# FURBEARER WINTER TRACK SURVEY SUMMARY, 2024

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## INTRODUCTION

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

In winter, tracks of carnivores are readily observable following snowfall. Starting in 1991, Minnesota initiated a carnivore snow-track survey in the northern portion of the State. The survey's primary objective is to use a harvest-independent method to monitor distribution and population trends of fishers (*Pekania pennanti*) and martens (*Martes americana*), two species for which no other survey data is available. Because sign of other carnivores is readily detectable in snow, participants also record tracks for other selected species. After three years of evaluating survey logistics, the survey became operational in 1994. Formal recording of gray fox (*Urocyon cinereoargenteus*) detections did not commence until 2008.

## METHODS

Presently, 58 track survey routes are established across the northern portion of the state (Figure 1); for various reasons, not all are surveyed each year. Each route is 10 miles long and follows secondary roads or trails. Most routes are continuous 10-mile stretches of road or trail, but a few are composed of multiple discontinuous segments. Route locations were subjectively determined based on availability of suitable roads or trails, but were chosen when possible to represent the varying forest habitat conditions in northern Minnesota. For data recording, each 10-mile route is divided into 20 0.5-mile segments.

Each route is surveyed once following a fresh snow, typically from December through mid-February, and track counts are recorded for each 0.5-mile segment. When it is obvious the same animal crossed the road multiple times *within* a 0.5-mile segment, the animal is recorded only once. If it is obvious that an animal ran along the road and entered multiple 0.5-mile segments, which often occurs with canids, its tracks are recorded in all segments but circled to denote it was the same animal. Though these 'duplicate' tracks are excluded in calculation of track indices (see below), recording data in this manner allows for future analysis of animal activity in relation to survey 'plot' size and habitat. Snowshoe hares (*Lepus americanus*) are recorded only as present or absent in the first 0.1 miles of each 0.5-mile segment. For standardization, routes are to be surveyed one day after the conclusion of a snowfall (ending by ~ 6:00 pm). However, in most years a few routes are completed two nights following snowfall; track counts on those routes are divided by the number of nights since snowfall.

Because most species of interest occur throughout the area where survey routes are located, calculated indices for all species in reports prior to 2015 utilize data from all surveyed routes. Starting with the 2015 report, all past marten indices were re-calculated using only those routes that fall within a liberal delineation of marten range (hereafter, the 'marten zone'). However, in general there were minimal differences in temporal patterns observed in this subset versus the full sample of routes.

Currently, I present three summary statistics for each species. First, I compute the percentage of 0.5-mile segments with species presence, hereafter the 'track index', after removing any duplicates (e.g., if the same red fox (*Vulpes vulpes*) clearly traverses two adjacent 0.5-mile segments of the road, and it was the only 'new' red fox in the second segment, only one of the two segments is considered independently occupied). In addition to this metric, but on the same graph, the average number of tracks per 10-mile route is computed after removing any obvious duplicate tracks across segments. For wolves (*Canis lupus*) traveling through adjacent segments, I use the maximum number of pack members recorded in any one of those segments as the track total for that particular group, though this is likely an underestimate of true pack size. Because individuals from many of the species surveyed tend to be solitary, these two indices (percent of segments occupied and number of tracks per route) will often yield mathematically equivalent results; on average, one tends to differ from the other by a constant factor. In the case of wolf packs, and to a lesser extent red foxes and coyotes (*Canis latrans*) which may still associate with previous offspring or start traveling as breeding pairs in winter, the approximate equivalence of these two indices will still be true if average detected group sizes are similar across years. However, the solitary tendencies in some species are not absolute, potential abundance in relation to survey plot size varies across species, and for wolves, pack size may vary annually. For these reasons, as well as to provide an intuitive count metric, I include both indices on the same graph. Because snowshoe hares are tallied only as present or absent, the two indices are equivalent. Dating back to 1974, hare survey data has also been obtained via counts of hares observed on ruffed grouse drumming count surveys conducted in spring. Post-1993 data for both the spring and winter hare indices are presented for comparison in this report.

In the second graph for each species, I illustrate the percentage of *routes* where each species was detected (hereafter, the 'distribution index'). I compute this measure to help assess whether any notable changes in the above-described track indices are a result of larger-scale changes in distribution (i.e., more/fewer routes with presence) or finer-scale changes in density along routes.

