MONTANA STATE UNIVERSITY

Population characteristics and winter habitat selection by pine marten in southwest Montana

by Kenneth Wesley Coffin

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Fish and Wildlife Management
Montana State University
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Abstract:
The Montana Department of Fish, Wildlife, and Parks and the U.S. Forest Service lacked site specific ecological data on which to base management decisions concerning pine marten in southwest Montana. This study, conducted during 1991 and 1992, was the last of 3 studies which began in 1989 to document population characteristics and habitat selection of pine marten in two areas of southwest Montana. Age and sex data from fur trappers catches was obtained to determine the effects of harvest on marten populations. Marten were radiocollared during the fall of 1991, and located using radio telemetry during the winter of 1991-1992. Marten locations were compared to random points to determine habitat selection. Habitat variables were divided into large, medium, and small scale categories. Small mammal trapping was conducted to determine the influence of small mammals in habitat selection of pine marten. Rest site structure was also noted. Juvenile marten outnumbered female marten 3:1 in harvested samples from Mosquito Gulch and Beaver/Tepee Creeks. Trappers regarded the 1991-1992 season as good, with catches being higher than the previous two years. Habitat use at the largest scale, involved all forested cover types but marten showed preference for mesic subalpine fir and lodgepole pine on the Big Hole study area. Sites with old growth characteristics were used less than expected on the Big Hole study area, but were sought out by marten on the Flats study area. On a medium scale, marten preferred areas with a higher basal area than that found at random points. At the smallest scale, marten locations were characterized by higher numbers of live trees and by a higher percent grass cover when compared to random points. Small mammal captures were not evenly distributed across habitats on the Big Hole or Flats study areas. Marten selected sites that were characterized by high densities of rodents. Marten utilized downed woody material in both areas for resting, but most rest episodes occurred in the tree canopy in red squirrel grass nests. Although pine marten in this study selected traits associated with mature forests they were found to be flexible with regard to habitat use on forested sites.

POPULATION CHARACTERISTICS AND WINTER HABITAT SELECTION BY PINE MARTEN IN SOUTHWEST MONTANA

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This thesis has been read by each member of the thesis comittee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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ABSTRACT

The Montana Department of Fish, Wildlife, and Parks and the U.S. Forest Service lacked site specific ecological data on which to base management decisions concerning pine marten in southwest Montana. This study, conducted during 1991 and 1992, was the last of 3 studies which began in 1989 to document population characteristics and habitat selection of pine marten in two areas of southwest Montana. Age and sex data from fur trappers catches was obtained to determine the effects of harvest on marten populations. Marten were radiocollared during the fall of 1991, and located using radio telemetry during the winter of 1991-1992. Marten locations were compared to random points to determine habitat selection. Habitat variables were divided into large, medium, and small scale categories. Small mammal trapping was conducted to determine the influence of small mammals in habitat selection of pine marten. Rest site structure was also noted. Juvenile marten outnumbered female marten 3:1 in harvested samples from Mosquito Gulch and Beaver/Tepee Creeks. Trappers regarded the 1991-1992 season as good, with catches being higher than the previous two years. Habitat use at the largest scale, involved all forested cover types but marten showed preference for mesic subalpine fir and lodgepole pine on the Big Hole study area. Sites with old growth characteristics were used less than expected on the Big Hole study area, but were sought out by marten on the Flats study area. On a medium scale, marten preferred areas with a higher basal area than that found at random points. At the smallest scale, marten locations were characterized by higher numbers of live trees and by a higher percent grass cover when compared to random points. Small mammal captures were not evenly distributed across habitats on the Big Hole or Flats study areas. Marten selected sites that were characterized by high densities of rodents. Marten utilized downed woody material in both areas for resting, but most rest episodes occurred in the tree canopy in red squirrel grass nests. Although pine marten in this study selected traits associated with mature forests they were found to be flexible with regard to habitat use on forested sites.

INTRODUCTION

Information regarding the biology and management of the pine marten (*Martes americana*) throughout its range is abundant, with many studies being completed within the last ten years (Archibald and Jessup 1984, Buskirk 1984, Buskirk and McDonald 1984, Wynne and Sherburne 1984, Bateman 1986, Raine 1987, Spencer 1987, Strickland and Douglas 1987, Thompson and Colgan 1987, Buskirk et al. 1988, Buskirk and McDonald 1989, Buskirk and Harlow 1989, Warren 1989, Fager 1991, Martin and Barrrett 1991, Corn and Raphael 1992, Kujala 1993). But until recently, little was known about the habits and habitat characteristics of the pine marten in southwest Montana. For decades, the only information collected on marten in southwest Montana had been pelt-tagging data from trappers (Fager 1991). Recent studies by Fager (1991) and Kujala (1993) have described habitat selection and harvest dynamics of the marten in this portion of their range.

