

Aerial Census of Wild Horses in Western Utah

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Abstract

The accuracy of aerial censuses in estimating absolute density of wildlife populations varies widely. Aerial censusing of wild horses was done to compare the effects of experience and aircraft type. The difference between aircraft types was not found to be statistically significant, while observer experience was significant at the 5% level. The variability caused by these factors places considerable uncertainty on projections of rate of increase based upon a comparison of two or more aerial censuses.

Aerial survey is the only practical means of counting larger animals in wilderness terrain (Fuller 1950), but is, at best, a rough method of estimating the size of a population (Caughley 1974). The literature contains no information on aerially censusing wild horses, but there is a wealth of data concerning large mammals. The various factors which affect the accuracy of aerial counts include variables related to observer (experience, fatigue, individual variation), animal (density, color, size, diurnal behavior pattern), technique (transect width, speed, height), physiography (terrain, vegetation), weather (clouds, turbulence, snow cover, light conditions), and equipment (aircraft type, pilot). In an aerial census of moose in 1-square mile enclosures, LeResche and Rausch (1974) found that seasoned observers without recent counting experience are as inaccurate as unseasoned observers. The accuracy of aerial censuses in estimating absolute density of wildlife populations varies from 29 to 88% (Caughley 1977).

In recent years, aerial censusing of wild horse populations has indicated that populations are experiencing phenomenal growth. Heady and Bartolome (1977) indicate an increase in numbers from 66 to 120 and 225 on the Three Fingers and from 94 to 113 and 150 on the Jackies Butte horse management areas in Oregon for the consecutive years of 1972, 1973 and 1974, respectively. The above authors state that "although inaccurate counting and addition of adults to the herds cannot be ruled out in either area, the major increase reflects natural reproduction. The data for Jackies Butte are believed accurate and they suggest a reproductive rate of 60% in 3 years or 20% per year." Two other examples of published data on rate of increase include an increase of 28%, 29%, and 18% for 1973, 1974, and 1975 respectively, in Idaho's Challis Planning Unit (U.S. Dep. Interior 1975) and 30% and 22% for 1974 and 1975, respectively, in California's Susanville District (U.S. Dep. Interior 1976).

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The aerial surveys in the Challis Planning Unit were made by fixed-wing aircraft in 1973-74 and by helicopter in 1975. The type of aircraft used in the Susanville District was not identified.

It is our contention that a large portion of the above increases can be attributed to the noncompensating errors naturally inherent in aerial surveys. The present study is not intended to give an absolute count of a population, since aerial surveys of large mammals consistently underestimate densities (Golley and Buechner 1968; Bergerud 1963; LeResch and Rausch 1974; Gilbert and Grieb 1957). The purpose was to evaluate differences in the results of wild horse aerial censusing with regard to (1) the experience of personnel and (2) the type of aircraft used, particularly as related to projections of wild horse population increase.

Study Area

The study area is situated on the Dugway Proving Grounds in west-central Utah (Fig. 1). The specific study sites within this area were the Granite Mountain and a portion of the Cedar Mountains with elevations ranging from 1,342 to 2,140 meters. These two areas were selected because the wild horse populations were isolated due to topography. The areas were geographically dissimilar, particularly in size and terrain. Granite Mountain occupies approximately 110 km² and resembles a butte. The slopes are rocky and very steep, with most horse activity on the adjacent flats. The Cedar Mountains, in comparison, have relatively accessible slopes, with many canyons along the range. This site comprises approximately 330 km² with horse activity observed throughout.

Vegetation on Granite Mountain consisted of plant species common to the northern desert shrub community. Big sagebrush (*Artemisia tridentata*), black sagebrush (*Artemisia nova*), shadscale (*Atriplex confertifolia*) and winterfat (*Ceratoides lanata*) were the common shrubs in the area. Grasses and forbs included wheatgrass (*Agropyron* spp.), galleta (*Hilaria jamesii*), cheatgrass (*Bromus tectorum*), scarlet globemallow (*Sphaeralcea coccinia*), and lupine (*Lupinus* spp.). Visibility of horses not limited due to the open terrain and lack of trees.

