

Introduction

The Newfoundland Pine Marten (*Martes americana atrata*) has been listed as endangered since 1996 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Historically, Pine Marten were distributed throughout the boreal forests of North America (Hagmeier 1956). On the Island of Newfoundland, Pine Marten were once found in most forested areas, although never in great numbers (Bergerud 1969; Snyder and Hancock 1985). Historical densities on the island appear to have been highest in the Grand Falls and Corner Brook sections of the boreal forest (Bergerud 1969). By the early 1900s, Pine Marten populations had begun to decline (Snyder 1984).

Trapping is thought to have been extensive in the early 1900s (Bissonette *et al.* 1988) and was perhaps one of the major causes of the initial decline of the island population. Habitat disturbance may have also played some role in the initial decline. Forest fires and insect damage destroyed extensive portions of the Island's suitable Pine Marten habitat in the late 1890s and early 1900s (Northland Associates 1980). The practice of clear cutting for pulp wood began about 1920 for the Grand Falls mill, while the Corner Brook mill did not open until 1925. Commercial wood harvesting is therefore considered to have had a minor role in the initial decline (Northland Associates 1980).

While trapping of Pine Marten on the island has been closed since 1934, the population appears to have continued its decline so that, by 1960, the species' range was no longer contiguous. At that time, it was estimated that there was one remnant population in north-central Newfoundland in the vicinity of Gander Lake (Northwest Gander River, and Gambo Pond) and a second population in the western part of the island, concentrated in and south of the Grand Lake-Little Grand Lake area (Bergerud 1969). By 1994 the island population was estimated to be approximately 300. In 1985, Pine Marten were thought to be primarily restricted to a few isolated areas of mature and over-mature forests in western and central Newfoundland (Snyder and Hancock 1985). By 1995, they were considered to be restricted to a few areas of mostly mature forest in western Newfoundland (Forsey *et al.* 1995).

Pine Marten on the Northern Peninsula do not appear to have ever been present at high densities. Bergerud (1969) stated that Pine Marten north of Parson's Pond were probably never common. A live-trap survey of the valley around St. Paul's Big Pond in 1975 revealed no Pine Marten (or scat) in the area despite the fact that it was considered good habitat (Mayo 1975). It was concluded that if a population existed, it was small and scattered. In 1997, a Pine Marten baiting program was initiated in the Silver Mountain/Burnt Hill Lakes area as part of the proposed Silver Mountain Hydroelectric Project's baseline data collection (AGRA 1997). In this study, no Pine Marten were baited within the Silver Mountain/Burnt Hill Lakes area, however one Marten was baited just north of Birchy Flats in a forested area which had been previously harvested approximately 60 years ago.

Sightings and accidental trappings have been recorded near Main River and the north side of Deer Lake during the late 1960s and early 1970s (Skinner 1974). Pruitt (1970) recorded a single Pine Marten sighting in the Silver Mountain area and there are trapping records from the 1920s of Pine Marten in the area that is now Gros Morne National Park (Mayo 1975). There have also been unconfirmed Pine Marten sightings near White's River (south of Silver Mountain) and animals snared near Taylor's Brook (AGRA 1997).

In an attempt to establish populations outside the known concentration areas, Pine Marten were introduced into the headwaters of the La Poile River (Mayo 1976a), the Main River area (Mayo 1976b), Siviars Island (Porter 1976), and Terra Nova National Park (Bateman 1985). It appears that the introductions to Siviars Island and La Poile River have been unsuccessful (Bissonette *et al.* 1988). In the Main River area, Pine Marten were released by the Provincial Wildlife Division at the upper end of Big Steady. In total, eleven animals were released; six in 1976 and five in 1978 (Northland Associates 1986).

Gros Morne National Park is presently conducting an experiment on the status of Newfoundland Marten in the greater Gros Morne area. Objectives of this study are to: determine the distribution of Marten; determine the minimum abundance of Marten in areas where they are known to occur; and determine the minimum abundance of Marten in potential flow (i.e. corridor) or proximate areas between Gros Morne National Park and the surrounding landscape. Marten were found to occur in the Adies Pond, White's River, Big Barren and Upper Humber areas of the greater Gros Morne landscape. In total, two marten were trapped, five bait stations were visited and tracks were also observed at seven other locations (Gerrow 2001).

CBPP and the Newfoundland Wildlife Division are currently working together on a five-year modified harvesting study within the Main River area. By monitoring marten in areas of modified harvesting it is hoped to provide direction for long term sustainability of both and provide direct validation of the new guidelines.

