CARNIVORE SCENT STATION SURVEY
AND
WINTER TRACK INDICES

NOTE: This survey is organized and coordinated by the Forest Wildlife Populations and Research Group, 1201 E. Hwy 2, Grand Rapids, MN 55744. Results are presented at this location in the book because of the statewide nature of the data.

CARNIVORE SCENT STATION SURVEY SUMMARY, 2014

John Erb, Forest Wildlife Research Group

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 39th 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/absence 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/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/absence 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 280 routes were completed this year. There were 2,605 operable scent stations examined on the 280 routes. Route density varied from 1 route per 532 km^2 in the Forest Zone to 1 route per 1,194 km^2 in the Farmland Zone (Figure 1).

Statewide, route visitation rates (% of routes with detection), in order of increasing magnitude, were 10% (wolves), 14% (domestic dogs and bobcats), 22% (coyotes), 29% (red foxes), 31% (domestic cats), and 33% (raccoons and skunks). Regionally, route visitation rates were as follows: red fox – FA 26%, TR 28%, FO 31%; coyote – FO 9%, FA 33%, TR 42%; skunk – FO 25%, TR 39%, FA 46%; raccoon – FO

19%, TR 45%, FA 60%; domestic cat – FO 15%, TR 48%, FA 54%; domestic dog – FO 5%, FA 21%, TR 27%; wolf - FA 0%, TR 3%, FO 17%; and bobcat - FA 0%, TR 15%, FO 18%.

Figures 2-5 show station visitation indices (% of stations visited) from the survey's inception through the current year. Although the survey is largely intended to document long-term trends in populations, confidence intervals improve interpretation of the significance of annual changes. Based strictly on the presence/absence of confidence interval overlap, the only significant changes this year were increases in the Farmland Zone domestic cat index (Figure 2) and Transition Zone skunk and bobcat indices (Figure 3). There was also a 'marginally significant' decline in the Forest Zone red fox index (Figure 4).

In the Farmland Zone (Figure 2), red fox indices remain well below the long-term average, whereas raccoon indices remain above average. Although the Farmland coyote index also remains above the long-term average, it has declined the past 2 years. The significant increase in the domestic cat index to a record level this year follows last year's significant decline.

In the Transition Zone (Figure 3), red fox indices had increased several years ago to near the long-term average. However, indices from the past 3 years have now declined and are once again well below the long-term average. The Transition Zone coyote index was unchanged from last year and remains at peak levels. Indices for most other species are near their long-term average.

In the Forest Zone (Figure 4), there was a marginally significant decline in the red fox index to its lowest level since the late 1980's. Coyote indices have remained below their long-term average, with indices from the past 3 years being the lowest recorded since the survey began. Raccoon and skunk indices remain near their long-term average.

After a recent (2009-11) rapid rise, the Forest Zone wolf index has subsequently declined to near the long-term average (Figure 5). The point estimate for the Transition Zone wolf index also dropped to near its long-term average, though the Transition Zone represents a small portion of wolf range and confidence intervals are large. The Forest Zone bobcat index remains near peak levels. The Transition Zone bobcat index had recently declined from peak levels to near the long-term average, and then exhibited a significant increase back to near-record levels this fall (Figure 5).

ACKNOWLEDGEMENTS

I wish to thank all of the cooperators who participated in the 2014 survey: DNR Division of Wildlife staff; Superior National Forest Aurora District; Agassiz, Rydell, Sherberne and Tamarac National Wildlife Refuges; 1854 Treaty Authority, White Earth, Red Lake, and Leech Lake Tribal Natural Resource Departments; Lori Schmidt and Vermillion Community College; Peter Jacobson and Faribault High School; Steven Hogg and the Three Rivers Park District; and Richard Nelles and Tom Stuber. This project was funded in part by the Wildlife Restoration (Pittman-Robertson) Program.

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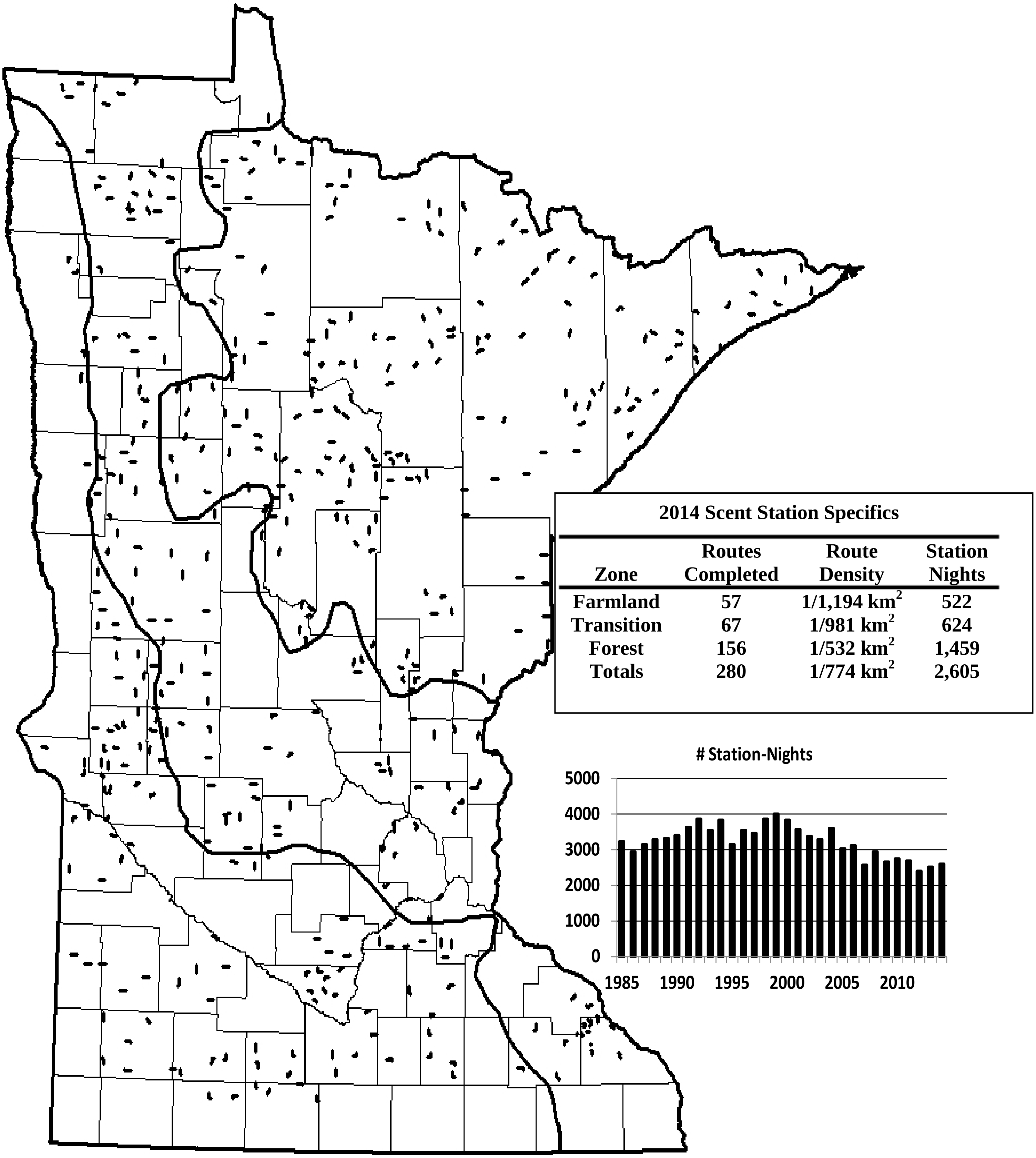

