Progress report for
Waabizheshi (American marten) Research Project on the Chequamegon - Nicolet National Forest in Wisconsin
2015 - 2016

by

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Background Information

Waabizheshi (American martens; *Martes americana*) were extirpated from the mainland of Wisconsin by the 1930s following unregulated fur harvest, timber harvest, and forest fires (reviewed by Williams et al. 2007). Martens were reintroduced to the CNNF Eagle River-Florence Ranger District (hereafter, Eagle River District; Figure 1) between 1975 and 1983 (N = 172 martens). Additional martens were reintroduced to the CNNF Great Divide Ranger District (hereafter, Great Divide District) between 1987 and 1990 (N = 139 martens). Marten numbers on the Eagle River District have been stable or have increased (Woodford et al. 2005) but marten numbers have likely declined on the Great Divide District (J. Gilbert, Great Lakes Indian Fish and Wildlife Commission, unpublished data). Additional martens were released on the Great Divide District in 2008-10 to augment marten numbers there (N = 90 martens; Woodford et al. 2013). A recent genetic mark-recapture study concluded that marten population growth was small (2%, SE = 25%) for the 4 years following augmentation (Manlick et al. 2016).

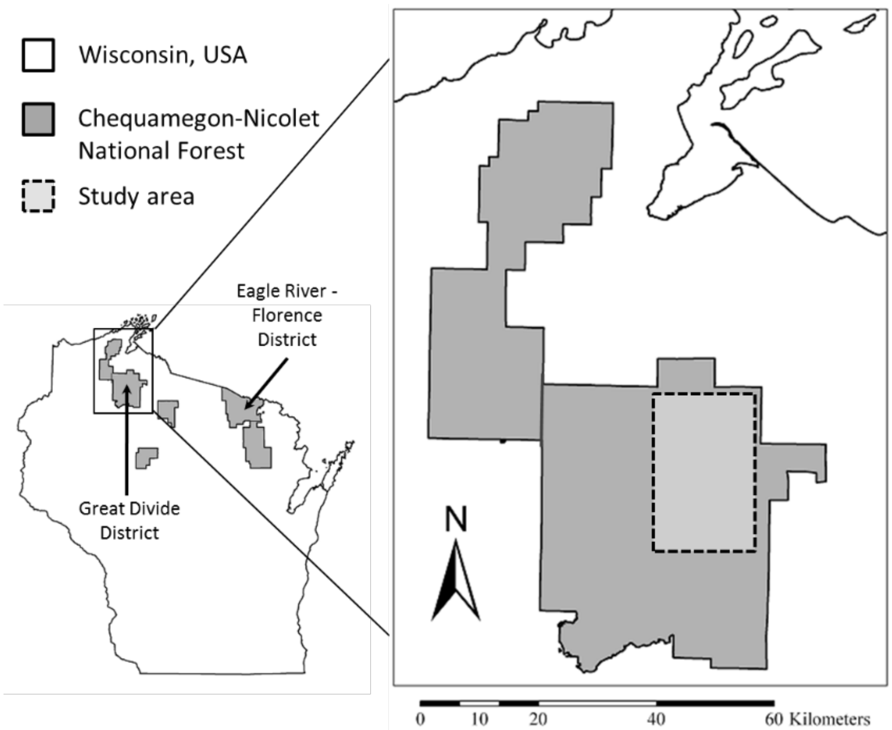

Figure 1. CNNF Ranger Districts where martens were released in Wisconsin, and location of current research.

Research has improved our understanding of marten survival, diet, and habitat selection on the Great Divide District – critical information for understanding why martens numbers have not increased. Survival of adult martens monitored using VHF collars was not low (McCann et al. 2010, Woodford et al. 2013). Low rates of juvenile captures and genetic analyses suggested low and moderate rates of juvenile recruitment (McCann et al. 2010, Manlick et al. 2016). Prevalence of shrews in marten scats may suggest prey limitation (Carlson et al. 2014).

Marten habitat selection studies have had different results. Dumyahn et al. (2007) found that martens selected mature upland hardwood forests. McCann et al. (2014) found that martens selected hemlock-cedar. Different habitat selection results are probably due to the spatial scale of data used during analysis. McCann et al. (2014) measured forest types at a fine spatial scale (i.e., spatial grain) while snow-tracking marten paths. Dumyahn et al. (2007) plotted VHF telemetry locations on maps delineating forest types measured at coarse spatial scales that omit forest type heterogeneity, including areas with hemlock and cedar that martens select (McCann et al. 2014).

