Status of the American Marten, *Martes americana*, on Cape Breton Island, Nova Scotia

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Recommended status: **ENDANGERED**

A report to the Wildlife Division, Nova Scotia Department of Natural Resources,
Kentville NS
January 2001

ABSTRACT

Sytematic bait-station surveys in 1997, and bait-station and live-trap surveys in 1998 and 1999, revealed that numbers were extremely low and that the species had disappeared from large portions of its former range. Sampling success rates were only 1.3 to 1.6 % as high as those in Maine, New Brunswick and Newfoundland, where the species is presumably at normal densities. The extent of occurrence comprises a total of approx 274.5 km^2; 63.5 km^2 in northwestern Cape Breton Highlands NP and 211 km^2 in the southeastern highlands of Victoria Co. The area of occurrence is approximately 272.8 km^2. Estimated total population is <<100 animals, probably in the range of 15 to 30 animals, in two disjunct subpopulations, one in the NW Cape Breton Highlands and one in SE Victoria Co.; the latter consists of at least 2 and probably 3 or more isolates. Optimal habitat is severely reduced and highly fragmented. The Cape Breton Island marten population has been genetically isolated from the mainland one for ~10,000 years. Extremely low numbers, and scarcity and high fragmentation of optimal habitat, put the remnant populations at high risk from inbreeding depression, accidental trapping and stochastic factors, and meet far more than the minimum IUCN criteria for Endangered status.

CONTENTS

INTRODUCTION

This species was once widespread throughout the province, with a population large enough to have sustained an annual harvest of about 1000 animals up to the 1860s (Gilpin 1867). By the last decade of that century a serious decline had set in and by the 1930s the American Marten was extirpated from virtually the entire mainland, and reduced to a few animals in Cape Breton Highlands National Park by 1935 (Dodds and Martell 1971). An eastern mainland reintroduction attempt in the 1950s failed. A reinroduction programme in Kejimkujik National Park between 1987 and 1994 was successful, with 116 releases from northern New Brunswick stock. Though some animals left the park, there were sighting or captures in all but one of the years, and evidence that released animals reproduced (Scott 1998). Based on capture rates, the population is probably still below carrying capacity.

The recently confirmed relict Cape Breton Island population is highly fragmented and extremely low in numbers, with no evidence of successful reproduction since 1979.

In neighbouring jurisdictions, marten populations are stable and not at immediate risk in New Brunswick and Maine. The Newfoundland subspecies (*M. americana atrata*) is now Endangered (1996), upgraded from Threatened status assigned in 1986. In the rest of Canada marten are widespread and common in all suitable habitats, primarily within the Boreal Forest region (Strickland *et al*. 1987).

SUMMARY OF STATUS INFORMATION FROM PREVIOUS REPORTS

The Cape Breton Island population was believed to have been virtually extirpated until confirmed records in the period 1959-69 (Scott 1998) indicated that a small number of animals still survived in the wild in isolated areas in and around the Cape Breton Highlands. Analysis of subsequent incidental sightings showed that the central highlands plateau had been vacated by marten following the extensive harvesting of budworm-killed balsam fir in the late 1970s. Systematic searching in 1997, by bait-station surveys, revealed that numbers were extremely low and that the species was apparently absent from large portions of the suitable range (Scott 1998 and references therein). In 1998 and 1999 (Nocera *et al*. 1999a,b; Miner 2000) live trapping and bait-station surveys continued to document extremely low numbers of marten. The present distribution is in two major regions: the northwestern quadrant of the Cape Breton Highlands, mostly within the National Park, and the southeast quadrant of the highlands from the Ingonish River valley southwest to Middle River.

TAXONOMIC STATUS

The Cape Breton Island population belongs to the nominate subspecies, *Mustela americana americana* Turton 1806. This is the subspecies originally occurring throughout the Maritimes, southern Quebec, Ontario and eastern Manitoba (Banfield 1974).

The Cape Breton Island population is separated from mainland Nova Scotia populations by the Strait of Canso. For the majority of post-glacial times that strait has been an absolute barrier because of fast tidal currents that made it unswimmable and prevented it from freezing in winter, and the Cape Breton Island marten population has been genetically isolated from the mainland one since the Strait of Canso was flooded ~10,000 years BP (R. Grantham, pers. comm.). It is only since the Canso Causeway was built in 1953-1955 that the strait west of the causeway has frozen solid in winter, providing a broad invasion route for larger mammals (*e.g.*, coyotes), in addition to the very narrow and heavily trafficked avenue provided by the causeway itself, possibly used by porcupines and raccoons. Subsequently there has been progressive development of both shores of the strait, eliminating any marten habit for a considerable distance inland on both sides.

