

need for translocation. Importing animals also poses risks of disease transmission. Regardless, bighorn sheep populations throughout the Mojave Desert are currently depressed to the extent that surplus animals are not available for importation.

Issue: Given the history of population declines in regions adjoining urban areas, it does not seem plausible for the recovery plan to claim that Peninsular bighorn sheep have a high potential for recovery.

Response: The recovery plan attempts to build on past examples and taking action soon enough to reverse the decline of sheep in our mountains. The Recovery Team and cooperating agencies believe that the recovery potential is high if the management recommendations in the recovery plan are implemented.

Issue: The further research and planning required through the captive rearing and augmentation guidelines in Appendix C does not recognize or expedite the immediate recovery needs and issues that must be addressed in the short-term. After many years of operation, these issues should already have been addressed and a plan ready to implement.

Response: The existing operations of the Bighorn Institute are reviewed annually by the agencies and adjustments made if needed. Captive breeding for population augmentation, population monitoring, and research have been and continue to be the primary emphases until changes in direction are agreed to by the Institute, agencies, and Recovery Team.

Issue: One commenter suggested that the draft recovery plan was deficient because a recent discovery of a desert bighorn sheep population in Ventura County was not addressed.

Response: Sheep populations in Ventura County are not included in the distinct population segment listed in the Peninsular Ranges and, therefore, are not relevant to the recovery plan.

Issue: Because bighorn sheep are wilderness animals, more emphasis should be placed on conservation efforts in Anza-Borrego Desert State Park, instead of urbanizing Coachella Valley, where prospects for success are less than in more remote areas.

Response: Numerous subpopulations are necessary to maintain the larger Peninsular Ranges metapopulation. Therefore, recovery will require protection of all areas needed to maintain the constituent subpopulations. This protection will require increased management emphasis and cooperation among land managers in urbanized areas.

Issue: The limited dispersal and colonization capabilities contradict statements elsewhere in the recovery plan that bighorn sheep are wide ranging animals dependant upon large tracks of habitat.

Response: True, each individual is a wide-ranging animal with a relatively large home range. This behavior and knowledge of these areas is learned by the offspring, which is transmitted across generations. Though colonizations of new habitat are known to occur, they are not a common event. Rams are more wide-ranging than ewes and are known to move between mountain ranges and ewe groups.

Issue: The draft recovery plan does not clearly indicate how or whether models would be used to assist in gaining a better understanding of the interacting factors that place sheep at risk.

Response: Models are a tool that help assimilate knowledge and understand factors that place bighorn sheep at risk, for later application through management prescriptions. Models should be used anytime they can help us to better understand bighorn sheep population dynamics, genetics, or ecosystems. Though the recovery plan provides examples of high priority issues that should be examined with models, the points at which a model would be appropriate are difficult to predict. Modeling is included in the section on research because it is an ongoing process that will have to be applied and modified as questions arise and more data become available.

Issue: The recovery plan is biologically inconsistent, arguing on the one hand that human disturbance in wild areas causes them to avoid otherwise important habitat but on the other hand arguing that fences are needed to prevent sheep from being attracted to urban areas.

Response: Bighorn sheep react differently to various kinds of disturbance depending on numerous factors, including location. The northern Santa Rosa Mountains ewe group is the only herd that has habituated to using the urban interface, yet when in wild habitat distant from the urban edge, these same sheep react similarly to nonhabituated herds—that is, individuals revert to normal wild behavior when away from the urban edge. The reaction is perhaps most pronounced during the lambing season, when ewes with lambs are frequently displaced by human disturbance. This effect has been repeatedly documented through radio telemetry research, where sheep are sometimes inadvertently “bumped” or “pushed” farther away by researchers, even though the sheep are still hundreds of meters distant and not visible to the researchers. In other words, behavioral reactions often depend on geographical and seasonal context, with the spectrum of contrasting responses to human stimuli most clearly evident within this ewe group.

PREDATOR CONTROL ISSUES

Issue: Radiocollars may render sheep more vulnerable to predation and therefore should not be used as prevalently as they are today.

