Appendix C – Need and Justification for the Use of Helicopter Net-Guns to Capture Sierra Nevada Bighorn Sheep

Introduction

This document is to present the necessity of authorizing the proposed helicopter landings in portions of wilderness areas on the Inyo National Forest for the purposes of capturing Sierra Nevada bighorn sheep (SNBS). While other capture methods have been used in the past, helicopter net-gun is the preferred method used by the California Department of Fish and Game (CDFG) and is the most commonly used capture technique for large numbers of animals (Foster 2005). The following three key points are presented in this document: 1) The amount of proposed helicopter net-gun use is necessary to meet recovery plan objectives; 2) Helicopter net-gunning is necessary for translocation captures to meet recovery plan objectives; and 2) Helicopter net-gunning is necessary for monitoring captures to meet recovery plan objectives.

Recovery Plan

Recovery (meeting downlisting criteria) within a reasonable period is defined in the 2007 Recovery Plan for Sierra Nevada Bighorn Sheep as ten years (2017) with optimal population growth rates. Delisting could be expected in an additional ten years (2027). The plan does recognize that under less than optimal scenarios, including unexpected catastrophes, one or more additional decades might be needed (Ibid, page viii).

One of the conservation goals of the recovery plan is to restore SNBS in a geographic distribution throughout much of its native range with genetic representation that assures its long-term viability as a unique life form (USFWS 2007, page 37). As stated in the recovery plan, recovery of SNBS, within a reasonable period, ultimately depends on translocation of bighorn sheep into unoccupied herd units that are needed for recovery, or to aid in the recovery of occupied herd units (USFWS 2007, page 47). Achieving the geographic distribution necessary for recovery requires translocation to unoccupied herd units because bighorn sheep are naturally slow to disperse and colonize new habitat, especially if doing so requires crossing the natural habitat breaks between recovery units or if herds are geographically isolated from other SNBS populations (USFWS 2007, page 47). Currently there are no SNBS in the Kern Recovery Unit and

the Olancha Peak herd unit (Southern Recovery Unit); CDFG does not anticipate SNBS to naturally colonize these areas within the next ten years.

Monitoring SNBS populations is an essential component of the Recovery Plan which requires an adaptive conservation approach that relies on scientific data collection to assess population viability and extinction risk. SNBS populations are monitored for progress towards numerical downlisting criteria (305 ewes distributed across 12 essential herd units in 4 recovery units), risk of disease transmission from domestic sheep and goats, patterns of habitat use, rates of reproduction and survival, causes of mortality, predation by mountain lions, and to determine which populations can be used for translocations. For all of these monitoring activities, collars (VHF and/or GPS) are required. SNBS must be captured to deploy collars.

Capture Methods

The CDFG is authorized by the U.S. Fish and Wildlife Service (USFWS) to capture SNBS by using methods that "have been proven to reduce the potential for injury to sheep given the specific set of circumstances during capture and processing, including: net-guns from helicopters, trucks, or on the ground[1]; and drop-nets, or tangle-nets (drive-nets)"; and chemical immobilization (darting) (USDI 2007b). As explained in Appendix B, CDFG has used helicopter net-guns almost exclusively since 2002, but has also conducted captures using drive-nets, drop-nets, and darting in the past. Darting is no longer considered to be a feasible method for capturing SNBS (personal communication Stephenson 2012) because of the high risk of injury or mortality to SNBS. Darting is generally more effective in bighorn sheep populations that are more accustomed to human presence and do not flee to steep escape terrain when approached by humans. This habituation behavior allows for safer captures with darting, as the animals have a lower potential of falling off steep cliffs when the drug takes effect (personal communication Stephenson 2012). The USFWS has limited the use of darting to situations in which netting methods are not feasible or safe because of terrain, or location of capture; on a site-specific basis following an assessment that capture through this method would have desired results; and a qualified individual conducts the darting. CDFG veterinarians who would be involved in the capturing of SNBS have stated that they would not authorize the use of this capture method unless it was absolutely necessary and would not recommend using this for routine monitoring or translocation captures (personal communication with Stephenson 2012). CDFG is not proposing to use darting for any monitoring or translocation captures because of the high risk of injury or mortality this capture method may have on SNBS.

