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The Blue Grouse In Colorado

STATE OF COLORADO — DEPARTMENT OF GAME, FISH AND PARKS

The Blue Grouse In Colorado

By GLENN E. ROGERS

A Survey-type Study by the Research Branch,
Colorado Game, Fish and Parks Department,
Game Bird Investigations, Project W-37-R,
Federal Aid in Wildlife Restoration.

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FOREWORD

THE main purpose of this publication is to provide wildlife administrators and forest-game managers in the blue grouse range with information gathered during 3 years of study on blue grouse in Colorado.

The project, largely survey in type, was beset with several difficulties — the relatively low blue grouse population in Colorado, lack of proved project design to meet forest game bird habitat and hunting conditions peculiar to the State, and, because of overloads elsewhere, some curtailment of field work in 1963, the final year of study.

This is a report, therefore, in which the rugged honesty of the author, Glenn E. Rogers, comes through. No shortcoming of data is minimized, no failure of method or plan is glossed over; and the connotation of “results were inconclusive,” used more than once, reflects the author’s objectivity and forthright appraisal of his own work.

Yet, a great deal was learned about the blue grouse in Colorado. The reader is referred to the *Summary and Conclusions* of this publication for a quick judgment. As a result of the work, it is certain that management of blue grouse in Colorado is more soundly designed than at any time in the past, and the broad background provided by this work will aid in future research directed toward additional refinement of management programs.

—*Gilbert N. Hunter*
Game Manager (Retired)

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— *Glenn E. Rogers*



The blue grouse, restricted to forests and brushland above 6000 feet elevation, provides a fine game bird over approximately 20,000 square miles in Colorado. It fills a habitat niche not occupied competitively by any other game species and now ranks eighth among harvested small game species in the State.

INTRODUCTION

THIS study of the blue grouse, *Dendragapus obscurus obscurus* (Say), was initiated in April 1961. The primary objectives were: (1) distribution in Colorado; (2) information on census methods used in other states and provinces; and (3) development of a basic type of census-trend route in each wildlife conservation officer district.

Except for Steinhoff's (1956) study of habitat requirements, previous work on this subspecies of grouse is limited to short accounts relative to occurrence, an observation or kill, a single crop content, or a nest seen and described. However, numerous life-history and ecology studies have been completed for the three subspecies of blue grouse inhabiting Montana, Oregon, and Washington, Alberta, and British Columbia.

Work accomplished in the present study involves historical background, habitat preferences, population densities, distribution limits, census methods, courtship behavior, daily movements, and harvest successes. Trials of recognized census methods in Colorado proved to be of doubtful value. As a result, the purposes of this bulletin are: (1) provide a general reference for future blue grouse studies; and (2) make available to Colorado game management personnel information gathered on blue grouse 1961 through 1965.

The primary blue grouse ranges covered in this investigation were the Uncompahgre National Forest in southwest Colorado, and the Grand Mesa National Forest in west-central Colorado.



DISTRIBUTION

TAXONOMIC

The dusky grouse, *D. o. obscurus*, inhabiting Colorado is only one of eight blue grouse subspecies in North America. It was commonly referred to in literature, largely by early explorers, settlers, and present-day hunters, as the blue or dusky grouse, spruce grouse, pine grouse, pheasant, partridge, mountain grouse, fool hen, willow grouse, and pine hen. There have been several changes in the taxonomic history of *Dendragapus obscurus* since its discovery and classification as *Tetrao obscurus* by Thomas Say on July 10, 1820 (James, 1823). Present taxonomic distribution as defined by Aldrich (1963) is shown in Figure 1.

Blue grouse are exceeded in size among North American species only by the sage grouse. Physical measurements of the blue grouse are within the following ranges: weight, 1½ to 3 pounds; total body length, 18 to 23 inches; and wing spread, 16 to 20 inches. The color of the male varies from a light blue-gray to a bluish black. Females tend to have a brownish cast. The terminal tailband, when present, is light gray in color, although occasionally mottled with black specks or brown barring, particularly in the females (Ridgway and Friedmann, 1946).

