Western States Wolverine Conservation Project
Baseline Camera Survey 2016–2017

Idaho Results

IDAHO DEPARTMENT OF FISH AND GAME

Virgil Moore, Director

600 South Walnut Street
Boise, Idaho 83712

Prepared By
Diane Evans Mack
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BACKGROUND

The Western States Wolverine Conservation Project conducted a coordinated 4-state camera survey during the winters of 2015–16 (Wyoming) and 2016–17 (Wyoming, Montana, Idaho, Washington) to establish a baseline of distribution, occupancy, and genetics of wolverines (Lukacs et al., in prep). This camera survey stemmed from recognition that (1) the southernmost extant population of wolverines (*Gulo gulo*) in North America occurs in small, semi-isolated subpopulations in the Rocky Mountains of Montana, Idaho, and northwestern Wyoming and the North Cascade Range of Washington; and (2) maintaining the wolverine metapopulation across this multi-state area is critical for ensuring wolverine persistence in the future. The baseline established by the 4-state camera survey forms the foundation to examine trends in occupancy and distribution over time as the survey is repeated.

The final report from the western states' camera survey is expected in early 2019. In the interim, this report presents results for Idaho, including locations of camera stations, the stations where wolverines were detected, the gender and individual profiles of wolverines for which high-quality DNA was collected, and a preview of the 4-state results.

This project was conducted in conjunction with Montana Fish, Wildlife and Parks; Wyoming Game and Fish Department; and Washington Department of Fish and Wildlife under the auspices of the Western Association of Fish and Wildlife Agencies' (WAFWA) Wildlife Chief's Wolverine Subcommittee.

METHODS

We established a 15 km x 15 km grid across a composite model of wolverine habitat comprised of persistent spring snow (Copeland et al. 2010) and primary habitat (Inman et al. 2013). We included in our sampling frame only grid cells that overlapped modeled wolverine habitat by at least 50%. Our final sampling frame included 633 grid cells across the 4 states (Western States Wolverine Working Group 2016). We used the Generalized Random Tessellation Stratified (GRTS) sampling procedure (Stevens and Olsen 2004) to generate a spatially balanced random selection of 185 grid cells to sample with state-run cameras. Of these, 59 camera stations were in Idaho and 1 additional station technically was in MT but essentially on the Idaho/Montana border (Figure 1).

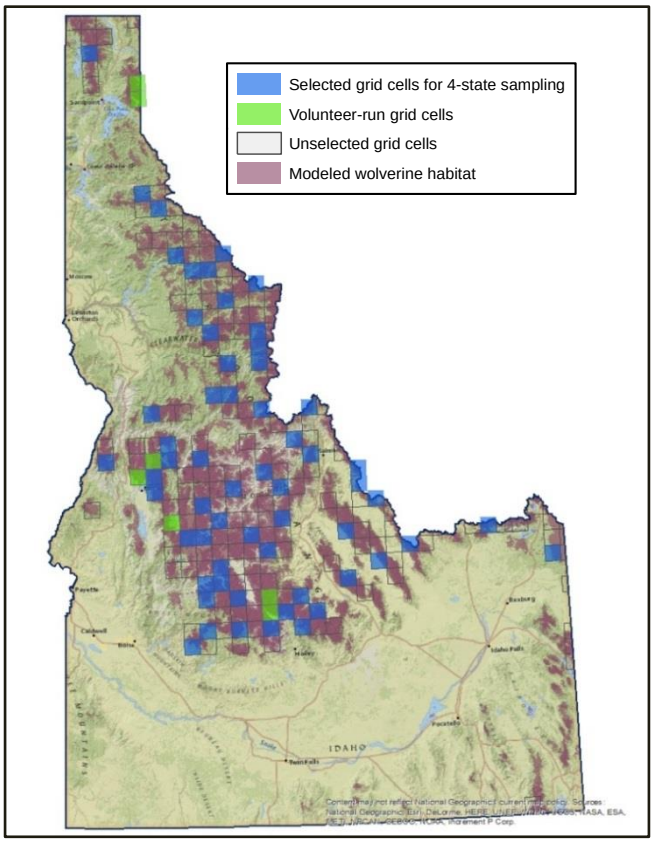


Figure 1. Grid cells selected for sampling in Idaho (blue) and additional volunteer-run cells (green).

We placed 1 camera in each cell. In Idaho we made a concerted effort to place cameras outside of wilderness if a suitable location within modeled habitat was available. As a result, of the potential 12 cells that were mostly wilderness, we deployed 7 camera stations in wilderness areas in Idaho: 3 in the Selway-Bitterroot, 3 in the Frank Church-River of No Return, and 1 in the Jim McClure-Jerry Peak. Wilderness stations in all 4 states followed a Minimum Requirements Decision Guide (MRGD) analysis approved by Regional Foresters in Regions 1, 2, 4, and 6 in September 2016.

Our sampling period in Idaho was 1 December 2016 through 31 March 2017. We used 2 types of camera stations (Figure 2). Accessible stations were revisited monthly to refresh bait and scent, collect DNA samples, and move everything higher up the tree as snow accumulated. Inaccessible stations were too remote to revisit in winter; these were deployed in late fall with a scent dispenser dripping onto a bone rather than bait and were not revisited until the following summer. The station components were intentionally deployed high in the tree in anticipation of snow.

Figure 2. Accessible (left) and inaccessible (right) camera station set-up.

A gun brush array secured to the tree with a corrugated plastic collar (P. Figura, California Department of Fish and Game, personal communication) was used to snag hair as animals climbed to investigate bait. A second, lower gun brush collar was added to detect lynx. Hair samples were submitted to the National Genomics Center for Wildlife and Fish Conservation, Missoula, MT, for DNA analyses. Camera station methods are detailed in a protocol (Western States Wolverine Working Group 2016) shared with Forest Service and other partners during a webinar and meetings held during spring and summer 2016.

In addition to the 60 state-run cameras, 7 volunteer-run cameras also were deployed in Idaho, placed in grid cells not being sampled by the 4 states (Figure 1). Volunteers in Idaho were from NGO groups. The protocol for these camera stations was less rigorous; cameras typically were deployed in January or February and remained active for a shorter period of time. Gun brushes were not used to collect hair samples at volunteer cells in Idaho.