Data that classify forest types precisely and accurately at fine scales have not been available at the broad spatial extents necessary for mapping suitable habitat for martens on the Great Divide District. Fine scale forest type data collected on marten snow-tracks have been useful for quantifying selection (McCann et al. 2014). Such data, however, are limited to areas near marten paths and are thus not useful for mapping forest types at broad spatial extents.

Newly-available LiDAR data for the Great Divide District should enable development of maps that can be used to assess marten habitat selection at fine scales. New GPS technology has led to GPS collars that are small and light enough for martens, which enables collection of fine-scale location data that elucidate patterns of space-use that cannot be detected using broad-scale location data (Moriarty et al. 2016). Pairing fine-scale GPS data with fine-scale LiDAR data should enable mapping of suitable marten habitat across broad spatial extents, which may elucidate whether habitat availability limits martens.

The goals of this research are to investigate year-round marten movement patterns (rates, timing, and tortuosity) and habitat selection using GPS collars and LiDAR. Our objectives for the 2015-16 field season were to deploy collars (Advanced Telemetry Systems G10 ultraLITE global positioning system; Figure 2) on 10 martens in fall and winter in order to collect location data. We also sought to evaluate GPS collar performance.

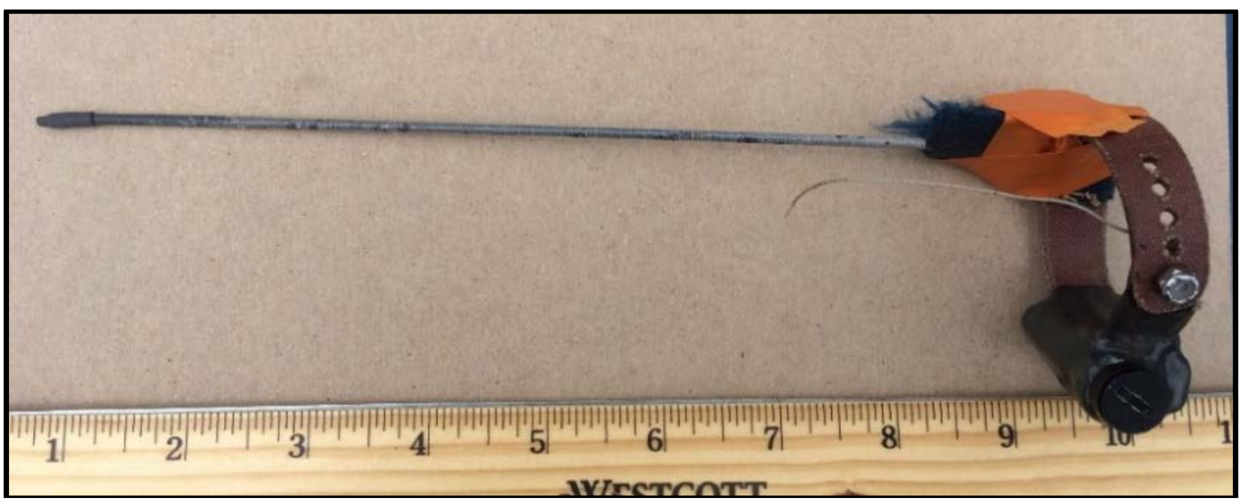

Figure 2. ATS G10 UltraLITE collar used to study martens in northern Wisconsin.

Key accomplishments for fall 2015 and winter 2016

Deployment of collars

We livetrapped martens for 7 weeks during fall 2015 (October, November, and early December). Technicians Adam Oja, Jose Estrada, Ron Parisien, and I set and maintained traps at a total of about 30 sites on the study area (Figure 1). Six martens (1 F, 5 M) were GPS-collared during fall (Table 1). One additional female (ID# F258) was released without a collar because she was too light to be fitted with a collar. She was GPS-collared in winter when heavier (> 600 g). One additional female marten (F251) was VHF-collared in fall, after we deployed available GPS collars. This female was not recaptured. Her collar was relocated within of the bole of a large hemlock, but was not recovered. Two martens were released without processing (because we did not have additional collars). Targeted trapping in the areas where these 2 martens were captured likely led to recapture of these 2 martens during late fall (M252) and winter (M260).

We livetrapped martens for 10 weeks during winter 2016 (January, February, and early March). We set and maintained traps at about 35 sites and GPS-collared 7 martens (2 F, 5 M; Table 1). Only 2 of these martens (1 F and 1 M) were new to the project and 5 (3 F, 2 M) had been captured previously. This resulted in a total of 9 individual martens (3 F, 6 M) being GPS-collared and 1 marten (F) being VHF-collared during fall and winter 2015-16. We periodically recaptured martens to swap collars, to verify collars were recording locations, and to recharge collar batteries. This resulted in 29 total captures with chemical immobilization.

