STUDY PLAN

Survey of Furbearer Populations on the Yukon Flats National Wildlife Refuge

by

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CONTENTS

SCOPE

The U.S. Fish and Wildlife Service (USFWS) is responsible for management of wildlife populations and their habitats and for providing opportunities for human use of wildlife on the Yukon Flats National Wildlife Refuge (YFNWR). The Alaska Department of Fish and Game (ADF&G) is responsible for management of wildlife populations and their consumptive use by humans statewide. Red fox (*Vulpes vulpes*), marten (*Martes americana*), and lynx (*Lynx canadensis*) have been identified by the USFWS as three of the most economically important furbearers on the YFNWR. Essential to the sound management of these species is information on their distributions, relative abundances, and general habitat relationships; the concurrent development of methods to gather and accurately assess such information is required. To meet these needs, the USFWS and the ADF&G have established a Cooperative Agreement (No. 14-16-0007-84-7416) whereby the USFWS will support the ADF&G to conduct a survey of furbearer populations on the YFNWR.

OBJECTIVES AND HYPOTHESES

To determine the distributions and relative abundances of red fox, marten, and lynx populations on the YFNWR.

> H_o: Distributions and relative abundances of each species are equivalent over the refuge in general.
>
> H_o: Distributions and relative abundances of each species are the same between different elevational strata.
>
> H_o: Distributions and relative abundances of each species are the same between different vegetation/fire patterns.

To test and establish aerial survey methods for red fox, marten, and lynx.

> H_o: Aerial counts of a species' tracks are equal to ground counts.
>
> H_o: Visibility of a species' tracks is equal under various physiographic conditions.
>
> H_o: Length of time after snowfall has no effect on the number of tracks observed intersecting a transect.

JUSTIFICATION

Testing the hypotheses and meeting the objectives outlined above will provide the USFWS and ADF&G with a base of information that will promote better understanding and management of red fox, marten, and lynx habitats and populations. Examination of geographical population patterns and the role that vegetation/fire patterns play in the distributions and relative abundances observed will give insight into the habitat requirements of the species studied; it should also open questions as to why red fox, marten, and lynx are more abundant in one area than another. Expected benefits extend further to the development of aerial survey methods, based on track counts of these species, that may be replicated on a regular basis over large areas and various habitat types, providing reliable trend data.

BACKGROUND

Study Area

The YFNWR consists of approximately 34,925 km^2 (13,485 mi^2) in interior Alaska. Private lands within the refuge boundaries include approximately 10,927 km^2 (4,219 mi^2) and are excluded from USFWS jurisdiction (Fig. 1). The refuge consists of most of the Yukon River basin wetlands, i.e., over 36,000 lakes and ponds and all or part of 10 major waterways (Todd 1978). Elevation ranges from 95 to 1,804 m (312 to 5,919 ft) over lowlands, benches, and highlands, although much of the refuge is characterized by little topographic relief.

Vegetation is typical of the boreal forest, or taiga (Viereck and Little 1972), with white spruce (Picea glauca), black spruce (Picea mariana), paper birch (Betula papyrifera), quaking aspen (Populus tremuloides), and balsam poplar (Populus balsamifera) the dominant forest species. Willow (Salix spp.), alder (Alnus spp.), ericaceous shrubs form most of the understory vegetation. The extensive open, wet meadows and bogs contain various grasses, sedges, and herbaceous species.

Vegetation types and patterns on the YFNWR reflect the occurrence of wildfire. Recurring fires create mosaics of pure and mixed plant communities that result in diverse habitat for wildlife (Foote 1983). Between the 1940's and 1970's, the total area burned each decade in interior Alaska declined from 502.4 to 201.7 thousand hectares (ha) (Foote 1983), but the area is still highly prone to lightning and human-caused fires (J. Foote, pers. commun.).

Populations

The most comprehensive assessment of furbearer populations in the region to date was done by Koontz (1968) for the Rampart Dam impoundment area. With the exception of beaver (Castor canadensis), Koontz reported only broad estimates of furbearer densities extrapolated from available literature. He listed marten and lynx densities at $0.08/km^2$ ($0.2/mi^2$) and red fox at $0.19/km^2$ ($0.5/mi^2$). Koontz's data on trapper harvest revealed red fox, marten, and lynx were of only moderate to low interest to trappers in the impoundment area between 1958 and 1962.