The primary analysis of the camera data was an occupancy analysis across all 4 states using wolverine detections and covariates calculated for each cell to estimate probability of 'use' for all 633 grid cells in our sampling frame (those with cameras and those not sampled; Lukacs et al., in prep). This is the metric that can be tracked over time for changes in occupancy and distribution.

Results from volunteer-run cameras did not contribute to the primary occupancy analysis, but detections of wolverines in photographs from volunteer-run stations were used in the final estimate of cells known to be occupied (Lukacs et al., in prep).

RESULTS

Distribution

Across all 4 states we obtained results from 183 of the 185 state-run camera stations (Lukacs et al., in prep; Figure 3). One camera in Idaho was stolen and 1 camera in Montana likely burned in a wildfire. We detected wolverines at 59 of these 183 camera stations (32%). Wolverines were detected at another 34 stations run by federal and NGO partners using the states' protocol or by volunteers using the less rigorous volunteer protocol.

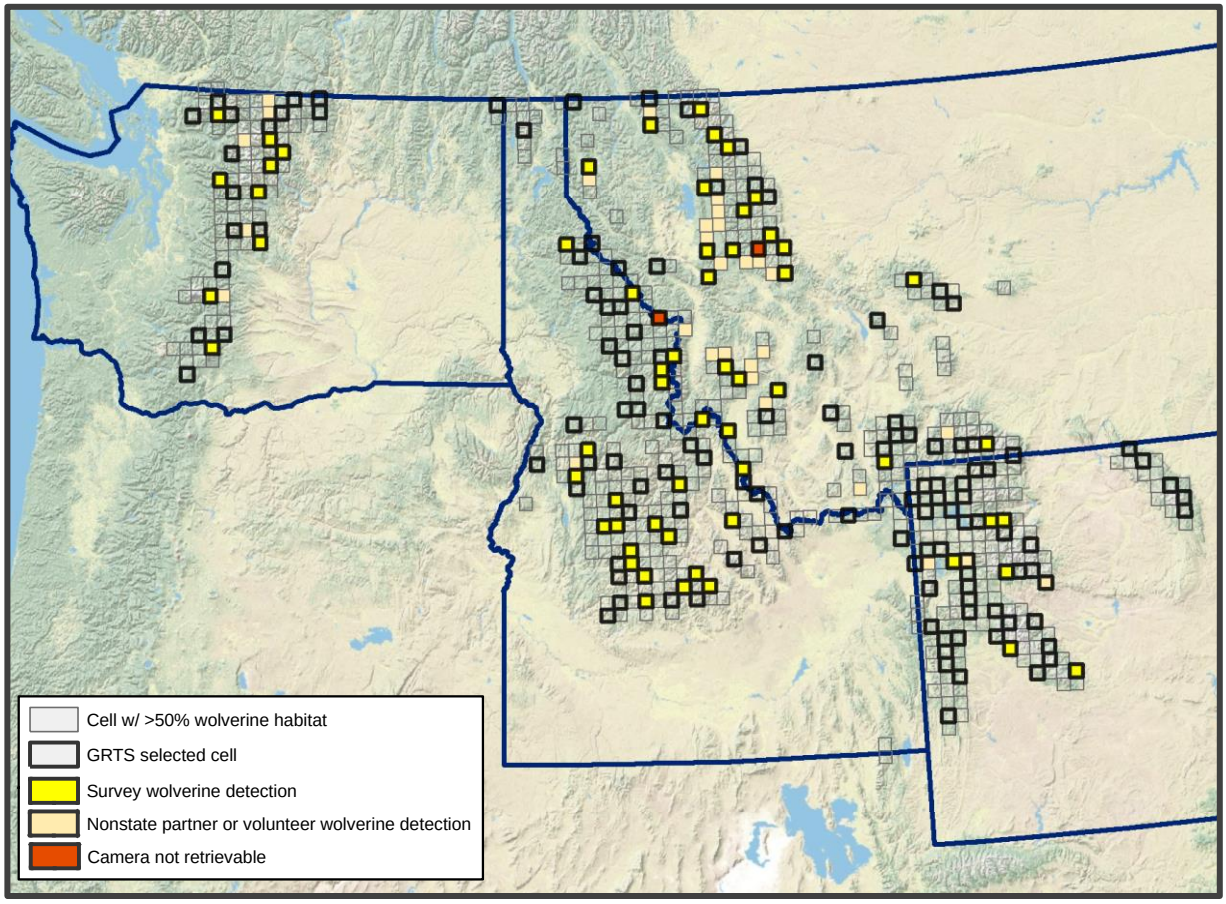


Figure 3. Sampling frame, selected cells, and grid cells with wolverine detections from the Western States Wolverine Conservation Project's camera survey, winters 2015–16 and 2016–17 (from Lukacs et al., in prep).

In Idaho, wolverines were detected with photographs at 22 of the 60 state-run cameras and 1 volunteer-run camera (Figures 3 and 4, Table 1). We logged 10,104 images of wolverines. The first wolverines (2 individuals) appeared at a camera station 6 days after the station was deployed (grid cell 214). Other quick responses were at grid cell 166 (9 days), 78 (13 days), and 293 (13 days). All 4

of these locations had known resident wolverines during the Idaho Wolverine–Winter Recreation Study (Heinemeyer et al. 2017).

Distribution of wolverine detections in Idaho generally was as expected. The Salmon River Mountains and Sawtooth Mountains in Central Idaho continued to support what appears to be the core subpopulation for the state. Detections at 3 stations in the Bitterroot Mountains of the Selway-Bitterroot Wilderness represented a single individual. Lack of detections in the Panhandle during our 1 winter of sampling was not particularly surprising, given the scale of our study. The Multi-species Baseline Initiative (MBI) had 8 detections of wolverine over 5 winters during 2010 through 2014, 3 of which were the same individual (Lucid et al. 2016). The MBI grid was higher resolution (5 k x 5 k) and sampled more intensively. The single animal detected in this study in North Idaho south of I90 (Figure 3) appeared late during the sampling period and could have been passing through. Based on camera photos, it did not climb the bait tree (the bait was deplenished) and thus did not leave a DNA sample to compare to other wolverines of known identity. In eastern Idaho, a single detection in the Lemhi Range and no detections in the Lost River Range raised the question of whether these narrow, isolated mountain chains could support resident wolverines.

