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June 2, 2013

Re: Comments on Proposed Rules and Critical Habitat for *Rana sierrae*, *Rana muscosa* (in the Sierra Nevada), and *Anaxyrus canorus*

To whom it may concern,

On April 25, 2013 you requested that I serve as a peer reviewer for the *R. sierrae*, *R. muscosa*, and *A. canorus* proposed rules and proposed critical habitat. The following constitutes my review. I do not have sufficient on-the-ground knowledge of the historical and current distribution of *A. canorus* to comment on the proposed critical habitat designation for this species. However, I have provided comments on all three proposed rules and on the proposed critical habitat designation for *R. sierrae* and *R. muscosa*. Please feel free to contact me if you have questions regarding my review.

Sincerely,

Roland A. Knapp

Roland A. Knapp, Ph.D.
Research Biologist

Proposed Rules

Rana muscosa (in the Sierra Nevada) and *Rana sierrae*

1. *Are the Service's descriptions, analyses, and biological findings and conclusions accurate, logical, and supported by the data and information in the proposed rule?*

   These proposed rules are generally very well-written and well-supported by the available scientific literature. Below I've described a number of suggested changes to correct errors or improve clarity.

   a. The taxonomy and nomenclature of the mountain yellow-legged frog species complex has changed several times during the past century, and can be quite confusing. Because of the way that the Proposed Rule references the species complex, the Proposed Rule further promulgates this confusion. To avoid this confusion, a paragraph should be added as close to the beginning of the Proposed Rule as possible that briefly summarizes the taxonomic and nomenclatural history of this species complex. The "Taxonomy" section on page 24474 describes this history, but it comes too late to avoid the confusion caused by the first 2.5 pages. In addition, the Proposed Rule should use "mountain yellow-legged frog" to refer to the species complex as currently described (*R. muscosa* and *R. sierrae*), and as historically described prior to the *R. muscosa*/*R. sierrae* split (mountain yellow-legged frog = *R. muscosa*). To differentiate *R. muscosa* as historically described versus currently described, the currently-described *R. muscosa* should be referred to by its formally-accepted common name, the "southern mountain yellow-legged frog".

   b. Page 24472: The statement that *R. muscosa* inhabited "the Transverse Ranges of southern California" is accurate but incomplete. This species also inhabited the Peninsular Ranges, including the San Jacinto Mountains and Palomar Mountain.

   c. Page 24474: The Sierran ranges of *R. sierrae* and *R. muscosa* are incorrectly described as being divided by the Kern River watershed (*R. sierrae* north of this watershed, *R. muscosa* from the Kern River watershed south). The ranges are accurately described in Vredenburg et al. (2007). That is, *R. sierrae* is found as far south as the Middle Fork of Kings River, and *R. muscosa* is found from the South Fork Kings River and south. The ridge the divides these species is the Monarch Divide in the west and the Cirque Crest to the east.

   d. Page 24476: In discussing the life cycle of mountain yellow-legged frogs, the Proposed Rule states, "Longevity of adults is unknown…". Matthews and Miaud (2007) specifically studied the longevity of *R. sierrae* and *R. muscosa* and reported ages up to 10 years (see #5 below). In addition, a recently published paper (Fellers et al. 2013) reports ages for *R. sierrae* of up to 16 years (see #5 below).

   e. Page 24474: The range of *R. sierrae* in Nevada is described only as "on the slopes of Mount Rose in Washoe County and likely in the vicinity of Lake Tahoe in Douglas County". In fact, there are at least seven historical records of *R. sierrae* in Nevada's Carson Range, only one of which is the Mount Rose locality. Because of its uniqueness, the Carson Range should be specifically mentioned as formerly-occupied habitat.

   f. Page 24474: The range of *R. sierrae* east of the Sierra Nevada crest is described as extending "from the Glass Mountains of Mono County, through Inyo County, to areas north of Lake Tahoe". This is confusing because Mono County is north of Inyo County and south of Lake Tahoe. I would suggest rewording this as follows: "…extends from Inyo

County, through Mono County (including the Glass Mountains), to areas north of Lake Tahoe".

g. Page 24478: The Proposed Rule states that the most pronounced declines of mountain yellow-legged frogs have occurred "north of Lake Tahoe…. and south of Sequoia and Kings Canyon National Parks". In fact, except for a few small populations in the Kern River drainage, *R. muscosa* is entirely extirpated from all of Sequoia National Park. Therefore, the above wording should be changed to state, "south of Kings Canyon National Park".
h. Page 24481: The statement that "fish eat aquatic flora and fauna" should be modified to read, "fish eat aquatic fauna".
i. Page 24483: Burros are rarely used as pack stock in the Sierra Nevada. As such, "burros" should be replaced with "mules", an animal that is commonly used.
j. Page 24485: The statement that introduced trout prey on all frog life stages is not correct, as predation on eggs has not been reported.
k. Page 24485: The mention that the chytrid fungus is present "on all five continents" should be changed to "on all six continents that harbor amphibians (i.e., all continents except Antarctica)".
l. Page 24485: The Proposed Rule states that the earliest documented case of chytridiomycosis in mountain yellow-legged frogs was in 1998 in Yosemite National Park. This is not correct. The earliest documented case is actually 1975 at Sequoia Lake, just west of Sequoia National Park (Ouellet et al. 2005, as cited in Vredenburg et al. 2010).
m. Page 24485: The description of the frog life stages that experience Bd-caused mortality is incorrect. Juvenile and adult mountain yellow-legged frogs are killed by chytridiomycosis, and this mortality can occur at any time of the year (not just overwinter).
n. Page 24486: As a citation supporting the ubiquitous distribution of Bd across Yosemite National Park, Knapp et al. (2011; see #5 below) is better than Briggs et al. (2010).
o. Page 24486: The range of effects of Bd on mountain yellow-legged frogs is incorrectly described. The sentence, "…ranging from extinction, to persistence with a high level of infection, to persistence with a low level of infection" should be modified by removing "to persistence with a high level of infection". This situation has not been reported.
p. Page 24486: The sentence, "Adults in persistent populations frequently recover and are subsequently re-infected by Bd at low levels" is inaccurate. I suggest replacing this sentence with this one: "Although most Bd-naïve populations are driven to extinction following the arrival of Bd, some populations that experience Bd-caused population crashes do not go extinct, and some may even recover despite ongoing chytridiomycosis".
q. Page 24486: The ranavirus infections mentioned in Knapp (2002a) and described in the Proposed Listing as "preliminary" have been confirmed using molecular techniques (Smith and Knapp, in preparation).
r. Page 24487: The Wilderness Act section gives the impression that livestock grazing is allowed within all wilderness areas. In fact, it is not allowed within wilderness areas managed by the National Park Service, including nearly all of Sequoia, Kings Canyon, and Yosemite National Parks.
s. Page 24495: The Proposed Rule states, "The best available science indicates the cause of the decline of the Sierra Nevada yellow-legged frog is the introduction of fishes to its habitat…". I agree that introduced trout are a major cause of declines, but the effects of

Bd are as well supported. As such, both introduced trout and Bd are well-supported primary causes of frog decline. This also applies to *R. muscosa* (page 24496)

t. Page 24495: The effect of Bd is described as having "caused localized extirpations of Sierra Nevada yellow-legged frog populations". In fact, the effects of Bd have been severe and rangewide (Rachowicz et al. 2006, Vredenburg et al. 2010; Knapp et al. in preparation). This also applies to *R. muscosa*.

2. *Are there instances in the proposed rule where a different, yet equally reasonable and scientifically-sound conclusion might be drawn from that reached by the Service?*

   No, the conclusions drawn by the Service are the only ones that can be supported by the available scientific literature.

3. *Does the proposed rule provide accurate and balanced reviews and analyses of the threats to the species?*

   The review and analysis of the threats are generally well-supported by the best available science. The only obvious exception to this is described in 1(s) and 1(t) above.

4. *Did the Service accurately describe the analyses, studies, and literature that are referenced in the proposed rule, and did the Service use the best available science to support its assumptions, arguments, and biological conclusions?* Yes

5. *Are there any significant peer-reviewed scientific papers that the proposed rule omits from consideration that would enhance the scientific quality of the document?*

   a. Matthews, K. R., and C. Miaud. 2007. A skeletochronological study of the age structure, growth, and longevity of the mountain yellow-legged Frog, *Rana muscosa*, in the Sierra Nevada, California. Copeia 2007:986–993.

   b. Fellers, G. M., P. M. Kleeman, D. A. W. Miller, B. J. Halstead, and W. A. Link. 2013. Population size, survival, growth, and movements of *Rana sierrae*. Herpetologica 69:147–162.

   c. Knapp, R. A., C. J. Briggs, T. C. Smith, and J. R. Maurer. 2011. Nowhere to hide: impact of a temperature-sensitive amphibian pathogen along an elevation gradient in the temperate zone. Ecosphere 2:art93.

6. Are there parts of the proposed rule that need additional detail or explanation? Are there parts that are superfluous, or that could be condensed?

   a. There seems little justification for keeping the northern and southern DPSs of *R. muscosa* separate. The status of frogs in both DPSs are affected by a similar list of threats, and recovery actions are also likely to be similar between the DPSs. Therefore, I would suggest combining the two DPSs into one listed species.

7. *Is the scientific foundation of the proposed rule fundamentally sound? Can the scientific foundation be strengthened?* Yes, and this foundation is probably as strong as it can be given the available literature.

8. Are scientific uncertainties clearly identified and characterized?

   a. There are some important uncertainties regarding the southern extent of the range of *R. sierrae* that should be mentioned in the Proposed Pule. The southern extent of the range of *R. sierrae* (east of the Sierra Nevada crest in Inyo County) is currently described as extending southward on the east side of the Sierra crest (Inyo County) to at least the Cottonwood Lakes. Figure 1 shows the southern extent of the *R. sierrae* range extending south of Owens Lake. In fact, although genetic analysis of frogs from north of the Cottonwood Lakes (Big Pine Creek) identified these as *R. sierrae* (Vredenburg et al. 2007), the frog species represented by the historical localities south of Big Pine Creek (specifically, in the Cottonwood Lakes area) remains unknown. There are no known museum specimens from the Cottonwood Lakes, making the identification of these frogs

all but impossible. To further complicate this situation, the frogs in the Mulkey Creek drainage have been identified via genetic analysis as *R. muscosa* (Vredenburg et al. 2007), and are separated from the Cottonwood Lakes drainage by relatively gentle terrain. This suggests that possibility that the frogs originally inhabiting the Cottonwood Lakes area were in fact *R. muscosa*. Some mention of this uncertainty is warranted.

b. There are additional uncertainties regarding the frog species inhabiting some low elevation areas in the northern portion of the range of *R. sierrae*. For example, the frogs in the Spanish Creek and Bean Creek areas are often considered to be *R. sierrae* (e.g., Wengert 2008). However, analyses conducted by Wengert (unpublished) and more recently by Poorten and Knapp (unpublished data) indicate that these frogs are *R. boylii*. Again, this uncertainty regarding species identity should be mentioned.

Anaxyrus canorus

1. *Are the Service's descriptions, analyses, and biological findings and conclusions accurate, logical, and supported by the data and information in the proposed rule?*
    a. Page 24499: Contrary to statements made in the Proposed Role, Martin (2008) did not use radio-telemetry to track toads. Instead, he attached spools of fine thread to toads, and used the thread to characterize movement patterns.
    b. Page 24499: The historical range of *A. canoru*s is not clearly described. Specifically, the Proposed Rule states that in the south the range of *A. canorus* extended to Kaiser Pass in the Evolution Lake/Darwin Canyon area. However, Kaiser Pass is more than 40 km northwest of the Evolution Lake/Darwin Canyon area. In addition, the southern extent of *A. canorus* extended at least to Blue Canyon, Kings Canyon National Park, which is approximately 15 km south of the Evolution Lake/Darwin Canyon area.
    c. Page 24500: The description of population estimates and status apparently relied entirely on localities on U.S. Forest Service (USFS) lands. Given that a substantial portion of the range of *A. canorus* is within Yosemite and Kings Canyon National Parks, relying solely on localities on USFS lands could give a very incomplete and potentially biased description of the status of this species. For example, the Proposed Rule states, "Yosemite toads have been found at 469 localities collectively on six National Forests…, indicating that the species is still widespread throughout its range." However, recent surveys of meadows in Yosemite National Park recorded *A. canorus* at 179 sites and predicted a high probability of toad occurrence at an additional 383 sites (Berlow et al., in review). Even if only the verified toad sites in Yosemite are considered, these 179 localities would increase the number of total localities by 38%. If both verified and predicted localities are considered, the total number of localities would increase by 120%. In addition to known localities in Yosemite National Park, there are another ~20 localities in Kings Canyon National Park that were apparently also not included in the localities described in the Proposed Rule. If the Proposed Rule did in fact not include those localities on national park lands, the toad's status would be considerably less precarious than is described in the Proposed Rule.
    d. Page 24501: Some of the strongest evidence that *A. canorus* has experienced significant declines is provided by the long-term study described in Sherman and Morton (1993). This study indicated the virtual elimination of toads from an area just east of Tioga Pass. However, it is worth mentioning in the Proposed Listing that *A. canorus* remains widespread and relatively abundant in Dana Meadows, immediately west of Tioga Pass (Sadinski 2004).

e. Page 24502: The section describing meadow loss and degradation relies on examples from outside the range of *A. canorus* (Halstead Meadow, Last Chance watershed). The choice of these areas as examples is puzzling because numerous examples of headcutting and stream incision are available from within the range of *A. canorus*, and would make for more compelling examples.
f. Page 24504: The section describing the effects of fire management on meadow habitats provides valuable information, but the research of Hossack and Corn (2007) should have been cited. This study showed that *A. boreas* (a close relative of *A. canorus*) increased its distribution following wildfires.

2. *Are there instances in the proposed rule where a different, yet equally reasonable and scientifically-sound conclusion might be drawn from that reached by the Service?*
    a. The Service determined that the Yosemite toad is a valid species, apparently based primarily on Crother et al. (2008). However, evidence from several recent studies that utilized molecular genetic methods does not support this conclusion. For example, Schaeffer et al (2000), Stephens (2001), and Goebel et al. (2009) all found limited or no support for monophyly of *A. canorus*. Goebel et al. (2009) concluded, "*A. canorus* appears to be either multiple entities or derived from multiple divergent mtDNA lineages". The inability to clearly identify *A. canorus* as a distinct species will make designing any recovery efforts difficult at best.
    b. The Proposed Rule makes are compelling case that although *A. canorus* remains widespread across its historical range it has disappeared from a significant fraction of historical localities. The Proposed Rule also uses available (but scanty) information to argue that the species has likely declined in abundance. However, given the difficulty of accurately quantifying toad abundance and the lack of studies that have provided such information, the evidence for declines in abundance remains weak. As such, we can really only conclude that *A. canorus* has disappeared from some sites, but that trends in abundance remain highly uncertain. These data would seem to provide a relatively weak foundation for listing *A. canorus* as threatened, and a "not warranted" conclusion could also be justified. The Service's argument for listing *A. canorus* as threatened is weakened considerably by the apparent failure to include all of the *A. canorus* localities in Yosemite and Kings Canyon National Parks in the analyses described in the Proposed Rule, and by the poorly-supported determination that the Yosemite toad is a valid species. These weaknesses make the alternative finding of "not warranted" for listing an alternative that is difficult to dismiss.
3. *Does the proposed rule provide accurate and balanced reviews and analyses of the threats to the species?* Yes, although there are relatively few studies available to use in evaluating these threats.
4. *Did the Service accurately describe the analyses, studies, and literature that are referenced in the proposed rule, and did the Service use the best available science to support its assumptions, arguments, and biological conclusions?* Yes, although as with #3 above, there isn't much information to include in this review.
5. *Are there any significant peer-reviewed scientific papers that the proposed rule omits from consideration that would enhance the scientific quality of the document?*
    a. Hossack, B. R., and P. S. Corn. 2007. Responses of pond-breeding amphibians to wildfire: short-term patterns in occupancy and colonization. Ecological Applications 17:1403–1410.
    b. Dodge, C. 2013. The distribution and effects of the amphibian chytrid fungus on Yosemite toads. Master's thesis, San Francisco State University.

6. *Are there parts of the proposed rule that need additional detail or explanation? Are there parts that are superfluous, or that could be condensed?* No.
7. *Is the scientific foundation of the proposed rule fundamentally sound? Can the scientific foundation be strengthened?* As described in #2 above, the justifications for (1) considering *A. canorus* as a valid species, and (2) the proposed listing of *A. canorus* as "threatened" need to be better supported.
8. *Are scientific uncertainties clearly identified and characterized?* There is relatively little information available to judge the long-term population trends of *A. canorus* and the threats to this species. That lack of information makes it challenging to come to strong conclusions, but despite this the Proposed Rule makes little mention of the substantial scientific uncertainties associated with these issues. These scientific uncertainties should be explicitly described.

Critical Habitat

Rana muscosa (in the Sierra Nevada) and *Rana sierrae*

1. *Our application of biological and ecological principles in the methods section, and in the criteria used for determining the extent and distribution of proposed critical habitat.*
    a. Page 24522: Section 2(e) "Overwintering refugee" should be replaced with "Overwintering refuges". In addition, the rock that provides these refuges need not be "granite" – replace "granite" with "bedrock". Section 3(a-ii): "montane hardwood conifer" does not make any sense, because conifers are softwood. Reword accordingly.
    b. Page 24523: In the section entitled, "Criteria Used to Identify Critical Habitat" the statement is made that "We are proposing to designate only geographic areas occupied by the species [mountain yellow-legged frog complex and the Yosemite toad] because the present geographic range is of similar extent to the historic range and therefore sufficient for the conservation of the species." This statement is likely true for the Yosemite toad, but not for the mountain yellow-legged frog. In the Sierra Nevada, mountain yellow-legged frogs are extirpated from nearly all low and mid-elevation localities throughout their range. For both species, this has resulted in a marked range contraction, characterized by the loss of virtually all populations along the western, eastern, and southern portion of the range. This range contraction has important implications for the designation of critical habitat, given the criterion that critical habitat units be currently occupied by mountain yellow-legged frogs (see comment 4 below).
    c. Page 24524: The "Data Sources" section should make clear that (1) the data used to describe currently occupied sites is based on surveys conducted at nearly all lentic habitat within the historical range of *R. sierrae* and *R. muscosa*, and (2) that nearly all of these surveys were conducted since 1995. Also, "CDFG Sierra Lakes Inventory Project" should be replaced with "CDFW High Mountain Lakes Project". The Sierra Lakes Inventory Project was the survey effort that I led in 1995-2002.
    d. Page 24524-5: The "Occurrence Criteria" section provides a detailed description of how occurrence data were used to delineate critical habitat. Unfortunately, this description is quite confusing and leaves this critical process less transparent than it needs to be. Adding a flow chart might help to clarify this delineation process.
    e. Page 24525: The description of the MaxEnt model and how it was used has several inaccuracies and omissions that need to be addressed.
        i. Language needs to be added to make it clear that the model provides an index of historical habitat quality, not current habitat quality (middle of 2nd column). This is the case primarily because I was unable to include predictor variables in the model that describe current habitat conditions, including the wide range of habitat alterations that have affected frog habitats. These alterations include the introduction of non-native fish, reservoir construction, water diversion, and modification of riparian habitats. These alterations are widespread in stream habitats within the historical range of the mountain yellow-legged frog and can have significant negative effects on these frogs. The inability to include variables in the MaxEnt model that describe these habitat alterations makes the model useful only for predicting historical frog habitat quality.

ii. The MaxEnt model was based on an unusually large and comprehensive data set of *R. sierrae* and *R. muscosa* historical localities from across their ranges. The size of this data set should minimize biases in model outputs, but one potential bias was unavoidable and should be discussed. This bias could originate from the unequal survey effort across the historical range (Syfert et al. 2013). For example, the lower elevation stream habitats in the northern, western, and southern portions of the historical range of the mountain yellow-legged frog have generally not been intensively surveyed, whereas the high elevation lentic habitats have been the focus of very intensive surveys. These differences in survey intensity could bias the MaxEnt output (i.e., predicted probability of historical frog occurrence) by underestimating the probability of occurrence in habitats that were less intensively surveyed and overestimating the probability of occurrence in more intensively surveyed habitats. Although there are ways to correct for survey effort, these methods could not be applied to the mountain yellow-legged frog data set because the survey effort in lower elevation stream habitats is not quantifiable. This potential bias is likely to be relatively small, but it could suggest smaller amounts of suitable low to mid-elevation stream habitat than was actually the case. This could result in these habitats being under-represented in the designated critical habitat (see also Comment 4(a) below).

iii. The Critical Habitat document describes separate model fits for *R. sierrae* and Sierran populations of *R. muscosa*. In fact, I only created separate models for mountain yellow-legged frogs in (1) the Sierra Nevada and (2) southern California. The AUC values of 0.916 and 0.964 apply to these two models, respectively.

f. Page 24531: “Interstate 50” should be “Highway 50”.

g. Page 24533: The name of subunit 3C, “Inyo”, is confusing. I suggest replacing it with “Minarets”.

h. In the document, the index map for the northern DPS of *R. muscosa* is provided before the index map for *R. sierrae*. This is a bit confusing because this means that critical habitat units 4 and 5 (for *R. muscosa*) are introduced before units 1-3 (for *R. sierrae*).

2. *Whether we have correctly evaluated the effects of climate change and whether our current proposed critical habitat designation is sufficient to address this threat factor.* Climate change effects will be extremely difficult to predict accurately. However, because large, deep lakes will likely be the habitats best able to resist the effects of climate change (compared to shallow lakes and streams), the emphasis on high elevation lake-dominated areas is likely to mitigate the effects of climate change to the maximum extent possible.

3. *The size, location, connectivity, and total area of the proposed critical habitat and its constituent units, and whether the proposed critical habitat is sufficient to provide for viable populations and the conservation of the species.*

a. The proposed critical habitat includes numerous critical areas that will be essential for the conservation of the species. However, as described in Comment 4(a), additional low to mid-elevation stream habitats should be considered for inclusion as critical habitat. If the currently-proposed areas and those suggested in Comment 4(a) retain their current *R. muscosa* or *R. sierrae* populations, these species are likely to persist across at least a significant fraction of their historical ranges. However, the

loss of populations from any of the critical habitat units and subunits would jeopardize the long-term viability of either species. As such, considerable research and management effort using fish eradications, frog translocations, reintroductions, and Bd treatments will likely be necessary to ensure the persistence of frogs in some units/subunits.

b. Subunit 3B is confusing because instead of containing only *R. sierrae* populations from genetic clade 3, it contains populations from both clades 2 (those in the Tuolumne drainage) and 3 (those in the Merced drainage; as described by Vredenburg et al. 2007). I would suggest re-drawing these boundaries to separate this unit into those populations in clades 2 (Unit 2) and 3 (Unit 3). If similar inconsistencies exist in other units and subunits, they should also be resolved to the extent possible by re-drawing unit/subunit boundaries.

4. *Whether there are additional areas that should have been considered or selected as critical habitat units, such as areas outside the historic range of the species as we know it. If so, please provide information on why such areas are essential to the conservation of the species.*

a. The Act requires that a number of key physical or biological features be used in determining the areas to designate as critical habitat. This includes that selected habitats are representative of the "historical, geographic, and ecological distributions of a species" [emphasis added]. The historical range of *R. muscosa* (in the Sierra Nevada) and *R. sierrae* is well known to have included lakes, ponds, and streams between approximately 1,370 m to 3,660 m (e.g., see Proposed Rule page 24476). Despite this broad range of habitat types and elevations that were occupied by these species historically, the Critical Habitat document focuses almost exclusively on high-elevation lake and pond habitats when designating critical habitat. For example, the document identifies "high-elevation water bodies, lake and pond complexes, and adjacent lands within and proximate to water bodies utilized by extant frog metapopulations (mountain lakes and streams) to be a physical or biological feature needed by mountain yellow-legged frogs…" (page 24519). Although this statement is accurate, low and mid-elevation stream habitat was also used as primary habitat by mountain yellow-legged frogs historically. Given this, every attempt should be made to include these habitat types within designated critical habitat units. Admittedly, there are few opportunities to designate low and mid-elevation streams as critical habitat because mountain yellow-legged frogs are almost entirely extirpated from these habitats and proposed critical habitat was limited to those areas "that are currently occupied" (page 24523). However, some key opportunities to include these habitat type were overlooked, and are highlighted here.

i. Upper and Lower Summit Meadow, and adjacent unnamed meadow to the northwest – Yosemite National Park: This meadow-stream complex contains a relatively large *R. sierrae* population, and is located immediately west of the proposed western boundary of Subunit 3B. Details of this population are given in Fellers et al. (2013; see Proposed Rule comment #5 for full citation). This is one of the largest known stream-dwelling populations of *R. sierrae* anywhere in its historical range, and is located at mid-elevation. As such, it is critical that Subunit 3B be expanded westward to incorporate this habitat.

ii. Calaveras Big Trees area – Stanislaus National Forest?: This area contains numerous historical *R. sierrae* populations that inhabited streams, and I've

heard several accounts of a relatively large extant stream-dwelling population in the vicinity. Gary Fellers or the Stanislaus National Forest could likely provide locality information.

iii. Meadow habitats on Sierra National Forest: Sierra National Forest staff have identified several extant *R. sierrae* populations that inhabit stream/meadow complexes (e.g., south of Yosemite National Park, and near Huntington Reservoir). Habitats occupied by several of these populations should be designated as critical habitat.

iv. Birch Creek – Inyo National Forest: This creek is located east of the Sierra Nevada crest, and supports a large *R. sierrae* population. This drainage should be designated as critical habitat.

v. Dry Creek/Crooked Meadows – Inyo National Forest: This meadow, stream, pond complex supported a very large *R. sierrae* population until the mid-1990s when it crashed due to a Bd outbreak. A few frogs may still persist here. This habitat is extremely unique because it is at mid-elevation and located east of the Sierra Nevada in the Glass Mountains. This is the only habitat not in the Sierra Nevada that is still (possibly) inhabited by *R. sierrae*. As such, this area should be considered for designation as critical habitat.

b. The Critical Habitat document states that proposed critical habitat is limited to those areas "that are currently occupied" (page 24523). This appears to be true for all critical habitat subunits except one: Subunit 4D. Historically, this subunit contained a large *R. muscosa* metapopulation that was the focus of intensive research by David Bradford in the 1970s. Unfortunately, this metapopulation crashed in the late 1970s (Bradford 1983), and was completely extirpated by 1991 (Bradford et al. 1991). The single *R. muscosa* locality that was apparently used to justify this subunit ("Table Meadows No. 5") was the result of a translocation of *R. muscosa* collected from Sixty Lake Basin in 1994 and 1995 and introduced to several sites in the Tablelands (Fellers et al. 2007). These populations have since gone extinct, but three adult *R. muscosa* were detected in 2000 when my field crews and I surveyed this area. Based on this information, this subunit should either be removed from consideration, or the statement that proposed critical habitat is limited to currently occupied areas needs to be modified.

5. *Additional information concerning the range, distribution, life history requirements, and conservation needs of the respective species for which critical habitat units are delineated.*

a. Page 24524: Frog movement patterns were described based on the results of two studies, Matthews and Pope (1999) and Wengert (2008). The Wengert study is problematic in this regard because of confusion over the frog species used in the study. At the time of the study, Wengert believed that she was studying *R. sierrae*. However, subsequent molecular genetic studies by Wengert (unpublished data) and Poorten and Knapp (unpublished data) indicate that they were likely *R. boylii*. Additional details will be available from Poorten and Knapp in 1-2 months. Regardless, using the Wengert (2008) study to describe movement patterns of *R. sierrae* is ill-advised. Although relying solely on Matthews and Pope (1999) is not ideal because this study was conducted on *R. sierrae* inhabiting a high elevation lake-dominated basin (and therefore may not accurately describe movement patterns in lower elevation stream-dominated systems), this reliance is unlikely to change the movement parameters used (in part) to identify critical habitat. Incorporating the movement information in Fellers et al. (2013) into the Critical

Habitat document would include a larger subset of the habitats typically used by mountain yellow-legged frogs, and help to generalize the movement information.

6. *Specific information on the amount and distribution of designated habitat, and whether that habitat is essential to the conservation of the species and why.* I do not have any specific information on the amount and distribution of designated habitat. As I said previously, the overall amount and distribution of critical habitat should be sufficient to maintain the current viability of both species.
7. *Our definition of the essential habitat features used in the development of the primary constituent elements that we have described for each species.*
    a. Page 24518: Most of the examples given here of primary constituent elements (PCEs) have nothing to do with mountain yellow-legged frogs ("roost sites, nesting grounds, seasonal wetlands, water quality, tide, soil type"). This discussion would be more useful to the reader if the example PCEs were directly relevant to the species that are the focus of this document.
8. *The use of the scientific or commercial data/publications/reports identified in the proposed critical habitat designation, and identification of any additional scientific material that we may have omitted from our analysis.* In general, this document makes good use of the existing literature and other information available for mountain yellow-legged frogs. I've made several specific suggestions related to this question throughout my comments.