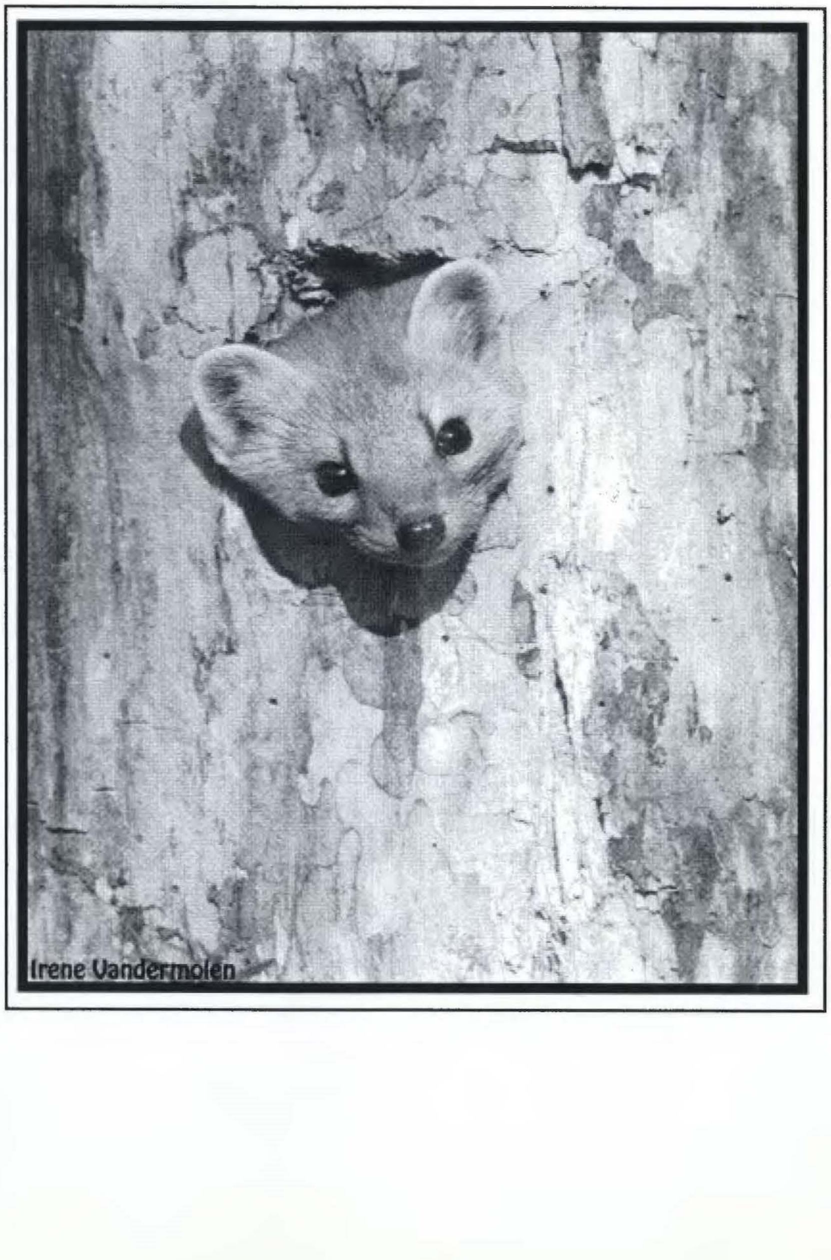
Alaska Department of Fish and Game
Division of Wildlife Conservation

Federal Aid in Wildlife Restoration
Research Progress Report
1 July 1993 - 30 June 1994

Ecology of Martens in Southeast Alaska

by
Rodney W. Flynn
and
Thomas Schumacher



Grant W-24-2
Study 7.16
December 1994

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PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: Ted Schenck, Kris Rutledge, Lowell Suring, U. S. Forest Service; Jim Faro, ADF&G, Merav Ben-David, UAF

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Study No.: 7.16 Study Title: Ecology of martens in Southeast Alaska

Period Covered: 1 July 1993-30 June 1994

SUMMARY

During the fourth year of field work on this project, 26 martens (*Martes americana*) (17 males and 9 females) were captured 102 times on the Salt Lake Bay study area and 28 martens (21 males and 7 females) were captured 42 times in Upper Game Creek, northeast Chichagof Island. At Salt Lake Bay, we radiocollared 19 new martens (13 males and 6 females), and all the captured martens at Game Creek were uncollared except one female. Altogether, we monitored 62 martens (38 males and 24 females) at least part of the year.

We recorded habitat use of the radiocollared martens at 542 aerial locations during the fall/winter/spring season. Habitat selection data were not analyzed for this report.

The estimated density of martens on the Salt Lake Bay study area in March 1994 increased about 43% from March 1993. During March 1994, we estimated that 23 martens, or 0.27 martens/km^2, were on the Salt Lake Bay study area. The increase in numbers resulted from more juveniles being resident on the study area, and more transient juveniles and yearling martens traveling through the study area.

Sixteen martens with active radiocollars (12 males and 4 females) died during the period. We estimated annual survival of radiocollared martens at 0.74. Eleven deaths (7 male and 4 females) resulted from natural causes, and 3 male martens were trapped near lower Game Creek during December and January. No one trapped the primary study area at Salt Lake Bay.

Male marten home range sizes (100% convex polygons) were quite variable, ranging from 0.9 km^2 to 19.1 km^2. The median home range size (5.5 km^2) decreased 53% from biological year 1992-1993 (11.8 km^2). Female home ranges varied in size from 2.2 km^2 to 4.8 km^2. Median home range size of females (2.7 km^2) decreased 67% from year 1992-1993 (8.2 km^2).

The snap-trap index for small mammal numbers increased for the first time and long-tailed voles were caught for the first time since 1992. Because small mammals are an important food source for martens, the higher snap-trap index indicated an increase in food availability.

Key words: Chichagof Island, demographics, forestry, habitat use, martens, *Martes americana*, modeling, old-growth forests, population biology, Southeast Alaska

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BACKGROUND

We have completed a fourth year of ecological research on martens in Southeast Alaska. This report contains a brief presentation of information collected during the past year. Each year, we have periodically live trapped study areas on northeast Chichagof Island and studied the movements, demography, and habitat use of the captured martens. We obtained additional demographic data from trapper-caught marten carcasses collected from trappers operating on Chichagof Island and northern Baranof Island.

Although designed as a broad ecological study, the project has been divided into 10 specific jobs. We presented progress on each job separately. During this report period, all jobs were active, but jobs 1, 4, and 5 were emphasized. Some aspects of this study were supported by the USDA Forest Service, Chatham Area, through contract 43-0109-9-0749. We also submitted this report to Forest Service personnel to satisfy their reporting requirements.

Martens have been found associated with late-succession and old-growth forests across much of North America (Weckwerth and Hawley 1962, Koehler et al. 1975, Mech and Rogers 1977, Soutiere 1978, Steventon and Major 1982, Spencer et al. 1983, Snyder and Bissonette 1987, Bissonette et al. 1989, Buskirk et al. 1989). Typically, marten populations have declined with the removal of forested habitat, increased human access, and unrestricted trapping (Clark et al. 1987). In Southeast Alaska, martens have been the focus of the fur industry with an average annual harvest of 2770 animals from 1984 and 1988 (ADF&G unpubl. records, Douglas). Because forest management activities were expected to affect population abundance and marten pelts represented significant economic value to local residents, martens were selected as a management indicator species (MIS) for the revision of the Tongass Land Management Plan (TLMP) (Sidle and Suring 1986, USDA Forest Service 1990). Old-growth forests were identified as a special habitat for the species in Southeast Alaska where the Tongass National Forest encompasses more than 90% of the land area. Although most of the original forested land was old growth, industrial-scale logging has converted large areas of old-growth forest habitat into clear-cuts and second growth. About 162,000 ha of old-growth habitat have already been logged on the Tongass National Forest, and the current Tongass National Forest Land Management Plan (TLMP) schedules an additional 708,000 ha for clear-cut logging (USDA Forest Service 1990). Additional background information on the study can be found in Flynn (1991).

OBJECTIVES

This research was designed to describe the habitat and population ecology of martens on northeast Chichagof Island. The information from this study will be used to evaluate the interagency habitat capability model.

The specific study objectives (jobs 1-8) are listed below.

1. Determine seasonal habitat use and selection patterns of a sample of martens living in logged and unlogged landscapes at the microsite, stand, and landscape level;

2. Determine the composition of habitats within the northeast Chichagof Island study area;

3. Evaluate the interagency habitat capability model;

4. Determine the demographic characteristics of marten populations on northeast Chichagof Island;

5. Determine marten movement and spatial patterns of martens on northeast Chichagof Island;

6. Determine the relative abundance of small mammal prey within the Chichagof Island study area;

7. Determine the seasonal diets of martens on northeast Chichagof Island; and

8. Evaluate whether the skull size criteria developed by Magoun et al. (1988) correctly classify Southeast martens by sex and age.

STUDY AREA

We chose northeast Chichagof Island for the study because its topography and habitat are typical of northern Southeast Alaska including a substantial amount of logged and unlogged areas. Also, a logging road system provided access to portions of the area, lodging facilities were available through the USDA Forest Service, and the area was relatively close to Juneau. The area adjacent to Salt Lake Bay (58° 56'N, 135° 20'E), 90 km (56 miles) west of Juneau and 26 km (16 miles) south of Hoonah, was selected as the primary study area. The upper Game Creek watershed, located directly north of Salt Lake Bay, was added as a second primary study in 1992. Because several martens moved off the primary study areas after capture, the entire northern portion of Chichagof Island was treated as a secondary study area.

The Salt Lake Bay study area included about 130 km^2 in USDA Forest Service Value Comparison Units (VCUs) 202, 222, and 223 on the Hoonah and Sitka ranger districts on the Chatham Area of the Tongass National Forest. The study area was bounded by Port Frederick to the north, Tenakee Inlet to the south, a narrow portage between the large water bodies on the west, and the Game Creek and Indian River drainages on the east and north (Fig. 1). The upper Game Creek study area included about 102 km^2 in VCUs 203 and 204 on the Hoonah Ranger District. Most habitats typical of northern Southeast Alaska are in the study areas including a range of physiographic types from beach fringe to alpine. Habitats in the study area are further described in Flynn (1991).