Monitoring of collared martens

We lost radio communication with 1 female GPS-collared marten (F255) shortly after collaring her. Because 2 other recovered collars were missing VHF antennas (appeared to be chewed) and WDNR-conducted VHF-telemetry searches by airplane did not locate this female shortly after she went missing, we suspect her VHF antenna is missing. We switched to antennas that were less rigid after collars with chewed VHF antennas were recovered. Subsequently, we have not had any martens go missing shortly after collaring.

Technicians monitored martens through late winter, but radio communication was lost with most martens by spring. WDNR provided monitoring assistance in July 2016 using airplanes equipped with VHF antennas. WDNR pilot Joe Sprenger searched for 8 martens, of which he found 5.

Collection and assessment of GPS locations

Collars were initially deployed to collect locations at short time intervals (1 minute fix rate). This interval led to exceptional datasets (e.g., Figure 3). The interval was increased to 5 and 10 minutes in January 2016 because martens were not recaptured quickly enough to ensure re-collaring before live-trapping was to cease in March 2016. Based on previous testing in summer 2015. These longer fix intervals should enable collars to collect data for ≥ 4 months (N.P. McCann, unpublished data).

Table 1. GPS collar deployment information. Collars were deployed on martens in fall 2015 and winter 2015-2016.

Animal ID	Sex	Age	GPS ID	Deployed	Retrieved	Days deployed	Days with locations	Locations	Location known[†]
M257	M	A	1428	11/1/2015	11/19/2015	18	18	7943	No
M257	M	A	727	11/19/2015	12/16/2015	27	19	945	
M257	M	A	731	12/16/2015	2/12/2016	58	3	154	
M257	M	A	1291	2/12/2016	NA[*]	NA	NA	NA	
M254	M	A	731	10/16/2015	12/3/2015	48	8	4296	Yes
M254	M	A	1427	2/2/2016	NA	NA	NA	NA	
M256	M	A	1402	10/30/2015	NA	NA	NA	NA	No
F259	F	J	727	1/31/2016	NA	NA	NA	NA	Yes
F255	F	A	727	10/17/2015	11/15/2015	29	2	233	No
F255	F	A	736	11/15/2015	NA	NA	NA	NA	
M252	M	A	1428	12/2/2015	1/6/2016	35	35	6025	Yes
M252	M	A	1352	1/6/2016	1/28/2016	22	22	2483	
M252	M	A	1428	1/28/2016	3/3/2016	35	0	0	
M252	M	A	1394	3/3/2016	NA	NA	NA	NA	
M253	M	A	736	10/15/2015	11/5/2015	21	20	6074	Yes
M253	M	A	1291	1/10/2016	2/1/2016	22	12	836	
M253	M	A	1352	2/1/2016	NA	NA	NA	NA	
F258	F	J	1233	1/7/2016	1/20/2016	13	10	410	Yes
F258	F	J	1427	1/20/2016	1/31/2016	11	0	0	
F258	F	J	1233	1/31/2016	NA	NA	NA	NA	
M260	M	J	1394	1/31/2016	2/22/2016	22	0	0	No
M260	M	J	731	2/22/2016	NA	NA	NA	NA	

[†] Location is known if relocated by WDNR pilot on 12 July 2016, and is otherwise unknown.
[*] Collars were recharged and redeployed in late winter 2016, except for the collar on F255, as F255 was not recaptured in winter.

