AN ASSESSMENT OF THE EFFECTS OF FOREST FIRES ON THE TRAPPING ECONOMY OF FORT SMITH, NORTHWEST TERRITORIES

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ABSTRACT

Fur harvest statistics for the years 1974-75 to 1980-81 were evaluated to assess the impact of widespread burning in 1979 on the local trapping economy of Fort Smith. Year to year changes in trapping revenue for individual trapping areas that were affected by recent burning are considered in relation to revenues for trapping areas that have no history of recent burning. Comparisons show that trapping revenue underwent a general decline after 1977-78. Trapline earnings on areas where there was no recent burning declined concurrently with similar changes for traplines that experienced burning in 1979. Prices for furs paid to trappers peaked in 1978-79 and declined in 1979-80 and 1980-81.

Although trapline earnings declined from 1977 to 1981-82, it cannot be concluded from analysis of the available fur harvest data that there is a definite cause and effect relationship between trapping success and forest fire. Improved information systems are necessary to establish correlations between environmental and other factors that have an impact on trapping success.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Wildfire in boreal forest ecosystems has been cited as a destructive force that causes the disappearance of furbearing animals, with corresponding losses of trapping revenue. Fire-trapping cause and effect relationships were adduced by Murphy et al. (1980) when they reported that (sic)...fires to the east of Fort Smith appear to have virtually destroyed the 1979-80 furbearer harvest on at least eight traplines.

Studying trends in trapping revenue during the years prior to, and following, the 1979 fire season is one method of assessing the impact of fire on the local trapping economy. The hypothesis that trapline productivity is diminished by fire can be tested by comparing fur harvest data from burned areas with harvest statistics for similar, nearby, control areas that escaped burning. Diminished productivity of a trapline affected by fire should have a corresponding decline in trapping revenue, while the revenue for the control area should remain stable. If other variables that influence trapping revenue, principally trapping effort, furbearer population levels and fur prices, remain constant while trapping revenue declines, the hypothesis of fire induced change on fur harvests would find expression as a logical consequence of cause-and-effect.

Fur harvests for 1974-75 to 1980-81 were compared in an attempt to detect an interdependance between trapping revenue and wildfire in trapping areas that were affected by burning east of Fort Smith during 1979.

METHODS

Study Area

The study area is bounded by the Slave River in the west, Great Slave Lake in the north, the Taltson and Tazin Rivers in the east and 60 degrees north latitude in the south, and corresponds with the Fort Smith and Hill Island Lake map sheets (Fig. 1). It is entirely in the high boreal and mid-boreal ecoregions described by Bradley et al. (1982). Trapping data for two traplines not in the study area, 822 and 828, are included in this discussion because of their fire history and proximity to the area.

Spruce-lichen and shrub communities common in the area are given high fuel-potential ratings by Sylvester and Wein (1981). A high fuel-potential rating is an indicator for ease of ignition and rate of fire spread. Fire history for the area supports the fuel-potential analysis. During the 16 year period from 1966 to 1981, there were 501[1] fires reported within 116,778 km^2 of woodlands that include the study area. The study area is in a region characterized by frequent occurrences of large fires as described by Johnson and Rowe (1975).

The zone of frontal activity with associated thunderstorms, that marks the transition from warm, moist maritime air to cool, dry arctic air, tracks a southwest to northeast course across the study area in May and early June (Johnson and Rowe 1975). Air-mass thunderstorms are the ignition source of most fires in the

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1 From fire statistics compiled by the Department of Indian Affairs and Northern Development for the Caribou Range Sub-district.

