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, 2007

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 (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 32^{nd} 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. 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 25^{th} and 975^{th} values constitute the lower and upper bounds of the confidence interval. We continue to electronically enter previous data so confidence intervals on pre-2001 can be computed.

RESULTS AND DISCUSSION

A total of 274 routes were completed this year (Figure 1). There were 2,571 operable scent stations examined on the 274 4.3 km routes. This was the fewest number of operable stations since the survey design was modified in 1983, a result of poor weather conditions and time or funding constraints that limited participation by numerous cooperating agencies. Route density varied from 1/512 km^2 in the Forest Zone to 1/1,309 km^2 in the Farmland (Figure 1).

Statewide, route visitation rates (% of routes with detection) were highest for red fox and skunk (35%), followed by domestic cat (30%), raccoon (28%), dog (22%), and coyote (19%). Regionally, route visitation rates were as follows: red fox – Farmland (FA) 23%, Transition (TR) 25%, Forest (FO) 43%; coyote – FA 33%, TR 18%, FO 14%; skunk – FA 42%, TR 43%, FO 29%; raccoon – FA 63%, TR 33%, FO 15%; domestic cat – FA 58%, TR 40%, FO 18%; and dog – FA 54%, TR 30%, 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 interval overlap, there were no significant changes from last year.

While multiple factors influence abundance, fox indices are lowest in the zone with the highest coyote index (Farmland), while coyote indices are lowest in the zones where wolves are present (Transition and Forest). Point estimates for the red fox index in the Farmland and Transition zones remain well below their long-term average (Figure 2 and 3), likely a combined result of increasing coyote numbers, mange, and habitat alteration. The Farmland coyote index continues it's upward trend (Figure 2), while the coyote index in the Forest zone remains below the long-term average (Figure 4). After several years of apparent decline in the Farmland zone, raccoon indices are back near peak levels previously observed. While wolf and bobcat indices in the Forest zone are below peak levels, they have not changed appreciably in the last 3 years, and both remain above their long-term average (Figure 5).

ACKNOWLEDGEMENTS

I wish to thank all of the cooperators who participated in the 2007 survey: DNR Division of Wildlife staff; Superior National Forest; Agassiz, Rydell, Minnesota Valley, and Tamarac National Wildlife Refuges; USFWS Wetland Management Districts; White Earth, Red Lake, and Leech Lake Reservations; Vermillion Community College; Beltrami and Cass County Land Departments; Marshall County Central High School; St. Croix National Scenic Waterway; and Richard Nelles and Tom Stuber.

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2007 Scent Station Specifics

Zone	Routes Completed	Route Density	Station Nights
Farmland	52	1/1,309 km^2	468
Transition	60	1/1,096 km^2	554
Forest	162	1/512 km^2	1,549
Totals	274	1/791 km^2	2,571