DNA analysis is required to establish whether there are any significant genetic differences between the Cape Breton Highlands animals and the historically occurring mainland Nova Scotia animals or those presently living in northern New Brunswick, the geographically closest wild native population. This will be done as soon as enough samples are on hand to assure statistical validity.

DISTRIBUTION

Present Cape Breton Island distribution appears to be grossly separated with a small population on the northwest side of the highlands, largely inside the boundaries of Cape Breton Highlands National Park (CBHNP), and a second population in the southeastern highlands. The separation is wide enough to make it improbable that any animals move between the two areas. Each of these populations appears to be further fragmented by habitat patchiness. This gross separation is recent (within the last 20-30 years) and is the result of habitat alteration/loss in the intervening area, largely from a combination of spruce budworm infestation and subsequent timber salvage operations on the plateau (Scott 1998). What useable habitat remains is also fragmented and under threat of harvesting.

PROTECTION

Present complete protection exists only for those animals within the boundaries of Cape Breton Highlands National Park. Outside the park, while trapping of marten is prohibited, occasional bycatch in traps set for other species cannot be eliminated. None of the recent known occurrences of marten is within any current Nova Scotia Wilderness or Protected Area, though two are within ~ 5 km of one (the French River and Middle River Areas respectively; Duke 2000, pers. comm.). If the relict Cape Breton Island population is designated Endangered under the Nova Scotia Endangered Species Act, that would provide protection for all individual animals, their potential residences (denning sites), and the core habitat required for their survival, once that habitat has been identified.

COSEWIC POPULATION CRITERIA

POPULATION SIZE AND TREND

1. Population size

Unknown but estimated to be < 100 by Nocera *et al*. (1999a). The population may well be *very* much less than that, in fact much fewer than 50 animals, based on the very small amount and apparent low carrying capacity of extant suitable habitat and on the extremely low sampling success rate (Tables 1 and 2), which indicate a population density only 1.3 to 1.6% as high as the known normal densities in Maine or New Brunswick; the number of animals thus could be as low as 10-20 and is probably not far above 15 to 30, split between two main areas of the highlands.

a. historic size

In 1866 the province as a whole exported about 1000 marten pelts (Gilpin 1867), an annual harvest that had not yet begun to decline and was presumably at least close to sustainable. Cape Breton Island comprises about one-fifth of the land area of the province and probably around one fourth of its mature and old-growth forests at that time (the result of more rugged topography and consequently much less extensive farming). There is no evidence or reason to believe that its share of the marten harvest was grossly out of proportion to its area. It is thus reasonable to speculate that the Cape Breton Island harvest may very conservatively have been in the range of 200 to 250 animals/year, which suggests a total population of at least 4 to 5 times that range, or 800-1250 animals. This equates to an average density for the island as a whole of from 14.25 to 9.12 km^2 per animal, a range that is broadly consistent with known densities in New Brunswick and Maine (Evans 1986, Soutiere 1979), based on the documented size of marten home-

ranges, which are not exclusive and overlap with each other (Strickland and Douglas 1987 and references therein).

b. recent survey results and interpretation

Only the survey results from 1997 onward are considered in the present population estimates, as the previous records from the winters of 1993 and 1994 are 6 to 7 years old and there is a high probability that some or all of the animals detected then as adults are no longer alive.

As summarized in Table 1, a 1997 highlands bait-station survey (164 stations, 656 checks) produced only 2 positive marten visits, in western CBHNP (Scott 1998). In 1998 and 1999 (Nocera *et al*. 1999a,b; Miner 2000) live trapping and bait-station surveys produced 4 marten records in 560 station checks and 2 animals in 965 trap-nights. A comparison with returns for normal wild populations (Table 2) shows densities almost 2 orders of magnitude lower, indicating that the Cape Breton Island populations are critically low. In addition they are grossly split into a northwestern CBHNP isolate and a southern Victoria Co. one which may be further fragmented. Most of the central plateau of the highlands has apparently been vacated by marten, with no records of any kind since 1979 (Scott 1998); this is presumably the result of extensive salvaging of budworm-killed timber in the 1970s. For this reason that area was not sampled significantly in the systematic trapping and bait-station surveys from 1997 onward.

