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Age Structure and Fecundity of American Martens Trapped on Chichagof Island, Southeast Alaska, 1991–1998

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Alaska Department of Fish and Game Division of Wildlife Conservation

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Cover Photo: ADF&G staff sealing martens caught on Chichagof Island at the Douglas Regional Office. Staff includes (from the left) Neil Barten, Rodney Flynn, and Thomas Schumacher. ©2000 ADF&G. Photo by LaVern Beier.

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Abstract

Population parameters of American martens (*Martes americana*) are often monitored by examining carcasses from trapped animals to guide management actions. We determined sex and age ratios and potential fecundity of American marten carcasses collected from trappers on Chichagof Island for 7 seasons, 1991–1992 through 1997–1998. We focused on the northeast portion Chichagof Island (NCI) because the marten-trapping season was closed on NCI in 1990–1991 because of a concern there had been overharvest during the previous 3 years. The total trapper catch, age ratios, and fecundity varied greatly during the study. After the trapping season reopened in 1991–1992, the trapper catch ranged from a low of 19 in 1993–1994 to a high of 354 in 1996–1997. We collected 1,367 carcasses (824 M and 544 F) from all of Chichagof Island and 599 (365 M and 234 F) from NCI. For the carcasses from NCI, the ratio of adult M:adult F ranged from a low of 0.9 in 1997–1998 to a high of 2.8 in 1992–1993. The juvenile:adult ratios ranged from 0.3 in 1997–1998 to 6.5 in 1993–1994. Juvenile:adult female ratios ranged from 0.6 in 1997–1998 to 13.0 in 1993–1994. Based on counts of corpora lutea, potential fecundity of trapped female martens ranged from 0.46 corpora per adult female in 1996–1997 to 3.50 in 1994–1995. Fluctuating pregnancy rates caused most of the variation in fecundity. Pregnancy rates averaged 34% and were under 50% in most years (except 1993–1994 and 1994–1995). We found corpora lutea counts highly correlated with recruitment the following fall. Demographic information from trapper–caught carcasses can provide useful management information for marten populations. Juvenile:adult ratios provide an estimate of recruitment for the harvest year. Age structure provides additional insight on population dynamics over the past several years. The ovarian analysis provides a measure of potential recruitment for the next biological year.

Key words: age structure, Chichagof Island, corpora lutea, demographics, fecundity, *Martes americana*, Southeast Alaska, trapping.

Introduction

Managers need to understand the demographics of American marten (*Martes americana*) populations in order to make informed decisions on harvest regulations. Recent fluctuations in the marten catch in portions of Southeast Alaska raised concerns among management agencies about the conservation of populations. Because of their secretive nature, marten populations are difficult to monitor directly. Thus, furbearer managers have often relied on demographic parameters collected from the catch to guide population management decisions (Yeager 1950, Quick 1956, Soukkala 1983, Strickland and Douglas 1987, Fortin and Cantin 1994, Aune and Schladweiler 1994, Strickland 1994). Fluctuations in age and sex structure, total catch, and fecundity have often been used to infer population trends. For fishers (*Martes pennanti*), Strickland (1994) recommended that 3 sex and age ratios could be used to monitor harvest rate: 1) the ratio of juveniles:mature females (age class 2^+); 2) juveniles:adult female (age class 1^+); and 3) the ratio of M:female. Although often used, few studies have experimentally evaluated the utility of sex and age ratios (Raphael 1994).

Fecundity is a basic population productivity parameter that is defined as the average number of live births per adult female (Caughley 1977). Because martens retain corpora lutea in the ovary for each shed ovum (Strickland and Douglas 1987), potential fecundity can be estimated based on counts of corpora lutea present in the ovaries. Because martens exhibit delayed implantation (Mead 1994), corpora lutea are present in the ovaries of pregnant females during the fall/winter-trapping season. Thus, the average number of corpora lutea per adult female is a measure of potential fecundity because all ovulations may not result in live births (Strickland and Douglas 1987, Aune and Schladweiler 1994). Actual recruitment into the pre-season population is a function of birth rate and post-birth survival to the fall (Caughley 1977). Often, fall age ratios are assumed to be a measure of recruitment (Strickland and Douglas 1987).

In the late 1980s, high and then declining harvest of martens on Chichagof Island raised concerns among management agencies about conservation of the population. From 1984–1985 to 1989–1990, the marten harvest had declined from 371 to 46 with a mean catch of 226. In 1990, a research project that focused on marten demographics (Flynn and Schumacher 2009) and habitat selection (Flynn and Schumacher 2016b) in northern Southeast Alaska was initiated by the Alaska Department of Fish and Game (ADF&G) in conjunction with the USDA Forest Service (USFS), Tongass National Forest. In addition, we monitored changes in age structure and fecundity of the marten catch on northeast Chichagof Island (NCI) in response to conservation concerns. We estimated these population parameters from marten carcasses collected from trappers operating on NCI beginning in the fall of 1991 and continued through the 1997 trapping season.