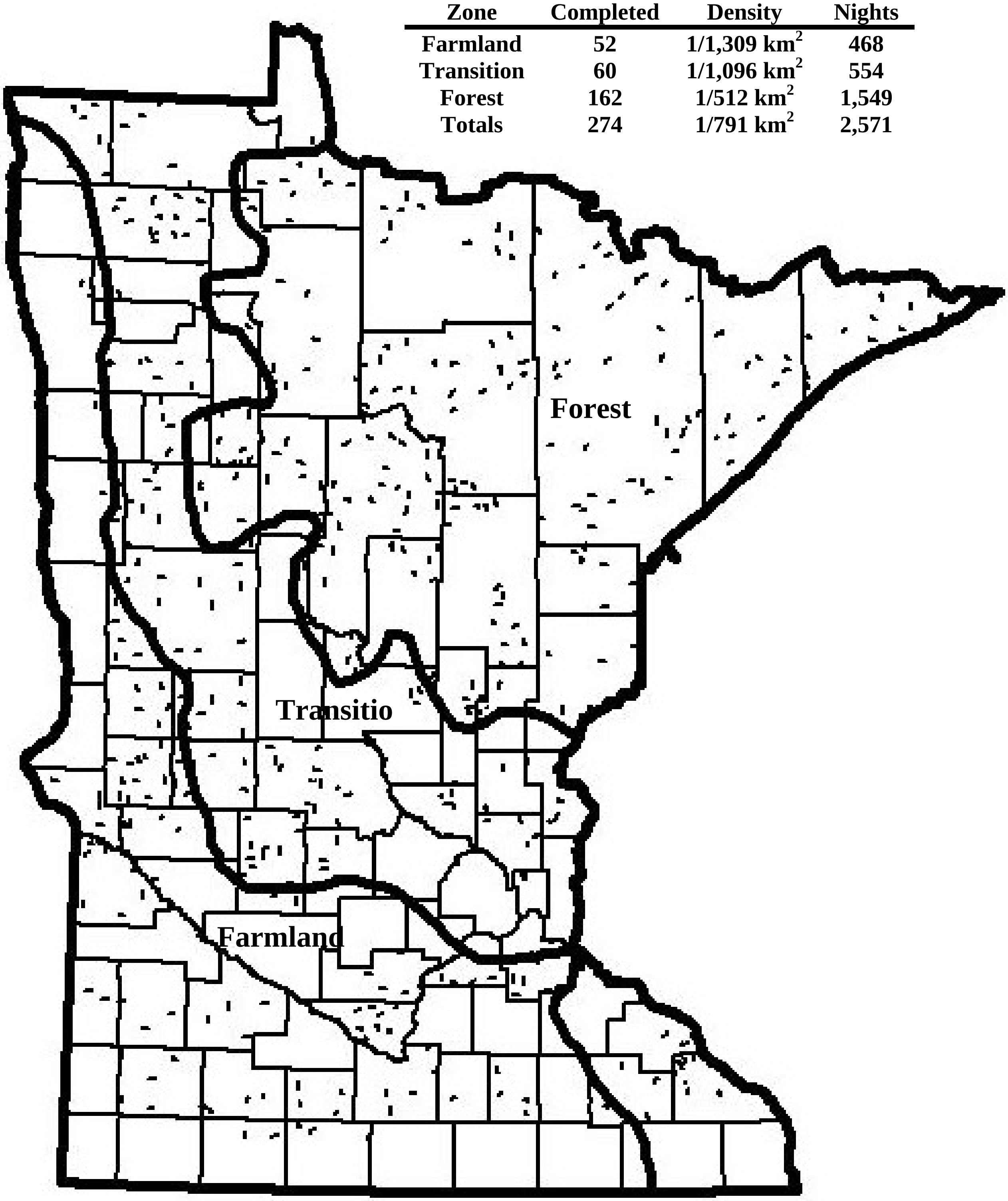


Figure 1. Locations of scent station routes. Inset shows 2007 route specifics.

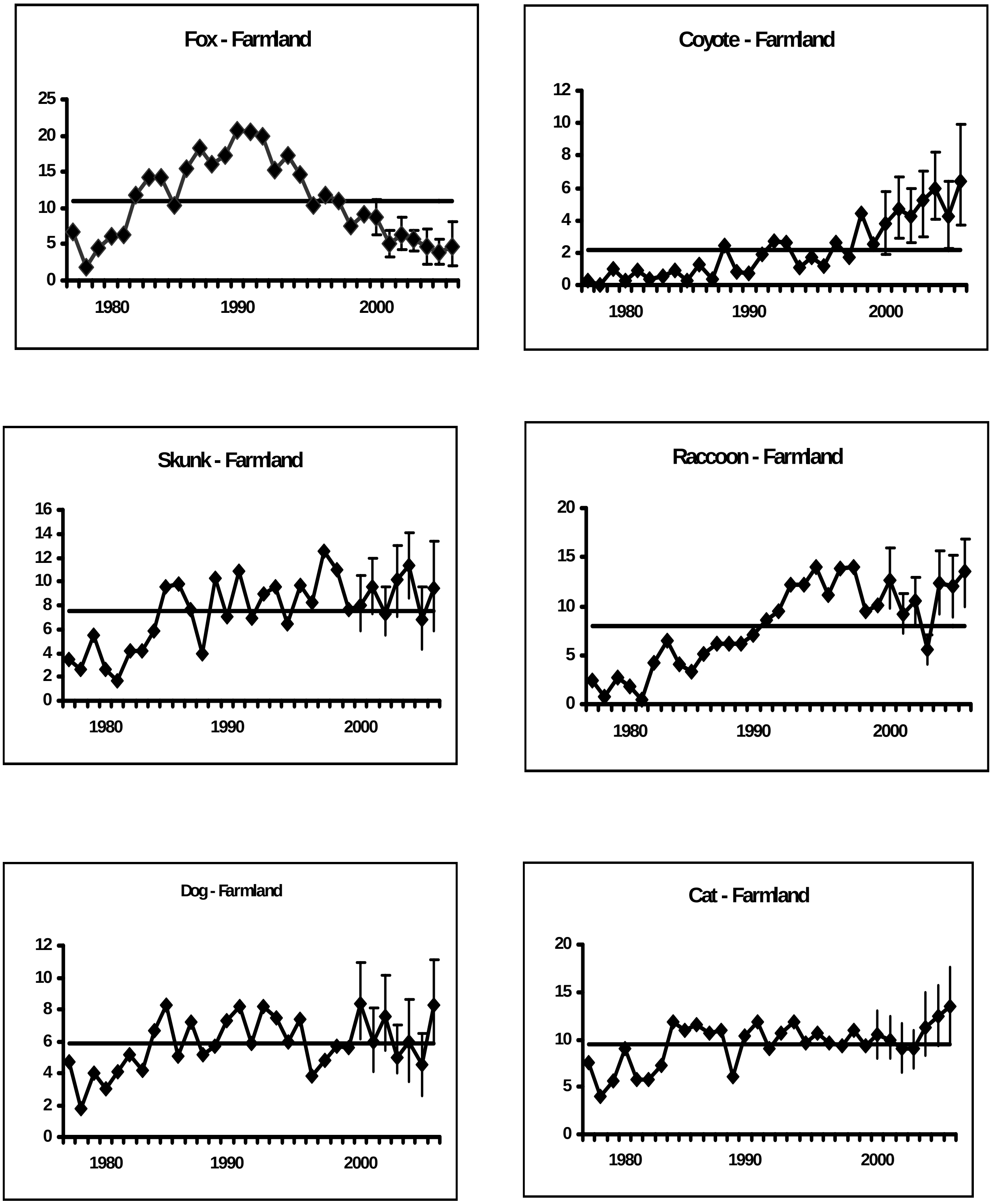


Figure 2. Percentage of scent stations visited by selected species in the Farmland Zone of Minnesota, 1977-2007. Horizontal line represents long-term mean.