Wolverines by Gender and Individual

From hair samples submitted for analysis, we received species confirmation of wolverine at 17 of the 23 stations where we detected wolverines on camera in Idaho. No wolverine DNA was confirmed at any camera where we did not also have photographic evidence of wolverine presence. In some cases wolverines did not leave a hair sample; in other cases the sample was of insufficient quality to identify species. Of the subset of stations that obtained wolverine DNA, 15 stations had sufficient-quality DNA to identify wolverines to gender. We had males at 6 stations, females at 7 stations, and both males and females at 2 stations (Figure 4, Table 1).

Only 1 of the 2 stations where we had DNA from both a male and female (station 214) was the same location where we observed 2 wolverines together in photographs. We detected 2 animals together in photographs at 2 other stations (91 and 167), but obtained quality DNA from only 1 animal. In contrast, at station 293 we detected both a female and a male via DNA but these animals visited at different times and were not captured on camera together.

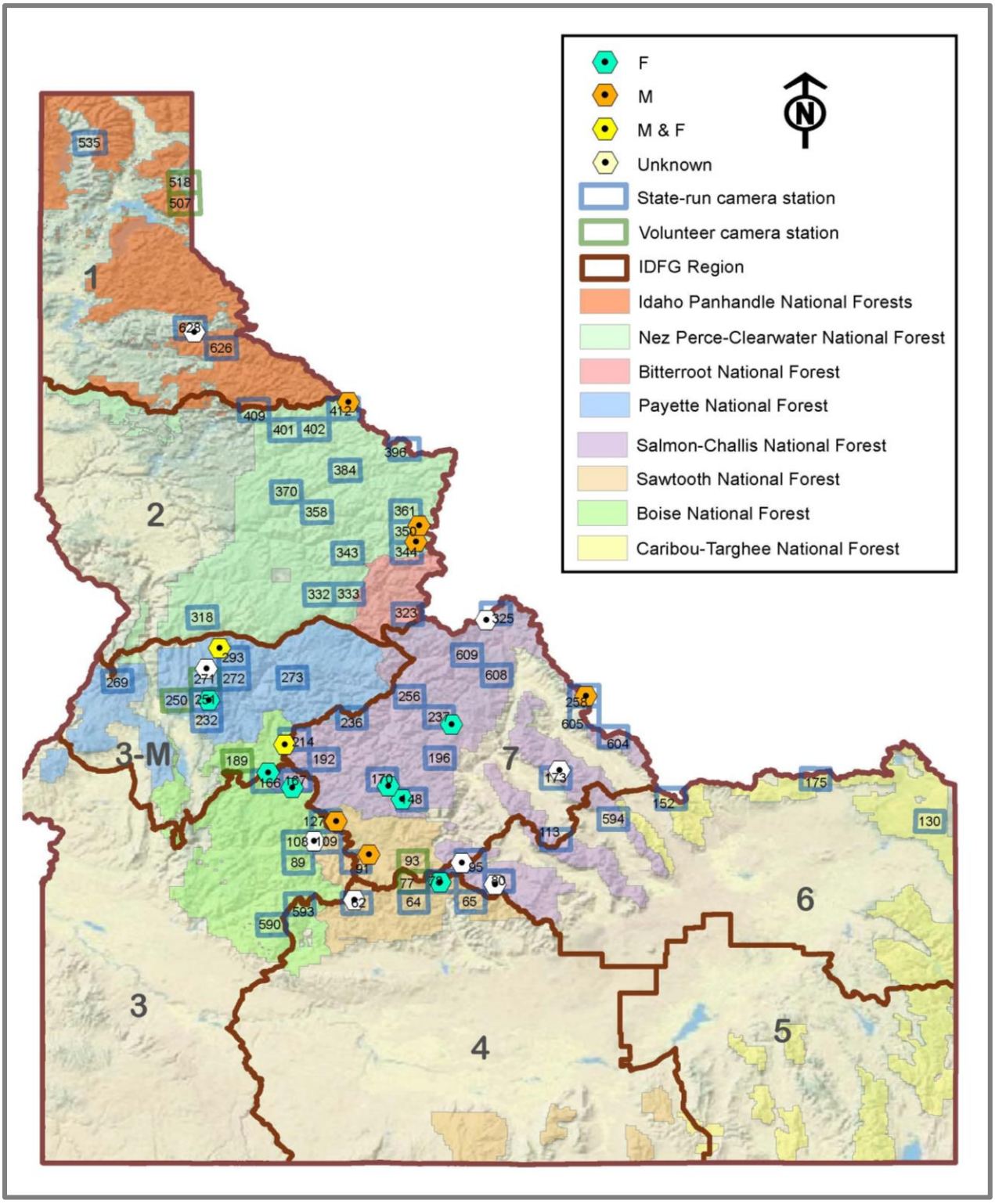


Figure 4. Wolverines were detected at 23 camera stations in Idaho during winter 2016–17. A subset of these was positively identified to gender. 'Unknown' gender was due to no wolverine DNA identified from hair samples or poor quality wolverine DNA that was insufficient to obtain gender. Sampled grid cells are labeled with grid cell ID.

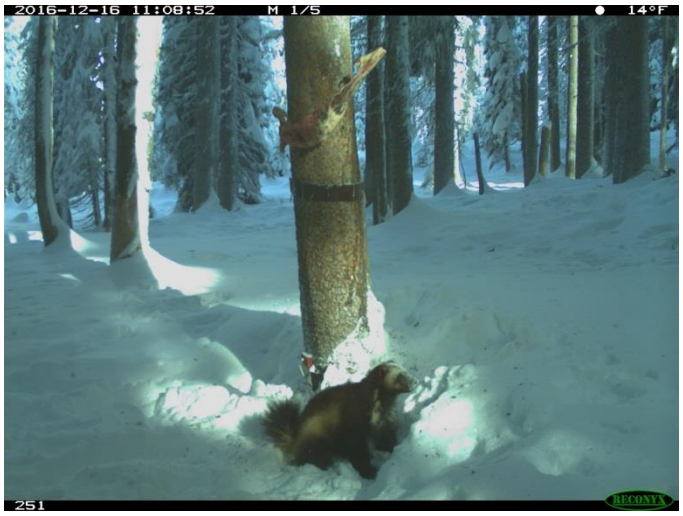
All of the animals identified to gender in Idaho also were identified to individual (Table 1). This revealed additional details on which animals were detected at which camera station. For example, we had 7 individual females from our samples and 9 stations where females were detected. DNA confirmed that 2 females each visited 2 different stations. In both cases the camera stations were in adjacent grid cells 12 km and 16.5 km apart, respectively. Similarly, we had 6 individual males, and detected males at 8 camera stations. One of these males visited 2 stations, also adjacent stations ~12 km apart. Another male visited 3 adjacent stations (the 3rd across the border in Montana) spread across a distance of ~30 km.

