Document Front Sheet

nalcor energy
LOWER CHURCHILL PROJECT

NE-LCP Contractor/Supplier

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NE-LCP

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- ☑ **01 – REVIEWED AND ACCEPTED – NO COMMENTS**
- ☐ **02 – REVIEWED – INCORPORATE COMMENTS, REVISE AND RESUBMIT**
- ☐ **03 – REVIEWED - NOT ACCEPTED**
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Lead Reviewer:	Date (dd-mmm-yyyy):	Project Manager:	Date (dd-mmm-yyyy):
Jackie Wells	02-Sep-2016		
NE-LCP Management:	Date (dd-mmm-yyyy):		

General Comments:

Nalcor Energy Lower Churchill Project, Environmental Effects Monitoring Program – 2016 Newfoundland Marten

Newfoundland Marten Hair Snag Trapping and Off Highway Vehicle Surveys

Prepared for:
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File No: 121413999

Interim Report

September 1, 2016

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EXECUTIVE SUMMARY

As part of commitments made during the environmental assessment process for the Labrador-Island Transmission Link Project (the Project), Nalcor Energy (Nalcor) has retained Stassinu Stantec Limited Partnership (Stassinu Stantec) to implement an Environmental Effects Monitoring Program (EEMP) for the Newfoundland population of American marten (*Martes americana arata*). This annual report summarizes efforts from 2016 and represents the final year of a three year commitment to monitor the presence and distribution of American marten in the vicinity of the transmission line Right-of-way (ROW) near Main River, on the Northern Peninsula of Newfoundland.

Hair snag trapping efforts were successful in 2016, with 42 hair samples submitted for genetic analysis and screening. Twenty-four individual marten were identified in 2016, comprised of 15 females and nine males. Marten were confirmed, through the use of multiple trap sites, to have crossed the cleared Right-of-way (ROW). The density of off highway vehicle (OHV) trails within marten critical habitat ranged from 0.4 trails / km^2 on March 14 to 10.7 trails / km^2 on April 7. Densities in the area surveyed immediately south of the marten critical habitat survey blocks ranged from 1.3 trails / km^2 to 5.9 trails / km^2. The low number of OHV trail observations during the March survey reflects a general low activity at that time, possibly related to poor snow conditions and/or weather events that discouraged OHV use.

A final report will be prepared combining result of annual monitoring (i.e., 2014-2016), and will provide an assessment of project-related effects on marten in the Main River Study Area.

1.0 INTRODUCTION

Furbearers were identified as a Valued Environmental Component (VEC) in the environmental assessment for the Labrador-Island Transmission Link Project (the Project) (Nalcor 2012). One furbearer species, the Newfoundland population of American marten (*Martes americana atrata*), hereafter referred to as marten, is listed as *threatened* and is protected both federally under the *Species at Risk Act* (COSEWIC 2007) and provincially under the Newfoundland and Labrador *Endangered Species Act* (Government of Newfoundland and Labrador 2004). As part of commitments made during the environmental assessment process, Nalcor Energy (Nalcor) retained Stassinu Stantec Limited Partnership (Stassinu Stantec) to implement an Environmental Effects Monitoring Program (EEMP) for this and other species and VECs. This report summarizes efforts from the final year of a three year commitment to monitor marten presence and distribution in the Project area (i.e., transmission line Right-of-way (ROW)) near Main River on the Northern Peninsula of Newfoundland.

1.1 Background

The Newfoundland population of marten was recommended for special status as a result of a substantial population decline (COSEWIC 2007). Following this designation a Recovery Plan was developed by the Newfoundland Marten Recovery Team (2010), which identified threats to this insular population including habitat loss and mortality from snaring and trapping. Critical habitat blocks (16 km^2) for this species were previously identified based on evidence of their occurrence and habitat quality data (The Newfoundland Marten Recovery Team 2010). However, the delineation of marten critical habitat did not identify recovery habitat, and therefore only partially fulfilled the requirements for critical habitat under *SARA* (Environment Canada 2013). Information collected as part of the marten EEMP will support the refinement of the delineation of marten critical habitat in the Main River marten core area.

2.0 STUDY OBJECTIVES

Based on monitoring requirements and commitments made during the environmental assessment, the Newfoundland Marten EEMP was designed to assess whether the cleared ROW acts as a barrier to Newfoundland marten distribution; to determine the efficacy of watercourse buffer zones, brush piles, windrows, and any applied modified vegetation management techniques as travel corridors; and to assess snowmobile access provided by the cleared ROW.

The primary objectives of the 2016 marten hair snag field program were:

- to determine the presence and distribution of marten in the core habitat areas within the proposed ROW; and
- to determine the amount of OHV use along the ROW and identify OHV access points along the RoW.

3.0 METHODS

3.1 Study Area

The Study Area for this program includes primary marten habitat throughout the Main River valley and the transmission line ROW. Stantec's Geographic Information System (GIS) personnel worked with Government of Newfoundland and Labrador Wildlife Division (NLWD) personnel to produce a map folio of the Main River valley and the Labrador-Island Transmission Link ROW indicating primary marten habitat (i.e., core marten habitat blocks) and transects to be surveyed for the assessment of OHV use during this late winter field program. Centroids from core marten block habitat were identified as locations for hair snag trap deployment (Figure 3-1).

