AERIAL INVENTORY AND CLASSIFICATION OF DALL SHEEP IN ALASKA

by

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Because they are white in color and inhabit almost exclusively the treeless alpine, Dall sheep are one of the best suited of all species to aerial census. In Alaska, they have been counted by air for a number of years by investigators working for the Alaska Department of Fish and Game, the U. S. Fish and Wildlife Service, and the U. S. National Park Service. Jones (1963), Nichols and Erickson (1968), Scott (1949), Sumner (1948) and others have reported on the use of aerial surveys in attempting to count and classify Dall sheep.

Workers in the past, myself included, fell into the trap of believing that these animals could be counted accurately and rapidly because they appear so obvious on the green, summer alpine range. However, the more we worked with the technique in attempting to determine population status, the more it became apparent that much more flight time and effort was required to get adquate area coverage and count accuracy than was spent in the past. Even though the sheep are white, they can blend with the landscape under certain conditions of light and terrain. Unless every alpine meadow, canyon and cliff is carefully searched, sheep will be missed. Animals will bunch when approached closely, making accurate counting very difficult. A few peaks covered with clouds may mean large groups missed. Worst of all, we found that it is nearly impossible to identify all age classes at any one time of year form the air and so obtain a true picture of herd composition.

Attempts to examine and compare herds by observed percentages of sex and age classes as done in the past also proved useless, partly because of improper animal identification and partly because comparison by percentages is relatively meaningless. Since the percentage in the herd of a particular class is dependent upon the abundance of the other age or sex classes, it is not an adequate means of examining and comparing the status of the class in question. For example, in a herd containing 75 rams, 100 ewes, 25 yearlings and 50 lambs, the percentage of lambs is 20 percent. In a herd of 25 rams, 100 ewes, 5 yearlings and 50 lambs, the lamb segment represents 28 percent of the herd, apparently indicating higher production. Actually, the best indicator of production is the lamb:ewe ratio, which in this case is identical at 50:100 showing equal production in each herd. Therefore it became obvious that we would have to expend more effort to obtain complete area coverage and accurate classification, and to interpret the data by means of valid comparisons. Further complicating the problem was our inability to accurately classify a herd from the air at any given season. During the common summer surveys, sufficient effort makes it possible to enumerate a high percentage of the total sheep present and to classify new lambs with very good accuracy. However, some rams invariably seem to be missed due to their often solitary habits and the exceptionally rough terrain they seek. Yearling females (between 12 and 15 months of age) and most yearling males are extremely difficult to differentiate from young adult ewes and so are usually classified as "ewes". Horn tips are hard to see against the dark green or brown summer background making it difficult to separate rams into size classes where this is of interest.

Classification counts conducted in the spring, preferably in April, make it possible to classify the past summer's lambs, thus enabling the determination of lamb survival through their first winter and, as will be explained later, the determination with reasonable accuracy of the proportion of adult ewes in the herd. Since the sheep are still more or less concentrated on their spring ranges, with the rams still occupying the same ranges as the ewes, an accurate determination of the proportion of rams to ewes may also be obtained at this time. Snow conditions are frequently spotty at this season, and it is easy to miss substantial numbers of sheep against the broken background, making an estimate of the total herd size impractical. For the same reason, classification of many rams by horn size is still difficult.

The best time for classifying rams has been found to be during midwinter. They are randomly distributed among the ewe bands during and shortly after the rut and horns show up very well against the snow background. A good estimation of the proportion of rams to ewes may be obtained, and classification by horn size is relatively easy. Ewe:lamb ratios during the winter may also be readily obtained. The disadvantages of midwinter surveys include the difficulty of obtaining adequate sample sizes due to the short hours of sufficient daylight, the difficulty in locating all groups of animals, making herd-size estimates impractical, and the usual problems of cold weather airplane and people operation, particularly in remote areas.

To make three detailed classification surveys each year of large sections of sheep habitat is beyond our budgetary and manpower means. Therefore, we have tentatively settled on two types of sheep count to determine the status of various herds.

The general inventory survey is a relatively simple one, designed to give an estimate of total population size and distribution. Such surveys are flown during the summer after most of the snow has melted off the sheep mountains and after the termination of lambing season. Relatively large blocks of habitat are covered, limited each year by manpower and budget. No systematic attempt is made to classify sheep during these counts because of the reasons previously given; however, lambs and adult rams are frequently tallied to give at least an impression of production and available animals for harvest.

