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, 2011

John Erb, Minnesota Department of Natural Resources, 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 36th anniversary 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 tab 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 283 routes were completed this year (Figure 1). There were 2,671 operable scent stations examined on the 283 4.3 km routes. Route density varied from 1 route per 538 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) were highest for red fox (40%), followed by skunk (35%), raccoon (30%), domestic cat (29%), coyote (19%), and domestic dog (19%). Regionally, route visitation rates were as follows: red fox – Farmland (FA) 33%, Transition (TR) 40%, Forest (FO) 42%; coyote – FA 22%, TR 26%, FO 15%; skunk – FA 63%, TR 47%, FO 18%; raccoon – FA 53%, TR 46%, FO 14%; domestic cat – FA 61%, TR 39%, FO 12%; and dog – FA 42%, TR 26%, FO 8%.

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 a decline in the Forest zone striped skunk index (Figure 4). In addition, some changes occurred that approached significance, including decreases in both the bobcat and wolf indices in the Transition Zone (Figure 3). However, the Transition Zone represents a comparatively small percent of both wolf and bobcat range in Minnesota. In the Forest Zone, point estimates for the wolf index reached a new high and the bobcat track index remained well above the long-term average, though neither index was statistically different from last year (Figure 5).

Over the last 10 years, red fox indices in both the Farmland and Transition zones had declined to levels well below their long-term averages (Figures 2 and 3). However, red fox indices in the Transition zone have been steadily increasing and have now returned to their long-term average. Red fox indices in the Farmland Zone have also increased in recent years, though they remain below the long-term average. After increasing for many years, Farmland coyote indices appear to have stabilized in recent years (Figure 2). Coyote indices remain comparatively low in the Forest zone (Figure 4), likely attributable to the presence of wolves. No significant trends have been observed in raccoon or skunk indices in recent years, and with the exception of the Forest zone skunk index, most indices remain near or moderately above long-term averages throughout the state.

ACKNOWLEDGEMENTS

I wish to thank all of the cooperators who participated in the 2011 survey: DNR Division of Wildlife staff; Superior National Forest Aurora District; Agassiz, Rydell, Sherberne, and Tamarac National Wildlife Refuges; USFWS Detroit Lakes Wetland Management Districts; 1854 Treaty Authority, White Earth, Red Lake, and Leech Lake Tribal Natural Resource Departments; St. Croix National Scenic Waterway; Vermillion Community College; Beltrami County Land Department; Marshall County Central High School; and Richard Nelles and Tom Stuber.

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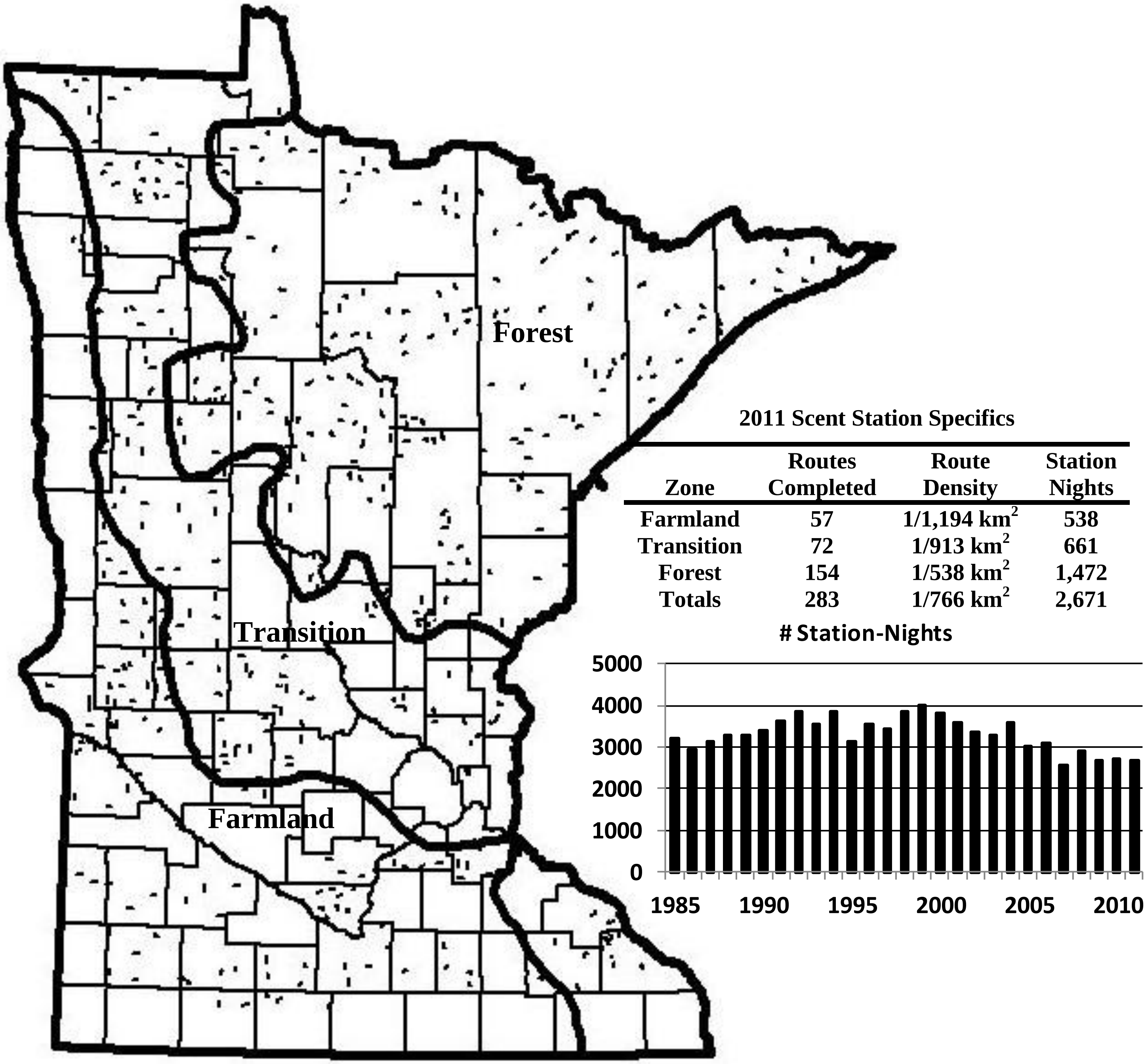