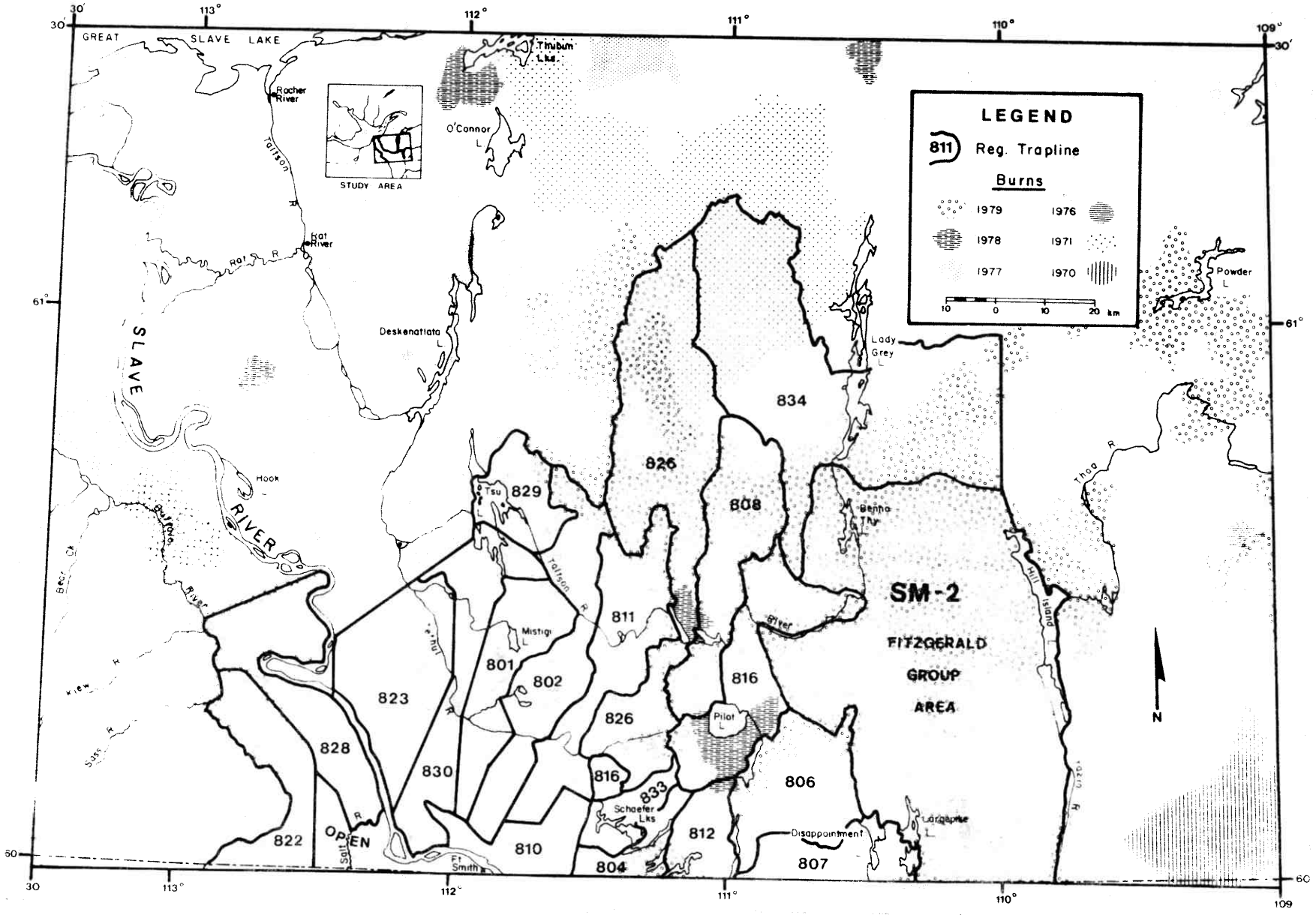

Figure 1. Study area showing registered trapline boundaries and major burns from 1970 to 1979.

area and, because frontal activity begins early in the summer, the burning season in the southwest part of the area is prolonged, compared with adjacent areas near the treeline. When the moderating effects of precipitation are lacking or limited, widespread burning results.

The conditions for burning in 1979 were conducive for the rapid spread of lightning-caused fires. Eleven separate fires joined to form a more or less continuous area of 725,400 ha (Murphy et al. 1980) shown in Figure 1 as SM2.

Data Source and Treatment

The boundaries of 17 registered trapping areas were plotted on a map showing the perimeters of recent forest fires (Fig. 1). Fur harvest data covering the period 1974 to 1981 for the trapping areas were obtained from statistics kept by the Northwest Territories Wildlife Service. Fur harvest statistics are derived from purchase records submitted by fur traders who used Fort Smith as their collection centre. Trappers are not compelled to furnish information about the number and types of furs taken on their respective trapping areas; thus fur purchase records are the only available source of data for assessing trapline productivity.

The trapping areas were classified into three groups in accordance with the extent to which they had been affected by recent fires. Trapping areas that had not experienced burning were included in Group I. Group II contains traplines with 25 percent or less of their surface areas burned and Group III contains traplines with more than 25 percent of their area

affected by fire. Trapping areas were grouped in this way in an effort to develop a general classification that maintains confidentiality and provides the basis for comparisons of trends.

Conclusions about fire-trapping cause-and-effect relationships based on fur harvest records are inferential because:

1) We cannot gauge trapping effort;

2) Pelts may be sold at more than one collection centre;

3) Pelts used locally in garments and handicrafts may not be shown in fur harvest data.

However, since these factors apply equally to all traplines, the available data can be used for comparing trends in trapping revenue for traplines which experienced burning and those which did not.

We calculated the relative economic importance of each species and type of furbearer taken by trappers in the study area during the years 1974-75 to 1980-81[1] and assigned numerical rankings to them.

There are no data respecting furs used locally in garments and handicrafts, sold or bartered privately, or delivered for sale to fur-traders in other collection centres. On balance, the value of these other fur transactions, for which there are no records, should remain proportionately constant. Thus, although the available data may not represent the total harvest, validity for the analysis of trends is retained.

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1 Annual trapping statistics include pelts harvested in the autumn of one year and spring of the succeeding year.

RESULTS

Year to year trends in fur revenue for Groups I, II and III are shown in Table 1 and Figure 2. The prices paid for furs taken in the study area during the 7 year period from 1974-75 to 1980-81 are shown in Table 2 and Figure 3. The general trend in fur revenues is shown in Figure 4. Tables 3 to 9 show the economic importance of each species and type of furbearer taken in the study area.

Trapping revenue increased rapidly between 1974-75 and 1977-78 (Table 1, Figs. 2 and 4). Concurrently, there was an increase in the amount paid to trappers by fur traders (Table 2, Fig. 3) but the rate of increase was not as great as change in overall trapline earnings. After fur revenue peaked in 1977-78, fur prices showed a further increase in 1978-79 but trapping income had declined. The rate of change in trapline earnings exceeded the rate by which fur prices declined (Figs. 2 and 3). The measured amplitude of fluctuations in trapping revenue from 1974-75 to 1980-81 (Table 1) shows a 15.3-fold difference between high and low values, whereas there is a 2.7-fold difference in the price paid to trappers (Table 2) during the same period.

