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, 2012

John Erb, Minnesota, Forest Wildlife 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 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).

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 37th 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, farmland, and transition).

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 258 routes were completed this year (Figure 1). There were 2,384 operable scent stations examined on the 258 4.3 km routes. Route density varied from 1 route per 601 km^2 in the Forest Zone to 1 route per 1,261 km^2 in the Farmland Zone (Figure 1).

Statewide, route visitation rates (% of routes with detection) were highest for red foxes (40%), followed by skunks (38%), raccoons (30%), coyotes (25%), domestic cats (24%), domestic dogs (19%), wolves (14%), and bobcats (12%). Regionally, route visitation rates were as follows: red fox – Farmland (FA) 28%, Transition (TR) 41%, Forest (FO) 45%; coyote – FA 48%, TR 41%, FO 8%; skunk – FA 46%, TR 50%, FO 28%; raccoon – FA 48%, TR 42%, FO 17%; domestic cat – FA 56%, TR 29%, FO 9%; and domestic dog – FA 24%, TR 20%, FO 5%.

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 on the presence/absence of confidence interval overlap, the only significant change this year was an increase in the Forest Zone striped skunk index (Figure 4), which follows a significant decrease last year. In addition, the increase in the Transition Zone wolf index approached significance (Figure 3), although the Transition Zone represents a comparatively small percentage of wolf range in Minnesota.

In the Farmland Zone, the red fox index remained well below its long-term average, whereas the Farmland coyote index remains well above its long-term average and was the highest yet recorded (Figure 2). Indices for most other species are near long-term averages, though the raccoon index has generally remained above-average in recent years (Figure 2).

In the Transition Zone, the red fox index has undergone fluctuations, but is currently near its long-term average (Figure 3). The Transition Zone coyote index continues an upward trend, with the point estimate for this year's track index the highest yet recorded. The indices for most other species are near their long-term average, although detection rates for domestic dogs have declined for several years (Figure 3).

In contrast to the other zones, the Forest Zone coyote index reached its lowest level since the survey began, although the decline was not a significant change from last year (Figure 4). Red fox and raccoon indices remain near their long-term average (Figure 4). The Forest Zone wolf index declined, though not significantly, and has remained above the long-term average for 3 years (Figure 5). Although the Transition Zone represents a small portion of wolf range and confidence intervals are large, the point estimate for the Transition Zone wolf index was the highest yet recorded (Figure 5). The Forest Zone bobcat index continues to increase to record levels whereas the Transition Zone bobcat index has declined appreciably the last 2 years to near its long–term average (Figure 5).

ACKNOWLEDGEMENTS

I wish to thank all of the cooperators who participated in the 2012 survey: DNR Division of Wildlife staff; Superior National Forest Aurora District; Agassiz, Rydell, Sherberne, and Tamarac National Wildlife Refuges; USFWS Detroit Lakes Wetland Management District; 1854 Treaty Authority, Red Lake, and Leech Lake Tribal Natural Resource Departments; St. Croix National Scenic Waterway; Lori Schmidt and Vermillion Community College; Jim Pederson and Marshall County Central High School; Peter Jacobson and Faribault High School; and Richard Nelles and Tom Stuber.

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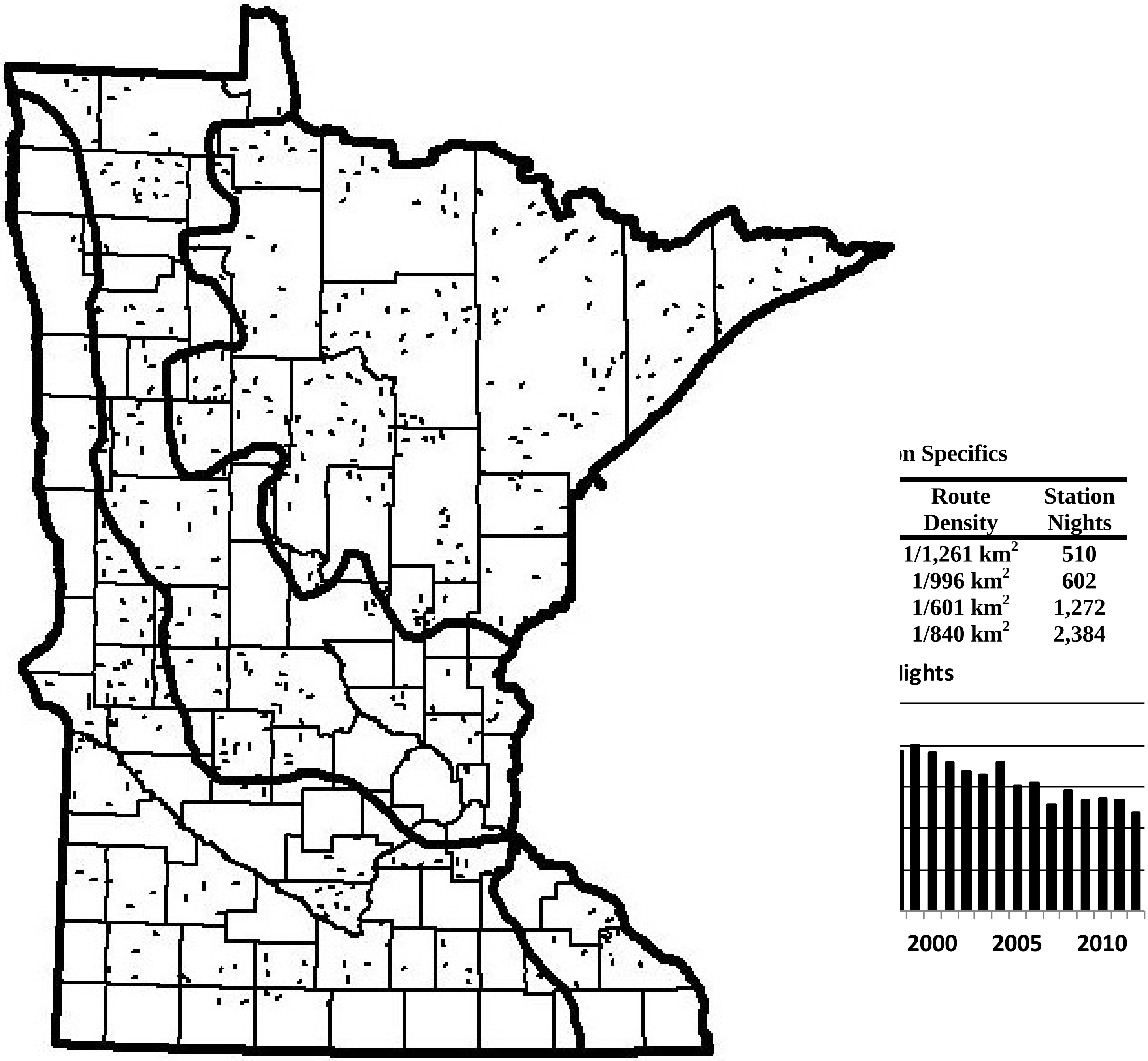

