CARCASS EXAMINATION OF HARVESTED MARTEN IN NORTHWESTERN NWT, 1990-91

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ABSTRACT

This report summarizes marten harvest trends and analysis of the third year of a carcass collection program, conducted in the NWT during 1990-91.

The 1990-91 harvest was 18,229 pelts, a decline from the 1987-88 high of over 37,000 pelts. Average pelt price dropped 24% from the previous year to $56.

A total of 356 carcasses was collected primarily from Sahtu trappers in Ft. Good Hope and Ft. Franklin to: a) evaluate differences in trapping intensity, body condition, and reproductive parameters, and b) examine techniques to separate juveniles from older age classes.

The age structure of martens harvested was similar between the two communities. Juveniles made up 56% and yearlings 21-22% of the harvest. Sixty percent of the martens were harvested by 1 December. Age and sex ratios suggest that overall trapping pressure was moderate.

Body fat content did not differ between areas or among the last 3 years; generally juveniles had more fat than older martens. Martens from the Sahtu had higher productivity than martens from the other areas of North America; these animals are among the largest and most productive in North America.

The temporal muscle coalescence technique reliably identified > 93% of age and sex classes, and can be used by trappers in the field to determine the proportion of juveniles and older marten in their harvest.

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.

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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 marten harvest in selected areas. This annual report summarizes marten harvest trends, and ongoing research programs 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) and Poole et al. (in press). Marten research conducted by Ron Graf, Regional Biologist in Ft. Smith, including carcass collections and the South Slave live-trapping study, and a radio-tracking study of marten habitat use in a burn near Norman Wells, will be reported elsewhere.

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 1990-91, 817 out of 1551 trappers in the NWT sold marten pelts, and harvested 18,229 pelts worth $1,021,000. Marten harvests have remained high for much of the past decade, but decreased significantly in 1989-90 (Fig. 1).

Harvests in recent years were concentrated throughout the western NWT (Table 1). A general drop in production was observed in most communities compared with 1989-90. Overall the harvest declined 20%. The only significant increases in the harvest between years were seen in Ft. McPherson and Ft. Good Hope. Pelt production decreased by 13% in the north Mackenzie (Sahtu and Inuvik areas), and 23% 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 decreased 24% and the number of trappers who sold marten pelts declined 26% between years, likely indicating an overall decrease 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 1990-91 season was $56, a drop of 24% from 1989-90.