Life History

Studies on Newfoundland Pine Marten have begun to piece together the life history of these animals in Insular Newfoundland.

Bissonette *et al.* (1988) found that female Marten in Newfoundland probably breed successfully during their third summer. Kits are usually born in March-April (O'Driscoll 1994) and litters usually contain 2-3 kits (Bissonnette *et al.* 1988). Each Marten maintains a territory that it defends from other Marten. The size can vary, however, the average home range size of an adult male Marten in Little Grand Lake was 16km² (JWEL 1998). Females usually have a home range approximately two-thirds that of a male (11km²). Territories of same-sex Marten do not generally overlap.

If no room exists within a kit's natal home range to establish a territory, it will become transient and disperse to a new area in an attempt to establish one. Transient Marten that were dispersing from the Little Grand Lake study area were generally less than two years old (dispersing was defined as a permanent move from the animal's natal home range; Bissonette *et al.* 1988). It appeared that kits were most likely to be transients and yearlings were more likely to remain and colonize an area. One of 16 kits studied managed to establish a permanent home range within the study area (a female) while at least five of ten yearlings established permanent home ranges (Bissonette *et al.* 1988). Most dispersion occurred from September through December. Long distance dispersal was documented for five animals in the study. The linear distances traveled were between 24 and 40 km, however one had to traverse around Grand Lake to get to its new range and therefore probably traveled much farther than the linear distance suggests.

Throughout most of the study, adults and yearlings were found to be in a 1:1 ratio and sex ratios were not significantly different from 1:1 for all age classes.

Effects of Forest Harvesting

As part of the Little Grand Lake Environmental Impact Statement submitted in 1990, CBPP cooperated in an extensive study on the effects of forest harvesting on Marten and small mammals in Western Newfoundland (Bissonette *et al.* 1988). This work was conducted in the Grand Lake-Little Grand Lake area by the Utah Cooperative Fish and Wildlife Research Unit, the Department of Fisheries and Wildlife, Utah State University, and the Newfoundland and Labrador Wildlife Division. Marten were tracked using radio-telemetry before, during, and after logging activities in order to determine its effects. In addition, small mammal trapping in uncut and harvested areas was conducted to determine the effect of harvesting on the food-base of marten. Animals trapped were principally meadow vole (*Microtus pennsylvanicus*) and masked shrew (*Sorex cinereus*).

The study determined that Marten use of clear-cuts was limited; kits were located in clear-cuts 11.5% of the time and older Marten 2.2% of the time. Another study has also indicated that Marten of all ages avoided clear-cuts during logging operations and for the first nine months afterward (Fredrickson and Bissonette 1990). Only three of the ten Marten provided sufficient radio signals to compare pre- and post-logging home range size (Bissonette *et al.* 1988). One experimental animal (located within the cut area before it was harvested) relocated from one part of the experimental zone to another before logging activities began; the new home range was 25% smaller than the old. Two control animals (located in the uncut control area before harvesting) showed an increase of 100 and a decrease of 13 percent respectively in home range size. The increased home range was primarily harvested forest within the experimental area.

Marten deaths during the study were attributable to at least four factors; disease, predation, handling, and accidental trapping. The number of Marten succumbing to each factor was 10, 3, 2, and 1 respectively.

Trapping of food-prey indicated that shrew numbers tended to remain unchanged between the old-growth (control) and harvested (experimental) areas until cut-overs became approximately 13 years of age. At that time, shrews became 3-7 times more abundant in the cut-over areas. In addition, meadow voles showed a similar pattern, whereby the old-growth and harvested areas had similar populations. It was noted that during the study, a significant drop in the overall food-prey density occurred over all habitat types sampled. Meadow vole populations apparently crashed in the Spring of 1987 and shrew populations did not show the typical population trend of an increase during the Summer and decrease in Winter. It appeared that something happened during the Summer of 1986 to prevent shrews from increasing.

Habitat Stability

The National Recovery Plan for the Newfoundland Pine Marten (Forsey *et al.* 1995) has identified the need for background studies to fill information gaps and gather necessary data pertinent to recovery efforts. Among the goals is the need to determine population

status and distribution of Pine Marten and to conduct research into the suitability of older second-growth forests for Pine Marten.

