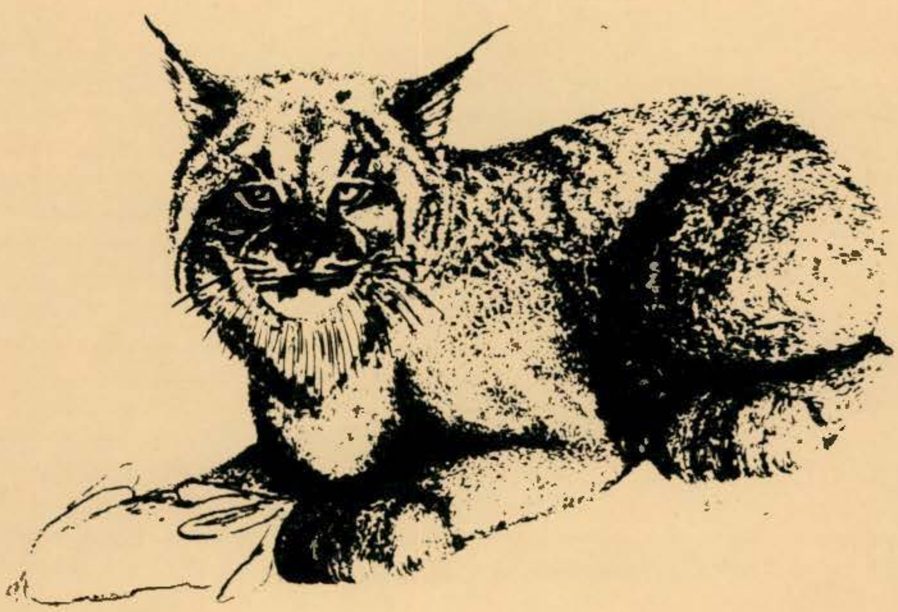
Alaska Department of Fish and Game
Division of Wildlife Conservation
Federal Aid in Wildlife Restoration
Research Progress Report

# DEVELOPMENT OF POPULATION ASSESSMENT TECHNIQUES FOR LYNX



**by**
**Kris J. Hundertmark**
**Earl Becker and**
**Charles C. Schwartz**
**Project W-23-2**
**Study 7.14**
**December 1989**

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SUMMARY

A single density estimate for lynx (*Lynx canadensis*) was conducted during this reporting period. Additional estimates were not conducted because of poor weather conditions. Four systematic samples, each consisting of three 2-mile transects, were walked, and the number of different lynx tracks encountered were recorded. This information, as well as movement data from radio-collared lynx, provided the basis for a density estimate. Inclement weather prohibited an adequate number of relocation flights for collared lynx; thus, movement data from 1988 was used in the estimate. This deviation from survey protocol resulted in a density estimate without confidence intervals. Lynx numbers were estimated to be 10.2 lynx/100 $km^2$. Because a suitable plane and pilot were unavailable, aerial transects were not flown.



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

CONTENTS



## BACKGROUND

Research to develop techniques for estimating the density of lynx with 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 estimate have been presented (Schwartz and Becker 1988, Schwartz et al. 1988).

## 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 density 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 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-hour 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. This information 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 by a known marked animal based on location or (2) by an unmarked animal. Radio-tracking surveys provided us with the information needed to determine the number of marked individuals within the area, and this coupled with the number of unmarked individuals (i.e., observed tracks) provided 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 simultaneously evaluated 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 1988, 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 landing aircraft, access to the area was prohibited. Once lakes froze sufficiently to allow access by ski-plane, there was insufficient snowfall to permit a census until early January.

A series of snow squalls hit the area during the first week in January. Snow stopped falling on 8 January, and the weather on 9 January was clear. Aerial relocation flights were conducted once per day on 8 and 9 January, and another survey was planned for 10 January; however, impending unfavorable weather conditions forced us to conduct the ground survey 24 hours earlier than planned.

Thus movements of radio-collard lynx were monitored for only 24 hours, despite the fact that the transects were walked 48 hours after the first relocations. Lynx movements for the 24 hours immediately prior to the census were not monitored. We believed that a density estimate based on 24-hour movements would yield poor results; therefore, we used 48-hour movement data collected during the March 1988 census and generated an estimate of lynx density with no variance or confidence intervals.

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 of their transect and walked the designated 2 miles. One person failed to complete his transect and returned the following day. Access to the 12 transects was provided as follows: two by auto, one by smowmachine, and the remaining nine 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 they 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 28 lynx tracks was counted. One set of tracks was observed on the portion of the transect walked on 11 January. The tracks were filled slightly with snow, indicating that they had been made during the census period, as opposed to being made on the evening of 10 January; therefore, they were included in the census. Based on the judgement of the observers, it was determined that these 28 tracks were made by 8 lynx (Table 1).