The term "blue grouse" is used in this report to refer to the species, and the term "dusky grouse" is used to refer to the one subspecies indigenous to Colorado. The recognized common names of blue grouse, according to Aldrich (1963), are: Great Basin grouse (*D. o. oregonus*), Swarth's grouse (*D. o. pallidus*), Richardson's grouse (*D. o. richardsonii*), Dusky grouse (*D. o. obscurus*), Oregon grouse (*D. o. fuliginosus*), Mountain Pinos grouse (*D. o. howardi*), Sierra grouse (*D. o. sierrae*), Sitka grouse (*D. o. sitkensis*), and these will be used to refer to individual subspecies. Also, the term "Dusky group" will be used to separate the first four subspecies listed as the inland

group, and "Sooty group" will be used to indicate the last four subspecies as the coastal group, as originally separated by Brooks (1929) and Ridgway and Friedman (1946).

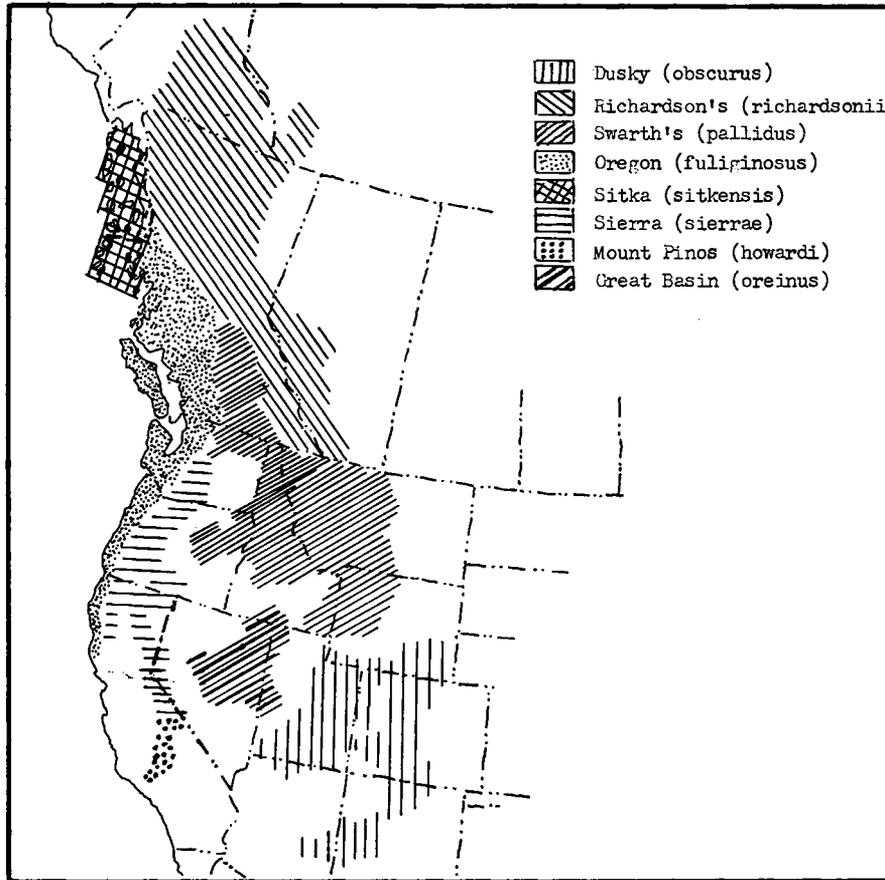


FIG. 1 — Distribution of the eight forms of blue grouse in North America. (after Aldrich 1963)

HISTORICAL

Information concerning the life-history and ecology of dusky grouse in Colorado has been dealt with in some degree by Warren (1916), Lincoln (1920), Neilson (1926), Flint (1928), Steinhoff (1958), and Rogers (1963). Also, some information in regard to historical occurrence was found in other references cited elsewhere in this report, in Colorado Federal Aid quarterly reports, and in field notebooks of various Colorado game management and law enforcement personnel.

Much of the historical information pertaining to blue grouse distribution may be inaccurate because of misidentification due to common-name confusion. In many areas of Colorado the southern white-tailed ptarmigan (*Lagopus leucurus altipetens*), the Columbian sharp-tailed grouse (*Pedioecetes phasianellus columbianus*), and the sage grouse (*Centrocercus urophasianus*) may inhabit the same range as dusky grouse. Early-day legislators, when establishing Colorado hunting seasons for grouse, used sage chicken, prairie chicken, mountain grouse, and willow grouse to cover all species.