Figure 1. Locations of existing scent station routes (not all completed every year). Insets show 2012 route specifics and the number of station-nights per year since 1983.

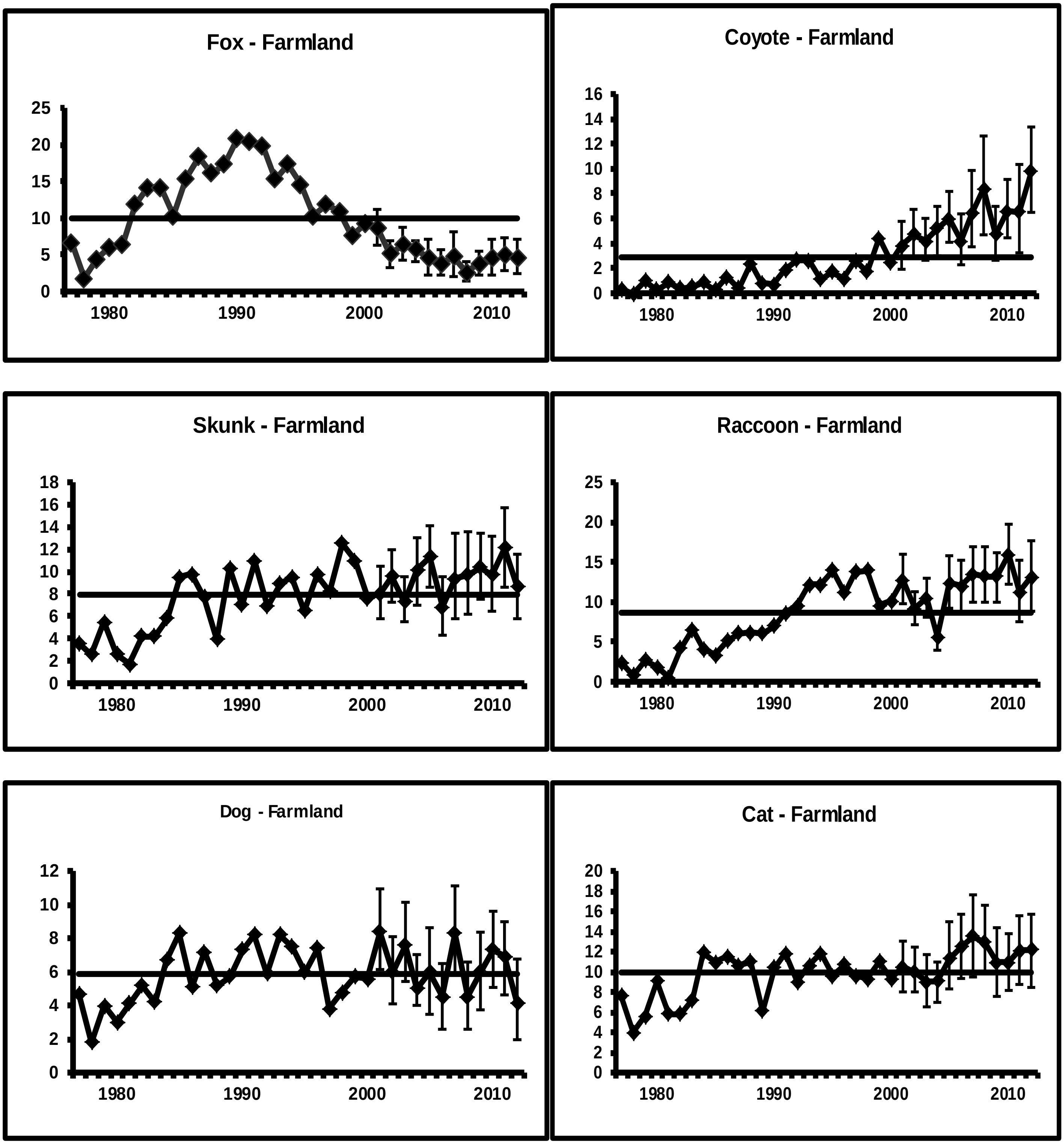

Figure 2. Percentage of scent stations visited by selected species in the Farmland Zone of Minnesota, 1977-2012. Horizontal line represents long-term mean.