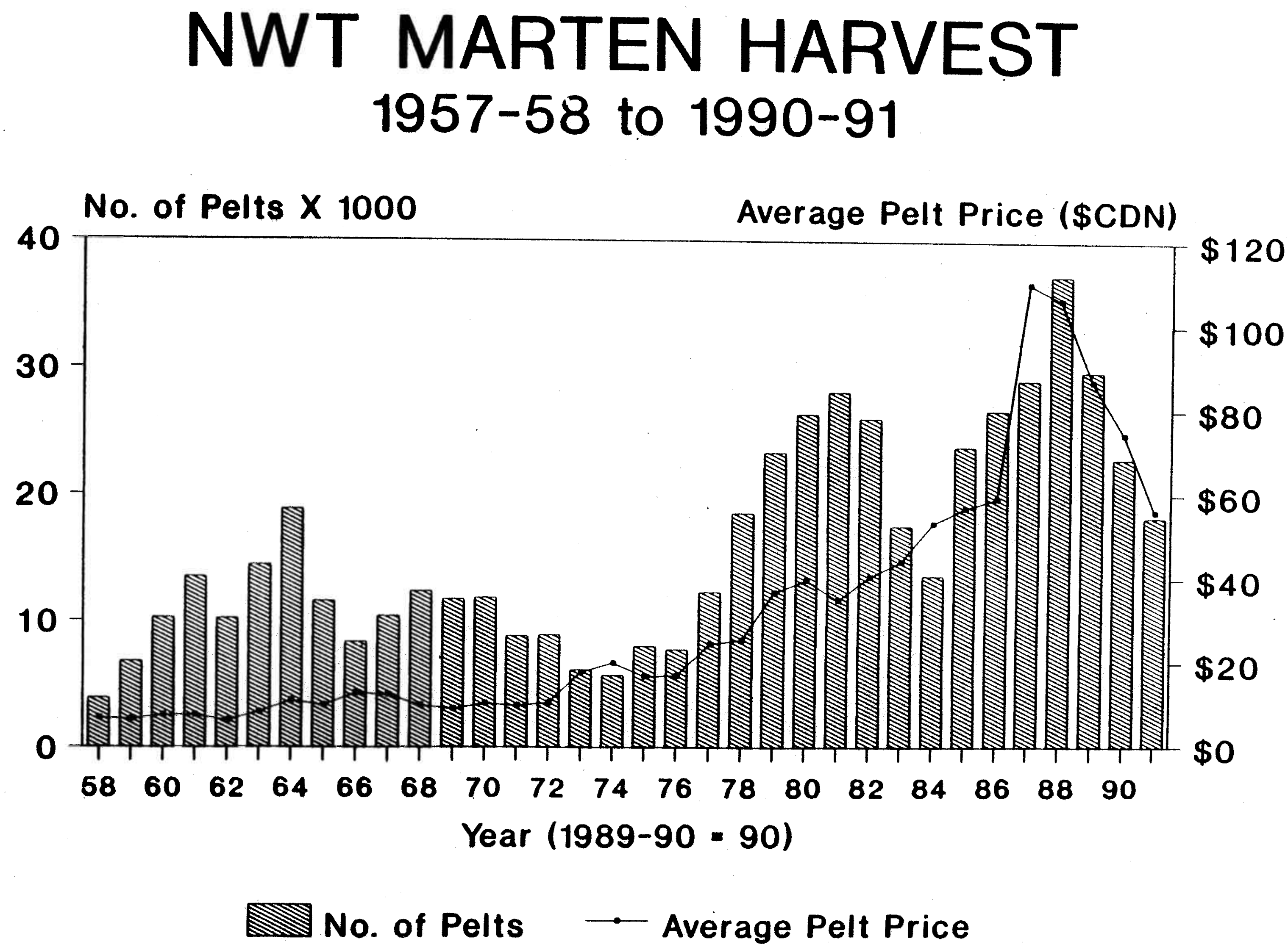

Figure 1. Marten harvest and average pelt price for the NWT, 1957-58 to 1990-91.

Table 1. NWT marten harvest from fur returns for 1989-90 and 1990-91.

Community	1989-90	1990-91	% Change
Aklavik	366	171	-53
Arctic Red River	323	317	-2
Colville Lake	835	626	-25
Ft. Franklin	1268	673	-47
Ft. Good Hope	1360	1732	+27
Ft. McPherson	1041	1410	+35
Ft. Norman, N Wells	643	519	-19
Inuvik	451	196	-57
Tuktoyaktuk	233	40	-83
Paulatuk	27	0	-100
Dettah	89	121	+36
Ft. Liard	1557	1685	+8
Ft. Providence	653	447	-32
Ft. Rae	2281	1538	-33
Ft. Reliance	41	15	-63
Ft. Resolution	445	415	-7
Ft. Simpson	1974	1893	-4
Ft. Smith	431	311	-28
Hay River	471	264	-44
Jean Marie River	150	35	-77
Kakisa Lake	332	179	-46
Lac La Martre	783	494	-37
Nahanni Butte	252	275	+9
Pine Point	24	29	+21
Rae Lakes	1706	1173	-31
Snare Lake	372	358	-4
Snowdrift	644	391	-39
Trout Lake	1705	1659	-3
Yellowknife	359	238	-34
Wrigley	963	981	+2
Other	1044	44	-96
Total NWT	22823	18229	-20

CARCASS COLLECTIONS

Introduction

The winter of 1990-91 was the third season that marten carcass collections were conducted in several areas of the NWT. Ron Graf, Regional Biologist in Ft. Smith, collected approximately 575 carcasses from Nahanni Butte, Ft. Simpson, Trout Lake, and Ft. Smith trappers; data from his sample will be reported elsewhere. This paper deals with a collection of 356 carcasses from Sahtu (Ft. Good Hope, Ft. Franklin and Norman Wells) trappers.