[1] CDFG does not fire net-guns from trucks or on-the-ground to capture SNBS because: 1) there is no road access within wilderness areas to use trucks and 2) the range of a net-gun from the ground is about ten feet. CDFG cannot approach SNBS at that close distance, or follow them quickly enough to allow for a successful capture of SNBS (Personal communication with Alexandra Few, CDFG SNBS biologist, June 6, 2012).

I. Necessity of using a helicopter net-gun to capture Sierra Nevada Bighorn Sheep

The following sections outline the reasons why it is necessary to use a helicopter net-gun to complete captures of SNBS by demonstrating the limitations in the other capture methods (drop-net and drive-net) and describing the project objectives and recovery actions that could only be achieved with the use of a helicopter.

A. Is the amount of helicopter netting for translocation and monitoring in the proposed action necessary to meet Recovery Plan objectives?

The primary objective of the recovery plan is to increase the number and distribution of Sierra Nevada bighorn sheep to ensure the long-term viability of the subspecies. Achieving the geographic distribution necessary for recovery requires translocation to unoccupied and under-populated herd units because bighorn sheep are naturally slow to disperse and colonize new habitat (USFWS 2007, p. 47). To ensure the viability and sustainability of herds used as sources of translocation stock and to assess progress towards recovery goals CDFG needs to be able to detect changes in population size and demographic rates, which is determined through the placement of VHF/GPS collars. As stated in the Purpose and Need Section of the EA (pages 13-21) the project objectives are directly tied to the recovery goals established in the recovery plan. The three objectives establish those activities which CDFG has identified as essential to achieve over the next ten years in order to further the recovery of SNBS. The amount of helicopter use needed to achieve each project objective is discussed below.

1. Amount of Helicopter Net Gunning to Achieve Project Objective 1: Maintaining VHF/GPS collars on 35% of SNBS ewes and collar all SNBS rams in the Northern Recovery Unit than other recovery units.

Herd sizes are monitored to track progress towards recovery goals, determine where and when to implement specific conservation activities (predator management, habitat enhancement, translocations, etc.), and identify sources of translocation stock. CDFG uses minimum counts to determine population size (Appendix B). Marked-resight methods are used to estimate abundance of herds (Appendix B). Demographic rates necessary to evaluate the health of populations used for translocation stock include survival and recruitment rates. Obtaining mark-resight estimates, survival rates, and recruitment rates require VHF/GPS collars on a percent of the ewes in a population.

To determine what percent of ewes need to be collared CDFG performed a parametric analysis (description and examination of relationships between different parameters) of population sizes and coefficient of variation (CV) necessary to detect a 10% change in

either population size or survival and recruitment rates. The maximum CV of a population estimate or demographic rate (survival or recruitment) to detect a 10% change in that population estimate or demographic rate is 8%. To obtain population estimates with a CV of <8% in populations of >25 ewes, 35% of the ewes need to be collared.

In the Northern Recovery Unit, ram movements in herds near domestic sheep grazing allotments (Mt. Gibbs and Mt. Warren) are monitored in real time using satellite-linked GPS collars to determine the risk of disease transmission from domestic sheep and goats. Rams travel long distances in search of female sheep, including domestic sheep, during the breeding season (the rut). Nose to nose contact between domestic and wild sheep can result in transmission of pathogens that result in respiratory disease in wild sheep. Respiratory disease in wild sheep can lead to catastrophic die offs of all age classes. To accurately assess the probability of a transmission event, CDFG has an objective to collar all rams at Mt. Warren and Mt. Gibbs. Helicopters are needed to capture SNBS in these two herd units because SNBS do not utilize low elevation winter habitat, limiting the ability to capture bighorn sheep by drop-or drive-nets.

To estimate how many SNBS need to be collared over the next 10 years in order to begin achieving the objective of collaring 35% of ewes, CDFG projected population growth in each herd unit based on minimum count and mark-resight data collected in 2010 and 2011. CDFG estimated a population growth rate of 6% for herds used as sources for translocations (Mt. Langley, Mt. Baxter, Sawmill Canyon, and Wheeler Ridge). CDFG averaged the last 10 years of population growth data for these herd units and chose the lower end of the range of growth rates to err on the conservative side (personnel communication Few 2012).

