Alaska Department of Fish and Game
Division of Wildlife Conservation
Federal Aid in Wildlife Restoration
Research Progress Report

# DEVELOPMENT OF POPULATION ASSESSMENT TECHNIQUES FOR LYNX


**by**
**Charles C. Schwartz**
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**and Earl F. Becker**



**Project W-23-3**
**Study 7.14**
**September 1990**

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SUMMARY

A single lynx (Lynx canadensis) density estimate was conducted during this reporting period. Four systematic samples, each consisting of three 2-mile transects, were walked, and the number of different lynx tracks encountered was recorded. This information, as well as movement data from radio-collared lynx, provided the basis for a density estimate. Lynx numbers were estimated to be 6.8 lynx/100 $km^2$ or 4.5 lynx/100 $km^2$, depending upon whether 2 or 4 different lynx crossed transect B2.

Key Words: census techniques, density estimate, lynx, Lynx canadensis

CONTENTS



## BACKGROUND

Research to develop techniques for estimating the density of lynx using systematic line transects (Becker 1989) was initiated in the winter of 1986-87 (Schwartz and Becker 1988). Background information for this study and results of previous year's estimates have been presented (Schwartz and Becker 1988, Schwartz et al. 1988, and Hundertmark et al. 1989).

## OBJECTIVES

To estimate lynx population density within 2 study areas on the Kenai Peninsula using line transect surveys.

To test the feasibility of aerial surveys for estimating lynx densities based on track counts.

To test a lynx population density estimator using simulation modeling.

## METHODS

### Density Estimates

Systematic lynx density estimates were made using a probability sampling design (Horvitz and Thompson 1952). Details of the mathematics and statistical calculations have been prepared for publication and are listed in Appendix A of Schwartz and Becker (1988). The design called for surveys to be conducted after a fresh snowfall (i.e., 24-96 hrs) to eliminate old lynx tracks. The surveys were to be repeated 4 times within the study area at the Moose Research Center (MRC) to determine variability over time. Existing roads, trails, and lakes provided access to the study area.

The key to developing a population density estimator relies on verifying that all assumptions of the mathematical model are met. Since the distance travelled by each collared lynx is critical to the estimator, aerial flights to locate radio-collared lynx in the study area were to be conducted continuously over a 24- to 96-hr period after snowfall. Frequency of flights was dependent upon weather conditions, ranging from a minimum of 1 time/day to 4 times/day. These flights enabled us to determine the distance traveled by each collared lynx, which is required for the estimator, and to pinpoint lynx locations just prior to the ground survey. Lynx tracks identified during the ground survey were then classified as follows: (1) made from a known marked animal, based on location, or (2) from an unmarked animal. Radio-tracking surveys provided us with the information needed to determine the number of marked individuals within the area and, coupled with the number of observed unmarked individuals (tracks), a minimum estimate to compare with the line transect estimator.

Aerial Surveys

Because of the expense and limited usefulness of ground surveys in remote areas, we planned to simultaneously evaluate aerial surveys using a Piper Supercub. We wanted to determine if a relationship existed between ground and aerial surveys. Because aerial tracking is difficult, particularly identification of lynx tracks, we used one pilot (Chuck Rogers, Fish and Wildlife Protection) and one observer (Ted Spraker, ADF&G) for all aerial surveys. This eliminated the potential for observer bias.

## RESULTS AND DISCUSSION

Density Estimates

Success of the density estimate was tied to snowfall and reliable weather conditions after each storm. During the fall of 1989, weather conditions were unsuitable for applying the technique. Early in the season, we had many snowfalls with good tracking conditions, but because most of the lakes within our study area were either not frozen or unsafe for aircraft landing, access to the area was prohibited. Once lakes froze sufficiently to allow access by ski-plane, the continuous eruptions of Mount Redoubt and the subsequent ash fall-out made it virtually impossible to complete any aerial work.

A snow storm hit the area during the 1st week of February. Snow stopped falling on 8 February, and the weather on 9 February was clear. Aerial relocation flights were conducted twice on the 9 February, but because of limited movement of radio-collared lynx between morning and afternoon locations, we only flew once per day from 10 to 12 February.