2014 Scent Station Specifics

Zone	Routes Completed	Route Density	Station Nights
Farmland	**57**	**1/1,194 km^2**	**522**
Transition	**67**	**1/981 km^2**	**624**
Forest	**156**	**1/532 km^2**	**1,459**
Totals	**280**	**1/774 km^2**	**2,605**

Figure 1. Locations of existing scent station routes (not all completed every year). Insets show 2014 route specifics and the number of station-nights per year since 1983.

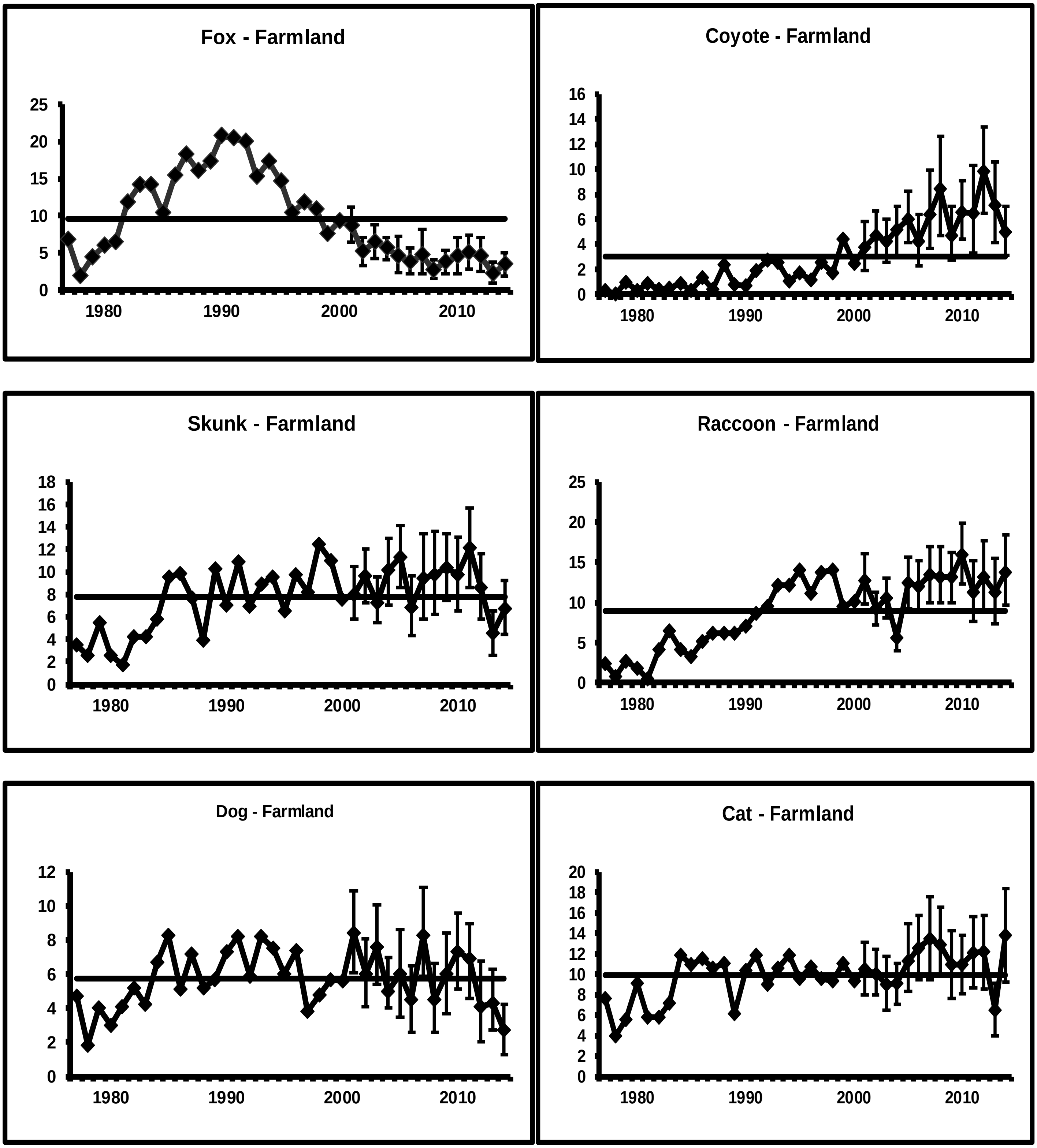

Figure 2. Percentage of scent stations visited by selected species in the Farmland Zone of Minnesota, 1977-2014. Horizontal line represents long-term mean.