For all other currently occupied herds, where populations are smaller, population growth was estimated at 2%. Population growth is needed in order to achieve recovery within a reasonable time period (personal communication Few 2012). Based on habitat quality, herds at the currently unoccupied Olancha Peak and Taboose are predicted to grow at 6% and 2%, respectively, once SNBS are reintroduced. Based on these rates of population growth and population estimates obtained in 2010 and 2011, CDFG expects to collar 327 bighorn over the next 10 years.

Helicopters are needed to successfully capture specific animals targeted for collar repair/replacement. Two landings are required within wilderness areas when capturing for monitoring purposes; one when the animal is captured and one when the animal is released (EA Section 2.2.2). Based on the minimum number of SNBS that need to be collared to maintain VHF/GPS collars on 35% of SNBS ewes and all SNBS rams in the Northern Recovery Unit, the minimum number of helicopter landings over a ten year period is 654.

CDFG is also conducting research on SNBS in Sequoia and Kings Canyon (SEKI) National Parks. This research includes collaring SNBS that can occur in both the Inyo National Forest and SEKI. The minimum number of landings needed to conduct this work is included in the 327 captures mentioned above. Therefore the minimum number of helicopter landings remains 654.

2. Amount of Helicopter Net-Gunning to Achieve Project Objective 2: Augment SNBS populations in the Mt. Warren, Mt. Gibbs, and Convict Creek herd units

Downlisting criteria in the recovery plan states that the population of SNBS must include a minimum total of 305 females at least one year of age. At least 50 of those females must be in the Kern Recovery Unit, 155 females in the Southern Recovery Unit, 50 females in the Central Recovery Unit, and 50 females in the Northern Recovery Unit. Currently there are approximately 182 female SNBS located in the recovery area; zero within the Kern Recovery Unit, 124 in the Southern Recovery Unit, 33 in the Central Recovery Unit and 25 in the Northern Recovery Unit. Based on a projected population growth rate of 2% (see A.1 above), CDFG recognizes that augmentations are needed in the Mt. Warren and Mt. Gibbs herd units (Northern Recovery Unit), as well as the Convict Creek herd unit (Central Recovery Unit) increase the number of females within these already occupied herd units. These growth rates indicate that ten female SNBS are needed to augment these recovery units (five SNBS into the Northern Recovery Unit and five into the Central Recovery Unit).

Helicopters are needed to both successfully capture and release SNBS into the Mt. Gibbs and Convict Creek herd units. Therefore 14 helicopter landings is the minimum number of helicopter landings necessary within wilderness for augmentations into these herd units. Only three landings are necessary to augment the Mt. Warren herd unit with three females, as SNBS can be released via vehicles in this herd unit. A total of 14 landings are needed to augment SNBS populations in the Mt. Warren, Mt. Gibbs, and Convict Creek herd units.

3. Amount of Helicopter Net-Gunning to Achieve Project Objective 3: Introduce SNBS populations into the Taboose Creek, Olancha Peak, Big Arroyo, and Laurel Creek essential herd units.

In order to determine the minimum number of SNBS necessary for introductions into these four unoccupied herd units, CDFG reviewed scientific research and past success of introductions of SNBS. Based on past introductions of SNBS within the Sierra, twenty animals moved into new areas allowed for successful re-introductions (Bleich et al 1990). The Taboose Creek herd unit is located adjacent to the Sawmill Canyon herd unit. CDFG has documented movements of SNBS between these two herd units and is assuming some natural colonization may occur over the next ten years. However, in order to ensure recovery of SNBS occurs within a reasonable time period, CDFG

determined 25 SNBS is the minimum number necessary for introduction into the Taboose Creek herd unit. This number is based on previous introductions conducted in the Sierra which showed that successful introductions occurred when 20 SNBS were introduced (Appendix B).

Other literature shows that demographic and genetic considerations need to be accounted for in choosing the number of bighorn sheep to move into a new area. This literature recommends that 30 bighorn sheep, of mixed sex, be used for introductions (Rubin et al 2002 and Ramey et al. 2000). Based on this data, the minimum number of SNBS needed for re-introduction into the Olancha Peak herd unit (Southern Recovery Unit) is 30 SNBS.