The population has declined significantly from historic highs in Nova Scotia (1000 pelts exported annually from the entire province in 1866; Gilpin 1867), but not recently enough to have eliminated genetic loading in the Cape Breton Island populations, which must be considered highly susceptible to inbreeding depression.

Table 1. Marten sampling effort, 1997-99 (Scott 1998; Nocera *et al*. 1999a,b; Miner 2000)

YEAR	SAMPLING METHOD	EFFORT	CAPTURES	VISITS	% SUCCESS
1997	bait stations	656 checks		2	0.031
1998	bait stations	503 checks		4	0.079
1999	traps	965 trap-nights	2		0.021
	bait stations	57 checks		0	0

Table 2. Comparison live trapping data for native (Nfld, NB and Maine) and reintroduced marten (SW Nova Scotia). The Newfoundland capture rates are probably inflated by trapping methodology and would ordinarily be aound 30 TN/capture (Thompson, 2000, pers. comm.)

JURISDICTION	CAPTURE RATE	% SUCCESS	SOURCE
Newfoundland	63.6 TN/capture	1.57	Evans 1986
	62.9 - 45.7 TN/capture	1.59 - 2.19	Evans 1986
New Brunswick	25.6 - 20.0 TN/capture	3.91 - 5.00	Evans 1986
	34.6 TN/capture	2.90	Evans 1986
Maine	26.4 TN/capture	3.79	Evans 1986
SW Nova Scotia	223 TN/capture	0.45	Muntz 1996

The existing populations in the northwest and southeast are divided by an extensive area in the centre of the highlands where there have been no marten records since 1979, the result of widespread clearcutting to salvage budworm-killed trees (Scott 1998)

Within each of these two regions there is probably not enough contiguous suitable habitat to maintain a single unfragmented population at or near the minimum size required to avoid continuing inbreeding depression or to assure a reasonable chance of survival over the mid-term (>100 years). At best it may only be feasible to sustain a metapopulation aggregating above those minima but with each subpopulation actually far below it, highly vulnerable to inbreeding depression and stochasticity and requiring active management, including

regular or periodic restocking from a captive breeding program, to maintain its existence.

Neighbouring jurisdictions (Table 2) show a capture success *63.29 to 74.76 times higher* than the lowest and highest rates for Cape Breton Island over three years, suggesting population densities in Cape Breton Island are between 1.3% and 1.6% of the presumably normal population densities in Maine, New Brunswick and Newfoundland. Even the capture rate for the recently reintroduced and still low-density population in southwest Nova Scotia is more than an order of magnitude higher than the live-trapping success rate in Cape Breton Island populations.

Given the known high trappability of marten when they are present, these figures indicate that the *populations in Cape Breton Island are dangerously low and fragmented, far below any theoretical thesholds for mid- or long-term survival (100-1000 years), and perhaps even for short-term survival (10 years).*

2. Population productivity

There are no data for the last three years. Previous to that, the only reproductively active animal documented on Cape Breton Island was an allegedly pregnant female carrying two embryos (size not given), trapped in the Ingonish Valley in December 1979 (Banks 1992). According to Thompson (pers. comm. 2000), this is extremely unlikely, as embryos would not implant until late February; she could have been carrying two blastocysts, but we cannot know for certain.

Given the apparently extremely low numbers of marten, and the high degree of fragmentation of suitable habitat, it is very probable that recruitment is drastically reduced and the majority of the population consists of reproductively capable but isolated and thus reproductively inactive adults.

3. Population trend

a. significance of numbers

The number of incidental probable or confirmed sightings/tracks/captures per year has declined slightly since the 1970s (Scott 1998, fig. 7). However, no systematic sampling was undertaken until the winter of 1993-94, and the huge increases in sampling effort from 1997 onwards have not significantly increased the number of records (Fig. 1).

4. factors associated with population changes

a. habitat quality

The major change has been the significant loss of stands of optimal or near-optimal forest, especially in the south-central highlands, which has been vacated by marten since 1979.

b. habitat fragmentation

The degree of fragmentation of optimal forest habitat is extreme (see map, Fig. 2). Mean patch size in Victoria Co. is 933 ha (Nocera *et al*. 1999a)

COSEWIC I.U.C.N.-BASED CRITERIA

DISTRIBUTION

extent of occurrence (km^2)

The polygons defined by the 1997-99 records comprise a total of approx 274.5 km^2; 63.5 km^2 in northwestern CBHNP and 211 km^2 in the southeastern highlands of Victoria Co. (map, Fig. 4). Since it is not known how many of these animals were resident and how many were transient, the areal extent of occurrence may be distributed differently than the polygons on the map indicate.

area of occupancy (km^2)

Approximately 272.8 km^2, if the area is estimated by multiplying the number of 1997-99 record locations (n = 8) by the mean maximum home range size of both sexes combined (34.1 km^2; based on New Brunswick data from Sullivan 1985 and Quann 1985).

range jurisdictions

Federal: Parks Canada (Cape Breton Highlands National Park). *Provincial*: Nova Scotia Department of Natural Resources (trapping regulations; Nova Scotia Endangered Species Act); Nova Scotia Department of Environment and Labour (Wilderness and Protected Areas).