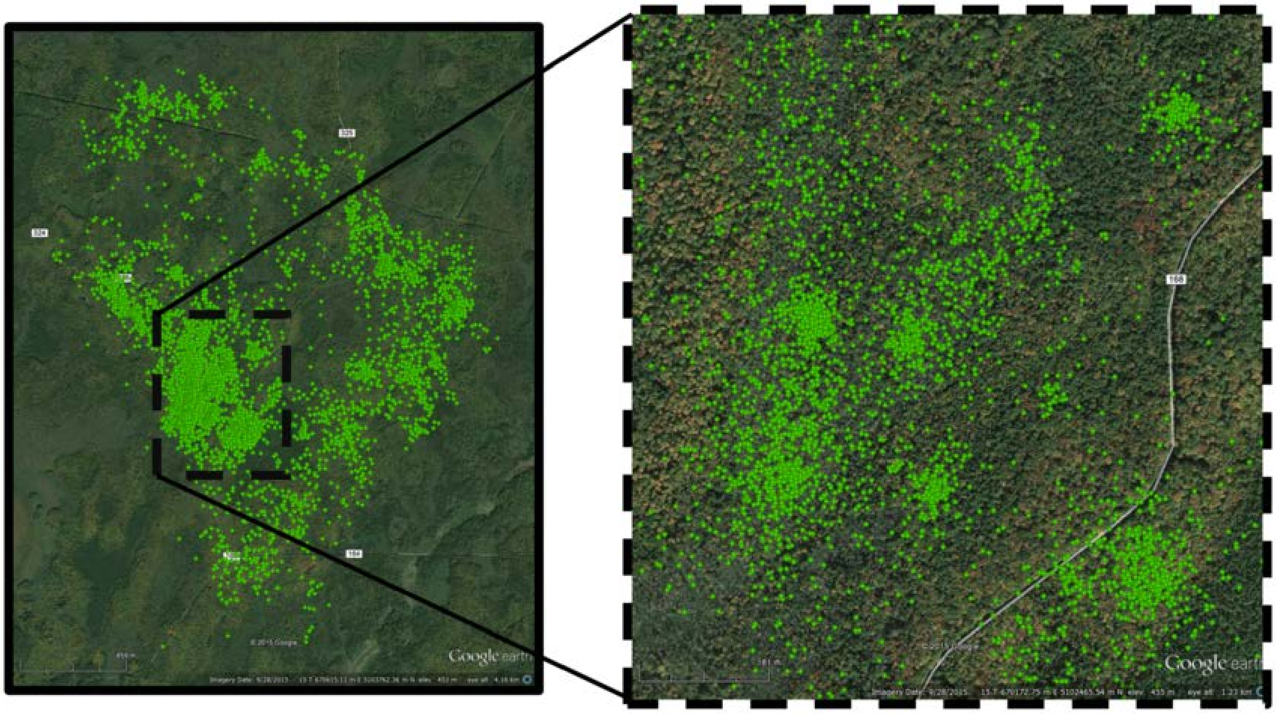

Figure 3. Location data collected from a male marten (ID# M253) using an ATS G10 for 20 days with a fix rate of 1 minute.

Collars were retrieved from 9 martens after 11- to 58-day deployments. Multiple retrieved deployments occurred for 4 martens (1 F, 3 M). The 13 collar deployments for which we retrieved location data, yielded a total of 29,399 locations (mean = 2,261, SD = 2,832). Collar location acquisition success was highly variable (CV = 1.25), as some deployments collected locations as programmed, while others did not. For example, 4 deployments each resulted in >4,000 locations while 3 other deployments resulted in 0 locations (Table 1).

Determining why GPS collars sometimes failed

The cause for such collar failures is unclear. I investigated multiple reasons why collars may fail. Most reasons have been ruled-out. First of all, collar functionality may have been reduced by cold winter temperatures. However, temperature was ruled-out as, although some failures occurred when winter temperatures were very cold (< -16 °F), other collar failures occurred when temperatures were mild (20 °F). Secondly, GPS collar 'batch' (a group of collars ATS produced – we placed multiple collar orders) may have influenced functionality, but some collars from each batch failed and some individual collars had both successful and failed deployments. Third, collars may have switched off when being 'knocked around' by martens. However, repeatedly dropping a collar on asphalt from 6 feet did not alter the fix rate of a collar I tested. Fourth, fix-rate schedule could have influenced functionality (as I used different schedules from fall to winter), but collars failed across multiple fix schedules.

Lastly, I investigated whether battery 'memory' (memory effect) influenced collar failure – the idea being that a partial battery drain (from a short deployment) leads to failure after re-charging and deploying the collar. Memory may have been an issue because we initialized some collars (causing partial battery drain) without deploying them during some weeks, before recharging, initializing, and deploying them the subsequent week. Unfortunately, testing data from spring 2016 do not support this hypothesis. Collar failures have not been diagnosed by me or by ATS.

Future research

We plan to continue research using GPS collars during fall 2016, winter 2016-17, and spring 2017. Of the 9 collars currently deployed on martens, 8 were programmed to collect locations through summer and fall 2016. We plan to re-trap GPS-collared martens in fall, download data, and recharge and redeploy collars. We also ordered 3 new G10 ultraLITE GPS collars and plan to deploy them. Emphasis will be on collaring adult females to facilitate potential parturition research in spring 2017. Parturition research would include identifying maternal dens and counting kits using camera traps and video cameras mounted on telescoping poles, following methods described by Erb and Sampson (2014).

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