About 7% of the Salt Lake Bay study area was logged from 1984 to 1988, and 27 km of logging roads were constructed. An additional 486 ha were clear-cut from 1990 to 1992. (USDA Forest Service 1989). Logging activity began in June 1990 with the construction of about 10 km of new logging road. Two units were felled before a court injunction suspended all logging activity at the end of June 1990. The court injunction was lifted during August 1991, and logging resumed September 1991. Logging activity continued until 10 December and about one half of the units were felled. Logging activity was suspended for the winter and resumed again in April 1992. All logging activity in the Salt Lake Bay area was completed by 31 October 1992.

The upper Game Creek watershed was the last major unlogged watershed on northeast Chichagof Island. Road building in the upper Game Creek drainage began in April 1992 with the construction of a bridge across the North Fork and two bridges across Game Creek. Road building continued at a rapid pace for the remainder of the year. Most of the planned road system was completed by winter. All the low-elevation cutting units were felled during summer and fall. During spring 1993, road building continued into the upper watershed of adjacent Seagull Creek and the remaining upper-elevation units in Game Creek were felled.

Recreational and subsistence trapping seasons for martens, mink, and weasels on the northeast portion of Chichagof Island were closed for the 1990-1991 regulatory year because of depleted marten populations. The portion of northern Chichagof Island west of Port Frederick remained open with season dates from 1 December to 15 February. The trapping season for both portions of northern Chichagof Island opened on 1 December for the 1991-1992 season. On northeast Chichagof Island, trapping with the use of a motorized land vehicle was prohibited on federal lands by federal subsistence regulation. The trapping seasons for marten, mink, and weasels were closed by emergency order on 24 January 1992 because of concern about the overharvest of martens. During the 1992-1993 season, marten trapping on northern Chichagof Island lasted 30 days beginning on 1 December. The prohibition of trapping with the use of a motorized land vehicle on federal lands by federal subsistence regulation was extended to cover the west side of Port Frederick. For the remainder of Unit 4, the marten trapping season ran from 1 December to 15 February with no additional restrictions. The marten trapping season remained the same in 1993-1994.

METHODS

Most study jobs required the capture and radiocollaring of a sample of martens on the primary study area. Martens were live trapped throughout the year at permanent trap sites systematically located along the logging road system. Trap sites were usually about 500 m apart. Traps (Models 203 and 205, Tomahawk Live Trap Co., Tomahawk, WI) were baited with strawberry jam during summer and sardines the rest of the year, covered with a green tarp, and placed under a log or the base of a tree at trap sites. We checked the traps at least daily. Captured martens were run into a holding cone and immobilized with a mixture of 18.0 mg/kg ketamine hydrochloride (Vetalar) and 1.6 mg/kg xylazine hydrochloride (Rompun). For short-term chemical restraint, we used a dosage of 13.0 mg/kg of ketamine and 1.0 mg/kg xylazine. All captured martens were ear- tagged (Size 1, Style 1005, National Band and Tag Co., Newport, KY), sexed, weighed, and measured. Two first premolar teeth were pulled for age determination by cementum analysis (Matson's Laboratory, Milltown, MT). We drew a 3.0 cc blood sample from the jugular vein from most captured animals, separated the serum, then froze both portions for future analyses for disease, diet, and pregnancy studies. All captured martens were radiocollared (Telonics, Mesa, AZ). A 30 g radiocollar (MOD-070, expected life of eight months) was placed on females and a 49 g collar (MOD-080, expected life of 12-18 months) was placed on males. After a marten had recovered from the immobilization, we released it near the capture site. Martens recaptured during a trapping session were released without additional processing. During a subsequent trapping session, all recaptures were chemically restrained, weighed, and measured. We replaced radiocollars as needed, and the collars on several animals were replaced during the year.

We attempted to capture all resident martens on the study area to determine the minimum number present and the sex and age composition of the resident population. Martens present on a study area throughout the year were considered resident animals. Temporary residents were present on a study area for less than a year. Martens that remained on the study area for less than a month and showed no site fidelity to a home range area were considered transients. Martens more than 1-year-old were considered adults unless otherwise identified. Young-of-the-year animals, or birth-year martens were called juveniles.

Job 1. Habitat use. We located radiocollared martens from small aircraft (Mech 1974, Kenward 1987) during daylight hours throughout the year. Mostly, we used a Piper Supercub aircraft. After an animal was located, we assigned it to a relatively homogenous habitat patch while circling in the aircraft. The location was plotted on high-resolution orthophotoquad maps (1:31,680 scale). The habitat patch for each location was described using USDA Forest Service definitions of timber volume class, stand size class, old-growth forest type, and physiographic location (riparian, upland, beach fringe, estuary fringe, subalpine, or alpine). We transferred the locations to mylar overlays on color aerial photographs (1:15,840 scale) of the study area for future photo interpretation work. Additional attribute information was recorded from the orthophotoquad maps including Universal Transverse Mercator (UTM) coordinates, elevation, slope, and aspect.

Habitat selection will be determined by comparing the proportionate use of habitats with the their availability (see Job 2) in the study area (Neu et al. 1974, White and Garrott 1990). We considered data collected from September through May to represent habitat use during the fall/winter/spring season. In future analyses, the habitat use of each animal will be compared with the availability of habitats within its home range area and the entire primary study area. A Chi-squared goodness-of-fit test will be used to test the null hypothesis that habitats were used by martens in proportion to their availability. If the null hypothesis is rejected, then each habitat will be evaluated separately for selection using Bonferroni normal statistics (Neu et al. 1974, Byers and Steinhorst 1984, White and Garrott 1990). Ivlev's index of electivity (E_t) (Ivlev 1961), scaled to vary from 0.00 to 1.00, and Manly's measure of preference (Manly et al. 1972, Chesson 1983) will be computed for each habitat category to characterize the degree of selection of a particular habitat. Habitat capability indices (HCIs), based on each selection index, will be computed by dividing the selection index for each habitat by the maximum value for that index (e.g., $HCI_i = E_{t\,i}/E_{t\,max}$).

Job 2. Habitat composition. The composition of habitats, described by timber volume class and physiographic type, for the stand-level analysis was generated by Forest Service staff from their geographic information system (GIS) "points" database for VCUs 202, 222, and 223. Information on the abundance of old-growth forest types as described by Boughton et al. (1992) was unavailable from this database. The GIS "points" database was created especially for the TLMP Revision project by systematic computerized sampling of the timber volume class maps with the elevation contours and physiographic types identified. Each point sample represented the midpoint of an 8.1-ha hexagon.

We will consider the proportion of habitats on the study area as a measure of habitat availability. To evaluate landscape-level effects, we will collect additional landscape attributes such as roads, corridors, stand size, and composition of adjacent stands. In future analyses, these effects will be evaluated.

Job 3. Habitat capability model evaluation. The habitat capability model for martens in Southeast Alaska, developed by an interagency group of biologists (Suring et al. 1992), will be evaluated in two ways using the general considerations listed by Schamberger and O'Neil (1986). During model testing, we will compare habitat coefficients values with observed habitat selection indices. Habitat selection indices for fall/winter/spring will be compared with habitat capability coefficients in the marten habitat capability model (Suring et al. 1992). We will compare the estimated density of adult resident martens on the primary study area with values predicted by the model.

Job 4. Population ecology. Each study area was trapped intensively several times during the year to determine the sex and age composition of martens. We recorded the time and location of all known deaths of radiocollared martens. We attempted to retrieve the carcasses of several martens that died naturally and examined them for cause of death. The carcasses of most trapper-caught study animals were retrieved. These carcasses were processed according to procedures established for the general collection of trapper-caught carcasses.

We surveyed martens on the Salt Lake Bay study area using mark-recapture methods (Seber 1982, White and Garrott 1990). Captured martens with only eartags or failed collars were treated as new individuals. We assumed that the population was closed during the 5-day trapping session and each animal had an equal probability of being captured at least once during the trapping session. The study area was defined by the composite home ranges of resident martens (84 km^2). Marten density on the primary study area was estimated by mark-recapture trapping sessions. We computed a Lincoln-Petersen estimate of population number for a closed population, single mark-release experiment for each trapping session. During a trapping session (at least shortly before or after), we located all of the radiocollared martens on the study area to determine the number present. The size of the study area was defined by the collective home range areas of the resident collared martens. In the mark-recapture analysis, we used the number of radiocollared martens on the study area during the trapping session as n_1, the total number of martens captured as n_2, and the number of collared martens recaptured as m_2. We used an Excel spreadsheet, originally developed by Sterling Miller (pers. commun., Alaska Department of Fish and Game, Anchorage), for the numeric analyses. including the population estimate, variance, and 95% confidence intervals using a normal distribution. Also, the minimum number of martens on the study area during the trapping session was determined by adding the number of new captures to the number of previously radiocollared animals that were present. Because the entire Salt Lake Bay study area was not trapped each session, we split the study area into eastern and western portions. Each portion was about the same size. At this point, we have not determined whether all of the assumptions for a Lincoln-Petersen mark-recapture experiment were met in this situation. Further evaluation of the appropriateness of the methods used will be done next year.

We estimated the survival rate of radiocollared martens using the Kaplan-Meier product limit estimator as described by Pollock et al. (1989) for the staggered-entry design. We converted a Lotus spreadsheet obtained from Pollock et al. (1989) to Excel for the numeric analyses. A monthly time step was used to develop annual survival functions. Animals not located for more than one month were considered as censored observations and eliminated from the analysis at the next time step. Marginal survival functions were constructed for trapping and nontrapping causes by treating deaths from causes other than the group being examined as censored observations (Pollock et al. 1989).

We attempted to collect the carcasses from all the martens trapped on northern Chichagof Island. Before the opening of the 1 December trapping season, a letter was sent to everyone who had trapped on northern Chichagof Island during the past three years. Trappers were offered $3.00 for each carcass received and instructed to record the date and location of capture and to freeze the carcasses immediately after skinning. Upon receiving the carcasses from the trappers, we kept them frozen until processing. All the carcasses were examined within 2 months of capture.

In 1992, the carcass examination job was expanded to included southern Chichagof Island and northern Baranof Island. We collected marten carcasses from this area again this year. This portion of the project was done under a separate USDA Forest Service contract and a separate report on the methods and results prepared (Appendix A).