POPULATION

total number of animals

Unknown, but estimated to be probably no more than 30, split into a northwest and southeast population or metapopulation, widely separated by extensive clearcutting and replanting on the central highlands. All indications are that this number of surviving animals is dangerously below any level that could be considered an MVP, especially as the decline is so recent that genetic loading cannot have been eliminated (Shaffer 1987).

number of mature reproductive animals

Unknown. Because of extreme fragmentation and lack of any breeding evidence since 1979, it is probable that recruitment is very low and population structure is heavily skewed toward adults.

generation time

1.25 to 2 years; 80% of yearling (15-month-old) females may become pregnant in western North American populations; reproductive lifespan of wild females can be up to 12 years. (Strickland and Douglas 1987.) In Ontario, pregnancy rates of females 1+ years old ranged from 20 to 70% (Thompson 2000, pers. comm.)

population trend

Numbers show a definite but nonsignificant decline of all record types (trapped animals, sightings, tracks) since focused monitoring began, despite dramatically increased systematic sampling effort in last three years.

% decline over 10 yrs/ 3 generations

insufficient data

number of subpopulations

Minimum of 2 (northwest CBHNP and southern Victoria County); southern subpopulation may in fact be a metapopulation consisting of at least 2 and possibly 3 subpopulations (Nocera *et al*. 1999a, Fig 7).

number of animals in each subpopulation

unknown; estimated to be <10 in northwest CBHNP, <20 in southern Victoria County.

number of extant sites

Eight, over last three years (Figs. 2, 3); one site produced an occurrence in both 1997 and 1998.

number of historic sites from which extirpated

If the occurrences, which are for the most part widely separated, are treated as sites, then a minimum of approximately 15 (high identification confidence), in the south-central highlands; a possible maximum of approximately 27 (high and low identification confidence) (Scott 1998, Fig. 7).

is population severely fragmented?

Apparently yes, especially in southern Victoria Co,where records are separated by 13 to 36 km.

does population undergo extreme fluctuations (>1 order of magnitude)?

Unknown, but very improbable; mustelid populations generally are not known to undergo natural fluctuations.

THREATS

actual population threats

Reduction of breeding opportunities through geographic isolation of individual animals; increased likelihood of inbreeding depression among those that do manage to reproduce; pre-commercial and commercial thinning of forest stands; stochastic events such as forest fires; and mortality as by-catch in traps set for other mammals. In the period 1977-1991 the known bycatch mortality was 10 animals (Scott 1998); no bycatch mortality has been reported since then. Nocera *et al*. (1999a) point out that there is no available information at all on legal harvesting by aboriginal peoples, or deliberate illegal harvesting by non-natives, though they assume that little if any of either has occurred.

It has been shown that the new access routes provided by logging activity can increase trapping mortality in a marten population (Hodgman *et al.* 1994) and this threat exists regardless of whether the marten are targeted by trappers or die as incidental by-catch in traps legally set for other species.

imminent population threats

Continuation/aggravation of present threats

actual habitat threats

Habitat destruction and degradation through forest thinning or harvesting; habitat fragmentation through forest harvesting or other landscape alteration; forest fire, budworm outbreaks.

imminent habitat threats

Further harvesting of the few remaining old-growth and mature conifer or mixed stands; consequent increased habitat fragmentation

RESCUE EFFECT

does species exist elsewhere in Canada?

Yes. The closest native population is in northern New Brunswick. The animals recently successfully reintroduced into Kejimkujik National Park in southwestern Nova Scotia came from northern New Brunswick.

status of outside populations

There are no known outside populations wihin reasonable dispersing distance, or large enough to produce significant numbers of surplus dispersers that might become colonists, even if they could cross the existing habitat barriers.

is immigration known or possible?