Personnel from the U. S. Fish and Wildlife Service and ADF&G assembled at the Kenai National Wildlife Refuge headquarters for a briefing on the census technique and to receive maps of their transect (Fig. 1). Each person then went to the starting point for their transect and walked the designated 2 mi. All transects were completed on the day of the survey, but because of a new snow storm, which began late the afternoon of the 12th, no backtracking was possible. Access to the 12 transects was provided as follows: four by auto, one by smowmachine, and the remaining seven by ski plane. Observers walked their transects and counted each set of lynx tracks encountered. If more than 1 set of tracks was observed, recorders determined if the tracks were from the same lynx or from a different one. Snowfall immediately following the census precluded the planned activity of returning to the field the following day to backtrack lynx on transects where multiple crossings had made determination of the number of individual lynx difficult.

A total of 6 or 8 lynx tracks were counted. Two sets of tracks on transect B2 were fresh, and 2 additional sets contained a slight amount of snow, making it difficult to determine if they were made prior to the start of the census. Based on the judgement of the observers it was determined that these tracks were made by 2 or 4 different lynx (Table 1).

Observers also recorded tracks of other carnivores and snowshoe hares (Table 1). Although the mean number of snowshoe hare tracks encountered on the transects in 1990 (26.0) was less than those encountered in 1989 (57.7) and 1987 (63.3), it was similar to that found in 1988 (15.4). As in previous years of the study, hare distribution was patchy and abundance of hare tracks was extremely variable. Hare trapping conducted by USFWS on 2 grids in the study area indicated a slight decline or no change in hare numbers from that of the previous year.

In addition to completing the 12 transects, it was necessary to determine the distance moved by each radio-collared lynx during the survey period. This distance was estimated by determining the average X-axis movement made by 4 radio-collared lynx from 9 February to 12 February 1990 (i.e., the morning of the census). By dividing the average distance moved by the lynx population during the 72-hour period, the number of lynx in our 285-$km^2$ study area was estimated. The best estimate of the mean distance moved on the X-axis ($\pm$ SE) by these marked lynx was 1.36 $\pm$ 0.36 mi. The X-axis distance moved by the population for the 4 systematic samples was estimated at 27.5 (SE 15.88) mi. Distances moved on the 4 systematic samples were 0.0, 73.33 or 36.65 (using 4 and 2 lynx on transect B2, respectively), 18.33, and 18.33 mi for samples A through D, respectively. Our best estimate of $\underline{N}$ (80% CI) was 19.32 (6.95-41.35) or 12.88

(6.71-24.26) for the 110-$mi^2$ study area; this converts to an estimate of 6.78 or 4.52 lynx/100 $km^2$.

Based on information derived from continuous observation of tracks during winter prior to this survey (W. Staples, pers. commun.) we believe that the lower estimate (4.52) was correct, although the 80% CI for both estimates overlaps the known number of lynx in the study area. During the census there were 4 radio-collared lynx located within the study area, with 2 additional collared lynx located within 7 km of the study area boundary. Neither lynx outside of the study area traveled into our census area. There were 2 or 4 lynx on transect B2; one was probably a radio-collared one with a dead radio. Lynx tracks encountered on transects C3 and D3 were from radio-collared lynx. There was also a high likelihood that 2 uncollared lynx known to frequent the northwestern and southwestern portions of the study area were in the study area during the census; therefore, a minimum of 8 or 10 lynx was known to be within the study area during the census.

The available period of daylight in February was adequate to conduct the census properly and safely with 1 plane. With 6 lynx collared, there was time for two relocation flights per day, but because the lynx were not moving great distances between morning and afternoon locations, we only flew once/day after the first day. Although the time required to ferry individuals to and from their transects by plane was lengthy, the pickups were completed before darkness. An impending snow storm the day of the census made late-afternoon flying conditions poor, but no one requiring an airplane pickup had to walk out after completing their transect.

Aerial Surveys

Our pilot and a suitable plane were not available the day of the census; therefore an aerial census was not conducted.

## RECOMMENDATIONS

We recommend that the study be completed at this point and a final report prepared.