Using a bootstrapping approach (percentile method; Thompson et al. 1998), I compute confidence intervals (90%) for the percent of segments with species' presence and the percent of routes with species presence. For each of 1000 replicates, survey routes are randomly re-sampled with replacement according to the observed route sample size, replicates are ranked according to the magnitude of the calculated index, and the $50^{th}$ and $950^{th}$ values constitute the lower and upper bounds of the confidence interval. 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 an informal approach (i.e., degree of CI overlap; Cumming and Finch 2005) to highlight changes from last year that likely represent significant differences.

**RESULTS AND DISCUSSION**

During winter 2024-25, 39 survey routes were completed (Figures 1 and 2). Survey routes took an average of 2.2 hours to complete. Snow depths averaged 7” along completed routes, below the long-term mean (Figure 3). Mean overnight low temperature the night preceding the surveys was -1°F, also below the long-term mean (Figure 3). Survey routes were completed between November 26th and March 18th, with the mean survey date of January 16th (Figure 3).

Reliable interpretation of annual changes in track survey results is dependent on the assumption that the probability of detecting animals remains relatively constant across years (Gibbs 2000, MacKenzie et al. 2004), though trends in indices should be reliable provided there is no increasing or decreasing trend in detection rate. Because assumption validity remains uncertain, caution is warranted when interpreting changes, particularly annual changes of low to moderate magnitude or short-term trends. Based on degree of confidence interval overlap, wolf, weasel, and marten track indices exhibited significant declines from last winter (Figure 4).

Fishers were detected on 3% of the route segments and along 36% of the routes (Figure 4). Although both are near their long-term lows, neither represented a significant change from the previous winter. Over the past decade, fishers have expanded in distribution and abundance along the southern and western edge of their Minnesota range, an area currently with few or no track survey routes. Hence, fisher indices in this report are most indicative of population trends in only the northern portion of fisher range. Indices have remained below their long-term mean for the past 17 years, and far below their peak; in 2002, fishers were detected on 14% of survey route segments.

Within the ‘marten zone’, martens were detected on 5% of the route segments and 45% of the survey routes (Figure 4), the former being the lowest since 2013 and representing a significant decline from the previous winter. At their peak in 1999, martens were detected on 13% of the ‘marten zone’ route segments and 83% of the ‘marten zone’ survey routes. Like but preceding the fisher decline by a few years, marten indices had also declined over a 14-year period (through 2008). Although low and without unidirectional trend since 2008, marten indices show indications of 3 - 5-year cycles consistent in timing with cyclic fluctuations of some of their rodent prey species in Minnesota (Figure 4; Berg et al. 2017, Swingen 2020). After last winter’s local peak, data suggests a cyclic decline this winter.

Bobcat indices had increased for approximately 14 years through 2012 (Figure 4). Since then, indices have erratically fluctuated but generally remained above, sometimes well above, the long-term average. Bobcats were detected on 4% of the segments and 44% of the routes, both above their long-term averages but representing non-significant changes from last winter (Figure 4).

Wolves were detected on 6.8% of the route segments and 79% of the survey routes, the former representing a significant decline from last winter. However, both indices were near their long-term average (Figure 4).  The average number of wolves detected per route was 2.4. Coyotes were detected on 5.6% of the route segments and 46% of the routes, both essentially identical to last winter. Both indices are at or near record levels since the survey began (Figure 4). The long-term trend in coyote indices has been stable, but as with martens and weasels (see below), past coyote track indices show indications of 3 - 5-year cycles consistent in timing with fluctuations in some rodent populations in MN. However, this winter's coyote index did not decline, as was the case for martens and weasels. Long-term, red fox indices have displayed somewhat of a 'stair-step' decline, being lowest and comparatively stable from 2013 – 2018. Over the last 6 years, indices have slowly climbed to near the long-term average. Red foxes were detected on approximately 11% of the segments and 87% of the routes (Figure 4), both representing non-significant changes from last winter. Although no long-term trend is evident in gray fox indices, data from the past 14 years suggests that, similar to coyotes, martens, and weasels, they may fluctuate in concert with cyclic rodent populations (Figure 4). Gray foxes were detected on <1% of the route segments and on 8% of the routes, both below their long-term means.