Observers also recorded tracks of other carnivores and snowshoe hares (Table 1). The mean number of snowshoe hare tracks encountered on the transects (57.7) was greater than that encountered during the previous reporting period (48.8) and similar to that observed in 1987 (63.3); however, 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 in hare numbers from 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; as noted previously, movement data from 1988 was used. This distance was estimated by determining the average X-axis movement made by 3 radio-collared lynx from 15 March to 19 March 1988. On 19 March tracks from radio-collared lynx were backtracked from the ground and from the air to determine the average X-axis distance moved by radio-collared lynx from the day after the end of the snowstorm to their radio location on 19 March (96-hour X-axis movements). By dividing the average distance moved by the lynx population during the 96-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 3.06 $\pm$ 0.65 miles. The X-axis distance moved by the population for the 4 systematic samples was estimated at 36.67 (S.E. 24.82) miles. Distances moved on the 4 systematic samples were 18.33, 18.33, 110.00, and zero miles for samples A through D, respectively. Our best estimate of $\underline{N}$, counting the track observed on 11 January, was therefore 11.99 lynx for the 110-$mi^2$ study area, or 4.21 lynx/100 $km^2$.

During the course of the study, there were 8 radio-collared lynx located within the study area, one of which was accompanied by an uncollared kitten, and an additional collared lynx located within 0.5 km of the study area boundary and within 1 km of a transect that had been crossed by 4 different lynx. Therefore a minimum of 9 lynx were within the study area during the census. Additionally, 1 lynx crossed a transect that was 11 km from the nearest location of a radio-collared individual. Assuming this transect had been crossed by an uncollared lynx yields a minimum of 10 lynx and a possible 11 within the study area. The population estimate of 10.2 (excluding the track observed on 11 January) or 11.6 (including the 11 January observation) was an accurate estimate of the known population.

A comparison of lynx densities (i.e., 14.5 vs. 5.8 vs. 11.2 lynx/110 $mi^2$ in 1986-87, 1987-88, and 1988-89, respectively) in the study area for the last 3 winters indicates an apparent increase in population size from the previous year; however, observations made by USFWS personnel indicate that there was no successful recruitment of kittens for 1987-88 ( W. Staples, pers. comm.) and population density is still depressed.

The available period of daylight in January was inadequate to conduct the census properly and safely with 1 plane. With 9 lynx collared, there was time for only 1 relocation flight per day, instead of the usual 2 flights. The time required to ferry individuals to and from their transects by plane was too lengthy for the available flying time, resulting in 2 individuals walking out to the nearest road after sunset, instead of being picked up by plane as originally had been planned. This posed a significant safety problem, because these individuals would have been required to spend the night in the field had they not been within walking distance of a road.

A snowstorm occurred on the study area on 21-22 March 1989. We conducted aerial relocation flights the afternoon of 22 March, morning and afternoon of 23 March, and the morning of 24 March, with the intention of conducting the ground census on the 24th. Examination of new snow coverage on the morning of the 24th resulted in cancellation of the ground census because tracking conditions were not consistent among different habitat types; those sites that were exposed to wind had insufficient depths of new snow to detect recent lynx movements.

### Aerial Survey

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 continued for at least one more year. Because of weather, we only completed 1 census during this reporting period. We recommend that the aerial surveys be continued, to evaluate the potential for aerial lynx censuses and to aid ground observers in locating lynx and sorting out multiple tracks crossing a single transect. Censuses should not be conducted during the period from late November through early February, unless an adequate number of planes is available.

## ACKNOWLEDGEMENTS

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## LITERATURE CITED

Becker, E. F. 1989. A terrestrial furbearer density estimator based on probability sampling. Submitted to Biometrics.

Horvitz, D. G., and D. J. Thompson. 1952. A generalization of sampling without replacement from a finite universe. J. Am. Stat. Assoc. 47:663-685.

Schwartz, C. C., and E. F. Becker. 1988. Development of population assessment techniques for lynx. Alaska Dep. Fish and Game, Fed. Aid in Wild. Rest. Proj. W-22-6, Job VII-7.14. 28 pp.

__________, __________, and K.J. Hundertmark. 1988. Development of population assessment techniques for lynx. Alaska Dep. Fish and Game, Fed Aid in Wild. Rest. Proj. W-23-1, Study 7.14, 8pp.

Stephenson, R. O. 1984. Development of lynx population estimation techniques. 1984. Alaska Dep. Fish and Game, Fed. Aid in Wild. Rest. Proj. W-22-26, Job 7.12R 19pages

PREPARED BY:

Kris J. Hundertmark
Wildlife Biologist II

APPROVED BY:

W. Lewis Pamplin, Director
Division of Wildlife Conservation

SUBMITTED BY:

Karl B. Schneider
Research Coordinator

W. Bruce Dinneford
Acting Planning Chief
Division of Wildlife Conservation

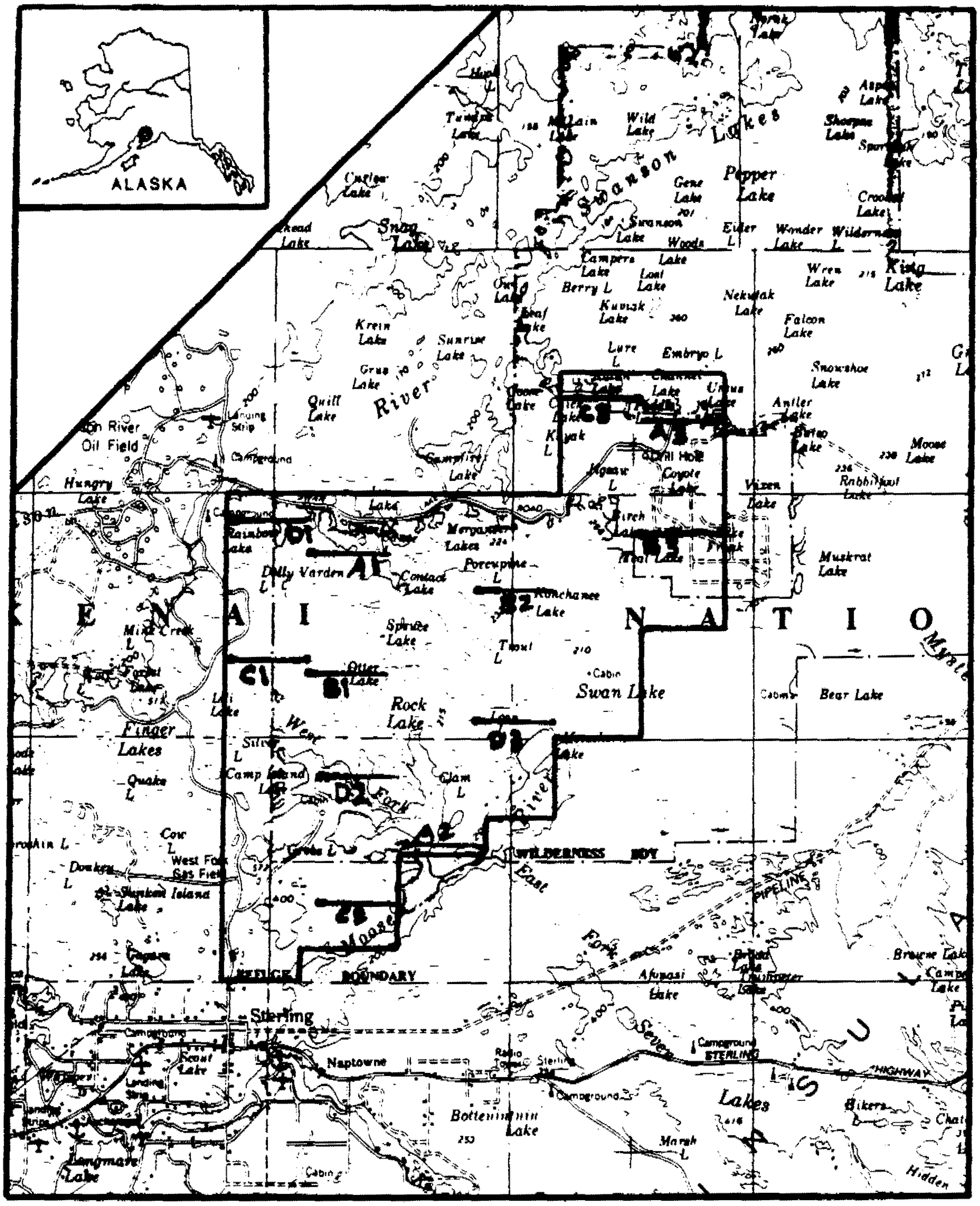


Figure 1. Moose Research Center study area located in the northcentral portion of the Kenai Peninsula lowlands. Study area boundaries and location of the 4 systematic samples (A-D) with the 3 transects per sample (1-3) are shown.

Table 1. Number of tracks encountered during 4 systematic samples (A-D) with 3 transects (1-3) per sample during a lynx density estimate on 10 January, 1989, at the Moose Research Center study area, Kenai Peninsula, Alaska.

| Systematic sample (transect) | Lynx tracks encountered | | Total tracks | | |
| --- | --- | --- | --- | --- | --- |
| | Total | Individuals | Wolf | Coyote | Hare |
| A(1) | 0 | 0 | 0 | 17 | 77 |
| A(2) | 2 | 1 | 0 | 1 | 26 |
| A(3) | 0 | 0 | 0 | 0 | 108 |
| B(1) | 0 | 0 | 0 | 0 | 15 |
| B(2) | 0 | 0 | 0 | 0 | 57 |
| B(3) | 1[a] | 1 | 0 | 0 | 84 |
| C(1) | 18 | 2 | 1 | 0 | 95 |
| C(2) | 0 | 0 | 0 | 2 | 7 |
| C(3) | 7 | 4 | 0 | 2 | >150 |
| D(1) | 0 | 0 | 0 | 5 | 47 |
| D(2) | 0 | 0 | 0 | 0 | 17 |
| D(3) | 0 | 0 | 0 | 0 | 9 |
| Total | 28 | 8 | 1 | 27 | >692 |

[a] This track was observed on the portion of this transect that was walked on 11 January.

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