We asked the National Genomics Center for Wildlife and Fish Conservation (US Forest Service, Missoula, MT) to compare individual profiles of wolverines from this camera study to all individuals in their database. We were particularly interested in the 24 individual wolverines identified during the Idaho Wolverine–Winter Recreation Study that occurred over 6 winters during 2010 through 2015 (Heinemeyer et al. 2017). We found DNA matches to 4 wolverines from the winter recreation study, 2 males and 2 females (Table 1), all from the McCall study area that encompassed the eastern portion of the Payette NF and northern Boise NF. One male (M12-Rex) and 1 female (F12-Mae) were detected at the same camera (site 293) located in the northern end of the Payette NF. These 2 animals initially had been live-trapped and collared in January 2014 at separate sites. The second male (M4-Mason) and female (F5-Tess) were detected at different cameras during our survey but had been captured initially at the same live trap on the northern Boise NF in January 2011. Although these 2 animals were not detected at the same camera station in our survey, another female was detected at the camera station where M4-Mason was detected (Table 1). Genetics of this female (MS-Gulo-F13) were consistent with a paternal-offspring relationship with M4-Mason.

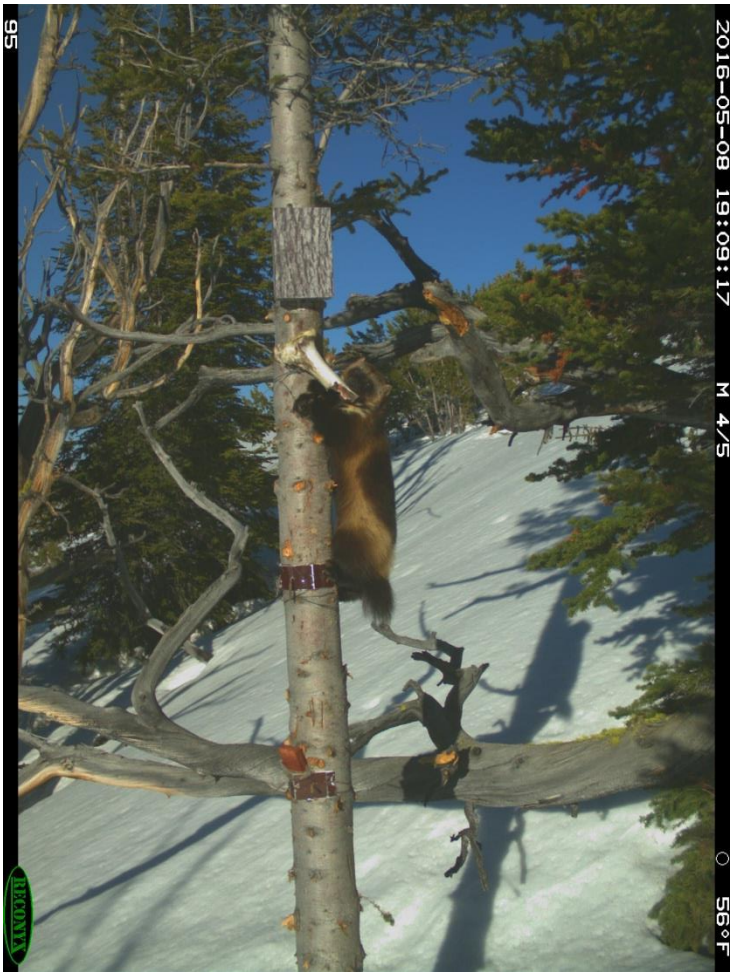
Of the 7 wolverines live-trapped and collared in the Stanley winter recreation study area during 2012 and 2013, none were confirmed among the animals detected on camera during the 2016–17 camera survey. However, 3 wolverines detected on camera that were identified to individual (MS-Gulo-F13, MS-Gulo-F16, and MS-Gulo-F20; Table 1) were genetically consistent with having parental-offspring relationships with several of the Stanley study animals, including F7-Luna, F8-Julia, and M7-Buster.

Because we lacked DNA profiles for all the wolverines detected on camera, we examined all 10,104 photographs of a wolverine from Idaho cameras to look for distinguishing characteristics that could be used to identify a unique individual. In addition to throat and upper chest markings, some animals had white toes and/or paws that were distinctive. In Idaho this genetic trait appeared more common in the Salmon Region along the Montana border and less so in Central Idaho. We

first attempted to create a physical description of each individual identified with DNA, then looked for characteristics that suggested a different animal. This effort was difficult overall, given the varying quality of images (night or day), how much of the animal was in view (on the ground or on the tree), and the aspect of the photograph (right or left side). We developed physical descriptions of 19 individuals, including the 13 identified genetically. We had more confidence in identifying the number of different individuals at any given station (Table 1) than in tracking individuals across stations.



Given that the scent pumps deployed at inaccessible stations were still experimental technology at the time of our survey, their performance was uncertain. Some pumps did stop working temporarily as a result of extremely cold temperatures, creating varying periods of time when fresh lure was not dispensed at some stations. Nevertheless, across all 4 states we found no statistical difference in detection between accessible and inaccessible stations (Lukacs et al., in prep).



We also expected that DNA samples from inaccessible stations would be less reliable, due to prolonged exposure to the elements, than samples from stations where hair could be collected more frequently. DNA from inaccessible stations did appear to have lower quality. We submitted 41 hair samples from the 12 scent pump stations in Idaho. Half of these (51%) had sufficient quality DNA to be identified to species. In comparison, success rate for identifying species averaged 87% from almost 400 samples submitted from Idaho's accessible stations. We detected wolverines on camera at 4 of the 12 inaccessible stations. Wolverine was confirmed by DNA at 3, but only 1 wolverine-positive sample had sufficient quality DNA to get to gender and individual.