Weasel (*Mustela* spp.) indices have been characterized by 3 - 5-year cycles or 'irruptions' superimposed on a declining trend, though the declining trend appeared to have leveled off beginning in 2012 (Figure 4). However, this winter's track index was the lowest yet recorded and represents a significant decline from last winter, perhaps attributable to a cyclic decline in their rodent prey. Below-average temperatures during this winter's survey may also have reduced above-snow weasel activity. Weasels were detected on 6.9% of the route segments (peak of 31% in 1995) and on 64% of the routes (peak of 88% in 1999).

Both spring and winter hare indices steadily increased from 1994 – 2012. Since then, there has been less consistency between the 2 indices though both had generally declined for 4 - 5 years and then remained relatively stable near their long-term averages (Figure 4); this year, neither the spring nor winter hare index changed significantly from the previous year. Historic data (pre-1994; not presented here) for the spring snowshoe hare index clearly exhibited 10-year cycles, with peaks and rapid declines often occurring in the first few years of each decade, often synchronous with the ruffed grouse cycle (which currently appears to be near a cyclic peak). Recent data suggests hare cycling has dampened or disappeared, with minimal similarity to the more distinct grouse cycles.

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## LITERATURE CITED

Berg, S. S., J. D. Erb, J. R. Fieberg, and J. D. Forester. 2017. Comparing the utility of varying amounts of radio-telemetry data for improving statistical population reconstruction of American Marten in Northern Minnesota. Journal of Wildlife Management 81:535-544.

Conn, P. B., L. L. Bailey, and J. R. Sauer. 2004. Indexes as surrogates to abundance for low-abundance species. Pages 59-76 *in* W. L. Thompson, editor. Sampling rare or elusive species: Concepts, designs, and techniques for estimating population parameters. Island Press, Washington, D.C., USA.

Cumming, G., and S. Finch. 2005. Inference by eye: confidence intervals and how to read pictures of data. American Psychologist 60: 170-180.

Erb, J., Coy, P., & Sampson, B. 2017. Survival and causes of mortality for fishers and martens in Minnesota. Pages 166-175 *in* Summaries of Wildlife Research Findings 2015, St. Paul, Minnesota.

Gibbs, J. P. 2000. Monitoring populations. Pages 213-252 *in* L. Boitani and T. K. Fuller, editors. Research Techniques in Animal Ecology. Columbia University Press, New York, USA.

Hochachka, W. M., K. Martin, F. Doyle, and C. J. Krebs. 2000. Monitoring vertebrate populations using observational data. Canadian Journal of Zoology 78:521-529.

Johnson, D. H. 2008. In defense of indices: the case of bird studies. Journal of Wildlife Management 72:857-868.

Mackenzie, D. I., J. A. Royle, J. A. Brown, and J. D. Nichols. 2004. Occupancy estimation and modeling for rare and elusive populations. Pages 149-172 *in* W. L. Thompson, editor. Sampling rare or elusive species: Concepts, designs, and techniques for estimating population parameters. Island Press, Washington, D.C., USA.

Swingen, M. 2020. 2020 Small Mammal Survey Report. Technical Report Number #20-13. 1854 Treaty Authority. Duluth, MN.

Thompson, W. L., G. C. White, and C. Gowan. 1998. Monitoring vertebrate populations. Academic Press, San Diego, California.

Wilson, G. J., and R. J. Delahay. 2001. A review of methods to estimate the abundance of terrestrial carnivores using field signs and observation. Wildlife Research 28:151-164.

