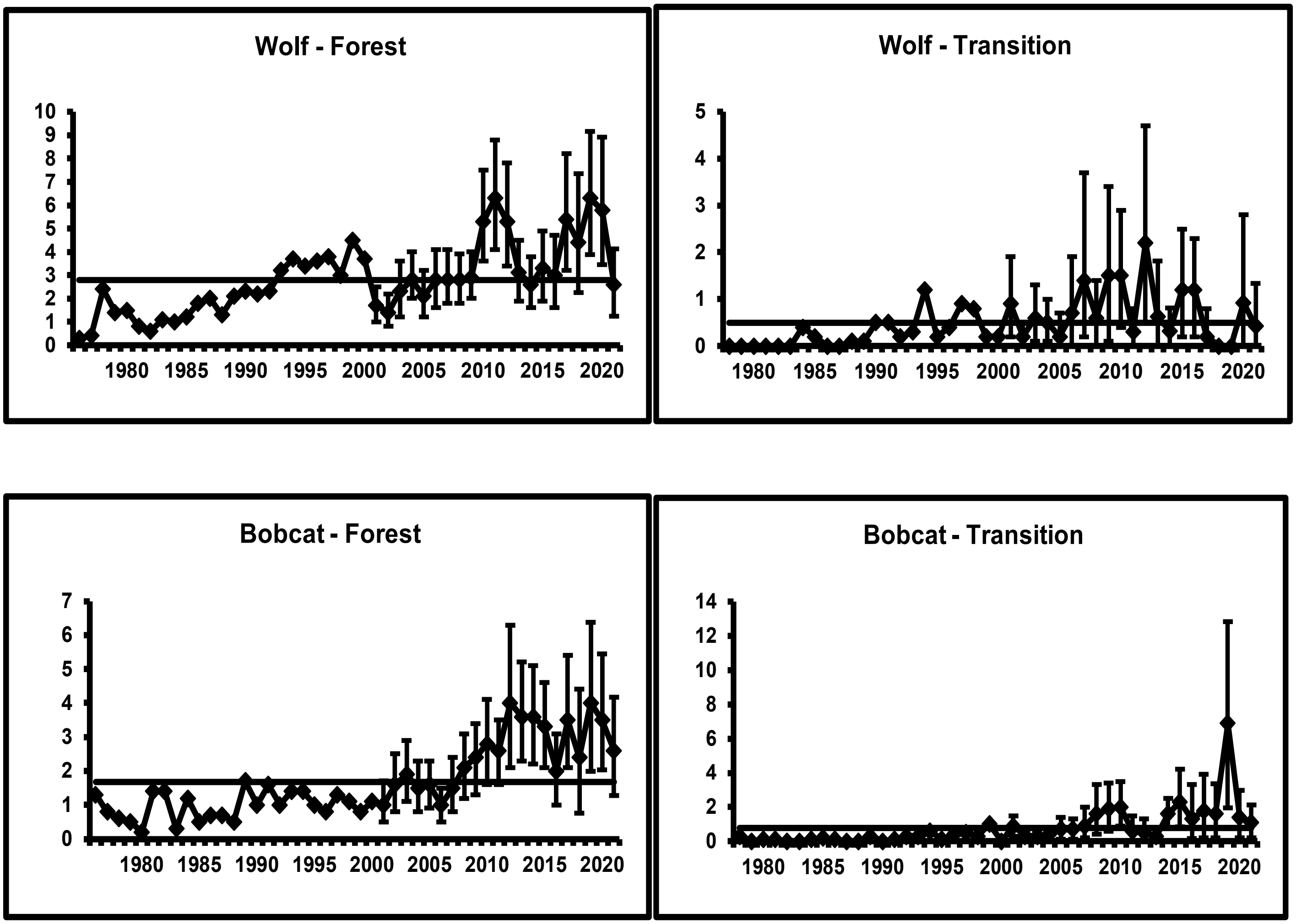

Figure 5. Percentage of scent stations visited by wolves and bobcat in the Forest and Transition Zones of Minnesota, 1976-2021. Horizontal lines represent long-term means.