NALCOR ENERGY LOWER CHURCHILL PROJECT, ENVIRONMENTAL EFFECTS MONITORING PROGRAM – 2016 NEWFOUNDLAND MARTEN

METHODS
September 1, 2016

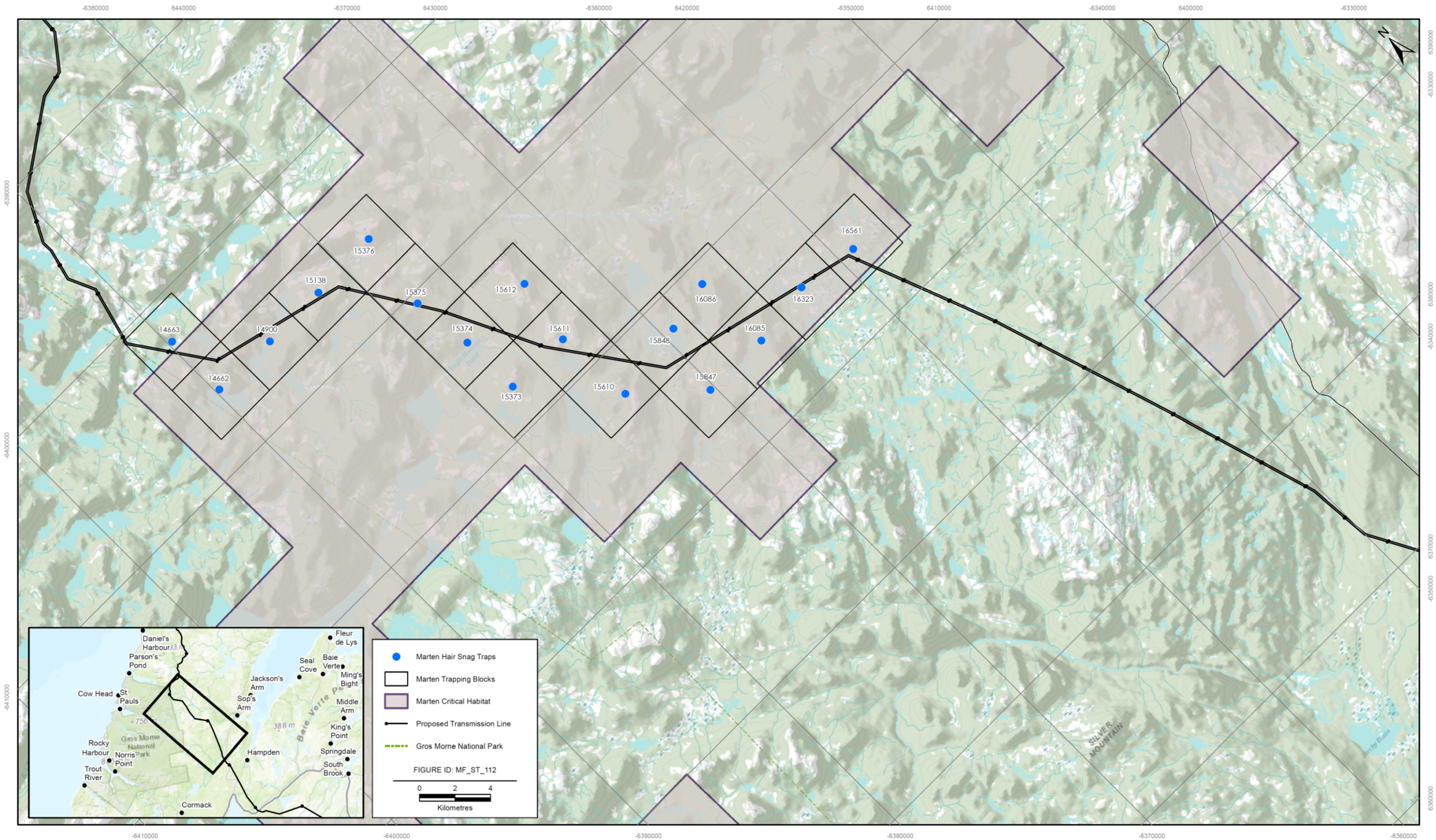

Figure 3-1 Marten Hair Snag Trap Locations, 2016

3.2 Study Team

The Study Team for the marten hair snag program included Stassinu Stantec personnel and pilots from Universal Helicopters Newfoundland Limited Partnership (UHNL) and Canadian Helicopters (Table 3.1).

Table 3.1 2016 Marten EEMP Survey Team

Name	Role	Organization
Stacey Camus	Field Lead / Biologist	Stantec
Tony Parr	Field Lead / Biologist	Stantec
Wayne Tucker	Biologist	Stantec
Karen Rashleigh	Biologist	Stantec
Matt Hoyles	Pilot	UHNL
Doug Whiting	Pilot	Canadian Helicopters
Dermot Cain	Pilot	Canadian Helicopters

Prior to the start of the field component, all personnel reviewed the Health, Safety, Environment and Quality and Project Execution Plan, and the Risk Management Strategy. A daily hazard assessment was completed each morning. The required scientific research permit (Permit #: IW2015-03, Appendix A) was granted by the Newfoundland and Labrador Wildlife Division prior to the surveys.

3.3 Hair Snag Trapping

All of the hair snag traps originally deployed or replaced in 2014 and 2015 were reused in 2016. Traps were visited and activated on March 2 and March 7, 2016. Four sticky pads and bait were placed in each trap, as per the NLWD guidelines. Traps were checked (and re-baited) on three occasions (approximately once per week) between March 14 and April 8. Snow depth (using a snow probe) and other weather conditions (e.g., temperature, wind) were also recorded at trap locations. All hair samples were labeled in the field, according to date and location, and stored in envelopes until sent for laboratory analysis.

3.4 Laboratory DNA Analysis

Hair samples were delivered to the Genomics and Proteomics (GaP) Facility of the CREAIT Network at Memorial University of Newfoundland for genetic analyses. Detailed methods are provided in Appendix C and are summarized below:

- DNA was extracted from 2-40 roots (one sticky pad per envelope submitted).
- DNA from hair samples were screened using standard operating protocols developed in the GaP Facility. Alleles were called independently by two readers.
- Sex determination of samples was carried out by amplifying an intron within the zinc-finger gene that is present on both sex chromosomes, using standard operating protocols developed in the GaP Facility. Agarose gels were read independently by two readers.
- Complete genotypes were run through GENECAP version 1.3, a Microsoft Excel macro that compares each individual multi-locus genotype with all other genotypes within the data set to locate matching genotypes (Wilberg and Dreher 2004) and thus identifies individuals within a set of samples.

DNA results were used to determine whether or not more than one marten visited a trap site, as well as assess use of multiple trap sites by an individual.

3.5 Off Highway Vehicle Survey

OHV activity was indexed by determining the number of recent (since the last snowfall) snowmobile trails recorded along the proposed ROW in the marten core area. This approach allows for an index of use only, as it cannot ascertain the total number of snowmobiles that used the trail.