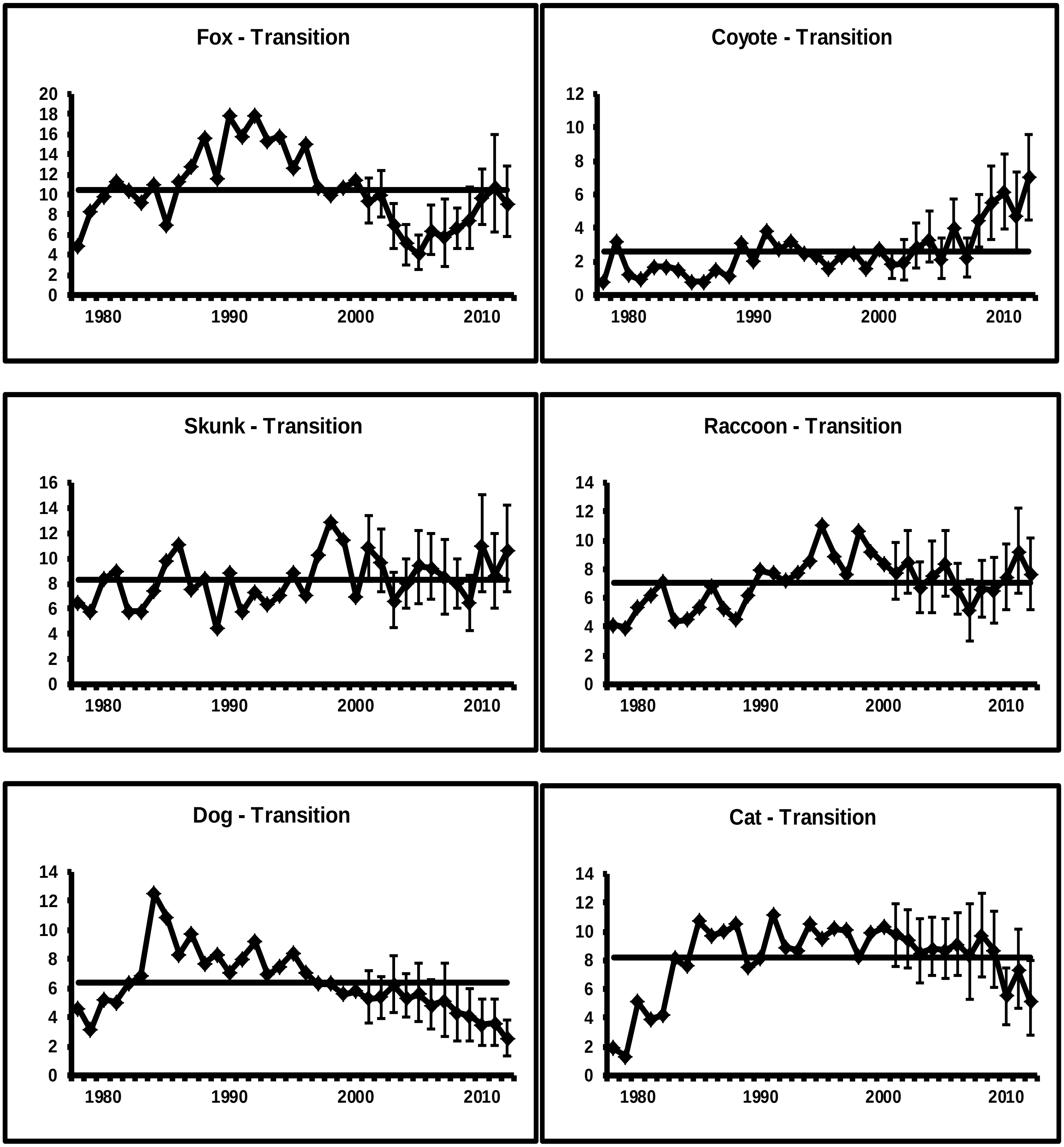

Figure 3. Percentage of scent stations visited by selected species in the Transition Zone of Minnesota, 1978-2012. Horizontal line represents long-term mean.