Each carcass was weighed, and an index of internal and external fat content assigned using an ocular estimation procedure developed by Blundell (1992, unpubl. report, ADF&G, Douglas, AK). We measured each skull according to Magoun et al. (1988) and classified the animal as juvenile or adult. The skulls were heated in water for several hours, then the lower canine and premolar 4 extracted. The teeth were stored frozen until sent to Matson's Laboratory (Milltown, MT) for age determination by cementum analysis. Body and tail lengths of each carcass were measured along with the method of skinning (i.e., feet skinned out or not). We examined the stomachs of each carcass for the presence of parasites, especially *Soboliphyme baturini* worms. The stomach contents were frozen for future diet evaluation. We extracted the ovaries from the reproductive organs of females and preserved them in 10% formalin. All ovaries were sent to Matson's Laboratory (Milltown, MT) for evaluation for the presence and number of corpora lutea (Strickland and Douglas 1987).

Job 5. Spatial patterns and movements. We estimated home ranges of resident martens from radiotelemetry locations (Kenward 1987). Radiocollared martens were located from small aircraft, usually a Supercub, about once a week depending on weather conditions. Aerial locations were plotted on high resolution orthophotoquad maps (1:31,680 scale) and recorded as Universal Transverse Mercator (UTM) coordinates. We modeled marten home ranges using the computer program HOME RANGE (Ackerman et al. 1990). Locations were tested for independence (Swihart and Slade 1985) and outliers examined (Samuel et al. 1985). For this report, we calculated the area of home ranges using 100% convex polygons. For the final report, several methods of delineating home range will be evaluated including the harmonic mean method (Dixon and Chapman 1980) and 75%, 95%, and 100% convex polygons

(Ackerman et al. 1990). Core areas within home ranges will be examined (Samuel et al. 1985b).

In order to locate transient martens, the entire northern portion of Chichagof Island was searched monthly from aircraft. We recorded the maximum distance traveled from initial capture sites and the maximum distance between relocations for each transient animal. We compared the mean distance traveled by males and females. Transient martens were difficult and expensive to locate because of their extensive travels and the limited range of the radio transmitters.

Job 6. Small mammal abundance. The abundance of small mammals, excluding red squirrels, was estimated using a snap-trap index (Calhoun 1948). Transects were established in three stands: a productive, western hemlock, old-growth stand; an unproductive, mixed conifer/blueberry, old-growth stand; and a 6-year-old clear-cut. We established 25 stations along each transect at 15-m intervals. Two Museum Special snap traps were placed at each station, baited with a mixture of peanut butter and rolled oats, and set for three consecutive nights. We operated traplines in September when small mammal populations should be at their annual peak. We recorded the number of animals of each species caught per transect and per 100 trap nights.

Job 7. Seasonal diets. Marten scats were collected at trap sites and opportunistically along roads and trails. The scats were labeled and frozen for future analyses.

Beginning in fall 1992, blood samples were drawn from the jugular vein of captured martens and sent to Merav Ben-David, University of Alaska Fairbanks, for analysis of stable isotopes of carbon, nitrogen, and sulfur (Schell et al. 1988). As part of her Ph.D. dissertation, Ben-David will compare the stable isotope signatures of the marten blood samples with the signatures of samples collected from potential food items to infer marten diet composition (Ben-David 1992).

Job 8. Evaluation of field sexing and aging technique. We collected marten skulls from trappers operating on northern Chichagof Island to evaluate the field technique for sexing and aging martens proposed by Magoun et al. (1988). We recorded total skull length and length of temporal muscle coalescence for each specimen according to procedures of Magoun et al. (1988). A lower canine tooth and premolar 4 were extracted from each skull for age determination by cementum analysis (Matson's Laboratory, Milltown, MT). We will compare the skull measurements according to Magoun et al. (1988).

RESULTS AND DISCUSSION

During biological year 1993-1994, we captured 26 martens (17 males and 9 females) 102 times on the Salt Lake Bay study area (Table 1). Nineteen of the captured martens (13 males and 6 females) were handled for the first time. In upper Game Creek, we caught an additional 28 martens (21 males and 7 females) (Table 2), and only 1 marten had been handled last year. All captured martens were weighed, measured, and aged by cementum analysis (Table 3). We radiocollared all of the animals except 6 which were only eartagged (Table 4.)

Job 1. Habitat use. Radiocollared martens were located 542 times from small aircraft during the fall/winter/spring season to determine habitat use. This information was recorded, plotted on aerial photographs, and stored on a computer file. The coordinate file was converted to an Arc/Info GIS coverage by US Forest Service personnel. We did not complete additional analyses for this report. More information on the selection of habitats will be collected next year and included in the final report.

Job 2. Habitat composition. We received several available GIS data files from US Forest Service staff. Next year, we will collect additional landscape attribute information from aerial photos and gather additional US Forest Service data. This data will be further analyzed for the final report with the use of GIS software.

Job 3. Habitat capability model evaluation. A comparison of the habitat capability coefficients in the habitat capability model with the habitat selection indices from this study was reported in the previous progress report (Flynn 1991). No additional analyses were completed during this report period.

Job 4. Population ecology. Of the 62 radiocollared martens monitored during at least part of the year, 38 were males and 24 were females. We classified 18 martens (10 males and 8 females) as residents on the Salt Lake Bay study area, and 1 male marten was considered a temporary resident (Table 5). Fourteen martens (9 males and 5 females) captured at Salt Lake Bay were transients and spent little time there. In upper Game Creek, 9 martens (5 males and 4 females) were classified as residents, and 19 martens (12 males and 7 females) captured there were transients. We could not determine the status of one male because it died in the trap. Because of the extensive live trapping in both study areas, most of the resident martens were probably captured.

We had only one opportunity for a good mark/recapture trapping session during the year. During March 1994, we estimated that 23 martens (95% CI = ±2.4) were on the Salt Lake Bay study area for a density of 0.27 martens/km^2. In contrast, Flynn (1993) estimated 16 martens (95% CI = ±1.0) in March 1993, or a density of 0.19 martens/km^2. Thus, the number of martens on the Salt Lake Bay study area increased about 43% from March 1992 to March 1993. The population increase resulted mostly from more juvenile and transient yearling animals. New juvenile and yearling martens were captured throughout the year, and we caught no new animals older than 1 year.

Sixteen radiocollared martens (12 males and 4 females) died during the period. Eleven deaths (7 male and 4 females) resulted from natural causes unrelated to human activities. Two deaths were related to our trapping and handling. Little trapping effort was expended on northern Chichagof Island this year, and no one trapped within the primary study areas. One trapper caught a male radiocollared marten during the open trapping season near Hoonah.

This person also caught 2 male martens in late January near Hoonah after the legal season had closed. Altogether, he had caught 7 martens along the lower Game Creek.

We estimated annual survival of radiocollared martens for biological year 1993-1994 at 0.74 (95% CI = 0.62-0.88). With only 3 trapping deaths, natural mortality was the major reason for failure to survive this year. Natural mortality occurred throughout the year with more in the late winter. In contrast, the annual survival rate of radiocollared martens was estimated at 0.88 (95% CI = 0.76-1.00) for 1990-1991, 0.25 (95% CI = 0.16-0.34) for 1991-1992, and 0.57 (95% CI = 0.42-0.72) for 1992-1993.

We have reported the age structure and productivity of martens taken by trappers on Chichagof and Baranof islands during the 1993-1994 trapping season in Appendix A.

Job 5. Spatial patterns and movements. Radiocollared martens were aerially located 542 times to collect information on movements and spatial use patterns. Annual home ranges were modeled for resident martens with an adequate number of relocations (Table 6). For this report, only 100% convex polygons were determined.

Male marten home range sizes were quite variable, ranging from 0.9 km^2 to 19.1 km^2. The median home range size (5.5 km^2) decreased 53% from biological year 1992-1993 (11.8 km^2). Female home ranges varied in size from 2.2 km^2 to 4.8 km^2. Median home range size of females (2.7 km^2) decreased 67% from year 1992-1993 (8.2 km^2). Next year we will complete a comprehensive analysis the spatial use data using GIS software.

Similar to previous years, transient martens of both sexes spent little time on the primary study areas and traveled extensively. Because of the short transmission range of the radiocollars, transient martens were difficult and expensive to locate. Because of costs, we spent less effort searching for transient martens and little search effort was made on the west side of Port Frederick.

Job 6. Small mammal abundance. During October 1993, 83 Sitka mice and 27 long-tailed voles were captured on 8 transects in 1250 trap nights (8.8 captures/100 trap nights). Small mammal trapping was increased substantially from last year with the addition of 1 transect at Salt Lake Bay and 4 new transects at Game Creek. The snap-trap index indicated that small mammal numbers increased this period after several years of low numbers. Long-tailed voles showed the greatest increase in number with no captures last year. Because small mammals, especially voles, usually compose a large part martens diets, the increase in small mammal numbers probably resulted in a greater availability of preferred foods on northeast Chichagof Island for martens during biological year 1993-1994.

Job 7. Seasonal diet. With the assistance of Merav Ben-David, we analyzed 207 marten scats collected from northern Chichagof Island. The results will be presented in the next report. Forty blood samples were obtained from live-trapped martens for stable isotope analysis. Merav Ben-David analyzed the blood samples, and the results will be discussed in the final report.

analysis. Merav Ben-David analyzed the blood samples, and the results will be discussed in the final report.

Job 8. Evaluation of field sexing and aging technique. We collected skulls from 500+ trapper-caught martens from throughout Southeast Alaska including Admiralty, Baranof, Chichagof, and Prince of Wales islands. We recorded cementum ages for each animal, and measured the skulls. These data will be analyzed and evaluated for the final report.

Job 9. Scientific meetings. No meetings were attended.

Job 10. Reports and scientific papers.

Ben-David, M. and R. Flynn. 1994. An assessment of diet in *Martes americana*: Sex, age, or individuality? Presented at the Fifth International Behavioral Ecology Congress, Nottingham, United Kingdom.

ACKNOWLEDGMENTS

Many individuals contributed to the project, and their assistance was appreciated greatly. Loyal Johnson collected and processed marten carcasses from the Sitka area. Several volunteers contributed to the field work including Cathy Connor and Steve Lewis. Merav Ben-David collaborated in the field and contributed to the diet analyses. Trooper David Jones, Fish and Wildlife Protection, greatly facilitated the field work by providing logistical support and office space in Hoonah. Brent Kennedy, Lynn Bennett, and Mike Dinkins, piloted the aerial surveys. Lowell Suring and Matt Kirchhoff contributed many useful ideas to improve the study. Kimberly Titus provided project review and direction. Mary Hicks edited the report. The assistance of USDA Forest Service cooperators, Ted Schenck and Kris Rutledge was quite helpful. Staff of the Hoonah Ranger District provided additional field support.