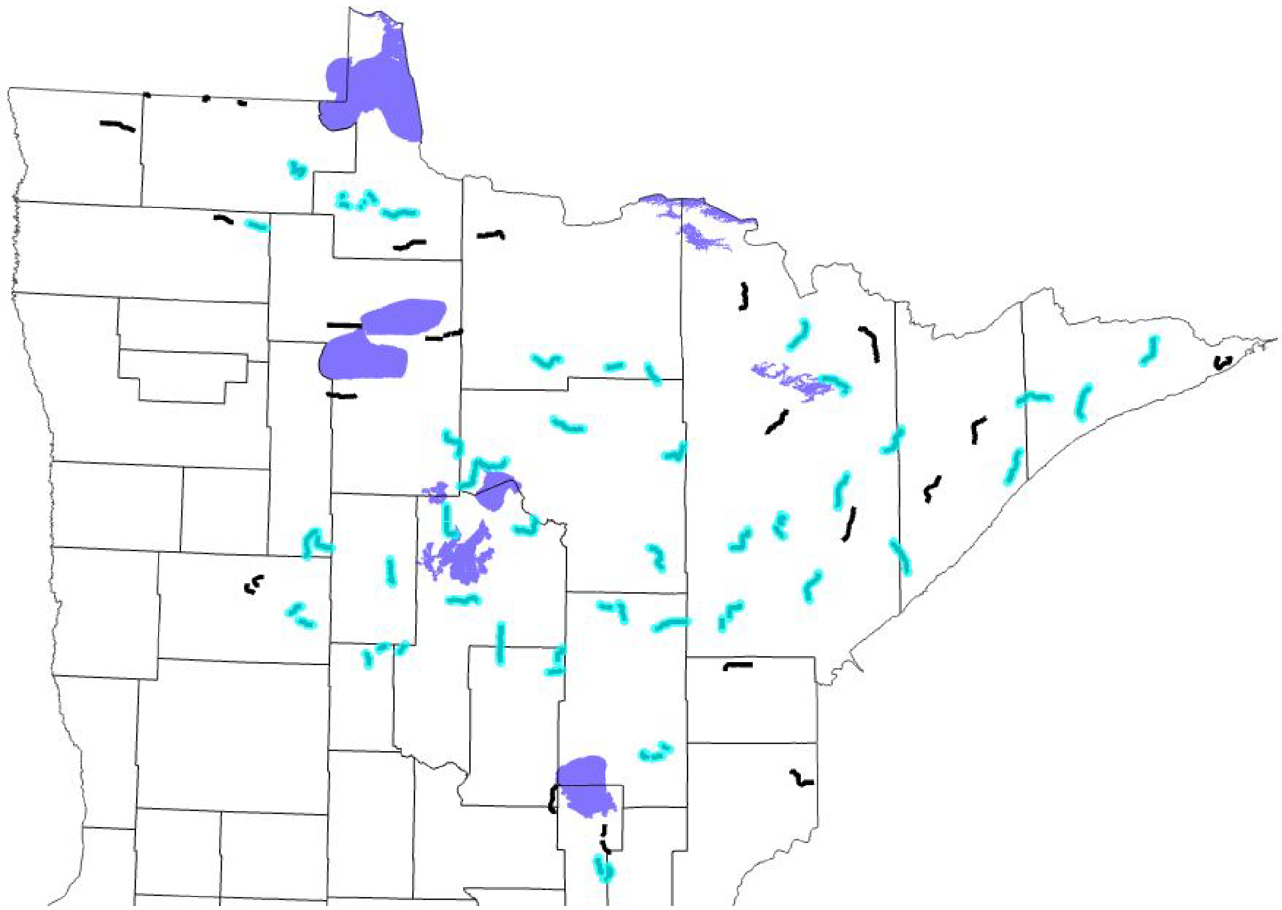

Figure 1. Locations of furbearer winter track survey routes in northern Minnesota. Blue routes are those completed during winter 2024-25.