HISTORY OF MARTEN TRAPPING ON CHICHAGOF ISLAND

Between 1949 and 1952, U. S. Fish and Wildlife Service personnel released 21 martens (5 M, 8 F, 8 unknown) near the community of Pelican on Chichagof Island to establish a marten population for human use (Elkins and Nelson 1954, Paul 2009). These martens came from Baranof Island (6), (original population source was near Cape Fanshaw), Stikine River area (5), Wrangell Island (4), Mitkof Island (2), Revillagigedo Island near Ketchikan (1), and near Anchorage (3). Red squirrels (*Tamiasciurus hudsonicus*) were concurrently introduced as a potential prey item for martens (Elkins and Nelson 1954).

The first trapping season for martens on Chichagof Island was in 1962. Since state management began in 1961, marten trapping seasons in Southeast Alaska have ranged from 30 to 100 days long and occurred during November, December, January, or February. To monitor harvest, beginning in 1984, trappers were required under state regulations to submit all marten hides taken in Southeast Alaska for sealing within 30 days after the close of the trapping season. ADF&G personnel or designated sealers recorded sex, month of take, and harvest location of each marten sealed.

Since dual management of wildlife resources began in 1990–1991, the federal and state trapping regulations have usually differed, changed frequently, and interpretations have varied. State and federal subsistence trapping seasons for martens on the NCI were both closed for the 1990–1991 season because of concern over depleted populations. The portion of NCI west of Port Frederick remained open to trapping with the season extending from 1 December to 15 February. When this study was initiated in 1991–1992, the trapping season on Chichagof Island opened on 1 December. On NCI, federal subsistence regulations prohibited trapping with the use of a motorized land vehicle on federal lands. This restriction was enacted to mitigate the effect of increased access to formerly inaccessible areas by a recently constructed network of logging roads. The trapping seasons for martens on NCI were closed on 24 January 1992 by state and federal emergency orders because of concern about overharvest. In regulatory year 1992–1993, the state and federal trapping seasons for NCI were reopened for one month, 1–31 December, and the restriction on use of land vehicles for trapping was expanded to all federal lands on the portion of NCI west of Port Frederick and north of a line from Tenakee Inlet to Idaho Inlet. Also, federal subsistence regulations restricted marten trapping on NCI to federally qualified subsistence users. From 1993–1994 through 1997–1998, these regulations remained unchanged, except trapping on federal lands was no longer restricted to federally qualified subsistence users. However, the vehicle restriction was interpreted to apply to individuals trapping under either state or federal regulations.

Study Area

Chichagof Island (Fig. 1) is located in the northern portion of Southeast Alaska (57–58°N, 135–136°E) about 80–160 km west of Juneau, Alaska. The northeast portion of Chichagof Island (NCI) (1,113 km^2), which is separated from the remainder of Chichagof Island by a narrow isthmus <50 m wide, was selected for detailed study (Fig. 2). Because of small sample sizes, we included female carcasses collected from all of Chichagof Island to estimate fecundity. Most of the female carcasses were collected from NCI. Habitats typical of northern Southeast Alaska occur on the study area, including a range of physiographic types from beach fringe to alpine (Flynn and Schumacher 2009). Landscapes included substantial amounts of logged and unlogged areas. Trapper access depended on the locations of communities, cabins, protected waters, and roads. Much of the area (855 km^2) is federally managed lands within the Hoonah and Sitka ranger districts, Chatham Area, Tongass National Forest, USFS (Fig. 2). The remainder of NCI (259 km^2) is either state or private lands.

Methods

CARCASS COLLECTION AND PROCESSING

We collected marten carcasses from trappers operating on Chichagof Island beginning in the fall of 1991 and continuing through the 1997 trapping season. For NCI, we attempted to collect carcasses from all martens taken during all years of the study, but we did not document trapping effort. Periodically, we also collected carcasses from other parts of Chichagof Island. Before the opening of the trapping season, we sent a letter to everyone who had trapped on NCI during the past three years. Trappers were provided with information on the objectives of the study, a number of aluminum tags, and offered $3.00 for each carcass received in good condition. Trappers were instructed to record the date and capture location on an aluminum tag, attach the tag to the appropriate carcass, and to freeze each carcass immediately after skinning. Upon receiving carcasses, we froze them until processing, and we processed all carcasses within 2 months of capture.

We weighed and sexed each carcass and assigned an index of internal and external fat content using an ocular estimation procedure developed by Blundell and Flynn (1992). We measured total, body, and tail lengths of each carcass and recorded the method of skinning (i.e., feet skinned out or not). We measured development features of each skull to classified individuals as juveniles or adults according to Flynn and Schumacher (2016a), and we extracted the lower canine and premolar 4 for age class determination by tooth cementum analysis (Matson's Laboratory, Milltown, MT).