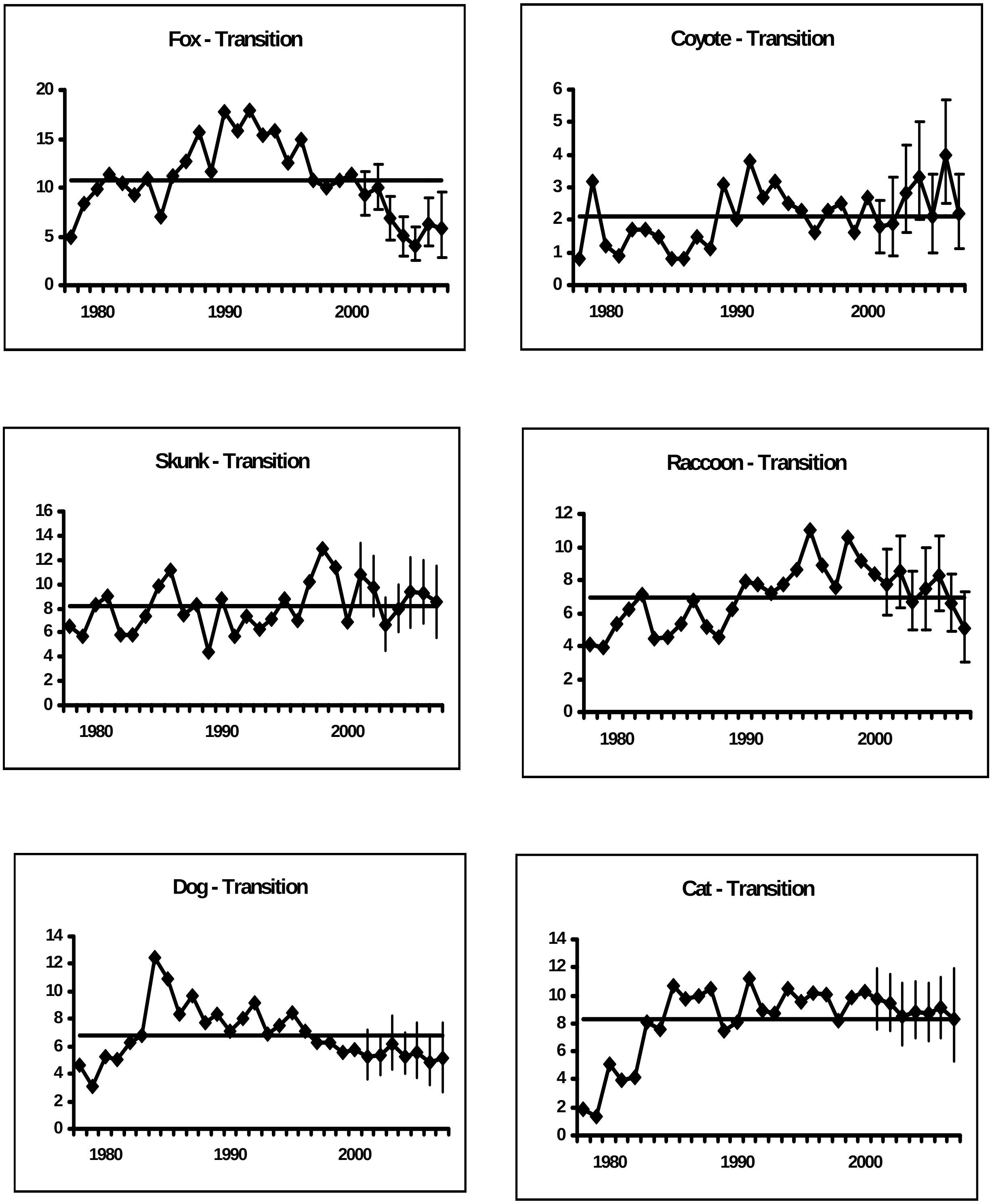


Figure 3. Percentage of scent stations visited by selected species in the Transition Zone of Minnesota, 1978-2007. Horizontal line represents long-term mean.