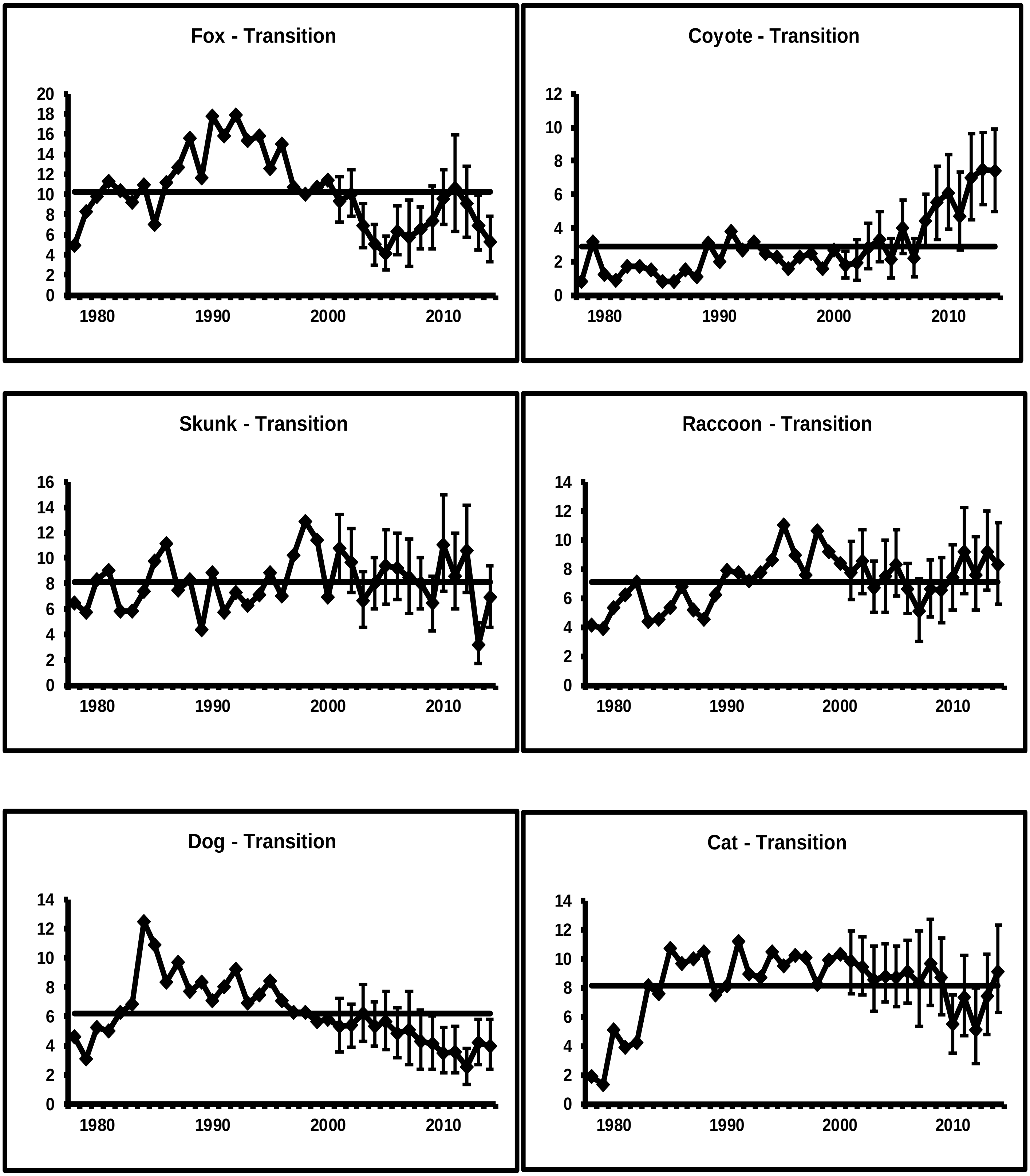

Figure 3. Percentage of scent stations visited by selected species in the Transition Zone of Minnesota, 1978-2014. Horizontal line represents long-term mean.