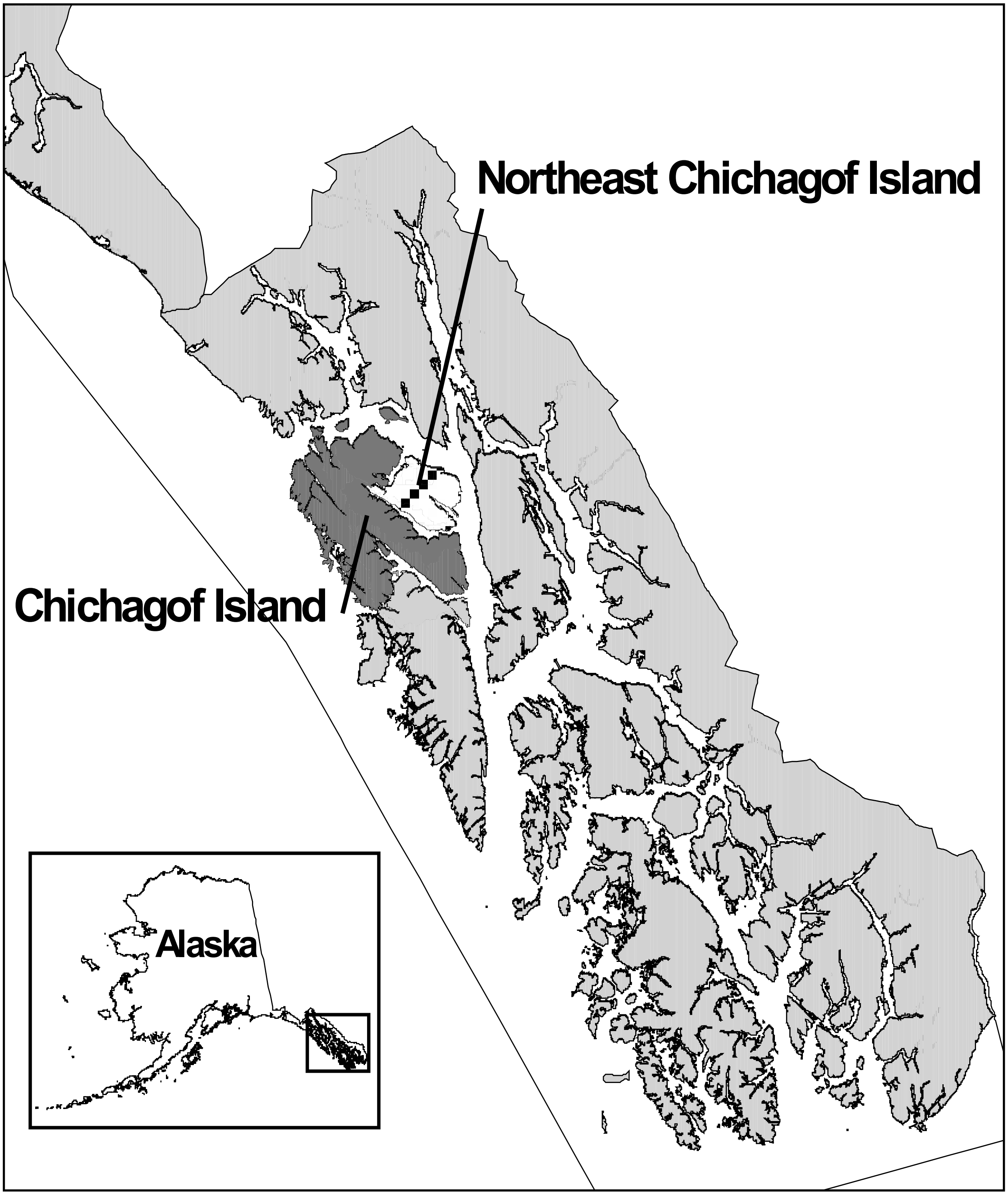

Figure 1. Study area on Chichagof Island, Southeast Alaska.