The technique used is to pre-select a block of mountains of a size that experience dictates can be covered with desired accuracy within time and financial limits. Boundaries should be picked which limit sheep movement to and from uncounted neighboring areas which may be surveyed in future years. Although the flying is not nearly so critical as in classification surveys, it still requires a suitable aircraft and a pilot experienced in mountain flying. Turbine-powered helicopters would be well suited for this job but are too expensive, at least for our budget. The best aircraft found for the job so far, and the only one really suitable for it, is the Piper PA-18-150 Supercub, a two-place, tandem-seated airplane in which both pilot and observer have excellent visibility from both sides of the plane.

One of the most helpful devices we use in sheep census is an intercom set which allows pilot and observer to communicate freely without shouting. Our set is completely self-contained so it can be used in any plane and is built into a pair of military-type crash helmets. Built-in boom microphones and earphones, and a continually "on" circuit, enable the carrying on of normal conversation without interference in flying or writing. The crash helmets provide an obvious safety device but are expensive. A similar unit can be built with much cheaper earphone-boom microphone sets. Being able to talk freely and easily enables the pilot and observer to cooperate readily in locating and classifying animals and increases of the work.

It is the pilot's job to help locate sheep, to put the observer in position to count them, and to keep him in contact with a given group until he feels it is completely enumerated. The pilot must also remain constantly oriented to prevent duplicate counting or missing of groups. The observer does the actual counting, plotting, recording and navigating. He is equipped with a suitable topographic map of the area, usually 1:250,000 scale although in some cases a:63,360 maps may be used where they do not cause inconvenience in the small cockpit. The observer plots the actual route of the count directly on the map during flight. This makes it possible to continually check the route for missed areas as well as to maintain orientation for observation plotting. Each sheep or group of sheep is plotted on the map by means of a consecutive index number, only, to avoid confusion. Forms are also carried by the observer which enable him to readily record each animal by sex or age class if desired, or at least by group size in the case of a rough inventory survey. Each observation is then recorded in desired detail on the form, using the same index number as given for that observation on the map. Each may thus be referred to by location, number, and/or composition. Distribution is then adequately portrayed and may be readily compared in future counts for detailed changes.

Results of each survey are later listed on a simple summary form for ease in reporting or quick reference. Original flight maps, observation and summary forms are filed together for reference.

The second type of survey used is the detailed classification count, conducted three times each year as previously described on selected sample or study areas. These are designed to supply data on herd-size trends, production, lamb survival, seasonal movements, abundance of harvestable rams, and sex ratios.

The sample areas chosen should lend themselves to aerial counting, contain a reasonable sample of sheep, be representative of the area and herd sampled, have boundaries as finite and impassable to sheep ingress or egress as possible, and require no more than four or five hours of flying time for a complete survey. If more time is required, they may not be completely surveyed in one, or at most two short winter days, making it possible for weather changes to interrupt the counting.

Weather, aircraft performance, and pilot technique and experience are much more critical than for inventory surveys. To obtain accurate data, it is necessary to get complete area coverage in the case of a total-herd count, and to classify all animals as accurately as possible. The pilot must be able to take the observer by the sheep in such a manner as to enable him to determine sex and age class of each animal. This requires low, slow passes, sometimes many of them so that compact, shifting groups may be sorted out. In some cases, groups bunch and shift so badly that they cannot be counted. Then it is necessary to split them up or make them move out into countable form by "buzzing" them with the plane. The observer must be willing to stay with each group until he is satisfied with his classification and counting. Needless to say, this takes time, skill and conscientious effort.

These counts should not be undertaken unless the weather is good. Strong winds are especially to be avoided since they cause turbulence that not only makes counting difficult and unpleasant, but creates a definite hazard in the form of severe downdrafts. Light winds may cause minor turbulence but should be no problem to a pilot experienced in mountain flying. Sometimes they can actually be of assistance, since by flying upwind past a group of sheep, groundspeed is reduced, giving the observer longer observation time.

When counting a number of sheep scattered on a broken slope, we have found that it is easier to keep track of animals by subdividing the slope into smaller units bounded by avalanche chutes, ridges, etc. Then the counting is started with the uppermost animals and the work progressed downwards until the segment is completed. Sheep usually tend to move directly up steep, broken mountainsides when "worked" by a plane. When the count is started at the bottom, tallied animals working upwards mingle with those as yet uncounted, creating confusion for the observer.

After the data have been gathered from the various counts, it is necessary to interpret them into useful form. As stated previously, herd composition cannot readily be determined from the results of any one survey. Therefore, it is necessary to mathematically construct a population from

The data which will represent the actual composition and size at any one time. The following example illustrates the method I use to arrive at an approximation of the herd status during the summer after lambing and prior to hunting. Although results are far from absolute, they represent the true composition of the sample herd better than results from one summer count.

