Progress Report

Trends in Mammal Populations of Cape Breton Highlands National Park over a Five-Year Period

by

M. C. Bateman

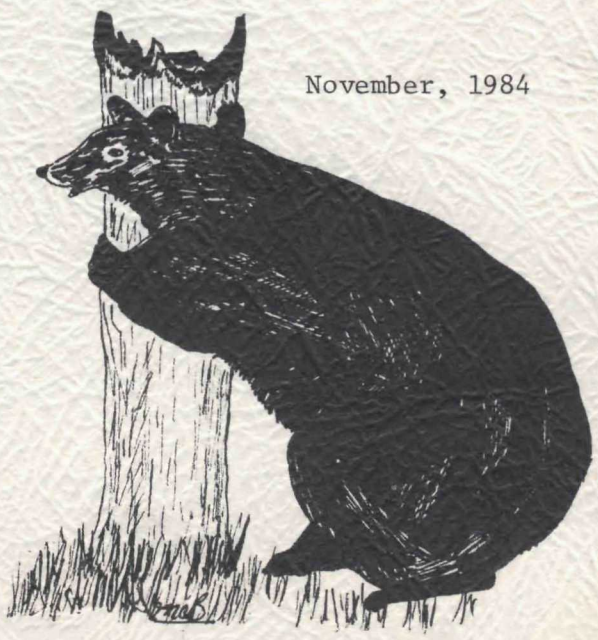
Prepared for Parks Canada

by

The Canadian Wildlife Service

Sackville, New Brunswick

November, 1984



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Introduction

Parks Canada's resource inventory and monitoring programs have collected extensive data over the past ten years. Renewable resources such as wildlife are not static over time, but exhibit temporal changes which make monitoring and updating programs necessary. The resource inventories provided a sound foundation on which to base monitoring programs and, where necessary, more detailed research projects. They also provided basic information which could be used in the decision making process as Parks Canada Managers strove to meet objectives demanding both public use and preservation.

Monitoring techniques for wildlife species in an uncontrolled dynamic environment, including National Parks, are primarily designed for obtaining indices of population abundance rather than population numbers. In some cases the number of individuals in a population can be estimated by comparing Park indices with indices from a known population, or by using special techniques such as mark and recapture. Reliable population estimates with reasonable confidence limits require many sample replications and intensive work. For most purposes it is not necessary to estimate numbers of animals but only to collect indices which indicate temporal and spatial trends.

Accessment of population trends is more reliable if based on more than one sampling technique. However, for many species that is not a realistic approach. Rather, the

objective must be to increase sample size and replications until statistically valid conclusions can be reached. Wildlife monitoring programs are most often set up to identify trends in population size over time and sometimes over space (due to habitat changes, for example). Results can also be used to infer relationships between wildlife species and between a wildlife species and its habitat. Those types of information are essential to an understanding of the ecological communities present in a park.

The mammal inventory of Cape Breton Highlands National Park was completed in 1980 (Prescott, 1980). Recommendations resulting from that study included techniques for a track transect monitoring system to sample vegetation types within the Park each year. From the data collected, spatial and temperal trends of some wildlife species can be determined. An additional advantage of the track transect program is that a permanent record of the status of each species recovered is kept in report form. Reports are less likely to go astray than "notes", "memos" or memories of population highs and lows. Park Wardens have carried out the field work and prepared annual reports since 1979. The Canadian Wildlife Service was requested to analyse the transect results for long term trends.