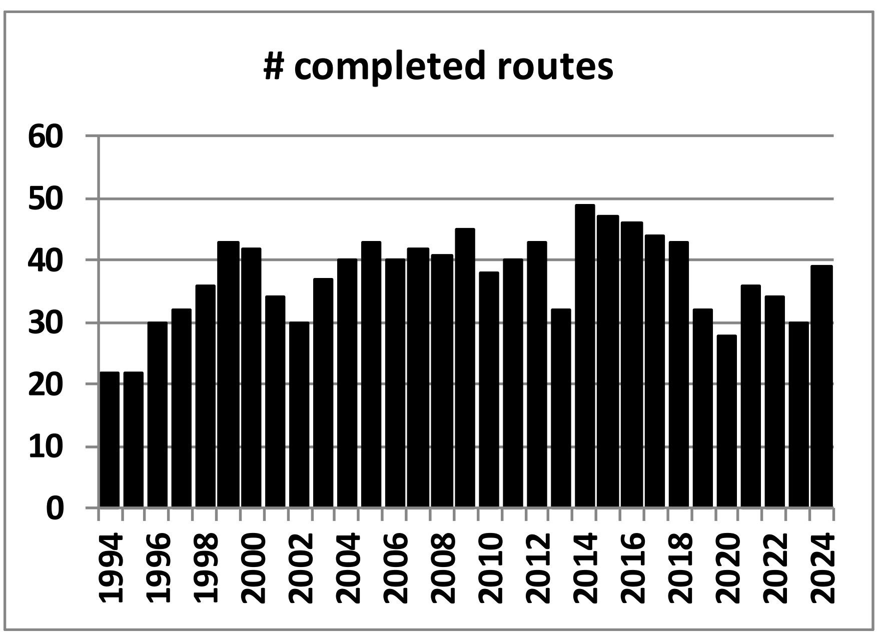


Figure 2. Number of snow track routes surveyed in Minnesota, 1994-2024.

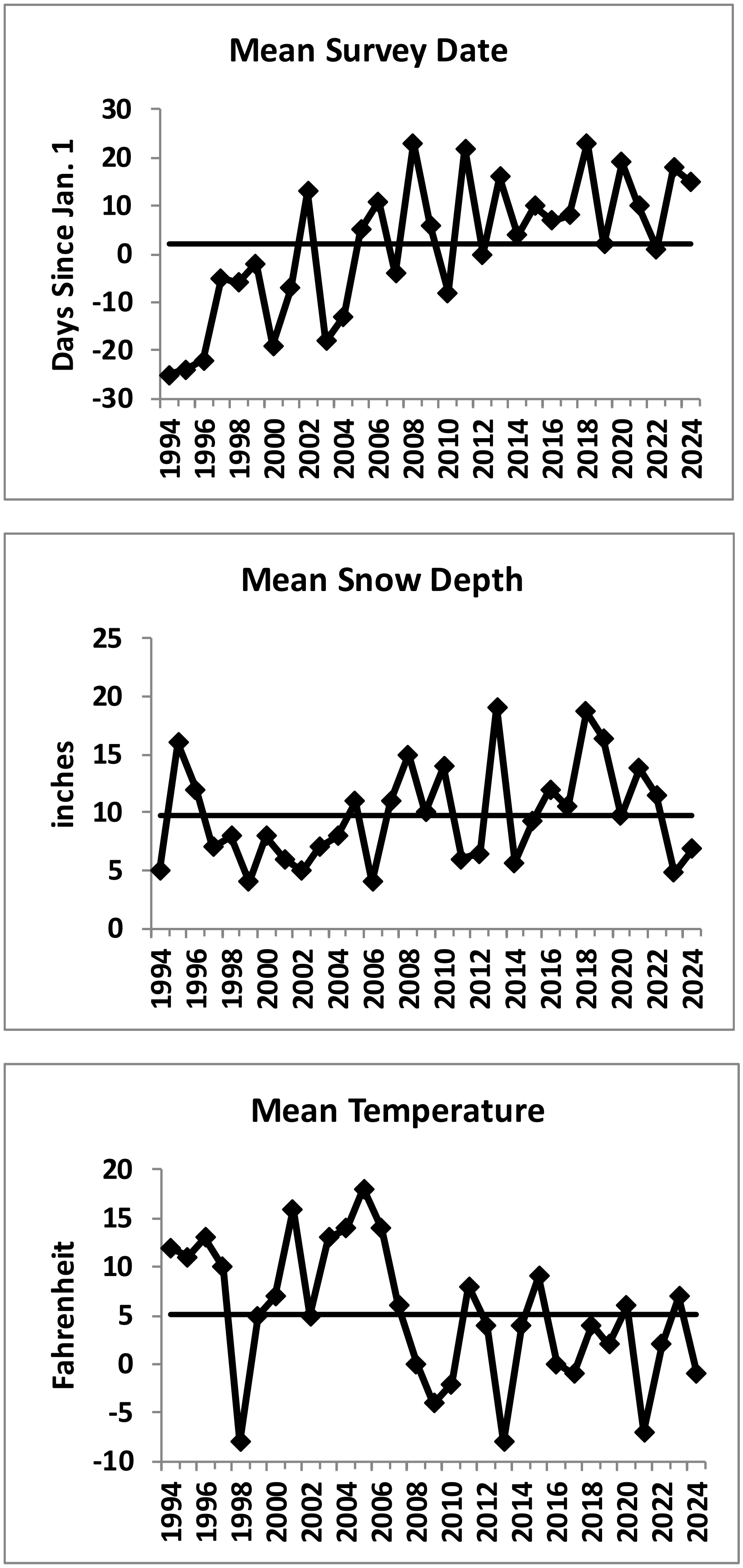


Figure 3. Average survey date, snow depth, and temperature for snow track routes completed in Minnesota, 1994-2024. Horizontal line represents long-term mean.