Changes in the fur fashion industry since then, and for lynx, the tenuous status of spotted cats worldwide, have made these three species more valuable, and therefore, more desirable to trappers. Recent harvest and trapper questionnaire data for Game Management Unit 25 (which includes the YFNWR) showed that the 1982-83 lynx harvest was 1,576, up 140 animals from 1981-82, with the highest takes in the Little Black and Porcupine River drainages (Nowlin 1984). The harvest in the Black River area declined from a previous 2-year high. Red fox populations showed little change between 1981-82 and 1982-83, and appeared to be at moderate levels (Ernest 1984). Marten populations have dropped, however, and appear to be below normal and declining (Ernest 1984).

Pilot Study

A pilot study was initiated in January 1984 to determine the feasibility of this project. Literature sources were reviewed and technical and logistical problems were analyzed. Several flights were made to the YFNWR during March. Howard Golden and Robert Stephenson flew over most of the refuge, noting vegetation, terrain, and animal tracks. Later flights were concentrated in the southern and southeastern portions of the refuge to familiarize Golden with aerial survey of furbearer tracks and to experiment with survey methods. Results of the pilot study form the basis of the following section.

METHODS

Furbearer Distributions and Relative Abundances

Aerial surveys of tracks in snow intersecting preselected transects will be the principal method of determining red fox, marten, and lynx distributions and relative abundances. Other potential methods, such as scent stations (Linhart and Knowlton 1975, Hon 1979) and ground transects (Pulliainen 1981, Douglass et al. 1983, Raine 1983) can provide population trend and habitat use data. However, their usefulness is restricted by the size and access of the area to be sampled. Aerial surveys appear to be the most efficient and productive sampling method for the YFNWR.

Transect Selection:

Aerial survey transects will be standardized at 5 km in length to allow straight-line travel in all terrain, to facilitate following a transect course accurately, and to provide adequate track-intersect sample sizes. Transects will be located systematically using a 10x10 km-scale grid that will overlay a 1:250,000-scale topographic map, and transects will orient in random compass directions. The pilot study showed that a prominent topographic feature (e.g., lake, stream, or hill) was required to serve as the starting and ending points. Thus, a transect will start at the nearest prominent topographic feature within a 2.5 km radius of the grid point. The end of the transect will be the nearest prominent topographic feature within a 2.5 km arc from the end point on either side of the random direction chosen. If no feature within the arc can be located, if the heading would bring two transects within 2 km of each other, or if the terrain covered would be too rugged, then a new random direction will be chosen. All transects will be within refuge boundaries, excluding private lands.

The refuge will be sampled with 343 transects, each repeated once. This should provide adequate coverage of the refuge, with one transect per approximately 100 km^2. Fig. 2 shows the transects to be used in the Black River area in the eastern portion of the refuge.

Survey Periods:

Survey periods will be in late winter/early spring to coincide with the greatest potential for track visibility (Stephenson 1984a). Snow cover, light, temperature, and animal activity are limiting factors for the timing of successful surveys. Snow must completely cover the ground for all areas sampled. Light must be direct or semi-obscured (Stephenson 1984a), and daylight hours must be long enough to permit a reasonable work period. Ambient temperatures must be cold enough to prevent snow from crusting and inhibiting track impressions, but not so cold as to hamper aircraft operation or to cause animals to reduce their activity (Buskirk 1983, Stephenson 1984a). The above criteria will generally be met on the YFNWR during the survey periods 15 February-25 March 1985 and 1986 (R. Nowlin, pers. commun.). The 35-40 day survey periods are adequate for survey completion and will allow for temporary poor weather conditions.

Data Collection:

A practiced team of a pilot skilled at low-level flying and an observer skilled at identifying animal tracks in snow will conduct the surveys in a PA-18 Super Cub. Transects will be flown a minimum of 3 days following a moderate to heavy snowfall to ensure an adequate track sample size. Weather should have ambient temperatures of more than -34°C (-30°F), calm to light wind, and clear skies to thin cloud cover. Various combinations of aircraft speed and altitude above-ground-level (AGL) were tried during the pilot study, and the most practical and safest was 60-70 mph at 300 ft AGL. This combination is generally consistent with that preferred in various surveys of tracks and bodies of animals using fixed-wing aircraft (LeResche and Rausch 1974, Caughley et al. 1976, Stephenson 1984a).