Variations Within Groups and Between Groups

Trapping areas with similar fire histories showed individual trends that were not consistent with the general trend of the respective groups. Thus, while the overall trend in Group I was toward reduced fur revenue, a slight increase was indicated for

Table 1. Total revenue ($) from registered traplines in the study area.

	TRAPPING SEASON						
Group[1]	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81
I	2836.85	8107.06	25339.77	34156.65	35939.70	27994.90	17350.17
II	1360.10	4769.79	24009.75	54501.00	54688.83	27511.45	14445.82
III	6657.39	17957.39	38688.72	77225.50	57666.35	31241.54	19595.25
Total Revenue:	10854.34	30834.24	88038.24	165883.15	148294.88	86747.89	51391.24

[1]Group I = 0% burn.
Group II = <25% burn.
Group III = >25% burn.

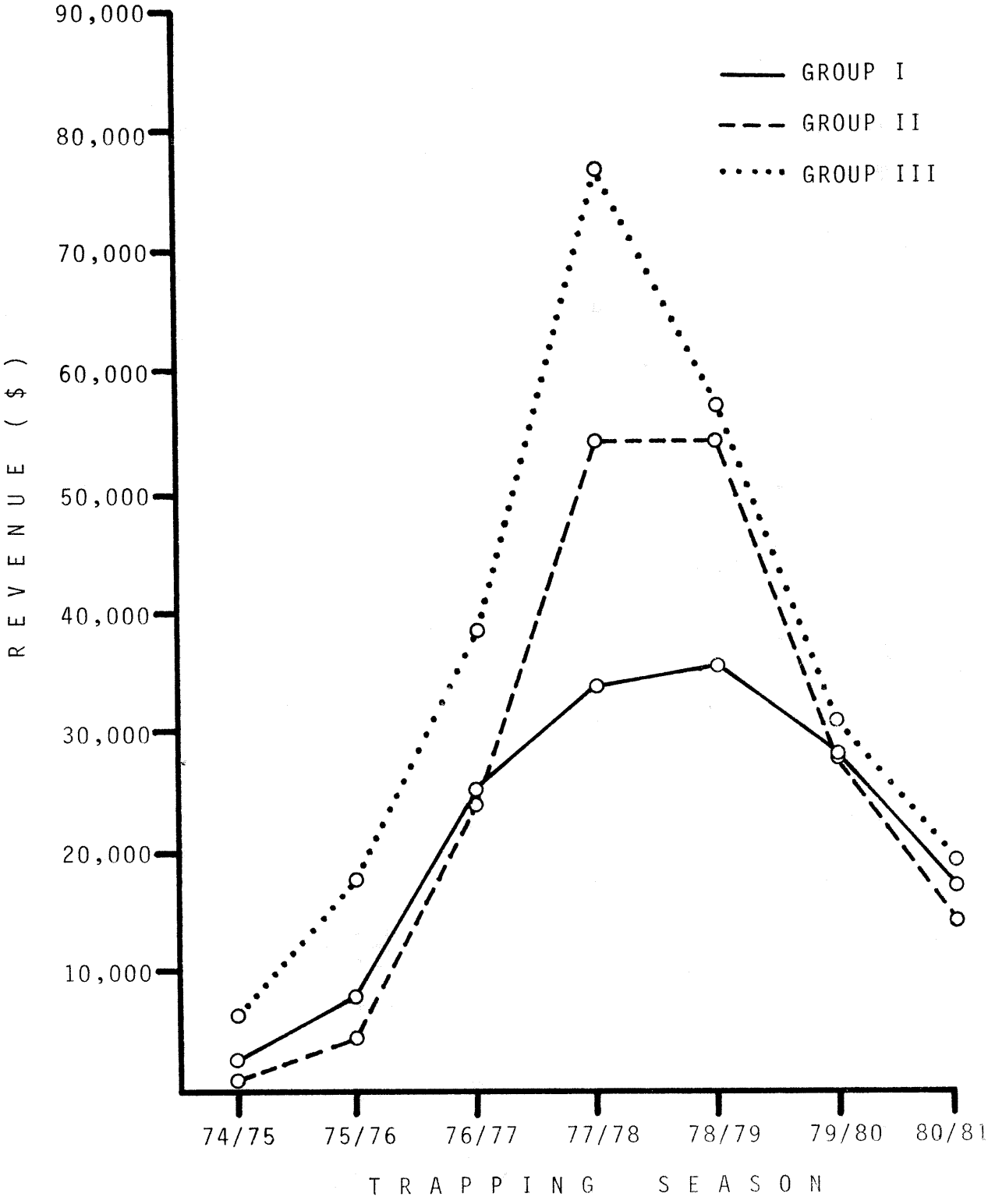

Figure 2. Trapping revenue for the study area showing Group fluctuations from 1974-75 to 1980-81.

Table 2. Average prices ($) paid for furs in Fort Smith, N.W.T.

