CARCASS EXAMINATION OF HARVESTED MARTEN IN NORTHWESTERN NWT, 1991-92

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ABSTRACT

This report summarizes marten harvest trends and analysis of the fourth year of a carcass collection program, conducted in the Northwest Territories during 1991-92.

The 1991-92 NWT harvest was 21,129 martens, an increase of about 3,000 from the previous year. Average pelt price increased 10% from the previous year to $62.

A total of 642 carcasses was collected from Sahtu trappers in Ft. Good Hope, Ft. Franklin, and Ft. Norman to evaluate differences in trapping intensity, body condition, and reproductive parameters. The age structure of martens harvested was similar between the harvests from Ft. Good Hope and Ft. Norman; juveniles made up about 50% and yearlings 19-23% of the harvest in these two communities. The Ft. Franklin sample was heavily skewed towards older animals. Only 6% of the harvest were juveniles, and the largest portions of the harvest were in the 1-2 and 6-7 age classes. Sixty-five percent of the martens were harvested by 1 December. Conventional age and sex ratios suggest that overall trapping pressure was moderate in Fts. Norman and Good Hope, but high in Ft. Franklin.

Body fat content of Ft. Franklin marten tended to be higher than Ft. Good Hope animals. Among the past 4 years there were no differences in body fat of Ft. Good Hope adults. All reproductive parameters were lower in Ft. Franklin females compared with martens from the other communities. Mean litter size for Ft. Good Hope martens over the past four winters were similar.

The unusual age structure observed in the Ft. Franklin harvest may not indicate overharvest, but may be the result of the initial year of harvesting a previously unharvested population (i.e., a population that is being impacted by some density-dependent feedback on reproduction and/or juvenile survival). Examination of age and sex ratios in the harvest should be coupled with ongoing mapping of current trapline distribution to provide better monitoring of harvest levels and intensity in the areas examined. Large untrapped refugia adjacent to most traplines may provide self-regulation of the harvest.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Martens (*Martes americana*) continue to be the single most valuable furbearing resource to trappers in the Northwest Territories (NWT). Marten pelt prices generally have weathered the recent downturn in the fur industry, ensuring that pressure on marten stocks likely will remain at least moderate for the near future.

Given the importance of martens to northern trappers, a program has been developed to monitor the harvest in selected areas. This annual report summarizes marten harvest trends and monitoring conducted during the past year. Some analyses and interpretations of the data have been conducted, but the information and conclusions provided here should be considered preliminary. Previous studies have been summarized in Poole (1989, 1990, 1991) and Poole et al. (in press).

The following areas will be covered in this report:

1. Trends in harvest and pelt price.
2. Carcass collections conducted primarily to:
   a) examine age and sex ratios in the harvest, and
   b) provide body and reproductive condition indices, and morphometric comparisons.

MARTEN HARVEST

During 1991-92, 1010 out of 1914 trappers in the NWT sold marten pelts, and harvested 21,129 pelts worth $1,307,000. Marten harvests were high for much of the past decade, decreased significantly starting in 1989-90, and increased in 1991-92 (Fig. 1).

Harvests in recent years were concentrated throughout the western NWT (Table 1). Overall the harvest increased 16% over the previous year. Pelt production increased by 14% in the north Mackenzie (Sahtu and Inuvik areas), and 17% in the Ft. Smith region (all communities south of Ft. Norman). No assessment of harvest effort has been conducted, but the total number of trappers increased 23% and the number of trappers who sold marten pelts increased 24% between years, likely indicating an overall increase in trapper effort.

The average price of a marten pelt increased during the late 1970s and increased again in the late 1980s to peak at $110 in the 1986-87 season (Fig. 1). The average pelt price for the 1991-92 season was $62, an increase of 10% from 1990-91.