The Kern Recovery Unit (Big Arroyo and Laurel Creek herd units) is geographically separated from the Southern Recovery Unit and population modeling conducted by CDFG indicates a low likelihood of natural colonization unless management action is taken to introduce SNBS in these units (EA, Section 1.3). The minimum number of SNBS CDFG would re-introduce into the Kern Recovery Unit is 60 SNBS of mixed sex (30 into the Laurel Creek herd unit and 30 into the Big Arroyo herd unit).

In order to meet the distribution of SNBS needed for recovery, a minimum of 115 SNBS need to be introduced in the Kern and Southern Recovery Units; with 87 of these captured on the Inyo National Forest and 28 captured in the portions of the source herd units within the Sequoia and Kings Canyon National Parks. Therefore the minimum number of helicopter landings necessary for introductions on the Inyo National Forest is 87. Helicopter landings will only occur when animals are captured, as the releases in herd units on the Inyo National Forest would be from vehicles or by helicopters outside of wilderness boundaries.

B. Is helicopter net-gunning necessary to meet recovery goals and project objectives for translocation captures?

Without the use of helicopter net-gun, other methods (drop-net and drive-net) would not allow CDFG to:

- Introduce SNBS in the currently unoccupied Olancha Peak, Taboose Creek, Big Arroyo, and Laurel Creek essential herd units.
- Capture the specific animals necessary for translocation purposes.
- Safely transport SNBS into the Mt. Gibbs and Convict Creek essential herd units for the purposes of augmenting those herds.
- Meet the recovery goal of increasing the distribution of SNBS, as defined in the recovery plan, within a reasonable time period.

1. Need for use of helicopter net-guns to introduce SNBS in the currently unoccupied Olancha Peak, Taboose Creek, Big Arroyo, and Laurel Creek essential herd units

As explained previously and in Appendix B, drop-nets and drive-nets are limited to use in low elevation winter range and are most likely to be successful where SNBS occur in large groups. Due to the changes in SNBS use of low elevation winter range (Appendix B) and the smaller group sizes in which they occur when using this winter range, CDFG would not be able to capture the minimum number of SNBS necessary for re-introductions into these herd units without the use of helicopter net-guns. As a result, delisting criteria would not be achieved without the use of helicopter net-guns (EA, section 3.3.2). This conclusion is supported by the following:

- As explained under A.3 above, CDFG has determined that a minimum group size of 25-30 SNBS of mixed sex is needed for introductions into currently unoccupied herd units. Because of the limitations described below, CDFG would not be able to capture enough SNBS of mixed sex to provide the minimum group size needed for introductions in Olancha Peak, Taboose Creek, Big Arroyo, and Laurel Creek without the use of helicopter net-guns. This is because drop-net and drive-net capture methods:
  - Are only feasible in low elevation winter range found in 4 of the 12 essential herd units (EA section 2.2.1 and Appendix B).
  - Would be attempted only once every four years in a given herd unit to avoid adverse effects to SNBS use of low elevation winter range (EA section 2.2.1).
  - Require large capture crews (estimated at 15 people) and more time for set-up (a few days) and two to six weeks of observing SNBS before capturing occurs.
  - Are expected to result in the capture of an average of 3 sheep per year (one capture event) compared to an average of 30 per year for helicopter net-gunning (two, three-day capture events) (EA section 3.3.1 and Appendix B) because:
    - These methods limit the number of capture attempts that can occur within each herd unit at one time due to the cost of each capture event and the number of personnel needed for each capture event.
    - These methods do not allow for flexibility in the areas you can capture SNBS, if SNBS move out of the capture site during the capture event.
    - Do not allow specific animals to be targeted for capture (see item 2 below).

2. Need for use of helicopter net-guns to capture the specific animals necessary for translocation purposes

As stated in the recovery plan, recovery of SNBS within a reasonable time period ultimately depends on translocation of bighorn sheep (USFWS 2007, page 47). Successful translocation depends on moving the most desirable animals into new locations based on their genetic diversity, presence of disease, and reproductive status (EA section 1.3 and Appendix B). Without the use of helicopter net-guns, CDFG would not be able to:

- Consistently capture the specific animals targeted for introduction or augmentation because of fitness, sex, health, genetics, etc. (EA section 3.3.1). CDFG would move whichever animals they capture by drop-net or drive-net, rather than move the animals they need to capture.
- Identify the animals best suited for translocation based on source population size, fitness, health, genetics, etc. This is because helicopter net-guns are needed to maintain the VHF/GPS collars needed to accurately estimate population size and collect health data (see item A.1 and C).