Species	TRAPPING SEASON 74/75	75/76	76/77	77/78	78/79	79/80	80/81
Black Bear	25.35	25.00	25.00	36.65	71.65	68.00	35.00
Beaver	12.95	13.15	19.70	13.75	25.10	33.65	25.10
Coyote	39.45	61.00	86.00	40.00	76.65	66.50	57.25
Fisher	31.15	39.30	58.95	75.50	124.85	115.00	67.70
Fox - Red	29.95	52.75	54.35	71.00	76.50	66.25	61.60
Fox - Cross	43.85	51.00	85.55	105.00	118.50	93.80	78.00
Fox - Silver	36.20*	45.00	40.00	33.50	20.00	66.65	70.00
Fox - White	17.60*	30.00	34.15	29.35*	57.00	35.60	31.75
Lynx	87.15	195.60	224.20	225.60	331.30	255.60	244.30
Marten	16.15	15.00	20.30	22.80	26.75	39.15	25.20
Mink	18.25	24.35	19.55	24.55	30.10	36.30	34.95
Muskrat	2.25	2.65	2.95	3.55	3.60	5.10	3.75
Otter	28.95*	40.55	62.05	48.80	79.60	77.20	53.10
Squirrel	0.65	0.50	0.55	0.75	1.75	1.55	1.20
Weasel	0.90	1.05	1.00	0.80	1.05	1.35	1.30
Wolf	48.20	61.25	75.00	142.00	180.00	112.85	89.30
Wolverine	73.90*	40.00	130.00	130.00	169.00	149.30	186.00
Combined ($)Value:	512.90	698.15	939.30	1003.60	1393.40	1223.85	1065.50
% Change:	-	+36 %	+35 %	+7 %	+39 %	-12 %	-13 %

* Average prices paid for these species in the N.W.T. as compiled by R. Tinling, G.N.W.T. Wildlife Service, 1982.

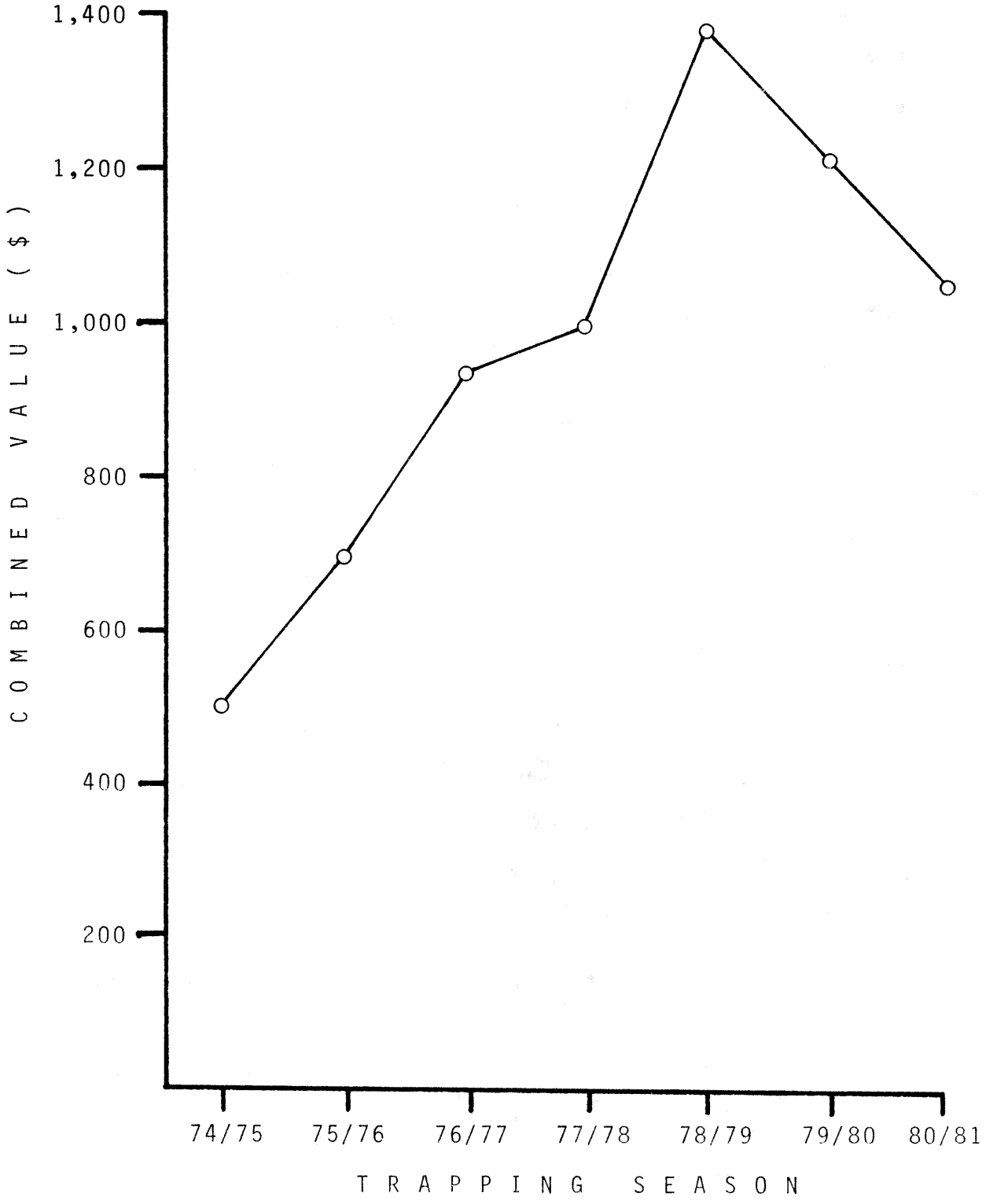

Figure 3. Combined value for one pelt of each furbearer species trapped in the study area.