Cedar Mountain was dominated by a juniper woodland, which was interspersed with open sagebrush parks along the ridges and canyon bottoms. Open flats bordered both sides of the mountain and contained vegetation common to the northern desert shrub community. Trees and shrubs included Utah juniper (*Juniperus osteosperma*), big sagebrush, rubber rabbitbrush (*Chrysothamnus nauseosus*), shadscale, and black sagebrush. Wheatgrass, cheatgrass, galleta, Indian ricegrass (*Oryzopsis hymenoides*), scarlet globemallow, bladderpod (*Lesquerella* spp.) and tansymustard (*Descurainia* spp.) were common grasses and forbs. Visibility of horses was limited due to density of vegetation and complexity of topography.

All flights over the study area were conducted during the period February 28 through March 7, 1977. The Cedar Mountains were covered with a light blanket of snow during all flights conducted with the Jet-Ranger helicopter. Patchy snow conditions were encountered during all other flights. Light conditions were excellent to good for 16

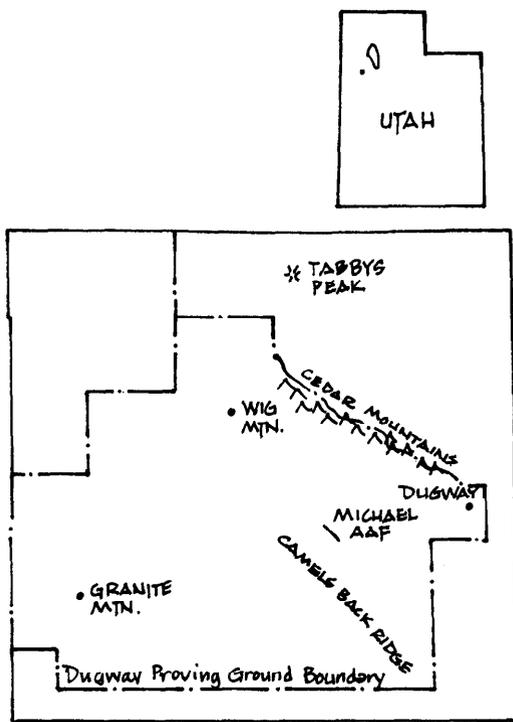


Fig. 1. Location map of study area.

of the 18 census flights. These factors represent realistic conditions frequently encountered in aerial surveys.

Methods

The censusing was done with three different aircraft and three observers with a variety of experience. The aircraft consisted of two helicopters: (1) a Bell Jet-Ranger, and (2) a Bell 47 utilizing the same pilot, and (3) a fixed-wing, aerobatic Citabria with a different pilot. The Jet-Ranger is a high powered turbine craft, as compared with the low-powered reciprocal engine in the Bell-47. The Bell-47's most favorable features are its lower hourly cost and the excellent visibility. The fixed-wing Citabria has the lowest hourly cost, but lacks the maneuverability and visibility offered by rotary-wing craft. The three observers were classified according to their prior experience in aerial censusing of wild horses. Observer A had 900 hours of census experience; B, 150 hours of census experience; and C, no census experience. Also, observer A had extensive recent ground and air experience in the survey area; B had a few hours past ground and aerial census experience in these areas; and C had no experience in the areas.

Each observer separately censused the two mountains in each of the aircraft. The pilots were instructed to maneuver the aircraft only when directed by the observer and to make no indication of horse sightings. Airspeed and altitude were left to the discretion of each observer as a function of experience; however, they generally remained similar for all observers. The number of animals was written down following each pass over a group or band. To compare counts between differing levels of experience, no specific surveying techniques or results were discussed prior to or during the censusing period. This was an attempt to keep each observer's findings from biasing another. Due to various constraints, the time of day of comparable flights was not made uniform, though a maximum time limitation was placed on the observer for any specific count. Each observer felt that the allotted time was more than sufficient to census the areas adequately and usually utilized less than the maximum time allowed. Each observer concluded each flight with the feeling that he had counted most of the animals within the area.

