

## **APPENDIX 'D'**

**The assumptions and procedure for calculating PMU population estimates**

## **CALCULATIONS OF PMU SAGE GROUSE POPULATION ESTIMATES**

### **(Submitted by Nevada Department of Wildlife)**

*The table on the following page provides two examples to follow while reading the text below.*

Base populations of Greater Sage-grouse are estimated by starting with the known leks in an area. That number is multiplied by the percent of active leks to give the total number of leks expected to be active (active leks). The percent of active leks is determined by recent lek counts of known leks and the percentage of those documented as active.

The next step is to calculate the average number of cocks/lek from the most recent lek counts (total number of cocks observed divided by the number of leks). The average number of cocks/lek is multiplied by the total number of active leks, which equals the total number of cocks one could expect to observe on all leks, if all leks were counted.

The next step is to expand the number observed on leks by assuming that 75% of cocks are observed on a lek at any given visit. The use of this figure is based on suggestions by Connelly et. al. (2003) and review from the External Scientific Peer Review Team. The product of this calculation provides the base population of males.

The next step involves estimating the base population of females. This involves multiplying the total number of males (product of above calculation) by 2 (assuming a 2:1 sex ration of females to males. This ratio is suggested by both Connelly et. al. (2003) and the External Science Peer Review Team. Recent population studies in Colorado suggest there are as high as 2.73 females/male in the spring population; however, the use of 2.0 provides a more conservative minimum population estimate.

The next step merely adds the base numbers of males and females to provide a total unexpanded base adult population.

The last step involves applying an estimated detection rate to the total number of known leks. The biologist estimates a low and high detection rate based on an assessment of the lek survey work conducted in a given area over time. The size of an area, the areas' remoteness, and the amount of time spent conducting survey in the area either by ground or air all contribute to this factor. For example, where extensive efforts have taken place in relatively small areas with a certain amount of suitable habitat, the biologist may surmise that at least 75% and as much as 90% of leks have been detected and surveyed in the area. On the other hand, in large and remote areas with vast expanses of suitable Greater Sage-grouse habitat, the biologist may reason that only 50% and not more than 75% of the leks have been detected in the area.

It should be made clear that this methodology only provides a minimum population estimate that can be considered crude because of uncertainty associated with lek attendance patterns (Beck and Braun 1980, Emmons and Braun 1984, Walsh 2002), possible differences in sex ratios among years and areas (Swenson 1986), and some lack of uniformity in counting procedures.

Example Table of Calculations to Estimate PMU Sage Grouse Populations

<b>PMU</b>	<b>Total Known Leks</b>	<b>% Active</b>	<b>% Active X Total Known Leks</b>	<b>Average Males/ Lek</b>	<b>% Active Leks X Average Males/ Lek</b>	<b>X 2 = Total Males (75% of males obs)</b>	<b>X 2.00 (females/male on lek) = Total Hens</b>	<b>Males + Females = Total Adults (before detection rate)</b>	<b>Highest Expected Detection Rate 1 (use decimal for %)</b>	<b>Lowest Expected Detection Rate 2 (use decimal for %)</b>	<b>X detection rate 1 = Low pop est</b>	<b>X detection rate 2 = High pop est.</b>
Area 1	18	0.85	15.3	10.0	153.0	204	408	612	0.9	0.75	680	816
Area 2	240	0.6	144.0	11.6	1670.4	2227.2	4454	6681.2	0.7	0.6	9545	11,135