There is evidence that dusky grouse were used by early-day Indians on the Western Slope. Former Wildlife Conservation Officer Holmes Fullenwider and his brother, Kenneth, have in their collection of Indian artifacts bags of dusky grouse tail feathers apparently used to fletch arrows.

It is probable that early Spanish missionaries (Bolton, 1950) killed dusky grouse in the Uncompahgre River valley near the present town of Ridgway in 1776. Also, Pike (Hart and Hulbert, 1932) mentions finding "pheasants" on the slopes of Pikes Peak in 1806. Near the junction of the Yampa and Little Snake rivers, a Mr. Iles (Burroughs, 1962) stated in his diary on December 24, 1874: "We packed up again and started, after having a lively time shooting grouse from the cottonwoods near camp." The diary of Frank H. Mayer (Roth, 1963) has the following entries for the Gore Range, Middle Park area: "August 2, 1878. . . . Blue grouse and sage hens were plentiful. Got six grouse with my revolver, shooting at their heads, but missed four. . . . September 3. Grouse are abundant on the higher slopes, and sage hens and sharptails exist in incredible numbers on the mesas and in the valleys."

From some accounts, it appears that trappers and early explorers were not interested in grouse as food. Irving (1832), although mentioning the occurrence of grouse several times in his writings of the West, summed up feelings as follows: "The rangers began to think turkeys and prairie hens deserving attention; game which they had hitherto considered unworthy of their rifles."

Rockwell and Wetmore (1914), in reporting on birds at Golden, Colorado, stated: "Rather surprised to find this bird [dusky grouse] so near Denver." Lincoln (1920) on September 4, 1911, stated, "I secured three birds [dusky grouse] near Golden within a quarter-mile of the valley flats." From some of these reports, it appears that dusky grouse utilized the valleys more than they do at the present time, but dusky grouse still inhabit the slopes of Lookout Mountain above Golden.

Warren (1916) reported: "Dusky grouse, a common resident, though much reduced in numbers during the past 20 years by persistent hunting, especially by the Austrians and Italians, most of whom have no regard for closed seasons or game laws, and no scruples about killing a bird on the nest or with a brood of newly hatched young." In the same volume, Warren later went on to state, "It is found everywhere from the upper limit of heavy, green timber down."

Lower valleys, now with farms, highways, and cities, were formerly inhabited by dusky grouse. Farnham (1843), Fowler (Coues, 1898), and Fremont (Nevins, 1955) suffered hardships from lack of food in present grouse range; but in many instances failure to mention grouse may have been due to their abundance rather than scarceness. However, historical population densities and degrees of change cannot be determined. The early trappers and explorers, as stated, evidently paid little attention to grouse when larger game animals (bear, buffalo, deer, elk, and mountain sheep) were available. However, settlers and miners apparently welcomed the change in diet afforded by grouse. The market price for game at Leadville and Aspen in the late 1800s either showed this preference or difficulty of harvest, since grouse brought 50 cents each while saddles of deer, elk, and mountain sheep averaged 7 cents, 9 cents, and 10 cents a pound, respectively (Hoover, unpubl.)

SEASONAL

A close correlation between dusky grouse distribution and areas of coniferous forest in Colorado is generally accepted, but observations show seasonal exceptions to this distributional pattern. In parts of Colorado, dusky grouse move from the heavy-timbered areas during March and April to surrounding meadow, brush, aspen (*Populus tremuloides*), or open timber stands for breeding or nesting. After breeding and nesting, hens and their broods and some males remain in the lower elevations until about mid-August, when they start a slow movement back to higher elevations.

On the north end of the Uncompahgre Plateau, this movement fails to follow the usual pattern. Here, the top of the ridge is an open-aspen, mixed-brush range, with timber occurring at lower elevations. Birds may move down to timbered areas during the winter months, or spend the winter on the mixed-brush range using snow roosts. Near Hayden, some dusky grouse remain on brush range areas year round, 10 mile from the nearest conifers. However, enough dusky grouse remain on timbered range, often up to timberline elevations, to give an impression of constant distribution throughout this zone.

It is not believed that seasonal movements cover long linear distances or extreme changes in elevation; generally it is not more than 1,000 to 3,000 feet in Colorado. It would appear that the availability of food, particularly mast and fruits, and possibly weather, influence the time and degree of movement.