Surveys were conducted on March 14 and April 7, 2016, and followed the same transect surveyed in previous years (i.e., 2014 and 2015). All snowmobile trails were recorded with locational data, and flight track files and digital photos were stored for future reference.

OHC trail density was estimated using the following formula:

$$\text{Index of OHV trail density} = \frac{\text{\# trails observed}}{\text{transect length x field of view (400 m)}}$$

4.0 RESULTS

4.1 Survey Effort, Trap Success and Conditions

Traps were deployed over a two-day period on March 2 and March 7, and checked and re-baited three times before removal on April 7 or April 8 (Table 4.1). Hair snag trapping efforts were successful, with hairs obtained from 71% of traps during the first visit, 94% of traps during the second, and 82% of traps during the third.

Table 4.1 2016 Survey Effort, Trap Success and Conditions

Date	Activities	Trap success	Notes
March 2 and March 7	Established sampling locations and set hair snag traps	17 traps activated	12 traps were activated on March 2 and the remainder on March 7.
March 14 and March 16	Checked and re-baited traps; Aerial OHV survey #1	12 traps with positive hits	OHV surveys were conducted on March 14
March 30	Checked and re-baited traps	16 traps with positive hits	
April 7 and April 8	Checked and removed traps; Aerial OHV survey #2	14 traps with positive hits	11 traps removed on April 7 and the remainder on April 8 OHV surveys were conducted on April 7

Notes:
OHV – Off Highway Vehicle
Trap locations are provided in Table B-1, Appendix B.

4.2 Off Highway Vehicle Trail Surveys

Approximately 48.8 km of linear transect was surveyed via helicopter on March 14, 2016 and 48.3 km on April 7, 2016. OHV trails were recorded at only three locations along the ROW on March 14 and 28 locations on April 7 (Table 4.2). The low number of OHV trial observations during the March survey reflects a general low activity at that time, possibly related to poor snow conditions and/or weather events that discouraged OHV use. The density of OHV trails within marten critical habitat ranged from 0.4 trails / km^2 on March 14 to 10.7 trails / km^2 on April 7. Densities in the area surveyed immediately south of the marten critical habitat survey blocks ranged from 1.3 trails / km^2 to 5.9 trails / km^2 (Table 4.2). The entire survey area, including the areas overlapping marten critical habitat survey blocks, was cleared of vegetation at the time of surveys.

Table 4.2 2016 OHV Survey Results

Survey Date	Distance Surveyed (km)			# of Trail Observations				Trail Density (trails / km²)			
	Within CH[1] Blocks	South of CH Blocks	Total	<5	5-10	>10	Total Trails[2]	Total Trails within CH Blocks	Density within CH Blocks	Total Trails south of CH Blocks	Density south of CH Blocks
March 14	29.8	19.0	48.8	0	3	0	15	5	0.4	10	1.3
April 7	29.3	19.0	48.3	12	3	13	170	125	10.7	45	5.9

Notes:

[1] CH = Critical Habitat

[2] OHV trails observed during aerial surveys were recorded as a range (i.e., 5-10) or as >10 when the number of trails observed was >5 trails. The number of trails used to calculate density when the actual number was not available was based following: 5 for the 5-10 range and 10 for data recorded as >10 trails.

Refer to Table B-3 of Appendix B for detailed results.

4.3 DNA Results and Individual Marten Movements

Forty-two envelopes containing hair samples were submitted for genetic analysis in 2016 and screened to identify individuals and determine sex. Complete genotypes were generated for 36 specimens, comprised of 24 different individuals (15 female and nine male) (Table 4.3).

Table 4.3 Newfoundland Marten Identified from the 2016 Survey

Individual ID	Sex	Traps Visited			Total # Traps Visited	Crossing ROW?
		Sample 1	Sample 2	Sample 3		
1	F	14662	14662	14662	1	No
2	M	15138			1	No
3	F	15373	15373	15373	1	No
4	M	15374	15374		1	No
5	M	15374	15375		2	Yes
6	F	15610			1	No
7	F	15847	15847		1	No
8	M	16085	16086	16086	2	Yes
9	F	14663			1	No
10	F	14900			1	No

NALCOR ENERGY LOWER CHURCHILL PROJECT, ENVIRONMENTAL EFFECTS MONITORING PROGRAM – 2016 NEWFOUNDLAND MARTEN

RESULTS
September 1, 2016

Individual ID	Sex	Traps Visited			Total # Traps Visited	Crossing ROW?
		Sample 1	Sample 2	Sample 3		
11	F	15138			1	No
12	M	15376			1	No
13	F	15610			1	No
14	F	15611			1	No
15	M	15847			1	No
16	M	15848	15848		1	No
17	F	16085	16086		2	Yes
18	M	14663			1	No
19	M	14900	15138		2	Yes
20	F	15375			1	No
21	F	15612			1	No
22	F	16085			1	No
23	F	16323			1	No
24	F	16561			1	No

Notes:
Trap locations are shown in Figure 3-1.

The results indicate that at least four different marten (three males and one female) visited multiple trap sites (i.e., >1) and that these same individuals crossed the cleared ROW (Figure 4-1) in 2016. Two of these marten (male ID #8 and female ID #17) visited the same trap sites. At least seven individuals repeatedly visited the same trap site.

