BEFORE THE UNITED STATES DEPARTMENT OF INTERIOR AND THE UNITED STATES FISH AND WILDLIFE SERVICE

In the Matter of the Petition to Delist the Preble's meadow jumping mouse (*Zapus hudsonius preblei*) from the Endangered Species Act

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PETITION OF DR. ROB ROY RAMEY II, CENTER FOR ENVIRONMENTAL SCIENCE, ACCURACY & RELIABILITY, WYOMING STOCK GROWERS ASSOCIATION, COLORADO CATTLEMEN'S ASSOCIATION, COLORADO ASSOCIATION OF HOME BUILDERS, AND HOUSING & BUILDING ASSOCIATION OF COLORADO SPRINGS TO DELIST THE PREBLE'S MEADOW JUMPING MOUSE UNDER THE ENDANGERED SPECIES ACT

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INTRODUCTION

Pursuant to 16 U.S.C. § 1533(b)(3) and 50 C.F.R. § 424.14(a), Petitioners Dr. Rob Roy Ramey II, Center for Environmental Science, Accuracy & Reliability, Wyoming Stock Growers Association, Colorado Cattlemen's Association, Colorado Association of Home Builders, and Housing & Building Association of Colorado Springs, hereby petition the Secretary of the Department of Interior and the United States Fish and Wildlife Service (collectively "the Service") to delist the Preble's meadow jumping mouse (*Zapus hudsonius preblei*) (hereinafter "Preble's mouse" or "mouse") from the list of threatened wildlife, 50 C.F.R. § 17.11(h), under the Endangered Species Act, 16 U.S.C. §§ 1531–1544.[1] Delisting is warranted because the best available scientific data show that the mouse's subspecies designation is based on unsound taxonomy. Published, peer-reviewed analysis of the available data demonstrate that the populations within the putative Preble's mouse subspecies actually belong to one of the largest and most widespread genetic lineages of North American jumping mice. Therefore, no basis exists to

[1] Pursuant to 50 C.F.R. § 424.14(b), Petitioners provided notice of their intent to petition to delist the mouse to the Colorado Parks and Wildlife Commission, the Colorado Parks and Wildlife Director, the Wyoming Game and Fish Commission, and the Director of the Wyoming Game and Fish Department 30 days prior to the submission of this delisting petition. *See* Attachment 2.

continue to apply the Act's protections to the Preble's mouse as a separate subspecies.

PETITIONERS

Dr. Rob Roy Ramey II

Dr. Rob Roy Ramey II is a longtime advocate for sound and unbiased scientific research. He earned his Bachelor's degree in Biology and Natural History from the University of California at Santa Cruz, his Master's degree in Wildlife Ecology from Yale University, and his Ph.D. in Ecology and Evolutionary Biology from Cornell University. At UC Santa Cruz, his honors thesis research documented the first reintroduction of bighorn sheep into its historic range in the Sierra Nevada. At Yale, he began his studies in evolutionary biology and conservation genetics, conducted field and laboratory research to investigate lead contamination in California condors, and took a leave of absence to bring condor eggs in from the wild for captive incubation. At Cornell, his dissertation research focused on the evolutionary genetics, systematics, and population structure of North American mountain sheep. While at Cornell, he took time away to research the role of genetics in elephant social organization in Zimbabwe, as well as the effects of forest fragmentation on rainforest birds in Costa Rica.

Dr. Ramey's postdoctoral work included research at the University of Colorado, Boulder, where, as a United States Department of Agriculture postdoctoral fellow, he produced research that answered a longstanding question on the host specificity of psoroptic scabies mites, which harm bighorn sheep and many other wild and domestic animal species. Later, at the Center for Reproduction of Endangered Species at the San Diego Zoo, and then at the University of California's White Mountain Research Station, he pioneered the development of non-invasive genetic sampling for mountain sheep.