Mussehl (1960), in a study of blue grouse movements in the Bridger Mountains in Montana, found birds returning to within 100 yards of their

previous summer tagging site. However, in Colorado repeated sightings of broods at specific locations were not observed on the Uncompahgre Plateau.

GENERAL

Of Colorado's 63 counties, parts of 43 are inhabited by dusky grouse (Fig. 2). The total area of these 43 counties, minus water surface, townsites, and crop lands, is 62,787 square miles. Major portions of the eastern tier of dusky grouse counties (Boulder, Douglas, El Paso, Huerfano, Jefferson, Larimer, Las Animas, and Pueblo) extend onto the plains and are not suitable range. Deserts, sagebrush plains, and open parks also comprise a portion of the land area for many Western Slope counties.

Current information was gained through interviews with field personnel of the U. S. Forest Service, U. S. Bureau of Land Management, and the Colorado Game, Fish and Parks Department. Each individual interviewed was asked to indicate on a map the location of all dusky grouse observed in the 3-year period, 1961-1963, and to outline the dusky grouse range in his district. U. S. Forest Service personnel were further requested to have each field crew keep a travel record during summer field work and indicate on a map the route of travel, location, and number of dusky grouse observed.

All reported observations, supplemented by years of personal reconnaissance, were plotted on a Colorado state map showing dusky grouse distribution. Distribution was considered to be discontinuous when reported sightings were more than 6 miles apart; but when observations were closer, the entire area was assumed to be occupied habitat. From these interviews it appeared that, while dusky grouse occur throughout a good part of the mountainous area of Colorado, their distribution is uneven and varies seasonally and yearly to conform with behavioral characteristics and with changes in ecological conditions.

In comparing the completed distribution map (Fig. 3) with maps showing vegetative types, elevations, and access roads or trails, it was apparent that all possible dusky grouse range did not receive equal coverage, and, very likely, rather large areas were not covered at all. Reported distribution tended to group around field projects and hunting and fishing roads, all directly correlated with human traffic. However, numerous large areas of forest lands, particularly of lodgepole pine (*Pinus contorta latifolia*), were covered during the study where dusky grouse were not observed.

Beer (1943) stated: "The genus *Abies* is undoubtedly one of the most important food plants of the blue grouse and plays a definite part in limiting its distribution. With the exception of the balsam fir (*Abies balsamea*), an outline map of this genus is almost identical with a similar map of the Blue Grouse territory." He also listed 16 species of 7 genera of conifers in the blue grouse diet. Conifers native to Colorado were *Abies concolor*; *A. lasiocarpa*; *Juniperus* spp.; *Picea* spp.; *P. engelmannii*; *Pinus* spp.; *P. ponderosa*; and *Pseudotsuga taxifolia*.

For Colorado, range distribution maps show that Douglas fir and white fir are complementary throughout the state, but the maps cannot be correlated

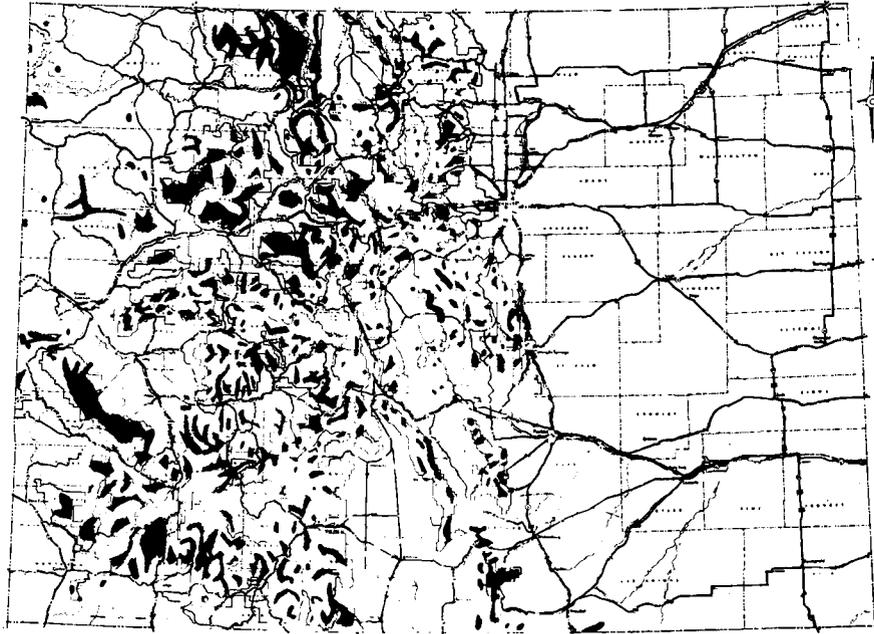


FIG. 2 — Blue grouse distribution in Colorado as plotted from interview information provided by state and federal wildlife and land-management personnel.