LITERATURE CITED

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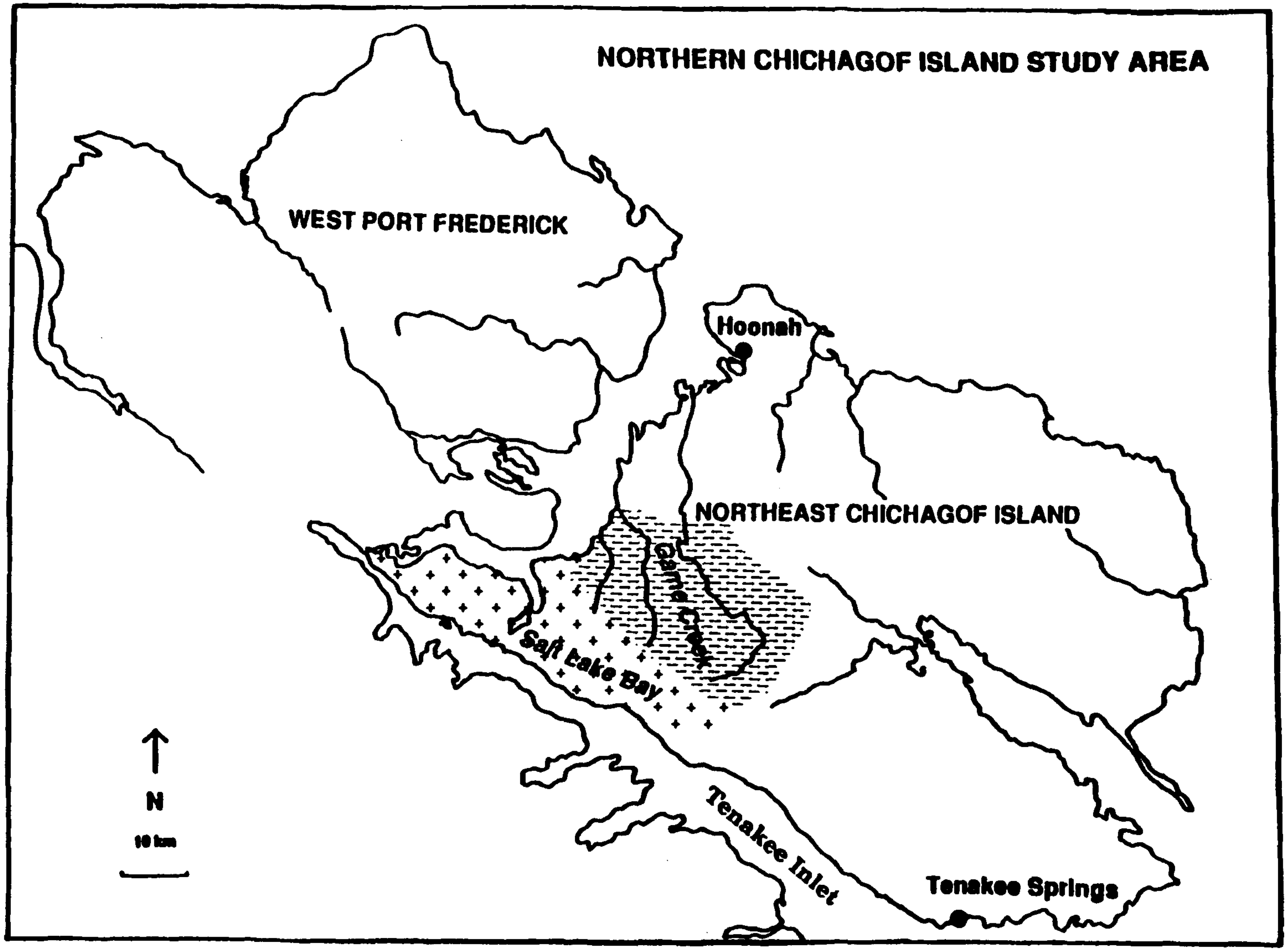

Figure 1. Location map of northern Chichagof Island study areas. The primary study areas at Salt Lake Bay and Upper Game Creek are indicated by cross-hatching.

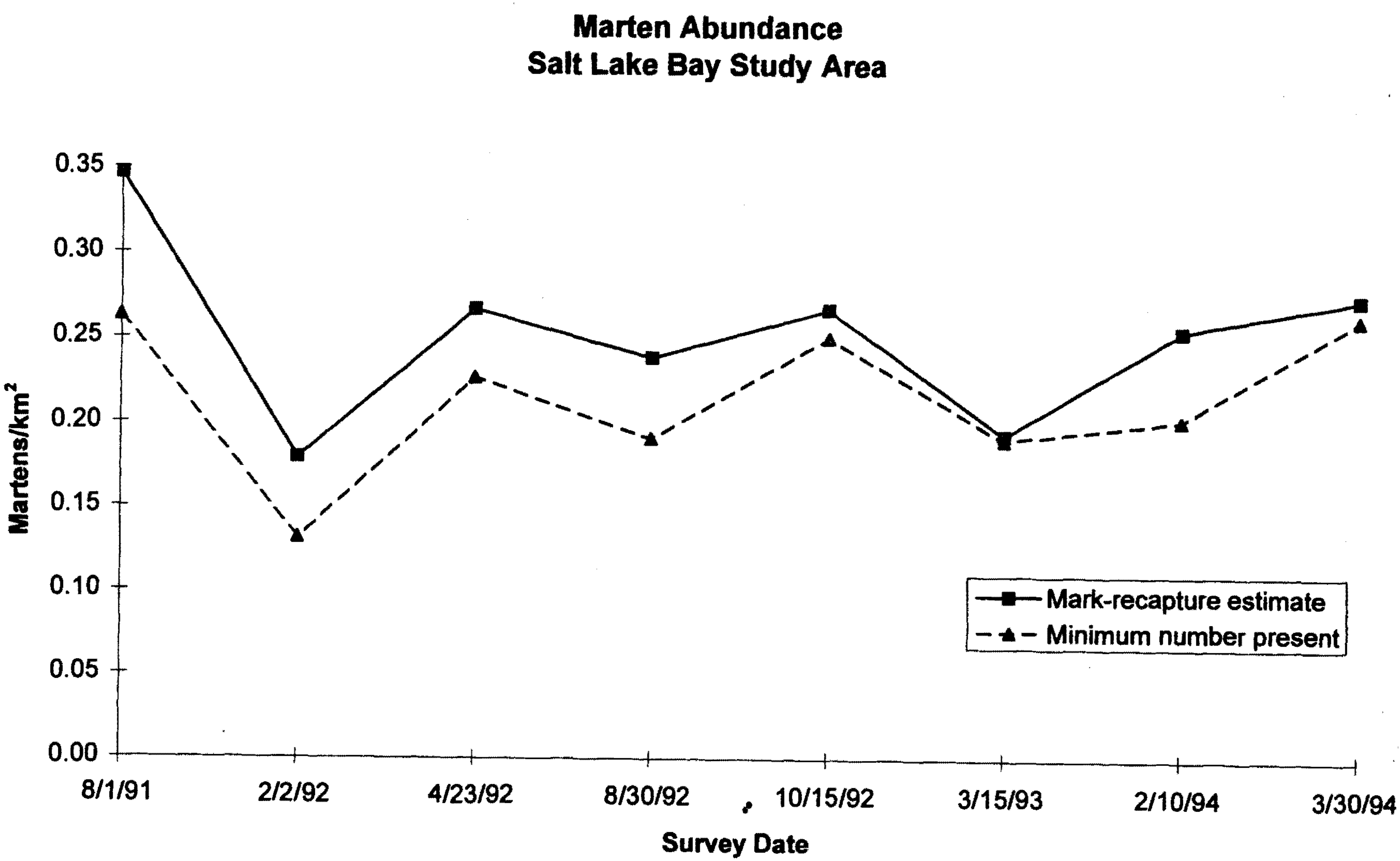

Figure 2. Density of martens on Salt Lake Bay study area, northern Chichagof Island, 1991-1993.