Dr. Ramey went on to become the Curator of Vertebrate Zoology at the Denver Museum of Nature & Science where, in addition to curatorial work, he pioneered the live-capture of wild argali sheep in Mongolia using horsemen and drive-nets. He also conducted research on the genetics of endangered wild sheep, as well as the genetic and morphological uniqueness of jumping mouse subspecies (including the so-called Preble's meadow jumping mouse). Additionally, he began long-term research projects on bighorn sheep demography in Mexico, and elephant genetics and social organization in Namibia, and began serving as a member of the Caprinae Specialist Group of the International Union for the Conservation of Nature.

Dr. Ramey subsequently was retained as a consulting Science Advisor to the Office of the Assistant Secretary of Fish and Wildlife and Parks at the

Department of Interior. In 2007, he founded Wildlife Science International, Inc., and began research and consulting full-time on scientific issues involving the Endangered Species Act. In 2009, he also began serving as Science Advisor for the Center for Environmental Science, Accuracy & Reliability. Dr. Ramey has an active research program, publishes the results of his research in peer-reviewed journals, and has testified three times before Congressional committees on the need for specific changes in implementation of the Endangered Species Act, including greater transparency and public access to the data that decisions are based upon.

In summary, Dr. Ramey has a deep commitment to the conservation of threatened and endangered species, as well as the effective prioritization of conservation efforts for their recovery. He believes that these goals will be served by the delisting of the Preble's mouse.

Center for Environmental Science, Accuracy & Reliability

The Center for Environmental Science, Accuracy & Reliability (CESAR) is a California 501(c)(3) nonprofit corporation committed to identifying fact-based science to assist in the conservation of species, to ensure the fair and even application of environmental laws, and to provide information on environmental conservation to the public, policy makers, and agency staff. CESAR has a longstanding concern over the misuse of taxonomic data to justify

the listing of populations under the Endangered Species Act. This concern is demonstrated by the many delisting petitions that CESAR has submitted to challenge the Service's faulty taxonomic decision-making, including the coastal California gnatcatcher and the Southwestern willow flycatcher.

Wyoming Stock Growers Association

The Wyoming Stock Growers Association (WSGA) is a Wyoming non-profit corporation that represents approximately 1,000 members engaged in ranching across the state. Founded in 1872, WSGA seeks to protect, promote, and assert the business, economic, social, and educational interests of its members, including sheep producers and beef cattle producers. It represents these interests by regularly engaging in legislative, administrative, and legal advocacy, including advocacy regarding the sustainable management of public and private lands. It promotes the role of the Wyoming livestock industry in resource stewardship by informing and educating the public. WSGA has a longstanding interest in endangered species issues, including controversies concerning the Preble's mouse and the impacts its regulatory protections have on the livestock industry.

Colorado Cattlemen's Association

The Colorado Cattlemen's Association (CCA) is a non-profit organization working collectively to advance the viability of beef production, while

enhancing the role of beef in a healthy lifestyle. CCA also works as a voice for the beef production industry, as well as for related industry members and landowners. Beef producers join CCA voluntarily and manage it cooperatively to accomplish goals that no producer could accomplish alone. Although there are numerous scientific and sociological reasons why CCA is interested in seeing the Preble's mouse removed from the endangered species list, the one that is foremost in importance to CCA's members and the organization is the economic factor. The cost of keeping the mouse listed, when the listing is unwarranted, harms landowners, including CCA's members, by imposing costly conservation and management measures, among other regulatory burdens. Peer-reviewed science establishes that the mouse is genetically the same as other jumping mice, and does not qualify as a subspecies. For that reason, its continued listing is improper.

Colorado Association of Home Builders

Founded in 1974, the Colorado Association of Home Builders (CAHB) is the unified voice of the Colorado home building industry. CAHB is an affiliate of the National Association of Home Builders and has ten local home builder associations across Colorado. With a statewide membership of nearly 2,000, representing 40,000 jobs, and adding $11.5 billion annually to the Colorado economy, CAHB plays a crucial role in providing housing for Coloradans.