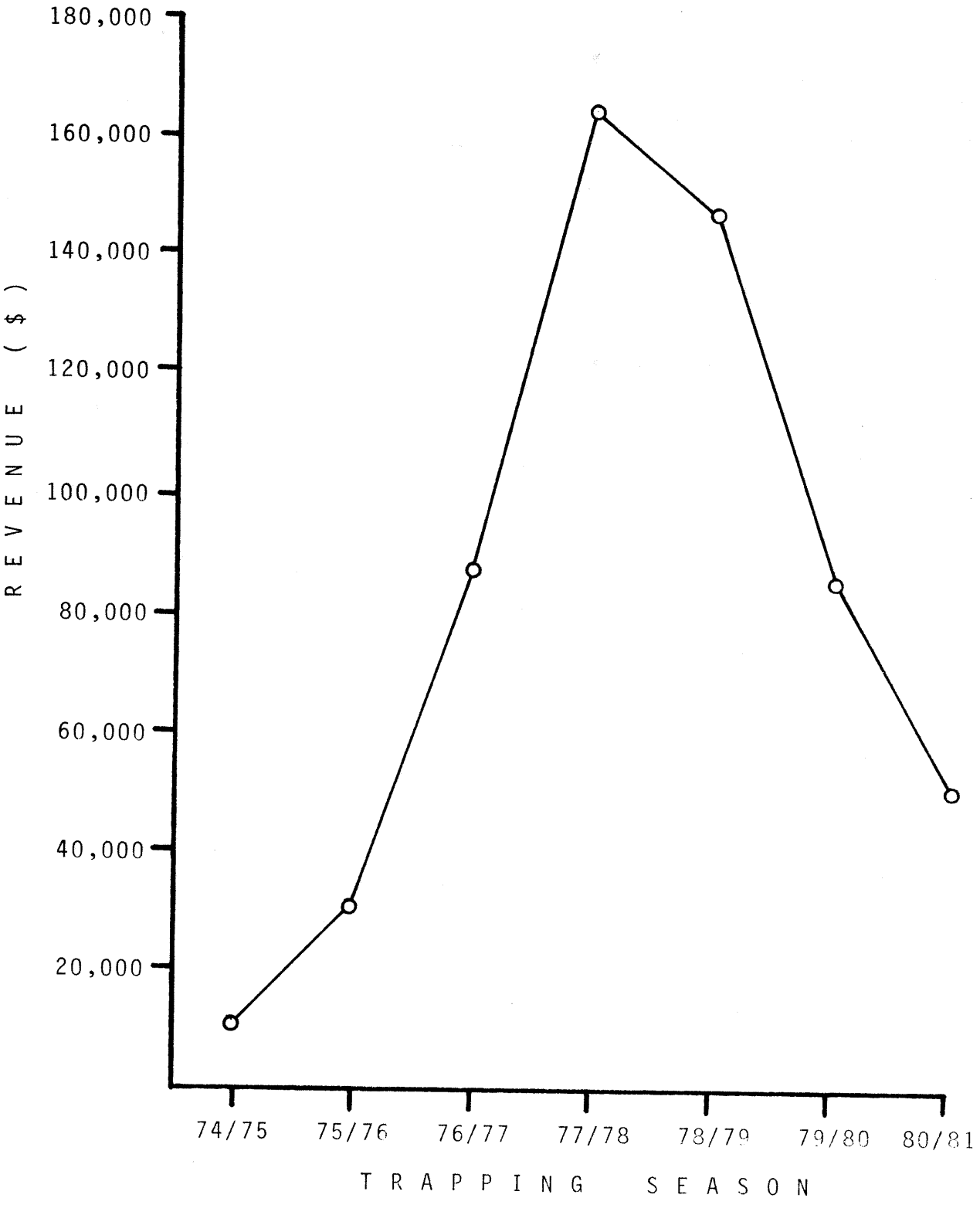

Figure 4. Annual fluctuations in total revenue for traplines in all Groups from 1974-75 to 1980-81.

Table 3. Total revenue and relative economic importance of individual species in 1974-75.

Rank	Species	No. taken	Total ($) value
1	Lynx	45	4,032.00
2	Muskrat	1,998	3,743.85
3	Beaver	92	1,389.75
4	Mink	30	481.75
5	Squirrel	518	353.97
6	Wolf	4	268.00
7	Marten	14	267.00
8	Black Bear	3	87.00
9	Fox - Red	3	86.00
10	Weasel	86	85.02
11	Fox - Cross	1	35.00
12	Fisher	1	25.00
		Total revenue:	$ 10,854.34

Table 4. Total revenue and relative economic importance of individual species in 1975-76.

Rank	Species	No. taken	Total ($) value
1	Lynx	76	15,929.00
2	Muskrat	3,605	8,953.90
3	Beaver	229	3,126.50
4	Mink	52	1,252.00
5	Coyote	7	479.00
6	Fox - Red	6	384.00
7	Otter	2	164.00
8	Black Bear	5	135.00
9	Fox - Cross	2	89.00
10	Fisher	2	65.00
11	Squirrel	112	58.96
12	Fox - Silver	1	45.00
13	Weasel	41	42.88
14	Wolverine	1	40.00
15	Wolf	1	40.00
16	Fox - White	1	30.00

Total revenue: $ 30,834.24

Table 5. Total revenue and relative economic importance of individual species in 1976-77.