## ACKNOWLEDGMENTS

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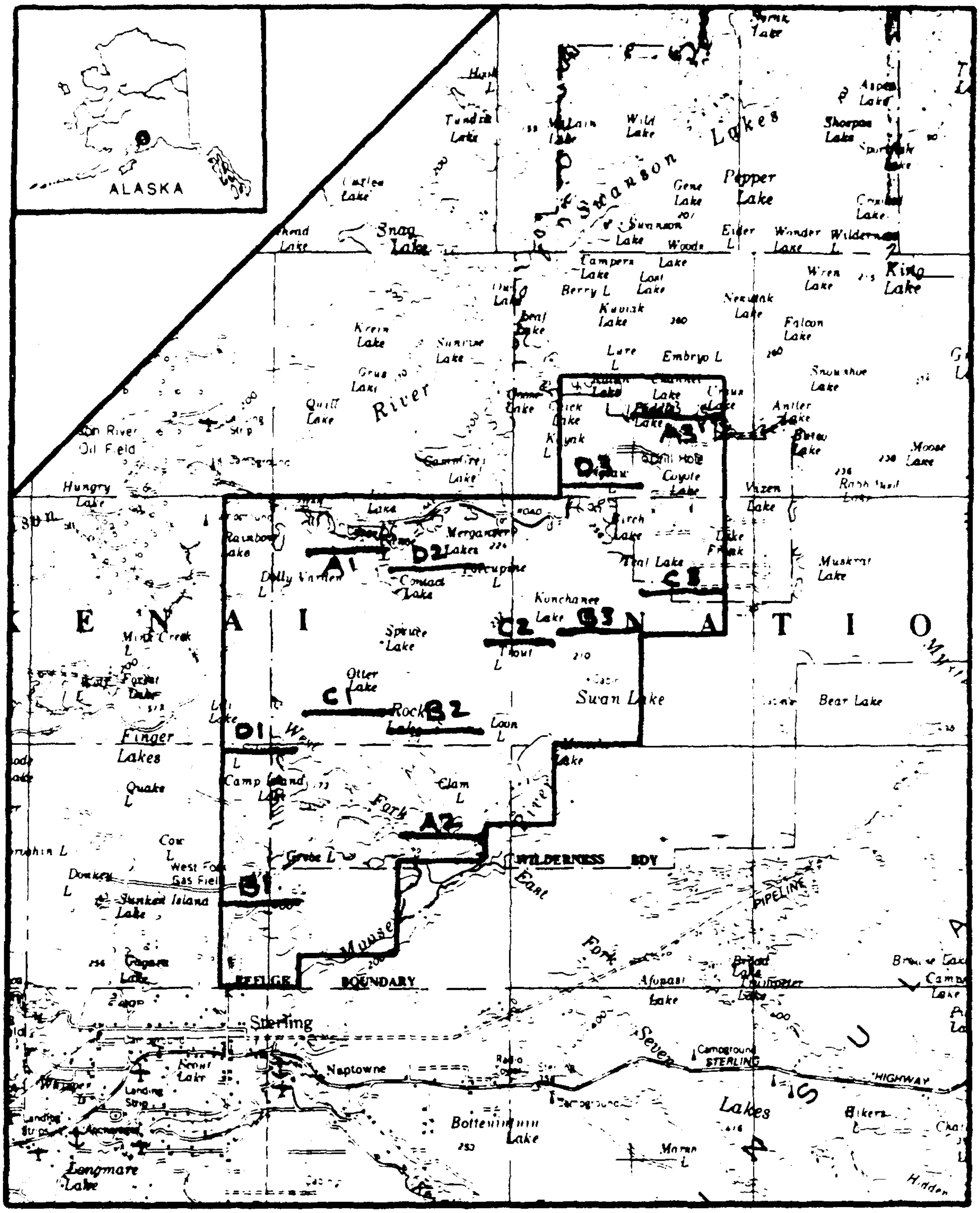


Fig. 1. Lynx study area located on the northcentral Kenai Peninsula lowlands.

Table 1. Number of tracks encountered during 4 systematic samples with 3 transects per sample during a lynx density estimate on 12 February 1990, at the Moose Research Center study area, Kenai Peninsula, Alaska.

| Systematic sample (transect) | Lynx tracks encountered | | Annual tracks | | |
|---|---|---|---|---|---|
| | Total | Individuals | Wolf | Coyote | Hare |
| A1 | 0 | 0 | 0 | 2 | 2 |
| A2 | 0 | 0 | 0 | 3 | 17 |
| A3 | 0 | 0 | 7 | 3 | 43 |
| B1 | 0 | 0 | 0 | 0 | 15 |
| B2 | 4 or 6 | 2 or 4 | 0 | 25 | 16 |
| B3 | 0 | 0 | 0 | 1 | 83 |
| C1 | 0 | 0 | 2 | 17 | 50 |
| C2 | 0 | 0 | 0 | 0 | 30 |
| C3 | 1 | 1 | 0 | 5 | 23 |
| D1 | 0 | 0 | 0 | 1 | 0 |
| D2 | 0 | 0 | 0 | 0 | 18 |
| D3 | 1 | 1 | 5 | 0 | 15 |
| Total | 6 or 8 | 4 or 6 | 14 | 57 | 312 |

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