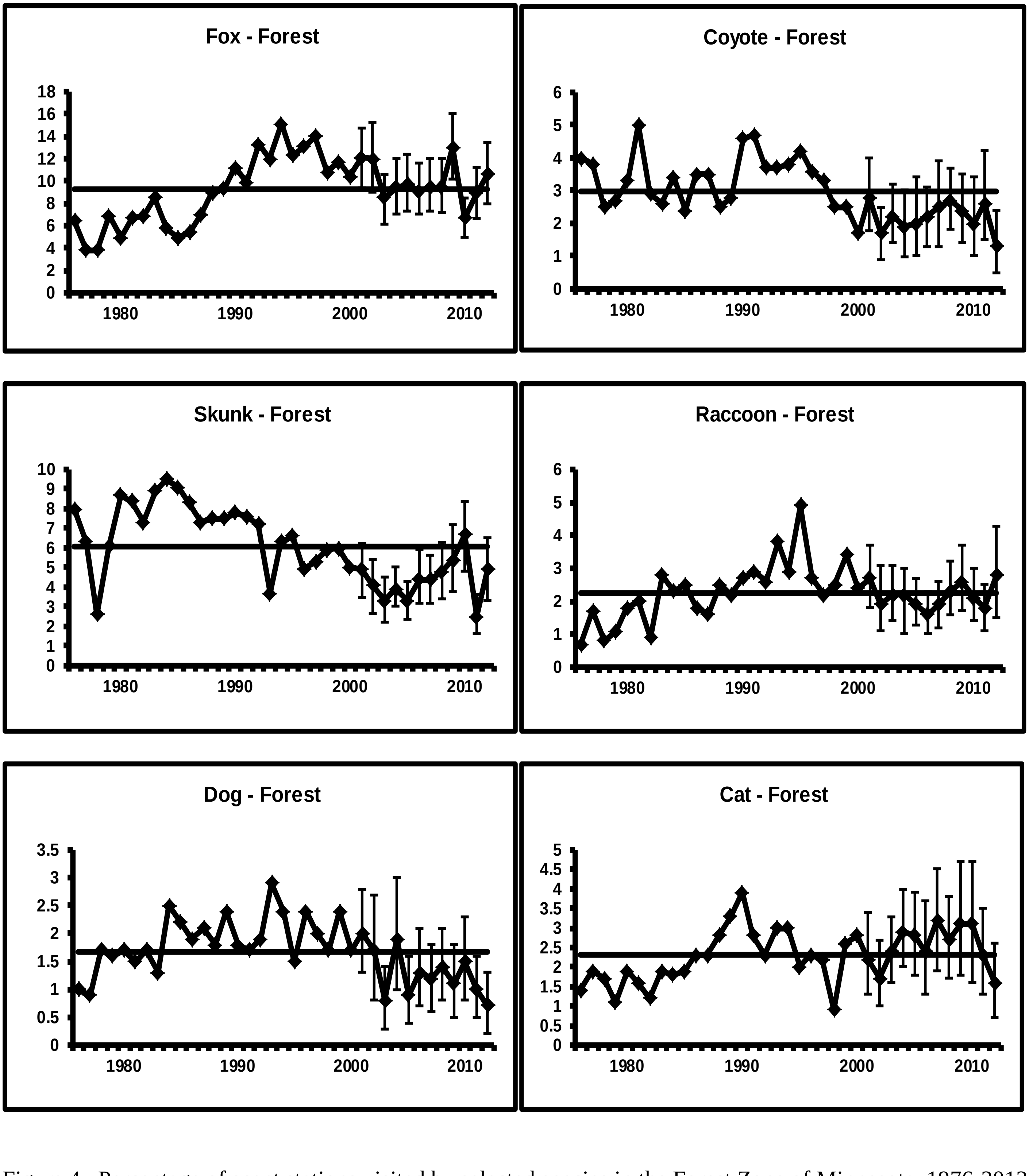

Figure 4. Percentage of scent stations visited by selected species in the Forest Zone of Minnesota, 1976-2012. Horizontal line represents long-term mean.

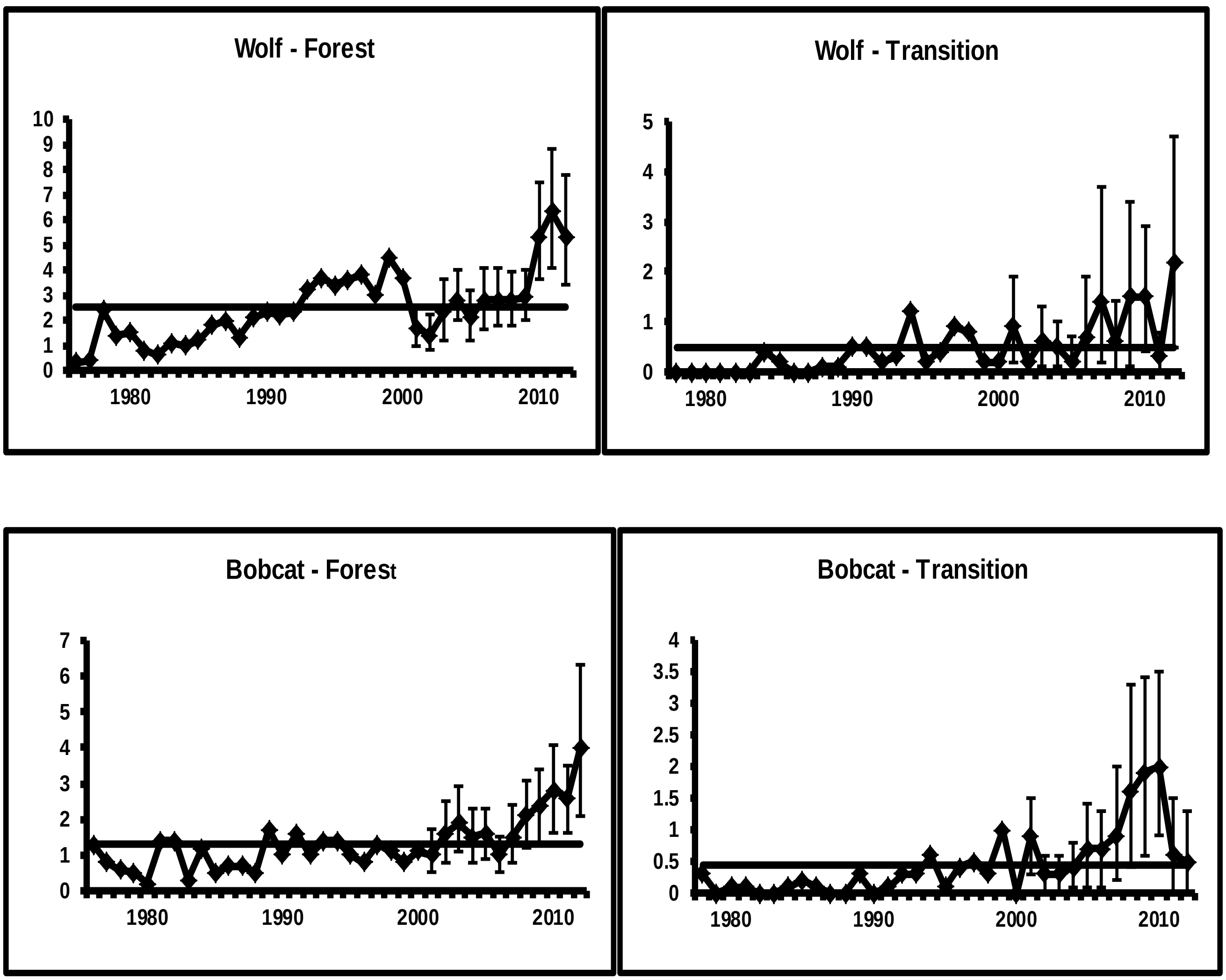

Figure 5. Percentage of scent stations visited by wolves and bobcat in the Forest and Transition Zones of Minnesota, 1976-2012. Horizontal lines represents long-term mean.