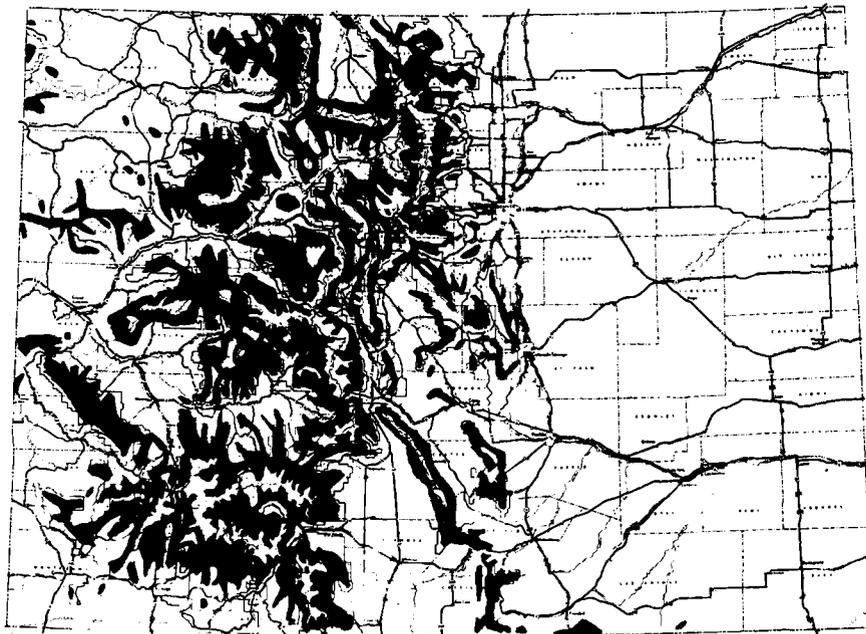


FIG. 3 — Blue grouse distribution in Colorado, 1964.

with distribution maps for dusky grouse except in a general sense (Figs. 4 and 5). The fault may lie with the inaccuracy of maps, due to small scale, and to misinterpretation of vegetative types. Also, Douglas fir, particularly at lower elevations, may occur in stands too small to be indicated on small-scale distribution maps. Douglas and white fir are often scattered through stands of ponderosa pine; it would, therefore, be extremely difficult to know if dusky grouse inhabited areas of ponderosa pine or utilized fir trees in the pine stands.

All of the 11 National Forests, 6 Bureau of Land Management grazing districts, and the one State Forest in Colorado contain dusky grouse. The total National Forest and State Forest area in the 43 counties is 20,607 square miles. Dusky grouse are unreported on some National Forest lands where there are extremely thick stands of conifers and some above-timberline lands, but they are present on private and public land, particularly at higher elevations, adjoining and within National Forest boundaries. From the maps (Figs. 2 and 6), it is estimated that the amount of dusky grouse range outside National Forest boundaries may equal the amount of range within boundaries where grouse have not been seen or reported. The total Colorado area inhabited by dusky grouse at some season of the year, therefore, may exceed 20,000 square miles.

Male and female grouse without broods were seen in areas widely varied in elevation, vegetation, and terrain. While some males were observed near hens with broods, the heaviest concentrations of males during the summer were at higher elevations. Differences in range type and use by sex and age, while recorded, were not included in the general statement on habitat conditions and requirements.