NWT MARTEN HARVEST
1957-58 to 1991-92

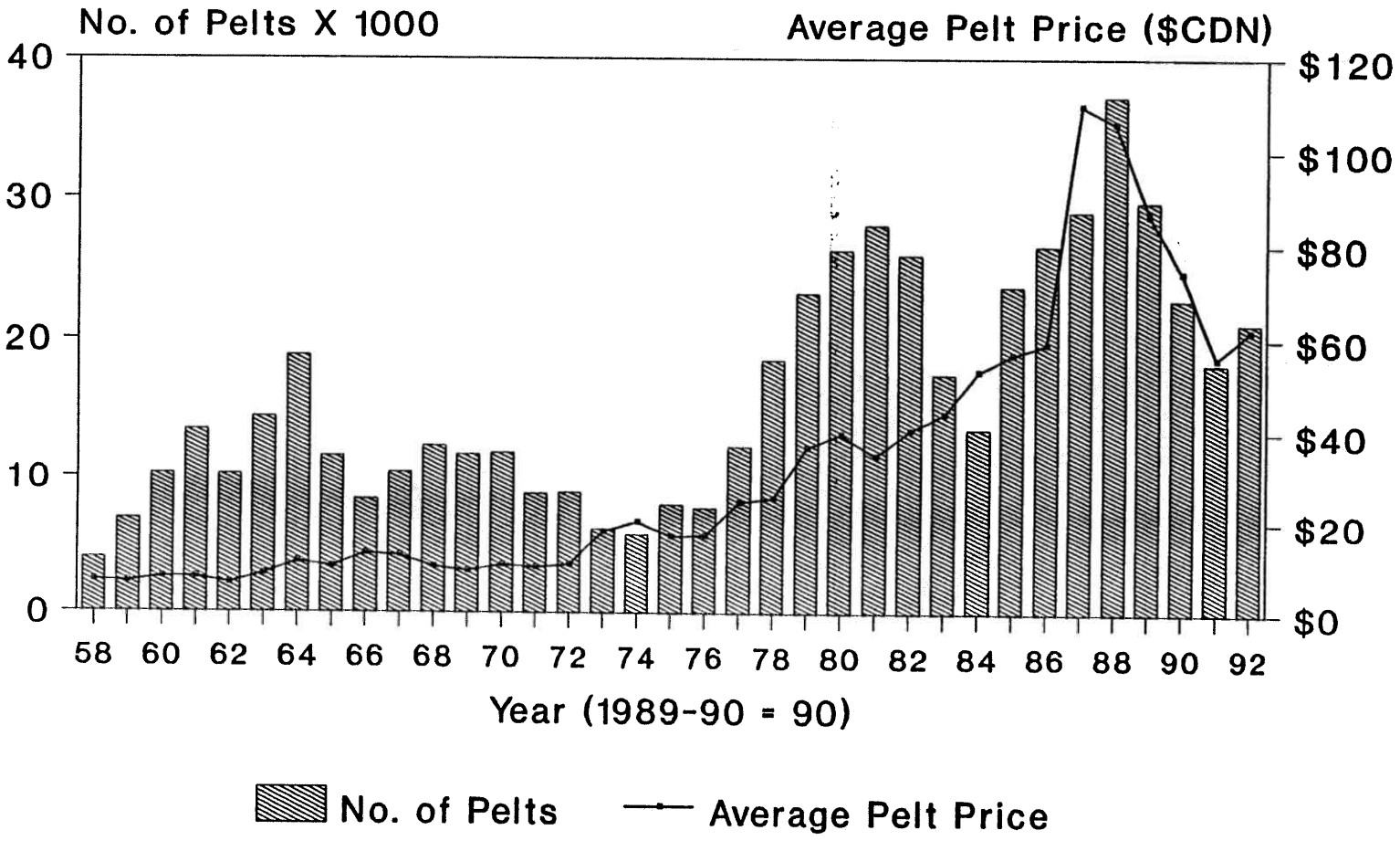

Figure 1. Marten harvest and average pelt price for the NWT, 1957-58 to 1991-92.

Table 1. NWT marten harvest from fur returns for 1990-91 and 1991-92.

Community	1990-91	1991-92	% Change
Aklavik	171	222	+30
Arctic Red River	317	461	+45
Colville Lake	626	979	+56
Ft. Franklin	673	1073	+59
Ft. Good Hope	1732	1634	-6
Ft. McPherson	1410	835	-41
Ft. Norman, N Wells	519	890	+71
Inuvik	196	330	+68
Tuktoyaktuk	40	61	+53
Paulatuk	0	1	--
Dettah	121	119	-2
Ft. Liard	1685	2122	+26
Ft. Providence	447	408	-9
Ft. Rae	1538	903	-41
Ft. Reliance	15	91	+507
Ft. Resolution	415	534	+29
Ft. Simpson	1893	2405	+27
Ft. Smith	311	394	+27
Hay River	264	408	+55
Jean Marie River	35	63	+80
Kakisa Lake	179	194	+8
Lac La Martre	494	390	-21
Nahanni Butte	275	385	+40
Pine Point	29	46	+59
Rae Lakes	1173	1060	-10
Snare Lake	358	317	-11
Snowdrift	391	428	+9
Trout Lake	1659	1805	+9
Yellowknife	238	290	+22
Wrigley	981	697	-29
Alta./Sask.	44	1584	--
Total NWT	18229	21129	+16