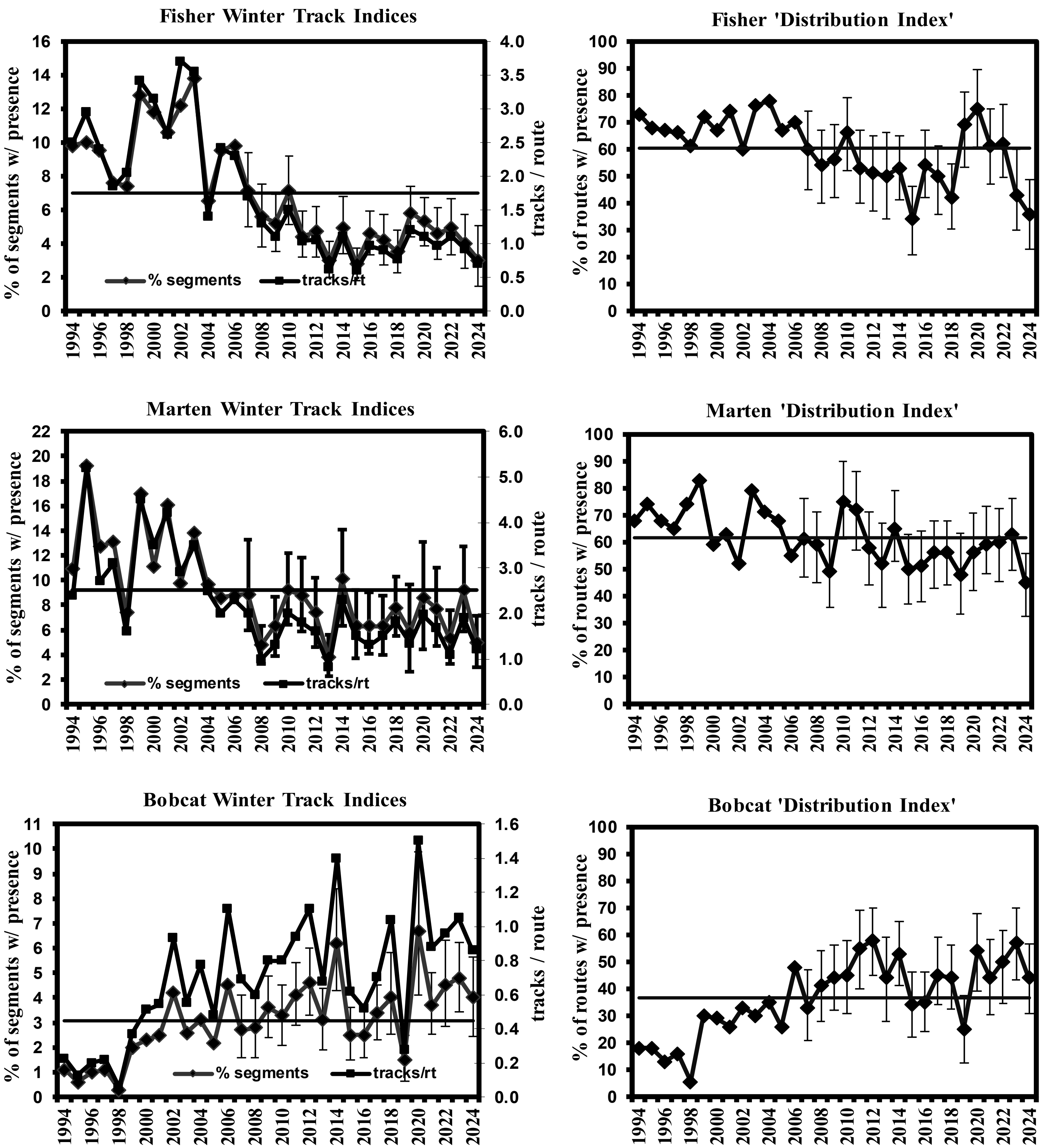


Figure 4. Winter track indices for selected species in Minnesota, 1994-2024. Confidence intervals are presented only for % segments and % routes with track presence; horizontal lines represent their long-term averages.