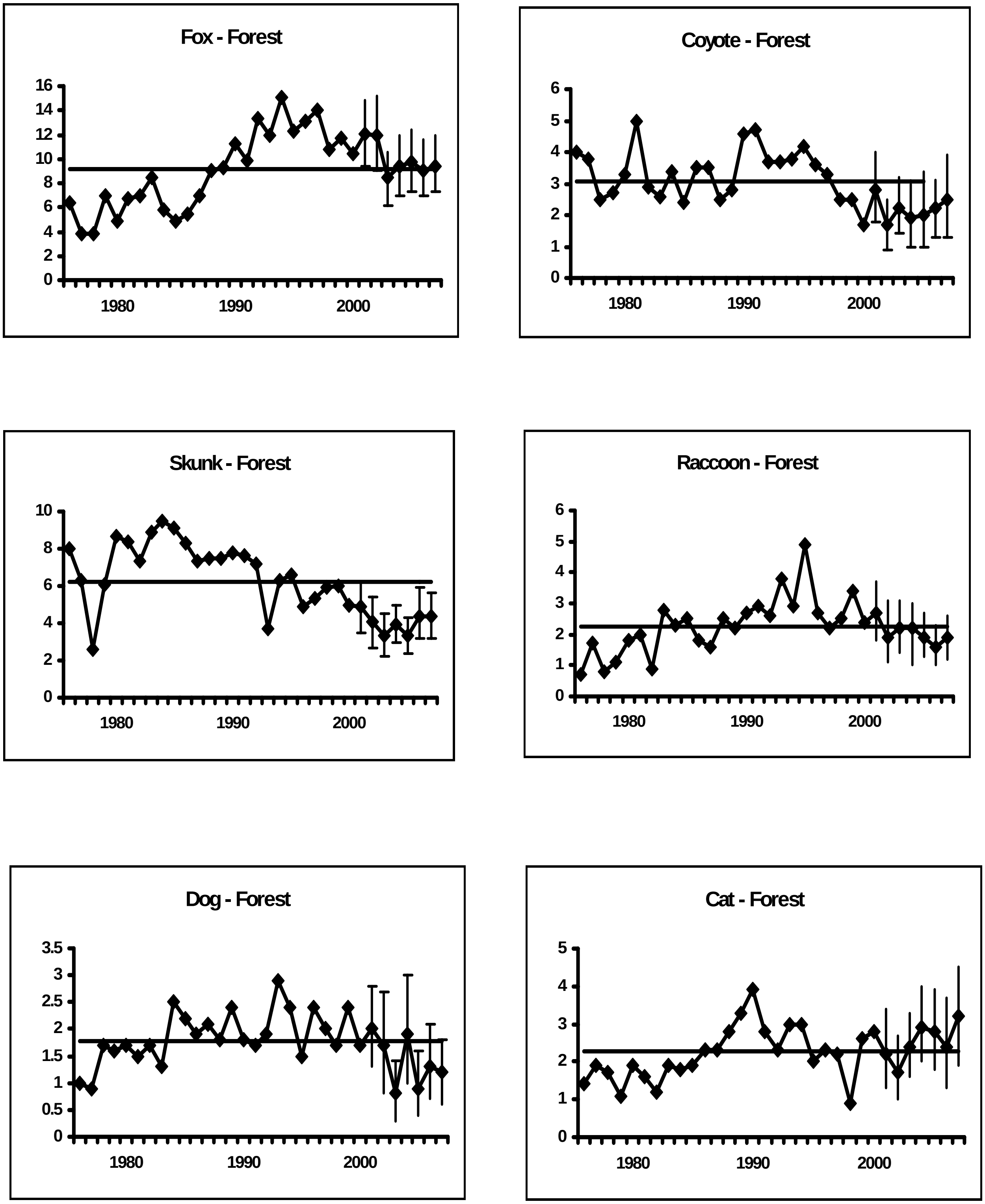
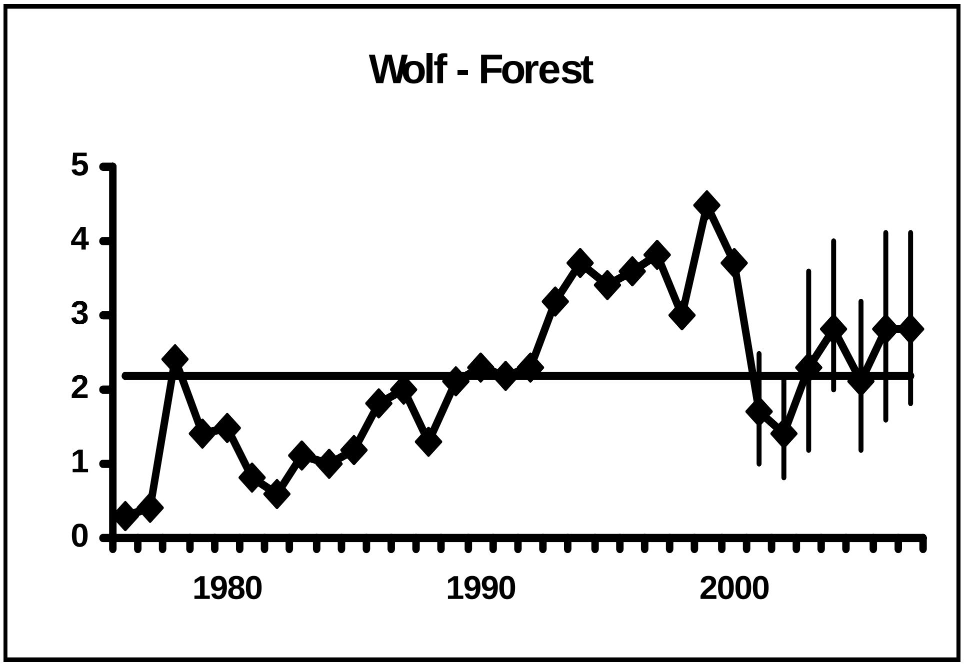


Figure 4. Percentage of scent stations visited by selected species in the Forest Zone of Minnesota, 1976-2007. Horizontal line represents long-term mean.