CARCASS COLLECTIONS

Introduction

The winter of 1991-92 was the fourth season that marten carcass collections were conducted in selected areas of the NWT. Ron Graf, Regional Biologist in Ft. Smith, collected approximately 250 carcasses from Nahanni Butte, Ft. Simpson, and Trout Lake trappers, and Inuvik biologists examined 530 carcasses from an area southwest of the Mackenzie Delta; data from these samples will be reported elsewhere. This paper deals with a collection of 642 carcasses from Sahtu trappers (Ft. Good Hope, Ft. Franklin and Ft. Norman).

The objectives of the 1991-92 collection were several-fold:

1. Age and sex ratios of harvested animals were examined. These ratios provide an indication of trapping intensity on a marten population because of differences in vulnerability to trapping between males and females and between juveniles and adults (Strickland and Douglas 1987). Because of seasonal variation in the relative proportion of age and sex classes of martens harvested, the entire harvest from a trapper or an area must be examined. Carcass examination can also document the chronology of age and sex classes in the harvest, that is, which classes tend to be taken more frequently at certain times of the season.
2. Carcasses from the harvest were examined to provide a comparison of marten body condition (using fat indices), reproductive parameters, and size differences among martens from the various areas.

Methods

With the assistance of Department of Renewable Resources (DRR) staff in Fts. Good Hope, Franklin, and Norman, cooperative trappers with a history of high marten harvests were provided with carcass tags, and were asked to tag all martens harvested, noting location and date taken. Trappers were asked to turn in their entire season's catch so that the complete chronology of age and sex over the trapping season would be obtained. Carcasses were examined in Yellowknife. Sex, body and tail length, weight, and fat indices (weight of fresh omental fat over fresh weight [minus stomach contents] of skinned carcass) (Buskirk and Harlow 1989) were recorded. Skinned carcass weight approximates 83% of whole body weight (Strickland and Douglas 1987). Stomach contents were weighed and frozen for later examination.

Ovaries from females judged to be 1 year or older (based on temporal muscle coalescence; Poole et al. in press) were stored in 70% alcohol, and subsequently soaked in water overnight and sectioned by freeze-microtome. Staining with Masson's trichrome was not conducted since there appeared to be no overall benefit to the process (Poole 1989). Corpora lutea counts were used to assess ovulation rates and *in utero* litter size in serially sectioned ovaries (Strickland and Douglas 1987). Counts were conducted by two technicians. Because marten exhibit delayed implantation (Strickland and Douglas 1987), corpora lutea counts reflect the number of young that would have been born during the spring after harvest had the female remained alive.

A lower canine and a lower fourth premolar were extracted by simmering mandibles in hot water (90 C) for 30-40 minutes. Following procedures outlined in Dix and Strickland (1986), the ratio of pulp cavity width:tooth width (percent pulp) in lower canines, as determined from radiographs, was measured. Radiographs were taken at the Stanton Yellowknife Hospital using a Senograph 600T Mammo Unit and Kodak Mammography film

exposed at 30 Kv and 7 Mas. Tooth and pulp cavity width were measured using a Canon microfiche reader, which projected images at 23.5X.

Lower fourth premolars from martens judged to be adults (based on percent pulp cavity and temporal muscle coalescence) were aged by cementum analysis by Matson's Laboratory in Milltown, MT. Any martens in questionable categories using either of the age class determination techniques and virtually all of the Ft. Franklin sample also were aged by cementum analysis.

Data were examined using SAS (1988) software. In this report age class "0" (juvenile) denotes martens in their first winter of life; yearling martens (in their second winter of life) are designated by age class "1". Statistical significance is at the $P \leq 0.05$ level.

Results

A total of 642 carcasses was collected from Ft. Good Hope (347 carcasses from 4 trappers), Ft. Franklin (252 carcasses from 2 trappers) and Ft. Norman (43 carcasses from 1 trapper). The Ft. Good Hope trappers were grouped into 2 groups that trapped adjacent traplines, and the Ft. Franklin trappers were combined into 1 for the same reason. Because of small sample size, the Ft. Norman sample was excluded from some analyses.