Rank	Species	No. taken	Total ($) value
1	Lynx	274	62,436.00
2	Mink	341	8,488.33
3	Muskrat	2,964	8,375.65
4	Beaver	270	5,147.50
5	Otter	11	725.00
6	Squirrel	1,121	651.49
7	Fox - Red	11	589.00
8	Wolverine	4	555.00
9	Wolf	4	245.00
10	Fisher	5	245.00
11	Fox - White	5	166.50
12	Weasel	153	159.77
13	Coyote	1	86.00
14	Black Bear	5	60.00
15	Fox - Silver	1	40.00
16	Marten	2	38.00
17	Fox - Cross	1	30.00
		Total revenue:	$ 88,038.24

Table 6. Total revenue and relative economic importance of individual species in 1977-78.

Rank	Species	No. taken	Total ($) value
1	Lynx	620	144,360.00
2	Mink	326	7,933.50
3	Muskrat	1,341	4,519.90
4	Beaver	223	3,181.50
5	Fox - Red	26	1,871.50
6	Fox - Cross	7	960.00
7	Squirrel	802	574.40
8	Wolf	4	568.00
9	Fisher	8	533.00
10	Wolverine	3	475.00
11	Otter	9	439.00
12	Weasel	162	134.35
13	Marten	6	116.00
14	Black Bear	3	110.00
15	Fox - Silver	2	67.00
16	Coyote	1	40.00

Total revenue: $ 165,883.15

Table 7. Total revenue and relative economic importance of individual species in 1978-79.

Rank	Species	No. taken	Total ($) value
1	Lynx	366	126,955.00
2	Mink	214	6,443.50
3	Beaver	178	3,644.00
4	Muskrat	751	2,669.88
5	Fox - Red	25	2,113.00
6	Fisher	15	2,063.00
7	Fox - Cross	11	1,367.00
8	Squirrel	645	1,276.20
9	Wolverine	3	570.00
10	Wolf	3	540.00
11	Otter	3	220.00
12	Black Bear	2	165.00
13	Marten	3	126.00
14	Weasel	54	68.30
15	Fox - White	1	54.00

Total revenue: $ 148,294.88

Table 8. Total revenue and relative economic importance of individual species in 1979-80.

Rank	Species	No. taken	Total ($) value
1	Lynx	199	51,503.00
2	Beaver	368	11,993.25
3	Mink	231	8,597.00
4	Muskrat	519	2,962.80
5	Fox - Cross	26	2,470.00
6	Fox - Red	32	2,132.50
7	Fisher	16	2,132.00
8	Squirrel	1,013	1,484.19
9	Wolverine	6	895.00
10	Marten	21	708.75
11	Black Bear	9	560.00
12	Fox - White	10	420.00
13	Wolf	2	315.00
14	Otter	3	225.00
15	Fox - Silver	3	210.00
16	Weasel	67	81.40
17	Coyote	1	58.00
		Total revenue: $	86,747.89

Table 9. Total revenue and relative economic importance of individual species in 1980-81.

Rank	Species	No. taken	Total ($) value
1	Lynx	117	33,293.00
2	Mink	114	4,302.50
3	Beaver	134	3,994.00
4	Fox - Red	24	1,692.00
5	Fox - Cross	18	1,559.00
6	Fisher	18	1,440.00
7	Muskrat	351	1,406.70
8	Squirrel	1,127	1,299.09
9	Marten	17	560.00
10	Wolverine	2	425.00
11	Otter	7	425.00
12	Wolf	3	285.00
13	Coyote	3	240.00
14	Fox - Silver	2	230.00
15	Fox - White	3	87.00
16	Weasel	65	82.95
17	Black Bear	2	70.00
		Total revenue:	$ 51,391.24

one trapline for the period from 1978-79 to 1980-81. Similarly, individual trapping areas in Groups II and III showed increases in fur revenue during the period of general decline from 1978-79 to 1980-81.

Trapping revenue for traplines having more than 25 percent of their areas affected by recent fire (Group III) peaked in 1977-78 (Fig. 2). In Figure 2, it is shown that trapping revenue for traplines in Groups I and II increased slightly from 1977-78 to 1978-79, whereas revenue from Group III trapping areas declined. Two trapping areas in Group III were affected by fire between 1977-78 and 1978-79 (Fig. 1).

DISCUSSION

The extent to which forest fires in the study area influenced the decline in trapping revenue since 1978-79 is open to speculation because there was a concurrent drop in fur prices. Figure 2 shows that traplines in Group I, those that had not been affected by recent fires, experienced a decline in trapping revenues after 1978-79. This trend toward lower trapline earnings continued in 1979-80 and 1980-81. If Group I traplines are used as a standard of comparison in judging the effects of forest fires on trapping revenue, it may be concluded that other factors were controlling trapline earnings because there was a general overall reduction in fur revenue in all Groups. The initial hypothesis would have been verified if trapping revenue for Group I traplines had remained stable or increased while the other groups, those that had been burned, declined.

The gross change in trapping revenue between 1978-79 and 1980-81 includes a wide range of factors that affected the trapping revenue in the study area. The impacts of wildfire are obscured by inclement weather that hinders trapping, environmental factors affecting abundance and distribution of furbearers, and a general disinclination from trapping when fur prices are declining. All of these factors may be considered together as influencing trapping effort.

In 1978-79, fur prices paid to trappers in the study area were at an all time high. Prior to 1978-79, the general trend was one of higher trapline earnings and the post-1978-79 trend has been toward lower trapping revenue. The pre-1978-79 trend may be

attributed to greater trapping effort because the general trend of increasing trapline earnings occurred concurrently with higher prices for furs paid to trappers (Table 2, Fig. 3). Following the peak in 1978-79, the price paid to trappers underwent a decline concurrently with the general reduction in trapline revenue.