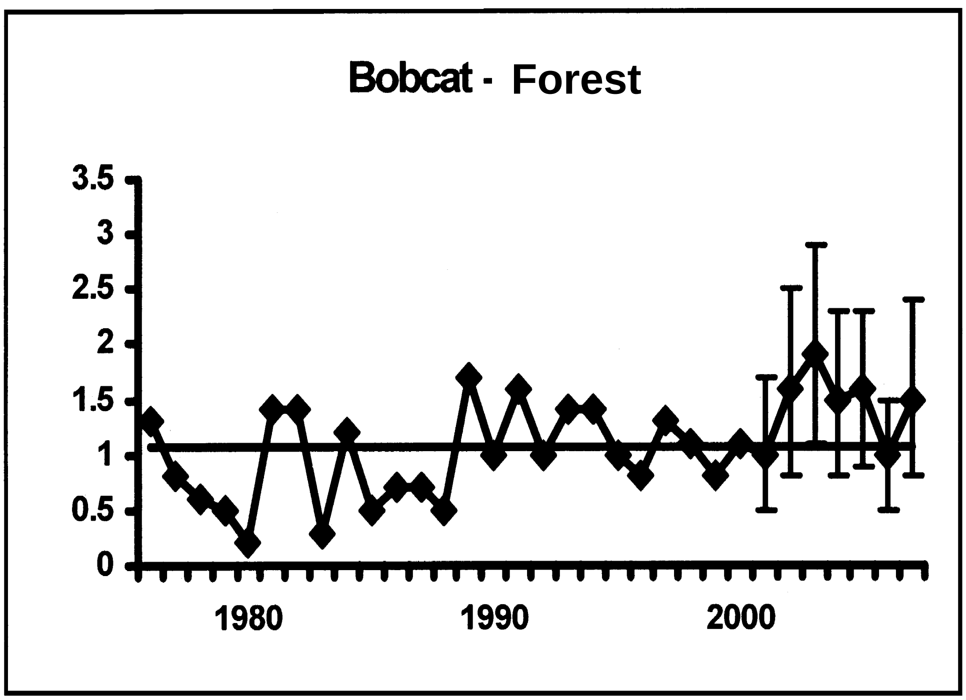


Figure 5. Percentage of scent stations visited by wolves and bobcat in the Forest Zone of Minnesota, 1976-2007. Horizontal line represents long-term mean.

FURBEARER WINTER TRACK SURVEY SUMMARY, 2007

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, 56 track survey routes are distributed across the northern portion of the state (Figure 1). Each route is 10 miles long and follows secondary roads or trails. 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 <u>within</u> 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 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 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 (*Lepus americanus*) are tallied only as present/absent, the 2 indices will by definition be equivalent. Hare survey data is also obtained via counts of animals observed on grouse drumming count surveys conducted in spring. Data for both the spring and winter indices are presented for comparison.

In the second graph, 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 notable changes in the above 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%) only for the percent of segments 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-two of the 56 routes were completed this year (Figure 2). Total snow depths averaged 11" for completed routes, with surveys taking an average of 2 hours to complete. Survey routes were completed between November 29th and February 15th this winter, with a mean survey date of December 28th.

While remaining similar to the previous 3 years, the fisher track index dropped to the second lowest level recorded since 1994. Fishers were detected on 60% of the routes, the lowest since the survey began. Marten track indices changed little, but remain near the low end of previous indices. Marten were detected on 45% of the survey routes, a marginal increase from last year's low of 40%.

Bobcat (*Lynx rufus*) track and distribution indices decreased from the record levels observed last winter, but remain noticeably above the pre-2000 average (Figure 3). Wolf indices have not changed appreciably in recent years. Wolves were detected on 67% of the routes, with an average of 2.4 wolves detected per route. Although red fox remain one of the most commonly detected species, this year's track index dropped significantly to its' lowest level since the survey began (Figure 3). Coyote track indices were within bounds of previous years. No long-term trends are apparent, and coyotes remain one of the least common species on the survey (Figure 3). Based on known cyclic tendencies, I continue to expect a decline in snowshoe hare indices. Nevertheless, no multi-year decline is yet apparent in either the spring or winter index (Figure 3).

DISCUSSION

Reliable interpretation of changes in 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.

I have computed confidence intervals only for the current year, but results for previous years should be available soon. Based on current information, the only significant change in track indices from last year is a decline in red fox abundance. Fisher and marten harvest seasons were reduced from 16 days to 9 days this year. In spite of an estimated 50% reduction in fisher and marten harvest, post-harvest tracks indices for these species did not increase.