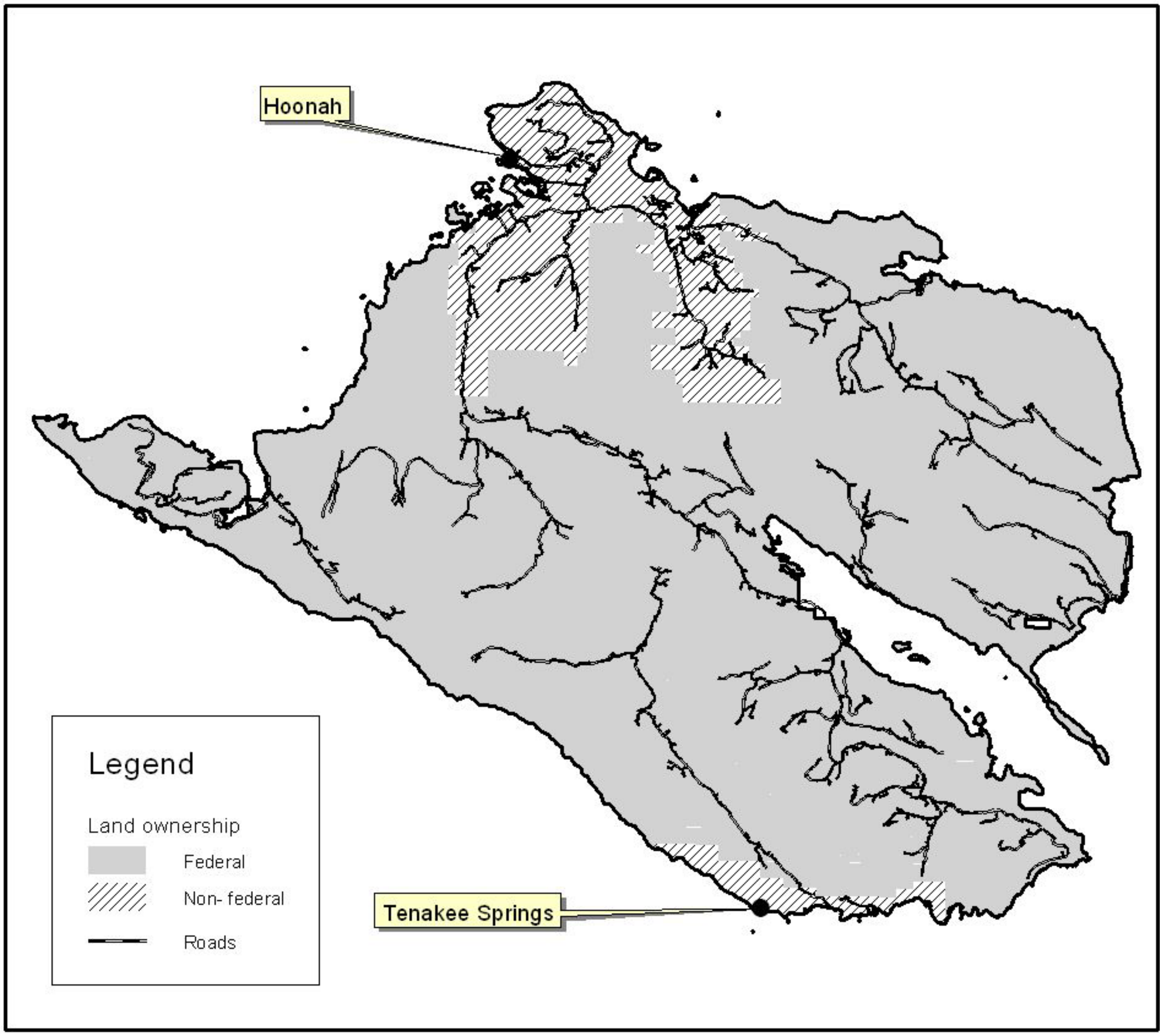

Figure 2. The portion of the study area on northeast Chichagof Island (NCI) showing land ownership patterns, communities, and the road system.

Ovarian Analysis

We estimated potential fecundity of the population by counting corpora lutea in the ovaries of female martens. Because ovulation is induced during mating, we considered females with corpora lutea present in either ovary to be pregnant at the time of death, and the sum of corpora lutea in both ovaries to represent the maximum number of offspring a female could produce the following spring (Clark et al. 1987). We removed ovaries from each female carcass and preserved them in a solution of 10% formalin. We then shipped ovaries in water to Matson's Laboratory (Milltown, MT) where a standard protocol was used to determine the presence and number of corpora lutea in each ovary. We calculated the mean number of corpora lutea present for females in several age classes and expressed that number as an age-specific pregnancy rate.

Juveniles were young of the year, and adults were ≥1 year old. Adult females were also grouped as yearlings (1 year old), and mature females (≥2 years old).

Analyses

The sex ratio was computed as the number of males per female (M/F) and the number of adult males (age class 1^+) per number of adult females (age class 1^+) (Ad M/Ad F). We expressed age ratios as the number of juveniles (age class 0) per adult (age class 1^+) (J/Ad), the number of juveniles per adult female (age class 1^+) (J/Ad F), and the number of juveniles per mature female (age class 2^+) (J/Ad F 2^+). We expressed potential fecundity as the number of corpora lutea per adult female (age class 1^+) (Cl/Ad F) and the number of corpora lutea per mature female (age class 2^+) (Cl/F Ad F $2^{+)}$. We compared means using *t*-tests or analysis of variance (ANOVA) as appropriate using Duncan post-hoc test to separate groups post-hoc (Snedecor and Cochran 1980). Relationships in the data were examined by correlation or linear regression.

Results

TOTAL CATCH AND CARCASSES COLLECTED

The mean catch for the entire period 1984–1985 to 1997–1998 was 160 martens (Fig. 3). During the study, yearly harvests on NCI ranged from 19 to 354 martens ($\bar{x}$ = 122, SD = 112) (Fig. 3). For the previous period (1984–1985 to 1989–1990), the mean catch (226) was significantly greater ($t_{11} = 1.71$, $P = 0.058$). Since 1991–1992, the average harvest was exceeded only once when a harvest of 354 martens was recorded during the 1996–1997 season. The harvest that year was near the 14-year maximum and achieved when trappers were restricted from using motorized land vehicles on federal lands. Thus, all the martens were trapped on the private lands near Hoonah and Tenakee Springs or along the shoreline using boats on federal lands.

We collected 1,367 carcasses (824 M and 544 F) from all of Chichagof Island (Table 1). From 1991–1992 to 1997–1998, 855 martens were harvested on NCI. We collected carcasses from 599 (70%) of these trapped martens (365 M and 234 F). The numbers of carcasses collected ranged from 15 in 1993–1994 to 257 in 1996–1997 (Table 2). The percentage of carcasses collected from trappers on NCI ranged from 44% in 1995–1996 to 89% in 1992–1993 ($\bar{x}$ = 66%).