2011 Scent Station Specifics

Zone	Routes Completed	Route Density	Station Nights
Farmland	57	1/1,194 km^2	538
Transition	72	1/913 km^2	661
Forest	154	1/538 km^2	1,472
Totals	283	1/766 km^2	2,671

Figure 1. Locations of existing scent station routes (not all completed every year). Insets show 2011 route specifics and the number of station-nights per year since 1983.

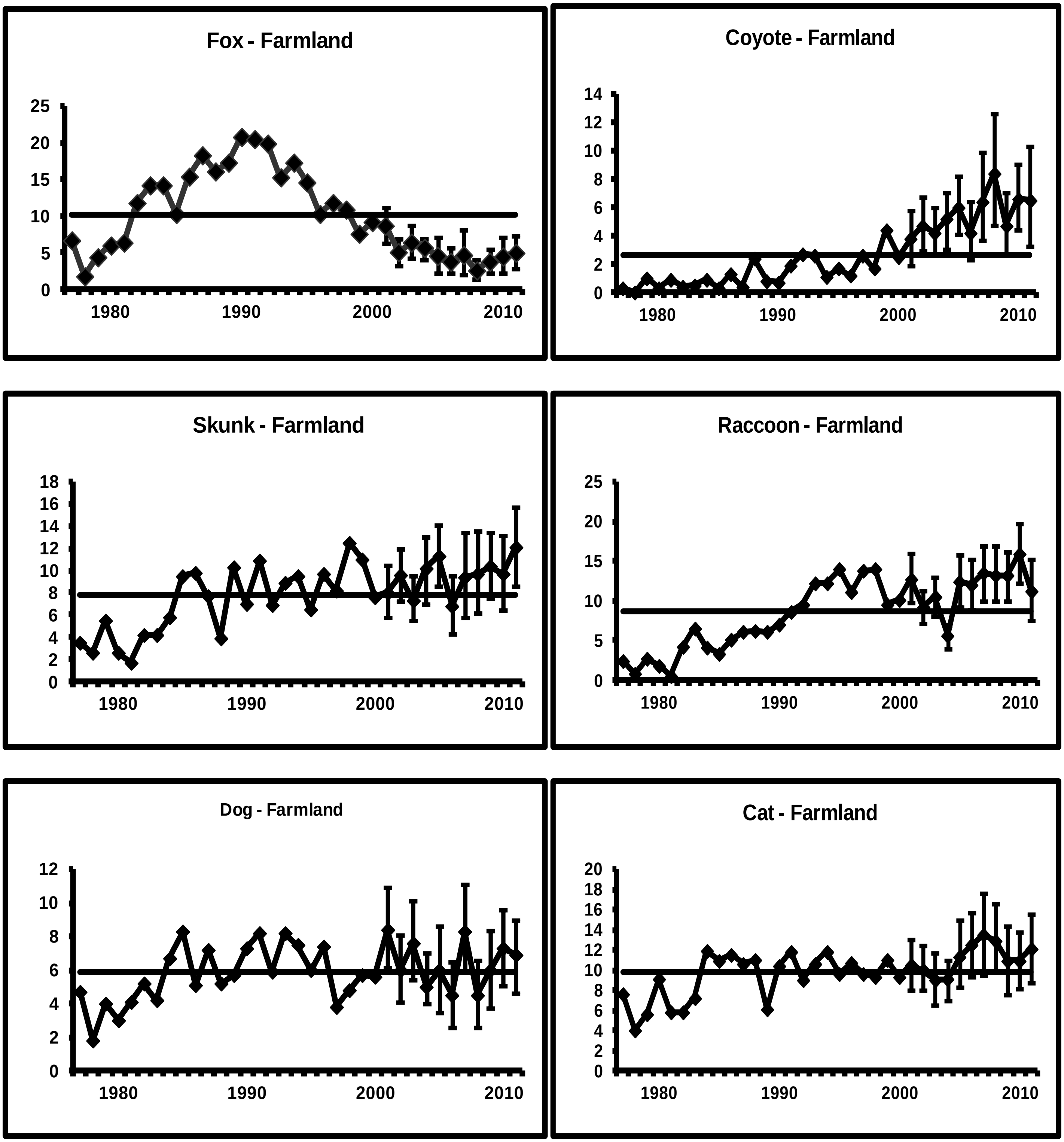

Figure 2. Percentage of scent stations visited by selected species in the Farmland Zone of Minnesota, 1977-2011. Horizontal line represents long-term mean.