The age distribution of martens taken in the Ft. Good Hope and Ft. Norman areas were similar (Fig. 2). Juveniles made up about 50% and yearlings comprised 19-23% of the sample from each community. The Ft. Franklin sample, however, was heavily skewed towards older animals. Juveniles made up only 6% of the harvest. The largest portions of the harvest were in the 1-2 and 6-7 year age classes. The oldest marten was 14 years of age.

The age and sex ratios from the collection areas differed considerably (Table 2). The juvenile:female and male:female ratios were highest in the Ft. Norman sample, and lowest in

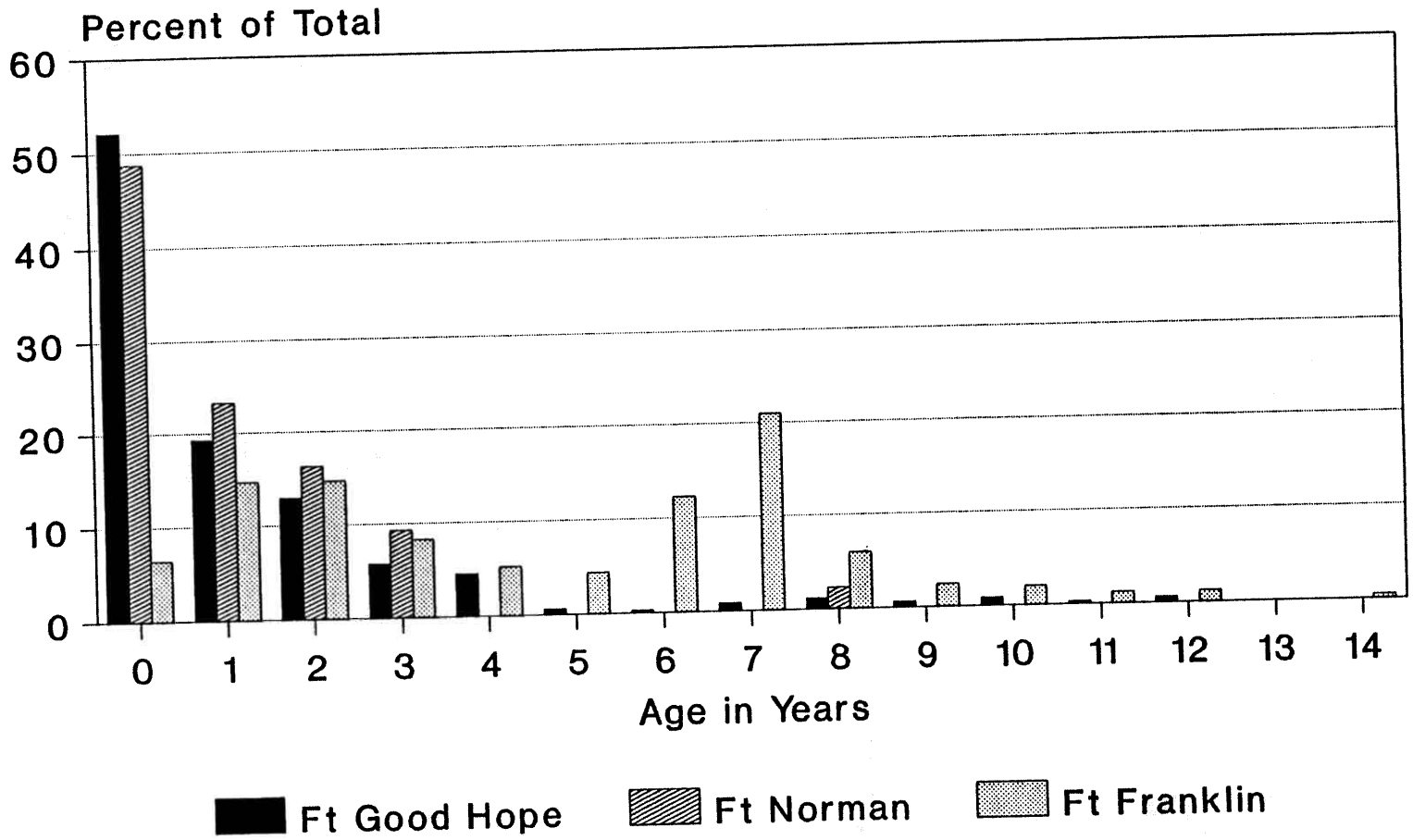

Figure 2. Age structure of marten carcasses collected from 3 NWT communities, 1991-92: Ft. Good Hope (n = 347), Ft. Franklin (n = 252), and Ft. Norman (n = 43).