Red fox, marten, and lynx tracks that intersect the transect flight line will be recorded by the observer using a tape recorder or hand-held counter. The pilot will not help count tracks, but will concentrate on accurately following the transect route. Information regarding track intersects observed, transect length, weather, aircraft speed and height, other wildlife, and general comments will be recorded for each transect (Appendix 1). Vegetation types and densities to cover-type level IV (Viereck and Dyrness 1980) will be recorded on maps just prior to counting track intersects, and later summarized on data sheets (Appendix 2).

A track-intersect rate (T = no. track intersects/kilometer) for each transect will be the unit of measure. Rates may be modified through correction factors derived from tests of the effects of vegetation density and height and of the number of days after snowfall on track observations.

Geographical Patterns:

Track-intersect rates per transect will be plotted on a map overlay of the refuge so that distribution and relative abundance patterns may be discerned. To allow a more refined geographic comparison, the refuge will be divided into elevational strata of unequal area. The strata will be defined by elevation relative to the topography, i.e., (1) lake flats and riparian areas, (2) bench areas, and (3) hills and mountains. These strata will also be mapped on an overlay.

Geographical groups of transects with similar track-intersect rates will be tested for significant differences, and confidence intervals (α = 0.10) will be calculated. Data from the first survey period may indicate that more rigorous statistical analyses would be applicable; the t-test is preferred at this time. However, pilot study results (Table 1), based on uncorrected data from 12 transects in the 3 elevational strata, indicated that several more samples per stratum would be needed in order to account statistically for the variability present (D. Reed, pers. commun.).

Vegetation/Fire Patterns:

Recent reports (Koehler and Hornocker 1977, Fox 1978, Viereck and Schandelmeier 1980, Stephenson 1984b) have suggested that fires have a positive influence on red fox, marten, and lynx populations; mosaics of cover are created and new vegetation growth is stimulated, which tends to increase prey populations. Because the YFNWR has frequent fires, sometimes over large areas, the relationship between vegetation/fire patterns and furbearer populations may be important and will be analyzed.

The correlation of track survey information and general vegetation/fire patterns will be determined primarily from data gathered during aerial surveys. Vegetation data recorded to cover-type level IV (Viereck and Dyrness 1980) will be combined with color infrared photos and Bureau of Land Management and Institute of Northern Forestry fire records to define patterns. Information on plant community regeneration following fire (Foote 1983) will be useful in describing the different-aged burns on the refuge.

Several burned areas will be incidentally sampled during aerial surveys by an, as yet, undetermined number of transects. Burns will be assigned, in part or altogether, to a particular successional stage common to interior Alaska, i.e., moss-herb, tall shrub-sapling, dense tree, hardwood, or spruce stages (Foote 1983). Track-intersect rates will be tested for significant differences between burns using the t-test, and confidence intervals (α = 0.10) will be calculated for each furbearer species. Further statistical analyses will be employed where data variability permit.

Trapper Information:

Information on red fox, marten, and lynx populations will also be gathered through trapper interviews in each village on the refuge after spring breakup. Data on observed, local abundances of furbearers and their relationships with prey and habitat types will supplement aerial survey data in determining furbearer distribution patterns.

Test of Aerial Survey Methods

Aerial surveys of animals or their tracks have been conducted for many species under a variety of conditions, and the problems inherent discussed (Stott and Olson 1972, LeResche and Rausch 1974, Caughley et al. 1976, Norton-Griffiths 1976, Stephenson 1984a). Two potential sources of bias in this study are the visibility of tracks in different densities and heights of vegetation and the relationship of the number of days after snowfall to the number of track intersects per kilometer. To establish survey methods for red fox, marten, and lynx, these potential sources of bias will be tested and, if necessary, correction factors will be derived and applied to the data analysis discussed in the previous section.

Test Periods:

Tests will be conducted in early spring each year from about 26 March to 15 April 1985 and 1986. These periods were chosen so that activities would not influence furbearer movements through the creation of trails from test transects, because of the extended daylight hours and warmer temperatures, and because it is usually still cold enough to minimize the chances of snow crusting.