One of the objectives of the Western Newfoundland Model Forest (WNMF) was to develop a Decision Support System (DSS), which would assist resource managers in developing forest harvesting plans that also consider other resources such as wildlife (JWEL 1998). The WNMF developed habitat suitability indexes (HSI) for a number of species including Marten. HSI rank habitat preference between 0.0-1.0; a 0.0 being unsuitable and 1.0 being most suitable.

Using the large amount of Marten data that has been collected in the Little Grand Lake area, HSI were developed for various stand types and age-classes used in the forest inventory database. The indexes were developed for stands in terms of food value and cover value for Marten. Table D1 shows the HSI values given. DFRA has determined that habitat types having less than a 0.5 HSI are not considered suitable habitat (JWEL 1998). Recent research and discussions amongst the National Recovery Team has resulted in the conclusion that forest structure, rather than stand age, is considered a more important value for Pine Marten.

Traditionally, suitable Newfoundland Pine Marten habitat has been classified as over-mature forest (i.e. >80 years old). Recent studies have concluded that marten respond to the structure available within a forest rather than actual stand age (Payer and Harrison 1999a; Sturtevant *et al.* 1996; and Drew 1995). Vertical stem structure and CWD appear to provide adequate security for the marten. CWD also offers interstitial spaces beneath the snow during winter months for prey species such as meadow voles, shrews and snowshoe hares. Fragmentation has also been identified as a possible limitation to Marten abundance (Hargas *et al.* 1999). Therefore, new habitat guidelines have been developed based on forest structure requirements instead of primarily forest age.

Table D1. Pine Marten HSI ratings for forest stand and age classification for food and cover value (reproduced from JWEL 1998).

Stand Age	Working Group (Forest Type)		
	Balsam Fir/ Black Spruce	Softwood Dominated Stands	Hardwood Dominated Stands
81+	1.0 (1.0)	1.0 (0.8)	1.0 (0.8)
60-80	0.8 (1.0)	0.8 (0.8)	0.8 (0.8)
40-60	0.5 (0.8)	0.6 (0.4)	0.6 (0.4)
20-40	0.3 (0.2)	0.4 (0.1)	0.4 (0.1)
0-20	0.2 (0.0)	0.2 (0.0)	0.2 (0.0)

(Cover ratings are in parentheses. The shaded areas represent what would be considered suitable habitat.)

Sturtevant *et al.* (1996) provides stand level management prescriptions that will maintain proper habitat for resident marten, as they are likely to respond to the structure available within a forest, rather than the actual stand age. Marten require overhead cover as an

escape from predators, as a source of thermal cover, and for prey availability. Coarse woody debris is also required as it provides a source of cover for marten and for their prey during the winter months. Sturtevant *et al.* (1996) suggests applying silvicultural techniques to younger forest stands, which will mimic that of older more suitable forest structure. Such recommendations include pre-commercially thinning stands to 1,100 stems/ha and providing for coarse woody debris. As a stand develops it will naturally thin and provide CWD. Manipulation of the stand at an earlier age can produce these results at a faster rate than would naturally occur.

Snyder and Bissonette (1987) concluded, in a study conducted in an area adjacent to Little Grand Lake, that marten seldom used clearcuttings and used residual stands greater than 25ha and undisturbed forests in proportion to their occurrence, but the use of smaller residual stands less than 25ha was greater than expected. Ninety percent of the captures were in forested areas, with 9% being in residual stands less than 15ha, 35% in residuals of 15–34.9ha, and 46% in larger stands. Ten percent of marten captures in the summer and fall were in clearcuts less than 15 years old and characterized by balsam fir regeneration less than 2m in height. Marten were not captured in older clearcuts 16 to 23 years after a harvest.

As taken from the Recovery Teams position on marten conservation, the classification of forest for Newfoundland marten within the Main River is no longer an age-based classification. It is now a height-based classification, including some softwood scrub as suitable marten habitat.

Mitigation/Marten Protection

Since mid-December 1998, the DFRA and CBPP have met on a regular basis to explore the incorporation of habitat requirements for the maintenance and recovery of the Newfoundland Marten within the context of CBPP's annual operating plans. To facilitate the process, CBPP and District Managers have identified areas that would not be harvested in the near future, if at all. These areas were evaluated in terms of the amount of forest that exists within various age-classes, the quantity of preferred Marten habitat, as well as the spatial relationships between these. Short-term Marten population and habitat goals for FMD 14, 15, and 16 have been identified and are used to help determine if habitat objectives are being met.