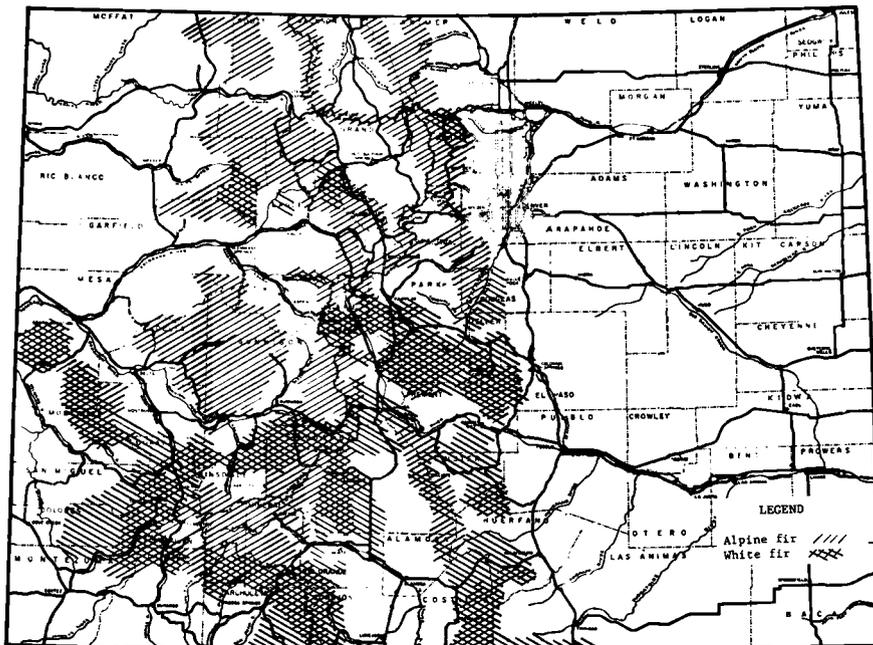


FIG. 4—Distribution of alpine and white firs in Colorado. (Longyear 1925)

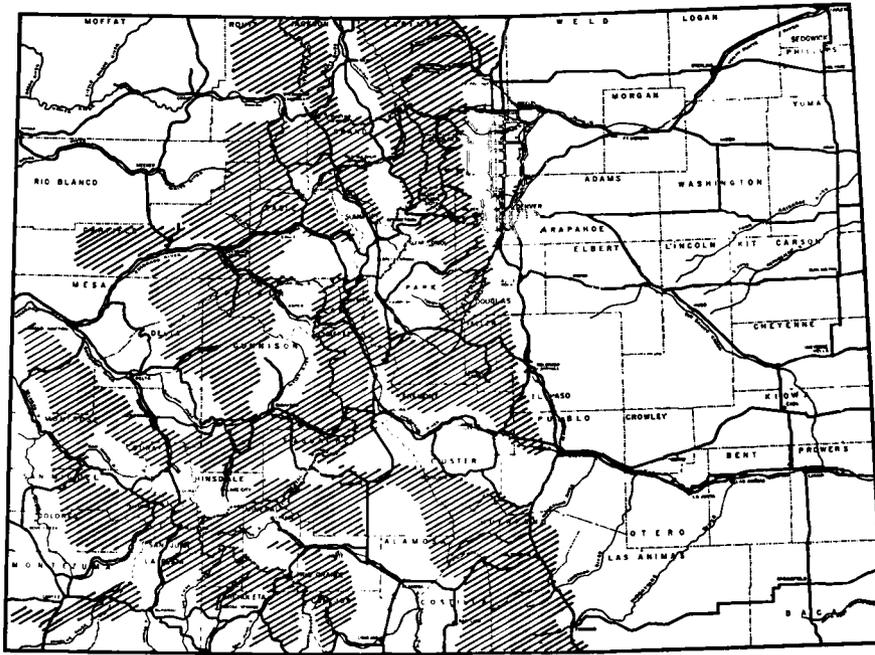


FIG. 5 — Distribution of Douglas Fir in Colorado. (Longyear 1925)