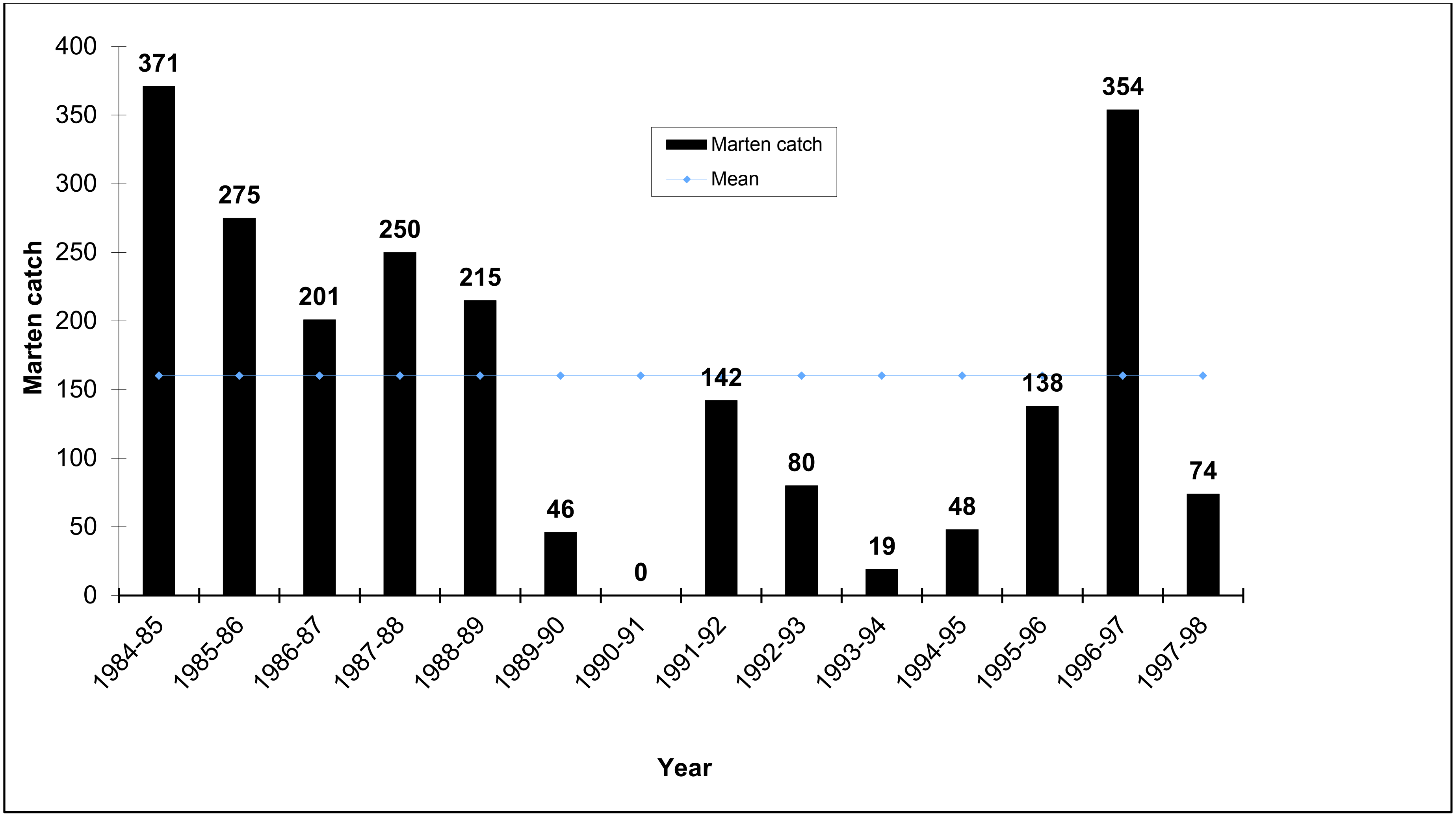

Figure 3. Marten catch on northeast Chichagof Island (NCI) 1984–1997. Data based on sealing records collected by the Alaska Department of Fish and Game. Mean annual catch was 160 martens.

Table 1. Sex and age class of American martens trapped on Chichagof Island, Southeast Alaska, 1991–1998. Data based on carcasses collected by the Alaska Department of Fish and Game. Ages of martens were determined by cementum analysis. Juveniles (J) are <1 year old and adults (ad) are ≥1 year old.

Year	Number carcasses	J M	J F	Ad M	Ad F	M/F	Ad M/ad F	J/ad	J/ad F
1991-1992	427	76	69	152	130	1.1	1.2	0.5	1.1
1992–1993	181	33	20	87	41	2.0	2.1	0.4	1.3
1993–1994	81	30	37	8	6	0.9	1.3	4.8	11.2
1994–1995	44	25	5	10	4	3.9	2.5	2.1	7.5
1995–1996	108	47	32	23	6	1.8	3.8	2.7	13.2
1996–1997	428	115	72	154	87	1.7	1.8	0.8	2.1
1997–1998	98	16	6	48	28	1.9	1.7	0.3	0.8
All	1,367	342	241	482	302	1.5	1.6	0.4	1.9
Mean	195	48.9	34.4	68.9	43.1	1.7	2.1	1.7	5.3

Table 2. Sex and age class of American martens trapped on northeast Chichagof Island (NCI), Southeast Alaska, 1991–1998. Data based on carcasses collected by the Alaska Department of Fish and Game. Ages of martens were determined by cementum analysis. Juveniles (J) are <1 year old and adults (ad) are ≥1 year old.