In addition, drop-nets and drive-nets have been shown to have increased rates of capture myopathy or introduce unnecessary risk of injury or mortality to bighorn sheep (Kock et al. 1987, Jessup et al. 1988). These methods may increase the risk of injury or mortality to animals that were not targeted for capture, but were part of the group the target animal was associated with.

3. Need for use of helicopter net guns to safely transport SNBS into the Mt. Gibbs and Convict Creek essential herd units for the purposes of augmenting those herds

To allow for successful augmentations, SNBS need to be transported and released in areas either within or immediately adjacent to currently occupied areas. In the Mt. Gibbs and Convict Creek herd units, the existing SNBS population occurs at higher elevations, not adjacent to roads or suitable trail systems.

Transporting SNBS via non-motorized methods (pack stock, sleds, etc.) to release sites within or immediately adjacent to the currently occupied areas is not feasible because:

- It would increase the time SNBS are restrained during transport.
- This increased restraining time increases the risk of injury or mortality due to raised body temperatures, which can lead to capture myopathy (EA section 3.2.1.1).

Therefore, the Mt. Gibbs and Convict Creek essential herd units could not be augmented to sustainable levels without the use of helicopter net-guns. Downlisting

criteria (number of females present within the Northern Recovery Unit) would not be met.

4. Need for use of helicopter net-guns to meet the recovery goal of increasing the distribution of SNBS, as defined in the recovery plan, within a reasonable time period.

Downlisting criteria for SNBS require a minimum total of 305 females at least one year of age distributed across the four recovery units (EA, Section 1.3). Delisting requires the minimum total number of females be maintained for at least seven years without intervention and that bighorn sheep of both sexes are present in all 12 essential herd units (EA, Section 1.3). Helicopter net-guns are necessary to distribute female SNBS across the four recovery units and introduce SNBS of both sexes in the 12 essential herd units. This is because:

- Currently eight of 12 essential herd units are occupied by SNBS. Bighorn sheep are naturally slow to disperse and colonize new habitat. CDFG does not expect, within a reasonable time period, for the Taboose Creek, Olancha Peak, Laurel Creek, and Big Arroyo herd units to become occupied naturally by SNBS of both sexes (EA Section 1.3 and USFWS 2007).
- Without the use of helicopter net-guns, CDFG would not be able to capture enough SNBS of mixed sex to provide the minimum group size needed for introductions in Olancha Peak, Taboose Creek, Big Arroyo, and Laurel Creek. These four essential herd units would remain unoccupied. See B.1 above.
- The distribution of female SNBS across the four recovery units would not be achieved. The Kern Recovery Unit (Big Arroyo and Laurel Creek herd units) would remain unoccupied.

C. Is helicopter net-gunning necessary to meet recovery plan objectives for monitoring captures?

Without the use of helicopter net-gun, other methods (drop-net and drive-net) would not allow CDFG to:

- Capture the needed number of animals, specifically ewes, to continue to monitor population trends and dynamics, crucial to meeting recovery goals.
- Capture specific animals which are in need of collar repair/replacement.
- Meet the following recovery goals: 1) estimate the number of ewes within each herd unit and throughout the recovery area, 2) knowledge of the overall health of the population, and 3) habitat use patterns and disease risk (EA page 14).