Vegetation and Track Visibility:

Three vegetation density classes (VDC) will be sampled for track visibility. The VDCs will be: (1) high = closed forest of 60-100% canopy cover, (2) moderate = open forest of 25-59% canopy cover, and (3) low = woodland forest, low shrub, or bare of <25% canopy cover. A forest will be defined to include trees and tall shrubs. Classifications are modified from Viereck and Dyrness (1980), and should adequately represent the various vegetation densities. Vegetation species composition will be ignored in this test. VDCs will be delineated on maps using information from aerial photos and reconnaissance flights, and their intersect points with seismic lines will be noted.

Each VDC will be sampled with a minimum of 10 test transects per test period. Test transects will be as straight as possible, will not cross VDCs, and will be oriented away from but not necessarily perpendicular to seismic lines in the vicinity of Canvasback Lake (Fig. 3). Transects will be standardized at 1 km in length, provided track-intersect sample sizes are adequate.

Each test transect will first be run in the air, via PA-18 aircraft, and then on the ground, via snowmachine or snowshoes, on the same day by the same observer. The pilot will orient the observer on the ground so that the same route is traveled. Once run, each line will be marked for easy identification from both ground and air. The same transects will be sampled during both test periods. Test data will be recorded as described for aerial survey transects, using the forms in Appendices 1 and 2. A photographic record will be compiled of track patterns in various vegetation and snow conditions as seen from the air and ground.

The number of track intersects/kilometer of transect (T) will be calculated for red fox, marten, lynx, and the three species combined. Depending upon data variability, the Kruskal-Wallis, paired t, or analysis of variance tests will be used to determine significant differences ($\alpha = 0.10$) of track rates between air and ground test transects within VDCs and between test periods. Significant differences between test periods may indicate the presence of unexplained variability that could bias data and make comparisons inconclusive. If between-test-period differences are not significant, then within-class results should be useful in deriving correction factors for aerial survey transects.

VDC correction factors (CFv) will be derived as follows:

(1) Calculate track rate estimates ($\hat{T} = \Sigma$ tracks intersects/Σ kilometers) from the 10 aerial (Ta) and ground (Tg) test transects for each VDC (high, moderate, or low).

(2) Calculate test quotients (TQ) per VDC; TQ = Tg/Ta. It is expected that Tg values will be greater than Ta values.

(3) Based upon vegetation type and density data collected during aerial surveys, calculate density percentages (DP) for each of the 343 aerial survey transects; i.e., convert the length of each VDC (high, moderate, or low) recorded along the total length of a transect to a DP of that transect length. This step is necessary because field methods preclude gathering vegetation and track-intersect data simultaneously.

(4) Multiply an aerial-survey transect DP by the reciprocal of the TQ per VDC from aerial/ground tests; assume uniform actual track occurrence over the ground.

(5) Sum the above products for all VDCs along an aerial survey transect; the reciprocal of that summation will equal the CFv, i.e., $CF_v = 1/\Sigma\ (DP_{h,m,l} \cdot 1/TQ_{h,m,l})$.

The original aerial-survey track rate (T) multiplied by the CFv will produce the corrected track rate for vegetation density (Tv), i.e., Tv = T • CFv.

Relationship of Snowfall to Tracks:

The relationship of the number of days after a snowfall to the number of track intersects per kilometer will be tested along one of two seismic lines near Canvasback Lake (Fig. 3). A seismic line will provide the most unrestricted view of tracks and, thereby, reduce variability. Each day, weather permitting, and during the test periods discussed earlier, a 10-km section of line will be flown in a PA-18 aircraft, and all track intersects per furbearer species and combined will be recorded. Daily measurement of the previous night's snowfall will be made at Canvasback Lake. Only depths of snowfall that effectively obscure tracks (e.g., 5-10 cm) will be considered in the analysis.

Regression analysis will measure the strength (±10% at the 80% confidence level) of the relationship of days after snowfall to the number of track intersects per kilometer (T). If significant, the linear model developed will predict T for a given number of days after snowfall. These values will then be converted to percentages based on a 3-day after-snowfall reference level. Thus, snowfall correction factors (CFs) will equal: (T for day 3) / (T for day i...j), where i = day 4 and j = maximum day after snowfall.