Aknowledgements

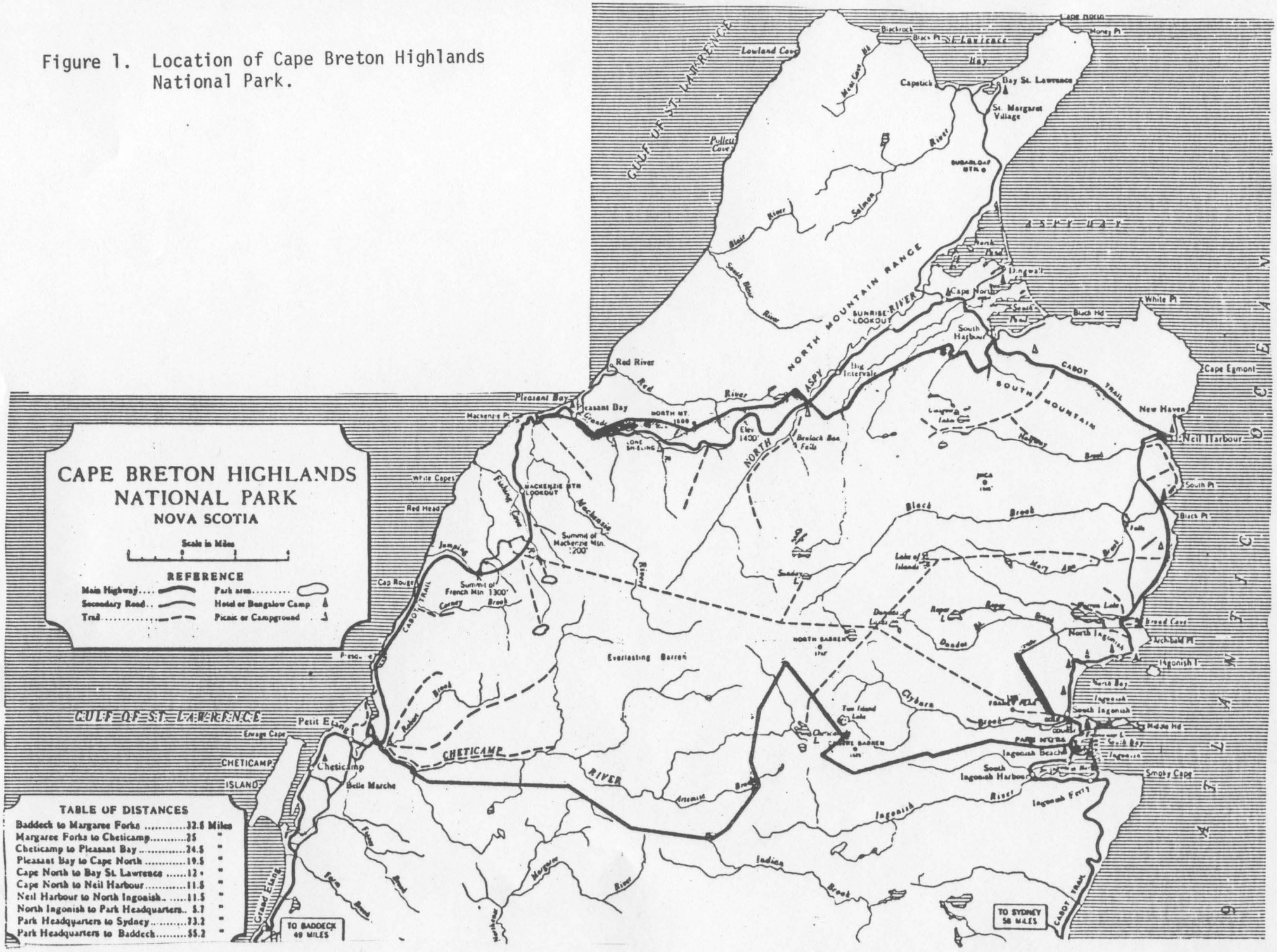
Park Wardens from Cape Breton Highlands National Park carried out the field work each winter. Most wardens serving the Park have assisted over the years, but special mention should be made of the efforts of Mac Savoy, Ian Morrison, Carl Betts and R. Farrier. W. Baldwin, D. MacKinnon, D. Godin, Jean Fau, A. C. Bird, T. Watts and G. Delaney have all been involved in the track transect program. Unlimited use has been made of the progress reports listed in the References Cited.

Description of Study Area

Cape Breton Highlands National Park contains 950 km^2 (367 sq. mi), is located on the northern part of Cape Breton Island and reaches from the Gulf of St. Lawrence on the west to the Atlantic Ocean on the east (Figure 1). The west coast of the Park is characterized by scenic cliffs rising from the Gulf. The eastern coastline is characterized by a more gradual increase in elevation. A central plateau is relatively flat with a maximum elevation of 529 m (1747 ft.).