Year	Number carcasses	J M	J F	Ad M	A F	M/F	Ad M/ad F	J/ad	J/ad F
1991–1992	108	27	27	33	21	1.2	1.6	1.0	2.6
1992–1993	73	19	12	31	11	2.2	2.8	0.7	2.8
1993–1994	15	9	4	1	1	2.0	1.0	6.5	13.0
1994–1995	44	25	5	10	4	3.9	2.5	2.1	7.5
1995–1996	62	22	27	9	4	1.0	2.3	3.8	12.2
1996–1997	257	53	31	105	68	1.6	1.5	0.5	1.2
1997–1998	40	6	3	15	16	1.1	0.9	0.3	0.6
All	599	161	109	204	125	1.6	1.6	0.4	2.2
Mean	86	23	16	29	18	2.0	1.8	2.1	5.3

Sex and Age Ratios

The sex ratio for all animals (both juveniles and adults) was similar to adults only ($t_6 = 0.43$, $P = 0.34$) (Table 1). For all of Chichagof Island, the sex ratio of adult males:adult females ranged from 1.2 in 1991–1992 to 3.8 in 1995–1996 ($\bar{x}$ = 2.1, SE = 0.4). Thus, the sex ratio for adults only for Chichagof Island was always greater than 1.0. On NCI, sex ratios (ad M/ad F) ranged from 0.9 in 1997–1998 to 2.8 in 1993–1994 ($\bar{x}$ = 1.8, SE = 0.3; Table 2). For all martens on NCI, sex ratios were again similar to only adults ($t_6 = 0.15$, $P = 0.44$). On NCI, the sex ratio for adults was less than 1 only once.

For all of Chichagof Island, the juvenile:adult ratios ranged from 0.3 in 1997–1998 to 4.8 in 1993–1994 (Table 1). Considering only NCI, juvenile:adult ratios were similar and ranged from 0.3 in 1997–1998 to 6.5 in 1993–1994 (Table 2).

Mean age class of martens harvested on NCI was 1.03 (SE = 0.25) and ranged from 0.33 years in 1993–1994 to 2.20 years in 1997–1998 (Table 3) and differed significantly among years ($F_{6, 594}$ = 8.0, $P < 0.001$). We found a strong correlation (r = -077) between mean age class of harvested martens and juveniles:adult ratios.

For Chichagof Island, juveniles:adult female ratios ranged from 0.8 in 1997–1998 to 13.2 in 1995–1996 (Table 1). We found ratios of juveniles:adult female on NCI ranged from 0.6 in 1997–1998 to 13.0 in 1993–1994 (Table 2).

Fecundity

No juvenile females were pregnant in any year, so this age class was dropped from further analyses. Only 13% of yearling females were pregnant, and pregnancy rates for mature females (age class 2^+) ranged from 33% for 2-year-olds to 73% for 4-year-olds (Table 4). The average pregnancy rate, weighted by age class, for adult females (age class 1^+) was 28% (Table 4).

Over the 7 years of the study, the mean pregnancy rate for adult females (age class 1^+) was 47% (SE = 12.3) and ranged from 16% to 100% (Table 5). Even for mature adult females (age class 2^+), the average pregnancy rate was only 51% (SE = 12.3; Table 6). Pregnancy rates for adult females below 50% were observed in 1991–1992, 1992–1993, 1995–1996, 1996–1997, and 1997–1998 (Table 5).

For pregnant females, the mean number of corpora averaged 3.31 (SE = 0.83) and ranged from 3.00 to 3.80 (Table 4). We found no relationship with age and corpora lutea counts for pregnant females ($F_{6, 70} = 0.77$, $P = 0.64$). The number of corpora lutea per adult females (age class 1^+) averaged 1.64 (SE= 0.47) and ranged from 0.46 in 1996–1997 to 3.50 in 1994–1995 (Table 5). For mature females (age class 2^+), the number of corpora lutea averaged 1.72 (SE = 0.39) and ranged from 0.88 in 1996–1997 to 3.33 in 1993–1994 (Table 6) not including the years 1993–1994 and 1994–1995 because of only 1 sample per year.

We found that mean age class in the trapper catch was strongly negatively correlated with the fecundity rate measured in the previous fall (r = -0.75, P < 0.01; Fig. 4). Thus, the mean number of corpora lutea recorded in fall was a good predictor for the mean age class in the following fall's harvest (R^2 = 0.58).

Table 3. Mean age class of American martens trapped on northeast Chichagof Island, Southeast Alaska, 1991–1997. Data based on carcasses collected by the Alaska Department of Fish and Game. Ages of martens were determined by cementum analysis. Means with the same letter were not significantly different (*P* > 0.05) based on ANOVA analysis with Duncan's post-hoc test.