Table 2. Age and sex ratios from marten carcasses, 1991-92.

Community/ Trapper	Sample Size	Ratios		
		Juv:1+Fem	Juv:2+Fem	Male:Female
Ft. Good Hope				
All	347	2.45	4.02	1.24
Rory L.	207	2.41	4.82	1.35
Lac Belot	140	2.50	3.26	1.09
Ft. Franklin				
All	252	0.14	0.18	1.15
Ft. Norman	43	3.00	7.00	1.69

the Ft. Franklin sample. The extremely low juvenile:female ratios from the Ft. Franklin harvest reflects the very low number of juveniles in the harvest. Sixty-five percent of the harvest from the Sahtu was taken in the first 5 weeks of the trapping season (by 30 November), and 81% was harvested by 1 January. No distinct trend was observed in the relative proportions of sex and age classes in the harvest as the season progressed.

As suggested by Thompson and Colgan (1987), there were significant differences in body fat between animals caught in leghold and quick-kill traps (ANOVA, $\underline{F} = 5.69$, 14,353 df, $\underline{P} < 0.0001$), thus comparisons among years can only be conducted examining animals caught by the same trap type. Ft. Franklin marten (caught in leghold traps) tended to be fatter than those caught by Ft. Good Hope trappers, significantly so for males ($\underline{P} < 0.001$) but not for females ($\underline{P} = 0.13$)(Table 3). Among the past 4 years there were no significant differences in body fat of Ft. Good Hope martens 1+ years old (males $\underline{P} = 0.80$; females $\underline{P} = 0.10$).

Table 3. Mean body fat of marten carcasses by sex and community[1].

Sex/ Community	Trap Type	Age Class (n) 0	1	2	3+
Male					
Ft. Good Hope	LH	2.88 (100)	1.60 (38)	1.74 (31)	1.74 (23)
Ft. Franklin	LH[2]	1.99 (11)	2.43 (13)	2.13 (22)	2.23 (89)
Ft. Norman	QK	5.56 (12)	2.31 (6)	3.11 (6)	3.28 (3)
Female					
Ft. Good Hope	LH	2.34 (81)	1.93 (29)	1.88 (14)	2.04 (31)
Ft. Franklin	LH[2]	2.76 (5)	2.50 (24)	2.10 (15)	2.51 (73)
Ft. Norman	QK	3.76 (9)	2.50 (4)	3.94 (1)	3.93 (2)

[1] Body fat derived from the following formula from Buskirk (1983):
Body fat = 603 x (omentum wt/carcass wt) + 0.87.
[2] Most (90%) of the Ft. Franklin harvest were caught in leg-hold traps.

Pregnancy rates differed markedly among the communities (Table 4). All parameters, including percent pregnant for both yearlings and older females, and mean litter sizes were lower for Ft. Franklin martens compared with Ft. Good Hope martens. Only 15% of yearlings from Ft. Franklin marten had corpora lutea. Comparison of mean litter size for Ft. Good Hope martens from 1988-89 to 1991-92 revealed no significant differences (ANOVA, $P = 0.59$).

Earlier examination of marten skull length among communities across the western NWT revealed that martens from the Ft. Good Hope/Colville Lake area are the largest in the NWT, and are among the largest in North America (Poole and Graf, unpubl. data). Comparisons between the Ft. Good Hope and Ft. Franklin martens for 1991-92 show Ft.

Table 4. Mean counts of corpora lutea (CL) and percentage of females pregnant by age class of martens, 1991-92.

Community	Age Class	n	Percent Pregnant	Mean CL/ Preg. Fem.	Mean[1] Fecundity
Ft. Good Hope	1	20	70	3.86	2.70
	2+	39	100	4.44	4.44
Ft. Franklin	1	19	16	3.33	0.11
	2+	76	80	3.62	2.91
Ft. Norman	1	4	75	4.00	3.00
	2+	1	-	5.00	5.00

[1] Mean fecundity = mean CL per pregnant female X pregnancy rate.