The climate of the Park differs markedly from west to east and between the coastal lowlands and the upland plateau. The west coast has slightly colder temperatures and heavier snowfall than the east coast. Average daily temperatures at Cheticamp, Pleasant Bay and Ingonish are 5.94 °, 5.88 ° and 6.27 ° C respectively (Prescott, 1980). The mean yearly total precipitation values at those three sites were 131.5 cm at Cheticamp, 124.5 cm at Pleasant Bay and 164.3 cm at Ingonish (Prescott, 1980). The weather conditions on the highlands of the Park are known to be much more severe than in the coastal areas although few data are available due to inaccessibility. Eastern Ecological Research Ltd. (1978) suggested that the highlands area of Cape Breton has a higher annual precipitation than any other area of the Maritimes. That fact, combined with the cold temperatures associated with the altitude and latitude of the Park, results in snow accumulations in excess of two

Figure 1. Location of Cape Breton Highlands National Park.



meters at some locations. Snow accumulation in the coastal areas are much less than on the uplands: the mean maximum over a five year period (1969-1974) was 63 cm at Cheticamp, 102 cm at Ingonish and 89 cm at Pleasant Bay (Prescott, 1980).

Three major forest types are represented in Cape Breton Highlands National Park: Acadian, Boreal and Taiga. Approximately 15 percent of the Park is covered with Acadian forest, over 50 percent with boreal forest and about 20 percent with Taiga. The Acadian forest is characterized by white birch (Betula papyrifera), yellow birch (Betula allegheniensis), sugar maple (Acer saccharum), eastern hemlock (Tsuga canadensis) and white pine (Pinus strobus). The Acadian forest in the Park occurs on the sides of most steep valleys and on the eastern coastal plain. The Boreal forest is dominated by balsam fir (Abies balsamea) and white birch and covers most of the central and western highlands. The balsam fir forests have recently been severely damagned by spruce budworm defoliation. The Taiga forest is found on the eastern highlands and is interspersed with blanket bogs. Common tree species are stunted black spruce (Picea mariana) and balsam fir.

Eastern Ecological Ltd. (1978) delinated 24 vegetation types during a biophysical inventory. Those categories were simplified for use in the track transect system. Approximately 61 percent of the park is softwood forest (Table 1) and 12 percent is mixed forest - softwood predominent. Dwarf black spruce makes up an additional 9 percent of the Park's area, and hardwood forest covers about 7 percent.

Table 1. Approximate areas of Cape Breton Highlands National Park covered by seven broad vegetatation types (derived from Eastern Ecological Ltd. 1978).

	Area (ha)	Percent of park	Length of transect (km)	Percent of transect
Softwood forest	57,130	60.6	25.95	39.2
Hardwood forest	6,901	7.3	15.33	23.1
Mixedwood-softwood	11,376	12.1	12.42	18.7
Mixedwood-hardwood			1.84	2.8
Fields	164	0.2	3.89	5.9
Mire and barren	10,010	10.6	5.62	8.5
Dwarf black spruce	8446	9.0	0.85	1.3
(Miscellaneous)	(316)	(0.3)	(0.38)	(0.6)
Total	94,343	100.1	66.28	100.1

Methods

The initial fifteen track transects used to monitor wildlife in Cape Breton Highlands National Park were located along roads and trails (Figure 2). Transects numbered 1 to 7 were in the Ingonish Management Area and transects numbered 9 to 16 were in the Cheticamp Management Area. The length of each transect through different vegetation types and biophysical units was determined from biophysical maps prepared by Eastern Ecological Ltd. (1978) (Table 1).

Each transect was traversed once or twice each winter between January and April. Transects were traversed between one and four days after a fresh snowfall. Careful records were kept of the number of days since the last snowfall, the vegetation type in which each track occurred and weather conditions. The location of each track was recorded on a 1:50,000 topographical map and was later related to the biophysical unit in which it occurred. Each transect was divided into sections corresponding to different vegetation types and biophysical units by attaching stamped metal tags to trees.