The United States Forest Service (USFS) is responsible for managing most of the pine marten habitat in southwest Montana. The National Forest Management Act of 1976 mandated each National Forest to select and monitor indicator species. Both the Beaverhead and Gallatin National Forests have selected the pine marten as one of several management indicator species. Ecological uses of vertebrate indicators include using them to assess population trends and habitat quality, then extrapolating this information to other species (Landres et al. 1988). To effectively evaluate the use of the marten as an indicator species in southwest Montana, more information regarding pine marten habitat relationships was needed.

Management of marten populations falls under the jurisdiction of the Montana Department of Fish, Wildlife, and Parks (MDFWP). The primary concern of this agency was the uncertainty of the effects of unlimited harvests of marten over a 2-month season in MDFWP Region 3 (southwest Montana) coupled with habitat alterations mainly in the form of logging.

The USFS and the MDFWP funded a 3-year study to answer questions concerning population characteristics, harvest levels, habitat relationships, prey relationships, and to determine the relative population densities of local marten populations in southwest Montana. These objectives were also included in studies by Fager (1991) and Kujala (1993). Specifically, the objectives of my study, the last in series of 3, were to: 1) determine the effects of harvest activities on local pine marten populations; 2) determine local population densities; 3) determine home range size and movements; 4) determine the influence of large, medium, and small scale features on the habitat selection of pine marten; 5) determine how the abundance and availability of prey influences habitat selection.

STUDY AREAS

Four study areas in southwest Montana were selected for this project. The upper Big Hole study area was located on the Wisdom Ranger district of the Beaverhead National Forest. The West Yellowstone Flats, Mosquito Gulch, and Beaver Creek study areas were located on the Hebgen Lake Ranger district of the Gallatin National Forest. These areas were chosen based on historic pine marten harvests and their proximity to large untrapped areas. Study area selection was also based on representative habitat types.

Upper Big Hole

The upper Big Hole study area (Fig 1) was located 15 km west of Wisdom and immediately northwest of the Big Hole National Battlefield. The study area included 153 square kilometers (km^2) of the Anaconda range in the Beaverhead National Forest. Major drainages include Placer, South Fork of Tie, Tie, Johnson, Shultz and Bender Creeks. The area was bounded by Highway 43 to the south, the Continental Divide to the north and west, and the sagebrush grassland of the upper Big Hole valley to the east (Fager 1991).

Elevation varied between 1,950 and 2,500 meters (m). Annual average precipitation at the town of Wisdom averages 30 centimeters (cm). Average temperature at Wisdom averages 1.7 C (NOAA 1990).