Species Composition of the Harvest

In Tables 3 to 9, the importance of each species of furbearer is considered in relation to its contribution to the total trapping revenue in each year. The relative importance of each species is determined by its abundance and the revenue collected for it.

Trapline earnings are greatly influenced by the harvest of a relatively small number of species; a factor that is particularly apparent with respect to lynx (Lynx lynx) pelts sold each year. The dramatic change in trapping revenue that occurred from 1977-78 to 1980-81 is largely accounted for by the number of lynx taken in those years (Fig. 5, Tables 6-9). Fur revenue in the study area peaked in 1977-78 (Fig. 4, Table 6) because 620 lynx pelts contributed $144,360 to the total revenue for that year. In 1978-79 the 366 lynx pelts taken in the study area had a value of $126,955. In 1979-80 and 1980-81, the numbers of lynx pelts were 199 and 117, resepctively. Revenue from lynx in 1979-80 was $51,503 and $33,293 in 1980-81.

The post-1977-78 trend in the number of lynx pelts reported for the study area differ notably from trends reported in harvest statistics for N.W.T. (Tinling 1982) and for Canada (Statistics

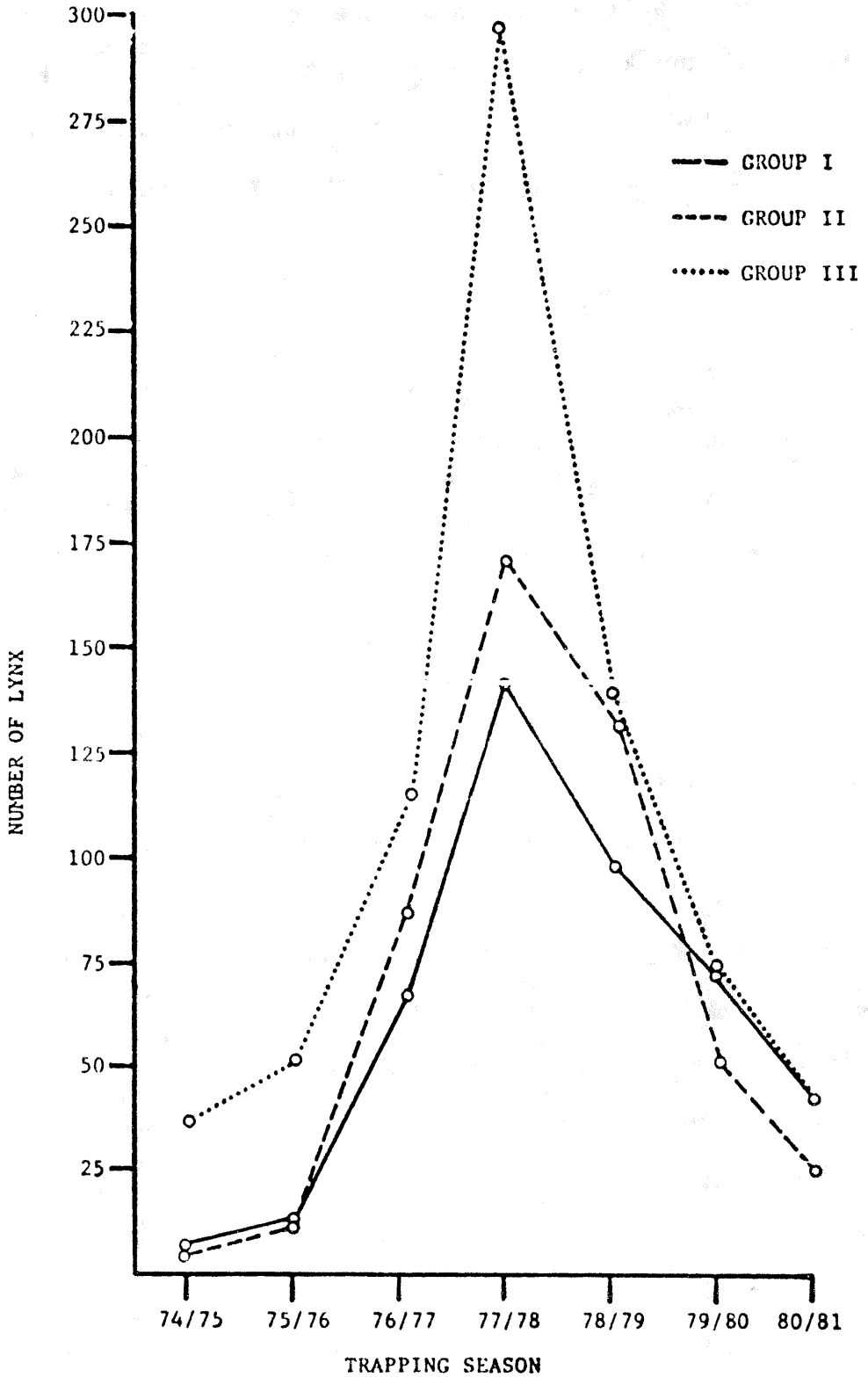

Figure 5. Annual fluctuations in the number of lynx pelts reported for each Group from 1974-75 to 1980-81.