While we have added several track routes in recent years, I continue to review the adequacy of survey route sample size and distribution, and have initiated fisher and marten research that, among other things, should provide some evaluation of 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).

ACKNOWLEDGEMENTS

I wish to thank all those who participated in this year's survey, including DNR field staff, tribal participants from the Leech Lake, Red Lake and Grand Portage Bands, and Tamarac National Wildlife Refuge.

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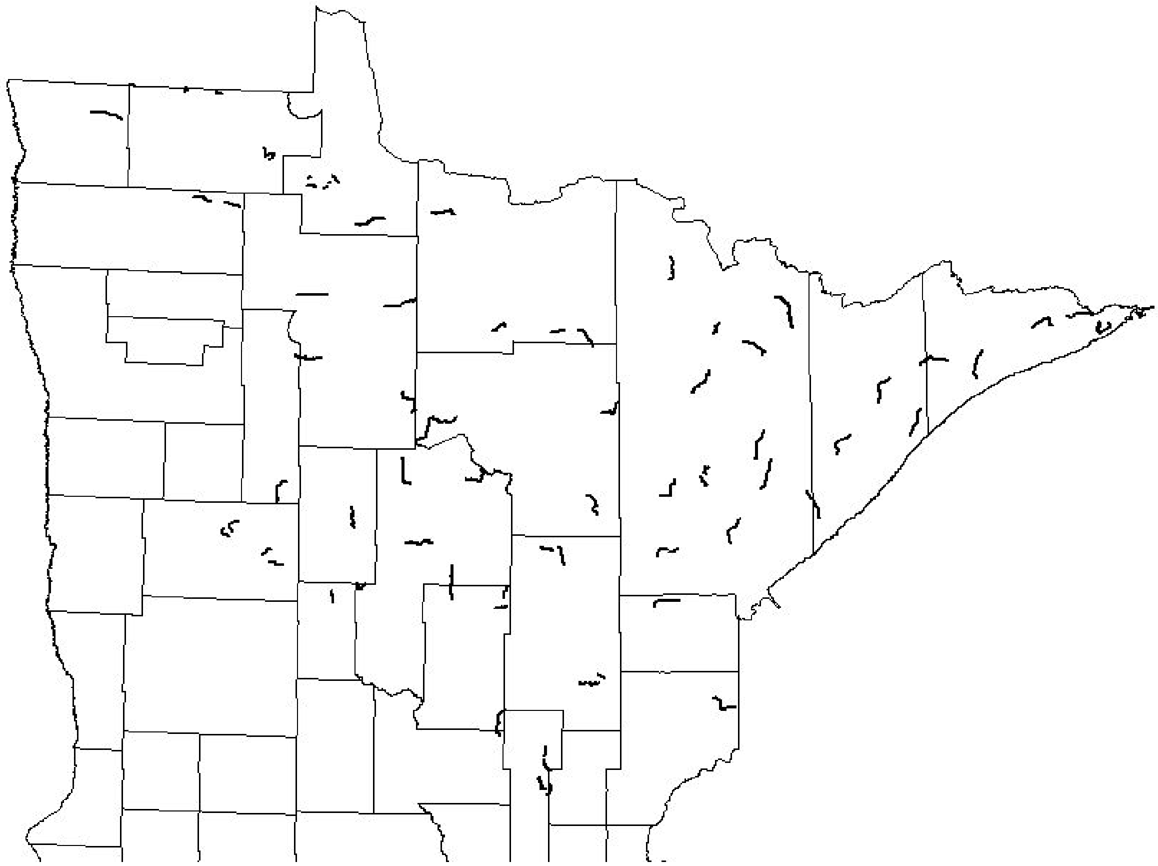


Figure 1. Locations of established furbearer winter track survey routes.

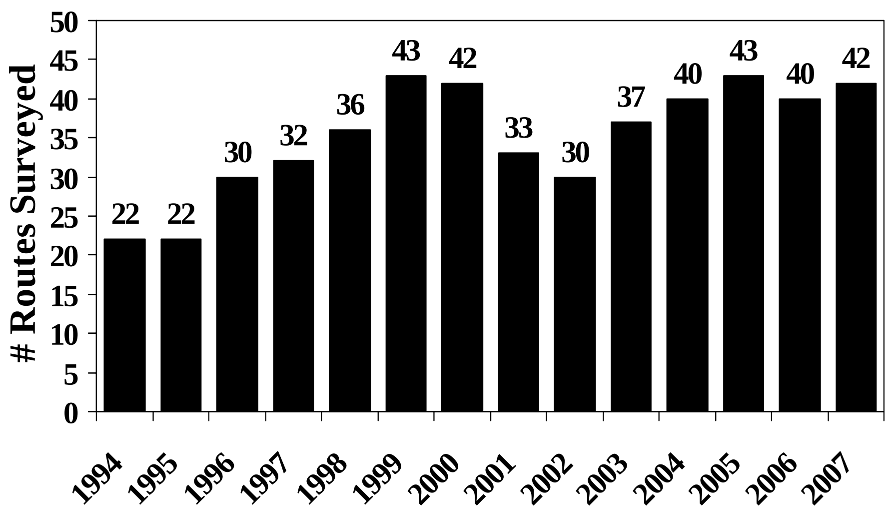


Figure 2. Number of winter track routes surveyed, 1994-2007.