There is no chance of immigration of wild animals from the mainland of Nova Scotia. Marten not known to occur in the wild in proximity to the Strait of Canso, which is an effective barrier to them except possibly in the middle of winter when the portion west of the causeway freezes over. Even then, it would mean that animals would be totally exposed for a long period during the crossing (a distance of 1.3 - 2 km), something they are behaviourally extremely unlikely to undertake. The causeway itself is considered impassable to marten because of traffic and the narrow steel/pavement bottleneck formed by the bridge at the northern end.

would immigrants be adapted to survive here?

Animals from New Brunswick would presumably be adapted to survive here, should it be genetically permissible to translocate them.

is there sufficient habitat for immigrants?

Possibly, but not for a great many, due to significant reduction in available habitat, both optimal and marginal.

CRITERIA MET AND CATEGORY

B: extent of occurrence <5000 km^2; *and* area of occupancy < 500 km^2 (only 1 required)
1 - severely fragmented *and* known at present from <10 locations (only 1 required)
2a,b,c,d, and possibly e as well
C2 - continuing decline *and* all populations < 250
D1 - number of mature individuals <250
Category: ENDANGERED

Scoring in any one of the three major criteria would qualify for Endangered status; the Cape Breton Island marten scores as Endangered in *three* major categories, and in *three* subcategories of B, when again only one is required.

HABITAT

Breeding habitat

Optimal breeding habitat is extensive stands of mature/"overmature" pure or predominantly coniferous or mixed forest with tree cavities for denning and windthrown/fallen trees to provide additional shelter for prey mammals and subnivean entry points for marten in winter.

Suboptimal breeding habitat includes forest stands of lesser age and/or with smaller or no conifer component, and/or with a higher degree of fragmentation. All bait-station records for the northwestern CBHNP subpopulation are *outside* of predicted marten habitat (Figs 2, 3.), and presumably in suboptimal habitats.

In western Quebec, Potvin *et al.* (2000) showed that marten can survive in landscapes that consist of as much as 40 - 50% open regenerating clearcuts, as long as there is contiguous extensive forest along at least a part of the home range edge.

Wintering habitat

Basically the same as breeding habitat, as far as is known. In western Quebec, marten showed a winter preference for stands that were largely or completely deciduous, in preference even to old mixed-age conifer stands (Potvin *et al*. 2000); those animals' summer habitat preferences were not investigated.

Habitat use and prey availability

Two different habitat models have been used to predict marten occurrence on Cape Breton Island, neither of them with complete success. The habitat patches mapped in Fig. 2 are those that meet the Martelle (1990) criteria and are essentially old growth forest, though not necessarily of any minimum height or basal area (in fact many do not meet criteria *c* and *d* , below, despite their age, which is why they do not appear in Fig. 3).

The habitat patches mapped in Fig. 3 are aggregates of all those that meet the following four criteria:

a) stand size ≥ 500 hectares
b) stand height ≥ 6 metres
c) basal area of stand ≥ 18 square metres per hectare
d) gap between stands ≤ 50 metres

Critera *a* and *d* are arbitrary, and clearly may exclude numerous stands of < 500 ha separated by > 50 m. For instance, all the bait-station records fall outside of the mapped stands but they could be in habitat patches or aggregations of patches that are only marginally short of meeting the criteria. Also, the gaps between stands are not necessarily nonforested and may well be forest stands of other types.

Criteria *b* and *c* are modest, in that many optimal stands will far exceed those lower limits. Basal area is an index of both tree size and stem density; according to Duke (2000, pers. comm.), a marketable stand can have a basal area of as much as 40 m^2/ha.

One major habitat type that has not been sampled for marten is the mature, steep, predominantly hardwood slope habitat in the valleys dissecting the margins of the highlands. Though fragmented, it comprises a significant area, is found around the entire periphery of the highlands and in some cases extends well into the interior of the plateau along the larger river valleys. The linearity of this habitat could provide potential corridors between isolates of optimal habitat. It is also the habitat least likely to be affected by any resource extraction.

For logistic reasons, trapping and bait-station sampling were done on the relatively level tops of the plateau, sometimes fairly close to the tops of these steep slopes, or on the valley floor, but never on the slopes themselves. They were inaccessible at the time of sampling because of their extreme steepness and deep snow cover (O'Brien, pers. comm.).

However, these slopes do support mature diversely-structured forest with a conifer component, as well as snags and blowdowns, and a known high population of small mammals, notably red-backed voles (NSMCRD). *Their potential as corridor habitats for marten, and possibly as at least temporary refugia, should not be overlooked*, especially in regions where all the apparently suitable habitat has been lost. Literature summarized in Evans (1986) indicates that spring and early-summer trapping is effective, though with a lower capture rate (at worst approximately 40-50% of that in winter trapping), so when the the snow melts and slopes are more accessible to humans, significant trapping effort should be put into at least one or two selected sites of this habitat type, close to areas where positive results from other sampling were obtained.