All tracks occurring after the last snowfall were recorded. In areas where high numbers of snowshoe hare tracks made accurate counts impossible, only those tracks crossing the trail were counted and trails were arbitrarily given a value of three tracks. Tracks which continued from one section of the

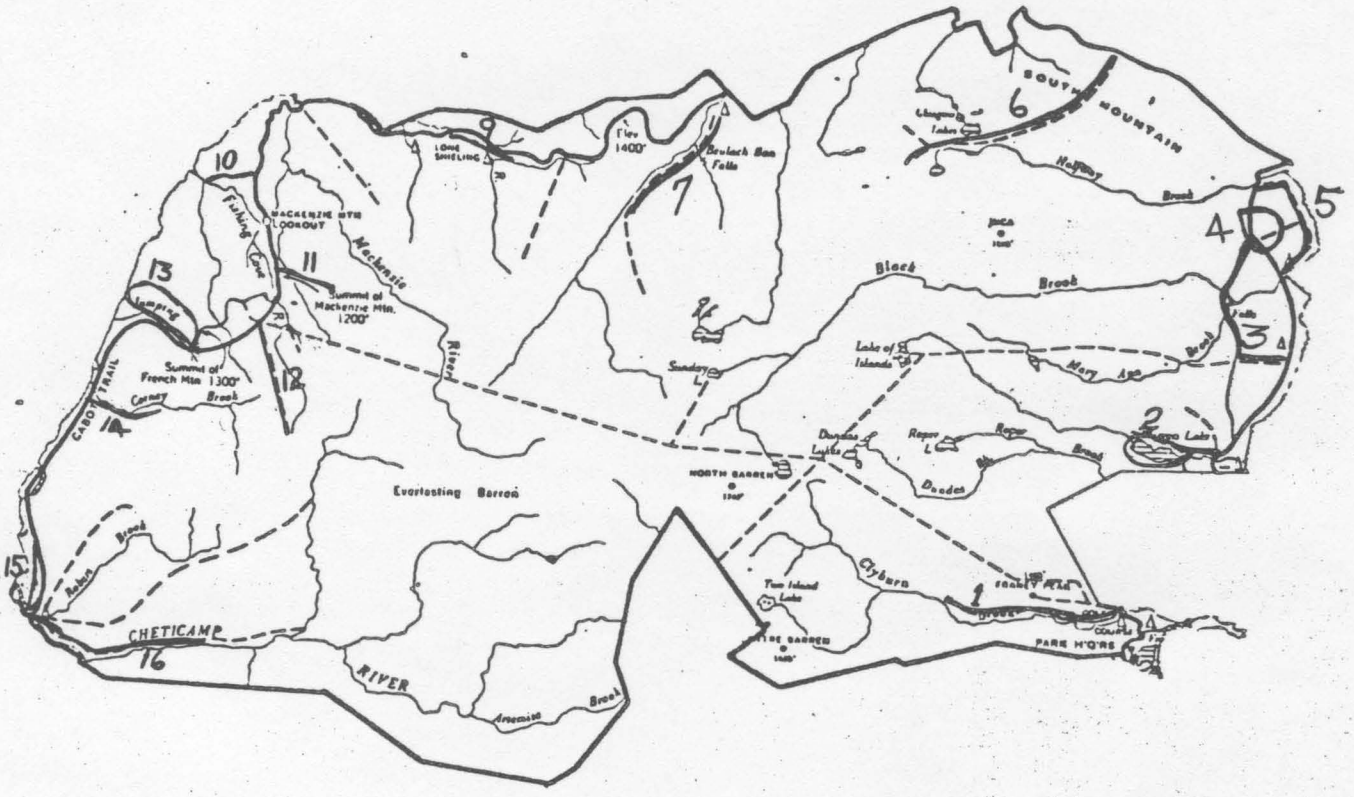


Figure 2. Locations of track transects in Cape Breton Highlands National Park: No. 1 - Clyburn, 2 - Warren Lake, 3 - Old Cabot Trail, 4 - Jigging Cove Lake, 5 - Still Brook - Neil's Harbour, 6 - South Mountain, 7 - Aspy, 9 - Grande Anse, 10 - Fishing Cove Trail, 11 - Benjie's Lake Trail, 12 - Fishing Cove Lake Trail, 13 - Skyline Trail, 14 - Corney Brook Trail, 15 - Le Buttereau Trail, 16 - Salmon Pool Trail.