Table 1. List of Western States Wolverine Conservation Project's camera survey stations in Idaho, winter of 2016–17, by IDFG Region and National Forest, with results for wolverine detection and DNA analysis to gender and individual.

Grid_ID[a]	IDFG Region	National Forest	Station Type[b]	Wilder-ness	Gulo Camera Detection	Gulo Gender[c]	Gulo ID	Previous Gulo ID	Min # Indiv Identified[d]
535	1	State of Idaho	A	No					
626	1	Idaho Panhandle	A	No					
628	1	Idaho Panhandle	A	No	Y	Unk			1
318	2	Nez Perce-Clearwater	A	No					
332	2	Nez Perce-Clearwater	A	No					
333	2	Nez Perce-Clearwater	A	No					
343	2	Nez Perce-Clearwater	In	No					
344	2	Nez Perce-Clearwater	In	Yes	Y	M	MS-Gulo-M25		1
350	2	Nez Perce-Clearwater	A	Yes	Y	M	MS-Gulo-M25		1
358	2	Nez Perce-Clearwater	In	Yes					
361	2	Nez Perce-Clearwater	A	No					
370	2	Nez Perce-Clearwater	A	No					
384	2	Nez Perce-Clearwater	A	No					
396	2	Nez Perce-Clearwater	In	No					
401	2	Nez Perce-Clearwater	A	No					
402	2	Nez Perce-Clearwater	A	No					
409	2	Nez Perce-Clearwater	A	No					
412	2	Lolo	A	No	Y	M	MS-Gulo-M6		1
323	2	Bitterroot	A	Yes					
232	3-McC	Payette	A	No					
236	3-McC	Payette	In	Yes					
251	3-McC	Payette	A	No	Y	F	MS-Gulo-F10		1
272	3-McC	Payette	A	No					
273	3-McC	Payette	In	No					

Grid_ID[a]	IDFG Region	National Forest	Station Type[b]	Wilder-ness	Gulo Camera Detection	Gulo Gender[c]	Gulo ID	Previous Gulo ID	Min # Indiv Identified[d]
293	3-McC	Payette	A	No	Y	F & M	MS-Gulo-F14 MS-Gulo-M8	F12-Mae M12-Rex	2
269	3-McC	Wallowa-Whitman	In	No					
166	3-McC	Boise	A	No	Y	F	MS-Gulo-F9	F5-Tess	1
214	3-McC	Boise	A	No	Y	F & M	MS-Gulo-F13 MS-Gulo-M11	M4-Mason	3
89	3	Boise	A	No					
108	3	Boise	A	No					
109	3	Boise	In	No	Y	Unk			1
593	3	Boise	A	No					
167	3	Salmon-Challis	A	No	Y	F	MS-Gulo-F9	F5-Tess	3
590	4	Boise	A	No					
62	4	Sawtooth	A	No	Y	Unk			1
64	4	Sawtooth	A	No					
65	4	Sawtooth	A	No					
78	4	Sawtooth	A	No	Y	F	MS-Gulo-F15		1
130	6	Caribou-Targhee	A	No					
152	6	Caribou-Targhee	A	No					
175	6	Caribou-Targhee	A	No					
594	6	Caribou-Targhee	A	No					
80	6	Salmon-Challis	In	No	Y	Unk			1
113	6	Salmon-Challis	A	No					
148	7	Salmon-Challis	A	No	Y	F	MS-Gulo-F16		1
95	7	Salmon-Challis	In	Yes	Y	Unk			1
170	7	Salmon-Challis	A	No	Y	F	MS-Gulo-F16		1
173	7	Salmon-Challis	A	No	Y	Unk			1
192	7	Salmon-Challis	In	No					
196	7	Salmon-Challis	A	Yes					

Grid_ID[a]	IDFG Region	National Forest	Station Type[b]	Wilder-ness	Gulo Camera Detection	Gulo Gender[c]	Gulo ID	Previous Gulo ID	Min # Indiv Identified[d]
237	7	Salmon-Challis	A	No	Y	F	MS-Gulo-F20		1
256	7	Salmon-Challis	In	No					
258	7	Salmon-Challis	A	No	Y	M	MS-Gulo-M12		2
325	7	Salmon-Challis	A	No	Y	Unk			1
604	7	Salmon-Challis	A	No					
608	7	Salmon-Challis	A	No					
609	7	Salmon-Challis	A	No					
91	7	Sawtooth	A	No	Y	M	MS-Gulo-M19		2
127	7	Sawtooth	A	No	Y	M	MS-Gulo-M19		3
605	7	State of Idaho	A	No					
Volunteer-run cells									
518	1	Idaho Panhandle	A	No					
507	1	Idaho Panhandle	A	No					
250	3-McC	Payette	A	No					
271	3-McC	Payette	A	No	Y	Unk			1
189	3-McC	Boise	A	No					
77	4	Sawtooth	A	No					
93	7	Sawtooth	A	No					

[a] See Figure 4 for grid cell location

[b] A=Accessible, In=Inaccessible

[c] F=Female, M=Male, Unk=Unknown. 'Unknown' gender due to (1) no wolverine DNA collected at camera station or (2) DNA was poor quality and could not yield gender and individual.

[d] Minimum number of individuals at camera station based on genetics and examination of physical appearance of wolverines in photos. This column cannot be summed across sites, as several individuals visited multiple sites.