Results

The combined total horse count for both mountains ranged

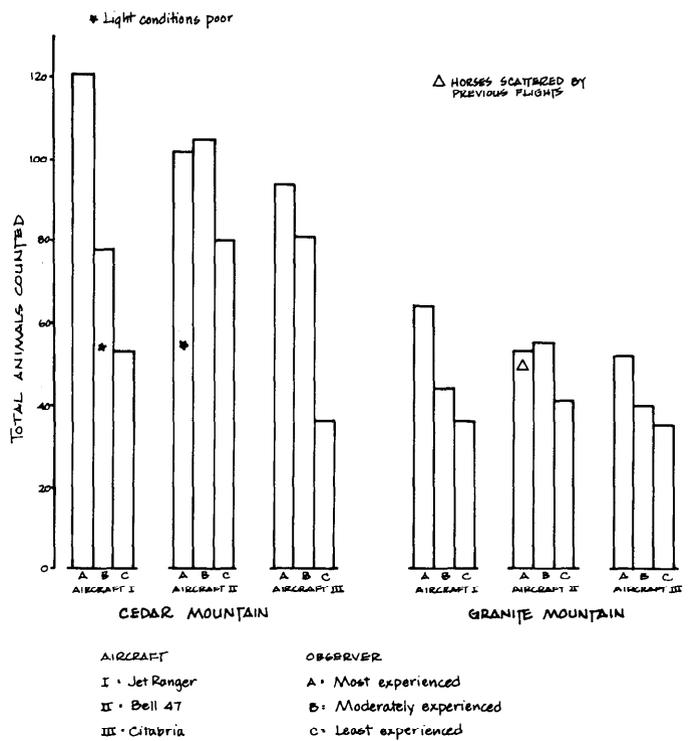


Fig. 2. Total animals counted by experience of observer, aircraft type, and mountain range.

from a minimum of 71 by the least experienced observer (C) in the fixed wing aircraft (3) to a maximum of 185 by the most experienced (A) in the Jet Ranger (1). This amounts to a 160% discrepancy between the minimum and maximum number of animals counted.

The histograms (Fig. 2 & 3) illustrate the marked differences between observers (experience) and aircraft. The average band size viewed by observers A and B was 5.2 animals, while the average size for observer C was 6.3. This may indicate that observer C viewed the larger bands, but missed small bands, or that he was unable to discern individual bands. The virtual inability of observer C to distinguish age classes using aircraft 1 is thought to be due to the fact that this was his first aerial census (Fig. 3).

Gilbert and Grieb (1957) state that the study area for deer populations should support at least 100 animals, or aerial census results will be obtained that will be unsatisfactory for statistical analysis. The counts on Granite Mountain involved considerably less than 100 animals. Because of this factor, differences between observers and aircraft on Granite Mountain did not lend themselves to statistical analysis.

A comparison of the total counts (Fig. 2) on both Cedar and Granite Mountains among observers, by aircraft, showed increasing numbers with more experience, except for aircraft 2. On these mountain ranges, the differences between observers A and B did not follow the pattern of the other flights. In the Cedar Mountains, the observers felt that the differences in results when utilizing aircraft 2 were due to excellent light conditions on the day that observer B flew, and overcast poor light conditions during the flight of observer A. On Granite Mountain, observer A felt that the animals were scattered into the adjacent flats by previous helicopter and fixed-wing flights, whereas observer B had the first flight of the day when the animals were relatively grouped.