Original track rates (T) for aerial transects will be multiplied by their respective daily correction factors (CFs) to derive corrected track rates for snowfall (Ts), i.e., Ts = T • CFs. Snowfall amounts and periodicity will be based on meteorological data from Fort Yukon and field observations.

PUBLICATION

The article for publication anticipated from this study will be on the results of determining the distributions and relative abundances of red fox, marten, and lynx, as well as the methods used and their management implications.

SCHEDULE

Field Preparation and Study Development:	1 November 1984 - 15 February 1985 15 October 1985 - 15 February 1986
Aerial Transect Surveys:	16 February 1985 - 25 March 1985 16 February 1986 - 25 March 1986
Aerial/Ground Test Surveys:	26 March 1985 - 15 April 1985 26 March 1986 - 15 April 1986
Data Analysis and Report Writing:	16 April 1985 - 15 June 1985 16 April 1986 - 30 June 1986
Progress Report Completion:	15 June 1985
Article for Publication and Final Report Completion:	30 June 1986

BUDGET

Salary Expenses	Year 1*	Year 2*	Total
Principal Investigator - GBI 15 months at $2780-$2865/mo.	19,460	22,920	42,380
Operating Expenses			
Aerial Transect Surveys 343 transects at $30 ea for 1st yr and $15 ea for 2nd yr; $2400/yr added for ferry time	12,690	7,550	20,240
Aerial/Ground Test Surveys 30 transects/yr at $256 ea	7,680	7,680	15,360
Snow machine gas and oil	250	250	500
Miscellaneous (5% of total) Supplies and contingencies	2,160	2,160	4,320
Salary plus Operating Expenses	42,240	40,560	82,800
Overhead (8% of total)	3,673	3,527	7,200
Total Expenses	45,913	44,087	90,000

* Refers to fiscal years 1 July-30 June 1985, 1986.

RESOURCES

Personnel	Source
Principal Investigator	Game Biologist I, ADF&G
Pilot(s)	Contract flying service
Equipment	
PA-18 Super Cub	Contract flying service
Other aircraft	Contract flying service
Snowmachine and sled	YFNWR, USFWS
Miscellaneous materials and equipment	ADF&G
Field Quarters	
Cabin in Ft. Yukon	YFNWR, USFWS
Cabin at Canvasback Lake	YFNWR, USFWS