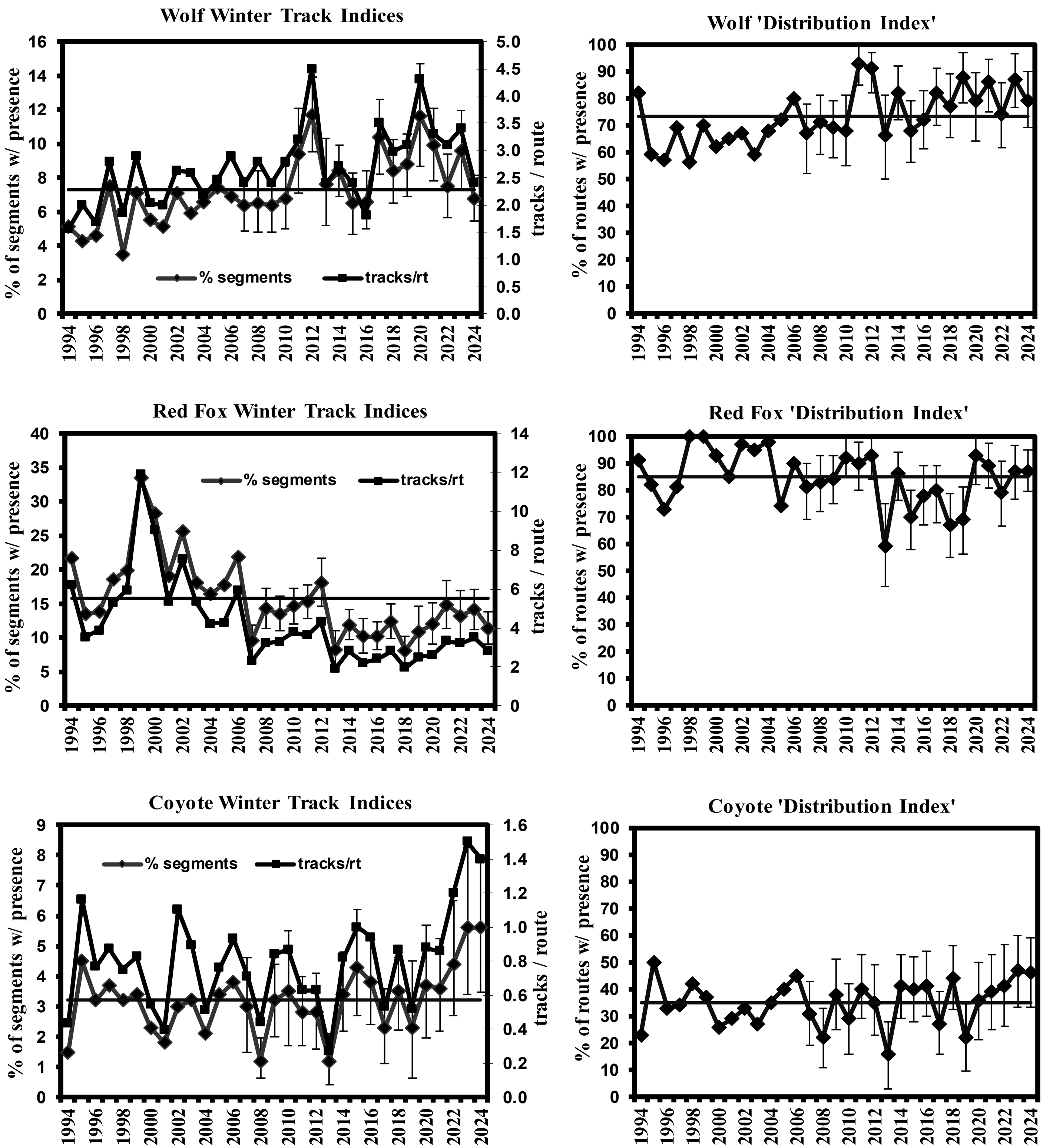


Figure 4 (continued). Winter track indices for selected species in Minnesota, 1994-2024.

