

POPULATION ORGANIZATIONAL SYSTEMS AND REGULATORY MECHANISMS OF A FOREST
CARNIVORE (PINE MARTENS) IN GRAND TETON NATIONAL PARK

Tim W. Clark
Department of Biology
Idaho State University

Presented here is a partial summary of ongoing research (May 1977 to date) and some results from previous phases of study (April 1975 to September 1976 - 17 mo.). The research is presently funded by the Northern Rocky Mountain Cooperative Study Project and Teton Natural History Association. Previous phases were funded by the National Geographic Society. Several people aided materially and cooperated in the project, and their assistance is greatly appreciated: T. Campbell, W. Barmore, P. Hayden, D. Casey, J. Weaver, J. St. Amant, G. Kantak, P. Lehner, I. Belan, T. Hauptman, and J. Hoak.

Study Objectives

The research is aimed at determining the role of animal behavior and environmental factors in regulating marten populations and social organization. This information has practical management applications. A model of population organization was presented by Clark (1977a). Discussion of specific hypotheses of this model and methods of evaluation was presented by Clark (1977b).

Methods

Marten spatial behavior and population composition is being measured via an intensive live-trapping program. Trapping techniques and handling and marking methods were outlined by Clark (1977a,b) and Clark and Campbell (1976).

Food use data are being obtained from scat examination (ca 25+ per month) following methods used by Clark and Campbell (1977).

Vegetational and physical attributes of marten habitat were measured at 93 sample plots (0.05 ha) systematically along marten trap lines. Data were analyzed by a stepwise discriminant function program (Cooley and Lohnes 1971) in an attempt to distinguish statistically between areas where martens were captured and areas where they were not.

Skulls are being collected from trappers in areas adjacent to the Park. Fourteen skull measurements were recorded. If a positive correlation can be found between any measurements and age (from cementum annuli), we will then have a simple, rapid means to age skulls and possibly live animals.

Marten vocalizations were recorded from live-trapped animals. A Nagra IV-L recorder and BASF 1.2 mil tape at 7 1/2 and 3 3/4 ips were used. Tapes were subsequently analyzed with a Kay Sono-Graphy 7029A, using a wide band pass filter and a frequency range of .16 - 16 KHz.

Study Area

The study area (9.6 km²) is located in Grand Teton National Park in a mixed lodgepole pine-Englemann spruce/subalpine fir zone at about 2200 m. This area was burned in 1879. Understory plants include huckleberry (Vaccinium membranaceum and V. scoparium), pinegrass (Calamagrostis rubescens), Geyer's sedge (Carex geyerii), and willows (Salix spp.). Annual temperatures 1950-1975 averaged 2.4 C (monthly range from -9.9 C to 15.7 C), with snow accounting for 70% of the annual precipitation of 61.5 cm.

Results and Discussion

Thirty-five martens have been captured since April 1975, 23 males and 12 females (1.9M:1.0F). Of 11 males, the mean stay on the study area was 242 days (range 1-629) and for 9 females was 143 days (1.508). Home range sizes from trap data average about 280 ha for males and 100 ha for females. Data collection and analysis continues.

Food uses based on analysis of 199 scats (8-36 per month) collected from December 1975 to August 1976 showed eight species or categories of mammal remains. These made up 91% of the total scat contents. Birds comprised 9% and small amounts of arthropods and plant materials were found. Scat collection continues so that seasonal and annual variations may be detected.

Seventeen parameters (vegetation, topography, etc.) of marten habitat were measured to try to distinguish areas occupied by martens. Areas were defined as occupied by martens if traps in that area captured animals more than once. Trapping records from April 1975 to November 1977 were used to determine occupied areas. Stepwise discriminant analysis of the selected parameters was performed with SPSS program on an IBM 370 computer.

Martens were captured more than once at 24 of 31 permanent trap stations with a wide range of structural characteristics (Table 1). Only three of the selected vegetation parameters were significant or nearly so in distinguishing occupied areas: basal area of trees defined as hunting sites (Clark and Campbell 1977) (P=0.04), Sapling density (P=0.12), and density of trees defined as hunting sites (P=0.13). The density of hunting sites, and their average basal area, and sapling density were all greater on sites unoccupied by martens. It is postulated that the values of these parameters on sites occupied by martens - while smaller - were still above a threshold level and thus adequate. It is believed that the close proximity of the unoccupied trap sites to a large pasture (moderately grazed by livestock) reduced their attractiveness to martens. Such open areas devoid of hunting sites did not provide martens access to staple microtine prey under deep snow cover.