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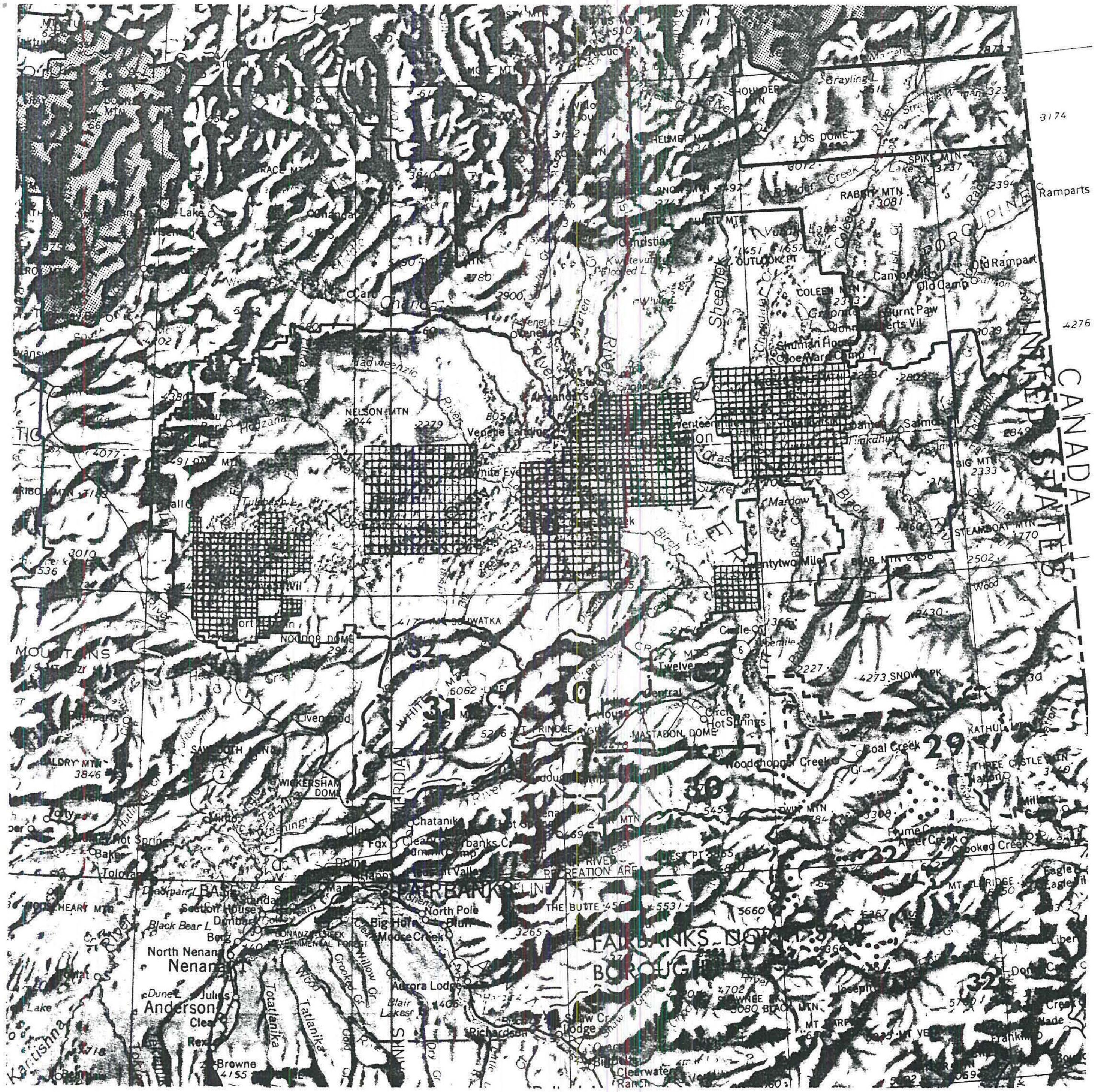

Fig. 1. Yukon Flats NWR (16) with private (Native) land shown (checkered areas).