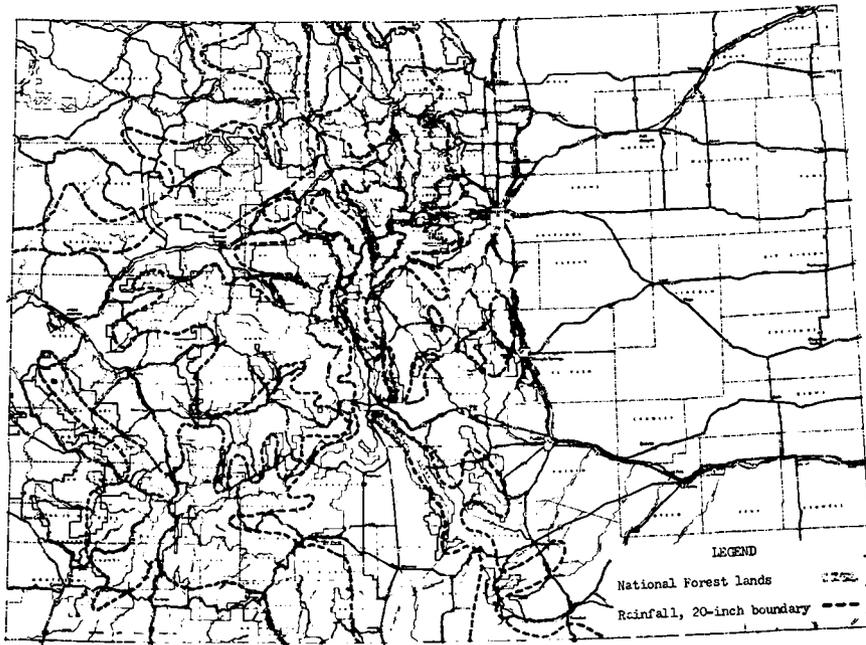


FIG. 6 — Lower limits of 20-inch rainfall boundary on national forest lands in Colorado.



ENVIRONMENT OF BLUE GROUSE IN COLORADO

A quantitative study of the environmental requirements of dusky grouse was conducted 1961 through 1963. At each grouse observation the following were recorded: date, time, elevation, topography, distance from water, behavior of birds (feeding, roosting, drinking, etc.), temperature, percent cloud cover, precipitation, dominant vegetation by species, percent frequency (of vegetation) per acre, soil type, disturbance factors, grazing use and degree, and general topography, botany, and geology of the surrounding area within a one-mile radius. While plant density, vegetative height, and species present are considered in judging "condition class," differences in grazing management practices and precipitation do cause range forage to vary by areas within years.

RANGE CONDITION

The general range, rated to "condition class" (Costello and Schwan, n.d.) varied from fair in 1961 to poor in the spring of 1963. Other game species (principally deer) were present, except during the winter months, and all ranges were utilized by cattle or sheep, and in some instances both, from May to October. No correlation between number of broods sighted and grazing use by livestock type could be determined. However, dusky grouse broods were not observed in areas after sheep had been bunched, watered, or bedded, thereby trampling the vegetation to less than effective height and density. Mussehl (1963) found the mean effective height of ground vegetation for brood cover to be 7 or 8 inches, plus or minus 2.

VEGETATION

Vegetative preferences, for purposes of this study, are divided into two categories, food and cover. Regardless of season, there appears to be a fairly close relationship between food and cover, and this is especially noticeable in winter when conifers furnish both. Seldom are dusky grouse observed over

1 mile from trees (conifer or aspen) or tall shrubs. Grouse were often seen eating knotweed (*Polygonum aviculare*) and dandelion (*Taraxacum* spp.) on roadbeds, and the presence of these plants may be a major reason why birds were seen on the Uncompahgre Plateau road transect. Open stands of conifers or aspens with an understory of brush, or stands of mixed brush with adjacent aspens or conifers, appear to be preferred as habitat areas.

While only one limited food study has been conducted in Colorado (Flint, 1928), blue grouse studies in other western states show a wide range of food items during spring, summer, and fall (Beer, 1943; Fowle, 1944; Wing, 1947; Bendell, 1954, 1955a, and 1955b; Mussehl, 1960, 1963; and Boag, 1963). Beer (1943) lists 138 species of plants, lumping all grass species and 34 animal species, but not separating the use of leaves and seeds of plants. Shrubs and forbs supply food and most of the cover during the summer months, and dusky grouse have not been observed in Colorado where shrubs are absent.

Winter foods of blue grouse are limited generally to conifer needles and buds. Lauckhart (1957) suggests a possible relationship between quality of winter food and population cycles. However, Hoffman (1961) did not find correlation between population trends and amount of crude protein in fir, and Boag (1963) theorized that heavy use of tamarack (*Larix* spp.) and a correspondingly lighter use of Douglas fir, alpine fir, and ponderosa pine may be correlated with a decreasing population.