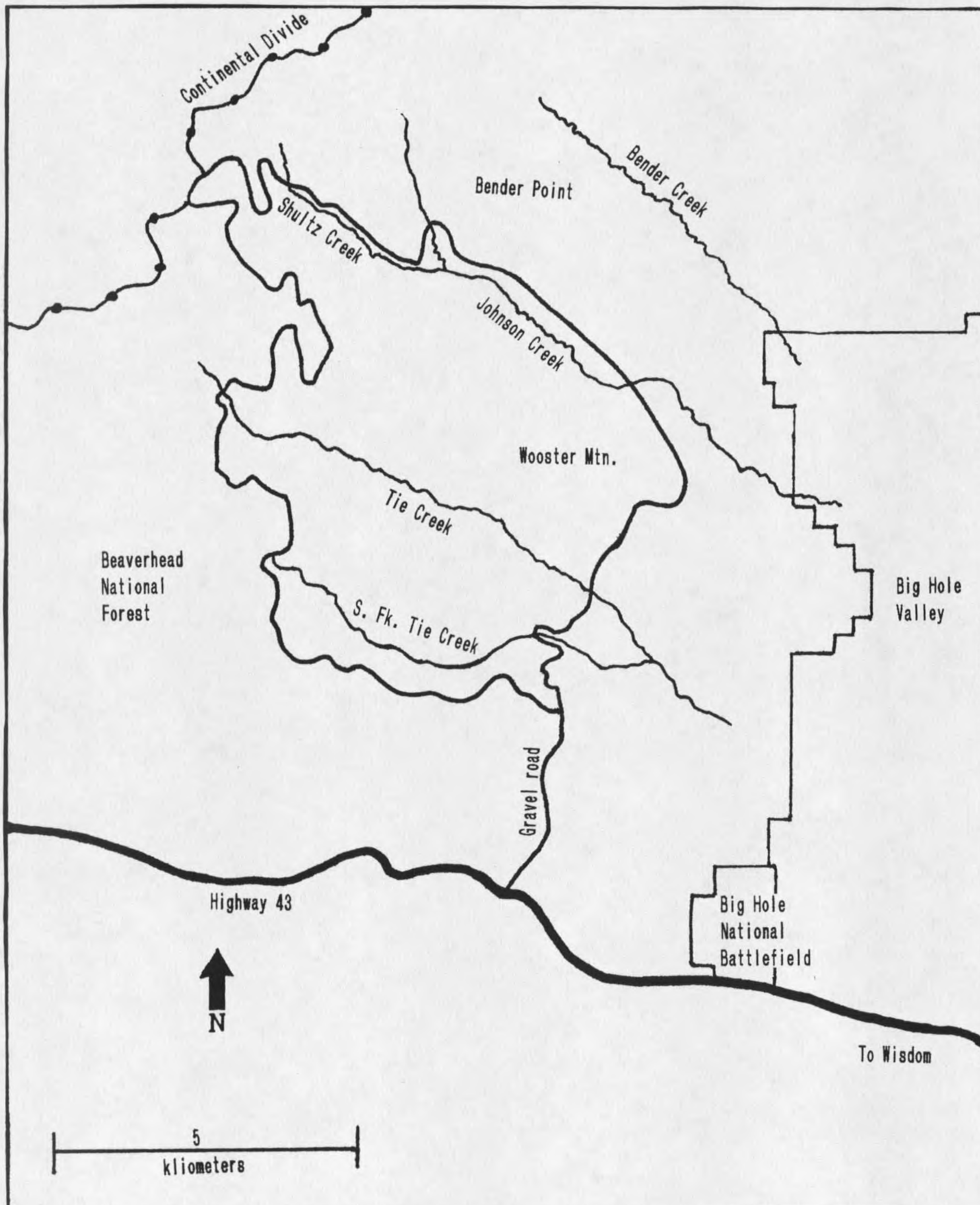

Figure 1. Map of the Big Hole study area, west of Wisdom Montana.

Spruce (*Picea spp.)* and subalpine fir (*Abies lasiocarpa)* habitat types were characteristic of drainage bottoms and higher elevation sites. Drier and lower elevation sites supported lodgepole pine (*Pinus contorta)* and Douglas-fir (*Pseudotsuga menziesii*) habitat types.

Major land uses in the area include logging, livestock grazing and recreation, mainly in the form of hunting and camping during the summer and fall and snowmobiling during the winter. Timber has been harvested on parts of the area since the late 1950's. Clearcut logging and associated road building were widespread in the last 2 decades, and consequently, motorized access to a majority of the study area was good (Fager 1991).

West Yellowstone Flats

The West Yellowstone Flats study area (Figure 2) was located in extreme southern Montana near the town of West Yellowstone on the Gallatin National Forest. Limited areas of Yellowstone National Park were included. The study area was bounded by Duck Creek on the north, Hebgen Lake and the South Fork of the Madison river to the west, Highway 20 to the south and Yellowstone National Park to the east. The Flats study area was situated in a high elevation basin at 2000 m with little topographic relief.

Average temperature for West Yellowstone is 1.6 C. (NOAA 1990). Precipitation in this area occurs primarily as snow and averages 56.7 cm (NOAA 1990).

A lodgepole pine-antelope bitterbrush association (*Purshia tridentata*) was the dominant vegetation in this area. Natural openings and clearcuts supported vegetation cover dominated by grass species. Willow (*Salix spp.*) communities were scattered throughout the area.

Primary land uses were recreation, logging, and firewood cutting. Recreational activities include hunting, fishing and camping during the summer and fall months. Snowmobiling was the dominant winter recreational activity followed by cross country skiing. Large scale timber harvesting has taken place on the study area since the late 1950's. An extensive network of roads and a flat physiographic nature permitted almost unlimited motorized access on the study area. Fur trapping has been intermittent for the last 50 years (Whitman pers. comm.)