CAHB's mission is to provide attainable, quality housing for all Coloradans. CAHB achieves its mission by: advocating for positive legislative solutions and by opposing measures that impair the ability to deliver housing and that unreasonably regulate the industry; empowering its members with learning opportunities at the local, state, and national levels; and supporting the goals and activities of each of the ten local associations. CAHB represents builders and developers whose property has been negatively affected by the listing of the Preble's mouse. The cost of complying with the mouse's threatened species regulations, along with the ensuing delays in the submittal and approval processes, the set-asides of otherwise usable land, cost overruns on infrastructure, and other measures requested by the Fish and Wildlife Service, have reduced the affordability of housing in Colorado. Therefore, the mouse's delisting would further CAHB's mission to protect and enhance the state's homebuilding industry.

Housing & Building Association of Colorado Springs

The Housing & Building Association of Colorado Springs (CSHBA) is a member trade association made up of more than 500 companies that include builders, developers, and remodelers, as well as trade contractors, materials suppliers, mortgage lenders, realtors, title companies, interior designers, architects, landscapers, among others. CSHBA works to promote policies that

allow these businesses and many others to contribute to the production of safe and affordable housing to, and the economic growth of, El Paso County, Colorado. CSHBA is interested in the Preble's mouse listing status and the potential to delist the mouse because a delisting would help developers and builders regain full use of the developable portion of their land and avoid further unneeded delays and cost caused by the regulations for a listed species.

BACKGROUND

A. Biological and Taxonomic Description of the Mouse

The Preble's mouse is a small rodent found along the Front Range of the Rocky Mountains in eastern Colorado and southeastern Wyoming. 63 Fed. Reg. 26,517, 26,517 (May 13, 1998). It is "greyish to yellowish-brown in color," has "large hindlegs and hindfeet," and "is adapted for digging." *Id.* at 26,517-18. Nocturnal or crepuscular in nature, the mouse "lives primarily in heavily vegetated riparian habits" and "hibernates approximately 7 months of the year in an underground burrow." *Id.* The mouse is considered a subspecies of *Zapus hudsonius* (the meadow jumping mouse); its designation as a subspecies was originally based upon "geographic separation and morphological differences from other subspecies." 78 Fed. Reg. 31,680, 31,682 (May 24, 2013) (citing Krutzsch (1954, pp. 452–53)). A genetic analysis examining 433 base-pairs of mitochondrial DNA across five subspecies of meadow jumping mouse

concluded "that the [Preble's mouse] formed a homogenous group recognizably distinct from other nearby populations of meadow jumping mice." *Id.* at 31,683.

The current purported taxonomy of *Z. hudsonius* includes 12 subspecies. In each of its many publications addressing the contested status of the Preble's mouse as a subspecies, the Service has relied on Philip Krutzsch's 1954 taxonomic observations. After studying the morphology of 3,600 specimens, Krutzsch identified the 12 subspecies. *Id.* at 31,682. Krutzsch delineated the Preble's mouse subspecies based on the "presence of physical habitat barriers and the lack of known intergradation . . . between the [Preble's mouse] . . . and other identified subspecies of meadow jumping mice ranging to the east and north." *Id.* Krutzsch based his claim that the Preble's mouse is a valid subspecies "on geographic separation and morphological differences," including qualitative differences in coloration and skull size between geographically adjacent subspecies. *Id.*

Relying on a morphometric analysis of four adult and seven non-adult specimens, Krutzsch reported seven distinguishing traits in the mice, although he only published quantitative results (nine measurements) on two of these traits for three specimens. *Id.* Notwithstanding this dearth of quantitative data, Krutzsch "concluded that the differences between [Preble's mice] and

neighboring meadow jumping mice was considerable and enough to warrant a subspecific designation." *Id.* The Service maintains that Dr. Krutzsch's taxonomy "has been generally accepted by most small mammal taxonomists for the past half-century." *Id.*