transect (vegetation type) to another were recorded in both sections. Track indices were calculated as follows:

$$\text{Track index} = \frac{\text{number of tracks crossing the transect unit}}{\text{number of days since snowfall} \times \text{km of transect in unit}}$$

Vegetation types delineated by Eastern Ecological Ltd. (1978) were simplified for use on track transects by using only seven broad types easy to identify: hardwood forest, softwood forest, mixed wood softwood predominant (mixedwood-softwood), mixed wood hardwood predominant (mixedwood-hardwood), open and dwarf black spruce, fields, and barrens and mires.

Data Analysis

Track indices from transects done twice in one winter were averaged before analysis so that one value was used for each transect, or sample unit such as vegetation type, for each year.

Each transect was considered a sample for each species each year. A nonparametric permutation test recommended by B. Collins, senior biostatistician, CWS was used to determine significance of the trend indicated by the data if a trend was indicated. The Friedman Rank Test was used to test for significance between two years of indices where appropriate.

Results and Discussion

The survey of abundance and distribution of mammal species with permanent track transects began in Cape Breton Highlands National Park in 1978-79 (winter 1979) when 15 transects (numbered 1 to 7 on the east side of the Park and 9 to 16 on the west side) were surveyed. In 1984 Park Wardens recommended that transects #1 (Clyburn) and #7 (Aspy) be discontinued because of winter disturbance by the public. This report is based on data collected during the winters from 1979 to 1983 inclusive. All transects were traversed at least once each year except in the winter of 1981 when transects #1 to #7 inclusive and #16 were not done due to poor snow conditions. Tracks of nine mammal species were recorded regularly on the transects, but sufficient data are not available for statistical analysis of all species. Uncontrolled variables such as weather can influence the results and it is essential that controllable variables, such as transect location, be carefully standardized.

Trend analysis

One important objective of the long term track transect program is to provide information on major changes over time in the abundance and distribution of species. It must be remembered, however, that the results are only as accurate as the data collected and the number of tracks observed depends on many variables other than the number of

individuals present. For example, snow conditions affect animal mobility and therefore the number of tracks crossing a transect; prey availability may affect predator movements, and weather conditions affect activity of some species, notably the red squirrel. In spite of these and other uncontrollable variables track transects can provide useful information (see Rivard, 1982 for a review of Parks Canada's track programs). Track transect monitoring is not a particularly sensitive technique and small year to year changes in track indices most likely reflect changes in local conditions or sample variation. Long term trends, however, are detectable.

Bobcat (Lynx rufus)

The bobcat was given the status uncommon in 1980 (Prescott, 1980). Track indices varied considerably from year to year during the five year survey period (Table 2). The average trend of the bobcat indices over the five year period was negative (-0.19) but it was not statistically significant ($P > .05$). A decrease in the bobcat population in the Park is not indicated at the present time, but surveys should be continued.

Table 2. Track indices (tracks per km per track day) calculated for bobcat for each transect in Cape Breton Highlands National Park, 1978-79 through 1982-83.

Transect Number	Year				
	1979	1980	1981	1982	1983
1	0.2	0.0	-	0.0	0.1
2	0.5	0.0	-	0.1	0.1
3	1.4	0.5	-	0.0	0.6
4	2.2	0.0	-	0.5	0.0
5	0.0	1.3	-	0.0	0.0
6	0.0	0.0	-	1.2	0.0
7	1.8	1.6	-	0.1	0.0
9	0.0	0.4	2.7	0.5	0.3
10	1.8	1.2	0.3	1.2	0.0
11	0.6	0.2	0.0	1.1	0.0
12	1.8	0.3	0.3	0.6	0.0
13	1.9	0.3	0.4	0.0	0.1
14	0.9	1.1	7.4	0.0	0.2
15	3.3	1.8	5.7	8.6	2.7
16	0.0	0.0	-	2.5	0.0
Ave.	1.1	0.6	-2.4	1.1	0.3

Average trend (slope) = -0.19 ($P \not< 0.12$ not significant)

Lynx (Lynx lynx)

Lynx was a common species in the Park during the mammal inventory (Prescott, 1980) even though it was rare in mainland Nova Scotia. Track indices were very similar each year during the survey period (Table 3). Statistical analysis was not done because average indices did not indicate a change in status.