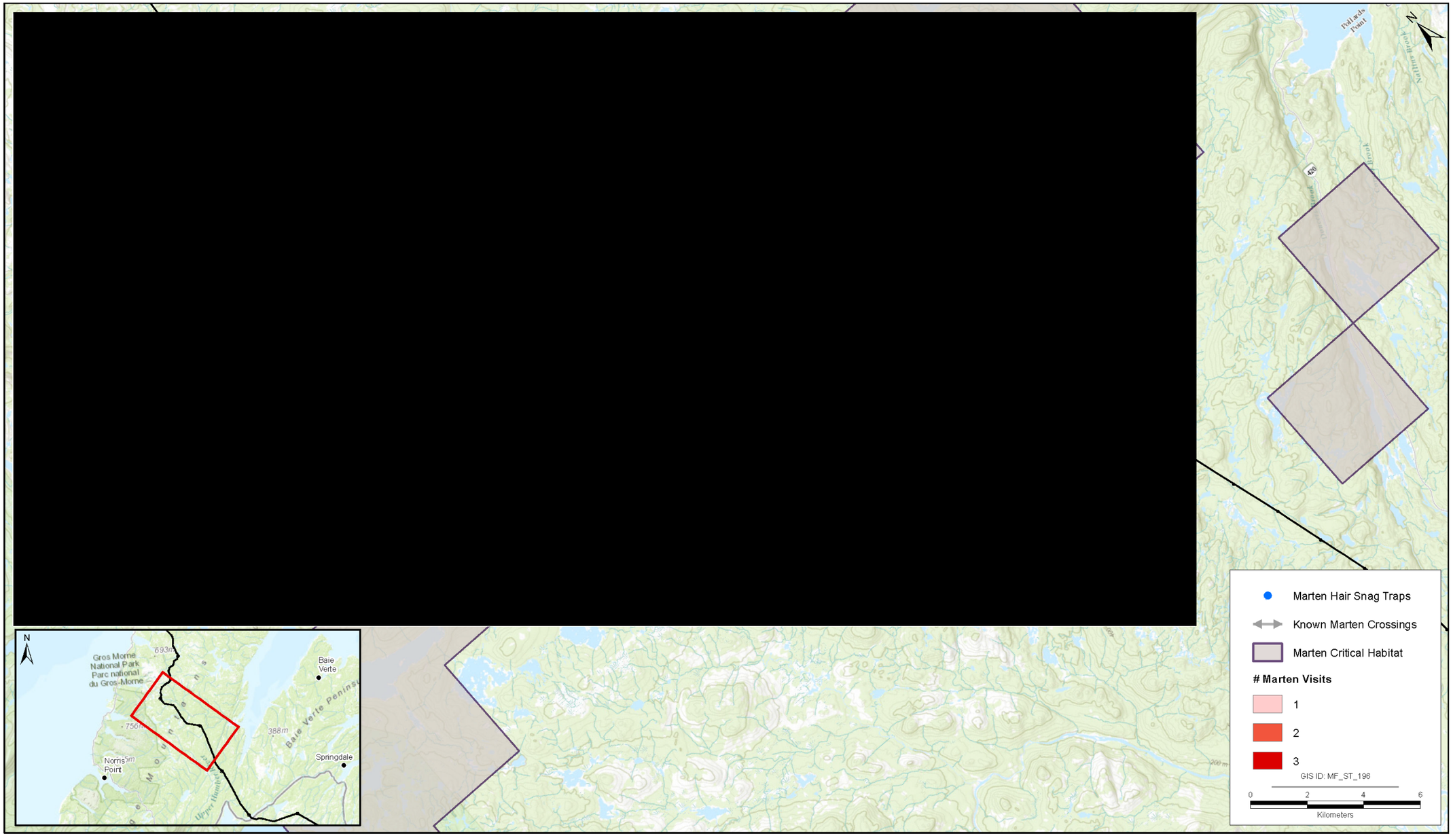

Figure 4-1 Marten Activity in the Study Area, March – April 2016

5.0 SUMMARY

Newfoundland marten presence in the Main River watershed in the vicinity of the Project was initially confirmed in 2014, through the observation of trails and collected hair samples. The results in 2016 provide additional information on the abundance, distribution, and habitat use by marten in the study area and further support the notion that marten continue to cross the Project ROW post-clearing. A final report will be issued compiling the results from all three years (i.e. 2014-2016), and will assess movement patterns in relation to the Project.

6.0 REFERENCES

Committee on the Status of Endangered Wildlife in Canada. (COSEWIC). 2007. COSEWIC Assessment and Update Status Report on the American Marten (*Martes americana atrata*) Newfoundland Population in Canada. vi + 26 pp. Ottawa.

Environment Canada. 2013. Recovery Strategy for the American Marten (*Martes americana atrata*), Newfoundland population, in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. 11 pp. + appendix.

Government of Newfoundland and Labrador. 2004. Endangered Species Act, 2004. Available at: http://www.assembly.nl.ca/Legislation/sr/statutes/e10-1.htm#31_. Accessed on: May 5, 2016.

Nalcor Energy (Nalcor). 2012. Labrador-Island Transmission Link Environmental Impact Statement. Volume 2B – Biophysical Assessment. 343 pp.

The Newfoundland Marten Recovery Team. 2010. Recovery Plan for the Threatened Newfoundland Population of American Marten (*Martes americana atrata*). Newfoundland and Labrador Wildlife Division, Corner Brook, NL.

Wilberg, M.J. and B.P. Dreher. 2004. Genecap: A program for analysis of multilocus genotype data for noninvasive sampling and capture recapture population estimation. Molecular Ecology Notes 4(4):783-5.

APPENDIX A

Research Permit

Newfoundland Labrador

GOVERNMENT OF NEWFOUNDLAND AND LABRADOR

Department of Environment and Conservation

A PERMIT TO ENGAGE IN AN ECONOMIC ACTIVITY UNDER SECTION 19 OF THE *ENDANGERED SPECIES ACT, SNL 2001 C.E-10.1*

DATE: November 14, 2014

ECONOMIC ACTIVITY: Development of the Labrador Island Transmission Link

PERMIT NUMBER: 2014/4

ISSUED TO: Lower Churchill Management Corporation, on behalf of Labrador Transmission Corporation, 500 Columbus Drive, St. John's, NL A1A 1W5.

SPECIES AFFECTED:

Woodland Caribou (Red Wine) (*Rangifer tarandus*)
Woodland Caribou (Mealy Mountain) (*Rangifer tarandus)*
American Marten (*Martes americana atrata*)
Common Nighthawk (*Chardeiles minor)*
Rusty Blackbird (*Euphagus carolinus)*
Olive-sided Flycatcher (*Contopus cooperi)*
Harlequin Duck (*Histrionicus histrionicus),*
Red Knot (*Calidris canutus rufa)*
Gray-cheeked Thrush (*Catharus minimus minimus*)
Short-eared Owl (*Asio flammeus*)
Bobolink (*Dolichonyx oryzivorus*)
Red Crossbill (*Loxia curvirostra*)
Boreal Felt Lichen (*Erioderma pedicellatum*)
Graceful Felt Lichen (*Erioderma mollisimum*)
Fernald's Braya (*Braya fenaldii)*
Long's Braya (*Braya longii)*

PERMIT TO: Construct the Labrador Island Transmission Link described in the Labrador-Island Transmission Link Long's Braya and Fernald's Braya - Shoal Cove Impacts Mitigation and Monitoring Plan: Nalcor Doc. No. LK-PT-MD-0000-EV-PL-0011-01 Revision B1 and the Species at Risk Impacts Mitigation and Monitoring Plan Nalcor Doc. No. ILK-PT-MD-0000-EV-PL-0001-01.

