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Dear US Fish and Wildlife Service:

The American Society of Mammalogists (ASM) is a non-profit, professional, scientific, and educational society consisting of nearly 3,000 members from all 50 United States and 60 other countries worldwide. The ASM was founded in 1919 and is the world's oldest and largest organization devoted to the study of mammals. We support the conservation and responsible use of wild mammals based on current, sound, and accurate scientific knowledge. The ASM has a long history of reviewing issues related to mammalian conservation, and where appropriate, adopting positions on issues concerning the conservation and responsible management of mammals and their habitats based upon our scientific expertise.

We are writing to you as part of the public comment period regarding the proposed listing of the wolverine (*Gulo gulo luscus*) as threatened in the 48 contiguous US states (hereafter contiguous US). After review of the proposal, we strongly agree with your efforts to protect the wolverine under the Endangered Species Act (ESA). However, we find that it falls short of the level of protection needed for the wolverine at this point in time, and especially into the future. We argue that the wolverine fully deserves to be protected as "Endangered" under the ESA. Further, we believe that critical habitat must be designated for the species. Herein, we provide scientific justification for our assertions to that effect.

First, the wolverine inhabits a relatively small portion of its former range in the contiguous US, currently including the northern Rocky Mountains (Montana, Idaho, Wyoming) and northern Cascade Mountains (Washington). In addition, single transient wolverines recently have been found in both Colorado and California. The latest population estimate of wolverines in the contiguous US is 250-300 individuals (US FWS 2013). However, the most recent and reliable estimate for N_e (effective population size) is only 35, suggesting that there are very few individual wolverines contributing to the gene pool in the contiguous US (Schwartz et al. 2009).

Wolverines typically occur at relatively low population densities, and in discrete, semi-isolated subpopulations within the contiguous US. Connectivity between these subpopulations is absolutely vital to ensure both genetic and demographic health of the entire population. Least-cost models indicate that dispersal routes through areas with persistent spring snow cover best explain genetic distance among subpopulations (Schwartz et al. 2009). Using this empirical approach, Schwartz et al. (2009) identified several corridors likely important for wolverine dispersal and population connectivity in the contiguous US. Because linkages between populations are important to the overall success of the species in the contiguous US, we believe these areas should also be designated "critical habitat" under the proposed ESA listing. Identifying and protecting these linkages among wolverine subpopulations will be critical for future conservation efforts.

As a result of limited connectivity in a species with such low density populations, there is great concern regarding diminished gene flow and inbreeding. High population substructure and remarkably low levels of gene flow have been found in wolverines from Montana (Cegelski et al. 2003, 2006). These findings contrast sharply with results from less fragmented landscapes in Alaska and Canada. In the contiguous US, the landscape of wolverine habitat is increasingly fragmented due to human development and disturbance (Cegelski et al. 2003). Furthermore, the limited gene flow in wolverines in the contiguous US primarily is by males (Cegelski et al. 2006), and wolverine populations that have been studied (e.g., Montana) show significant matrilineal structuring and substantially restricted female gene flow, which suggests that demographic viability will depend upon the movement of female wolverines into new territories (Cegelski et al. 2006). However, movement of female wolverines into new territories may be minimized by their strong preference for areas with heavier spring snowpack for denning sites. Cegelski et al. (2006) found that at least 400 breeding pairs (or 1-2 effective migrants/generation) would be necessary to ensure genetic viability in the long-term for each population in the contiguous US. The most recent estimate of only 35 breeding individuals for the entire metapopulation in the contiguous US (Schwarz et al. 2009) is much less than the requirement calculated by Cegelski et al. (2006).

Second, according to the scientific literature, the fate of the wolverine in the contiguous US (and across its worldwide range as well) is largely dependent on, and can be predicted by, snow cover. The geographic distribution, gene flow, reproductive activity, and population dynamics of this species are constrained by snow depth (Brodie and Post 2010; Copeland et al. 2010; Inman et al. 2012; Schwartz et al. 2009). However, over the past 30 years, average snowpack depths have declined, and model predictions suggest this trend will continue (Brodie and Post 2010; McKelvey et al. 2011; Mote et al. 2005). Consequently, because of rapid decline in quality habitat, as well as average summer temperatures that substantially exceed those currently tolerated by wolverines, populations of wolverine in the contiguous US may not persist through this century (Peacock 2011). High summer temperatures may limit wolverine distributions at the southern end of their range, which includes the contiguous US (Copeland et al. 2010). Using multiple radiotelemetry datasets, Copeland et al. (2010) found that 89% of

nearly 8,000 wolverine relocations were in agreement with spring snow coverage maps. Furthermore, female wolverines selected den sites (n=562) with persistent snow cover. In North America, female wolverines selected snow-covered den sites 69% (45 of 65) of the time. Based on these data, Copeland et al. (2010) caution that if current trends in climate-driven losses of wolverine habitat continue, a significant portion of wolverine habitat will be lost, beginning in the southern portion of their range in the contiguous US.