B. The Listing of the Preble's Mouse as a Threatened Subspecies

In 1998, the Service listed the Preble's mouse as a threatened subspecies. *See* 63 Fed. Reg. at 26,517. In support of its decision, the Service claimed that "[h]abitat alteration, degradation, loss, and fragmentation" due to residential development and commercial land-use had adversely affected the mouse's populations and caused a reduction in the size of the subspecies' range. *Id.* at 26,525. The Service defended its reliance on Krutzsch's research to justify the mouse's subspecies status, asserting that Krutzsch's 1954 revision of the genus *Zapus* was the definitive taxonomic authority on North American jumping mice. *Id.* at 26,517. In response to public comments questioning the validity of the Preble's mouse as a subspecies, the Service asserted that the mouse "is widely recognized as a valid subspecies by the scientific community." *Id.* at 26,521. The agency cited the only genetic study then available concerning the uniqueness of the Preble's mouse relative to neighboring subspecies, a mitochondrial DNA analysis conducted by Larry Riggs. *Id.* at 26,518. The Riggs report concluded that "a geographically contiguous set of populations

previously recognized as Preble's meadow jumping mouse (*Z. h. preblei*) form a homogenous group recognizably distinct from other nearby populations and from geographically-adjacent species of the genus."[1] *Id.* at 26,518 (quoting Riggs, *et al.* (1997)). Following the listing, the Service assembled a team to develop a recovery plan for the Preble's mouse, and later designated approximately 32,000 acres of critical habitat. *See* 68 Fed. Reg. 37,276 (June 23, 2003).

C. The Mouse's Contentious Tenure on the List of Threatened Species

The listing of the Preble's mouse has proven both scientifically and politically controversial, in large part due to the Service's continued reliance on Krutzsch's decades-old, morphology-based subspecies taxonomy. Ever since the mouse was first listed, private and public institutions have questioned the Service's recognition of the mouse as a subspecies and challenged various regulatory actions taken by the Service regarding the mouse. The following account of the Service's management of the mouse over the past decade-and-a-half demonstrates the persistent scientific controversy over whether the Preble's mouse constitutes a valid taxon.

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[1] The Service has acknowledged that "[t]he Riggs *et al.* (1997) results were not published in a peer-reviewed journal," but were reviewed by David Hafner of the New Mexico Museum of Natural History and Science. 78 Fed. Reg. at 31,683.

In December, 2003, Wyoming's Office of the Governor and Coloradans for Water Conservation and Development each petitioned the Service to delist the mouse. Their petitions contended that the mouse's taxonomy was no longer valid. They relied on a soon-to-be published study (Ramey, *et al.* (2005)) asserting that the Preble's mouse should be synonymized with an unthreatened subspecies (*Z. h. campestris*), on account of the lack of morphological, genetic, and ecological evidence of the latter's distinctiveness. *See* 69 Fed. Reg. 16,944 (Mar. 31, 2004). Krutzsch himself reviewed the study and, notwithstanding his prior taxonomic conclusion to the contrary, agreed that the Preble's mouse subspecies was no longer defensible.[2]

In a subsequent 12-month finding, the Service endorsed Dr. Ramey's study "as the best scientific and commercial information available regarding the taxonomy" of the mouse. The agency then published a proposed rule to delist the mouse. 70 Fed. Reg. 5404, 5409 (Feb. 2, 2005). Before publishing a final rule, the Service sought to verify the Ramey study's results. To that end, it requested the U.S. Geological Survey to conduct an additional genetic analysis and comparison of the mouse with four neighboring subspecies. 73

[2] *See* David Holthouse, *Building a Better Mousetrap*, WESTWORD (Jan. 20, 2005), http://www.westword.com/news/building-a-better-mousetrap-5082658. Notably, the Service has so far failed to acknowledge Krutzsch's disavowal of his earlier conclusion that the Preble's mouse is a distinct subspecies.

Fed. Reg. 39,790, 39,791 (July 10, 2008). The resulting study, King, *et al.* (2006), claimed to find "systemic error" in Ramey's study, and concluded that the Preble's mouse should *not* be synonymized with geographically-adjacent subspecies.