Snowshoe hare (Lepus americanus)

Snowshoe hares exhibit fluctuations in number at approximately ten year intervals. Rabbits were very abundant in the Park between 1976 and 1979 (Prescott, 1980) but declined in 1980 (Park Wardens per. com.). Track indices recorded a statistically significant downward trend in snowshoe hare numbers (Table 4) through the five year record. The indices stabilized in 1982 and 1983 with no statistical difference (P 0.05) between those two winters.

Red Squirrel (Tamiasciurus hudsonicus)

Red squirrel densities change from year to year with no predictable pattern. Changes may be related to food supply. The red squirrel was common in 1980 and high densities were reported in 1974 and 1977 (Prescott, 1980). Track indices (Table 5) suggest a high population in winter 1983. The indices for 1983 were significantly higher than in 1982

Table 3. Track indices (tracks per km per track day) calculated for lynx for each transect in Cape Breton Highlands National Park, 1978-79, through 1982-83

Transect Number	Year				
	1979	1980	1981	1982	1983
1	0.0	0.8	-	0.0	0.0
2	0.0	0.6	-	0.1	0.0
3	0.0	0.0	-	0.7	0.0
4	0.0	0.0	-	0.0	0.0
5	0.0	0.0	-	0.4	0.0
6	0.8	0.2	-	0.5	1.5
7	0.0	0.0	-	0.0	0.2
9	0.0	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0	0.0
11	1.7	0.8	0.0	0.4	0.9
12	2.7	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0
14	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.3	0.0	0.0
16	0.0	0.0	-	0.0	0.0
AVE	0.3	0.2	0.04	0.1	0.2

Table 4. Track indices (tracks per km per track day) calculated for snowshoe hare for each transect in Cape Breton Highlands National Park, 1978-79 through 1982-83

Transect Number	Year				
	1979	1980	1981	1982	1983
1	4.3	2.4	-	0.2	0.6
2	20.3	5.8	-	0.7	0.6
3	29.1	1.3	-	9.0	1.2
4	27.4	37.6	-	1.9	1.9
5	8.4	8.7	-	2.2	0.8
6	19.9	3.5	-	2.0	4.2
7	24.1	11.2	-	3.3	5.2
9	36.8	3.4	2.6	1.0	2.9
10	258.8	82.0	37.1	38.8	11.9
11	101.0	15.5	0.7	0.4	4.6
12	19.7	14.5	0.0	0.9	6.8
13	289.6	42.2	15.0	19.6	41.0
14	221.3	9.1	6.8	11.3	3.3
15	332.2	133.0	132.0	90.0	159.0
16	63.3	0.4	-	0.8	0.4
AVE	97.1	24.7	27.7	12.1	16.3

Average trend (slope) = -17.4 ($P \leq 0.05$; significant)

Table 5. Track indices (tracks per km per track day) calculated for red squirrel for each transect in Cape Breton Highlands National Park, 1978-79, through 1982-83

Transect Number	Year				
	1979	1980	1981	1982	1983
1	0.0	0.1	-	0.0	0.6
2	0.0	0.1	-	0.0	0.3
3	0.0	0.0	-	0.0	0.1
4	0.0	0.0	-	0.0	0.8
5	0.0	0.4	-	0.0	2.9
6	0.0	0.0	-	0.0	0.4
7	0.1	0.1	-	0.1	0.8
9	0.4	0.2	0.0	1.6	0.0
10	0.0	0.0	0.0	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.2
13	0.0	0.0	0.0	0.0	0.7
14	0.9	0.2	3.2	0.0	1.7
15	0.0	0.0	0.0	0.0	5.7
16	0.3	0.0	-	0.0	0.8
AVE	**0.1**	**0.1**	**0.4**	**0.1**	**1.0**

Difference between 1982 and 1983 significant ($P \leq 0.05$)

($P \leq 0.05$). Although red squirrel activity, and therefore the number of tracks recorded, is greatly affected by weather conditions, the high track indices relative to previous years and the greater number of transects on which tracks were recorded indicate a relatively high population density in 1983.