The short-term population goal for Districts 14, 15, and 16 is a minimum of 260 adult or territorial Marten. The long-term population goal is a minimum of 400 Marten. CBPP and DFRA have recently reached an agreement on habitat protection that will maintain the short-term Marten population goal, consisting of three separate populations each with a minimum viable population of 50 animals. The locations of the three populations are:

- the area north of the Humber River up to the northern boundary of FMD 16 including Gros Morne Park (70-80 Marten);
- the Little Grand Lake Reserve area (130+ Marten); and

- the western portion of FMD 15 and FMD 14 (50 Marten).

Meetings between CBPP, DFRA, DTR, as well as the Recovery Team, have evolved a set of marten habitat management guidelines. The Newfoundland guidelines are based on research conducted throughout North America (see Payer and Harrison 1999a; Payer and Harrison 1999b; Payer and Harrison 2000; Fuller and Harrison 2000a; Fuller and Harrison 2000b; Bull and Blumton 1999). They have also recently been adopted by the Pine Marten Recovery Team (G. VanDusen pers comm.). The guidelines include requirements for:

- The basic unit for evaluation will be the home range size for male (30 km²) and female (15 km²) marten;
- All forest types can be considered if they meet the following requirements;
- 70% or greater of that unit must be suitable habitat;
- 40% or greater of the unit should have trees | 9.6 m in height;
- The remaining portion of the 70% (30% or less), unit should have trees between 6.5 and 9.6 m;
- 50% of the unit should be contiguous. Stands will have to be within 50 m of an adjacent habitat to be considered contiguous;
- A qualifying stand will have to be within 160 m of another stand or habitat patch to be considered as habitat;
- Minimum patch size = 20 ha;
- Basal area requirement = (~ 18 m²/ha); and
- Hardwood stands, (insect kill and blowdown) will be considered suitable habitat where crown closure is | 30%.

Softwood scrub, which meets the minimum height requirements (6.5 m) will be considered habitat. Where height is not known, Softwood scrub within 50 m and adjacent to a qualifying stand will be considered habitat.

Thus, these new habitat guidelines have been based on forest structure requirements rather than solely on forest age.

REFERENCES

AGRA Earth & Environmental Limited 1997. Pine Marten Technical Report. Silver Mountain Upper Humber River, Newfoundland, 1997. Prepared for Deer Lake Power Co. Ltd., Deer Lake, NF. 9pp. and appendices.

AGRA Earth & Environmental limited, 2000. Environmental Preview Report for the Proposed Amendment to the Current Five-Year Operating Plan for District 16 (Main River and Sheffield Lake areas. Prepared for CBPP Limited, NF. 128pp.+appendices.

- Bateman, M. C. 1995. Termination report on the Atlantic Region Marten re-introduction program. Report prepared Parks Canada by Canadian Wildlife Services, Sackville, NB. 10pp.
- Bergerud, A.T. 1969. The status of pine marten in Newfoundland. *Can. Field-Nat.* 83:128-131.
- Bissonette, J.A., R.J. Frederickson, and B.J. Tucker. 1988. The effects of forest harvesting on marten and small mammals in western Newfoundland. Unpublished report, Utah State University, Logan. 109 pp.
- Bull. E.L. and A.K. Blumton. 1999. Effect of Fuels Reduction on American Martens and Their Prey. Research Note PNW-RN-539. Pacific Northwest Research Station, Forest Service, United States Department of Agriculture.
- Drew, G.S. and J. Bissonette. 1995. Winter Habitat Selection by American Marten (*Martes Americana*) in Newfoundland, Canada: Why Old Growth? Ph.D. Thesis, Utah State University, USA, 83pp.
- Fuller, A.K. and D.J. Harrison. 2000a. Influence of Partial Timber Harvesting on American Marten and their Primary Prey in Northcentral Maine. Prepared for the Maine Cooperative Forestry Unit, Maine Department of Inland Fisheries and Wildlife.
- Fuller, A.K. and D.J. Harrison. 2000b. Partial Harvesting Guidelines for Maintenance of Marten and their Primary Prey. *In: Cooperative Forestry Research Unit (CFRU) Research Notes (CFRU RN00-03)*. Maine Cooperative Forestry Unit, Maine Department of Inland Fisheries and Wildlife.
- Fredrickson, R.J., and J. Bissonette. 1990. The Effects of Disease, Prey Fluctuation, and Clear-cutting on American Marten in Newfoundland, Canada. M.Sc. Thesis, Utah State University, USA, 84pp.
- Forsey, O., J. Bissonette, J. Brazil, K. Curnew, J. Lemon, L. Mayo, I. Thompson, L. Bateman, L. O'Driscoll. 1995. National Recovery Plan for the Newfoundland Marten. Report No. 14. Ottawa: Recovery of Nationally Endangered Wildlife Committee, 29 pp.
- Garrow, S. 2001. Distribution and Abundance of the American Marten (*Martes Americana*) in the Greater Gros Morne Area: A Proposal. Prepared by Gros Morne National Park, Newfoundland.
- Hargis, C.D., J.A. Bissonette, D.L. Turner. 1999. The influence of forest fragmentation and landscape pattern on American martens. *Journal of Applied Ecology* 36:157-172.