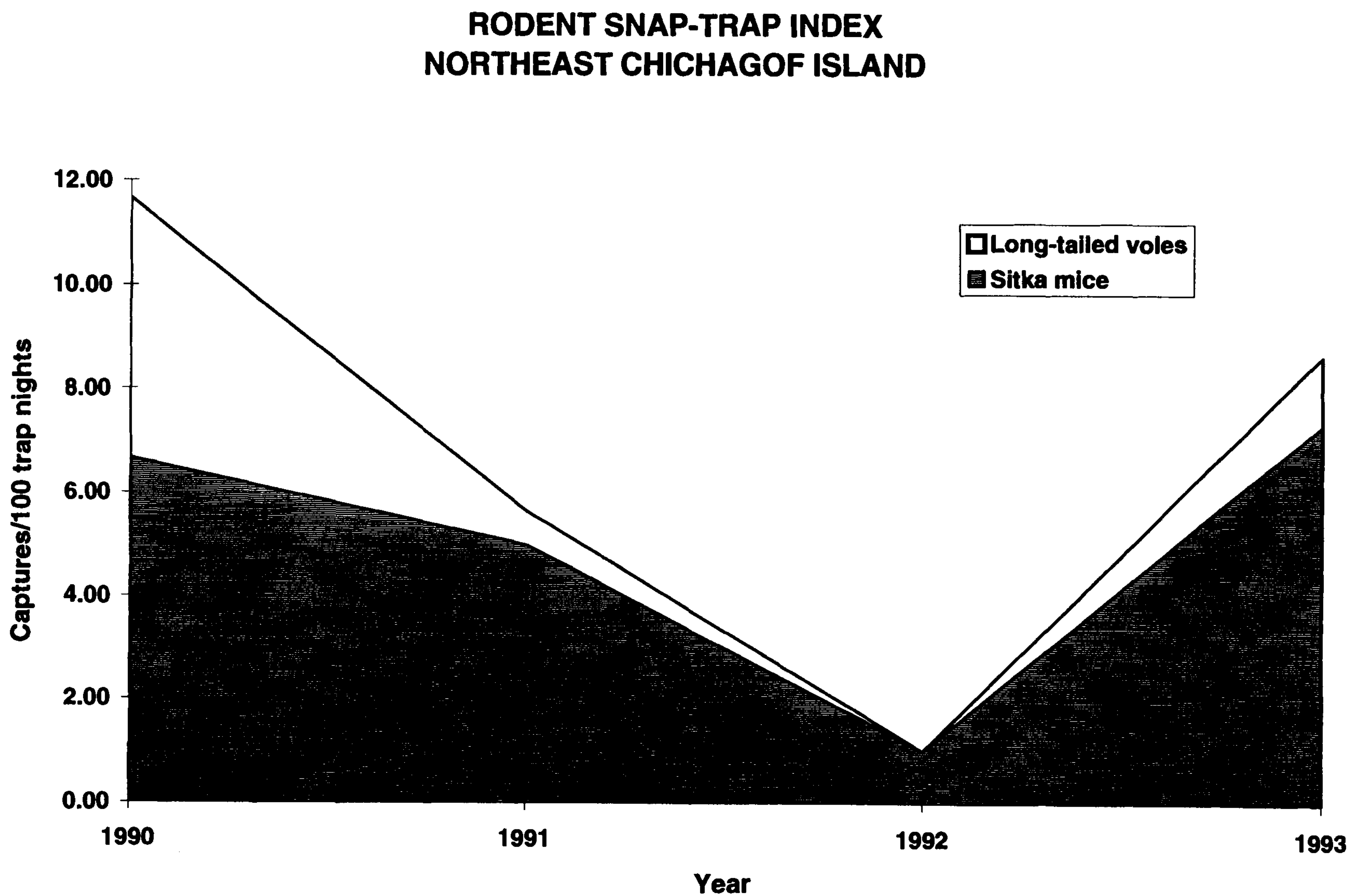

Figure 3. Snap-trap indices for Sitka mice and long-tailed voles on northeast Chichagof Island, 1990-1993.

Table 1. Live-trapping effort and success rates for martens on Salt Lake Bay study area, northeast Chichagof Island, Southeast Alaska, 1993-1994.

Month	No. of trap nights	Total captures	Captures/ 100 trap nights	New captures	New captures/ 100 trap nights
June	0				
July	79	5	6.3	0	0
August	0				
September	161	2	1.2	2	1.2
October	0				
November[1]	302	13	4.3	5	1.3
December	121	19	15.7	7	5.8
January	0				
February	148	7	4.7	2	1.4
March	0				
April[2]	294	48	16.3	5	1.7
May	190	5	2.6	1	0.5
Totals	1295	102	7.9	22	1.7

[1] Actual trapping period was Oct. 27 - Nov. 5.
[2] Actual trapping period was Mar. 27 -April 6.

Table 2. Live-trapping effort and success rates for martens on Upper Game Creek study area, northeast Chichagof Island, Southeast Alaska, 1993-1994.

Month	No. of trap nights	Total captures	Captures/ 100 trap nights	New captures	New captures/ 100 trap nights
June	0				
July	0				
August	0				
September	0				
October	260	12	4.6	10	3.9
November	165	16[1]	9.7	8	4.9
December	0				
January	0				
February	0				
March	0				
April					
May	211	14	4.9	6	3.4
Totals	708	42	5.9	24	3.4

[1] Includes 1 marten that escaped while handling.

Table 3. Age, sex, and status of radiocollared martens monitored on northeast Chichagof Island, 1993-1994.

Animal no.	Sex	Age class	Date collared	No. of captures	Study[a] area	Residency[b] status	Survival status[c]
24	F	3	01/09/91	0	SLB	R	Censored - Oct.
36	M	3	08/02/91	6	SLB	R	Survived
45	M	4	11/16/91	3	SLB	R	Censored - May
48	F	2	02/02/92	0	SLB	R	Censored - March
49	F	4	02/04/92	0	SLB	R	Censored - Oct.
52	F	4	03/05/92	1	SLB	R	Survived
55	M	9	04/27/92	0	SLB	R	Natural death - Dec.
56	F	4	04/27/92	2	SLB	R	Survived
58	F	3	04/28/92	3	SLB	R	Censored - ?
60	M	3	05/01/92	8	SLB	R	Survived
65	F	3	09/18/92	0	GC	R	Censored - July
67	M	3	09/20/92	0	GC	R	Censored - Oct.
73	F	1	10/11/92	0	SLB	T	Censored - Aug.
77	M	3	11/10/92	3	GC	R	Survived
79	M	4	12/20/92	2	SLB	R	Censored - March
80	M	4	01/15/93	0	SLB	R	Censored - Jan.
81	M	4	03/12/93	0	SLB	R	Natural death - Nov.
82	M	2	04/07/93	0	GC	R	Censored - Dec.
83	F	2	04/08/93	0	GC	T	Censored - July
84	F	2	04/27/93	0	GC	T	Censored - July
85	F	8	04/28/93	0	GC	T	Natural death - July
86	F	5	05/02/93	0	GC	R	Censored - Dec.

Table 3. Continued.

Animal no.	Sex	Age class	Date collared	No. of captures	Study[a] area	Residency[b] status	Survival status[c]
87	F	4	05/02/93	0	GC	R	Censored - Nov.
88	M	0	09/26/93	9	SLB	R	Survived
89	F	0	09/26/93	10	SLB	R	Survived
90	M	0	10/15/93	1	GC	T	Trapped -Dec.
91	M	0	10/17/93	3	GC	R	Survived
92	M	1	10/18/93	1	GC	T	Survived
93	M	0	10/20/93	1	GC	T	Censored - Feb.
94	M	0	10/20/93	2	GC	T	Survived
95	M	1	10/21/93	1	GC	T	Trapped - Jan.
96	F	0	10/21/93	2	GC	T	Natural death - Jan.
97	F	0	10/21/93	1	GC	T	Natural death - Jan.
98	F	0	10/21/93	1	GC	T	Survived
99	M	0	10/21/93	1	GC	U	Trap mortality
100	M	0	10/29/93	5	SLB	T	Trap mortality
101	M	0	10/29/93	3	SLB	T	Survived
102	M	0	10/29/93	7	SLB	R	Survived
103	M	0	11/13/93	3	GC	T	Trapped - Jan.
104	M	0	11/05/93	1	GC	T	Censored - Dec.
105	M	0	11/15/93	2	GC	T	Natural death - Jan.
106	M	0	11/17/93	1	GC	T	Natural death - Jan.
107	M	0	11/18/93	1	GC	T	Natural death - Jan.
108	M	0	11/18/93	1	GC	T	Censored - April

Table 3. Continued.

Animal no.	Sex	Age class	Date collared	No. of captures	Study[a] area	Residency[b] status	Survival status[c]
109	M	0	11/18/93	2	GC	R	Survived
110	F	1	11/18/93	1	GC	T	Censored - Dec.
111	M	1	11/18/93	1	GC	T	Natural death - Feb.
112	M	1	12/09/93	7	SLB	T	Survived
113	M	1	12/09/93	2	SLB	T	Survived
114	M	1	12/10/93	3	SLB	T	Survived
115	F	1	12/11/93	9	SLB	T	Survived
116	F	1	12/11/93	1	SLB	T	Natural death - May
117	M	1	12/11/93	8	SLB	T	Survived
118	M	1	12/11/93	6	SLB	T	Natural death - May
119	M	1	02/13/94	1	SLB	T	Survived
120	F	1	02/15/94	2	SLB	R	Survived
121	M	0	03/29/94	1	SLB	T	Survived
122	F	0	03/31/94	1	SLB	T	Survived
123	F	0	04/02/94	1	SLB	T	Survived
124	M	0	04/02/94	2	SLB	R	Survived
125	M	0	04/04/94	1	SLB	R	Survived
129	M	3	05/02/94	2	GC	R	Survived
130	F	9	05/04/94	2	GC	R	Survived

[a] SLB = Salt Lake Bay and GC = Game Creek.
[b] R = resident, TR = temporary resident, OR = other resident, T = transient, and U = undetermined.
[c] The animal was considered censored for the survival analysis when the radio signal was not found after the month listed.

Table 4. Age and sex of martens only ear tagged on northeast Chichagof Island, 1993-1994.

Animal no.	Sex	Age class	Date captured	No. of captures	Study[a] area
126	M	0	04/29/94	3	GC
127	M	0	04/30/94	1	GC
128	F	0	05/01/94	1	GC
131	M	1	05/04/94	1	GC
132	M	0	05/23/94	1	GC
133	M	0	05/23/94	2	GC

[a] GC = Game Creek

Table 5. The sex and residency status of martens monitored on northeast Chichagof Island, Southeast Alaska, 1993-1994.

Status	Males	Females	Total
Salt Lake Bay			
Resident	10	8	18
Temporary resident	1	0	1
Game Creek			
Resident	5	4	9
Unknown	1	0	1
Transients			
Captured at SLB[a]	9	5	14
Captured at GC[b]	12	7	19
Totals	38	24	62

[a] GC = Game Creek
[b] SLB = Salt Lake Bay

Table 6. Home range size estimates for resident martens on northeast Chichagof Island, Southeast Alaska, 1992-1993. n = the number of relocations.

Animal no.	n	Convex polygons (km^2) 100%
Males		
36	21	5.3
45	19	4.5
55[a]	12	5.4
60	20	14.2
79	17	19.1
80	11	5.6
88	13	36.2
91	10	4.6
102[b]	8	2.3
109[b]	9	6.5
Median		5.5
Females		
48	15	3.5
52	15	2.2
56	21	3.1
58	18	1.8
77	13	2.2
89	13	4.6
Median		2.7

[a] Animal died during December 1993.
[b] Animal was radiocollared during mid year.

APPENDIX A

AGE STRUCTURE AND FECUNDITY OF MARTENS TRAPPED ON CHICHAGOF AND NORTHERN BARANOF ISLANDS, SOUTHEAST ALASKA, DURING THE 1993-1994 SEASON

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Abstract: Marten (*Martes americana*) carcasses were collected from trappers on Chichagof Island and northern Baranof Island to determine age structure and maximum fecundity. On Chichagof Island, the marten catch decreased for the second consecutive year to 117 animals from 367 in 1992-93 (-68%). The marten catch on Baranof Island increased 104% to 172 animals. Age structures were similar among areas with a high percentage of juveniles in the catch. Few yearling martens were caught, especially on Chichagof, and only one animal older than 5 years was caught on either area. Most female martens were juveniles (87%). Juveniles:adult female ratios increased substantially on all areas, varying from 10.6 on southern Chichagof to 16.5 on Baranof Island. Corpora lutea counts indicated an increase in fecundity for all areas. Nearly all females aged 2 years and older (93%) were pregnant. Only one yearling female marten was examined, and she had not ovulated. The mean number of corpora lutea per adult female (3.25) and the mean number of corpora lutea per pregnant female (3.71) were high for all areas. On southern Chichagof Island, the reduced trapper catch probably resulted from low marten numbers caused by low recruitment since 1991-92 and continued high trapping effort. The low catch on northern Chichagof primarily resulted from reduced trapper effort. The high pregnancy rates and corpora lutea counts indicate that recruitment should increase in all areas during 1994-95.