Probably the most insidious threat faced by wolverines in the contiguous US is climate change. Although none of us can know with certainty future climates in North America, the best scientific modeling and other data indicate that climates likely will differ substantially from the recent past climate. The wolverine, with its many morphological and physiological adaptations for cold weather and deep snowpack, is particularly sensitive to the timing and duration of snow cover, and is expected to experience great difficulty adapting to projected climate changes (Peacock 2011). McKelvey et al. (2011) predicted that climate change will shift wolverine distributions, connectivity, and dispersal corridors. Using ensemble-averaging climate modeling techniques promoted by the Intergovernmental Panel on Climate Change as a method deemed more reliable than any single model, McKelvey et al. (2011) predicted that spring snow cover would decrease to 67% of current within their study area (MT, ID, WY) through 2030-2059; and would decrease to only 37% through 2070-2099. Additionally, contiguous areas of spring snow cover are predicted to become smaller and more isolated over time. Only three areas within the contiguous US are predicted to retain substantial contiguous areas of habitat (north-central Washington, northwestern Montana, and the Greater Yellowstone NP region). The conclusion of McKelvey et al. (2011) that wolverine habitat will persist throughout the species range until at least 2050, but that populations likely will continue to become smaller and more isolated than they are now, underscores the urgency of this situation.

Third, the listing proposal would not allow continued trapping of wolverines in Montana or other of the contiguous US states, an action with which we strongly agree. At present, the wolverine is harvested in only two US states (Montana and Alaska). Dalerum et al. (2008) found that harvested wolverine populations must be regarded as "sink" populations (e.g., populations that inevitably decline over time), and that both "source" populations and the availability of sufficient dispersal corridors are essential for any wolverine harvest to be sustainable. This leads to two conclusions: first, even the Alaska population should be considered a "sink" population, which adds to the urgency of protecting wolverines in the contiguous US as "endangered"; and second, no harvest of wolverine in the contiguous US will be sustainable until the conditions outlined in Dalerum et al. (2008) are met (e.g., actually having "source" populations and sufficient dispersal corridors), which is quite unlikely for the foreseeable future.

If any proposed listing of wolverine is implemented, cooperation between the USFWS and Canadian wildlife agencies is necessary to realize future wolverine recovery goals. We agree with Krebs et al. (2004) in suggesting that adopting more conservative harvest strategies in southern British Columbia will protect fragmented wolverine populations in that region. These subpopulations are vital to the persistence of the imperiled wolverine metapopulation in the contiguous US. Unexploited wolverine populations in Canada can increase ~6.4% per year

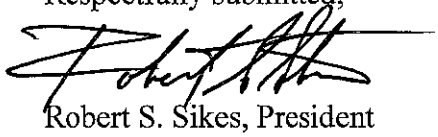
(Krebs et al. 2004) and provide immigrants into Washington, Idaho and Montana subpopulations via important cross-border dispersal linkages. Maintaining such cross-border connectivity through international cooperation is essential for persistence of wolverine populations in the contiguous US.

Finally, when deliberating whether a taxon should be designated "endangered" versus "threatened", it is instructive to consider all available scientific data and then re-examine the ESA for its definitions and intent. Given the facts distilled in this letter, we argue that the wolverine clearly qualifies as "an animal or plant in danger of extinction within the foreseeable future throughout all or a significant portion of its range".

In summary, the ASM has reviewed the available scientific evidence pertaining to wolverine demography and its current range. Based on this review, we believe there is an urgent need for legal protection of the wolverine as an endangered species in the contiguous US as defined by the ESA. We also highlight the need for designated critical habitat in the case of the wolverine. Climate change is likely to continue, leading to additional loss of snowpack in the western US (McKelvey et al. 2011; Mote et al. 2005; Peacock 2011) and further limiting the amount of available wolverine habitat in the contiguous US. Wolverines are top predators in ecosystems and have life history traits characteristic of top predators (e.g., so-called "K-selected" life history traits, including low population densities and low reproductive output). Those traits, their many adaptations to boreal forest existence, and their extremely restricted geographic range in the contiguous US all suggest a high risk of local extinction (Purvis et al. 2000). Further climate-driven reductions in critical habitat and population connectivity likely will exacerbate extinction risks. Protection garnered through an "endangered" listing under the ESA, and subsequent designation of critical habitat, will provide an important, much-needed first step toward ensuring wolverine persistence in the contiguous US.

We thank you for the opportunity to provide comments on this very important issue, and stand at the ready to offer our expertise on this subject at any time.

Respectfully submitted,



Robert S. Sikes, President

American Society of Mammalogists

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