Studies in previous years have examined rapid and cost-effective techniques to separate juvenile (young-of-the-year) from older age classes, and determine sex (if heads alone are collected), so that large samples of carcasses may be processed (Poole 1989, 1990; Poole et al. in press). Radiographs of the percentage of pulp cavity in marten canines (Dix and Strickland 1986, Nagorsen et al. 1988), and the degree of coalescence of the temporal muscle on the top of the skull (Magoun et al. 1989) have been found to be inexpensive and effective techniques to distinguish between juveniles and adults (Poole et al. in press). If heads alone were collected, total skull length (Magoun et al. 1989) was found to determine sex most reliably (Poole et al. in press).

The purpose of the 1990-91 collection was 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) and reproductive parameters among martens from various areas.
3. Further analysis of temporal muscle coalescence as a reliable technique to distinguish between juveniles and adults was conducted.

Methods

With the assistance of Department of Renewable Resources (DRR) staff in Ft. Good Hope and Ft. Franklin, 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. Marten carcasses harvested by a trapper working adjacent to the marten study area near Norman Wells also were examined. 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. A total of 356 carcasses was collected from Ft. Good Hope (201 carcasses from three trappers), Ft. Franklin (137 carcasses from two trappers) and Norman Wells (18 carcasses from one trapper). Because of the relative proximity of trapping areas ($<$120 km apart), samples from Ft. Good Hope and Ft. Franklin were combined (Sahtu area) for some analyses. Because of small sample size, the Norman Wells sample was excluded from some analyses.

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; Magoun et al. 1989) 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.

All lower canines were extracted by simmering lower jaws in hot water 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 canines 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 were also 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 $\underline{P} \leq 0.05$ level.

Results

The age distribution of martens taken in the Ft. Good Hope and Ft. Franklin areas were similar (Fig. 2). Juveniles made up 56% and yearlings comprised 21-22% of the sample from each community. The Norman Wells sample was heavily skewed towards juveniles. The oldest martens were 9 years of age.

The age and sex ratios from the two main collection areas differed somewhat (Table 2). The juvenile:2+ female ratio was slightly higher from the Ft. Franklin sample compared to that of Ft. Good Hope, but the sex ratio was nearly even in the former, while favouring males in the latter.

Forty-four percent of the harvest from the Sahtu was taken in the first 3 weeks of the trapping season, and 60% was harvested by 1 December (Table 3). The proportion of juveniles in the harvest and the juvenile:adult female ratio varied with period of capture, but with no consistent trend. The male:female ratio tended to decrease as the trapping season progressed.

Body fat content for marten carcasses taken in the Sahtu were compared over the past three seasons, by age class and sex, to determine whether or not differences existed. There were no significant differences in fat content by age and sex classes among years (SAS, PROC GLM $\underline{P} > 0.5$); however, in all three age classes of males examined, animals taken in 1989-90 were slightly fatter than those taken in 1990-91, which in turn had more fat than those taken in 1988-89. The pattern in females was inconclusive. In all years and for both sexes, juveniles generally had greater mean body fat than older age classes, although this was not the case in 1990-91 for Ft. Franklin males (Table 4).

Although the 2+ age class had higher mean *in utero* litter size than yearlings in both main communities (Table 5), the differences were significant only with the Ft. Franklin sample ($\underline{t}$-test, $\underline{P} < 0.001$). Pregnancy rates were similar between the two communities