FURBEARER WINTER TRACK SURVEY SUMMARY, 2012

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*), 2 species for which no other survey data was available. Because sign of other carnivores is readily detectable in snow, participants also record tracks for other selected species. After 3 years of evaluating survey logistics, the survey became operational in 1994.

METHODS

Presently, 60 track survey routes are distributed 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 1 day after the conclusion of a snowfall (ending by 6:00 pm), thereby allowing 1 night for tracks to be left, a few routes are usually completed 2 nights following snowfall. In such cases, track counts on those routes are divided by the number of days post-snowfall.

Currently, 3 summary statistics (2 graphs) 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 2 adjacent 0.5-mile segments along the road, and it was the only ‘new’ red fox (*Vulpes vulpes*) in the second segment, only 1 of the 2 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 1 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 2 indices (% segments occupied and # tracks per route) will often yield mathematically equivalent results (i.e., 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 start traveling as breeding pairs in winter, the approximate equivalence of these 2 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 will by definition be 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) and/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 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

Forty-three of the 60 routes (Figure 2) were completed this year. Survey routes took an average of 2.2 hours to complete. Total snow depths averaged 6” for completed routes and mean overnight low temperature the night preceding the surveys was 4°F, both measures slightly below their long-term averages (Figure 3). Survey routes were completed between November 26th and March 6th, with a mean survey date of January 1st (Figure 3).

Neither fisher nor marten track indices changed significantly, and both remain near their lowest level since the survey’s inception (Figure 4). Fishers were detected on 4.7% of the route segments, and along 51% of the routes (Figure 4). This represents the smallest percentage of routes with fisher detection since the survey began. However, numerous sources of information indicate that fishers have been expanding 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 likely indicative of fisher population trends only in the previous ‘core’ of fisher range, not in the southern and western periphery where they appear to be increasing. Marten were detected on 5.6% of the route segments, and 47% of the survey routes (Figure 4).

In spite of a significant increase in bobcat (*Lynx rufus*) harvest in recent years, bobcat track indices increased again though the changes were not statistically significant. Bobcats were detected on 4.6% of the route segments and 58% of the survey routes, the most since the survey began (Figure 4). Wolf indices did not change significantly, but index point estimates reached or remained near record levels the past 2 years. Wolves were detected on 12% of the route segments and 91% of the survey routes (Figure 4).

No notable changes were observed in red fox or coyote indices, with indices for both species near their long-term averages (Figure 4). Weasel (*Mustela erminea* and *Mustela frenata*) indices continue to be characterized as exhibiting a downward trend with periodic irruptions (Figure 4). Although historic data (pre-1994; not presented here) for snowshoe hares clearly exhibited 10-year cycles, in recent times the cycle appears to have dampened though hints of the cycle remain. Cycle peaks have historically occurred, on average, near the beginning of each decade. Data from the past 2 years is consistent with this pattern, but with the low to moderate cyclic increases being superimposed on a generally increasing trend since 1994 (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) Because this remains an untested assumption, caution is warranted when interpreting changes, particularly annual changes of low to moderate magnitude, or short-term trends.

Based on confidence intervals, there were no statistically significant changes from last year. In general, fisher and marten indices remain near their low point, with neither species appearing to be positively responding to the reduced fisher-marten harvest seasons over the past 6 years. Wolf and bobcat indices have increased in recent years to peak levels, whereas red fox and coyote indices are near their long-term averages. Trends are suggested for both weasels (decreasing) and snowshoe hares (increasing), but with indications of cyclic increases every ~ 8 years (weasels) or ~10 years (hares).

Confidence interval data for previous years will continue to be calculated and incorporated as time permits. Various changes or issues are being considered related to the logistical practicality of the survey in the foreseeable future, adequacy of route sample size and distribution, research to evaluate current survey assumptions or standardization, design alternatives to address spatial correlation of track segments along routes, and possible approaches for estimating, and hence correcting for, any differences in the probability of detecting animals across years (e.g., MacKenzie et al. 2004).

ACKNOWLEDGEMENTS

I wish to thank all those who participated in this year's survey, including Minnesota DNR field staff, Superior National Forest staff (Ely District), Tamarac National Wildlife refuge, Tribal staff from the Fond-du-Lac, Red Lake, and Grand Portage Bands, and the 1854 Treaty Authority.