To obtain the ewe-yearling-lamb segment of the population, we use the pre-lambing (April) and post-lambing (July) surveys. Yearlings and ewes (always including a few unidentified young rams as "ewes") may be directly classified in the early count, while lambs may be readily identified in the later count but ewes and yearlings are not easily distinguished and so must be lumped. For the moment, the ram segment may be ignored. Assume a count as follows:

Count Date	Rams	Ewes	Ewes+ Yearlings	Yearlings	Lambs	Total
April	60	150	(180)	30	--	270
July	70	?	(240)	?	80	390

The yearling:ewe ratio may be used as observed in April and is 30:150 or 20:100. Since sample sizes are different in the two counts, the yearling:ewe ratio (assumed to remain the same) must be extrapolated to determine the number of ewes and yearlings in the summer population. The difference between the 240 ewes+yearlings observed in July and the 180 observed in April is 60 ewes+yearlings assumed missed in the April survey. At the ratio of 20:100, these represent 10 yearlings and 50 ewes which must be added to the observed 30 yearlings and 150 ewes in April to give the summer composition, or 40 yearlings and 200 ewes. Thus, the computed ewe and yearling and observed lamb composition of the herd is as follows:

	Ewes	Yearlings	Lambs
Computed July Population	200	40	80

The next step is to determine the ram segment of the sample herd by using the classifications obtained in the various surveys as follows:

Count Date	Unclas. Rams	Young Rams	Legal Rams	All Rams	Ewes
April	25	30	5	60	150
July	20	40	10	70	200*
January	--	24	5	29	100

Several factors regarding the counts are apparent: the greatest number of animals was counted in July, the best time for a "total" count. The April and January counts were for the purpose of obtaining ratios and were sample counts, only. A number of rams were unclassified as to size in the April and July counts when horn tips were hard to see. (A "legal" ram in Alaska is one with a horn curl of 270° or greater: a 3/4-curl ram). All rams were classified in January when visibility was best.

The highest ram:ewe ratio was observed in the April count at 60:150 or 40:100. Ram:ewe ratios obtained in the January count could only be used in computing the following summer's population unless the past fall's harvest is known. The highest observed ram:ewe ratio is used for computations under the assumption that young rams may sometimes be classified as "ewes", but rarely are ewes classified as "rams". Therefore, the highest ram:ewe ratio seen is probably the most accurate.

By applying the ram:ewe ratio of 40:100 to the computed 200 ewes in the July population, a total of 80 rams should have been present in the herd at that time. Ten rams were assumed to have been missed during the summer survey.

The January survey data are used to determine the classification of rams in the past July's population, and the number of rams harvested during the hunting season which fell between the July and the January censuses. A known harvest would make it possible to check the accuracy of the computations.

The observed ratio of 29 rams to 100 ewes in January cannot be used in direct comparison with the July figures since in January, the 100 "ewes" include unidentified yearlings. At the computed July ratio of 40 yearlings to

*Computed

240 yearlings+ewes, 17 yearlings and 83 ewes should make up the 100 ewes+yearlings in the January count. Thus, the observed ram:ewe ratio should be 29:83. Extrapolating this to the computed 200 ewes which should still be in the herd, there would be 70 rams altogether in the January population. Subtracting the 70 computed for January from the 80 computed for July would leave 10, presumably legal rams removed by hunting.

At the observed ratio of legal rams to all rams of 5:29, or 17:100, there should be 12 legal rams in the computed January ram population of 70. The remaining 58 young rams may be presumed to have been present in the July population as well as in that of January.

The hypothetical July population can now be reconstructed as follows:

Young Rams	Legal Rams	All Rams	Ewes	Yearlings	Lambs	Total
58	22	80	200	40	80	400

Ratios obtained from the foregoing computations for this population are:

Rams:Ewes	=	40:100
Legal Rams:Ewes	=	11:100
Yearlings:Ewes	=	20:100
Lambs:Ewes	=	40:100

These ratios should give a more accurate indication of herd sex and age composition, production, and survival than direct counts during any survey, and may be compared directly and meaningfully with similar ratios from other herds or from year to year.

Although this method is probably more useful already than direct count data, several refinements are necessary to improve its accuracy. More must be learned about adult mortality by season and about ram horn growth between count periods. The method at present cannot take into consideration mortality or changes in status between "young" and "legal" rams from count to count. Two-year-old ewes (22-24 months of age) can be identified from the air in the spring by horn and body size, but I am not yet sure of the identification of rams of the same age class. If animals of this age class are sexually mature by their second breeding season at approximately 18 months of age, they can logically be included with the "adult" ewe and ram segments in computations. However, if they are not, they will have to be classified separately in order to accurately determine production, survival, etc. as ratios to 100 adult ewes. Most of this needed information should be provided within the next few years by present and projected sheep studies in Alaska.

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