Year	No. carcasses examined	Cementumage		
		$\bar{x}$	SE	
1991–1992	109	0.94	0.14	ABC
1992–1993	73	1.21	0.17	BC
1993–1994	15	0.33	0.23	A
1994–1995	44	0.64	0.19	AB
1995–1996	62	0.42	0.42	A
1996–1997	257	1.49	0.12	CD
1997–1998	40	2.20	0.38	D
Means	87	1.03	0.25	

Table 4. Mean counts of corpora lutea (CL) and percentage of females with corpora lutea by age class of martens collected by trappers on all of Chichagof Island, Southeast Alaska, 1991–1997. The overall means were weighted by the sample size of each age class. Female martens with corpora lutea had ovulated and were considered pregnant at the time of death.

Age class	No. F examined	Pregnant F (%)	CL/pregnant F		CL/ad F	
			$\bar{x}$	SE	$\bar{x}$	SE
1	141	13	3.11	0.15	0.42	0.09
2	72	33	3.29	0.20	1.10	0.20
3	21	38	3.13	0.23	1.19	0.35
4	11	73	3.00	0.27	2.18	0.46
5	8	63	3.80	0.37	2.38	0.73
6	8	50	3.25	0.25	1.63	0.62
>6	20	45	3.22	0.28	1.45	0.38
Weighted means		28	3.21	0.83	0.88	0.09
2^+	140	50	3.28		1.66	

Table 5. Mean counts of corpora lutea (CL) and percentage of adult females (age class 1^+) with corpora lutea of martens collected by trappers from all of Chichagof Island, Southeast Alaska, 1991–1997. Female martens with corpora lutea had ovulated and were considered pregnant.

Year	No. F examined	Pregnant F (%)	CL/pregnant F		CL/ad F	
			$\bar{x}$	SE	$\bar{x}$	SE
1991–1992	116	22	3.04	0.10	0.68	0.12
1992–1993	41	49	3.35	0.17	1.63	0.28
1993–1994	6	83	4.00	0.32	3.33	0.72
1994–1995	4	100	3.50	0.64	3.50	0.64
1995–1996	6	33	3.00	0.00	1.00	0.63
1996–1997	80	16	2.85	0.15	0.46	0.12
1997–1998	27	26	3.57	0.43	0.93	0.32
Means	40	47	3.33	0.15	1.64	0.47

Table 6. Mean counts of corpora lutea (CL) and percentage of mature adult females (age class 2+) with corpora lutea of martens collected by trappers from all of Chichagof Island, Southeast Alaska, 1991–1997. Female martens with corpora lutea had ovulated and were considered pregnant.

Year	No. F examined	Pregnant F (%)	CL/pregnant F		CL/mature ad F	
			$\bar{x}$	SE	$\bar{x}$	SE
1991–1992	44	36	2.94	0.14	1.07	0.22
1992–1993	28	64	3.39	0.18	2.18	0.33
1993–1994	6	83	4.00	0.32	3.33	0.71
1994–1995	1	100	5.00		5.00[a]	
1995–1996	1	0	0.00		0.00[a]	
1996–1997	42	31	2.85	0.15	0.88	0.21
1997–1998	17	29	3.80	0.58	1.12	0.46
Means	20	51	3.14	0.59	1.72	0.39

[a] Excluded from means because of only 1 sample for year.

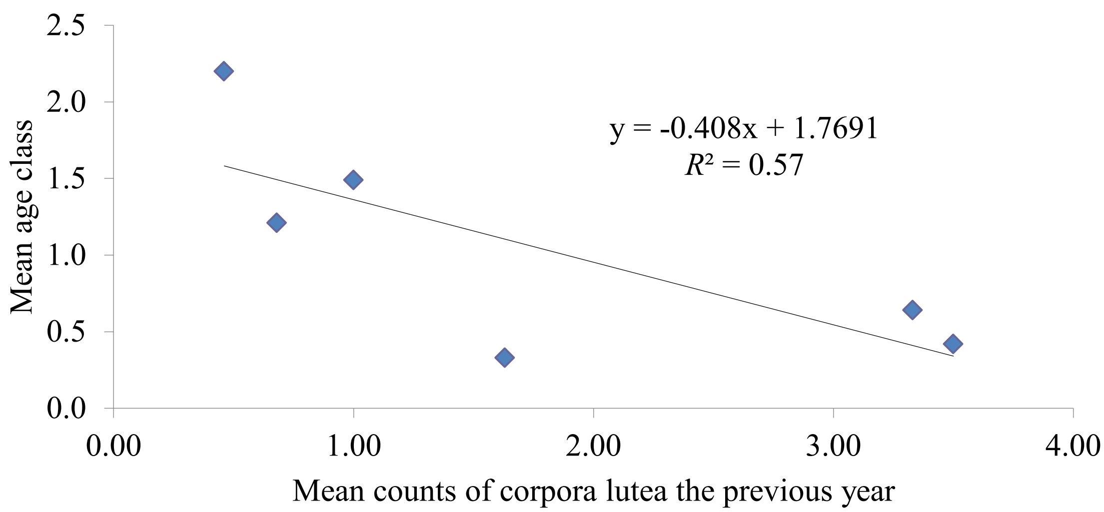

Figure 4. Relationship between mean age class of the harvest sample and counts of corpora lutea of adult females (age class 1+) the previous fall on Chichagof Island, Southeast Alaska, 1991–1998.