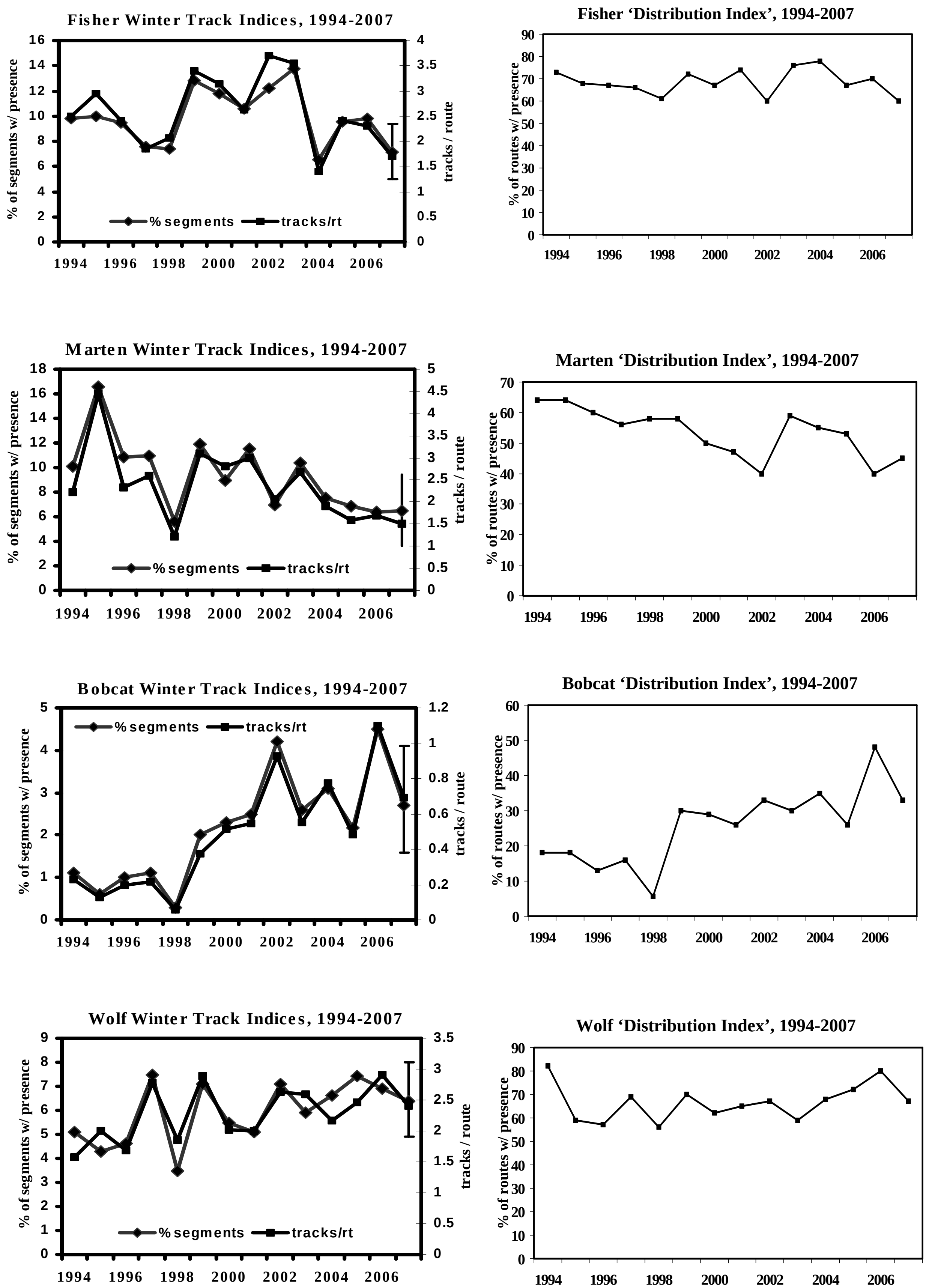
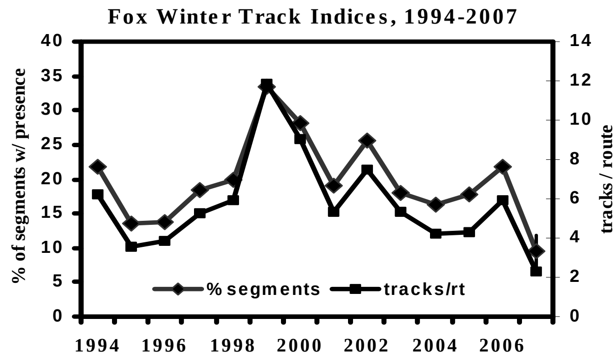
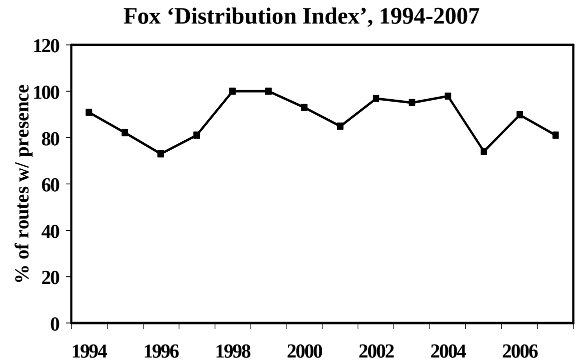
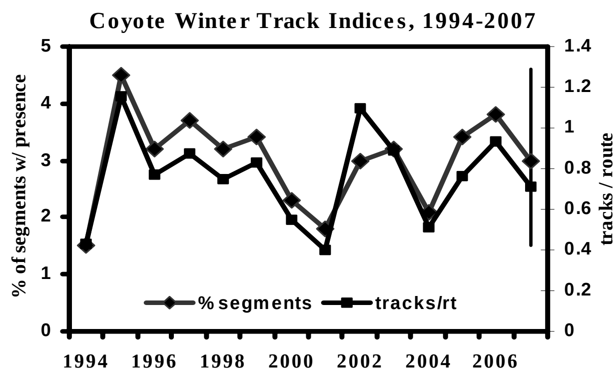
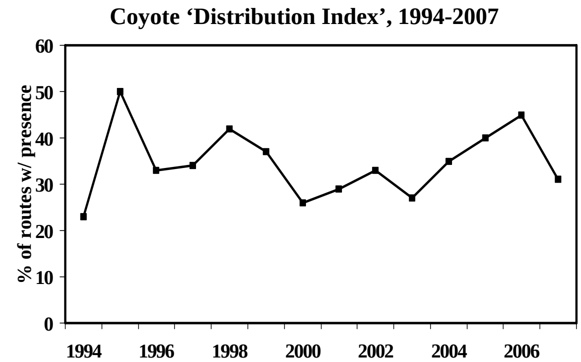