Response: We are not aware of data that indicates radiocollared animals are at greater risk of predation than uncollared animals. Nonetheless, cooperating agencies have attempted to balance the number of radiocollars to minimize potential risk without compromising information needed to achieve population recovery.

Issue: Whereas one commenter asserted that the proposed predator management measures were too lax and should be more aggressive in terms of moving predators from the area before they become an issue, another commenter claimed

that scientific evidence was sufficient to indicate that mountain lion predation was not a problem and that management measures, therefore, were not warranted.

Response: This issue was discussed vigorously by the team and agencies. Because documented mortalities were particularly high in certain ewe groups, the team and agencies decided the prudent course of action dictated a measured management response, which would be modified as more data became available.

Issue: Predator management should be given higher priority than land management restriction because mortality to predators is the more likely limiting factor on bighorn populations.

Response: The draft recovery plan and available evidence indicate that individual subpopulations are affected by a variety of influences that affect population levels and that the combinations and relative strength of these influences typically differ among ewe groups and change over time. Therefore, the recovery plan focuses on the range of threats facing bighorn sheep. The recovery plan prescribes predetermined criteria for initiating predator management and recognizes the importance of habitat protection so that recovered populations have sufficient space to inhabit.

Issue: The long-term decline in habitat quality and deer populations in the Santa Rosa Mountains should be identified as a cause of high levels of mountain lion predation on bighorn sheep, with a strategy to reverse the situation. The recovery plan should more clearly establish the relationship of bighorn sheep to mule deer by superimposing a deer distribution map.

Response: Mule deer typically occur at higher elevations than bighorn sheep, though ranges may overlap regionally and seasonally, such as during the winter when deer in some areas move to lower elevations. Traditional predator/prey theory holds that predator populations increase and decrease in response to fluctuating prey populations. However, there are no data indicating that high levels of predation are due to declines in habitat quality or deer populations, or whether prey switching may be occurring in the Peninsular Ranges. Because data on habitat quality, as well as deer and mountain lion populations in the Peninsular

Ranges are not sufficiently robust to provide insight into these questions, the draft and final recovery plans propose focused research to address this ecological issue.

Issue: The recovery plan does not provide compelling evidence that the predator/prey system is not viable, and therefore, predators should not be managed unless a cause and effect relationship with bighorn population declines is established.

Response: The high incidence of predation, comparatively lower adult survivorship rates than in other regions, and long-term population declines suggest to land managers that predation is a limiting factor to population growth in some areas of the Peninsular Ranges. The cooperating agencies have agreed that this evidence is sufficient to prompt responsible but cautious management intervention.

Issue: One commenter argued that counter to claims in the draft recovery plan, the only available scientific evidence indicates a declining trend in statewide mountain lion populations.

Response: The evidence presented by the commenter lacked associated statistical analysis; therefore, the statistical resolution of the data cannot be evaluated and no conclusion on population trend is possible.

TRAIL ISSUES

Issue: The constant presence of bighorn sheep along Highway 111 in Rancho Mirage indicates human activities, such as hiking and jeep use, may not create movement barriers, as suggested in the draft recovery plan. Further information is requested to support why back roads and trails are detrimental to sheep when they are known to cross 6-lane highways (e.g. Highway 111 in Rancho Mirage).

Response: The recovery plan cites numerous studies that have documented avoidance behavior to human related disturbance (see Papouchis *et al.* 1999 for example). Numerous records of vehicular related mortality provide further evidence of adverse effects. The recovery plan seeks to remedy the maladaptive

behavior of habituation to urban sources of food and water so that sheep are better able to survive in the wild.

Issue: A trails map to clarify and accompany Table 10 is needed.

Response: Though a good idea, an accurate trails map is not currently available. The cooperating agencies are pursuing the development of such a map.

Issue: Detailed maps of lambing, rearing, and watering habitat are needed to justify any decisions to close trails.

Response: The distribution of lambing, rearing, and watering habitat is incompletely known and, therefore, cannot be accurately mapped. The final recovery plan has been modified to include a more complete set of information upon which trails decisions should be based.

Issue: A permit system should be used for controlling trail use on all trails for which conflicts were identified in the recovery plan.