Mosquito Gulch

The Mosquito Gulch study area (Figure 2) was located south of the Flats study area. This area was bounded by the South Fork of the Madison river to the east, the Idaho border on the south, Two Top mountain to the west, and the Flats to the north.

The area had a diverse topography, ranging from relatively flat benches to drainages with high topographic relief. Elevation ranged from 2035 m to 2500 m. Average precipitation is approximately 112 cm, at the Madison Plateau SNOTEL site, mostly in the form of snow. Average temperatures were similar to those in West Yellowstone.

Timber harvesting began in the late 1950's. Harvest activities are ongoing today, although not at the high rate of the past 3 decades. Recreation is the only other land use of the area. Hunting and sight seeing were the primary recreational activities during the summer and fall months. Snowmobiling and cross country skiing were the primary winter recreational activities. An extensive network of groomed snowmobile trails was maintained throughout the winter and provided good access to the area. Fur trapping has taken place on the Mosquito Gulch study area for at least the last 50 years (Whitman pers. comm.)

Vegetation of the area was dominated by communities of subalpine fir, lodgepole pine, and Douglas-fir. Grass cover was most pronounced in clearcuts, and willow communities were common along streams.

Beaver Creek

Beaver Creek (Figure 2) was located northwest of Hebgen Reservoir and 14 km northwest of the Flats study site. This area included 32 km^2 and was bordered on the south by Highway 287, the Lee Metcalf Wilderness to the west, Potamogeton Park to the north, and Cabin Creek to the east. Mean precipitation and temperature, measured at Hebgen Dam, are 73.2 cm, and 2.2 C. Elevation ranged from 2,000 m to 2,800 m. The topography of this study area was much steeper than any of the other study areas.

Spruce (*Picea engelmannii*) and subalpine fir dominated the creek bottom and much of the steep valley sides. Douglas-fir was a common component on all landforms. Lodgepole pine occurred in successional stands of Douglas-fir and subalpine fir habitat types.

Recreation and logging were the primary land uses in this area. Big game hunting and hiking/camping were the dominant recreational activities. Logging was limited to areas on the east side of the drainage. Clearcuts were isolated and comprised approximately 6% of the area at the time of the study (Kujala 1993). Timber harvesting activities were not widespread on the area. The last harvest activities took place in the early 1970's. Beaver Creek has been trapped for fur for at least the last 50 years (Whitman pers. comm.)