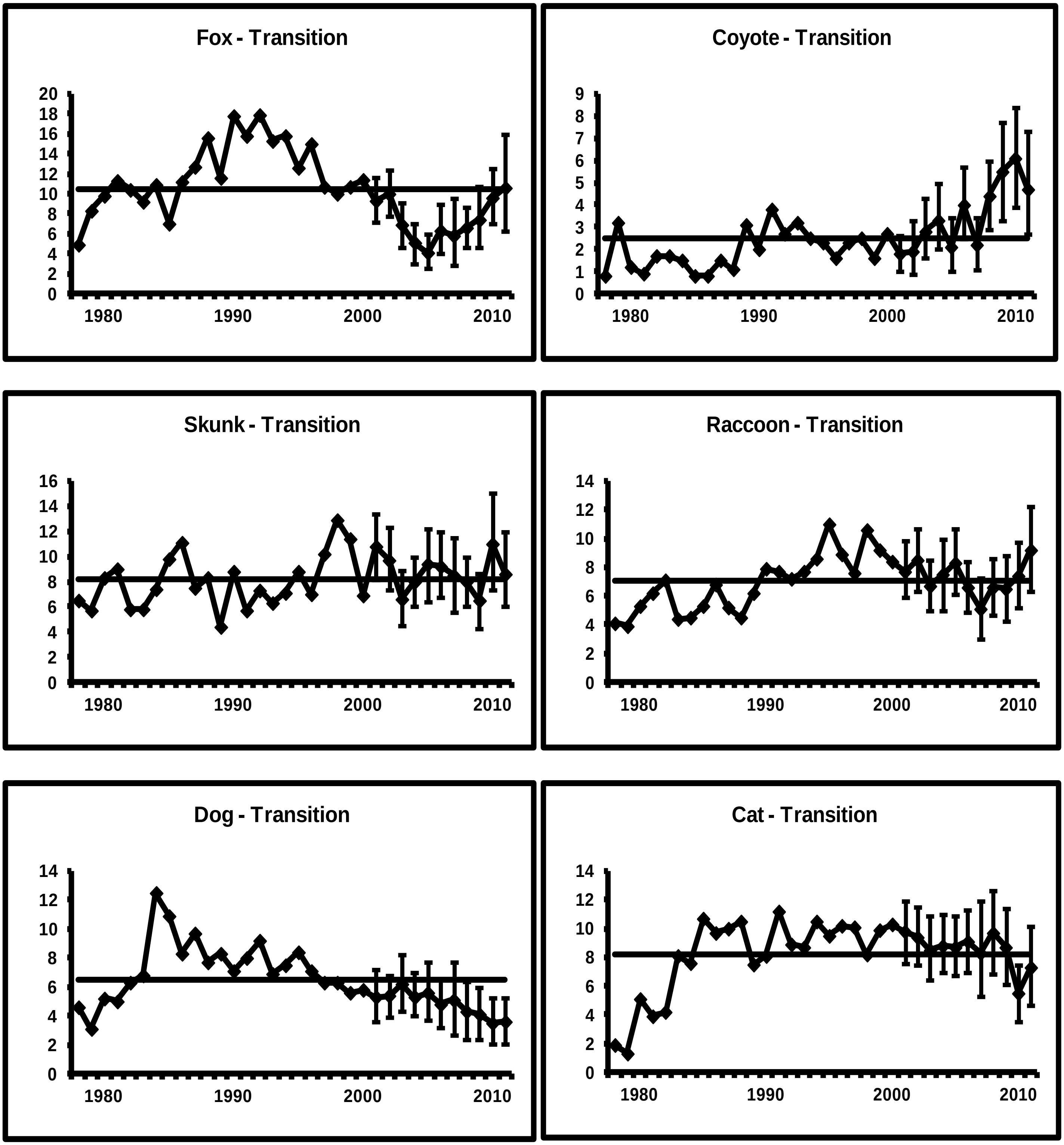

Figure 3. Percentage of scent stations visited by selected species in the Transition Zone of Minnesota, 1978-2011. Horizontal line represents long-term mean.