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

Population managers need to understand marten demographics to make decisions on harvest regulations. Recent fluctuations in the marten catch in Southeast Alaska raised concerns among management agencies. In 1990, a research project on marten demographics in northern Southeast Alaska was initiated by the Alaska Department of Fish and Game in conjunction with the USDA Forest Service (Flynn 1990). Marten carcasses were collected from trappers operating only on northern Chichagof Island during 1991-92 (Flynn and Blundell 1992). The following two years, the carcass collection was expanded to include all of Chichagof Island and northern Baranof Island (Flynn 1993). This report presents age structure and fecundity information on martens captured by trappers on Chichagof Island and northern Baranof Island during 1993-94.

Many individuals and agencies contributed to the project. Gail Blundell was field and lab technician for the project in 1991 and 1992. Loyal Johnson collected and processed the carcasses from southern Chichagof and northern Baranof islands under a contract with the Department of Fish and Game. E. L. Young, Area Management Biologist, was instrumental in initiating the study, and Jim Faro facilitated the project in 1993. Trooper David Jones, Division of Fish and Wildlife Protection, provided field and office support in Hoonah and helped with obtaining carcasses. The assistance of USDA Forest Service cooperators, Ted Schenck and Kris Rutledge, greatly facilitated the study. We appreciated the cooperation of all trappers who provided carcasses. Gary Matson evaluated the teeth for cementum age and the ovaries for corpora lutea. Support for the project was provided by the Alaska Department of Fish and Game through Federal Aid in Wildlife Restoration Project W-23-4, Job 7.16 and the USDA Forest Service through Sikes Act purchase order 43-0109-3-0354.

STUDY AREA

We chose Chichagof Island and northern Baranof Island (Fig. 1), located in the northern portion of Southeast Alaska (57-58°N, 135-136°E; 80-160 km west of Juneau), for this study because of concerns for marten populations there. Most habitats typical of northern Southeast Alaska occurred on the study area including a range of physiographic types from beach fringe to alpine (Flynn 1991). Landscapes included substantial amounts of logged and unlogged areas. Trapper access depended on the locations of communities, cabins, protected waters, and logging roads. Most of the lands were within the Hoonah and Sitka ranger districts, Chatham Area, Tongass National Forest, USDA Forest Service.

Federal Fish and Wildlife Service personnel introduced martens to Baranof and Chichagof islands to establish populations for human use (Elkins and Nelson 1954). Seven martens (4 males and 3 females), captured on the mainland near Cape Fanshaw, were released on Baranof Island in 1934. Twenty-one martens (5 males, 8 females, 8 unknown) were released near Pelican on Chichagof Island between 1949 and 1952 (Elkins and Nelson 1954). The animals were captured from several geographic areas including 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).

The trapping season on Baranof Island for martens was first opened in 1950-51, and the first marten trapping season 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 during November, December, January, and February. Because of conflicts over subsistence, the state and federal government began dual harvest management in 1990-91. Recreational and subsistence trapping seasons for martens, mink, and weasels on the northeast portion of Chichagof Island were closed during 1990-91 because of depleted marten populations. The portion of northern Chichagof Island west of Port Frederick remained open with season dates from 1 December to 15 February. During 1991-92, the trapping season for both portions of northern Chichagof Island opened on 1 December. On northeast Chichagof Island, federal subsistence regulations prohibited trapping with the use of a motorized land vehicle on federal lands. The trapping seasons for marten, mink, and weasels on northern Chichagof Island were closed on 24 January 1992 by state and federal emergency orders because of concern about the overharvest of martens. For regulatory year 1992-93, the restriction on the use of land vehicles for trapping was expanded to federal lands on the portion of northern Chichagof Island west of Port Frederick and north of a line from Tenakee Inlet to Idaho Inlet. Also, federal subsistence regulations restricted marten trapping on northern Chichagof Island to rural residents of the state. The season for northern Chichagof Island ran from 1 December to 31 December. For Baranof Island and southern Chichagof Island, the marten season remained from 1 December through 15 February with no additional restrictions. These same regulations were continued for the 1993-94 trapping season.

METHODS

Marten catch

The total number of martens caught by trappers in the area was obtained from the department's furbearer sealing program. Regulation required that all martens trapped in Southeast Alaska be sealed by the department within 30 days of season closure. During sealing, authorized department representatives recorded the location, month of capture, number, and sex of all martens taken. The sealing information was summarized by the same geographic areas as the carcass data.

Carcass collection

The marten carcass collection was handled in two ways depending on area. For northern Chichagof Island, we attempted to collect the carcasses from all martens trapped during the 1-31 December 1993 trapping season. Before the opening of the trapping season, we sent a letter to everyone who had trapped on northern Chichagof Island during the past three years. Trappers were provided with information on the objectives of the study 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 frozen them until processing. For the marten carcasses collected from southern Chichagof Island and northern Baranof Island, Loyal Johnson contacted area trappers, collected carcasses from them, and processed the carcasses following the procedures described below. All the carcasses were processed within 2 months of capture.

We weighed each carcass and assigned an index of internal and external fat content using an ocular estimation procedure developed by Blundell (1992). Total, body, and tail lengths of each carcass were measured along with the method of skinning (i.e., feet skinned out or not). The stomachs of each carcass were examined for the presence of parasites, and the number of *Soboliphyme baturini* worms was recorded. Each skull was measured and classified as juvenile or adult according to Magoun et al. (1988). The skulls were heated in water for 2-4 hours at 80° C, then the lower canine and premolar 4 extracted. The teeth were stored frozen until sent to Matson's Laboratory (Milltown, MT) for age class determination by tooth cementum analysis.

Each carcass was assigned a code for geographic area following the department's hierarchical numbering system. For analysis, we grouped the samples by the following major geographic areas: northern Chichagof Island was the area north of Tenakee Inlet and east of Idaho Inlet; southern Chichagof Island was the area south of Tenakee Inlet and north of Peril Strait; and northern Baranof Island was the area north of Goddard and Redoubt Lake. For some analyses, northern Chichagof Island was further divided into northeast Chichagof Island, the portion east of Port Frederick.

Ovarian analysis
The ovaries of each female were removed and preserved in a solution of 10% formalin. Before shipment to Matson's Laboratory (Milltown, MT), the ovaries were washed in water 3 times and subsequently packed in water. Ovaries were serially sectioned at 10 microns, and sections for evaluation were taken at 0.4 mm intervals throughout the series. Preparations were stained in a trichrome solution. A standard protocol developed by G. Matson was used to determine the presence and number of corpora lutea in each ovary. Corpora lutea form in either ovary upon shedding of an ovum and remain in the ovary during pregnancy (Strickland and Douglas 1987). The martens for this study were trapped during the period of arrested development of the blastocyst and before its implantation in the uterus (Clark et al. 1987). Because ovulation is induced during mating, a female marten with corpora lutea present in either ovary was considered pregnant at the time of death. The proportion of females in an age class with corpora lutea was expressed as an age-specific pregnancy rate. We summed the counts for a pair of ovaries to determine the total number of corpora lutea present for an individual female marten. The total number of corpora lutea was considered a measure of maximum fecundity of the female marten at the next birth pulse (i.e., spring 1994) because some shed ova will not result in live births. The mean number of corpora lutea was computed by age class to estimate age-specific fecundity rates. Several age-class groupings were used for determining fecundity and pregnancy rates. Juveniles were young of the year, and adults were yearlings (age class 1) and greater. Also, adult females were grouped as yearlings (i.e., age class 1), and mature females (age class 2+). No juveniles were pregnant, so this age class was dropped from any additional analyses.

RESULTS AND DISCUSSION

Total Catch
The marten catch continued to decline in year 1993-94 on Chichagof Island, but increased on Baranof Island (Fig. 2). On northern Chichagof Island, only 22 martens (27% females) were reported taken by 2 trappers compared with 113 martens (32% females) in 1992-93 and 513 martens (48% females) during the 1991-92 trapping season. On southern Chichagof Island, the catch declined to 95 (47% females) from 254 (33% females) in 1992-93 and 610 (42% females) in 1991-92. In contrast, the marten catch on north Baranof Island increased to 172

animals (33% females) from 84 (30% females) in 1992-93. During the 1991-92 season, 347 martens (42% females) were taken on northern Baranof.

The reduced catch on northern Chichagof Island probably resulted partially from less trapping effort, especially along the road system on the private lands near Hoonah and along the shores of upper Tenakee Inlet. During 1992-93, the roaded portions of the private lands on both sides of Port Frederick were trapped extensively and provided most of the catch for northern Chichagof Island. Also, several miles of the shoreline of upper Tenakee Inlet were trapped in 1992-93. In 1993-94, the road systems near Hoonah and the shoreline of upper Tenakee Inlet were not trapped. One trapper worked a small section of shoreline near Tenakee Springs and another trapper made a few sets near their home at lower Game Creek and in Neka Bay. Low success in year 1992-93 and an outlook of poor success seemed to reduce trapping interest in 1993-94. Also, the trapping regulations were more restrictive by federal subsistence regulations in 1993-94 with trapping on federal lands restricted to rural residents.

On southern Chichagof Island, the reduced catch probably resulted from low marten numbers because the trapping effort seemed similar to 1992-93. The increased catch on Baranof Island probably resulted from increased marten numbers because trapping effort was also similar during both years.

We collected carcasses from 15 martens (68%) reported trapped on northern Chichagof Island during 1993-94. On southern Chichagof, carcasses were collected from 68% of the 95 martens reported trapped there. Of the 172 martens trapped on northern Baranof Island, 52% of the carcasses were collected.