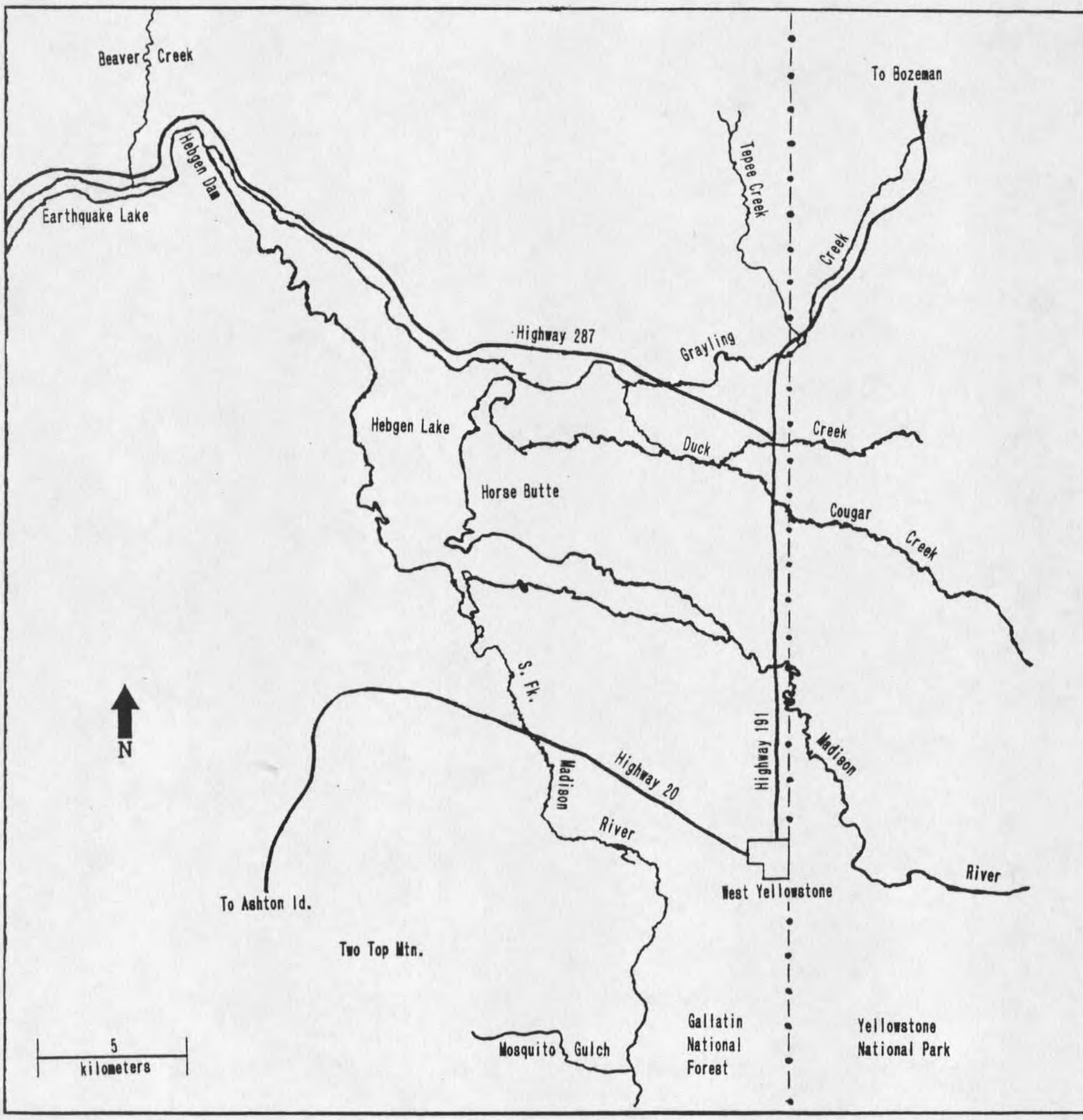

Figure 2. Map of the Flats, Mosquito Gulch, and Beaver Creek study areas.

METHODS

To meet the objectives of this study pine marten were livetrapped, fur trapping records were monitored, and track transects were established to determine effects of trapping and population densities. Radio telemetry was employed to determine home range size and movements and for habitat evaluation. Small mammal trapping was conducted to ascertain the availability of small mammal as prey.

Livetrapping

Pine marten were livetrapped on all study sites. Tomahawk, single door, live traps were placed in areas I identified as possible marten travel corridors (tree bands between clearcuts, mesic drainages) in fragmented habitats. On other sites, I simply saturated an area with traps where marten were known to occur. At the micro-site level, traps were placed in slash piles, under deadfall, or at the base of trees. A "cubby" set was constructed around each site using materials at the site as well as conifer limbs and snow in an effort to make the set more attractive to marten. This approach also provided thermal protection for trapped marten. All active traps were checked at least once every 24 hours via snowmobile, truck, or by foot. Traps were baited with deer (*Odocoileus hemionus*), elk (*Cervis elaphus)* or antelope (*Antilocapra americana)* hides and/or flesh. Also various species of Salmonids were used as bait. Sable oil was used to aid in attracting marten to sets.

Captured marten were anesthetized with 0.1 - 0.4 cc of ketamine hydrochloride (100mg/ml), depending on the size of the animal. Time from injection to release was generally under 30 minutes. Immobilized marten were placed back in the trap after processing and held until they displayed behavior similar to that observed before anesthesia.

Marten were classified as either juvenile or adult, as determined from sagittal crest development (Marshall 1951) and canine wear. Sex was also noted. Body weights and lengths were recorded for captured marten.

Ear tags were placed on unmarked marten. Marten caught the previous year who had retained ear tags or had removed them were not fitted with new tags. Radio transmitters, 148 mhz, (AVM Instrument Co., Livermore, CA or Telonics, Mesa, AZ) were placed on the majority of captured marten.

Furtrapping

Furtrapping was conducted only on the Mosquito Gulch and Beaver Creek study areas during 1991 and 1992. Trappers active in the study areas were asked to report numbers and sex of pine marten trapped as well as numbers of traps utilized and lengths of trap lines. I also inquired about historic population levels using harvests in past years as an index to relative status of the 1991-1992 harvest. Age of marten trapped on the Beaver Creek and Mosquito Gulch study areas was determined by cementum analysis (Aune and Schladweiler 1993).