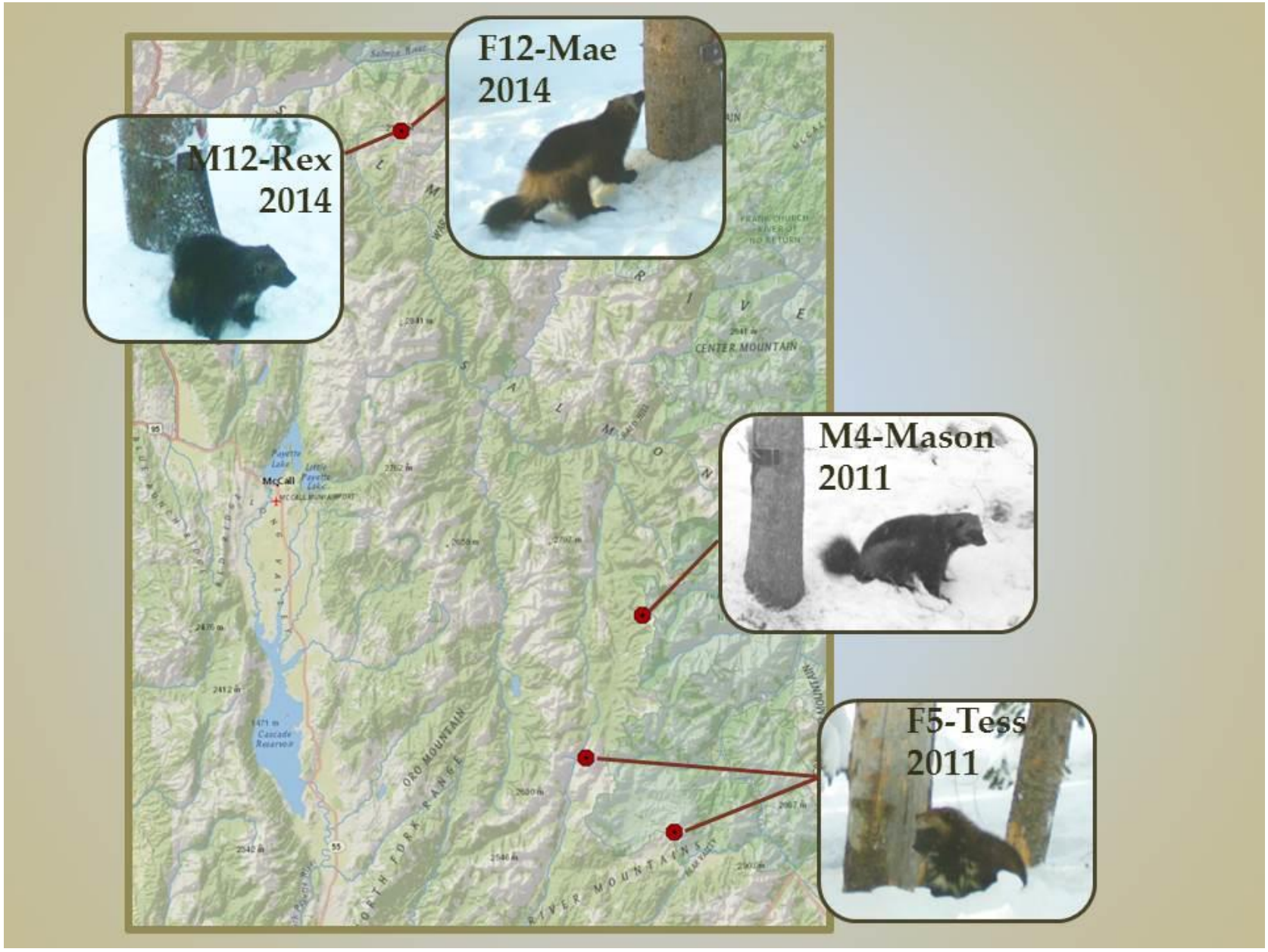


Figure 5. Camera stations (red circles) visited in winter 2016–17 by wolverines first identified during the Idaho wolverine–winter recreation study, 2010 through 2015 (Heinemeyer et al. 2017).

All of the DNA samples confirmed as wolverine in Idaho belonged to haplotype Wilson-A and were grouped with Montana and Wyoming (Figure 6). Haplotype Wilson-A is the most common and widely distributed haplotype in North America (McKelvey et al. 2014). In contrast, all samples from Washington matched haplotype Wilson-C, found elsewhere only in isolated locations in western Canadian provinces. Haplotypes were determined from mitochondrial DNA and reflect ancestral relatedness.