Age Structure

Age structures of martens taken in year 1993-94 were much younger than the previous year on all areas. Juvenile martens composed 82.7% of the total on Chichagof Island (Table 1) and 74.1% on Baranof Island (Table 2). In 1992-93, juvenile martens composed only 27.4% and 48.6%. Likewise, the ratio of juveniles:adults was high for all areas, varying from 2.9 to 6.5 (Table 3), and increased greatly from 1992-93. The greatest increase in the juvenile:adult ratio was recorded on Chichagof Island (Table 4). On northern Chichagof, the ratio increased from 0.5 in 1991-92 and 1992-93 to 6.5. For southern Chichagof, the juvenile:adult ratio increased from 0.3 in 1992-93 to 3.1 in 1993-94. On Baranof Island, the ratio increased from 1.0 to 2.9.

The percentage of females in the catch varied from 33% on northern Chichagof to 57% on southern Chichagof (Table 5). On both islands, trapped females were mostly juveniles (Chichagof = 86% and Baranof = 88%), and few mature females (age 2+) were taken (6%). No yearling females were recorded. Thus, juvenile:adult female ratios were high on all areas varying from 10.6 to 16.5 (Table 3). On northern Chichagof Island, the juvenile:adult female ratio has increased each year from 0.95 in 1991-92 to 1.39 in 1992-93 and 13.0 in 1993-94. On southern Chichagof, the juvenile:adult female ratio increased greatly from 0.95 in 1992-93 to 10.6. On Baranof, the ratio increased from 5.0 in 1993-94 to 16.5. Because no yearling females were taken in 1993-94, the ratios of juveniles:females age 2+ were the same as the ratios of juveniles:adult females.

Juveniles:female age 2+ ratios increased greatly on Chichagof Island. On northern Chichagof, the ratio increased from 2.2 and 2.7 in 1991-92 and 1992-93 to 13.0. On southern Chichagof, the juveniles:female age 2+ ratio increased from 1.2 in 1992-93 to 10.6. The ratio on Baranof was about the same each year (17.0 vs. 16.5) indicating a more static situation.

The increased adult:juvenile ratios were consistent with greater recruitment during 1993-94 on Chichagof Island. The high ratios may also been influenced by a reduced vulnerability of adult females to trapping. Strickland and Douglas (1987) recommended that juvenile:adult ratios in the catch should be greater than 3.0 to avoid an overharvest of adult females. Because the juvenile:adult female ratios in the catch for all areas were greater than 3.0, an overharvest of adult females probably did not occur in 1993-94. On northern Baranof Island, the juvenile:adult female ratio was well above the guideline of Strickland and Douglas (1987).

Fecundity

Potential fecundity of trapped female martens was high in 1993-94 (Table 6). Nearly all adult female martens (93%) were pregnant. Only one yearling female marten was examined, and she had not ovulated. Corpora lutea counts averaged 3.25 for all adult female martens with pregnant females averaging 3.71 corpora lutea. Because of the small number of adult females examined in 1993-94 (n = 16), we pooled the ovarian data. For comparisons among areas and years, we assumed that the pooled data reflected fecundity rates for the entire area.

In 1992-93, pregnancy rates for female martens age 2+ on Chichagof Island ranged from 56% on the southern portion to 75% on northern Chichagof. On northern Chichagof Island, a mean number of corpora lutea per adult female of 3.25 indicated a great increase from the lows of 0.68 in 1991-92 and 1.65 in 1992-93. Also, the mean number of corpora lutea per pregnant female has increased each year from 2.94 in 1991-92 to 3.55 in 1992-93 to 3.71. On southern Chichagof Island, the mean number of corpora lutea per adult female has also increased from a low of 1.52 in 1992-93.

The mean number corpora lutea indicated an increase in potential fecundity of martens on Chichagof Island for the 1994-95 biological year. Because the trapped females would have given birth in May 1994, recruitment for 1994-95 should increase across Chichagof Island. Fecundity rates for 1993-94 (3.25) were within the upper portion of the range (2.26-3.48) reported by Strickland and Douglas (1987) for a 12-year period in Ontario. Strickland and Douglas (1987) found pregnancy rates for adult females varying from 81 to 100% with an overall yearling pregnancy rate of 78% and a 93% rate for mature females (age class 2^+). In Ontario, Thompson and Colgan (1987) found reduced ovulation rates by female martens in response to food scarcity, especially in yearlings. They found that pregnancy rates for yearling female martens decreased from 7% to 0% during a decline in the availability of small mammal prey while pregnancy rates of mature females varied from 50% to 72%. The high pregnancy rates and mean number of corpora lutea are consistent with an increased food availability on Chichagof Island.

MANAGEMENT IMPLICATIONS

Age structure information from the marten carcass collection during the 1993-94 trapping season indicated increased recruitment rates across Chichagof Island. The low marten catch in 1993-94 probably reflected low population numbers resulting from low recruitment since 1991-92, the high trapper catch during the 1991-92 season, and reduced effort in some areas, especially northeast Chichagof. The almost complete lack of yearlings in the catch reflected low recruitment in 1992-93. The high corpora lutea counts indicate that increased recruitment can be expected in 1994-95. Because of low recruitment and substantial trapping pressure over the last several years, marten numbers will still be relatively low across Chichagof Island during fall 1994.

On northern Chichagof Island, the pregnancy rate for age 2+ female martens increased from 36% in 1991-92 to 75% in 1992-93 to 93%, but the pregnancy rate for yearlings probably remained low. Pregnancy rates of older females were near the highest reported and should increase recruitment unless juvenile survival is poor this fall. The increased fecundity of older females suggests a response to increased nutrition on Chichagof Island. Additional study is needed to further explore the relationship between marten fecundity and nutrition. More research on marten demographics would help clarify relationships among recruitment, catch statistics, corpora lutea counts, and food abundance.

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. If a commercial laboratory is available for the tooth cementum and ovarian analyses, the data collection procedures are relatively easy for the investigator to complete.

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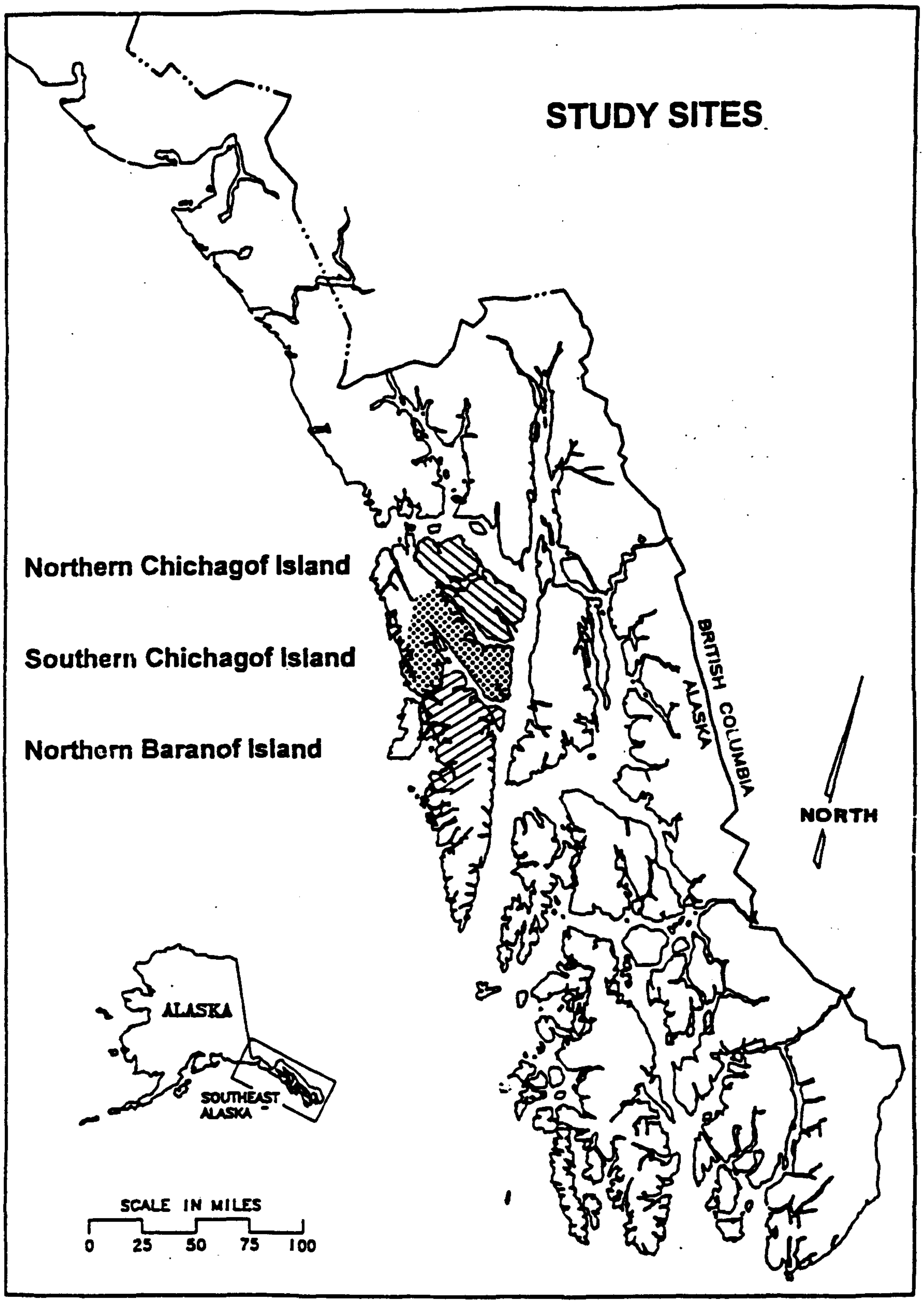


Figure 1. Study sites on northern Chichagof Island, southern Chichagof Island, and northern Baranof Island in southeast Alaska.