Weasel (Mustela erminea)

Weasel densities may change considerably between consecutive years. Such fluctuations are believed dependent on the availability of mice. Weasel were uncommon in the Park in 1980 (Prescott 1980) and track indices indicate little change (Table 6). The average indices for 1981 (2.3) and 1982 (2.4) are higher than other years, but not significantly so ($P > .05$).

White-tailed deer (Odocoileus virgianus)

Analysis of track indices for white-tailed deer is difficult because of the species' winter behaviour. Deer yards often have trails in which individual tracks are impossible to detect. The degree of concentration depends upon snow conditions. In a winter when mobility is not seriously impaired, deer may be so scattered that few (or many, depending upon transect location) tracks are recorded. Track transects can provide information on deer distribution if properly designed. Track indices should not be completely disregarded but analysed with caution. Average annual track indices were

Table 6. Track indices (tracks per km per track day) calculated for weasel for each transect in Cape Breton Highlands National Park, 1978-79, through 1982-83

Transect Number	Year				
	1979	1980	1981	1982	1983
1	0.0	0.1	-	0.0	0.5
2	0.0	0.0	-	0.1	0.1
3	0.0	0.0	-	1.3	0.2
4	0.0	0.0	-	0.0	0.8
5	0.0	0.0	-	0.0	1.9
6	0.2	0.1	-	0.5	1.7
7	0.9	3.2	-	0.0	3.5
9	0.4	2.2	1.4	11.0	1.3
10	1.2	0.6	0.0	1.2	0.9
11	2.8	0.5	0.0	0.4	0.6
12	1.4	2.1	0.0	0.0	2.4
13	3.1	1.4	0.4	0.0	2.9
14	5.6	2.4	6.8	4.8	6.3
15	0.6	6.6	7.5	15.0	3.6
16	0.6	0.1	-	1.9	1.0
AVE	1.1	1.3	2.3	2.4	1.8

Average trend (slope) =+0.3 ($P < 0.20$. not significant).

surprisingly similar over the five year period (Table 7) with the exception of 1981 for which there is incomplete data. For those transects with complete data (#9 to 15) the 1981 index (4.1) is high, but that may be due to a different distribution pattern during the abnormal winter.

Moose (Alces alces)

Moose were common in Cape Breton Highlands National Park in 1980 (Prescott, 1980) and track indices indicate little change in status (Table 8). Moose mobility and winter distribution, and therefore track indices, can be greatly affected by snow conditions. Moose are recorded irregularly on many transects, particularly on the west side of the Park (transects #9 to 16). It is therefore doubtful if an adequate sample of the moose population is being recorded. For transects on the east side of the Park only (#1 to 7) average annual indices are very similar over the survey period (no data are available for 1981).

Table 7. Track indices (tracks per km per track day) calculated for white-tailed deer for each transect in Cape Breton Highlands National Park, 1978-79, through 1982-83

Transect Number	Year				
	1979	1980	1981	1982	1983
1	1.3	0.7	-	0.5	0.1
2	1.2	0.9	-	0.9	1.8
3	0.4	0.0	-	0.0	1.8
4	0.5	0.0	-	0.0	3.0
5	3.7	1.4	-	1.2	1.9
6	0.0	0.0	-	0.0	1.9
7	2.1	0.1	-	0.1	0.0
9	0.0	2.0	5.4	0.0	1.3
10	6.5	8.5	9.6	8.8	6.8
11	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0
13	1.2	0.1	0.6	9.0	1.2
14	7.8	13.0	6.5	4.3	5.9
15	0.0	2.0	6.8	1.4	3.8
16	0.0	0.7	-	3.3	1.2
AVE	1.6	2.0	4.1	2.0	2.0

Average trend (slope) = +0.1 ($P < 0.6$ not significant).