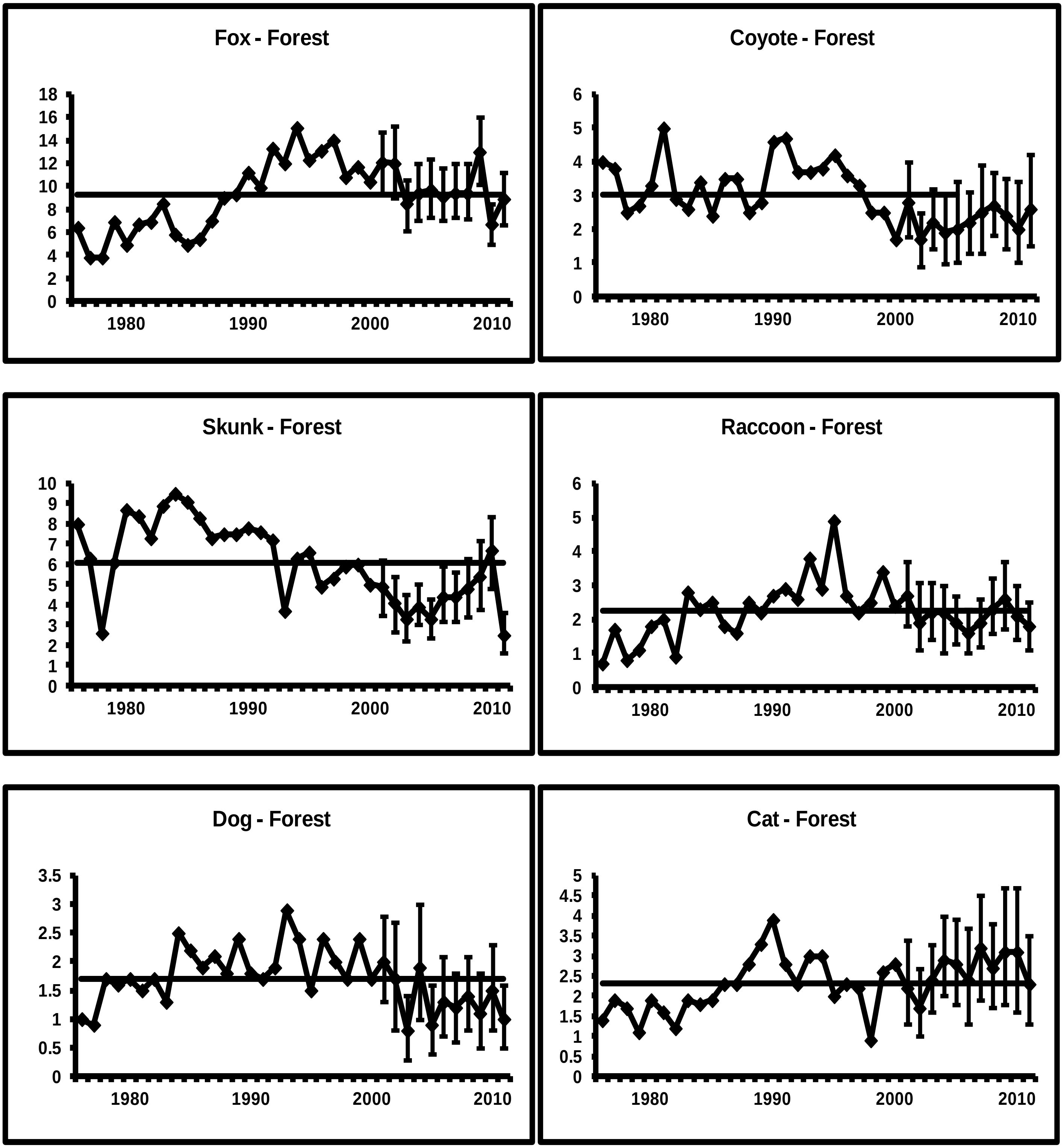

Figure 4. Percentage of scent stations visited by selected species in the Forest Zone of Minnesota, 1976-2011. Horizontal line represents long-term mean.