The principal prey species for marten in most of its range are small rodents, usually the red-backed vole (*Clethrionomys gapperi*) (Simon *et al*. 1999). This species is widespread and common to extremely abundant in forested habitats around the slopes of the Cape Breton Highlands, but collection data (NSMCRD) indicates that it is less common on the top of the plateau, where topography is less diverse and forests tend to be dominated by a single tree species. The similar-sized deer mouse (*Peromyscus maniculatus*) is almost as abundant and widespread. By far the most productive small mammal habitat known on Cape Breton Island is the above-mentioned forested talus slope habitat of the steep dissecting valleys.

Secondary prey are probably snowshoe hare (*Lepus americanus*) and ruffed and spruce grouse. In Labrador, Simon *et al*. (1999) showed that while the number of snowshoe hares eaten is less than the number of voles, the hares are preferentially selected in winter because of their much higher caloric value (more energy per capture). This preference undoubtedly occurs wherever snowshoe hares are available, as they are in Cape Breton Island.

Dispersal requirements

Apparently marten will disperse through any forest habitat type, but are generally reluctant to cross extensive open areas if there is an alternative; thus large clearcuts may be a barrier when they are very new; clearcuts aged > 15 years may be regularly traversed and/or utilized for foraging around their margins (Soutiere 1979).

EVALUATION AND PROPOSED STATUS

The Cape Breton Island populations are clearly extremely low (1.3 - 1.6% of normal densities), comprise probably less than 50 animals in total, fragmented into two or more subpopulations, at high risk for inbreeding depression and stochasticity as well as bycatch mortality. The optimum habitat is also drastically reduced from former levels, highly fragmented and at risk of loss or degradation in many areas. Mean habitat patch size in Victoria Co. is 933 ha, roughly one-third of the mean home range size

The Cape Breton Island population meets virtually *all* of the IUCN criteria for endangerment, and amply justifies the term "*critically* endangered" even though that is not a formal category.

PERSONAL COMMUNICATIONS

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ACKNOWLEDGEMENTS

Staff of the Wildlife Division, Nova Scotia Department of Natural Resources, Kentville NS, were extremely helpful during the preparation of this report. Sherman Boates, Manager of Biodiversity, and Mark Elderkin, Species at Risk Biologist, gave me support and guidance. I also thank Joe Nocera and Mike O'Brien for useful information and advice. Tracy Horsman and Tony Duke, respectively, produced the maps I used in Figures 2 and 3. Dave Shutler, Associate Professor of Biology, Acadia University, showed that unfortunately, no statistically significant comparisons could be made with the Cape Breton island capture data. Ian Thompson, Research Scientist, Canadian Forest Service, Sault Ste. Marie, ON, and Dan Banks, Regional Wildlife Biologist, Department of Natural Resources, Baddeck NS, were external reviewers of the manuscript of this report and made useful comments and suggestions.

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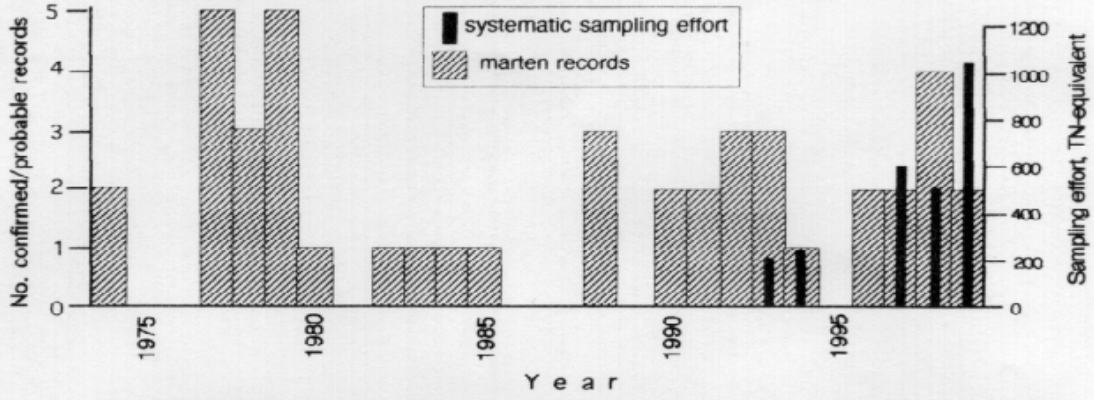

Fig. 1. Number of confirmed and probable marten records by year, 1974-1999. Sampling effort for 1993-94 was estimated by D. Banks (pers. comm.).