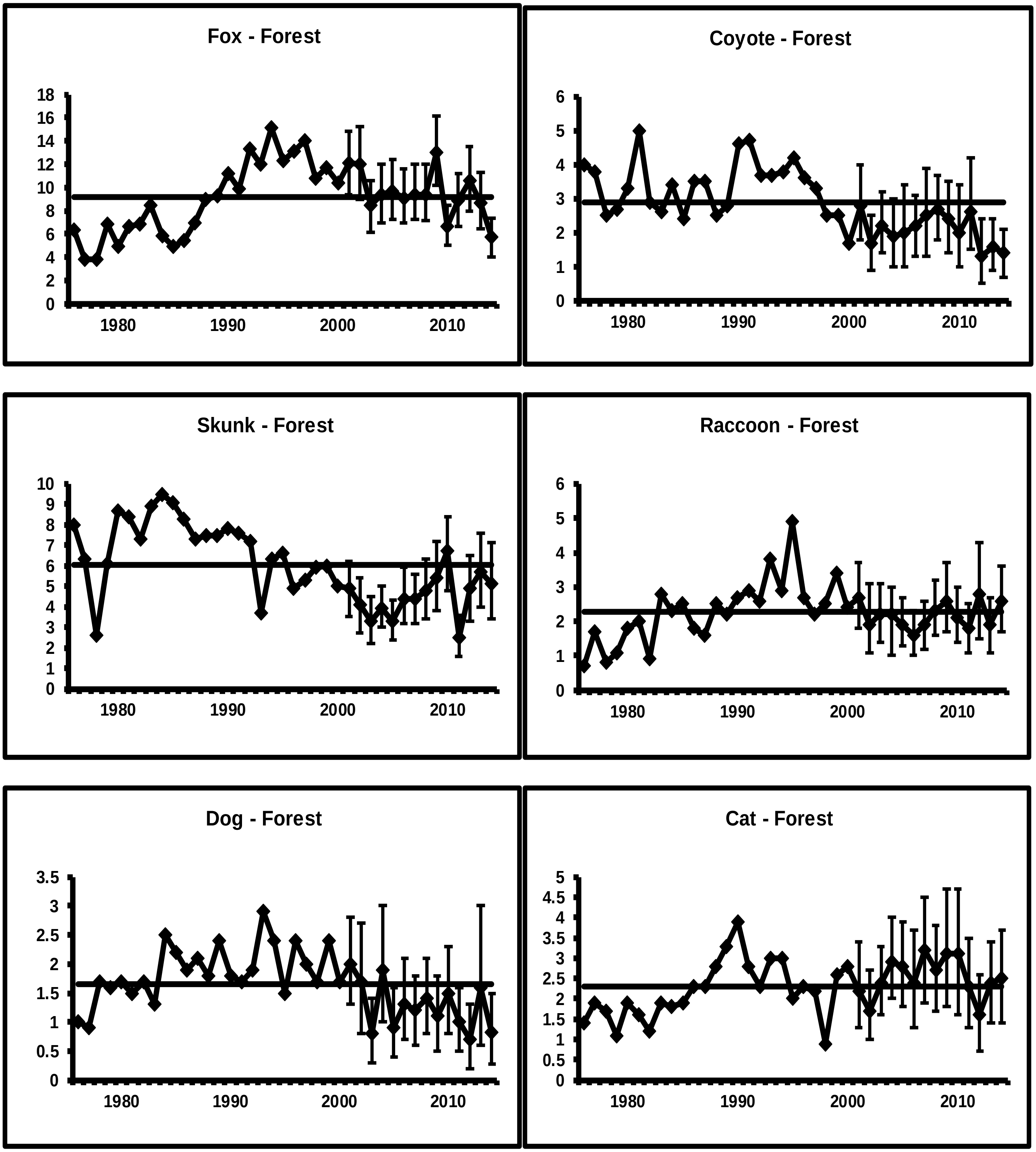

Figure 4. Percentage of scent stations visited by selected species in the Forest Zone of Minnesota, 1976-2014. Horizontal line represents long-term mean.

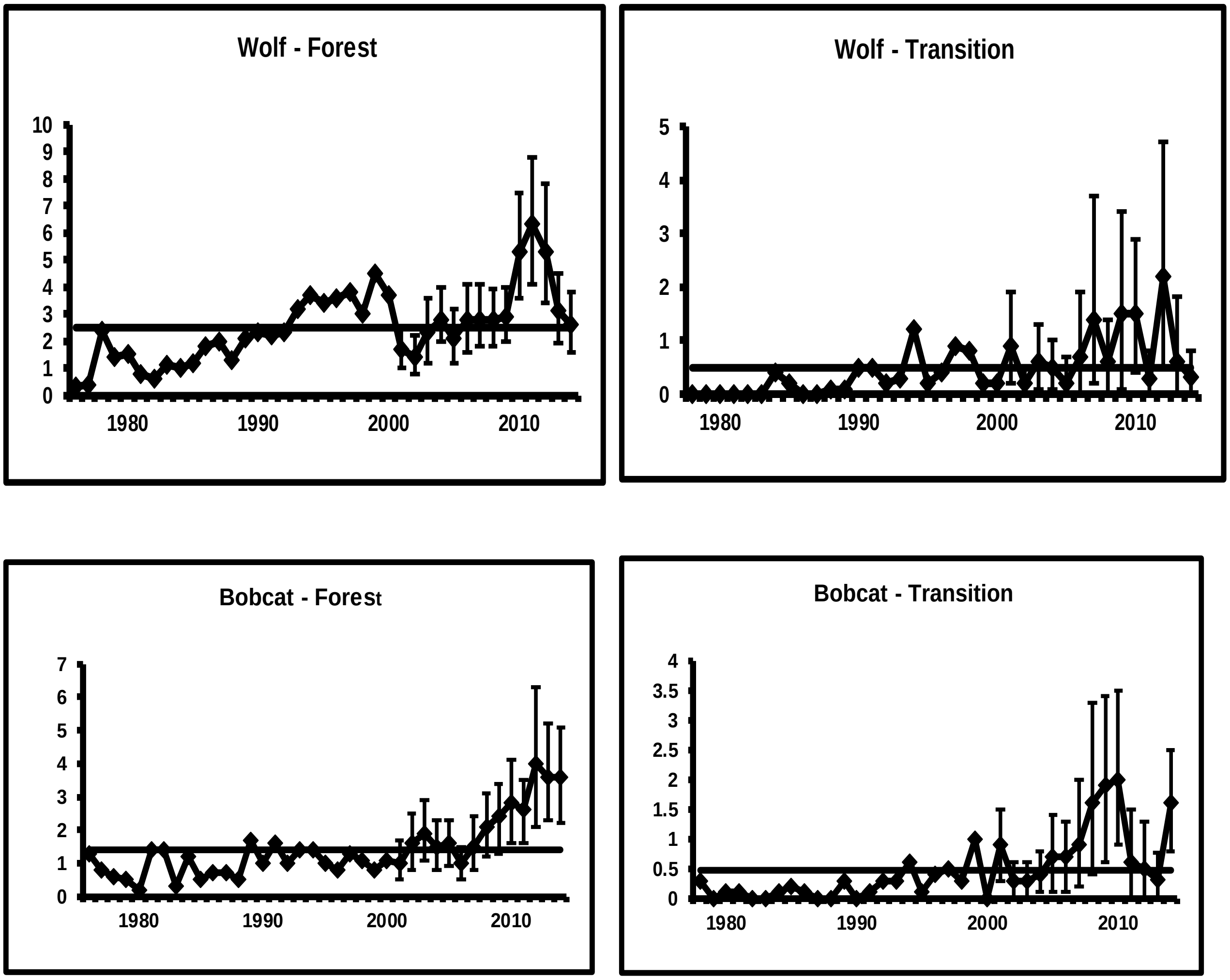

Figure 5. Percentage of scent stations visited by wolves and bobcat in the Forest and Transition Zones of Minnesota, 1976-2014. Horizontal lines represents long-term mean.

FURBEARER WINTER TRACK SURVEY SUMMARY, 2014

John Erb, Forest Wildlife Populations and Research Group

INTRODUCTION

Monitoring the distribution and abundance of carnivores can be important for documenting 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 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 such populations over time (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 fisher (*Martes pennanti*) and marten (*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.