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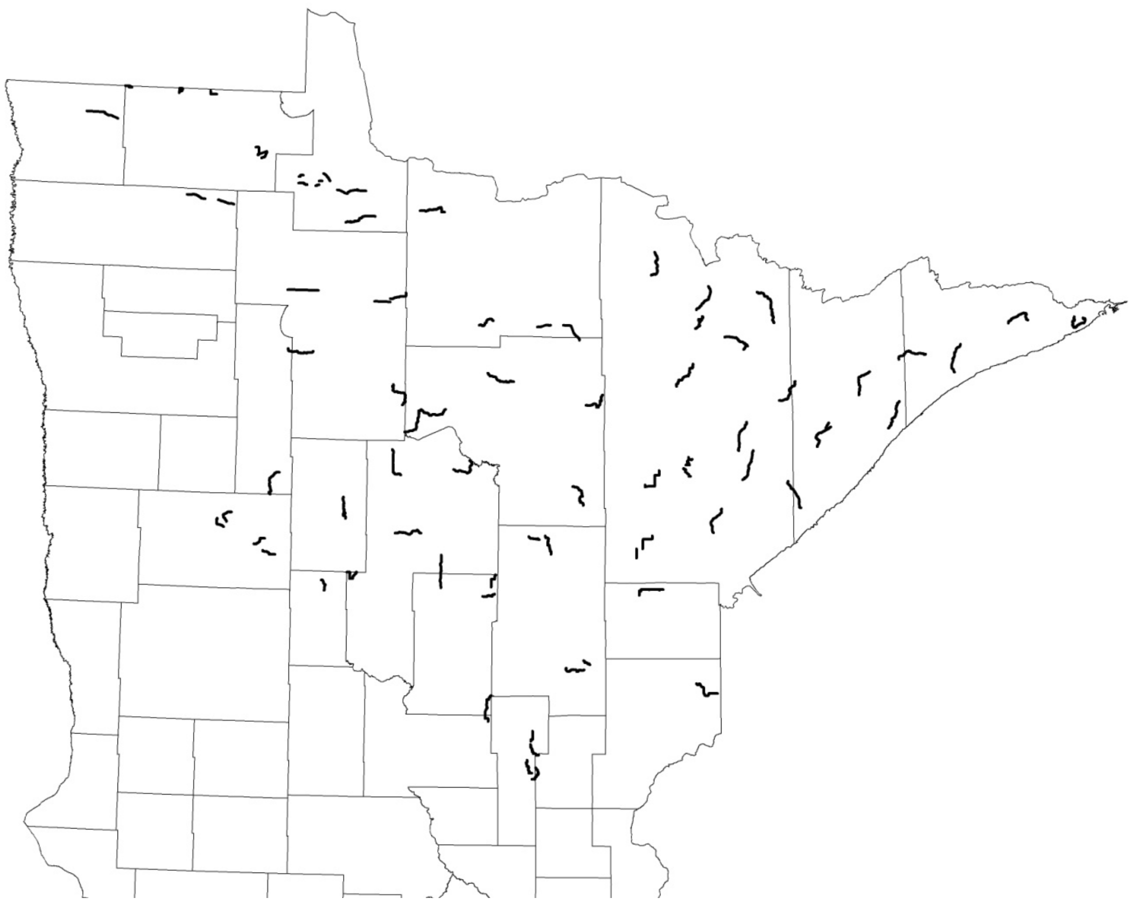

Figure 1. Locations of established furbearer winter track survey routes in northern Minnesota.

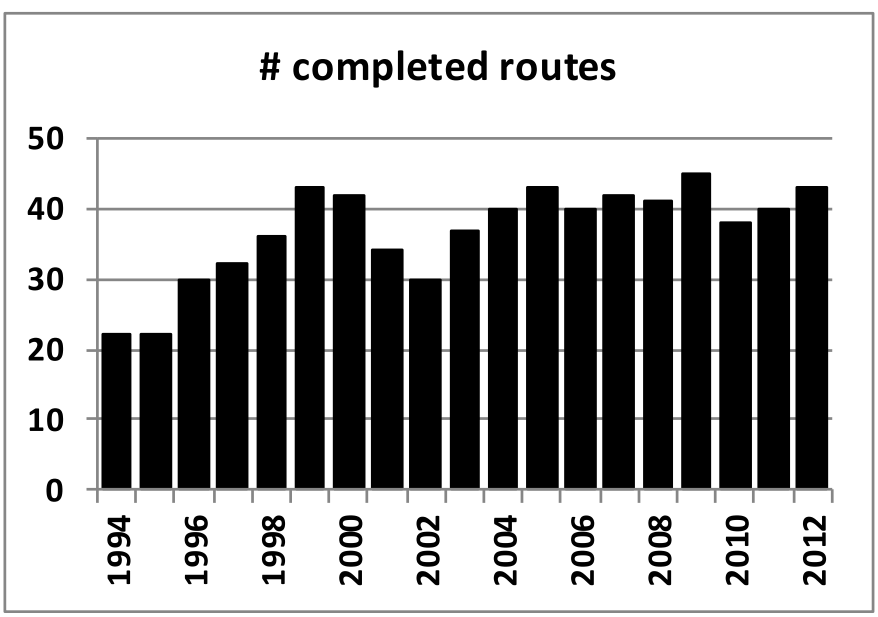

Figure 2. Number of winter track routes surveyed in Minnesota, 1994-2012.