- Hagmeier, E.M. 1956. Distribution of marten and fisher in North America. *Can. Field-Nat.* 70(4):149-168.
- Jacques Whitford Environmental Ltd. 1998. Progress Report Marten Habitat Modelling. Prepared for Department of Forest Resources and Agrifoods, Wildlife Division, St. John's, NF.
- Mayo, L. 1975. Investigation of possible pine marten presence in Gros Morne National Park. Provincial Wildlife Department.
- Mayo, L. 1976a. Introduction of Pine Marten to the head of LaPoile River. Project No. 75 PM-2. Newfoundland and Labrador Wildlife Division., St. John's, NF.
- Mayo, L. 1976b. Transfer of Pine Marten from Grand Lake to Main River. Project No. 76 M-1. Newfoundland and Labrador Wildlife Division, St. John's, NF.
- Northcott, T.H. 1974. The Land Mammals of Insular Newfoundland. Wildlife Division, Department of Tourism.
- Northland Associates. 1980. Cat Arm wildlife resources study, phase II. Report prepared for Newfoundland and Labrador Hydro, St. John's, NF. 89p.
- Northland Associates Limited. 1986. Upper Humber/Main River Wood Harvesting Operation Environmental Impact Statement. Prepared for CBPP Limited, Corner Brook, NF. 349pp.+appendices.
- O'Driscoll. L. 1994. Newfoundland Pine Marten: A Vanishing Animal. Prepared by the provincial Wildlife Division, Government of Newfoundland and Labrador.
- Payer, D. and D.J. Harrison. 1999a. Effects of Forest Structure on Spatial Distribution of American Marten. Technical Bulletin No. 787. National Council of the Paper Industry for Air and Stream Improvement. Research Triangle Park, NC.

- Payer, D. and D.J. Harrison. 1999b. Influences of Timber Harvesting and Trapping on Habitat Selection and Demographic Characteristics of Marten. Prepared for the Main Department of Inland Fisheries and Wildlife, Main Cooperative Forestry Research Unit, Maine Forest Service, Department of Conservation.
- Payer, D.C. and D.J. Harrison. 2000. Managing Harvested Areas to Maintain Habitat for Marten. *In*: Cooperative Forestry Research Unit (CFRU) Research Notes (CFRU RN00-01). Maine Cooperative Forestry Unit, Maine Department of Inland Fisheries and Wildlife.
- Porter, B. 1976. Pine Marten introduction to Siviars Island. Internal Progress Report No. 76PM-3. Newfoundland and Labrador Wildlife Division, St. John's, NF.
- Pruitt, W.O. 1967. Wildlife Inventory of the Proposed Gros Morne-Long Range National Park Region in Western Insular Newfoundland. Final Report submitted to Canadian Wildlife Service, 1 May 1967. Department of Biology, Memorial University of Newfoundland, St. John's, Newfoundland.
- Skinner, W. 1974. Pine marten studies in Newfoundland. Paper presented at the Annual Meeting of the Atlantic Chapter, Canadian Society of Environmental Biologists, Corner Brook, NF, 1974.
- Snyder, J.E. 1984. Marten use of clearcuts and residual forest stands in western Newfoundland. Ms. Thesis. Univ. Maine, Orono, ME. 31pp.
- Snyder, J.E. and J. Hancock. 1985. Newfoundland pine marten population estimate. Internal Report, Newfoundland and Labrador Wildlife Division, St. John's.
- Sturtevant, B., J. Bissonette., and J. Long. 1996. Temporal and spatial dynamics of boreal forest structure in western Newfoundland: silvicultural implications for marten habitat management. *For. Ecol. Manage* 87: 13-25.