METHODS

Presently, 56 track survey routes are operational across the northern portion of the state (Figure 1). Each route is a total of 10 miles long and follows secondary roads or trails. A majority of routes are continuous 10-mile stretches of road/trail but a few are composed of multiple discontinuous segments. Route locations were subjectively determined based on availability of suitable roads/trails but were chosen where 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 only recorded 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. While such duplicate tracks are not included 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. While most routes are surveyed one day after the conclusion of a snowfall (ending by ~ 6:00 pm), thereby allowing one night for tracks to be left, a few routes are usually completed two nights following snowfall. In such cases, track counts on those routes are divided by the number of days post-snowfall.

Currently, three summary statistics are presented for each species. First, I compute the percentage of 0.5-mile segments with species presence after removing any duplicates (e.g., if the same fox clearly traverses two adjacent 0.5-mile segments along the road, and it was the only 'new' red fox (*Vulpes vulpes*) 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 presented after removing any obvious duplicate tracks across segments. For wolves (*Canis lupus*) traveling through adjacent segments, the maximum number of pack members recorded in any one of those segments is used 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 (% segments occupied and # 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 fox 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, both indices are currently presented. Because snowshoe hares are tallied only as present/absent, the 2 indices are by definition 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'). This measure is computed to help assess whether any notable changes in the above-described track indices are a result of larger-scale changes in distribution (more/less routes with presence) or finer-scale changes in density along routes.

Using bootstrap methods, 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 50th and 950th values constitute the lower and upper bounds of the confidence interval.

RESULTS

In spite of infrequent snowfall this winter, 49 of the 56 routes were completed, the most since the survey began (Figure 2). Survey routes took an average of 2.2 hours to complete. Total snow depths averaged 5.7" along completed routes, slightly below the long-term average (Figure 3). Mean overnight low temperature the night preceding the surveys was 4°F, also slightly below the long-term average (Figure 3). Survey routes were completed between November 20th and February 25th, with a mean survey date of January 5th (Figure 3).

Considering presence or degree of confidence interval overlap, bobcat, coyote, and marten indices exhibited significant increases, with the bobcat index the highest yet recorded (Figure 4). Indices for fisher, red fox and weasel exhibited marginally significant increases, though all remain below their long-term averages (Figure 4).

Fishers were detected on ~ 5% of the route segments and along 53% of the routes (Figure 4). Numerous sources of information indicate that 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 presumed indicative of fisher population trends only in the previous 'core' of fisher range. Marten were detected on ~ 8% of the route segments, and 49% of the survey routes (Figure 4).

Wolf indices were near their long-term average, essentially unchanged from last winter. Wolves were detected on ~ 8% of the route segments and 82% of the survey routes (Figure 4). The average number of wolves detected per route was 2.7.

Although weasels (*Mustela erminea* and *Mustela frenata*) exhibited a marginally significant increase this winter, their track index continues to be characterized by a downward trend with periodic irruptions (Figure 4). No significant changes were observed in either the spring or winter snowshoe hare indices. Historic data (pre-1994; not presented here) for snowshoe hares clearly exhibited 10-year cycles, but in recent times only faint hints of a cycle are apparent during the first couple years of each decade. Since the winter track survey began in 1994, hare indices have steadily increased, with some leveling off in the past 4 years (Figure 4).

DISCUSSION

Reliable interpretation of changes in these 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). Because this remains an untested assumption, caution is warranted when interpreting changes, particularly annual changes of low to moderate magnitude or short-term trends. Surveys this winter were completed during snow and temperature conditions near but slightly below the long-term average from previous surveys. Nevertheless, other factors can influence animal movement and hence detection rates. Acknowledging these caveats, indices for most species exhibited significant or marginally significant increases this winter, following across-the-board declines observed last winter when surveys were conducted during particularly cold and deep-snow conditions.

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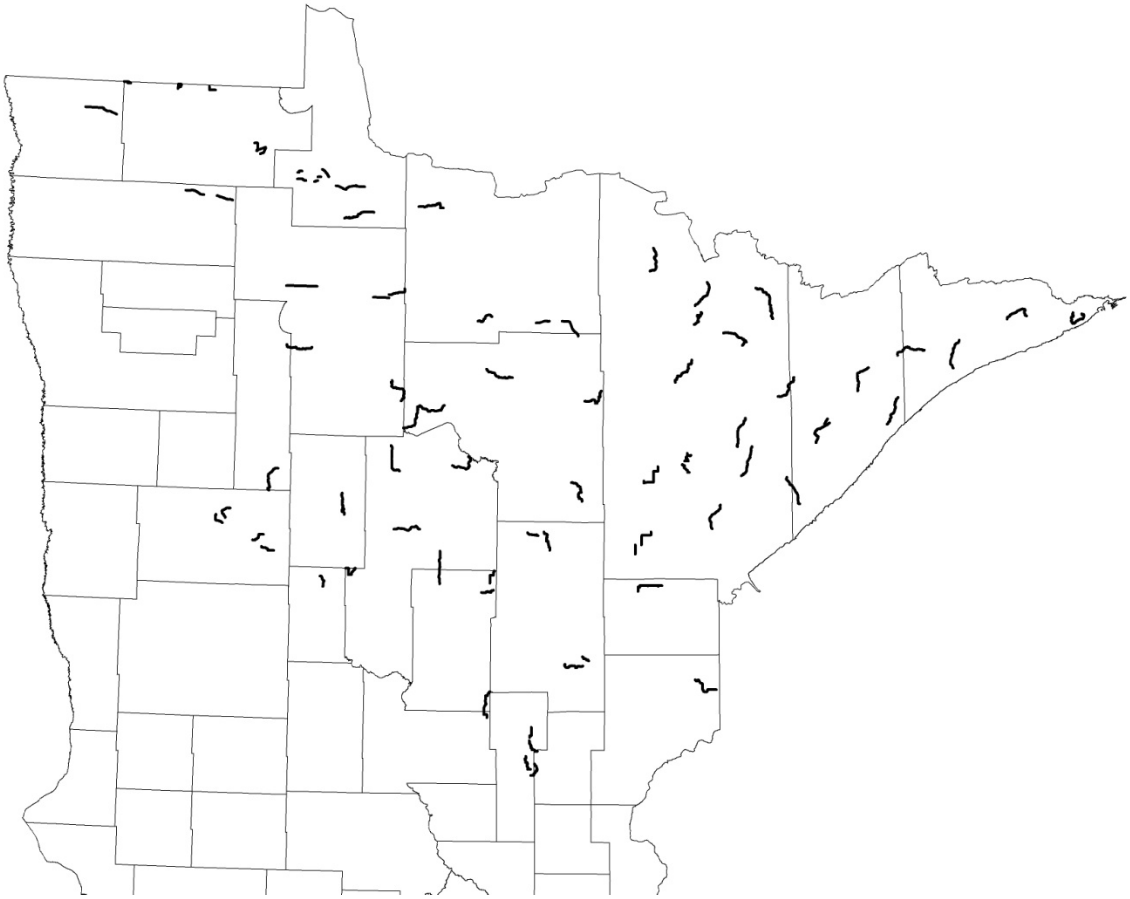

Figure 1. Locations of established furbearer winter track survey routes in northern Minnesota.