EFFECTIVE DATE: November 14, 2014

EXPIRY DATE: December 31, 2017

This permit allows Lower Churchill Management Corporation, on behalf of Labrador Transmission Corporation to engage in activities as described in the Labrador-Island Transmission Link Species at Risk Impacts Mitigation and Monitoring Plan Nalcor Doc. No. ILK-PT-MD-0000-EV-PL-0001-01 and the Labrador-Island Transmission Link Long's Braya and Fernald's Braya - Shoal Cove Impacts Mitigation and Monitoring Plan: Nalcor Doc. No. LK-PT-MD-0000-EV-PL-0011-01 Revision B1, affecting the designated species listed above, the residence of a specimen of any of these designated species or their critical or recovery habitat related to the development of the Labrador Island Transmission Link under the authority of the *Endangered Species Act* SNL 2001 C.E-10.1.

This permit does not supersede any prohibitions under the federal *Migratory Birds Convention Act* or the federal *Species at Risk Act*, and covers requirements under the *Endangered Species Act,* SNL 2001 C.E-10.1 only.

CONDITIONS

1) The permit holder must adhere to all commitments outlined Labrador-Island Transmission Link Species at Risk Impacts Mitigation and Monitoring Plan Nalcor Doc. No. ILK-PT-MD-0000-EV-PL-0001-01 and the Labrador-Island Transmission Link Long's Braya and Fernald's Braya - Shoal Cove Impacts Mitigation and Monitoring Plan: Nalcor Doc. No. LK-PT-MD-0000-EV-PL-0011-01 Revision B1 including conducting monitoring and survey work and providing regular reporting.

2) The permit holder may designate other individuals to perform permitted actions on their behalf. The permit holder is responsible for ensuring that the designated individuals follow all conditions of this permit.

3) The permit holder must keep a list of all individuals having access to monitoring data for species at risk, including all caribou collar data, and the list must be provided to the Wildlife Division, Department of Environment and Conservation upon issuance of the permit. If new individuals are provided with access to the data, an updated list must be provided. The permit holder must advise all individuals that their information will be provided to the Wildlife Division and may be further disclosed as permitted or required by law. Data on species at risk shall not be shared outside the permit holder or its contractors.

4) Upon receipt of this permit the permit holder must provide the Wildlife Division with a timeline for the development of the project this time line should also be presented through georeferenced images, maps and data.

5) Upon receipt of this permit and throughout construction of the project the permit holder will maintain communications with the Wildlife Division to ensure the Division is fully informed of all upcoming activities. Pre-quarter plans must be provided at least 3 months before the initiation of activities.

6) Prior to beginning monitoring activities, the permit holder will meet and/or correspond with the Wildlife Division to develop a timeline for monitoring activities. .

7) Reporting Requirements:

a. Immediate reporting is required if individuals of a designated species listed above is harassed, damaged, injured or killed as a result of the project activities.

b. Weekly reports of where activities have occurred, species at risk observations and the upcoming week's activities are required every Monday morning. These reports need to be specific to species at risk but may include other Wildlife issues and observations.

c. Monthly reporting shall include a detailed synopsis including maps and photographs of activities such as access roads, trails, or forest clearing resulting in the removal, loss and or alteration of forests, wetlands or other natural features and an update to geo-referenced and spatial data.

d. Species Monitoring Conclusion Reports shall be submitted at the conclusion of each component of the work outlined in the SAR IMMP documents as listed in condition 1. Reports must provide a synopsis of the location of surveys, methods employed, number of samples/specimens taken, location of samples/specimens, additional relevant ecological information, and raw data and coordinates (submitted in digital format). If monitoring is conducted over multiple years then an interim report must be provided annually.

8) A copy of this permit must be in the possession of at least one person working in the field undertaking monitoring activities. The copy of the permit must be provided to a Fish and Wildlife Enforcement Officer, Wildlife Division official, or other authorized official upon request.

9) The permit holder must adhere to the caribou monitoring and mitigation requirements outlined in Schedule A.

10) Any changes to the site design or survey design and/or methodology outlined in the SAR IMMP documents as listed in condition 1 require approval from the Wildlife Division before implementation.

11) A digital copy of the shape files of all survey routes must be provided prior to the annual initiation of the field program for effects monitoring and baseline investigations.

12) The permit holder is responsible to obtain any and all permissions which may be required to release any information required under this permit to the Wildlife Division.

13) This permit does not absolve or relieve the permit holder from compliance with any other applicable laws, or orders or the obtaining of any other necessary permits or any requirement to obtain permission to access private property.

DAN CRUMMELL, MHA
District of St. John's West
Minister

SCHEDULE A: Caribou Monitoring and Mitigation Conditions

1. Aerial transect surveys shall be for the primary purpose of investigating for the presence of Woodland Caribou. Aircraft shall not descend lower than 100 feet on located caribou and observation time shall be limited to the minimum amount of time required to count and classify observed caribou, and shall not exceed 2 minutes.

2. Ground surveys shall be for the purpose of assessing caribou occurrence in relation to, and in proximity to project development activities such as roads, and hydro lines. Ground surveys may include use of motor vehicles, ATVs, and water craft. ATVs and snowmobiles may only be used on roads, forest roads and hydro line corridors.

3. The permit holder shall submit all raw data collected during the surveys (including GPS caribou locations, description of caribou observations, caribou tracks or observed caribou craters) within one week of the completion of any survey activities.

4. All capture, restraint, sampling, and collaring of caribou will be conducted only by Wildlife Division staff. No capture, restraint or any handling of caribou can occur under any circumstances except in the presence of Wildlife Division staff.