Response: The cooperating agencies are working with interest groups in the formulation of a range of alternative trails strategies that include this option.

Issue: The recovery plan should consider that in the San Jacinto Mountains, the existing trails network appears to provide a passive disturbance boundary that may control sheep access to the urban interface and prevent exposure to the urban hazards experienced in the northern Santa Rosa Mountains. Consequently, seasonal or permanent trail closures could have unintended adverse effects.

Response: A trails management plan prepared by the land management agencies and interest groups will consider the merits of this comment. Certain adjustments to the existing trails network and associated monitoring could be implemented to improve upon this concept.

Issue: More specificity is needed in describing where human disturbance and other indirect effects of urbanization is conflicting with sheep conservation.

Response: Human intrusion and associated disturbance has the potential to extend wherever access into habitat is provided. Though lambing and watering habitats are particularly vulnerable, excessive human use throughout the year may also affect bighorn persistence.

Issue: Will mitigation credits be given for the eradication of invasive non-native plants?

Response: Conservation measures for proposed projects will be determined on a case by case basis through regulatory processes of local, State, and Federal agencies.

Issue: The January through June trail conflicts in the San Jacinto Mountains appear excessive if the lambing season there extends only through mid-March.

Response: The draft recovery plan stated on page 12 that DeForge *et al.* (1997) found a similar onset to the lambing season in February in the San Jacintos. Cunningham found that lambing in Carrizo Gorge extended only to mid-March. Lambs are critically dependent upon their mothers for several months after birth.

Issue: Rather than monitoring to ensure compliance with seasonal trail closures before allowing construction of trail reroutes out of lambing habitat, the recovery plan should allow simultaneous construction of alternative trail routes to enhance the effectiveness of seasonal closures on existing trails in lambing habitat.

Response: The final recovery plan has been modified to incorporate flexible approaches that will be provided in more detail in the trails management plan prepared by the cooperating agencies and interests. Without adequate management and monitoring, this approach could result in more trails and no reduction in use of problematic trails.

FENCING ISSUES

Issue: The draft recovery plan does not provide evidence for the effectiveness of the proposed fencing as a mitigation measure and fails to address the associated

financial and visual burdens. Except in areas with vehicular related mortalities, the need for fencing is questionable, considering the potentially detrimental effects of severing habitat, restricting sheep movement, and rendering sheep more vulnerable to predation against fences. Alternatives to fences, such as nonmotorized trails adjoining development, which would provide a deterrent to sheep movement into urban areas, warrant more analysis. By imposing the mandate for fencing on private property without adequate justification, the draft recovery plan acted in an arbitrary manner in excess of statutory authority.

Response: The cooperating agencies are open to alternative means of controlling sheep movements into urban areas. However, some landowners and jurisdictions have chosen fencing as an affordable and reliable solution to the problem of behavioral habituation. When installed, fences have proven effective and aesthetic concerns have been addressed through alternative designs and alignments. Fencing along the urban interface is intended to benefit sheep by curtailing movement into areas with unnatural sources of mortality and help reduce herd mortality rates to sustainable levels. The demonstrated loss of animals to vehicular related mortality, poisoning from landscaping plants, drownings, etc., establish a legal nexus to warrant measures to prevent these adverse effects.

NON-NATIVE ANIMAL ISSUES

Issue: *The recovery plan needs to establish a buffer zone between bighorn sheep habitat and cattle grazing, as was done for domestic sheep grazing, so that the risk of disease transmission is minimized.*

Response: There is no conclusive evidence to support a buffer zone for disease protection from cattle as there is for domestic sheep. The recovery plan recommends research on disease transmission between livestock and bighorn, and if a buffer zone is shown to be warranted, future iterations of the recovery plan will be amended accordingly.

Issue: *Cattle grazing and associated fencing should not be allowed for various reasons, including disease hazards and risk of physical injury to bighorn sheep.*

Response: We agree that fencing should be minimized and eliminated if possible. If fencing is necessary, design guidelines have been developed that minimize and prevent the risk of injury. The recovery plan establishes the need to thoroughly review the appropriateness of cattle grazing in sheep habitat and take action if prudent.

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October 2000