Table 8. Track indices (tracks per km per track day) calculated for moose for each transect in Cape Breton Highlands National Park, 1978-79, through 1982-83

Transect Number	Year				
	1979	1980	1981	1982	1983
1	0.0	0.6	-	0.4	0.1
2	0.0	2.0	-	2.0	0.4
3	1.2	0.4	-	0.0	2.6
4	5.9	1.6	-	0.0	0.0
5	0.0	0.6	-	0.2	0.0
6	0.6	0.0	-	0.0	1.0
7	1.4	0.0	-	0.9	0.2
(ave)	(1.3)	(0.7)	(-)	(0.5)	(0.6)
9	0.0	0.0	0.0	0.0	0.3
10	0.0	0.6	0.0	0.0	0.3
11	0.0	0.0	0.3	0.4	1.3
12	0.0	0.0	0.0	0.3	7.1
13	0.0	0.1	0.1	0.0	3.9
14	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	-	0.0	0.0
AVE	0.6	0.4	0.1	0.3	1.1

Red fox (Vulpes vulpes)

Results of the track transects indicate that there was no significant change in red fox densities in the Park during the survey period (Table 9). Prescott (1980) reported that the species was common betweem 1974 and 1979.

Mink (Mustela vison)

Mink tracks were recorded only once on the east side of the Park: transect #7 in 1980 (Table 10). The species was recorded more frequently on the west side where it was reported on three transects in 1979, one in 1982 and five in 1983. There are too few data to analyse statistically but an unusually high number of tracks was recorded on the west side of the Park in 1983.

Table 9. Track indices (tracks per km per track day) calculated for red fox for each transect in Cape Breton Highlands National Park, 1978-79, through 1982-83

Transect Number	Year				
	1979	1980	1981	1982	1983
1	0.5	1.5	-	0.0	0.1
2	1.6	1.1	-	0.0	0.0
3	0.7	0.0	-	0.0	0.1
4	2.2	0.5	-	0.0	0.0
5	1.4	0.0	-	0.0	0.0
6	1.2	0.0	-	0.0	0.5
7	0.0	0.0	-	1.1	0
9	0.0	0.0	0.0	0.0	0.8
10	0.0	0.0	0.0	0.0	0.0
11	0.6	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	2.9
13	0.0	1.0	0.0	0.0	2.6
14	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	-	0.0	0.0
AVE	0.5	0.3	0.0	0.1	0.5

Table 10. Track indices (tracks per km per track day) calculated for mink for each transect in Cape Breton Highlands National Park, 1978-79, through 1982-83

Transect Number	Year				
	1979	1980	1981	1982	1983
1	0.0	0.0	-	0.0	0.0
2	0.0	0.0	-	0.0	0.0
3	0.0	0.0	-	0.0	0.0
4	0.0	0.0	-	0.0	0.0
5	0.0	0.0	-	0.0	0.0
6	0.0	0.0	-	0.0	0.0
7	0.0	0.1	-	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0
10	0.6	0.0	0.0	0.0	0.4
11	0.0	0.0	0.0	0.0	0.0
12	0.4	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.3
14	0.4	0.0	0.0	0.0	5.9
15	0.0	0.0	0.0	0.0	2.3
16	0.0	0.0	-	1.4	0.4
AVE	0.1	0.01	0.0	0.1	0.6

Conclusions and Recommendations

Five years of track transect data from Cape Breton Highlands National Park provided some insight into trends of mammal populations in the Park despite data missing because of poor weather conditions.

Trend analysis indicated relatively stable populations of mink, red fox, weasel, lynx, and bobcat over the five year period.

Snowshoe hare indices confirmed a sharp decrease in the population in 1980 and a stablization in 1982 and 1983.

Red squirrel were unusually abundant in winter 1983.

White-tailed deer and moose track indices indicated a relatively stable population although winter yarding behaviour of those species complicates analyses.

It is recommended that track transects be continued. If transects #1 and #7 must be abandoned because of public disturbance, two other transects should be selected because the sample size is already minimal.

This report includes analysis for population trends over time only. Complete data for vegetation type preference analysis are not available at this time.

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