The Service further delayed publishing a final rule to delist the mouse in order to address the discrepancies between the Ramey and King studies, and eventually contracted with Sustainable Ecosystems Institute (SEI) to review the two studies. *See* 71 Fed. Reg. 8556 (Feb. 17, 2006). SEI convened a panel of genetic and systematics experts. Placing the burden on those who would challenge the subspecies designation, Brian S. Arbogast, *et al.*, SEI, *Evaluation of Scientific Information Regarding Preble's Meadow Jumping Mouse* 39 (2006), the panel ultimately sided with maintaining the mouse's subspecies listing. *See* 78 Fed. Reg. at 31,686. Nevertheless, the panel conceded that the mouse's subspecies designation could not be supported by a lack of ecological exchangeability. SEI 41. Moreover, the panel acknowledged that the mouse's status as an evolutionarily significant population "is debatable," and that the mouse would not qualify as a phylogenetic species (which some taxonomists equate with the biological species concept). *Id*. at 45-46. *Cf*. Holly Doremus, *The Endangered Species Act: Static Law Meets Dynamic World*, 32 Wash. U. J.L. & Pol'y 175, 186 (2010) (noting that the

phylogenetic species concept is actually more generous to new taxa than the biological species concept). Dr. Ramey disputed the SEI report's affirmance of the mouse's subspecies classification, but the Service declined to respond to his objections or pursue further investigation of his claims. *See* 78 Fed. Reg. at 31,686.

In September, 2006, the State of Wyoming gave notice of its intent to sue the Service for "failure to publish a final determination on [its] 2005 proposed delisting rule within the timeframes allowed by the [ESA]." *Id.* at 31,681. The following year the Service and Wyoming settled, with the agency agreeing to publish a new proposed regulation after "considering the [mouse's] taxonomy and the subspecies' threatened status in light of all current distribution, abundance, and trends data." *Id.* The Service eventually published a final rule removing the Act's protections for the mouse in Wyoming. The Service explained that, while the mouse was not threatened throughout its entire range, the subspecies should retain its threatened status in Colorado, which the agency deemed a significant portion of the mouse's range. *See* 73 Fed. Reg. 39,790 (July 10, 2008).

Soon thereafter, the Service's interpretation of the statutory phrase "significant portion of its range" was successfully challenged. *See Center for Native Ecosystems v. Salazar*, 795 F. Supp. 2d 1236 (D. Colo. 2011). The

Service therefore reinstated the regulatory protections for the mouse in Wyoming. *See* 76 Fed. Reg. 47,490 (Aug. 5, 2011). Also, the agency was ordered to respond to the two 2003 delisting petitions in a 12-month status review of the mouse. *Ctr. for Native Ecosystems*, 795 F. Supp. 2d at 1244. The Service combined the court-ordered status review with the statutorily-mandated five-year review of the mouse, and published the findings on May 24, 2013. *See* 78 Fed. Reg. at 31,680-712. In its decision, the Service reiterated that the "best scientific and commercial data available support the conclusion that the [mouse] is a valid subspecies," such that "delisting the [mouse] is not warranted at this time." 78 Fed. Reg. at 31,686, 31,709.

A NEW STUDY CONFIRMS THAT THE PREBLE'S MEADOW JUMPING MOUSE IS NOT A VALID SUBSPECIES

A recent phylogenetic study on North American jumping rice, Malaney and Cook (2013), Attachment 1,[2] now represents the best available science on the Preble's mouse. The Malaney and Cook study demonstrates that the populations of mice comprising the Preble's mouse taxon are actually part of a large and distinct lineage of jumping mice with a range extending north along the Rocky Mountains all the way into Canada and Alaska. Accordingly, the

[2] Other than Malaney and Cook (2013), all of the scientific references in this delisting petition have been cited in prior Service findings, are therefore presumably in the Service's files, and thus are not attached to this petition.

mouse should be considered taxonomically synonymous with the rest of this lineage. The Malaney and Cook study definitively supplants Krutzsch's antiquated taxonomy. It demonstrates how the data on which the Service has relied in all prior decisions on the mouse's listing status, including the 2006 King study and subsequent SEI review, were fundamentally flawed. It shows that these prior studies improperly limited their analyses to the Preble's mouse and other mouse populations geographically adjacent to the presumed range of the Preble's mouse.

A. The Service Must Delist a Species When the Best Data Available Show That the Original Listing Was in Error

Under the Endangered Species Act, any interested person has the right to petition the Service to add or remove a species from the lists of protected populations. *See* 16 U.S.C. § 1533(b)(3). Upon receipt of a petition, the Service must respond within 90 days by making a finding "as to whether the petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 50 C.F.R. § 424.14(h)(1). The Service's regulations define "substantial . . . information" as that amount of information that would lead "a reasonable person conducting an impartial scientific review [to] conclude that the action proposed in the petition *may* be warranted." *Id.* § 424.14(h)(1)(ii) (emphasis added). For populations that have already been

subject to a formal status review—as is the case with the Preble's mouse—the Service must determine "whether a reasonable person conducting an impartial scientific review would conclude that the action proposed in the petition may be warranted despite the previous review or finding." *Id.* § 424.14(h)(1)(iii).

The standard "for evaluating whether substantial information has been presented by an 'interested person' is not overly-burdensome [and] does not require conclusive information." *Moden v. U.S. Fish and Wildlife Serv.*, 281 F. Supp. 2d 1193, 1204 (D. Or. 2003) (characterizing the standard as "non-stringent"). *See Ctr. for Biological Diversity v. Morgenweck*, 351 F. Supp. 2d 1137, 1140–41 (D. Colo. 2004) (noting that the Endangered Species Act "sets forth a lesser standard" for evaluating whether a petition contains substantial information such that an action by the Service may be warranted). Upon finding that a petition presents substantial information that listing or delisting of a species may be warranted, the Service must commence a review of the status of the species, and within twelve months from the date the petition was filed, promptly publish its finding as to whether the petitioned action is warranted. 16 U.S.C. § 1533(b)(3); 50 C.F.R. § 424.14(h)(2).

The Service is required by statute to make any listing or delisting determinations "solely on the basis of the best scientific and commercial data available." 16 U.S.C. § 1533(b)(1)(A). Its regulations require that taxonomic

determinations must be based on "standard taxonomic distinctions and the biological expertise of the Department [of Interior] and the scientific community," and set forth three grounds for delisting a species or subspecies. 50 C.F.R. § 424.11(a), (d). One of these grounds—the original data for classifying the species were in error, *id.* § 424.11(d)(3)—applies to the Preble's mouse.

As mentioned above, in the agency's most recent 12-month finding, the Service maintained that "the best scientific and commercial information currently available indicates that the [mouse] is a valid subspecies." 78 Fed. Reg. at 31,686. The Service based that conclusion on Krutzsch's taxonomy and the genetic analysis of the King, *et al.* (2006), study, which had purportedly debunked Dr. Ramey's previous study concluding that the mouse is not a valid subspecies. *Id.* The Service, however, also acknowledged two ongoing studies aimed at further addressing taxonomic and evolutionary questions regarding the mouse. The agency therefore agreed to "evaluate any new information as it becomes available." *Id.* One of the studies specifically anticipated by the Service in its 2013 finding is Malaney and Cook (2013), the most recent study "[seeking] to clarify genetic relationships between meadow jumping mice across North America." *Id.* In light of the results of the Malaney and Cook study, which now represents the best available scientific data on the Preble's

mouse, the Service must delist mouse. *Cf.* 50 C.F.R. § 424.14(h)(1)(iii) (new information not previously considered by the Service may constitute "substantial . . . information" warranting delisting).

B. Malaney and Cook (2013) Constitutes the Best Available Scientific Data on the Preble's Mouse

Malaney and Cook (2013) is the first and only study of the Preble's mouse to combine genetic analyses with species distribution modeling and tests of ecological interchangeability. Malaney and Cook (2013) at 1. Particularly significant is that, unlike all previous genetic studies of North American jumping mice (including King, *et al.* (2006), which only examined five neighboring subspecies of meadow jumping mice), Malaney and Cook (2013) obtained a comprehensive sampling of every subspecies of jumping mouse found in North America, using DNA sequences from 762 specimens. *See id.* at 3, 7. The study produced a species-tree phylogeny that identified 21 significantly divergent historical-biogeographical lineages of North American jumping mice. *See id.* at 4 fig. 2. Notably, the tree "failed to document significant support for all *morphologically* based subspecies," such as the Preble's mouse. *Id.* at 8 (emphasis added). The study points out that the Krutzsch taxonomy and previous molecular studies of the mouse—for example, Ramey, *et al.* (2005), and King, *et al.* (2006)—"assumed that spatially adjacent

subspecies were most closely related, leading to limited sampling of taxa (½ subspecies) and geographical breadth (<1/3 *Z. hudsonius* range) as the basis for the federal listing." Malaney and Cook (2013) at 10–11. In contrast, Malaney and Cook (2013) used "lineage-based evolutionary divergence and tests of ecological variation across *all infraspecific taxa*, not just adjacent subspecies." *Id.* at 2 (emphasis added). In addition to its comprehensive sampling, Malaney and Cook (2013) used a rigorously quantitative approach to assess lineage distinctiveness, integrating genetic, evolutionary, and ecological data. Consequently, the study's lineage-based species-tree phylogeny is vastly superior to Krutzsch's morphologically-based taxonomy in its representation of the genetic diversity of North American jumping mice.

Previous genetic studies, such as King, *et al.* (2006), had "focused on geographically proximate taxa that were assumed to be close phylogenetic relatives." Using a contrastingly broader approach, Malaney and Cook (2013) discovered that "far northern (geographically distant) subspecies . . . form a closely related clade with Front Range *Z. h. preblei*." *Id.* at 8. Malaney and Cook (2013) also found no distinguishing nuclear DNA base pair changes between Front Range populations (*i.e.*, all Preble's mouse populations) and populations found much farther north in Canada and Alaska. *Id.* The study's

phylogenetic analyses also "documented four errors in reporting data from King *et al.* (2006)," *id.* at 7, further undermining that study's validity.

The results of Malaney and Cook (2013) were informed by the study's integration of historical biogeography, a spatiotemporal perspective analyzing demographic signals and spatial shifts of lineages over time. With regard to the Northern lineage, including the Preble's mouse populations, the study found low measures of intra-lineage genetic differentiation. This finding is consistent with a recent northward expansion of the mouse. *Id.* at 1. Such expansion was an ecological response to the Earth's latest deglaciation, which allowed closely related jumping mice populations to expand rapidly to the north as part of a general "poleward shift of biota." *Id.* In addition to genetic data, fossil data and niche studies bolster the conclusion "that during the early Holocene as glaciers retreated, ancestors of the Northern lineage . . . tracked suitable conditions westward from the Great Plains to regions along the Front Range of the Southern Rockies and northward to Alaska." *Id.* at 12 (citations omitted).

Malaney and Cook (2013) emphasized "the need to assess evolutionary variation within a comprehensive historical-biogeographical context, as a first step in evaluating conservation status." *Id.* at 11. The study therefore noted that Krutzsch's morphologically based taxonomy and previous molecular

studies of the mouse had erroneously "assumed that spatially adjacent subspecies were most closely related."[3] *Id.* at 10. To be sure, Malaney and Cook (2013) agreed with King, *et al.* (2006), that the Preble's mouse, as part of the Northern lineage, is evolutionarily distinct from the Northern Plains lineage of jumping mice. Nevertheless, Malaney and Cook (2013) concluded that the mouse's taxonomy as accepted by the Service is antiquated. In light of genetic similarity and a lack of any distinct variation in both niche and morphological characteristics, the Preble's mouse should be considered taxonomically synonymous with the two other subspecies constituting the Northern lineage, *Z. h. alascensis* and *Z. h. tenellus*. *Id.* at 9.

The final endeavor of Malaney and Cook (2013) was to calculate conservation prioritization scores based on the evolutionary distinctiveness and risk of extinction for each of the twenty-one lineages identified. *See id.* at 6, 7 fig. 3. The study stressed "that management plans for species-of-concern should, at a minimum, require comprehensive sampling of a species range coupled with phylogeographical analyses to establish a broad spatial and

[3] Malaney and Cook (2013) posits that the mouse conforms to a common biogeographical evolutionary pattern in North America. Malaney and Cook (2013) at 1 (citations omitted) ("[M]olecular signatures reveal that across multiple species, many high-latitude populations share recent ancestry with distant low-latitude populations due to rapid northward colonization following glacial retreat. Conversely, adjacent low-latitude populations are often genetically divergent, reflecting enduring spatial disjunction.").

temporal perspective on diversity as a strong foundation for prioritizing conservation efforts." *Id.* at 9. Calculations revealed that "[o]ver 75% (16/21) of jumping mice lineages rank higher in the [Evolutionarily Distinct and Globally Endangered] conservation priority than the Northern lineage." *Id.* at 12. Because the Northern lineage has a wide and expanding range, as well as a comparatively large effective population size, and has experienced recent demographic growth, the Northern lineage most likely fits the International Union for Conservation of Nature status of "least concern." *Id.* Notably, Malaney and Cook (2013) also pointed out that the five jumping mice lineages with the highest extinction threats currently have no protected status. *See id.* at 11, 12, Table 3. Thus, conservation resources currently in place to protect the Preble's mouse populations might be better spent on preserving some of the lineages that are far more ecologically and evolutionarily divergent, as these lineages are also more prone to anthropogenic fragmentation due to their lower-latitude habitats.[4] *Id.* at 12.

[4] The original Ramey study made the same point. *See* Ramey, *et al.* (2005) at 341 ("[The listing of] an invalid taxon or non-distinct population . . . affects other species because limited conservation resources are then misallocated.").

To summarize, Malaney and Cook (2013) has undercut the taxonomy supporting the listing of the Preble's mouse. The study's rigorously quantitative methodology is far more intricate and comprehensive than Krutzsch's almost entirely qualitative approach. The study's phylogenetic results completely supplant Krutzsch's outmoded taxonomy as the best taxonomic data on the mouse. Additionally, in light of Malaney and Cook (2013), the Service can no longer rely on King, *et al.* (2006), as the best available genetic data on the mouse. Because the King study considered only adjacent subspecies in its analysis, and did not undertake complete taxon sampling, its methods were erroneous and its conclusions illegitimate. Put simply, the King study could never have discovered that the Preble's mouse is genetically synonymous with two unthreatened Northern subspecies, because the King study failed to include those subspecies in its analysis. Both in methodology and in scope, Malaney and Cook (2013) is the most comprehensive study of the mouse. The Service must defer to its findings as the best scientific information currently available.

CONCLUSION

Malaney and Cook (2013) constitutes the best scientific information on North American jumping mice. The study's results strongly support the conclusions that the Preble's mouse is *not* a valid subspecies and that the genetic lineage to which it belongs is *not* threatened. They also demonstrate that the previous data relied on to justify listing the mouse as a threatened subspecies were both deficient and erroneous. Therefore, the Preble's mouse should be delisted.

DATED: March 29, 2017.

Respectfully submitted,

DAMIEN M. SCHIFF

Attorney for Dr. Rob Roy Ramey II, Center for Environmental Science, Accuracy & Reliability, Wyoming Stock Growers Association, Colorado Cattlemen's Association, Colorado Association of Home Builders, and Housing & Building Association of Colorado Springs