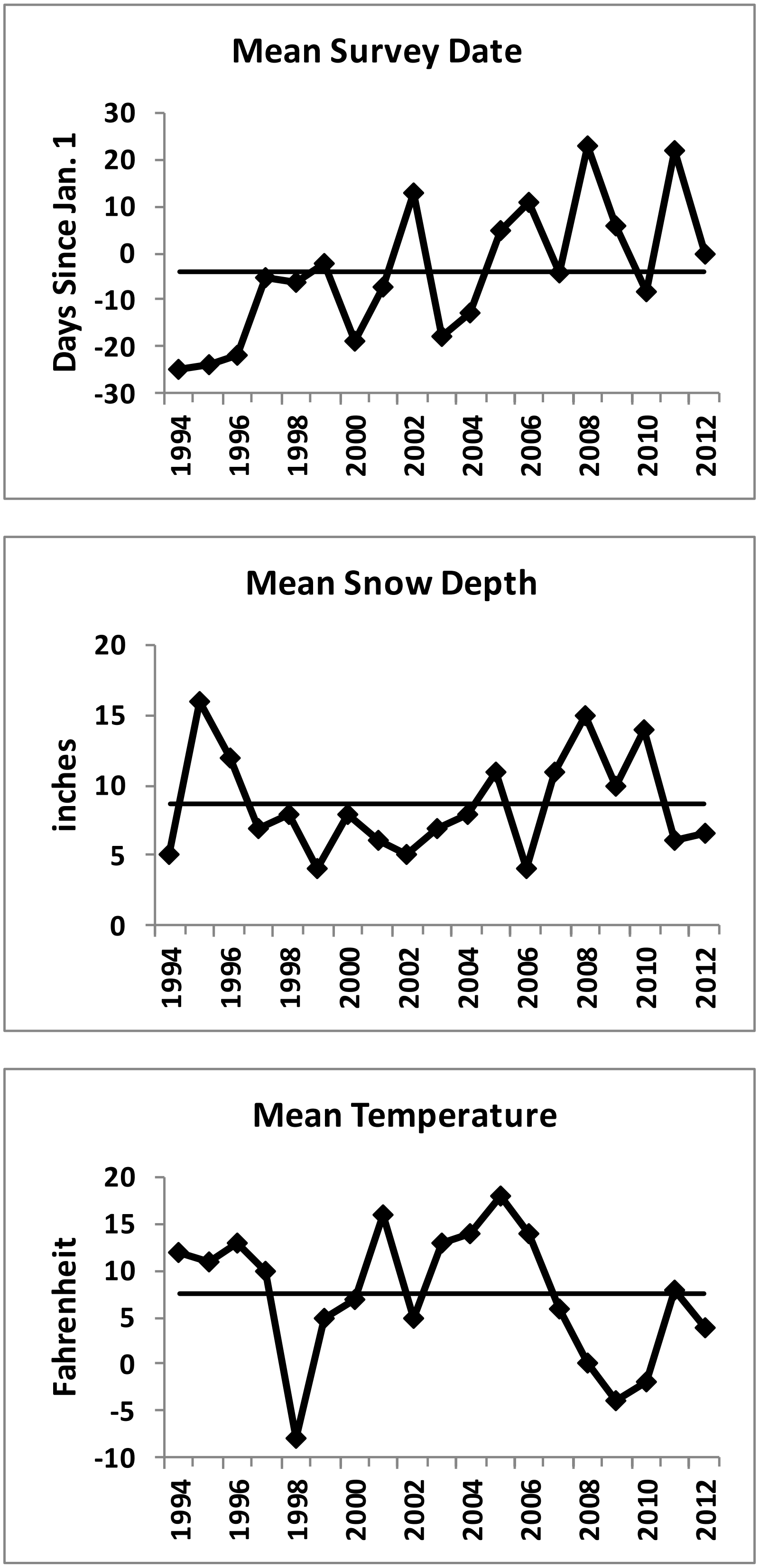

Figure 3. Average survey date, snow depth, and temperature for track routes completed in Minnesota, 1994-2012. Horizontal line represents long-term mean.