5. The permit holder will deploy up to 5 collars during the construction phase of the project. The permit holder is responsible for all costs associated with the deployment of and data fees related to the collars.

6. Wildlife Division will arrange with the collar manufacturer to have collar location data made available to both the Wildlife Division and the permit holder via an online data account as the data becomes available. The permit holder and the Wildlife Division shall mutually agree on the programming schedules for collars and Wildlife Division staff will be responsible for collar programing.

7. All caribou collar location data from all caribou collars, and all collars deployed by the permit holder under this permit, is strictly confidential. The data shall not be released to any individual or group except those individuals directly involved in caribou monitoring or mitigations. No raw or geographically representative data shall to be shared by the permit holder or any employees, contractors or subcontractors without the written permission of the Wildlife Division.

APPENDIX B

2016 Field Data

Table B.1 Trap Locations and Habitat Description

Site	UTM Location (Zone 21U)		Altitude (m)	Habitat Description (Canopy Cover)
	Easting	Northing		
14663	[redacted]	[redacted]	462	balsam fir dominant
14662	[redacted]	[redacted]	496	balsam fir dominant
14990	[redacted]	[redacted]	465	balsam fir dominant
15183	[redacted]	[redacted]	509	balsam fir dominant
15376	[redacted]	[redacted]	467	balsam fir and black spruce mixedwood
15375	[redacted]	[redacted]	519	balsam fir and black spruce mixedwood
15374	[redacted]	[redacted]	410	balsam fir and black spruce mixedwood
15373	[redacted]	[redacted]	519	balsam fir and black spruce mixedwood
15612	[redacted]	[redacted]	484	balsam fir and black spruce mixedwood
15611	[redacted]	[redacted]	487	balsam fir dominant
15610	[redacted]	[redacted]	509	balsam fir dominant
15848	[redacted]	[redacted]	338	black spruce (75%) dominant with some balsam fir (25%)
16086	[redacted]	[redacted]	407	balsam fir and black spruce mixedwood
15847	[redacted]	[redacted]	361	balsam fir (75%) dominant with some black spruce (25%)
16085	[redacted]	[redacted]	414	balsam fir and black spruce mixedwood
16323	[redacted]	[redacted]	318	black spruce (75%) dominant with some balsam fir (25%)
16561	[redacted]	[redacted]	318	balsam fir and black spruce mixedwood

Table B.2 2016 Hair Snag Results

Site	March 2 and 7	March 14 and 16		March 30		April 7 and 8	
	Snow Depth (cm)	Snow Depth (cm)	# Tabs with Fur	Snow Depth (cm)	# Tabs with Fur	Snow Depth (cm)	# Tabs with Fur
14663	110	152	3	153	2	133	4
14662	130	117	4	113	2	113	3
14990	152	147	3	165	2	168	3
15138	138	150	4	147	3	172	2
15376	140	145	0	125	4	175	0
15375	160	145	4	143	2	185	3
15374	132	128	3	145	4	158	4
15373	122	108	4	140	3	132	4
15612	140	127	0	147	2	175	3
15611	110	122	0	120	2	148	0
15610	127	127	4	143	4	152	0
15847	85	95	3	123	3	87	4
15848	108	123	0	145	3	122	3
16086	85	90	4	128	4	87	4
16085	130	127	4	132	4	133	4
16323	97	90	2	127	0	78	4
16561	75	67	0	85	2	77	4
Total Hits			**12**		**16**		**14**

Notes:
Snow depths were approximated using a snow probe, and averaged among three samples

Table B. 3 2016 OHV Survey Results

Date	UTM Location (Zone 21U)		# OHV Trails	Perpendicular to RoW	Parallel to RoW	Comments
	Easting	Northing				
March 10	496296	5494903	5+	Y	N	N/A
March 10	491735	5509053	5+	N	Y	Coordinates listed were taken at the start of trail; end coordinates were 490828 E / 5511443 N
March 10	470770	5526809	5+	Y	N	Circled around
April 7	492848	5506151	1	Y	N	N/A
April 7	479906	5518605	2	Y	N	N/A
April 7	479816	5518792	2	Y	N	N/A
April 7	478471	5521377	2	Y	N	N/A
April 7	482820	5513969	3	Y	N	N/A
April 7	475652	5524191	3	Y	N	N/A
April 7	492461	5507174	4	Y	N	N/A
April 7	478931	5520609	4	N	Y	N/A
April 7	496676	5493656	10+	N	Y	Going up RoW
April 7	496291	5494959	10+	Y	N	Bridge crossing
April 7	495114	5498943	10+	Y	N	N/A
April 7	491809	5508929	10+	N	Y	N/A
April 7	482392	5514576	10+	Y	N	N/A
April 7	481033	5516506	10+	N	Y	N/A
April 7	480073	5518270	10+	Y	N	N/A
April 7	479385	5519682	10+	N	Y	N/A
April 7	479256	5519940	10+	Y	N	N/A
April 7	478179	5521845	10+	Y	N	N/A
April 7	477778	5522473	10+	Y	N	N/A
April 7	477148	5523518	10+	Y	N	N/A
April 7	473770	5524659	10+	N	Y	N/A
April 7	484029	5513180	5+	Y	N	N/A
April 7	481892	5515249	5+	Y	N	Old
April 7	476671	5523926	5+	N	Y	N/A
April 7	489355	5511918	4	N	Y	4 Snowmobiles on ROW

APPENDIX C

Results of Genetic Analyses (Memorial University CREAIT Network Report) - 2016

Species, Microsatellite and Sex Identification of Hair Donors From Newfoundland Marten (*Martes americana atrata*) Hair Traps (Nalcor)

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Summary

The Genomics and Proteomics Facility of the CREAIT Network at Memorial University of Newfoundland received a total of 42 envelopes containing hair samples on April 29th, 2016. Envelopes contained 2 – 4 sticky pads; we processed one sticky pad per envelope. A single sample was analysed to identify species of the hair donor. All 42 hair samples were screened with 11 microsatellite loci to identify individual Newfoundland marten, and the sex of each individual was determined.