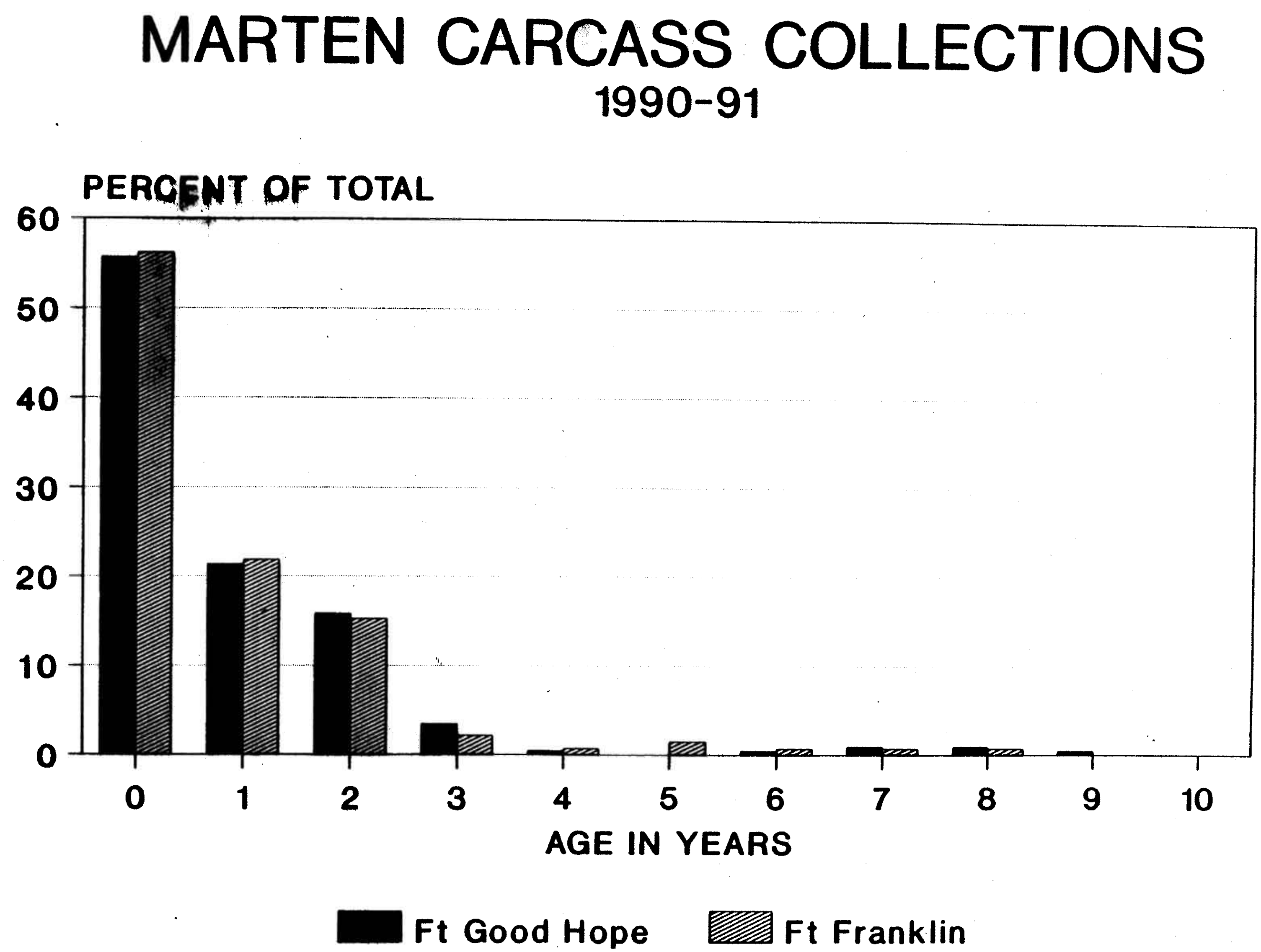

Figure 2. Age structure of marten carcasses collected from two NWT communities, 1990-91: Ft. Good Hope ($\underline{n}$ = 201) and Ft. Franklin ($\underline{n}$ = 137).

Table 2. Age and sex ratios from marten carcasses, 1990-91.

Community/ Trapper	Sample Size	Ratios		
		Juv:1+Fem	Juv:2+Fem	Male:Female
Ft. Good Hope				
All	201	3.29	5.89	1.21
Trapper A	40	9.33	14.00	1.22
Trapper B	79	1.68	2.91	1.47
Trapper C	82	4.33	8.67	1.00
Ft. Franklin				
All	137	2.57	6.42	0.99
Trapper D	19	2.67	2.67	2.80
Trapper E	118	2.55	7.66	0.84
Norman Wells	18	7.50	15.00	1.57

Table 3. Age and sex ratios in harvested martens by 2 week or 1 month period, Sahtu, 1990-91.

Time period	n	% juveniles	Juvenile:2+ female	Male:female
25 Oct-14 Nov	158	56.3	8.1:1	1.16:1
15-30 Nov	57	59.7	4.3:1	1.48:1
1-31 Dec	46	71.7	16.5:1	1.19:1
1-31 Jan	64	48.4	5.2:1	1.06:1
1 Feb-5 Mar	31	54.8	3.4:1	0.63:1

Table 4. Mean body fat of marten carcasses by sex and community[1].