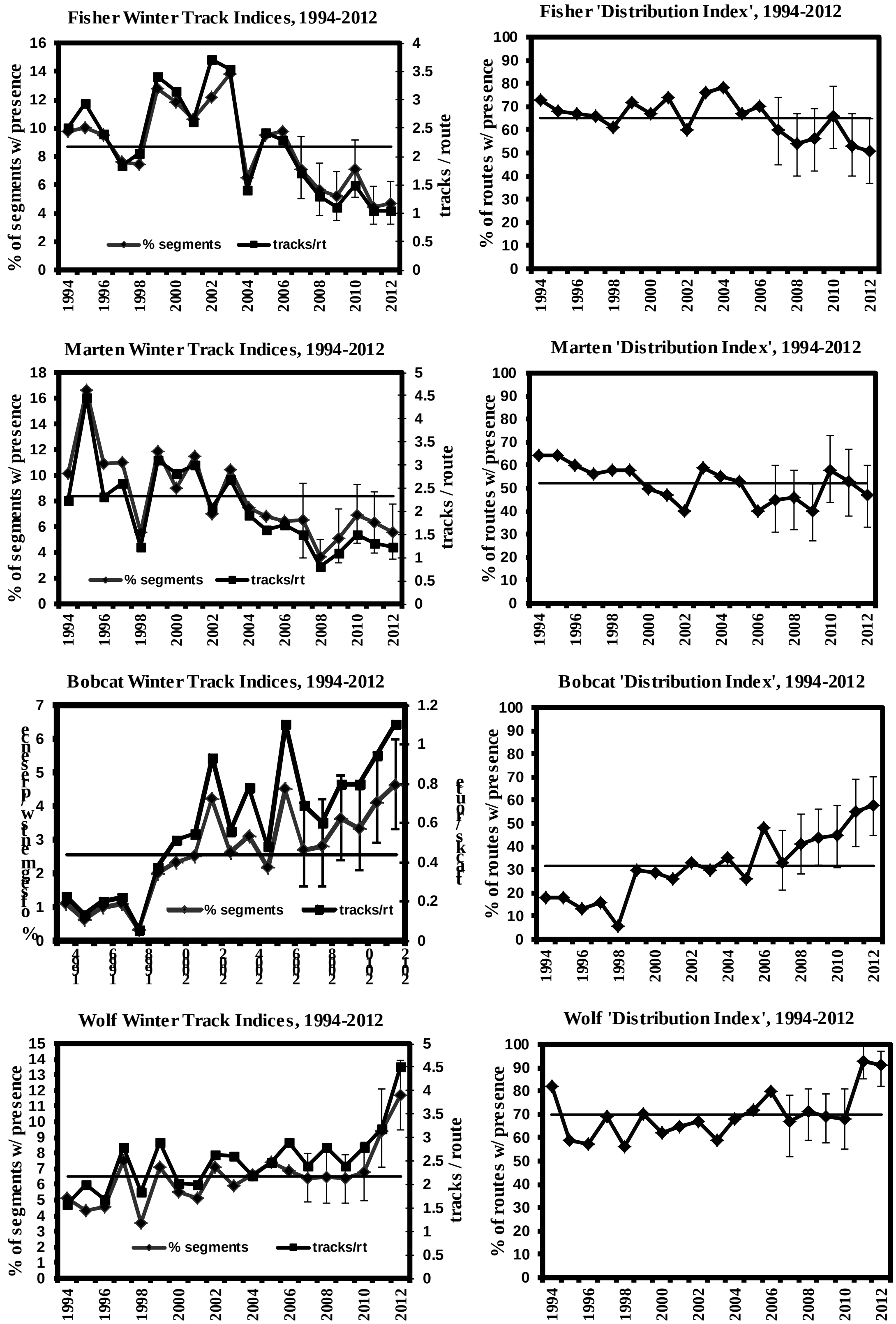

Figure 4. Winter track indices for selected species in Minnesota, 1994-2012. Confidence intervals only presented for % segments and % routes with track presence. Horizontal lines represent long-term average for percentage of segments and routes with presence.

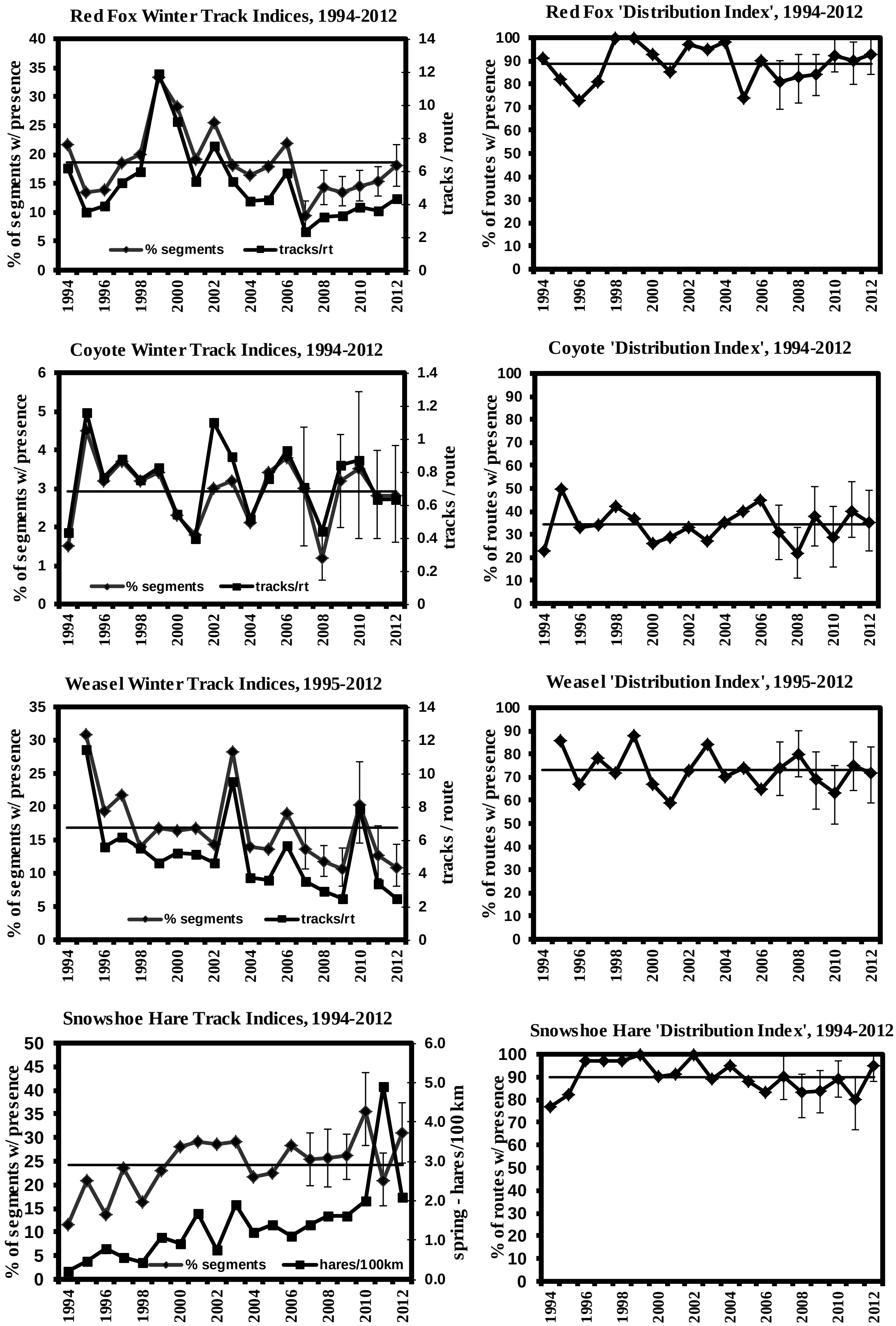

Figure 4 (continued).