Findings

- The single sample that required species confirmation was identified as a Newfoundland marten.
- Of the 36 complete microsatellite genotypes generated, 24 individual Newfoundland marten were identified (9 male and 15 female).
- Nine individuals were recaptured; the remaining 15 individuals were captured once.

The purpose of this work was twofold: i) identify donor species of hair samples that could not be identified by visual inspection; ii) identify individual Newfoundland marten by screening DNA extracted from hair samples with a suite of microsatellite loci, and in addition determine sex of each individual.

On April 29th, 2016 the Genomics and Proteomics (GaP) Facility of the CREAIT Network at Memorial University of Newfoundland received 42 hair samples (N 1.14662 – N 3.16561 detailed in Table 1).

One sticky pad per envelope was processed. DNA was extracted from 2 – 40 roots using the Qiagen DNeasy Blood and Tissue Kit (Qiagen Inc., Toronto, Ontario, Canada) following the manufacturer's tissue protocol, except that DNA was re-suspended in two consecutive 75 µL elutions, for a total volume of 150 µL of DNA. Hair roots were digested overnight.

We identified species of a single hair donor (N1.14663) by sequencing a fragment of the cytochrome b gene, found in the mitochondrial DNA. DNA was analysed using standard operating protocols developed in the GaP Facility.

In order to identify individuals, DNA from the 42 hair samples were screened twice at the following 11 microsatellite loci using standard operating protocols developed in the GaP Facility: Ma1, Ma2, Ma7, Ma9, Ma10, Ma11, Ma14, Ma18, Ma19 (Davis and Strobeck 1998); MP0085, MP0114 (Jordan et al. 2007). Alleles were called independently using GeneMapper v4.0.

Complete microsatellite genotypes were run through GENECAP version 1.3 (Wilberg and Dreher 2004) to identify individuals within the set of samples.

Sex determination of samples was carried out by amplifying an intron within the zinc-finger gene that is present on both sex chromosomes using primers LGL331 and LGL335 (Shaw et al. 2003) with standard operating protocols developed in the GaP Facility. Samples with two bands (zinc finger X and Y) were identified as male, and those with one band (two copies of zinc finger X) as female. Agarose gels were read independently.

We were able to identify the donor species of the single sample (N1.14663) that required confirmation as a Newfoundland marten.

Complete microsatellite genotypes were generated for 36 Newfoundland marten hair samples (Table 2).

The overall probability that two first order relatives shared the same genotype by chance (P_{SIB}) was p = 0.007, and therefore, we are confident in an analysis that screens at 11 microsatellite loci to identify individuals.

Based on complete genotypes, we determined that these samples represent 24 individual Newfoundland marten of which 9 are male and 15 are female and X unknown (Table 3). Nine individuals were recaptured. The remaining 15 individuals were captured only once.

Table 1. Inventory of hair samples analysed in this report, detailing sample ID, collection date, recheck number, hiar snag ID, and number of sticky pads collected.

GaP ID	Sample Collection Date	Recheck	Hair Snag ID	# Hair Samples Collected
N 1.14662	14-Mar-16	1	14662	4
N 1.14663	14-Mar-16	1	14663	3
N 1.14900	14-Mar-16	1	14900	3
N 1.15138	14-Mar-16	1	15138	4
N 1.15373	14-Mar-16	1	15373	4
N 1.15374	14-Mar-16	1	15374	3
N 1.15375	14-Mar-16	1	15375	4
N 1.15610	16-Mar-16	1	15610	4
N 1.15847	16-Mar-16	1	15847	3
N 1.16085	16-Mar-16	1	16085	4
N 1.16086	16-Mar-16	1	16086	4
N 1.16323	16-Mar-16	1	16323	2
N 2.14662	30-Mar-16	2	14662	2
N 2.14663	30-Mar-16	2	14663	2
N 2.14900	30-Mar-16	2	14900	2
N 2.15138	30-Mar-16	2	15138	3
N 2.15373	30-Mar-16	2	15373	3
N 2.15374	30-Mar-16	2	15374	4
N 2.15375	30-Mar-16	2	15375	2
N 2.15376	30-Mar-16	2	15376	4
N 2.15610	30-Mar-16	2	15610	4
N 2.15611	30-Mar-16	2	15611	2
N 2.15612	30-Mar-16	2	15612	2
N 2.15847	30-Mar-16	2	15847	3
N 2.15848	30-Mar-16	2	15848	2.5
N 2.16085	30-Mar-16	2	16085	4
N 2.16086	30-Mar-16	2	16086	4
N 2.16561	30-Mar-16	2	16561	2

Table 1 continued.

GaP ID	Sample Collection Date	Recheck	Hair Snag ID	# Hair Samples Collected
N 3.14662	07-Apr-16	3	14662	3
N 3.14663	07-Apr-16	3	14663	4
N 3.14900	07-Apr-16	3	14900	3
N 3.15138	07-Apr-16	3	15138	2
N 3.15373	07-Apr-16	3	15373	4
N 3.15374	07-Apr-16	3	15374	4
N 3.15375	07-Apr-16	3	15375	3
N 3.15612	07-Apr-16	3	15612	3
N 3.15847	08-Apr-16	3	15847	4
N 3.15848	08-Apr-16	3	15848	3
N 3.16085	08-Apr-16	3	16085	4
N 3.16086	08-Apr-16	3	16086	4
N 3.16323	08-Apr-16	3	16323	4
N 3.16561	08-Apr-16	3	16561	4

Table 2. Microsatellite alleles and sex identification results for hair samples (N = 42) detailed in Table 1. '-' indicates missing data.