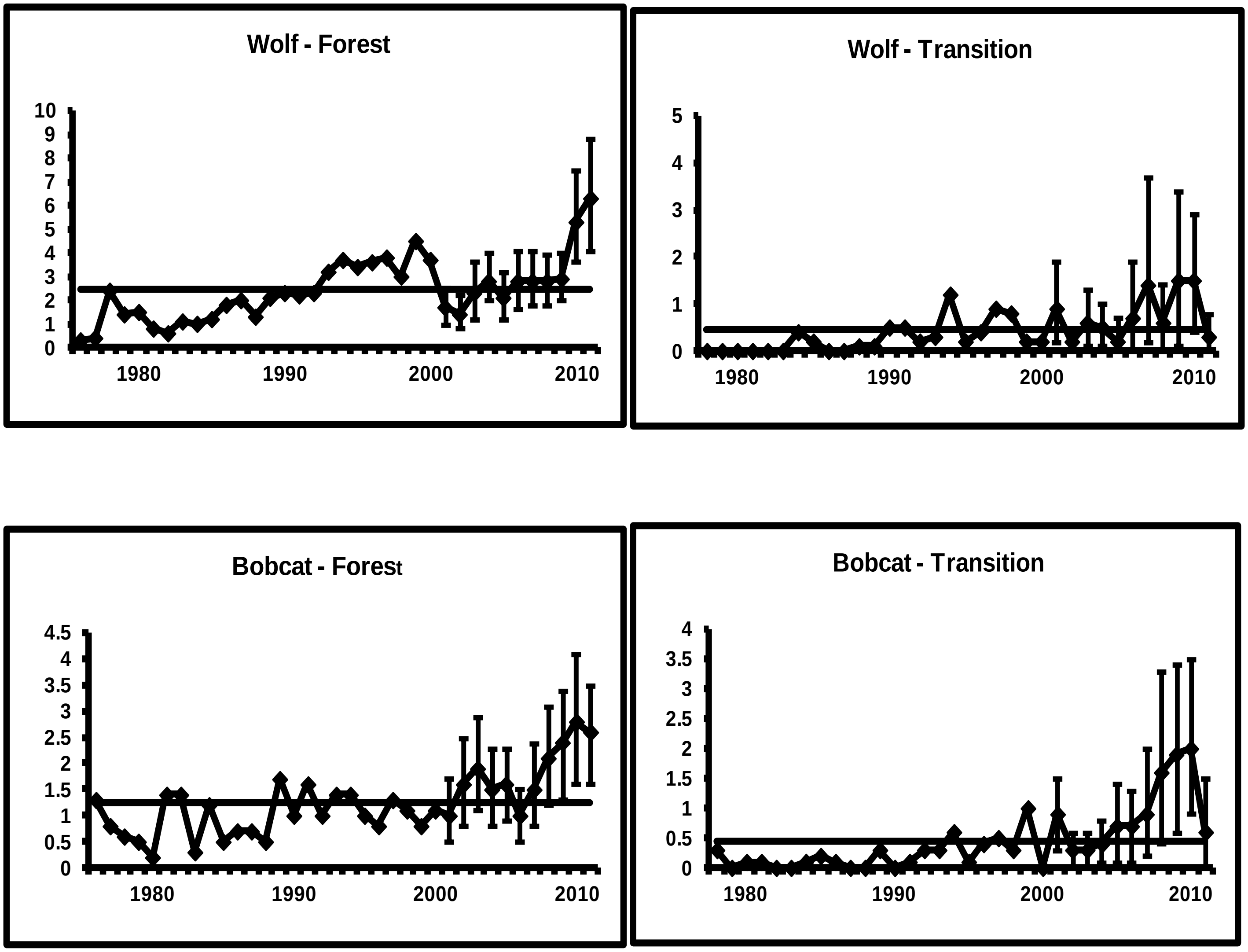

Figure 5. Percentage of scent stations visited by wolves and bobcat in the Forest and Transition Zones of Minnesota, 1976-2011. Horizontal lines represents long-term mean.

FURBEARER WINTER TRACK SURVEY SUMMARY, 2011

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 of 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 hare (*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 track 'registry', 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 the second graph for each species, I illustrate the percentage of <u>routes</u> 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 of the 60 routes were completed this year (Figure 2). Survey routes took an average of 2.1 hours to complete. Total snow depths averaged 6" for completed routes, slightly below the long-term average (Figure 3). Mean overnight low temperature the night preceding the surveys was 8°F, similar to the long-term average (Figure 3). Survey routes were completed between December 24th and February 23rd. The mean survey date of January 23rd was the second latest since the survey began (Figure 3).

Though not a statistically significant change, both fisher track indices were the lowest since the survey began (Figure 4). Because poor snow conditions pushed the average date of survey completion into mid-January, a time when ongoing research has shown fishers are least active, it's possible that the declines may partially reflect lower detection rates. Fishers were detected on only 4% of the route segments, and along 53% of the routes (Figure 4). While also a non-significant change, both marten track indices also declined (Figure 4). Marten were detected on 6% of the route segments, and 53% of the survey routes.

In spite of a record bobcat harvest (70% above previous record), bobcat (*Lynx rufus*) track indices increased, though the changes were not statistically significant. Bobcats were detected on 55% of the survey routes, the most since the survey began. Both wolf track indices increased to record levels, with wolves being detected on 9% of the track segments and 93% of the survey routes, the latter representing a statistically significant increase. No notable changes were observed in red fox or coyote indices, though the red fox track index remains below its long-term average (Figure 4). After a significant increase last year, the weasel (*Mustela* spp.) index decreased appreciably (though not statistically significant) this year, and through time is best characterized as exhibiting a slight downward trend with periodic irruptions. Although historic data for snowshoe hares clearly exhibited 10-year cycles, in recent times the cycle appears to have significantly dampened, though hints of a cycle remain. Cycle peaks have historically occurred, on average, near the beginning of each decade. This year's spring hare index did undergo a large increase to its highest level since the 1980 peak (pre-1994 data not depicted in this report). Following the large increase in this spring's hare index, the hare winter track indices declined significantly (Figure 4), collectively suggesting that hares have peaked and are now beginning a cyclic decline.

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. Of note this year, average survey date was the second latest (January 23rd) since the survey began, although snow depths and temperatures at this time were similar to previous surveys. Nevertheless, ongoing research has suggested that fishers, and to a lesser extent martens, may reduce activity in January, which may have reduced detection rates this year. However, repeat surveys are not conducted on this winter survey, so it is not currently possible to determine whether detection rates in fact differed from the previous year.

Based on confidence intervals, the only statistically significant changes from last year were an increase in the percentage of routes on which wolves were detected, and a decline in the track index for snowshoe hares. Acknowledging the potential for reduced detection rates for fisher and marten this year, neither species appears to be appreciably increasing in response to the reduced harvest seasons over the past 5 years.

Confidence interval data for previous years will continue to be incorporated in future years, and I hope to begin a formal review of the adequacy of survey route sample size and distribution. We also hope to expand ongoing fisher and marten research to examine track survey assumptions 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). In particular, I hope to initiate repeat surveys on a subset of survey routes each winter, thereby allowing for estimation of year-specific detection rates.