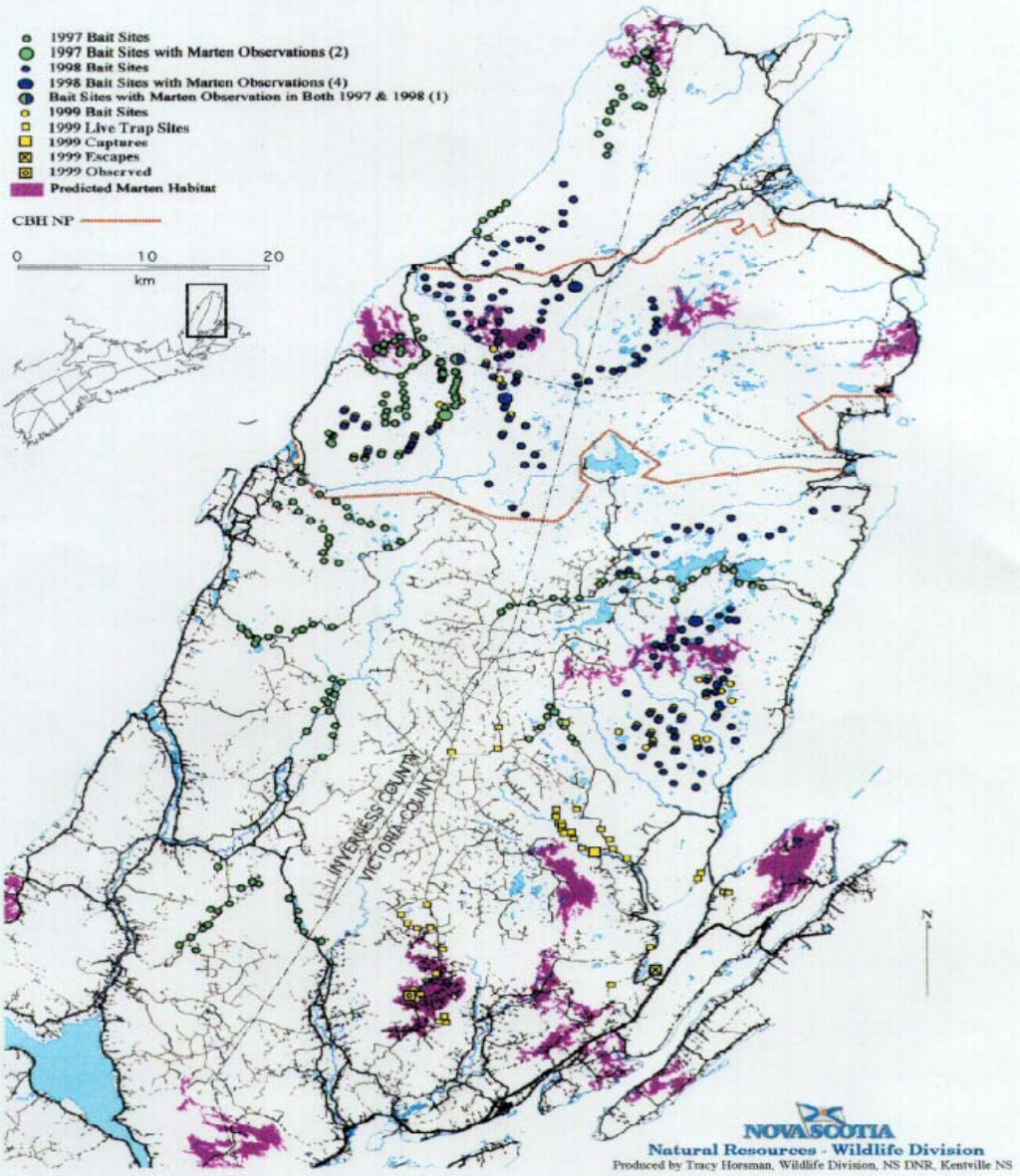

Figure 2. Distribution of marten sampling sites and records, 1997-1999, in relation to predicted marten habitat (Martelle 1990).