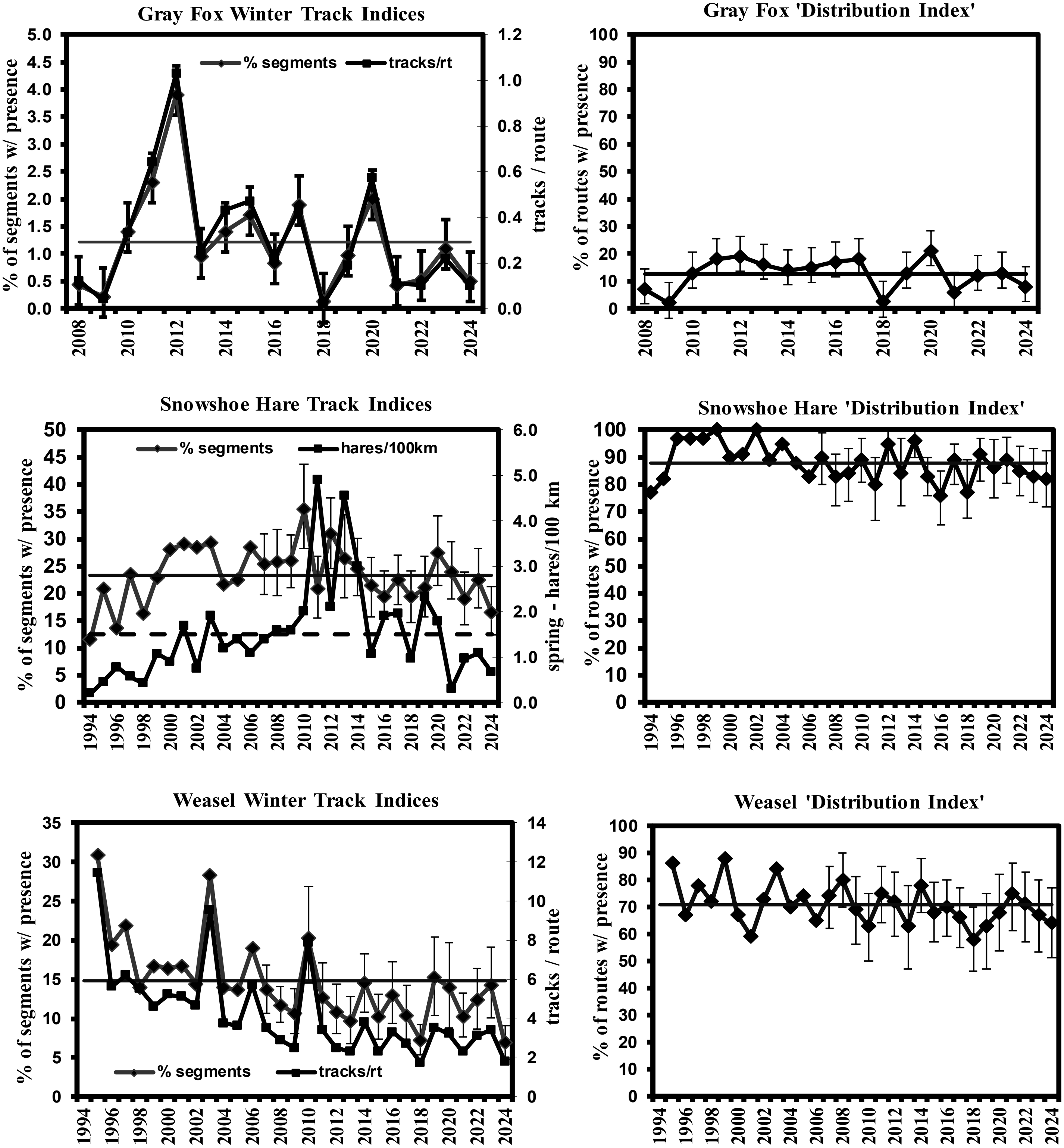


Figure 4 (continued). Winter track indices for selected species in Minnesota, 1994-2024.