Marten Locations

Pine marten locations were designated as resting or foraging. Locations were classified as resting when I determined that a radio signal was constant indicating that a marten was not moving before, or after a search effort. A fading radio signal indicated that a marten was moving. In this case a visual sighting, or marten track was marked as the foraging location. Marten were located by ground searches, triangulation, and by using fixed-wing aircraft. Most ground searches resulted in a visual sighting of the marten, a precise location of the rest site (within 1 m) or a fresh track. Triangulation was used when terrain or distance limited search efforts. The Horse Butte fire lookout tower was used often to locate marten on the Flats study area. All locations were recorded on 1:24,000 U.S. Geological Survey maps using Universal Transverse Mercator (UTM) coordinates. Ground locations were marked with flagging so the same locations could be relocated for further habitat measurements later in the summer.

Home Range Determination

Home ranges for marten were determined using the minimum convex polygon method (Mohr 1947) and the computer program TELDAY (Lonner and Burkhalter 1992). Locations gained via ground searches, triangulations, and fixed wing aircraft were used in home range calculations.

To index marten movement, daily straight line distances between locations were calculated from UTM coordinates of locations. Only locations from consecutive days were used to calculate this index.

Population Monitoring

Thirteen 1-kilometer (km) track transects were established (5 on the Upper Big Hole study area, 4 on the West Yellowstone Flats, and 4 on the Beaver Creek study area) in 1989-90 (Fager 1991) and monitored by methods described by Thompson et al. (1989). Each transect was examined 18-96 hours after a snowfall that was likely to have covered existing tracks. Replicated counts throughout the winter were used to assess the viability of this approach as a means of determining relative population densities of pine marten on the study areas.

Habitat Evaluation

Habitat variables were measured at all marten locations during the summer (May-August) of 1992. Measurement of habitat variables followed procedures developed by Fager (1991) for marten locations and random plots. This procedure was based on a modified timber stand exam procedure (U.S.D.A. 1985). Random plots measured by Fager (1991) were used for comparison against marten locations. Random points within clearcut boundaries were not included in habitat analysis. Since both Fager (1991) and Kujala (1993) showed that marten did not use clearcuts, I was only interested in comparing marten locations with forested random locations. Habitat analyses were only conducted on the Big Hole and Flats study areas. Marten were not collared in Beaver Creek, and only one collared marten survived the trapping season on the Mosquito Gulch site.

Combined marten and individual marten locations were compared to random points. Only those marten with 20 or more locations were compared individually to random locations. All three marten from the Big Hole study area had more than 20 locations each (m030=32, m040=26, m060=26). Five marten from the Flats study area were used for habitat analysis. Three of these marten had 20 or more locations (m140=37, m150=20, m578=43). Martens 080 and 110 had 8 and 12 locations, respectively, and were included in combined marten locations. I used aggregated resting and foraging locations to describe habitat use.

Tree species, diameter at breast height (dbh), and tree height were measured for each tree, $\geq$ 12.7 cm dbh, in a variable radius plot. A 20 basal area factor (BAF) angle gauge was used to identify specific trees included in the variable plot. Age was determined by coring the largest tree of every species on the plot (Kujala 1993). Canopy cover was obtained using a densiometer. Downed woody material was estimated with methods described by Brown (1974). One 8.2-m transect was run on an easterly bearing from plot center at all marten locations. Intercepts of woody material $\geq$ 7.6 cm in diameter were recorded to the nearest 2.5 cm diameter at the point of intercept and rated as sound or rotten.

Marten locations were classified to habitat type (Pfister et. al. 1977). Each marten location was also designated as mesic or xeric (Warren 1989). I used Forest Service old growth criteria (Appendix A Table 30), to classify each location as old growth or non-old growth.

To describe habitat use by pine marten from the landscape level to the micro site, I divided habitat evaluation into large, medium, and small scale habitat features. Habitat features at marten locations were compared to random points scattered across the study area.

Large scale habitat features

Habitat selection with respect to habitat series, old growth, and mesic versus xeric sites was determined through use-availability analysis using methods described by Marcum and Loftsgaarden (1980). I combined all marten locations for use-availability analysis. Habitat selection was determined for habitat series and mesic/xeric sites only on the Big Hole study area. These analyses could not be performed on the Flats study area because the lodgepole pine/bitterbrush habitat type made up >90% of available habitats and >90% of use by marten. Old growth use-availability was determined for both sites with the minimum age criteria for lodgepole pine habitats reduced from 150 to 100 years for the Flats study area only (See Appendix A Table 30).