Sample ID	Sex	Microsatellite Alleles (base pairs):																					
		Ma1		Ma10		Ma11		Ma14		Ma18		Ma19		Ma2		Ma7		Ma9		MP0085		MP0114	
N-1.14662	Female	225	225	181	181	108	108	203	209	165	167	214	214	175	175	204	206	146	146	134	136	170	170
N-1.14663	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1.14900	-	-	-	-	-	106	106	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-1.15138	Male	225	225	181	181	108	108	199	209	167	169	210	214	175	181	204	206	146	146	136	136	162	170
N-1.15373	Female	225	225	180	181	108	108	199	209	169	169	212	214	177	181	204	206	146	147	134	136	162	162
N-1.15374	Male	225	225	181	181	108	108	199	199	167	169	210	214	175	181	206	206	146	146	134	136	162	170
N-1.15375	Male	225	225	180	181	108	108	199	209	169	169	210	214	177	181	206	206	146	147	134	136	162	170
N-1.15610	Female	225	225	180	181	108	108	209	209	169	169	212	214	181	181	204	206	147	147	134	134	162	170
N-1.15847	Female	225	225	181	181	108	108	199	203	169	169	210	210	181	181	206	206	147	147	134	136	162	170
N-1.16085	Male	225	225	180	181	108	108	199	209	167	167	210	214	181	181	204	204	146	147	136	136	162	162
N-1.16086	Male	225	225	180	181	108	108	199	209	167	167	210	214	181	181	204	204	146	147	136	136	162	162
N-1.16323	-	-	-	-	-	108	108	-	-	167	167	214	214	-	-	204	206	-	-	-	-	-	-
N-2.14662	Female	225	225	181	181	108	108	203	209	165	167	214	214	175	175	204	206	146	146	134	136	170	170
N-2.14663	Female	225	225	181	181	108	108	203	209	165	167	214	214	175	175	204	206	146	146	136	136	170	170
N-2.14900	Female	225	225	181	181	108	108	209	209	167	169	210	210	181	181	206	206	146	147	136	136	162	162
N-2.15138	Female	225	225	180	181	108	108	199	209	169	169	210	214	175	181	204	206	147	147	136	136	162	162
N-2.15373	Female	225	225	180	181	108	108	199	209	169	169	212	214	177	181	204	206	146	147	134	136	162	162
N-2.15374	Male	225	225	180	181	108	108	199	209	169	169	210	214	177	181	206	206	146	147	134	136	162	170
N-2.15375	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N-2.15376	Male	225	225	181	181	108	108	199	199	169	169	210	214	175	181	206	206	146	146	136	136	162	170
N-2.15610	Female	225	225	180	181	108	108	209	209	167	169	212	214	175	181	204	206	147	147	134	136	170	170
N-2.15611	Female	225	225	180	181	108	108	203	209	167	167	210	214	181	181	204	204	146	147	136	136	162	162
N-2.15612	-	-	-	181	181	-	-	-	-	-	-	-	-	-	-	204	204	-	-	-	-	162	162
N-2.15847	Male	225	225	180	180	108	108	203	209	169	169	210	210	177	177	204	204	147	147	134	136	162	170
N-2.15848	Male	225	225	180	181	108	108	199	209	167	169	210	210	181	181	204	206	146	147	136	136	162	162
N-2.16085	Female	225	225	180	181	108	108	199	209	167	169	210	212	181	181	204	206	147	147	134	136	162	170
N-2.16086	Female	225	225	180	181	108	108	199	209	167	169	210	212	181	181	204	206	147	147	134	136	162	170
N-2.16561	-	-	-	-	-	108	108	203	203	-	-	-	-	-	-	204	204	-	-	-	-	-	-

Table 2 continued.

Sample ID	Sex	Microsatellite Alleles (base pairs):																					
		Ma1		Ma10		Ma11		Ma14		Ma18		Ma19		Ma2		Ma7		Ma9		MP0085		MP0114	
N-3.14662	Female	225	225	181	181	108	108	203	209	165	167	214	214	175	175	204	206	146	146	134	136	170	170
N-3.14663	Male	225	228	181	181	108	108	203	209	167	169	212	214	175	181	204	204	146	147	134	136	162	170
N-3.14900	Male	225	225	181	181	108	108	199	209	167	169	214	214	175	181	204	206	146	146	136	136	162	170
N-3.15138	Male	225	225	181	181	108	108	199	209	167	169	214	214	175	181	204	206	146	146	136	136	162	170
N-3.15373	Female	225	225	180	181	108	108	199	209	169	169	212	214	177	181	204	206	146	147	134	136	162	162
N-3.15374	Male	225	225	181	181	108	108	199	199	167	169	210	214	175	181	206	206	146	146	134	136	162	170
N-3.15375	Male	225	225	180	181	108	108	199	209	169	169	210	210	177	181	206	206	146	147	134	136	162	170
N-3.15612	Female	225	225	181	181	108	108	209	209	169	169	214	214	175	181	204	204	147	147	134	136	162	162
N-3.15847	Female	225	225	181	181	108	108	199	203	169	169	210	210	181	181	206	206	147	147	134	136	162	170
N-3.15848	-	225	225	180	181	108	108	199	209	167	169	210	210	181	181	204	206	146	147	136	136	162	162
N-3.16085	Female	225	225	180	181	108	108	199	209	167	169	210	212	181	181	204	206	147	147	136	136	162	170
N-3.16086	Male	225	225	180	181	108	108	199	209	167	167	210	214	181	181	204	204	146	147	136	136	162	162
N-3.16323	Female	225	225	180	180	108	108	199	203	169	169	210	214	181	181	204	204	146	147	136	136	162	162
N-3.16561	Female	225	225	180	181	108	108	199	203	167	169	214	214	175	181	204	204	146	147	134	136	162	162

Table 3. Individual Newfoundland marten identified in this study (including sex results) with samples having identical genotypes identified (ie. recaptured individuals).

Individual	Sample IDs with matching genotypes			Sex
1	N-1.14662	N-2.14662	N-3.14662	Female
2	N-1.15138			Male
3	N-1.15373	N-2.15373	N-3.15373	Female
4	N-1.15374	N-3.15374		Male
5	N-1.15375	N-2.15374		Male
6	N-1.15610			Female
7	N-1.15847	N-3.15847		Female
8	N-1.16085	N-1.16086	N-3.16086	Male
9	N-2.14663			Female
10	N-2.14900			Female
11	N-2.15138			Female
12	N-2.15376			Male
13	N-2.15610			Female
14	N-2.15611			Female
15	N-2.15847			Male
16	N-2.15848	N-3.15848		Male
17	N-2.16085	N-2.16086		Female
18	N-3.14663			Male
19	N-3.14900	N-3.15138		Male
20	N-3.15375			Female
21	N-3.15612			Female
22	N-3.16085			Female
23	N-3.16323			Female
24	N-3.16561			Female

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