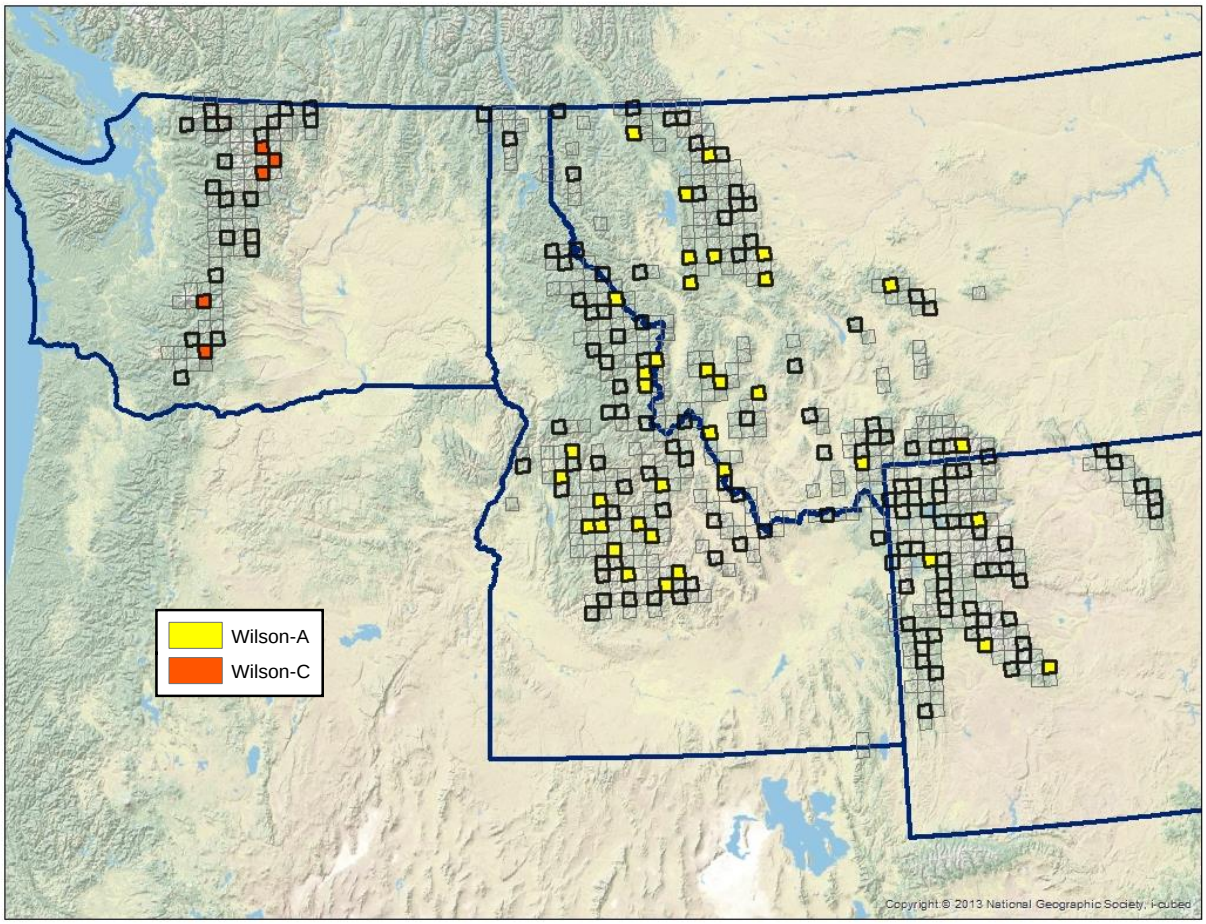


Figure 6. Two haplotypes were identified from wolverine DNA samples across the 4 states, with the Rocky Mountains distinct from the Cascade Mountains (from Lukacs et al., in prep).

OTHER SPECIES

We detected a multitude of other species at Idaho camera stations, from chickadees, flying squirrels, and small rodents to grizzly bears and wolves. Red fox was the most-photographed species (23,794 images) and occurred at more than half the stations. Marten was the most ubiquitous animal, detected at 54 of the 60 state-run cameras (Table 2). Two species of marten are now recognized in North America: American marten (*Martes americana*) and Pacific marten (*M. caurina*; Pilgrim et al. 2017 and cites therein). Both species were identified from hair samples

collected at Idaho camera stations, although most of our samples were of *M. caurina*. Of the 3 stations where *M. americana* was identified, 2 stations had DNA for both species. Hybridization is known to occur between these species in the northern Rocky Mountains, and further genetic testing on these samples could be performed to determine the level of hybridization (Pilgrim et al. 2017).

We detected fisher on camera at 6 state-run stations and 2 volunteer stations (Table 2). We obtained DNA confirmation at 4 of these (DNA was not collected at the 2 volunteer-run stations). Fisher samples were analyzed for mitochondrial DNA haplotype. Samples with sufficient quality DNA yielded haplotypes 6 and 12 (Figure 7). Haplotype 6 reflects reintroduction from British Columbia, whereas haplotype 12 reflects a native population unrelated to reintroduction sources (Vinkey et al. 2006). IDFG translocated 39 fishers from British Columbia to Chamberlain Basin in 1962 and 1963 (IDFG 1992).

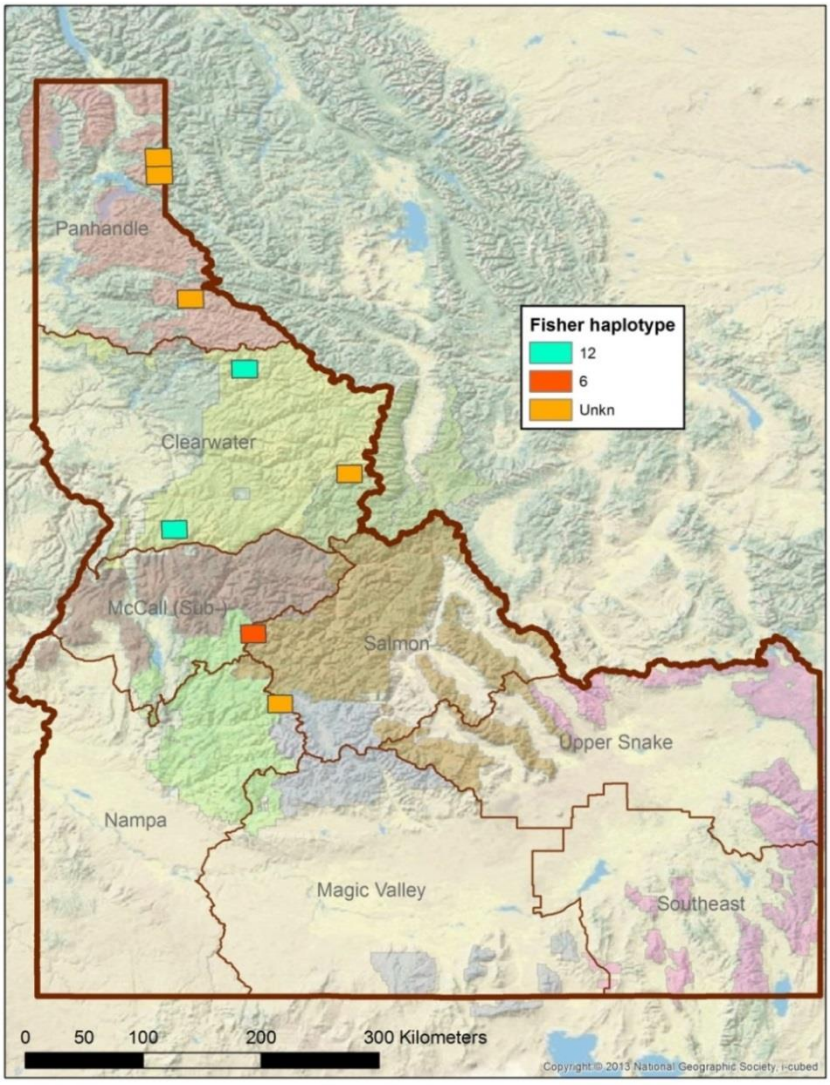


Figure 7. Two haplotypes were identified from fisher DNA samples. 'Unknown' haplotype was due to no fisher DNA collected or poor quality DNA that was insufficient to obtain haplotype.

Table 2. A sample of other species detected in Idaho at camera stations deployed for the Western States Wolverine Conservation Project's camera survey, winter of 2016–17.