Medium scale habitat features

Medium scale habitat features were described at the stand level. All marten and random locations were used to calculate mean trees/hectare, average stand diameter (ASD), stand density index (SDI), basal area (BA), mean downed woody material (DWM), and mean canopy cover. Trees/hectare, SDI, ASD, and BA were calculated according to procedures described by Daniel et. al. (1979). Downed woody material was expressed in metric tons/hectare. Medium scale habitat features were compared between marten locations and random points using t-tests.

Small scale habitat features

Only those marten and random locations where live trees, snags, or downed woody material were present, within 11.2 m of the actual marten location, were used to calculate small scale habitat features. For example, if a pine marten were resting in a live tree less than 12.7 cm in diameter and no trees with a dbh of 12.7 cm or greater were included in the variable radius plot, that location would not be included in the small scale habitat analysis of live trees. This approach allowed me to delete sites without the habitat variable in question which would have biased mean values for the size and number of trees and deadfall. Habitat variables examined include: mean dbh for all trees combined, live trees, snags, and diameter of deadfall material; mean numbers of live trees, snags, combined live trees and snags, and deadfall intercepts. Ground cover was also described at the micro-site level. Differences between marten and random locations were compared using t-tests. Chi-squares were used to detect differences between the frequency of random plots with a specific habitat variable and marten locations with that same variable.

Rest Site Selection and Red Squirrel Midden Association

Marten rest sites were noted as being on the ground or in a tree nest. The presence of a red squirrel (*Tamiasciurus hudsonicus)* midden within 11.3 m of the rest site was also noted. Rest site refers to the physical structure (eg., tree nest or deadfall) while rest episode refers to the activity.

Small Mammal Trapping

Small mammal trapping was conducted to determine the availability of small mammals as prey on the Big Hole and Flats study areas. Traps were set during the summer and fall of 1991 and the spring and summer of 1992. Sherman live traps were baited with peanut butter and rolled oats. Cotton was placed in each trap as insulation. Trapping sites were chosen to be representative of poor, fair, and good, pine marten habitat. Chi-square statistics were used to determine if small mammal captures were equally distributed among habitats.

Spring/Fall

Spring/fall trapping was done in order to determine relative abundance of small mammals and to gather information concerning over-winter survival across several different habitats. Traps were set in a single line of 50 or 2 parallel lines of 25, spaced 5 m apart. During each sampling period, sites were trapped for 3 consecutive nights and checked every morning. Animals were identified to species ear tagged or toe clipped, for future identification, and released.

Four sites were trapped on the Big Hole study area. Included were a dry lodgepole pine upland site, a spruce/fir riparian site, a spruce/fir/beargrass site and a recent clearcut with little regeneration over 50 cm (Appendix A Table 34). The dry lodgepole and the clearcut sites were trapped in both fall and spring while the creek bottom and spruce/fir sites were trapped only in the fall.

Seven sites were trapped on the Flats study area. All sites, with the exception of a moist Douglas-fir type, had a lodgepole pine cover type. Sites differed with respect to understory vegetation and structural makeup (Appendix A Table 35).

Summer

A more intensive trapping scheme was conducted during the summer months. Four grids were trapped on both the Big Hole and Flats study areas (Appendix A Table 36). Each grid was approximately 1 hectare in size (100 m x 100 m), and was sampled between July and September of 1991 and 1992. Ten parallel rows (10 traps per row) were set on each grid for 3 consecutive nights at bi-weekly intervals for a total of 3 trapping periods each year. Captured animals were ear tagged for future identification. To determine survival, recruitment, and rodent biomass lost over a 2-week period, an enumeration technique described by Chitty and Phipps (1966) was employed.

RESULTS

Livetrapping

Twenty-four marten were trapped in 4 study areas (Table 1). Livetrapping success in fall did not differ significantly among study areas (chi-square=1.8, df=3, P=0.62). Winter livetrapping success was not significantly different between the Big Hole and Flats study areas (chi-square=0.35, df=1, P=0.55). Livetrapping success in fall was not significantly different than winter in the Big Hole (chi-square=0.31, df=1, P=0.58), but success was higher in winter than fall on the Flats study area (chi-square=6.2, df=1, P=0.01).