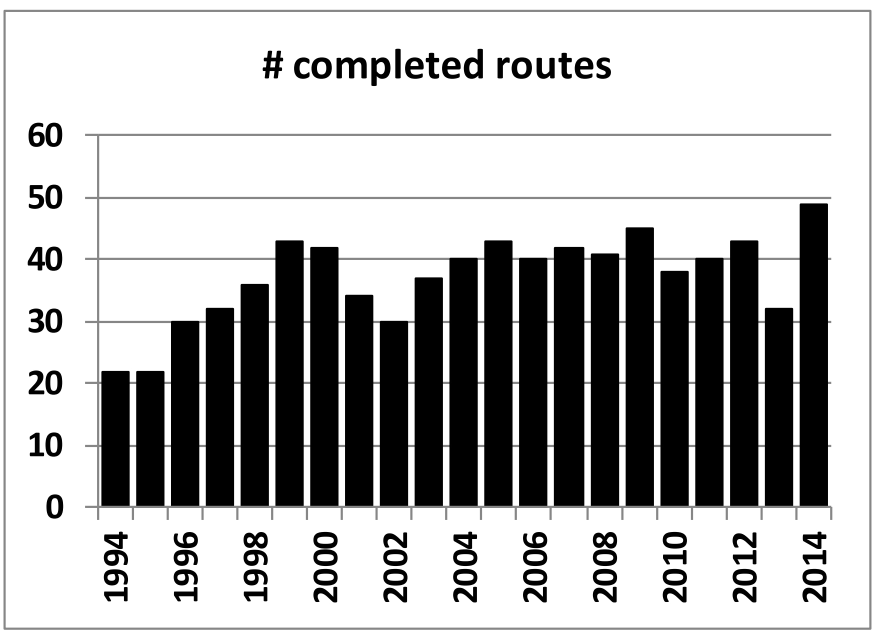

Figure 2. Number of snow track routes surveyed in Minnesota, 1994-2014.

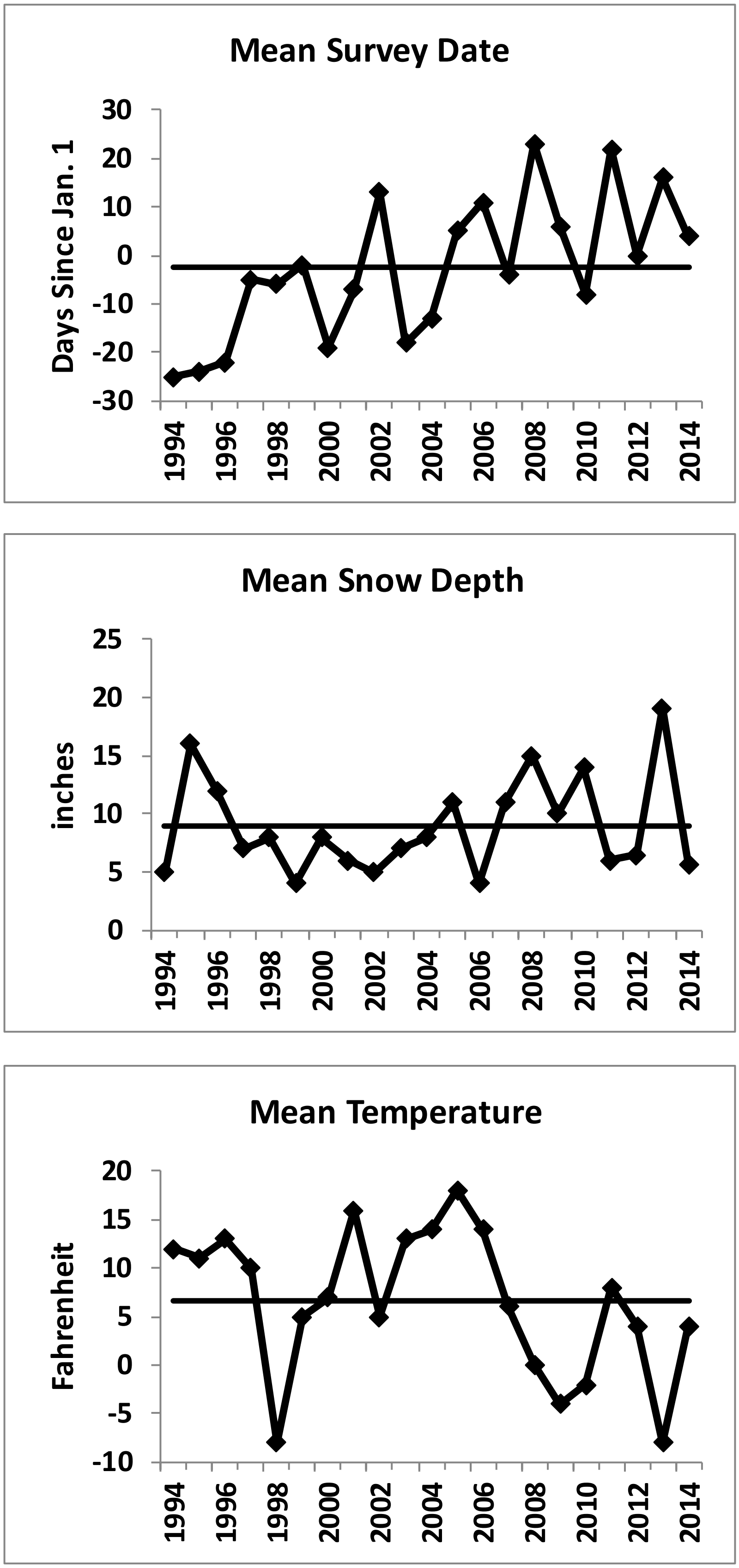

Figure 3. Average survey date, snow depth, and temperature for snow track routes completed in Minnesota, 1994-2014. Horizontal line represents long-term mean.