Discussion

The number of martens trapped on NCI varied greatly among years. This variation likely resulted from changes in the abundance of martens and changes in trapping effort. Marten numbers fluctuate in response to fur trapping and changing abundance of prey (Thompson and Colgan 1987, Flynn et al. 2004, Flynn and Schumacher 2009). Although we did not document trapping effort, trappers indicated that in years when martens were abundant they usually expended more effort than during years when martens were scarce. We experienced good cooperation with trappers providing carcasses. Consequently, the percentages of the harvest that we collected remained similar, but the actual number of carcasses varied among years.

Fecundity was influenced more by pregnancy rate than by the number of corpora lutea per pregnant female (Table 5). Overall, the number of corpora lutea per pregnant adult female changed little from year to year, varying from 2.85 to 3.57. However, pregnancy rates ranged from 16 to 100%.

The marten population on Chichagof Island periodically experienced poor recruitment (below 1.0 corpora lutea per female), i.e., 1991–1992, 1996–1997, and 1997–1998. Most studies have found high marten fecundity rates. Over 12 consecutive years, Strickland and Douglas (1987) reported that both pregnancy rates and numbers of corpora lutea in pregnant female martens in Ontario were stable, ranging from 91–100% and 3.19–3.53, respectively. Aune and Schladweiler (1997) reported pregnancy rates similar for 2 populations in Montana, ranging from 76–95% over 5 years, but a lower mean number of corpora (2.6) per adult female in the southwestern part of the state. Also in Ontario, Thompson and Colgan (1987) reported 2.74–3.46 corpora lutea in pregnant females. Thus, martens on NCI appeared to be less productive than most populations in North America.

We observed that fecundity of female martens varied by age class. Although counts of corpora lutea for pregnant females did not differ by age class, pregnancy rate did vary with age. Only about 13% of yearling females were pregnant. Therefore, on Chichagof Island few yearling female martens breed and give birth. Also, yearling martens found to be pregnant may have been incorrectly aged. Females aged 2 (33%) or 3 (38%) had lower pregnancy rates than older females (45–73%), indicating that a female marten may not achieve full reproductive capability until older than 3 years-of-age.

Fecundity of martens on Chichagof Island varied through time and was often lower than reported elsewhere. During several years, the marten reproduction on NCI nearly failed completely. We found marten fecundity seldom within the range (2.3–3.5 CL/ad F) reported by Strickland and Douglas (1987) for a 12-year period in Ontario. They found pregnancy rates for adult females varying from 91–100% with an overall yearling pregnancy rate of 78% and a 93% rate for mature females (≥2 years old). Also in Ontario Thompson and Colgan (1987) reported pregnancy rates for mature females to range from 5–72%. In contrast, we found an overall pregnancy rate of 34% for adult females with average pregnancy rates of 13% for yearlings and 50% for mature (age class 2^+) females. Thompson and Colgan (1987) attributed reduced ovulation and pregnancy rates, especially among yearlings, to declining food resources. Our findings support the conclusions of Thompson and Colgan (1987) because changes in fecundity on Chichagof Island also appear related to changes in abundance of food resources, primarily due to natural fluctuations in abundance of long-tailed voles. Marten populations on Chichagof Island appear to have lower and more variable fecundity over time than populations elsewhere and that lower fecundity appears related to lower availability of prey. Therefore, managers should consider the availability of prey when setting trapping regulations.

The age structure of marten harvested on Chichagof Island likely reflected changing recruitment rates over time. We found a strong correlation between fecundity measured by corpora lutea counts with mean cementum age the next year. Thus, counts of corpora lutea provide managers with a measure of possible recruitment for the following year. Because reproduction in martens has been linked to availability of prey (Thompson and Colgan 1987), monitoring prey abundance may provide some insight into productivity of the population and harvestable surplus during a given year.

When managing populations of martens, Strickland and Douglas (1987) recommended that to avoid overharvest of adult females, the ratio of juveniles:adult female be greater than 3.0. During our study, juveniles:adult female ratios on NCI exceeded 3.0 only 3 times (1993–1994, 1994–1995, 1995–1996). The juveniles:adult female ratio was ≤ 3.0 in the remaining 4 years. Higher juvenile:adult female ratios likely reflect greater recruitment. However, ratios of sex or age groups in the harvest can be highly variable when sample sizes are small. Therefore, when using ratios to inform management decisions, it is important to consider the sample size from which the ratio was calculated.

Management Implications

Demographic information from trapper-caught carcasses can provide useful management information for marten populations. Juvenile:adult ratios provide an estimate of recruitment for the harvest year, especially mean age class. Age structure provides additional insight on population dynamics over the past several years. The ovarian analysis (CL/ad F) provides a measure of potential recruitment for the next biological year. If a commercial laboratory is available for tooth cementum aging and ovarian analyses, the data collection procedures are relatively easy for the investigator to complete by collecting carcasses from trappers. Otherwise, you can separate marten carcasses into sex and age groups using skull characteristics (Flynn and Schumacher 2016a). Wildlife managers can use population modeling to explore sustained-yield management in their marten populations.

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