Sex/ Community	Age Class (n)			
	0	1	2	3+
Male				
Ft. Good Hope	2.61 (54)	1.65 (28)	1.72 (20)	1.89 (7)
Ft. Franklin	2.24 (38)	2.61 (12)	2.37 (12)	1.49 (6)
Norman Wells	3.39 (10)	-	-	3.90 (1)
Female				
Ft. Good Hope	2.35 (57)	2.16 (15)	1.73 (12)	1.88 (7)
Ft. Franklin	2.11 (39)	1.71 (18)	2.05 (9)	1.71 (3)
Norman Wells	2.49 (5)	2.43 (1)	3.21 (1)	-

[1] Body fat derived from the following formula from Buskirk (1983):
Body fat = 603 x (omentum wt/carcass wt) + 0.87.

Table 5. Mean counts of corpora lutea (CL) and percentage of females pregnant by age class of martens, 1990-91.

Community	Age Class	n	Percent Pregnant	Mean CL/ Preg. Fem.	Mean[1] Fecundity
Ft. Good Hope	1	14	86	4.00	3.43
	2+	12	94	4.25	4.00
Ft. Franklin	1	17	82	3.43	2.82
	2+	12	92	4.73	4.33
Norman Wells	1	1	-	5.00	5.00
	2+	1	-	4.00	4.00

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

(Table 5). Comparison of mean litter size for Ft. Good Hope martens from 1988-89 to 1990-91 revealed no significant differences (ANOVA, $\underline{P} = 0.28$).

Magoun et al. (1989) proposed that female martens with 0 mm temporal muscle coalescence were juveniles, and those >0 mm were yearlings or older. Male martens in the 0 age class were distinguished by temporal muscle coalescence of <30 mm. Using these criteria, >93% of the martens in these categories were aged correctly (Table 6). The technique appears to be more accurate for males. The data are presented by 0, 1 and 2+ age classes in the table in an effort to determine whether or not the yearling category can be distinguished reliably. This did not seem possible, particularly with male martens.

Table 6. Distribution of martens within each age class by groups of length of temporal muscle coalescence (after Magoun et al. 1989, Poole et al. in press).

Temporal Muscle Length (mm)	Age Class		
	0	1	2+
Females			
0	94	3	0
1-10	7	23	12
>11	0	8	20
% Aged Correctly	93.1	95.5 (1+)	
Males			
0-30	99	0	1
>30	3	40	44
% Aged Correctly	97.1	98.8 (1+)	

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).

In 1990-91, trapper D from Ft. Franklin trapped the same area as another Ft. Franklin trapper in 1989-90 (Poole 1990), on a large peninsula on the west side of Great Bear Lake. The 1989-90 sample was almost absent of juveniles (4/140), with the 2- and 3-year-old cohorts being most represented in the harvest. In 1990-91, the sample from trapper D contained 42% juveniles, indicating a shift to what could be considered a more normal harvest age structure. I can only speculate that recent wildfires or a regional prey crash may have caused the unusual age structure (Thompson and Colgan 1987, Poole 1990).

The pregnancy rates and mean corpora lutea counts, and thus the mean fecundity, from NWT females, especially those from the Ft. Good Hope area, is high when compared with other areas. From a large data set from southcentral Ontario, Strickland and Douglas (1987) found mean corpora lutea counts of 3.29 for yearlings and 3.57 for 2+ females, and pregnancy rates averaging 80% for yearlings and 93% for older animals. In northcentral Ontario, Thompson and Colgan (1987) had mean counts of about 2.0. In the Yukon, Archibald and Jessup (1984) found mean pregnancy rates of 74% and mean corpora lutea counts of 3.3 and 3.8 for yearlings and 2+ females, respectively. Fortin and Cantin (1990) found a pregnancy rate of 46% for yearlings and 92% for 2+ adults, and mean corpora lutea counts of 3.43 and 4.44 for yearlings and older females, respectively. Although corpora lutea counts are only an index to litter size since some *in utero* mortality likely occurs, the data suggest that NWT martens have one of the highest reproductive capacities documented for the species. Reasons for this high reproductive output are unknown, but may relate to optimum prey availability and habitat.

The temporal muscle coalescence technique to determine age class is not as reliable as using percent pulp cavity, where often $\geq$ 97% of age and sex classes were identified correctly (Poole et al. in press). The technique can, however, be used by trappers in the field to monitor their harvests as the season progresses, and provides a second independent method to estimate age class.

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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