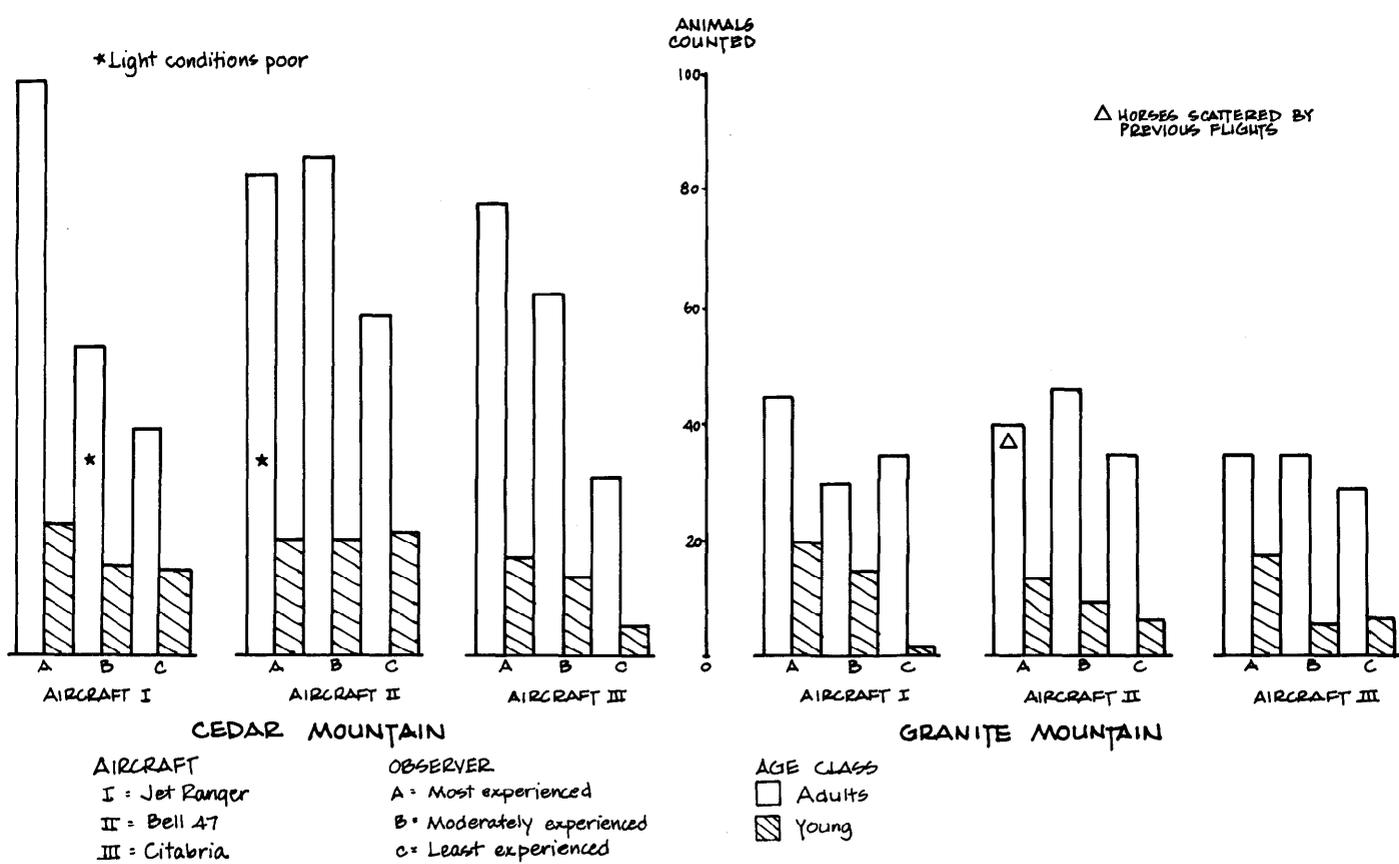


Fig. 3. Age class distribution of horse populations by experience of observer, aircraft type, and mountain range.

An analysis of variance was initially performed on the total animals derived from both mountains. The considered factors were (a) experience, (b) aircraft type, and (c) mountain. When analyzing the counts by analysis of variance, a lack of replication severely limited the degrees of freedom that could be used. Several sources of variation (aircraft, aircraft \times experience, mountain \times aircraft \times experience) were pooled to produce an estimate of the error term. Visually (Figs. 2 and 3), the difference among factors looks significant, and statistically the comparison between mountains was significant at the 1% level, with experience being significant at the 5% level. The large significance of the mountain factor and the lack of replications appeared to be masking the difference between aircraft. Because of this, and the larger population of Cedar Mountain, it was determined that statistical analysis be limited to the Cedar Mountain only.

An analysis of variance was next performed on the total animals counted on the Cedar Mountain. From these data, a comparison of computed versus table *F* values (Table 1) demonstrated that the differences among aircraft were not significant at the 5% level while the differences among observer

experience were significant at the 5% level.

To obtain a pictorial representation of the differences among observer experience and aircraft type, an analysis of means following Ott (1975) was performed on the data. As shown in Figure 4, the points representing the means of the counts obtained from each type of aircraft are contained within the .05 limits, thereby indicating their lack of significance at the 5% level. However, the spread of the means of the aircraft counts points towards a very positive difference between types of

Table 1. Analysis of variance for total wild horses counted on the Cedar Mountain.