Teeth from skulls from Teton Wilderness (n=16) averaged 3.6 ± 4.2 cementum layers (range 0-13) and those from Targhee National Forest (n=21) showed a mean of 1.2 ± 2.0 (range 0-7). Approximately 100 other skulls are being examined. A problem in interpreting cementum annuli counts from unknown age animals is to determine at what age and at what time of year the first annulus is deposited (Kelly 1977). The sable, a member of the same genus as pine marten, was found to have annual layers which corresponded exactly to age in 55% of the specimens while the remaining ones were equal to age plus or minus one year (Klevezal' and Kleinenberg 1967). An attempt is being made to obtain known age marten skulls. Skull parameters will then be analyzed in relation to numbers of cementum layers for correlations.

Vocalizations were analyzed in five adults (3 females and 2 males). Sounds were classified as they were perceived by myself, I. Belan, and P. Lehner and as their physical characteristics were revealed by analysis of the sonograms. The 7 vocalizations are not discrete but represent a continuum with intermediate forms. Since all the recordings were made while martens were in live-traps, it is believed that these vocalizations were either agonistic or distress sounds. However, since the American pine marten is considered to be solitary and territorial except during its reproductive period, it is likely these 7 vocalizations represent the pine marten's repertoire, except for vocalizations used during courtship and mating. This work has been submitted for publication (Belan et al. 1977).

Literature Cited

- Belan, I., P. Lehner, and T. Clark. 1977. Vocalizations of the American pine marten, Martes americana. J. Mammal. Submitted.
- Clark, T.W. and T.M. Campbell. 1976. Population organization and regulating mechanisms of pine martens in Grand Teton National Park, Wyoming. Paper presented before First Conference of Scientific Research in National Parks. New Orleans, La. 9-13 Nov., 1976.
- Clark, T.W. 1977a. Analysis of pine marten population organization and regulatory mechanisms in Jackson Hole, Wyoming. Nat. Geogr. Soc. Res. Repts.: In Press.
- Clark, T.W. 1977b. Population organizational systems and regulatory mechanisms of a forest carnivore (pine martens) in Grant Teton National Park. Research Proposal. Unpubl. 26 p.
- Clark, T.W. and T.M. Campbell. 1977. Short-term effects of timber harvests on pine marten behavior and ecology. Terminal report to Bridger-Teton National Forest, Wyoming. Unpubl. 60 p.
- Cooley, W.W. and P.R. Lohnes. 1971. Multivariate data analysis. Wiley and Sons, New York. 364 p.
- Kelly, G.M. 1977. Fishers (Martes pennanti) biology in the White Mountains National Forest and adjacent areas. Ph.D. Thesis Univ. Mass. 178 p.

Klevezal', G.A. and S.E. Kleinenberg. 1967. Age determination of mammals from annual layers in teeth and bones. USDI and NSF, Washington, D.C. Translated from Russian.

Table 1. Descriptive statistics for vegetation structure of sites occupied vs. unoccupied by martens, Grand Teton National Park, Wyoming, 1976-1977.

Parameter	Occupied (n=24)			Unoccupied (n=7)		
	Mean	SE	Range	Mean	SE	Range
Sapling Density	655.0	96.3	100-1620	1074.3	347.3	220-2440
Tree Density	327.5	31.8	60-660	328.6	51.6	180-600
Lodgepole Pine Density	220.8	32.0	0-620	285.7	56.5	140-600
Subalpine Fir Density	75.0	18.3	0-360	42.9	18.2	0-120
Basal Area of Live Trees	4.3	0.6	2-16	3.3	0.4	2-4
Density of Size Class 1-5.4	248.3	29.4	40-620	274.3	34.6	180-420
Density of Size Class 5.5-10.4	66.7	9.8	0-180	54.3	26.1	0-180
Density of Size Class 10.5	12.5	4.8	0-80	0	0	0
Density of Dead Standing Trees	171.7	26.9	0-500	125.7	35.9	20-260
Basal Area of Dead Standing Trees	5.6	0.9	0-20	5.4	1.0	2-9
Density of Down Trees	282.7	35.7	80-740	251.4	57.4	40-480
Diameter of Down Trees	16.9	0.8	9-26	16.4	1.7	8-23
Height of Down Trees	12.3	1.3	0-22	15.3	4.2	0-27
Length of Down Trees	6.7	0.3	4-10	6.3	0.9	3-9
Density of Hunting Sites	11.7	3.4	0-60	28.4	16.1	0-99
Basal Area of Hunting Sites	0.5	0.1	0-3	2.4	1.7	0-12
Length of Hunting Sites	2.3	0.6	0-11	2.3	1.3	0-9