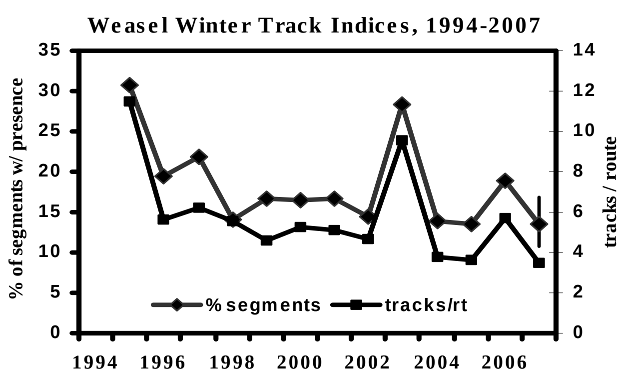
Figure 3. Winter track indices for selected species in Minnesota.

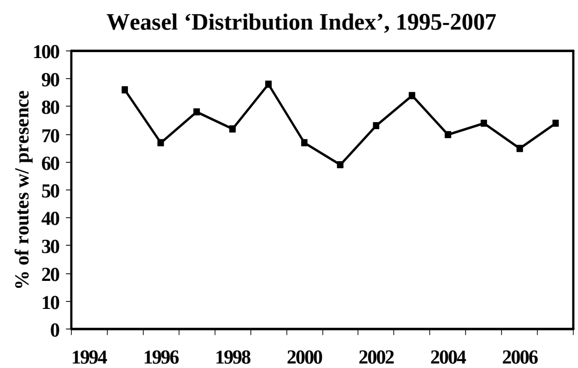


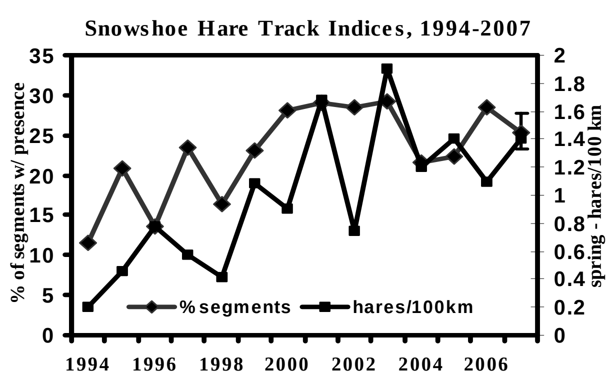












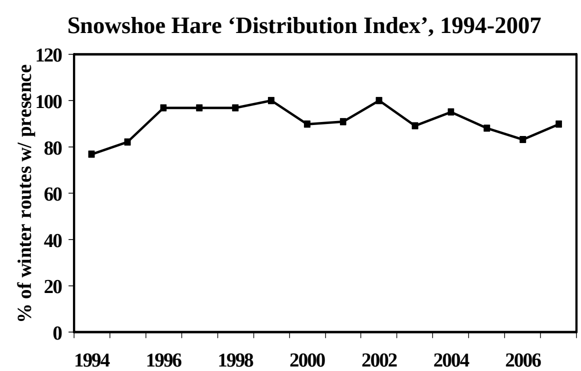


Figure 3 (continued). Winter track indices for selected species in Minnesota.