Grid_ID	Fisher	Marten	Fox	Wolf	Grizzly Bear	Black Bear	Bobcat	Golden Eagle	Goshawk	Moose	Mt Lion
626	●	●									
628		●	●						●		
318	●	●	●								
332		●									
333		●	●								
343		●									
344	●	●				●					
350		●									
358		●	●			●					
361		●									
370		●									
384		●	●								
396											
401	●					●					
402		●									
409		●				●					
412		●									
323											
232		●	●								
236		●									
251		●	●								
272		●	●								
273		●				●					
293		●	●								
269			●								
80											
95						●					

Grid_ID	Fisher	Marten	Fox	Wolf	Grizzly Bear	Black Bear	Bobcat	Golden Eagle	Goshawk	Moose	Mt Lion
113		●	●								
148		●	●				●				
167		●	●								
170		●	●								
173		●	●							●	
192		●	●			●					
196		●	●								
237		●	●								
256		●									
258		●									
325		●	●	●							
604		●	●								
608		●	●								
609		●	●								
89		●	●	●							
108		●	●			●					
109		●	●								
166		●	●								
214	●	●	●								
590		●	●								
593		●	●	●				●			
62		●	●								
64		●	●	●							
65		●	●								
78		●	●								
91		●									
127	●	●	●	●							
130		●	●								
152		●	●								
175		●	●		●					●	●

Grid_ID	Fisher	Marten	Fox	Wolf	Grizzly Bear	Black Bear	Bobcat	Golden Eagle	Goshawk	Moose	Mt Lion
594		●	●								●
535		●								●	
605		●						●		●	●
Volunteer-run cells											
518	●	●									
507	●					●					
250		●	●								
271		●	●								

SUMMARY

The camera survey conducted across 2 consecutive winters, 2015–16 and 2016–17, established a baseline of wolverine occurrence and an estimate of the probability of occupancy in each of 633 grid cells across a 4-state area (Lukacs et al., in prep). The sampling design and field protocol proved to be effective. Our detection probability was high (we would have detected a wolverine 9 times out of 10 if it was within our study area during our sampling window) and the design effectively covered remote areas as well as front-country sites (Lukacs et al., in prep). In addition to providing a broad-scale view of wolverine distribution, results can be used to identify finer-scale questions. For example, the single detection in the Lemhi Range of eastern Idaho during the camera survey prompted IDFG to conduct a follow-up effort in the Lemhi and Lost River Ranges during the winter of 2017–18 with a higher sampling intensity (1 camera in each grid cell vs. a random selection of cells) to explore if these locations supported resident animals. The occupancy framework also allows for estimating numbers of occupied cells at a finer scale, such as within a specific mountain range or National Forest. This process is detailed in Lukacs et al. (in prep).

The Western States Wolverine Conservation Project plans to repeat the camera survey during the winter of 2021–22, 5 years from its initial undertaking. The intent of repeating the survey will be to compare wolverine distribution with the baseline established in 2017. Comparisons also can occur at a finer scale (e.g., the southern end of the known wolverine range, or a particular geographic area). If distribution or probability of occupancy has changed, we can, over time, potentially link changes to management actions, conservation efforts, or environmental conditions.

LITERATURE CITED

Copeland, J. P., K. S. McKelvey, K. B. Aubry, A. Landa, J. Persson, R. M. Inman, J. Krebs, E. Lofroth, H. Golden, J. R. Squires, A. Magoun, M. K. Schwartz, J. Wilmot, C. L. Copeland, R. E. Yates, I. Kojola, and R. May. 2010. The bioclimatic envelope of the wolverine (Gulo gulo): do climatic constraints limit its geographic distribution? Canadian Journal of Zoology 88:233–246.

Heinemeyer, K. S., J. R. Squires, M. Hebblewhite, J. S. Smith, J. D. Holbrook, and J. P. Copeland. 2017. Wolverine–winter recreation research project: investigating the interactions between wolverines and winter recreation. Unpublished final report, 15 December 2017. Available at: www.roundriver.org/wolverine.

IDFG. 1992. Idaho Wildlife, Fall 1992. Idaho Department of Fish and Game, Boise, Idaho, 83707, USA.

Inman, R. M., B. L. Brock, K. H. Inman, S. S. Sartorius, B. C. Aber, B. Giddings, S. L. Cain, M. L. Orme, J. A. Fredrick, B. J. Oakleaf, K. L. Alt, E. Odell, and G. Chapron. 2013. Developing priorities for metapopulation conservation at the landscape scale: Wolverines in the western United States. Biological Conservation 166:276–286

Lucid, M., L. Robinson, and S. Ehlers. 2016. Multi-species Baseline Initiative Project Report: 2010-2014. Unpublished report September 2016. Idaho Department of Fish and Game, Coeur d'Alene, Idaho, USA. Available at https://idfg.idaho.gov/baseline.

Lukacs, P., D. Evans Mack, R. Inman, J. Ivan, J. Gude, R. Lanka, J. Lewis, R. Long, R. Sallabanks, M. K. Schwartz, S. Torbit, and Z. Walker. In prep. Wolverine occupancy, spatial distribution, and monitoring design in the western United States.

McKelvey, K. S., K. B. Aubrey, N. J. Anderson, A. P. Clevenger, J. P. Copeland, K. S. Heinemeyer, R. M. Inman, J. R. Squires, J. S. Waller, K. L. Pilgrim, M. K. Schwartz. 2014. Recovery of Wolverines in the Western United States: Recent Extirpation and Recolonization or Range Retraction and Expansion? The Journal of Wildlife Management; DOI: 10.1002/jwmg.649.

Pilgrim, K., B. Eubank, and M. Schwartz. 2017. Genetic analysis of samples from the multi-state wolverine (*Gulo gulo*) survey submitted by Idaho Department of Fish and Game. Unpublished report to IDFG, October 10, 2017. National Genomics Center for Wildlife and Fish Conservation, Missoula, MT 59801, USA.

Stevens, D. L., Jr., and A. R. Olsen. 2004. Spatially balanced sampling of natural resources. Journal of the American Statistical Association 99: 262–278.

Vinkey, R. S., M. K. Schwartz, K. S. McKelvey, K. R. Foresman, K. L. Pilgrim, B. J. Giddings, and E. C. Lofroth. 2006. When reintroductions are augmentations: the genetic legacy of fishers (*Martes pennanti*) in Montana. Journal of Mammalogy 87(2):265–271.

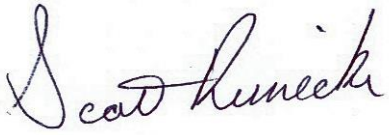
Western States Wolverine Working Group. 2016. Western states wolverine conservation project baseline survey: standard operating procedures for camera–DNA stations. Version 3.2, September 30, 2016.

Submitted by:

Toby Boudreau
Federal Aid Coordinator

Approved by:

IDAHO DEPARTMENT OF FISH AND GAME



Scott Reinecker, Chief
Bureau of Wildlife