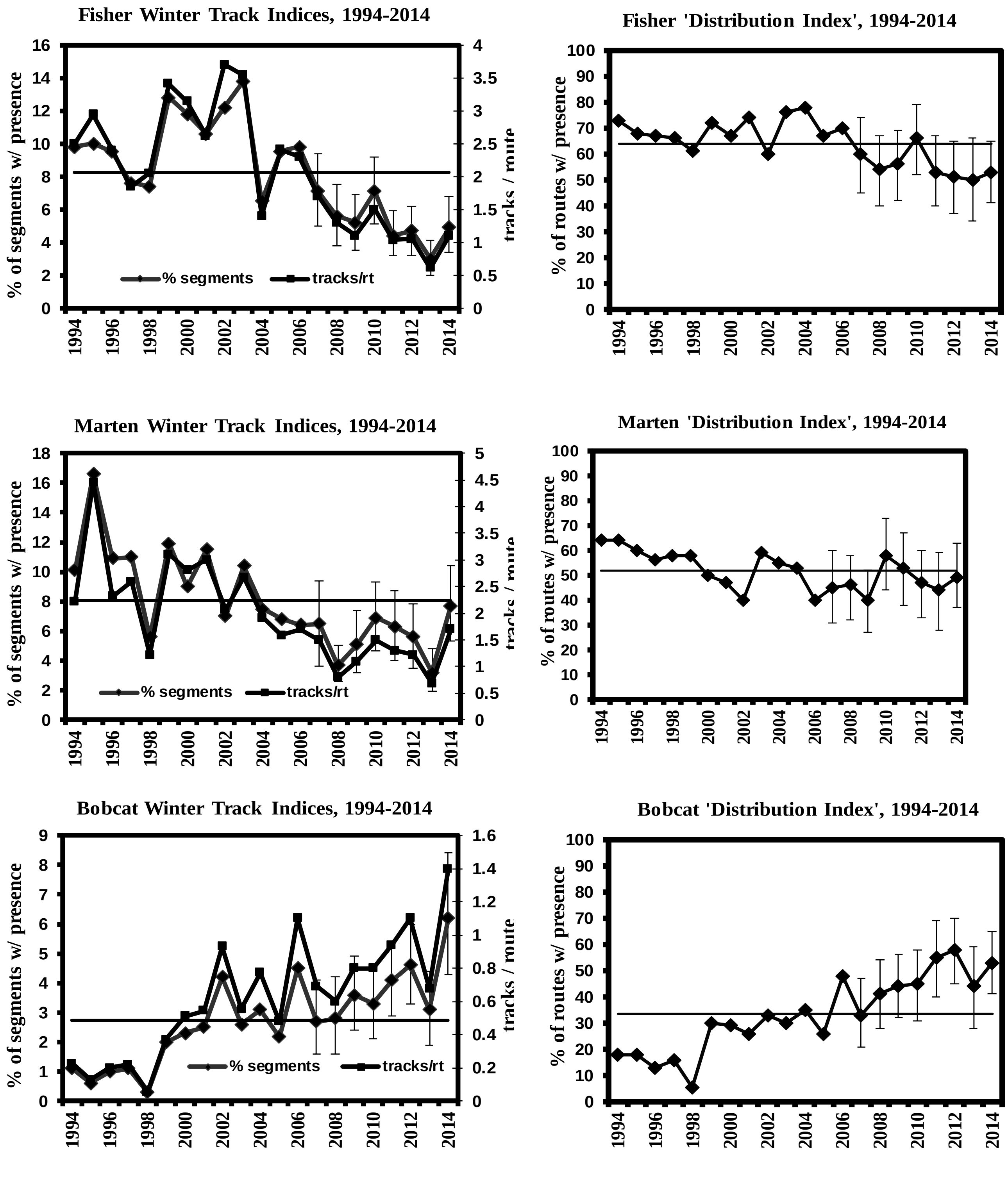

Figure 4. Winter track indices for selected species in Minnesota, 1994-2014. Confidence intervals are presented only for % segments and % routes with track presence; horizontal lines represent their long-term averages.