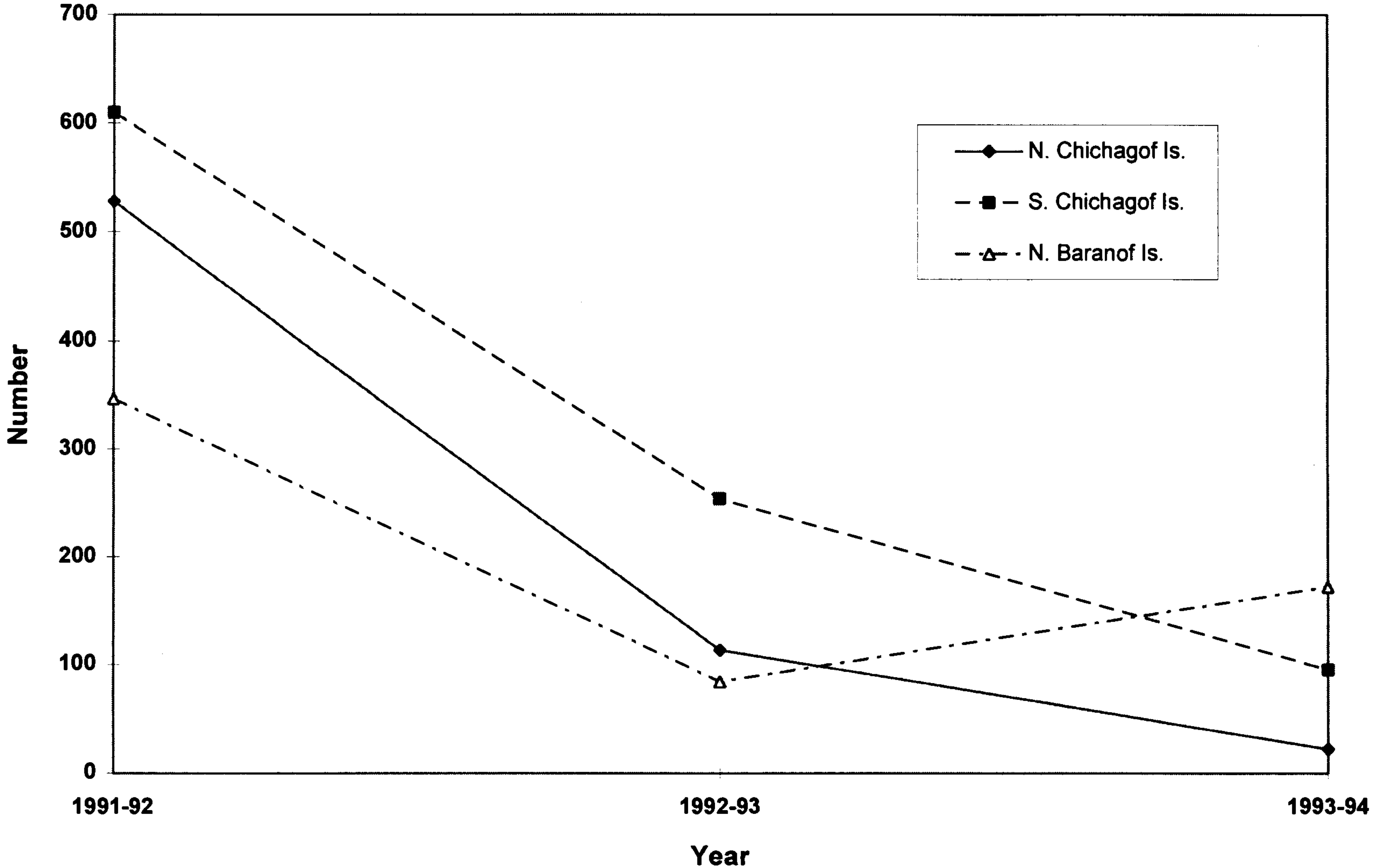


Figure 2. Marten catch on Chichagof and northern Baranof islands for 1991-92 to 1993-94 trapping seasons. Information based on Alaska Department of Fish and Game sealing records.

Table 1. Age distribution of martens captured by trappers on Chichagof Island, Southeast Alaska, 1993-1994.

Age class	Males		Females		Totals		Females (%)
	No.	%	No.	%	No.	%	
0	30	37.0	37	45.7	67	82.7	55
1	1	1.2	0	6.9	1	25.0	0
2	2	2.5	0	0.0	2	2.5	0
3	2	2.5	2	2.5	4	4.9	50
4	3	3.7	2	2.5	5	6.2	40
5	0	0.0	1	1.2	1	1.2	100
>5	0	0.0	1	1.2	1	1.2	100
Totals for ages >0	8	9.9	6	7.4	14	17.3	43

Table 2. Age distribution of martens captured by trappers on Baranof Island, Southeast Alaska, 1993-1994.

Age class	Males		Females		Totals		Females (%)
	No.	%	No.	%	No.	%	
0	37	41.5	29	32.6	66	74.2	44
1	6	6.7	0	0.0	6	6.7	0
2	5	5.6	0	0.0	5	5.6	0
3	6	6.7	2	2.3	8	9.0	25
4	1	1.1	2	2.3	3	3.4	67
5	1	1.1	0	0.0	1	1.2	0
>5	0	0.0	0	0.0	0	0.0	
Totals for ages >0	19	21.2	4	4.6	23	25.8	17

Table 3. Age ratios of martens captured by trappers in northern Southeast Alaska, 1993-1994.

Area	n^a	Juveniles/ adult	Juveniles/ age 1+ female	Juveniles/ age 2+ female
Northern Chichagof Is.	15	6.5	13.0	13.0
Southern Chichagof Is.	65	3.1	10.6	10.6
Northern Baranof Is.	89	2.9	16.5	16.5

n^a = the total number of carcasses collected.

Table 4. Comparison of juvenile/adult ratios of martens captured by trappers in northern Southeast Alaska between trapping seasons 1992-1993 and 1993-1994.

Area	1992-93		1993-94	
	n	Ratio	*n*	Ratio
Northern Chichagof Is.	100	0.5	15	6.5
Southern Chichagof Is.	82	0.3	65	3.1
Northern Baranof Is.	72	1.0	89	2.9

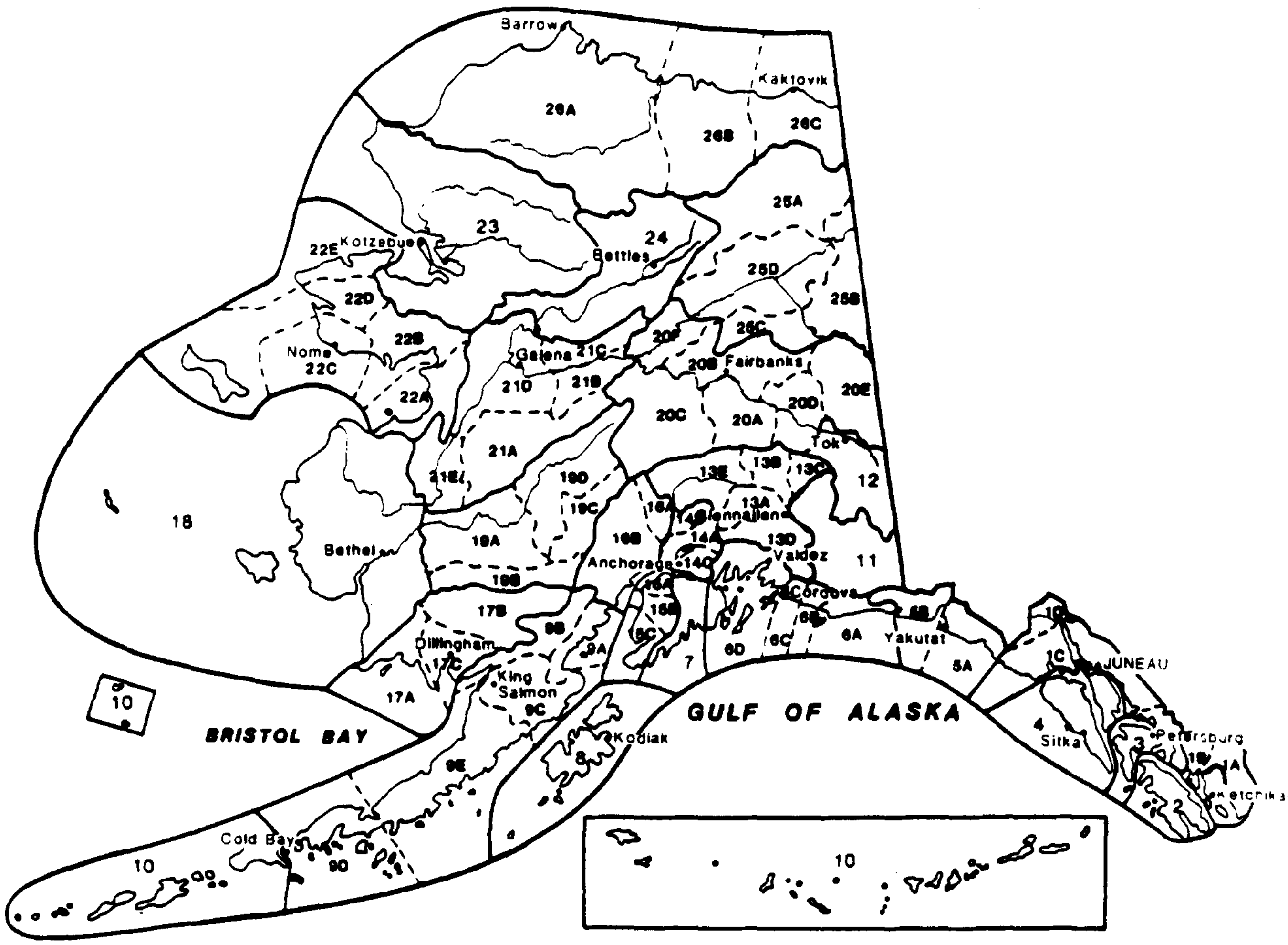
Table 5. Comparison of the percentage of female martens captured by trappers in northern Southeast Alaska between trapping seasons 1992-1993 and 1993-1994. *n* = the total number of carcasses collected.

Area	1992-93		1993-94	
	n	%	*n*	%
Northern Chichagof Is.	100	35	15	33
Southern Chichagof Is.	82	32	65	57
Northern Baranof Is.	72	30	89	37

Table 6. Mean counts of corpora lutea and percentage of females with corpora lutea by age class of martens collected by trappers in northern Southeast Alaska, 1993-1994. Female martens with corpora lutea had ovulated and were considered pregnant.

Age class	No. females examined	% females pregnant	Corpora lutea per pregnant female		Corpora lutea per female	
			$\bar{x}$	SE	$\bar{x}$	SE
1	1	0	0.00		0.0	
2	1	100	3.00		3.00	
3	5	75	3.67	0.33	2.75	0.95
4	7	100	3.57	0.20	3.57	0.20
5	1	100	4.00		4.00	
6	1	100	4.00		4.00	
>6	1	100	5.00		5.00	
Totals	16	88	3.71	0.16	3.25	0.35
Totals for age classes >1	15	93	3.71	0.16	3.47	0.29

Alaska's Game Management Units



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Thomas Schumacher

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