Franklin males were significantly larger than Ft. Good Hope males (t-test, $P < 0.001$), but no differences for females ($P = 0.27$).

Discussion

Population indices as obtained from carcass analyses may provide an indication of harvest impact. As summarized by Strickland and Douglas (1987:541), "the differences in vulnerability between males and females, and between juveniles and adults, are reflected in the sex and age ratios of trapped animals, and these ratios form the bases of indices of overharvest." A harvest with a low proportion of juveniles and a high proportion of adult females indicates that the population may be overharvested (Strickland and Douglas 1987, Thompson and Colgan 1987). Strickland and Douglas (1987) suggest that a healthy harvest has occurred if the ratio of juveniles to adult females 2+ years old is twice, or more, the fecundity rate (based on corpora lutea counts in the previous winter). If radiographs are used

to separate juveniles from adults (1+ years), a harvest rate of at least three juveniles per adult female 1+ years represents an adequate harvest level (Strickland and Douglas 1987, Thompson and Colgan 1987). Sex ratios will similarly indicate potential overharvest, although less strongly (Strickland and Douglas 1987, Thompson and Colgan 1987). Since usually two or three males are caught per female caught, sex ratios that are nearly even or are dominated by females may indicate overharvest (Quick 1956, Soukkala 1983, Archibald and Jessup 1984).

Using the above logic, the sex and age ratios from the Ft. Good Hope harvest suggests moderate trapping pressure, and from the Ft. Franklin harvest severe overharvesting. I doubt the latter interpretation is correct for several reasons. The Ft. Franklin trapping took place on the northeast side of Great Bear Lake, where no trapping had taken place for at least 17 years (W. Bayha, pers. comm.). The harvest from the area was relatively high, with no pronounced shift to older animals or females in the harvest as the season progressed. In addition, a relatively normal male:female ratio was observed, all reproductive parameters were lower than usually found, and the Ft. Franklin animals were as fat or fatter than the Ft. Good Hope sample.

In a study of a previously un-harvested marten population in Quebec, Fortin and Cantin (1990) found the initial juvenile:1+ female ratio of 4:1 dropped to 2.3:1 by the fourth year of harvest. The authors also observed overall high reproductive parameters, and no change in these parameters in the first 2 years of trapping. The data from the Ft. Franklin harvest do not parallel the results of the Quebec study.

Possible causes for the unusual age structure of the Ft. Franklin harvest may relate to 1) some density-dependent feedback on reproduction and/or juvenile survival (which basically translates to some factor(s) that are shutting down either breeding or survival of young, because the population is essentially saturated), 2) regional prey crashes (not too likely since body fat levels were normal), 3) regional fire history, 4) the fact that the trapped population

is at the northern extent of its range, on a peninsula, not far from tree-line, or 5) any or all of the above. Perhaps alternative techniques need to be developed to monitor the harvest in previously untrapped areas.

Management Recommendations

As noted by Fortin and Cantin (1990), harvest indicators (age and sex ratios in the harvest) are not foolproof guidelines to trapping intensity, and often give conflicting signals, for instance when a previously untrapped area with a relatively stable population and a high proportion of adults is initially harvested. Fortin and Cantin (1990) recommend that population size be estimated using density and trapping success, and that harvest rate should not exceed 25% of the pre-harvest population. To obtain this information, however, effort (number of trap-nights [TN]), success (number of captures per TN), and yield (number of martens harvested per 10 km^2) is required. Given the group trapping area regime used in most northern areas where there are few or no "registered" traplines that can be managed on a trapline basis, these types of data are difficult to obtain. Other factors that would affect the marten population and harvest rates are the impact of weather and food supply (Thompson and Colgan 1987, Fortin and Cantin 1990).

Monitoring of all these factors may be required in areas where overall trapping pressure is high, for instance where traplines are tightly packed, but may not be possible or the necessary approach in northern trapping areas. Many traplines may be self-regulated. If sufficient unharvested areas (refugia) exist adjacent to the trapline, the harvest would be regulated by the reproductive success and dispersal of martens in the adjacent refugia (Quick 1956, Archibald and Jessup 1984). I recommend that yearly mapping efforts be expended to describe the temporal distribution of traplines used at any time during the winter in the areas

to be monitored. This information, coupled with ongoing monitoring of age and sex ratios in the harvest, may provide better monitoring of the harvest from year to year.

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