Source of variation	Sum of squares	Degree of freedom	Mean square	Computed <i>F</i> values	Table <i>F</i> values	
Aircraft type	522.9	2	261.4	2.15	6.94	18.00
Observer experience	2928.2	2	1464.1	12.04	6.94	18.00
Error	486.4	4	121.6	—	—	—
Total	3937.6	8	—	—	—	—

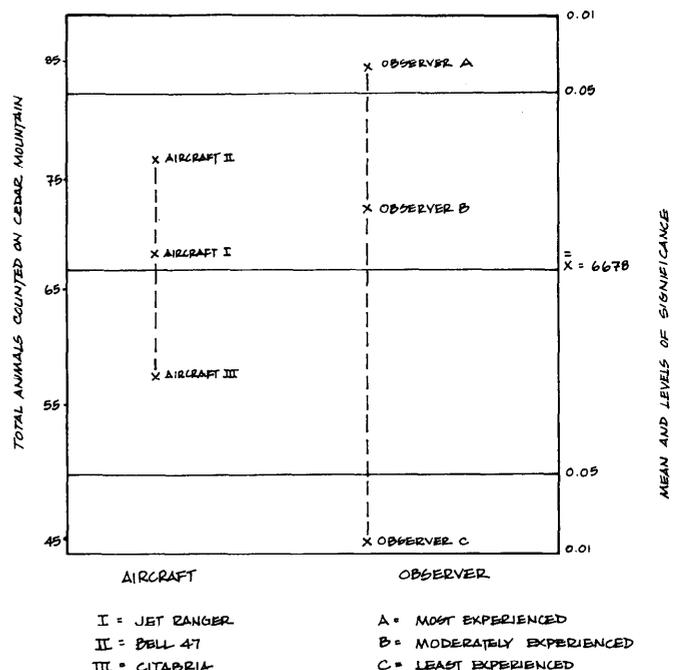


Fig. 4. Analysis of means.

aircraft used. This can logically be attributed to the physical characteristics of each aircraft. Although not demonstrated statistically, it is felt that the analysis of means (Fig. 4) indicates the selection of aircraft will have a considerable affect on relative population counts.

The histograms (Figs. 2 & 3) illustrate the fact that the differences between experience were least when utilizing aircraft 2. This is thought to be a function of the slower speed and greater visibility of this aircraft. For these reasons the Bell 47 helicopter is considered to be the aircraft of choice, among those considered, in the aerial census of wild horses. Cost and horsepower limitations will be important considerations in selecting one of the types of aircraft.

Conclusions

Statistically, experience was the most significant factor analyzed in this study. The study illustrates that under similar conditions aerial counts on a wild horse population could increase significantly if successive counts are performed by more experienced personnel. To a degree this is an unavoidable variable, since experience will increase every time an aerial census is conducted. Therefore, the factor of experience alone could easily account for a significant portion of the large increases in numbers of wild horses that have been noted by aerial census. The results indicate that for the most accurate counts of relative wild horse numbers, only personnel with census experience should be used. Also, better counts will be obtained from those familiar with the area on the ground and from the air.

As a general conclusion, the authors believe the wide variability in animals counted, demonstrated by this study, places considerable uncertainty on rate of increase projections which are based upon a comparison of two or more aerial censuses. At best, aerial census will provide minimally acceptable estimates of wild horse population densities and broad overviews of population trend. Since population increase is a function of fecundity and survival, these factors should be important considerations in rate of increase projections.

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Election Results

The 2,007 ballots cast in the 1978 election were counted on December 8. Selected by the membership to serve the Society during the next 3 years were:

President Elect **Harold F. Heady**
Directors **S. Clark Martin**
Jack R. Miller

The new officers will be installed at the forthcoming Annual Meeting in Casper, at which time Daniel Merkel, the current president elect, will succeed to the presidency. Harold Heady will serve as president in 1980, and the two newly elected directors will serve for the 3-year term 1979-1981.

Retiring next month from the Board of Directors are Past President Thadis W. Box and Directors Edward A. McKinnon and Jeff Powell. The very significant service rendered to the Society by these men is greatly appreciated.

Dr. Harold F. Heady is at present assistant vice president for Agriculture and University Services and associate director of the Agricultural Experiment Station, University of California.

Dr. S. Clark Martin is principal range scientist with the Rocky Mountain Forest and Range Experiment Station, U.S. Forest Service, Tempe, Arizona. Jack R. Miller, is a range and wildlife specialist for the U.S. Forest Service, Missoula, Montana.

Members voted to amend Article 1, Section 6 of the Bylaws to read: Family (membership dues)—As shall be established from time to time by the Board of Directors.

Office staff at the SRM headquarters in Denver counted the ballots. Ballots and tally sheets are kept on file in the Society office for 1 year.