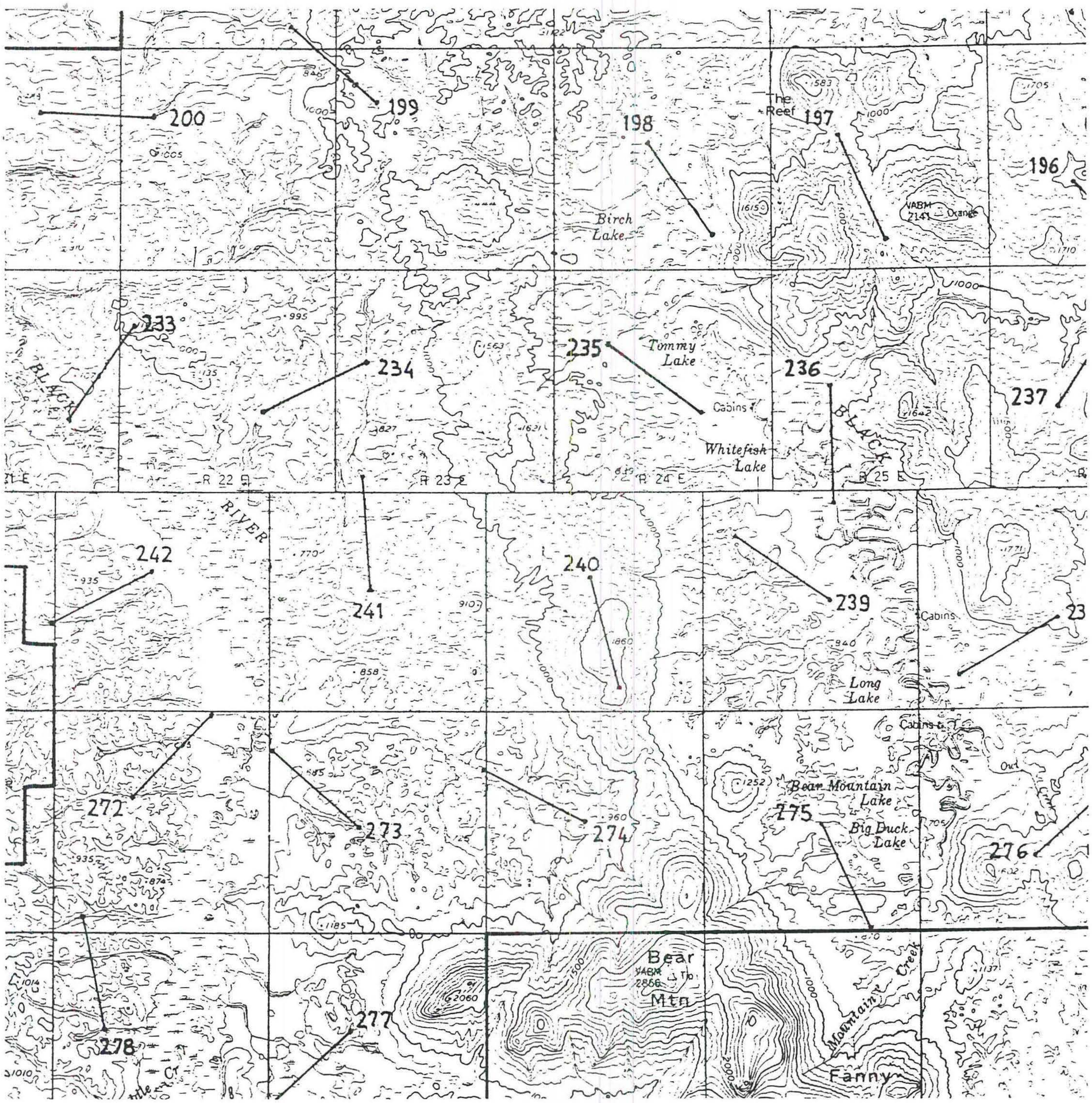

Fig. 2. Transects to be used in the Black River area in the eastern portion of the Refuge.