ACKNOWLEDGEMENTS

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

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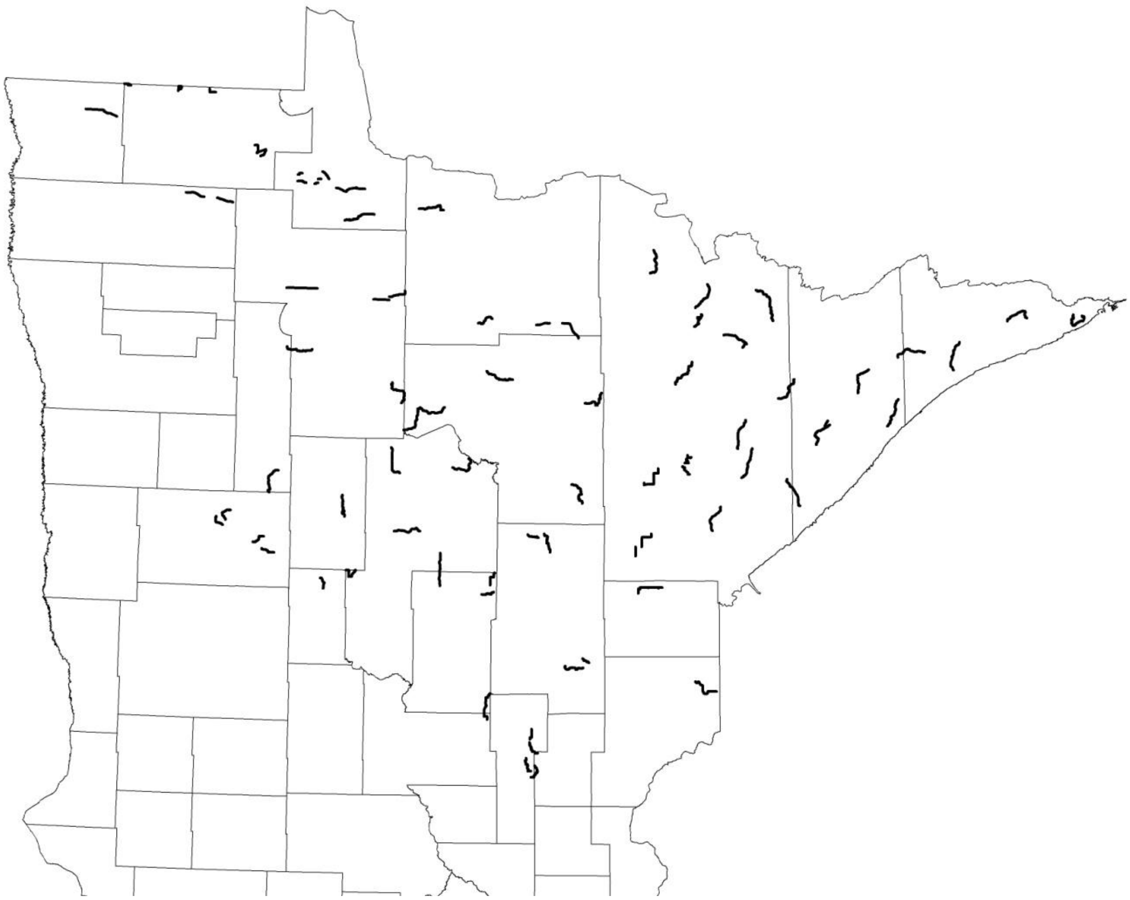

Figure 1. Locations of established furbearer winter track survey routes in northern Minnesota.

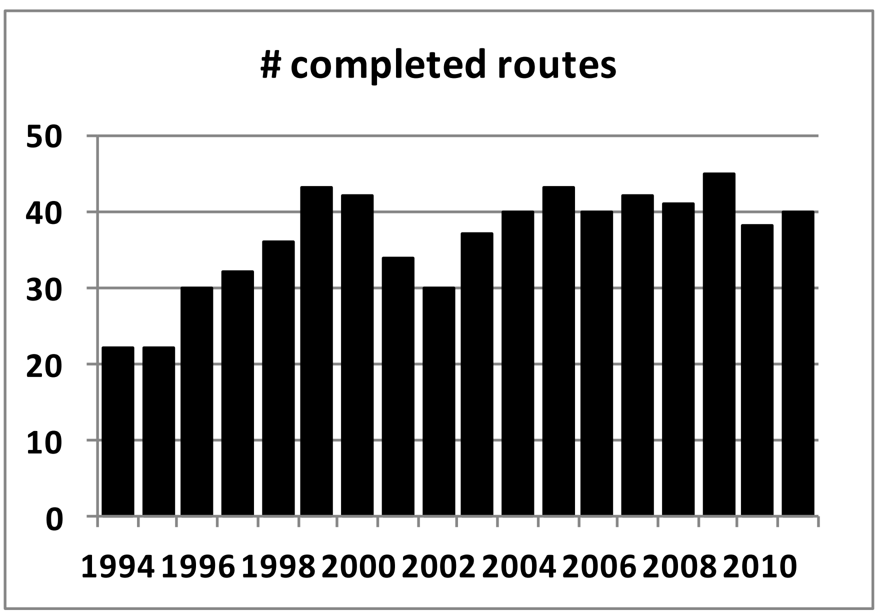

Figure 2. Number of winter track routes surveyed in Minnesota, 1994-2011.

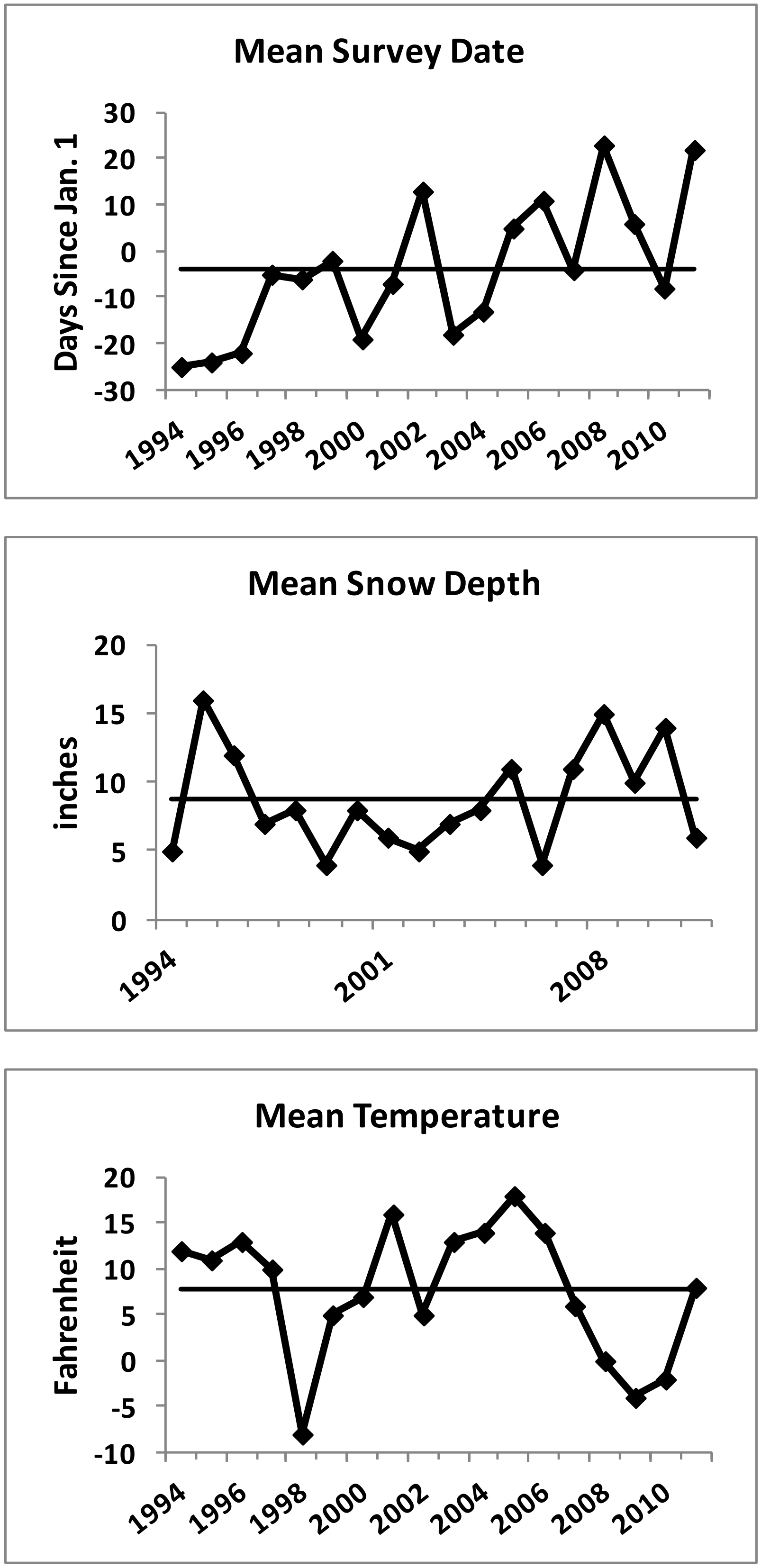

Figure 3. Average survey date, snow depth, and temperature for track routes completed in Minnesota, 1994-2011. Horizontal line represents long-term mean.

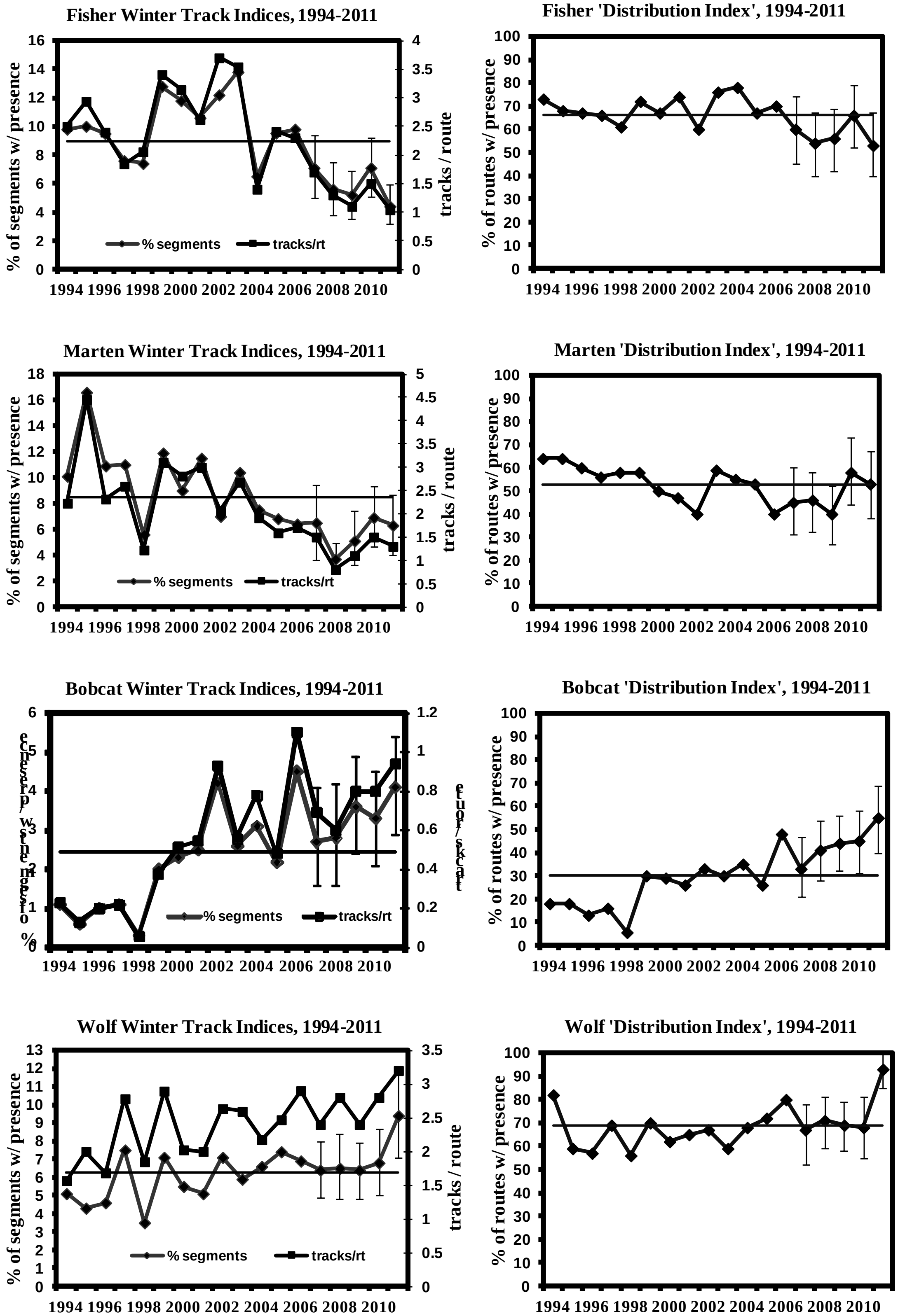

Figure 4. Winter track indices for selected species in Minnesota, 1994-2011. Confidence intervals only presented for % segments and % routes with track presence. Horizontal lines represent long-term average for percentage of segments and routes with presence.

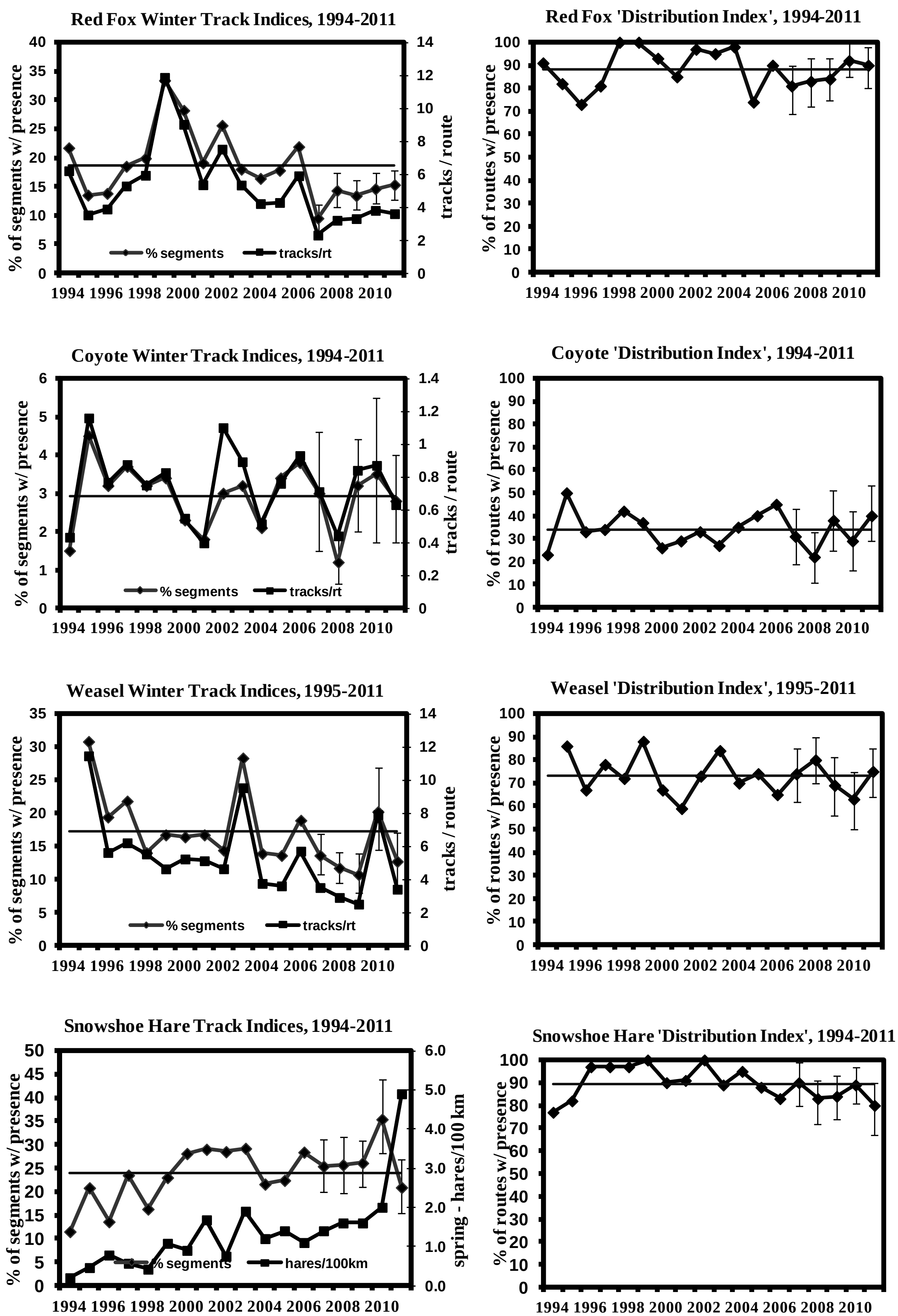

Figure 4 (continued). Winter track indices for selected species in Minnesota.