Table 1. Livetrapping success for fall and winter on the Big Hole, Beaver Creek, Mosquito Gulch, and Flats study areas, 1991-1992.

		Fall*		Winter	
Study area	Tot. marten caught	Marten	Total trap nights	Marten	Total trap nights
Big Hole	10	8	473	2	76
Beaver Cr.**	3	3	286		
Mosquito Gulch	3	3	181		
Flats	8	5	581	3	66

*Fall trapping period September-December. Winter trapping period January-March.

**Beaver Creek and Mosquito Gulch areas were not trapped after December 1.

I did not detect significant differences in the sex ratio (Table 2) of live-captures among areas (chi-square=5.0, df=3, P=0.2). However, males outnumbered females on all study areas with the exception of Mosquito Gulch. Greatest deviation from a 50:50 ratio was on the Flats study area, 7M:1F.

Table 2. Sex and relative age structure of livetrapped marten by study area, 1991-1992.

	Study area			
Age/Sex	Big Hole	Beaver Cr.	Mosquito Gulch	Flats
Adult males	4	2	1	4
Adult Females	0	0	1	1
Juvenile males	4	1	0	3
Juvenile females	2	0	1	0
Total	10	3	3	8

Furtrapping

Only the Mosquito Gulch and Beaver Creek study areas were trapped during the 1991-1992 trapping season (Table 3). The 27 marten caught in the Mosquito Gulch area included marten that were marked on the Flats study area and were trapped on the Mosquito Gulch site. Only one trapper was active in the Mosquito Gulch area. He worked a trapline that ran approximately 48 km with approximately 2 traps/km.

Table 3. Fur harvest success and trapping effort for the Mosquito Gulch and Beaver Creek study areas, 1991–1992.

Study area	Total marten caught	Trap nights	Number of trappers	Trap nights/ marten
Mosquito Gulch	27	4280	1	156
Beaver Creek	27	3602	2	133

This individual has maintained about the same number of traps in the same locations since the 1985–1986 trapping season, with numbers of marten caught remaining the same or increasing each year. The 27 marten caught in the Mosquito Gulch area in 1991–1992 represents the highest catch in the 6 years this individual had trapped this area (Fountaine pers. comm.).

Two people trapped the Beaver Creek study area. One individual placed traps with a snowmobile along the roaded portion of the study area, with approximately 5 traps/km. Another trapper skied an 8 km loop starting at the end of the Beaver Creek road with approximately 4 traps/km. I combined the trap nights of these two trappers to determine trap nights/marten in the Beaver Creek study area.

Trapper success in Mosquito Gulch and Beaver Creek did not statistically differ (chi-square=0.4, df=1, P=0.5). Marked marten trapped on the Mosquito Gulch and Beaver Creek study areas made up 15% and 19% of the respective harvests (Table 4). All adult males that were marked previous to the trapping season were harvested in both areas.

Table 4. Harvest of marked and unmarked marten for the Mosquito Gulch and Beaver Creek study areas, 1991-1992.

Study area	Marten harvested	Marked marten	Marked marten in catch	Marked animals as percent of harvest
Mosquito Gulch	27	6 2AM,2JM* 1AF,1JF	4 2AM,1JM 1JF	15%
Beaver Creek	27	7** 4AM,1JM 2AF	5 4AM,1AF	19%

*AM=adult male, JM=juvenile male, AF=adult female, JF=juvenile female

**Includes 4 marten captured and collared in February 1991.

Cementum analysis revealed that 81% of the marten from the Mosquito Gulch harvest (Figure 3) were < 20 months old. Only 5 of 27 marten were between the age of 2 and 5. None of the harvested marten were older than 5 years. Not all the marten from the Beaver Creek area were submitted for aging. Those that were, were combined with marten trapped near the study area in Tepee Creek (Appendix B Figure 8). Age distribution of these marten was similar to those on the Mosquito Gulch site, with 76% of the Beaver/Tepee Creek catches consisting of marten < 20 months old. Juveniles accounted for 37% and 35% of the harvests on the Mosquito Gulch and Beaver/Teepee Creek study areas, respectively.

Sex ratios of marten on the Mosquito Gulch site were 56% males and 44% females, while on the Beaver/Teepee Creek site males made up 53% of the harvest and females 47%.