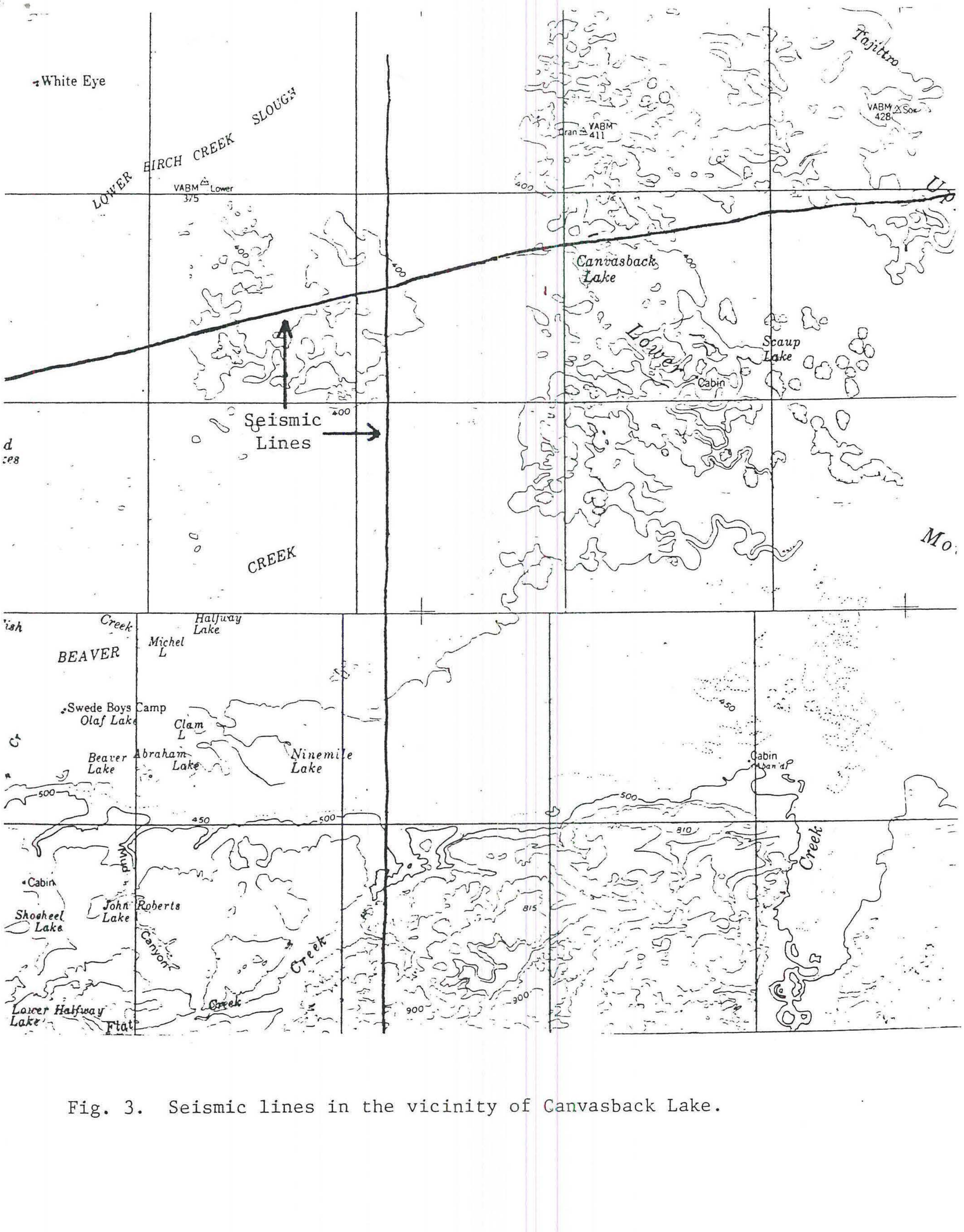

Fig. 3. Seismic lines in the vicinity of Canvasback Lake.

Table 1. Uncorrected furbearer track-rate estimates, $\hat{T}$[a], sampling variances, $s_q^2/\bar{x}^2$[b], and confidence intervals, CI (α = 0.10), for the 3 elevational strata-types.[c]

Strata type	n	Red fox $\hat{T}$	Red fox $s_q^2/\bar{x}^2$	Red fox CI	Marten $\hat{T}$	Marten $s_q^2/\bar{x}^2$	Marten CI	Lynx $\hat{T}$	Lynx $s_q^2/\bar{x}^2$	Lynx CI
A	3	2.32	1.1203	0.91-3.73	1.10	0.2628	0.42-1.78	0.55	0.0409	0.28-0.82
B	6	0.28	0.0696	0.11-0.45	0.88	0.1675	0.61-1.15	0.28	0.0558	0.12-0.44
C	3	0.52	0.3863	0.31-1.35	1.90	6.1639	-1.41-5.21	0.52	0.3645	-0.29-1.33

[a] $\hat{T} = \Sigma$ track intercepts/Σ kilometers.

[b] $s_q^2/\bar{x}^2$ = sampling variance of track rates/squared mean of total kilometers.

[c] Strata types: A = lake flats and riparian areas, B = benches, and C = hills and mountains.

APPENDIX A. Yukon Flats NWR Furbearer Survey
Track-Transect Data Sheet

Transect:_______ Survey:_______ Date:_______ Transect Length:_______

Map(s)/Photo(s):________________ Observer/Pilot:______________________

Airspeed:________ Alt. AGL:________ Temp:________ Wind Speed:_______

Cloud Cover:_______ Date Last Snow:_______ Days Post-Snowfall:_______

Depth Last Snow:_____ Est.Avg. Snow Depth:_____ Est. Depth Drifts:_____

Species	No. Track Intersects	No. Track Intersects/km
Red fox		
Marten		
Lynx		
Hare		
Wolf		
Wolverine		
Otter		

Comments:

APPENDIX B. Yukon Flats NWR Furbearer Survey
Vegetation Density/Composition Data Sheet

Transect:________ Survey:________ Date:________ Heading:________

Map(s)/Photo(s):________________ Observer/Pilot:________________

Transect	Vegetation Density/Composition	%
End	____________________	____
	____________________	____
	____________________	____
	____________________	____
	____________________	____
	____________________	____
	____________________	____
	____________________	____
	____________________	____
Start	____________________	____

Gen. Type:

Density Percentages: High________ Moderate________ Low________

Comments: