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Public Comments Processing, Attn: RIN 1018-AV07
Division of Policy and Directives Management
U.S. Fish and Wildlife Service
4401 N. Fairfax Drive, Suite 222
Arlington, VA 22203

RE: Comment on Designation of Critical Habitat for the Peninsular Ranges Population of Desert Bighorn Sheep (*Ovis canadensis nelsoni*); Proposed Rule (FR 73 50498).

To whom this may concern,

Thank you for the opportunity to comment on the revised proposed critical habitat for bighorn sheep (*Ovis canadensis*) in the Peninsular Ranges (FR 73 50498). Last December, at the invitation of the U.S. Fish and Wildlife Service (Service), I provided a peer review of the October 10, 2007 proposed critical habitat (FR 72 57740). My original review is included in this letter as Addendum A.

In my current review of the Service's revised proposal for critical habitat, I am pleased to see that the Service included several additional areas of known bighorn sheep occurrence, based on data that had previously been provided to the Service. However, the addition of those lands only results in a minor improvement to the proposed critical habitat and I still have serious concerns about the proposed critical habitat delineation. Although the Service partially addressed one of my previous concerns (adding the abovementioned areas of documented bighorn sheep use) the proposed critical habitat still falls terribly short being adequate for recovery of this population. I see the following as major weaknesses in the Service's current approach to delineating critical habitat for this population:

1) There is a lack of connectivity of proposed critical habitat throughout the range.
2) The rule does not provide adequate detail on how proposed critical habitat was delineated, and it does not provide a transparent description of how Primary Constituent Elements (PCEs) were identified or mapped. Furthermore, the Service appears to deviate from following the general methods that it does state in the rule.

3) Proposed critical habitat excludes many alluvial fans and areas of gentle slope that are important to bighorn sheep. These areas, primarily along the eastern edges of the range, face the largest threat of habitat loss and modification and therefore require the maximum possible protection.
4) The currently proposed critical habitat delineation does not appear to be based on the best science, while the original critical habitat (designated in 2001) was based on an expert-based model of essential habitat and is supported by recent modeling efforts using advanced methods.

Lack of Habitat Connectivity

The 2000 Recovery Plan for this population, which was approved and adopted by the Service, stresses the importance of habitat connectivity throughout the range (U.S. Fish and Wildlife Service 2000). Maintenance and re-establishment of habitat connectivity is listed as a Priority 1 recovery action in the Recovery Plan, with the Service listed as one of the lead responsible agencies for carrying out this action (U.S. Fish and Wildlife Service 2000, page 113). The importance of habitat connectivity is supported by multiple scientific publications (e.g., Hanski and Gilpin 1991, Mills and Smouse 1994, Bleich et al. 1996, Soulé and Terborgh 1999, Epps et al. 2005), and its importance was stated explicitly in the text of the Service's October 2007 proposed rule (page 5744).

> "Because of the metapopulation structure of the Peninsular bighorn sheep population, it is important for genetic exchange and the conservation of the subspecies to ensure space for movement and connectivity between ewe groups. Furthermore, maintaining connectivity within the metapopulation will help safeguard against local extinctions of the remaining subpopulations".

In the face of global climate change, habitat connectivity becomes even more important, because it allows species to shift their distribution in terms of elevation or latitude, making them more resilient to changing habitat conditions.

Yet, the proposed critical habitat doesn't reflect an attempt to maintain connectivity and two large breaks remain in the proposed critical habitat. The rule for proposed critical habitat does not specifically state why lands within these two gaps are excluded, and the reader is left to assume that these areas do not provide important habitat (the methods for delineating important habitat are not clearly stated in the rule, however, so the reader can not verify this. See discussion about "lack of scientific methods" below). I have provided the Service with information that demonstrates that animals move through these areas. In addition, it should be noted that there are occurrence data within these gaps shown in the 2000 Recovery Plan (page 71). Having said this, however, I stress, as I and the Recovery Team have done on many occasions, that a reliance on known sheep locations is inappropriate because it doesn't address the possibility of "false absences". False absences may occur in areas where a species occurs but occupancy has not been recorded because (1) the area was not surveyed during the period of interest, (2) the area was surveyed but the species was not detected during the survey (a possible scenario for bighorn sheep given their cryptic coloration in their desert environment), or (3) the species occupies the area but only during some time periods, either seasonally or during unpredictable environmental conditions, that did not coincide with times of surveys.

In the case of the two gaps in the proposed critical habitat, there is solid evidence (from field data and from genetic analyses) that these areas are used by animals moving among subpopulations (Boyce 1995, Boyce et al. 1997, DeForge et al. 1997, Rubin et al. 1998), and recent predictive habitat modeling supports these areas as contiguous bighorn sheep habitat (Rubin et al. In review). The Recovery Plan clearly states that connected habitat throughout the range is essential for the conservation of this population (pages 69-70, 75-77), and this, according to Section 3 of the ESA, defines these areas as critical habitat.

If the gap between the San Jacinto and Santa Rosa mountains (between Unit 1 and Unit 2A) is, in reality, due to overlap with the draft Habitat Conservation Plan (HCP) proposed by the Agua Caliente Band of Cahuilla Indians or the proposed Coachella Valley Multiple Species Habitat Conservation Plan (MSHCP), then the rule for proposed critical habitat should have stated this upfront. If this is the case, these lands should be designated as critical habitat, and then (if appropriate, based on protection under the HCPs) be vacated from critical habitat if and when these plans are approved and finalized. However, as mentioned above, the proposed rule never stated why these lands were not included in proposed critical habitat.

Lack of Adequate Detail Describing Methods Used to Identify and Map Critical Habitat, and Exclusion of Multiple Alluvial Fans and Areas of Gentle Slope

In my previous comments I stated my concern that many alluvial fans and areas of gentle slope were excluded. I also noted that the methods of delineating critical habitat were not presented in adequate detail (see Addendum A). These concerns have not been addressed and, in fact, I see additional inconsistencies in the way the Service approached delineation of critical habitat:

As stated in the rule "Section 3 of the Act defines critical habitat as the specific areas within the geographic area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features essential to the conservation of the species and that may require special management considerations or protection, and [emphasis added] specific areas outside the geographic area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species." The proposed rule lists five primary constituent elements that were deemed to be essential to the conservation of the species, and states that these primary constituent elements were used to delineate critical habitat. Specifically, the rule (page 50500) states that the following data were used to delineate proposed critical habitat: (1) areas that contain occupancy data from 1988 to the present time, (2) areas within the ewe groups distributions delineated by Rubin et al. (1998), (3) areas where occupancy data points indicate repeated Peninsular bighorn sheep use but which were not captured within the ewe group distribution boundaries identified by Rubin et al. (1998), ".....and [emphasis added] (4) areas that contain the essential physical and biological features required by the DPS as determined from aerial imagery and Geographic Information System (GIS) data on vegetation, elevation, and slope". Page 50500 of the rule goes on to define these essential physical and biological features as Primary Constituent Elements (PCEs) and states that these include the following: elevations below 4,600 feet, areas with 30 percent canopy cover or less, escape terrain, slopes of 20 percent or greater, alluvial fans, washes, and water sources "....immediately adjacent to the identified ewe groups".

Yet, the Service failed to follow these stated methods, choosing to leave out areas containing PCEs when occurrence data were not available. For example, page 50501 describes the exclusion of PCEs (namely, alluvial fan habitat in this case) adjacent to the Santa Rosa Mountains ewe groups simply because occurrence data did not exist in that area. Not only does this contradict stated methods, but it demonstrates, once again, a misguided reliance on known sheep locations. If the Service included defined PCEs as claimed on page 50500 of the rule, these alluvial fans should be included in critical habitat.

Furthermore, the rule states (page 50500) that "Our proposed revision to critical habitat is designed to capture ewe groups; lambing areas; foraging areas, including alluvial fans; water sources; ram movement; and areas used for associated herd (i.e., male, female, and young) movements and migration [emphasis added]." Yet, as discussed above, the revised proposed critical habitat does not protect habitat connectivity among all subpopulations in the Peninsular Ranges, and leaves two large gaps in areas known to provide important connectivity between subpopulations.

Other observations, such as the following, also raise questions about the methods used:

- in reference to the PCEs, the rule does not state how "escape terrain" was defined,
- in reference to the PCEs, the rule does not state how it defined "...immediately adjacent to the identified ewe groups" (page 50500). Did this take into consideration some measure of bighorn sheep movement distances?
- in my December 2007 review (see Addendum A), I questioned several portions of the proposed critical habitat, where the line of habitat followed an absolutely straight line and did not appear to conform to (or follow) any recognizable PCE or other biological or topographical feature (for example, a perfectly straight line for miles along the eastern edge of the San Ysidro and Vallecito mountains). Now, in the revised proposed critical habitat, this line has a gentle arc to it. It now includes some (but not all) known sheep occurrences in that area, which is an improvement, but it is still unclear how the original perfectly straight line was generated in the first place.
- On page 50502, the rule describes the addition of areas south of Interstate 8 due to recent sightings and reports of sheep activity "....around and within the Interstate 8 'Island', including suitable habitat areas...". How is "suitable habitat" defined? If it is defined as areas including PCEs, why wasn't it included originally, regardless of occurrence data? Again, this contradicts stated methods.

These observations contribute to my concern that a robust scientific method was not used to delineate the proposed critical habitat line.

Proposed Critical Habitat is Not Based on a Sound Biological Delineation of Habitat

The delineation of critical habitat should be preceded by a delineation of essential habitat, which should be based strictly on biology, and should be clearly presented. The current rule does not provide details on how essential habitat was delineated or what areas were identified as essential habitat. In contrast, the original critical habitat (designated in 2001) was based on an expert-based model of essential habitat, which is clearly depicted in the 2000 Recovery Plan (page 11). The expert-based model was developed by the Recovery Team, guided by expert knowledge of

bighorn sheep in the Peninsular Ranges as well as a literature review, and methods used to develop this model are described in Appendix B of the Recovery Plan. As described in my previous review (see Addendum A), the essential habitat line identified by the Recovery Team is supported by recent modeling efforts used two quantitative computer-aided methods and GPS data to develop additional models of bighorn sheep habitat (Rubin et al. In review).

Additional concerns:

In addition to the above, I am also concerned about the exclusion of critical habitat based on future management plans. Even given the best of intentions, it is risky to rely on a draft Tribal HCP and the draft Coachella Valley MSHCP to provide protection for a Federally endangered population when these plans are not yet completed. For example, the current draft Tribal HCP provides inadequate detail to demonstrate that conservation measures are adequate for providing effective protection of sheep habitat, and it is unclear if adequate funding will be available to carry out many of the conservation efforts described in the Coachella Valley MSHCP. I therefore urge you to include these areas as critical habitat to assure that future land uses are compatible with recovery of this population.

In 1999, the Service designated a Recovery Team to provide expert input and help guide recovery of this population. However, this team, which I am a part of, was not involved in developing the methods used to delineate critical habitat, and the Service has not shared the exact methods with us, beyond what we can read in the October 2007 and August 2008 rules for proposed critical habitat. It is unclear to me why the Service would not use the expertise of their own Recovery Team when undertaking one of the most important recovery actions intended to benefit a Federally endangered population

I provide these comments in the hopes that the Service will reconsider and improve the currently proposed critical habitat line. Critical habitat should be based on robust scientifically defensible methods, and I don't see evidence of this in the currently proposed delineation. I encourage the Service to work with Recovery Team members and others familiar with bighorn sheep in this population to revise the existing approach and re-delineate critical habitat, or to retain the 2001 critical habitat delineation which was based on essential habitat identified by the Recovery Team.

Sincerely,

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Senior Ecologist

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Addendum A

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December 8, 2007

Dear Mr. Bartel,

At the invitation of the U.S. Fish and Wildlife Service (USFWS), I am providing a peer review of the proposed rule to revise critical habitat for bighorn sheep (*Ovis canadensis*) in the Peninsular Ranges of southern California (FR 72 57740). I based the following review on 13 years of experience researching bighorn sheep in these mountains. I conducted my doctoral research on this population[1], conducted post-doctoral research on their habitat use and social behavior[2], and have published multiple peer-reviewed scientific articles related to bighorn sheep in these mountains (CV attached). In 1999, I was invited to be a member of the USFWS Recovery Team for this population. The Recovery Team invested a great deal of care and effort in developing a Recovery Plan, including a delineation of essential habitat, which was subsequently approved by the USFWS, Bureau of Land Management, U.S. Forest Service, California Department of Fish and Game (CDFG), California Department of Parks and Recreation (CDPR), and the Agua Caliente Band of Cahuilla Indians (USFWS 2000).

I strongly urge you to designate critical habitat for bighorn sheep in the Peninsular Ranges under Section 4 of the Endangered Species Act. Bighorn sheep in this population live in close proximity to some of the fastest growing communities and cities in the United States, making them vulnerable to habitat loss, modification, and fragmentation, as well as impacts of recreation, mining, and other human activities within areas inhabited by bighorn sheep. Habitat protection is, therefore, identified as a primary recovery strategy in the Recovery Plan.

[1] 2000. Dissertation title: "The Ecology of Desert Bighorn Sheep (*Ovis canadensis*) in the Peninsular Ranges of California". University of California, Davis.
[2] Millennium Post-doctoral Program, Conservation and Research on Endangered Species, Zoological Society of San Diego.

However, I have a number of serious concerns about the proposed critical habitat designation, as it is described in the *Federal Register* (FR 72 57740). The proposed delineation does not appear to be based on good science or conservation principles, and the major reduction in area (as compared to the original critical habitat delineated in 2001) will jeopardize the chances of recovery and survival of this population. The following are my primary concerns, which I explain in greater detail below:

1. There is a lack of connectivity of proposed critical habitat throughout the range.
2. Proposed critical habitat excludes many alluvial fans and areas of gentle slope that are important to bighorn sheep. These areas, primarily along the eastern edges of the range, face the largest threat of habitat loss and modification and therefore require full protection.
3. Proposed critical habitat excludes multiple areas documented to be used by bighorn sheep at or since the time of listing.
4. The rule does not provide adequate detail on how proposed critical habitat was delineated. For example, the rule does not provide details on how "Primary Constituent Elements" were identified or mapped, or how "areas unlikely to be used by Peninsular bighorn sheep" were identified.
5. The currently proposed critical habitat delineation does not appear to be based on the best science, while the original critical habitat (designated in 2001) was based on an expert-based model of essential habitat and is supported by recent modeling efforts using advanced methods.

Lack of Habitat Connectivity

The Recovery Plan for this population identifies habitat protection as a crucial part of the recovery strategy, and identifies maintenance and re-establishment of habitat connectivity as a Priority 1 recovery task (USFWS 2000, p. 113). As stated in the Recovery Plan (p. 77), "the ability of bighorn sheep to move freely throughout all parts of the range is critical to recovery because it: (1) facilitates exchange of genes between ewe groups, (2) allows habitat colonization, and (3) allows selection of alternative habitat in response to predation pressure or temporary changes in habitat quality (Schwartz et al. 1986, Bleich et al. 1996) and human-related disturbance." The current rule for proposed critical habitat discusses the benefits of habitat connectivity at length, and summarizes these benefits very succinctly on page 57744:

> "Because of the metapopulation structure of the Peninsular bighorn sheep population, it is important for genetic exchange and the conservation of the subspecies to ensure space for movement and connectivity between ewe groups. Furthermore, maintaining connectivity within the metapopulation will help safeguard against local extinctions of the remaining subpopulations".

Despite this recognition in the *text* of the proposed rule, the proposed critical habitat delineation does not promote habitat connectivity. Although essential habitat (as identified by the Recovery Team and depicted in the Recovery Plan) and critical habitat originally designated in 2001 both

promote habitat connectivity among all subpopulations, the proposed critical habitat essentially severs the San Jacinto Mountains subpopulation (at the north end) and the Carrizo Canyon subpopulation (at the south end) from the remainder of the range.

I recognize that the USFWS may still recognize areas outside of proposed critical habitat as bighorn sheep habitat, but excluding these areas from critical habitat suggests that they are not critical to the long-term recovery or survival of the population, which is inaccurate. The reasons for excluding these areas from critical habitat were not explained in the rule (see also "Lack of Adequate Detail Describing Methods Used to Identify and Map Critical Habitat" below).

For example, the area between "Unit 3" and "Unit 2B" is largely owned by the California Department of Parks and Recreation. Anza-Borrego Desert State Park recently purchased portions of this land for protection of natural resources, including bighorn sheep, because this area contains habitat features important to bighorn sheep and has been documented to provide connectivity between the Carrizo Canyon subpopulation and the remainder of the population. Why was this area excluded from proposed critical habitat?

It is also unclear why the area between "Unit 1" (the San Jacinto Mountains) and the remainder of the range was excluded from proposed critical habitat. In addition to including habitat that supports bighorn sheep, this area literally provides the *only* connection between the San Jacinto Mountains subpopulation and the entire remaining range. It is absolutely essential that these lands are protected. The Bighorn Institute in Palm Desert has documented multiple moves of rams across this area, and provided this information to the USFWS prior to the current proposed critical habitat revision (J. DeForge, Bighorn Institute, personal communication).

Land in this excluded area is owned by the Agua Caliente Band of Cahuilla Indians (ACBCI) or falls within the proposed Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP). If this area was excluded from proposed critical habitat for this reason (because the USFWS assumes that this area will be protected under the CVMSHCP and the ACBCI's future HCP), this is inappropriate because the CVMSHCP and the ACBCI's HCP have *not* yet been approved, and therefore provide absolutely no protection to bighorn sheep or their habitat at this time. I would suggest this area be included as critical habitat until such time that each plan is approved and the USFWS has determined that each plan provides solid management and conservation of bighorn sheep habitat. The USFWS is well aware that this area provides important connectivity and that the Recovery Team identified this area as "essential habitat". It should therefore have been recognized as essential habitat, included as critical habitat, and then, if necessary, proposed as an exclusion from critical habitat once *approved and finalized* management plans come into full effect.

I am also very concerned with the proposed exclusion of lands within Unit 1 (San Jacinto Mountains). Exclusion of these lands would sever connectivity between the northern and southern portions of the San Jacinto Mountains and would fail to protect important alluvial fans and canyon bottom habitat, for example as in Chino Canyon (see also "Loss of Alluvial Fans and Other Gentle Terrain", below).

Related to the need for habitat connectivity, the rule for proposed critical habitat states that researchers have documented movement of rams "between up to three ewe groups" (p. 57744). This statement incorrectly cites Rubin et al. (1998), which documented male movement among at least 6 groups, and the rule therefore underestimates the importance of connectivity throughout the range. Researchers have, in fact, documented movement of radiocollared males (and in some cases females) among all eight subpopulations (W. Boyce, personal communication, J. DeForge, personal communication, E. Rubin, unpublished data), demonstrating that all eight subpopulations are currently linked via animal movement. As stated in the Recovery Plan, the long-term goal for recovery is to maintain connectivity throughout the entire range, from north to south. Designating critical habitat that promotes connectivity would demonstrates that the USFWS is truly planning for recovery of this population.

Loss of Alluvial Fans and Other Gentle Terrain

Although the proposed rule for critical habitat clearly, and correctly, states that washes and alluvial fans are important to bighorn sheep in the Peninsular Ranges (p. 57744), the proposed critical habitat delineation excludes extensive areas of alluvial fans and other low elevation habitat. Based on a GIS evaluation of proposed critical habitat by CDPR staff, nearly 250,000 acres (1011 km^2) of habitat have been removed from the eastern side of critical habitat, as compared to critical habitat designated in 2001. This area includes alluvial fans, washes, bajadas, canyon bottoms, and open playas, which provide bighorn sheep with important forage resources and are also used during moves between more mountainous terrain. As noted in the Recovery Plan (USFWS 2000, p. 158), "[w]ashes and alluvial fans often support a higher diversity, quality, and quantity of forage species than less productive rocky slopes (Leslie and Douglas 1979), seasonal and perennial water sources (Wilson et al. 1980, Holland and Keil 1989), bedding and thermal cover (Andrew 1994), alternative forage sources in times of drought, resource scarcity, and stress (Leslie and Douglas 1979, Bleich et al. 1997), and a source of forage with higher nutritional value during the lambing and rearing season (Hansen and Deming 1980)."

These areas represent some of the most threatened bighorn sheep habitat in the Peninsular Ranges, due to habitat loss, modification, and fragmentation caused by human activities including urban development, mining, recreation, and water diversion. Many of these areas have already been lost. The remaining alluvial fans and other low elevation habitat areas are therefore in dire need of protection as critical habitat.

Lack of Inclusion of Areas Used by Bighorn Sheep Since the Time of Listing

Proposed critical habitat excludes areas used by bighorn sheep in recent years. Although critical habitat should encompass areas of historic occupancy if it is truly intended to aide in the *recovery* of a species, I recognize that the current protocol focuses on areas occupied at the time of listing. Two shortcomings of this approach are (1) it designates critical habitat based on the distribution of a species at its lowest abundance level, and most likely its most limited spatial distribution, thereby reducing the probability of encompassing areas required for full recovery, and (2) it assumes that all areas have been sufficiently surveyed to document occupancy. It

therefore doesn't address the possibility of "false absences". False absences may occur in areas where a species occurs but occupancy has not been recorded because (1) the area was not surveyed at or since the time of listing, or it may never have been surveyed, (2) the area was surveyed but the species was not detected during the survey (a possible scenario for bighorn sheep given their cryptic coloration in their desert environment), or (3) the species occupies the area but only during some time periods, either seasonally or during unpredictable environmental conditions, that did not coincide with times of surveys (for example, an area may be used in the spring or summer and not during the autumn when helicopter surveys are typically conducted).

The proposed rule states that areas were included if "occupancy data points indicate historically occupied habitat", a protocol which I support. But given the possibility of false absences described above, the delineation of critical habitat must also rely on robust methods of identifying and mapping critical habitat based on habitat features rather than simple occurrence (see "Lack of Adequate Detail Describing Methods Used to Identify and Map Critical Habitat").

Not disregarding the above, critical habitat should, *at the very least*, include areas occupied by bighorn sheep at or since the time of listing. The proposed critical habitat delineation fails to do so. Areas that have been documented to be occupied at or since the time of listing but are not included in proposed critical habitat include Grapevine Mountain, Sentenac Canyon, parts of Grapevine Canyon, areas in the northeastern portions of the Vallecito Mountains, and upper Palm Canyon, among others. Locational data documenting this use were provided to the USFWS prior to the delineation of proposed critical habitat. These areas provide lambing habitat, foraging areas, connectivity between mountainous areas, and important water sources.

An examination of locational data collected during 2001 – 2003 with the use of Global Positioning System (GPS) collars in areas between Highway 74 and the southern edge of the Vallecito Mountains revealed that nearly 1000 of these locations are not included in proposed critical habitat. Granted, this is a relatively small proportion of the many locations captured within proposed critical habitat, but it does suggest that many areas used by bighorn sheep since the time of listing have been left out. The actual occupied habitat excluded from proposed critical habitat is likely much larger than indicated by these locations because only a small proportion of the population (34 GPS-collared animals, or about 5 % of the population in 2002) were represented in that dataset, data were sometimes collected at low frequency (with no data collected on some days), and animals were only GPS-collared for two years (so their habitat use may not be representative of a wider range of habitat needs across longer time periods and different environmental conditions). The GPS data were provided to the USFWS prior to delineation of proposed critical habitat.

Lack of Adequate Detail Describing Methods Used to Identify and Map Critical Habitat

The proposed rule does not provide specifics on how proposed critical habitat was delineated. Although the proposed rule text provides lengthy discussions about the types of habitat characteristics that represent Primary Constituent Elements, the actual *methods* of identifying and mapping these elements are not included in the rule. It leaves one to wonder how important

decisions regarding the location of the critical habitat line were made. A number of questions, such as the following, remain:

- Was a model employed? What type? Was it based on expert opinion?
- Were Primary Constituent Elements weighted?
- How were "areas unlikely to be used by Peninsular bighorn sheep" identified?
- The rule states that a vegetation GIS layer was used. Which one was used?
- The rule states that areas with canopy cover greater than 30% were excluded. What information was used to determine this cut-off point? What GIS data layer was used to identify these areas?

Along several sections of the proposed critical habitat boundary, proposed critical habitat follows a perfectly straight line which does not appear to conform to (or follow) any obvious biological or topographical feature. How was this line placed? What methods were used, and what Primary Constituent Elements guided placement of this line? Also, as mentioned above, several areas where bighorn sheep occurrence has been documented since the time of listing were not included in proposed critical habitat. If Primary Constituent Elements were used to delineate the line, which elements were missing to cause these areas to be excluded?

In its limited description of methods, the rule states that areas with slope less than 20% were excluded unless use was documented in a particular area or the area overlapped with ewe group delineations in Rubin et al.1998 (p. 57747). This decision doesn't reflect the fact that bighorn sheep often use flat and gentle terrain for feeding and movement, as noted in the rule (p. 57746): "Much of the lost habitat consisted of low elevation alluvial fans and washes that provided important sources of nutrients to ewes when they are rearing their lambs (PCE 2 and 4)." These areas also provide important resources to male bighorn sheep (Bleich et al. 1997). The fact that bighorn sheep use gentle terrain such as alluvial fans and washes, even though use of these area may increase their risk of predation (Berger 1991), provides strong evidence that these areas provide critically important resources (Bleich et al. 1997). As noted in the Recovery Plan, bighorn sheep have been observed at great distances from slopes of $\geq$ 20%, and the Recovery Team chose to define essential habitat as those areas within 800 meters of slopes with $\geq$ 20%. The team recognized that this area would capture not all, but the majority, of use in these areas, and that inclusion of these areas represented inclusion of important resources.

The rule for proposed critical habitat states that essential habitat delineated by the Recovery Team included a "buffer" of 0.5 miles (0.8 km) around slopes $\geq$ 20%. Although we did include this distance around slopes $\geq$ 20%, it is important to note that we did not included these areas as a "buffer". We added these areas as "essential habitat" because they include important resources for bighorn sheep, as mentioned above.

<u>Proposed Critical Habitat is Not Based on a Sound Biological Delineation of Habitat</u>

The delineation of critical habitat should be preceded by a delineation of essential habitat, which should be based strictly on biology. The current rule does not show what habitat was delineated as essential habitat, and proposed critical habitat does not appear to be based on the best science. In contrast, the original critical habitat (designated in 2001) was based on an expert-based model of essential habitat and is supported by recent modeling efforts using advanced methods.

The expert-based model was developed by the Recovery Team, guided by expert knowledge of bighorn sheep in the Peninsular Ranges, and is depicted in the Recovery Plan as "essential habitat" (USFWS, 2000, p. 11). Recent modeling efforts used two quantitative computer-aided methods and GPS data to develop additional models of bighorn sheep habitat. This recent modeling project used Ecological Niche Factor Analysis (ENFA) implemented in the program BioMapper (Hirzel et al. 2002a, b), and Genetic Algorithm for Rule-set Production (GARP) implemented in the program DesktopGARP (Version 1.1.6; http://nhm.ku.edu/desktopgarp; Stockwell and Noble 1992, Stockwell and Peters 1999) to predict bighorn sheep habitat in the Peninsular Ranges (Rubin et al. In prep).

Although it is difficult to identify the single "best" model, there are commonalities among the expert based model and the two recently developed models that support the original critical habitat line (2001) but that do not support the currently proposed critical habitat delineation. In particular, all three models (the expert-based, the ENFA model, and the GARP model) depict continuous habitat from north to south, without any breaks (see attached figure). This is consistent with known animal moves across this range. In addition, the eastern edge of habitat is relatively consistent among the three models, providing support for inclusion of these lower elevational areas. The GARP model, which tended to have better predictive abilities than the ENFA model when tested with a separate set of GPS data held aside for testing purposes, provides particularly good support for the expert-based model and critical habitat designated in 2001 (see attached figure).

Although the recent models are based on two years of GPS data from a subset of the total population, and may therefore underestimate use of some areas, they provide support for the essential habitat line and the original (2001) critical habitat line. They do not provide support for the currently proposed critical habitat delineation.

The rule for proposed critical habitat states that the proposed delineation is supported by the draft model provide to USFWS by me and collaborators as part of the abovementioned project, because areas designated "roughly fall within the upper level habitat suitability classes derived form the preliminary model"(p.57747). This is an incorrect interpretation of the draft model, suggesting a lack of understanding of the model results. In my May 31, 2007 letter that accompanied the draft model results, I recommended care in interpreting habitat "suitability" ratings, and stressed that all identified habitat (even areas with lower habitat ratings) represent potentially important habitat for bighorn sheep.

The rule for proposed critical habitat suggests that the proposed delineation was based partially on ewe group delineations in Rubin et al. (1998). It should be noted that the Rubin et al. (1998) ewe group delineation was intended to document the approximate known distribution of ewe groups at that time. The delineation was not intended to represent essential habitat, it does not include additional areas used by rams, and it does not represent areas of connectivity. In addition, the ewe group delineation in Rubin et al. (1998) was based on a small number of VHF-collared animals (GPS collars had not been used in our study at that time), it did not include locational information on animals in the San Jacinto Mountains, and it was based on data collected in the mid-1990s when the population was at its smallest known size. Although the

rule implies that ewe-group delineations in Rubin et al. (1998) were based on animal locations collected during 1971-1996 (p. 57747), ewe-group delineations were actually only based on data collected during 1993-1996. Rubin et al. (1998) did use data collected since 1971, but those data were only represented by water-hole count data (used to examine long-term abundance trends). The ewe group delineations in Rubin et al. (1998) therefore present a *minimum* distribution of bighorn sheep in these mountains.

In summary, I do not support the proposed critical habitat as presented in FR 72 57740. I am providing these comments in the hope that they will help the USFWS improve the delineation of critical habitat for bighorn sheep in the Peninsular Ranges. Critical habitat delineation will improve their chances of recovery, if critical habitat delineation is based on science and the goal of population *recovery*.

Sincerely,

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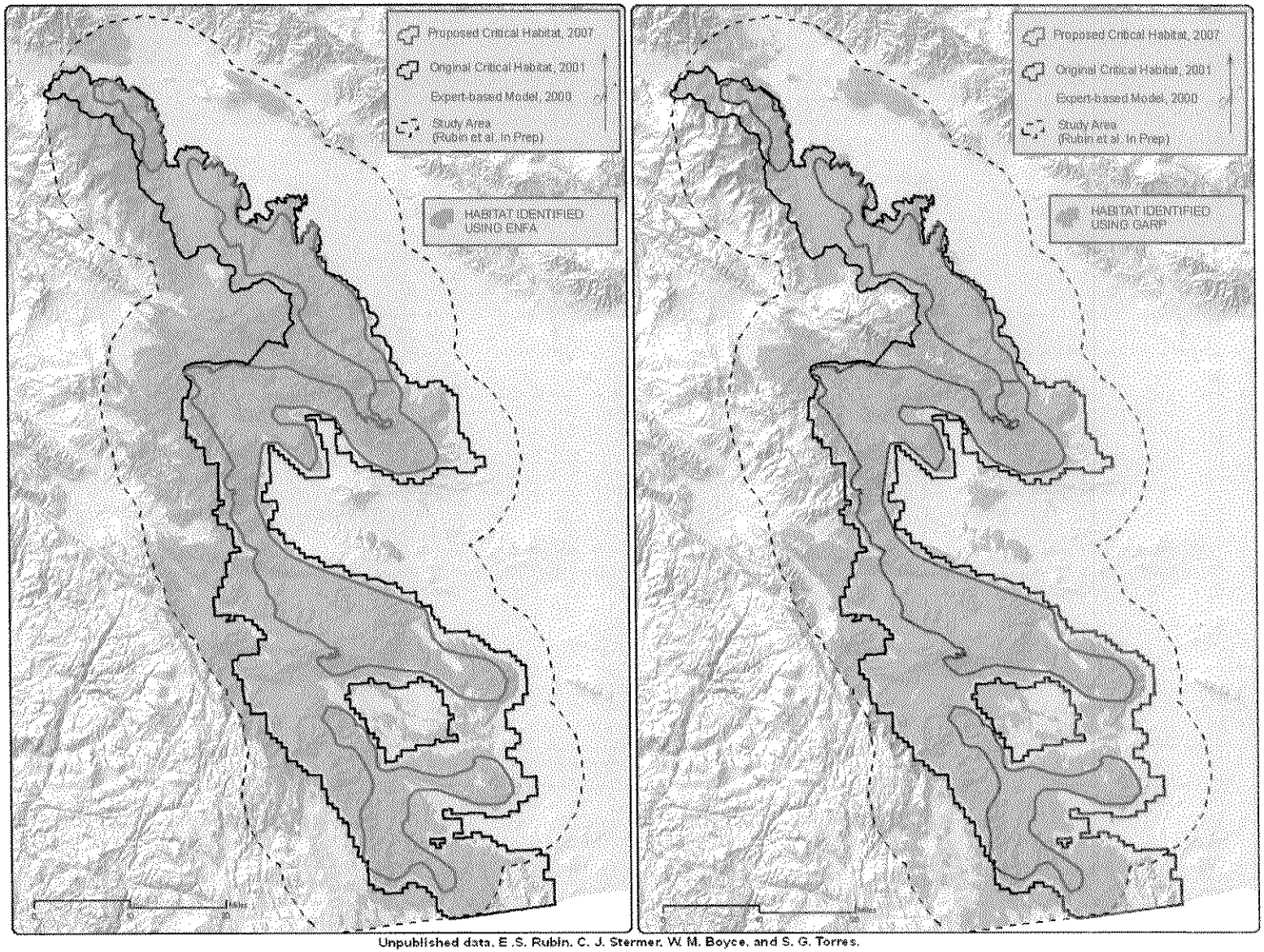
COMPARISON OF PROPOSED CRITICAL HABITAT WITH 2001 CRITICAL HABITAT AND THREE INDEPENDENT MODELS



Unpublished data, E.S. Rubin, C. J. Stermer, W. M. Boyce, and S. G. Torres.