Canada 1983). These harvest data show increasing numbers of lynx pelts harvested from 1977-78 to 1981-82. We have no way of knowing whether this inconsistency stems from a decline in lynx numbers in the Fort Smith area or from other factors (e.g., diminished effort). Analysis of fur returns (Dasmann 1964) and fieldwork (Keith et al. 1978) have concluded that the numbers of lynx tend to be dependent on the numbers of snowshoe hares (Lepus americanus). We cannot ascertain if the trend in the numbers of lynx pelts after 1977-78 is a function of prey abundance because the hare population was not monitored.

There was a 5.3-fold difference between the highest (620) and lowest (117) number of lynx pelts sold in 1977-78 and 1981-82, respectively. Peaks and low lynx densities in central Alberta are reported to vary by 4.3-fold in response to cyclic fluctuations in snowshoe hare densities (Brand et al. 1976). The observed magnitude of change in the number of lynx pelts taken by trappers east of Fort Smith could be a numerical response to fluctuations in the abundance of snowshoe hares.

In years with highest fur revenues, 1977-78 and 1978-79 (Tables 6 and 7), money from the sale of lynx pelts contributed 87 percent and 86 percent, respectively, to the annual total revenue. Individual trappers, who sold more than $10,000 worth of furs (Table 10), derived an average of 75 percent[1] of their total earnings from the sale of lynx pelts.

Fire is often cited as a destructive influence for species that ordinarily occur in climax forest communities. Changes in

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1 Ranging from 58 to 96 percent.

Table 10. Number of trappers, and percentage of total, earning less than $1,000; more than $1,000 but less than $10,000; and more than $10,000.

Trapping season	< $1,000		$1,000 to $10,000		> $10,000		Total # trappers
	#	%	#	%	#	%	
1975/75	14	82	3	18	nil	nil	17
1975/76	14	61	8	35	1	4	23
1976/77	14	41	18	53	2	6	34
1977/78	17	40	20	49	4	10	41
1978/79	9	32	15	54	4	14	28
1979/80	12	36	21	64	nil	nil	33
1980/81	16	53	14	47	nil	nil	30

abundance of marten (Martes americana) in burned forest is a concern frequently expressed by trappers; however, such direct cause and effect is not reported in the literature.

Investigations by Lensink et al. (1955), Murie (1961), and Weckwerth and Hawley (1962) have shown that marten utilize opportunistic foraging strategies in which there is no dependence on food items that occur exclusively in mature forest. Marshall (1942) concluded that food conditions may govern the ecological requirements for marten. Steventon (1982) reported that marten use leaning and fallen trees, resulting from natural forest mortality in mature stands, in order to gain below snow access. Foraging conditions for marten may improve in burns where fire effects produce a mosaic of plant communities (Koehler 1977). Post-burn increases in the populations of seed-eating mouse species that marten prey upon are reported in the literature (Ahlgren 1966). Improved below snow access for hunting and resting, ecological diversity and greater prey abundance may reduce the impact of fire on marten soon after burning.

In 1979-80, the trapping season immediately following widespread burning in 1979, marten increased to tenth place in the relative-value ranking system (Table 8). In 1980-81, the relative importance of marten advanced to ninth place (Table 9). This change disagrees with the presupposed detrimental effects of forest fires on marten trapping success.

Market conditions and species abundance in one or two species can greatly influence trapping revenue from individual traplines. Comparison of Figures 2 and 5 shows that trends in trapping

revenue parallel trends in the number of lynx pelts that were reported. Furthermore, trends in revenue and numbers of lynx pelts for areas that were affected by forest fires are paralleled by similar trends in areas that did not experience recent burning.

CONCLUSION

Fur harvest statistics show that trapping revenue in the Fort Smith area has declined since 1979. This trend commenced in 1977-78 and affected trapping areas which did not experience any burning in 1979, as well as those with 25% or more of their areas affected by fire. These fluctuations can be traced to changes in the number of lynx pelts that were sold yearly to a general lowering in fur prices. These factors point to a complex of variables which make it difficult to isolate a definite cause-and-effect relationship between trapping success and any single factor, such as forest fire.

RECOMMENDATIONS

There is a serious lack of reliable information that can be used as the basis for assessing fire effects on the trapping economy. Fur purchase records have relevance as indicators of long-term trends if trappers sell their furs to fur traders in the same collection centre from year to year. However, reliable information about trapping success and effort must come directly from trappers.

1. An information gathering system that compiles fur harvest and trapping intensity data from trapping returns should be implemented. Such a system could be developed through a cooperative effort between the Department of Renewable Resources and the Hunters' and Trappers' Associations (HTA) in trapping communities. Contact with trappers in the field is important to verify the location of productive trapping areas. If a trapper declares that pelts sold by him came from a particular trapline, there is no a priori reason to doubt him, but the reliability of information can be earned through close and frequent contact with the trapline administrators.

2. The local trapping economy of the Fort Smith study area should receive further and more intensive study to analyze trends in the fur harvest in relation to post-fire habitat changes in areas burned in 1979. Concurrently, studies on the ecology and population dynamics of important furbearer

species should be undertaken. Available data do not support the generalized effects of burning that are frequently adduced through indirect means; therefore, specific research is required.

3. Methodology for assessing fire effects should be developed. Landsat imagery should be used to map burned areas, with special attention to distribution and configuration of unburned areas in the general fire perimeter.

4. Trappers should receive counselling and assistance to reduce fire hazard around cabin sites and places where equipment is stored.

5. A scheme to stabilize trapline earnings should be considered. Such a program should have the object of buffering the trapping economy against price reduction, as well as providing relief from losses due to natural hazards, like fire.

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