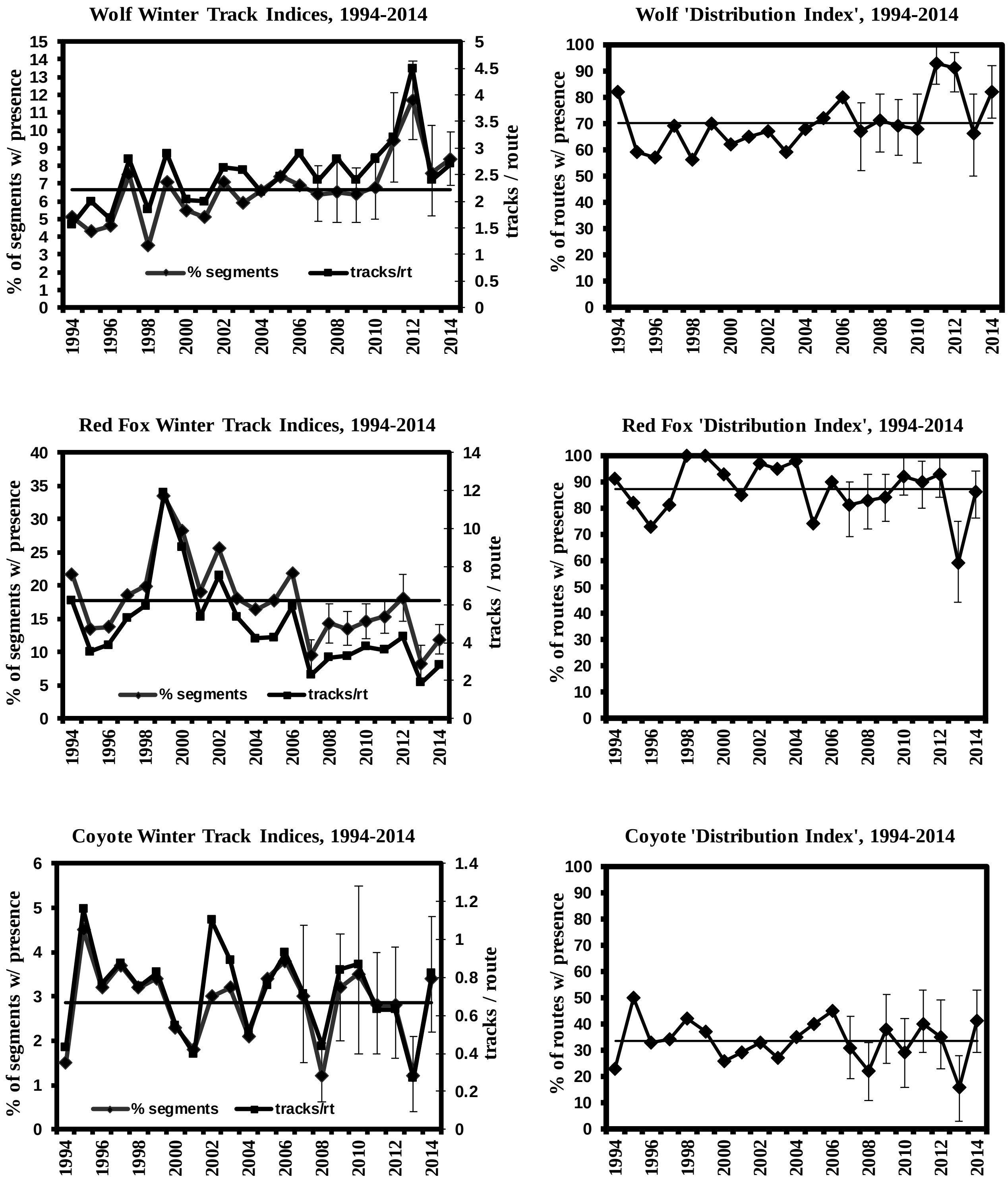

Figure 4 (continued). Winter track indices for selected species in Minnesota, 1994-2014.

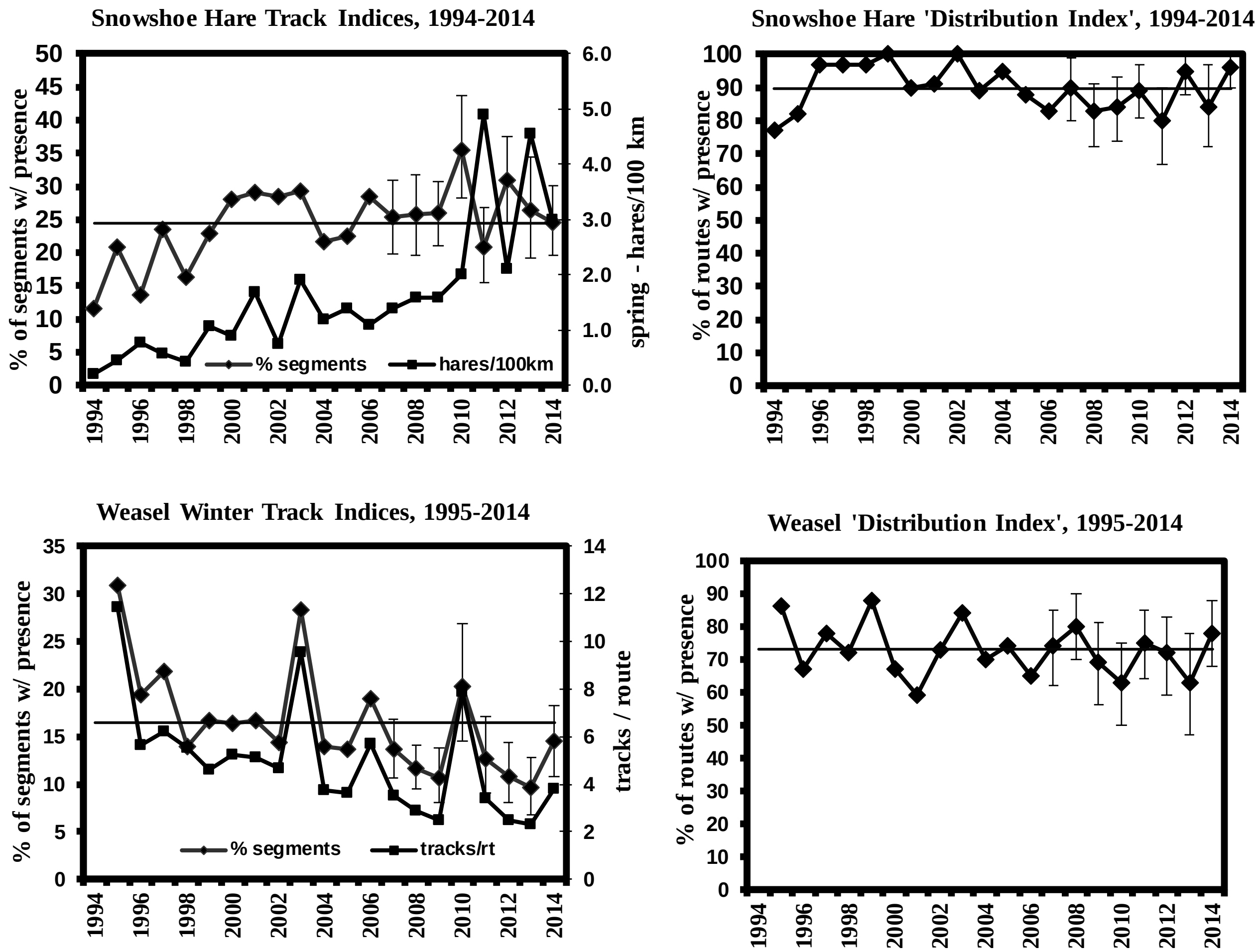

Figure 4 (continued). Winter track indices for selected species in Minnesota, 1994-2014.