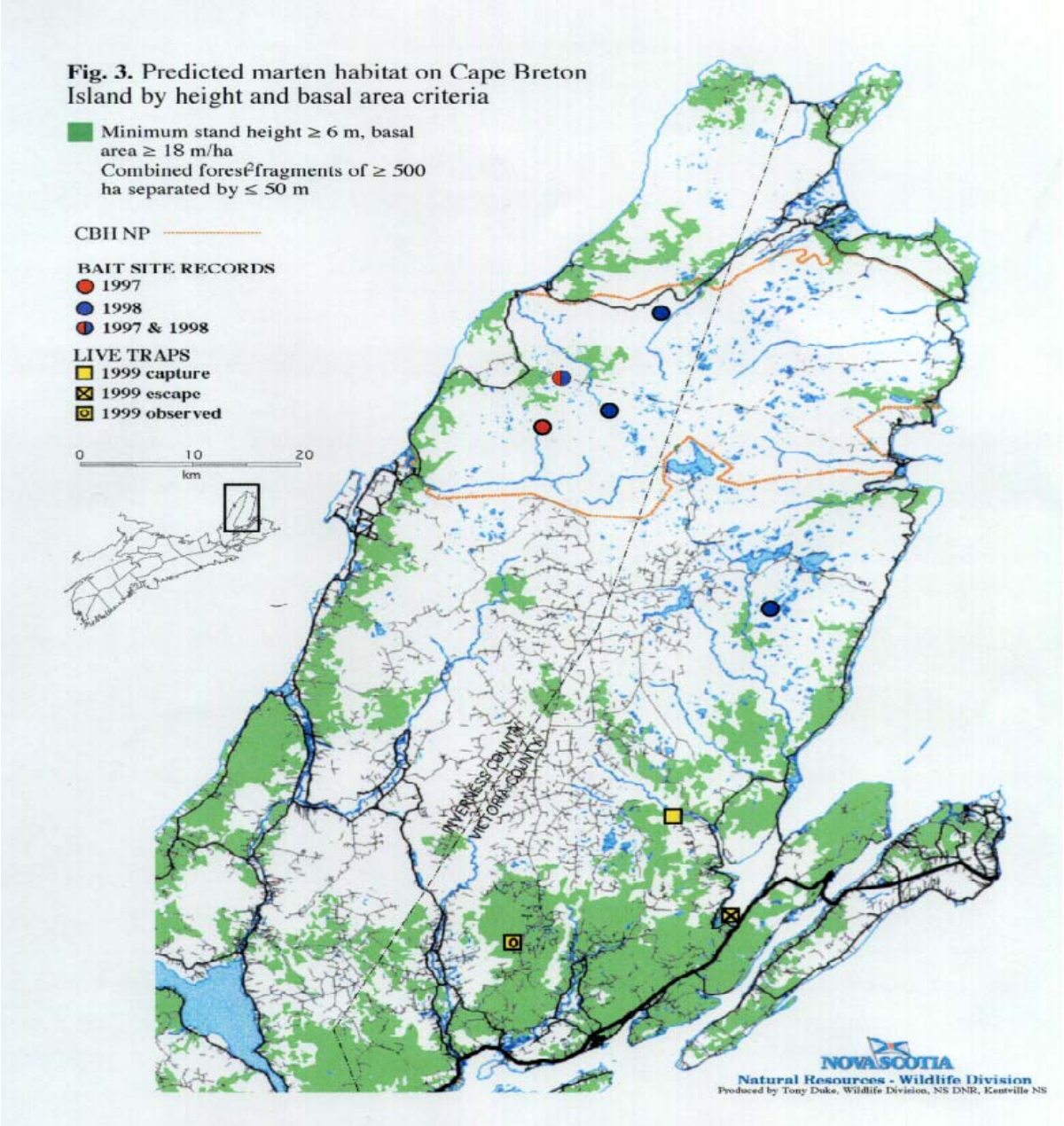
Fig. 3. Predicted marten habitat on Cape Breton Island by height and basal area criteria
Minimum stand height ≥ 6 m, basal area ≥ 18 m/ha
Combined forest fragments of ≥ 500 ha separated by ≤ 50 m
CBH NP
BAIT SITE RECORDS
1997
1998
1997 & 1998
LIVE TRAPS
1999 capture
1999 escape
1999 observed
0
10
20
km
INVERNESS COUNTY
VICTORIA COUNTY
NOVA SCOTIA
Natural Resources - Wildlife Division
Produced by Tony Duke, Wildlife Division, NS DNR, Kentville NS


current known distribution of Marten
Cape Breton Island