1. Need for use of helicopter net guns to capture the needed number of animals, specifically ewes, to continue to monitor population trends and dynamics, crucial to meeting recovery goals

As explained previously and in Appendix B, drop-nets and drive-nets are limited to use in low elevation winter range within four herd units. The restriction of capturing SNBS ewes only in these herd units limits the number of ewes captured throughout the recovery area and therefore reduces the ability to monitor SNBS populations for recovery purposes (USFWS 2007). Without the use of a helicopter net-gun CDFG would not be able to increase the amount of collared ewes within the entire recovery area and monitor the entire population trend and status. This lack of population data would not meet delisting and downlisting criteria (EA section 3.3.1 and USFWS 2007). This conclusion is supported by the following:

- As explained under A.1 above, CDFG has determined that a minimum of 35% of SNBS ewes need to be collared in order to detect changes in population size or survival and recruitment rates. Because of the limitations described below, CDFG would not be able to capture the number of SNBS ewes throughout the recovery area to provide for this detection without the use of helicopter net-guns. This is because drop-net and drive-net capture methods:
    - Are only feasible in low elevation winter range found in 4 of the 12 essential herd units (EA section 2.2.1 and Appendix B).
    - Would be attempted only once every four years in a given herd unit to avoid adverse effects to SNBS use of low elevation winter range (EA section 2.2.1).
    - Require large capture crews (estimated at 15 people) and more time for set-up (a few days) and two to six weeks of observing SNBS before capturing occurs.
    - Would only increase the amount of collared SNBS ewes within four herd units and not throughout the entire SNBS recovery area.
    - Are expected to result in the capture of an average of 3 sheep per year (one capture event) compared to an average of 30 per year for helicopter net-gunning (three-day capture event) (EA section 3.3.1 and Appendix B) because:
        - These methods limit the number of capture attempts that can occur within each herd unit at one time.
        - These methods do not allow for flexibility in the areas you can capture SNBS, if SNBS move out of the capture site during the capture event.
        - Only allow for an increase in the number of SNBS collared within the four low elevation winter range herd units. CDFG would place new collars on any SNBS ewe captured.

- Do not allow specific animals (i.e. ewes) to be targeted for capture (see item 2 below).

2. Need for use of helicopter net-guns to capture specific animals which are in need of collar repair/replacement

As stated in the EA (section 1.3) GPS collars are in need of replacement once every two years and VHF collars, although have a longer battery life, may need repair every few years. Successful replacement and repair of collars depends on CDFG capturing specific animals each year (EA section 1.3). Without the use of helicopter net-guns, CDFG would not be able to:

- Consistently capture the specific animals targeted for collar repair or replacement (EA section 3.3.1). CDFG would rely upon the specific animal needing to be captured to be located within the group of animals caught at that time.
- Maintain collars throughout the recovery area, where data is needed to meet both downlisting and delisting criteria (EA section 1.3 and USFWS 2007).

3. Need for use of helicopter net-guns to meet the following recovery goals: 1) knowledge of the overall health of the population and 2) determine habitat use patterns and disease risk (EA page 14).

As stated in the recovery plan, monitoring of the health of SNBS, habitat use patterns, and disease risk is an essential piece to meeting downlisting and delisting criteria. The information gathered from collars informs SNBS management actions by CDFG including translocations (EA section 1.3). Without the use of helicopter net-guns, CDFG would not meet recovery goals. This conclusion is supported by the following:

- As explain above under A.1 and B.1, captures using drop-nets and drive-nets would be restricted to only four herd units. This reduces the information gathered on habitat use patterns, individual animal health and disease risk in the remaining herd units throughout the recovery area.
- CDFG would not be able to collar SNBS rams within the Northern Recovery Unit, reducing the ability to monitor disease outbreaks in this area. SNBS do not utilize low elevation winter range, limiting the ability to conduct captures with non-motorized methods.
- The inability to collar SNBS ewes in all herd units would decrease the effectiveness of using mark-resight surveys to estimate abundance, which is essential in determining the current population trend and status.

Conclusion

In order to meet project objectives and recovery goals helicopter net-guns are needed for the capturing of SNBS. If helicopters are not used in managing SNBS populations

then recovery would not be met within a reasonable time period, putting SNBS populations at risk of local extinctions caused by stochastic environmental events, predation by mountain lions, or disease outbreaks. Increasing the geographical distribution and populations within herd units will allow for recovery to occur and decrease the risk of local extinctions. Although non-motorized methods can be used for capturing SNBS, they do not allow the ability to meet project objectives and recover SNBS within a reasonable time period. Restoring SNBS to their native range will have long-term beneficial effects on the natural quality of the Ansel Adams, Hoover, Golden Trout, John Muir, and South Sierra Wildernesses.

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