The dominant tree, shrub, forb, and grass recorded at each grouse observation during the Colorado study was the same for all years except for forbs. Aspen was the dominant tree; snowberry (*Symphoricarpos* spp.) was the dominant shrub; bromegrass (*Bromus carinatus*) was the dominant grass; and groundsel (*Senecio* spp.) and vetch (*Astragalus* spp.) were the dominant forbs. Juniper, spruce, Douglas fir, and ponderosa pine were recorded less frequently, along with oakbrush (*Quercus utahensis*), chokecherry (*Prunus pennsylvanica*), sagebrush (*Artemisia* spp.), rose (*Rosa* spp), willows (*Salix* spp.), and elderberry (*Sambucus pubens*); blue grass (*Poa* spp.), fescues (*Festuca* spp.), June grass (*Koeleria cristata*), nodding brome (*Bromus porteri*), buckwheat (*Eriogonum* spp.), larkspur (*Delphinium* spp.), mint (*Monarda* spp.), lupine (*Lupinus* spp.), false hellebore (*Veratrum californicum*), clover (*Trifolium* spp.), loveroot (*Ligusticum porteri*), cinquefoil (*Potentilla* spp.), sneezeweed (*Helenium hoopesii*), yarrow (*Achillea lanulosa*), sunflower (*Helianthus* spp.), balsamroot (*Balsamorhiza sagittata*), dandelion, nettle (*Urtica dioica procera*), mustard (*Sisymbrium* spp.), and knotweed.

Occasionally hens were observed nesting or with broods on pinion (*Pinus edulis*) and juniper ranges. In 1948, a dusky grouse hen nested under a pinion on Piney Creek in Eagle County, over 5 miles from aspen and spruce-fir timber. In 1961, a hen and brood were observed in the same drainage on juniper and mixed-brush range. On June 19, 1964, Wildlife Conservation Officer W. Allison Mason and Educator Jesse E. Williams observed a hen and six young near a stock pond on Cherry Creek in La Plata County. These birds were at 7,000 feet on a pinion-juniper and sagebrush range that had been recently chained.

Males and females with broods showed variance in vegetative preference when found at the same elevations. Summer concentrations of males at sub-alpine elevations were usually in open coniferous stands where vegetation

consisted of spruce-fir, blueberry (*Vaccinium* spp.), willow, bistort (*Polygonum* spp.), pink plum (*Geum* spp.), and hairgrass (*Deschampsia* spp.). Here, the vegetative understory may be shorter, the overstory more open, and the terrain flatter than at lower elevations. Escape cover is limited to conifer species.

WATER

Distance from water at which broods were sighted varied from 50 to over 1,000 feet, with an average of 432 feet. This distance may have been influenced by the type of transects (road), and by less than normal precipitation for 2 of the 3 years. Although dusky grouse broods generally were observed near water, little is known of their actual free-water requirements.

ELEVATION

Blue grouse tend to move to higher elevations in the fall and winter and to lower elevations in the spring and summer (Beer, 1943; Bendell, 1955a; Mussehl, 1960). There are exceptions to this movement pattern for some dusky grouse remain relatively static through the year. Most dusky grouse in Colorado occur between 7,000 and 10,000 feet elevation (Fig. 7). They are common above timberline in some localities. The highest elevation at which observed is 12,700 feet in 1964 by Lamont Jensen while studying ptarmigan near Independence Pass. Where broad expanses of willow occur above timberline, broods were common; if willow are in scattered clumps, usually only males were seen.

The lowest elevation at which the writer has observed dusky grouse in Colorado is 6,105 feet. In the spring of 1952, two birds flew into a grove of Russian olive (*Elaeagnus angustifolia*), surrounding the Little Hills Game Experiment Station headquarters west of Meeker and fed on seeds of the shrub. Several groups of grouse were observed near the station through 1953. The dominant cover type in this area is pinion-juniper and mixed brush, but small stands of Douglas fir occur.

During the period of study, the elevation at which broods were sighted varied from 7,700 to 12,400 feet, averaging about 9,000 feet. However, more hours of observation were on the Uncompahgre Divide transect where sightings were necessarily limited to the peak elevation of 9,600 feet and lower.

Weather and food conditions influence elevational movements of dusky grouse. One of the most common examples is downward in the fall to feed on Gambel oak acorns. A preferred food supply (berries or mast) at lower elevations also appeared to delay upward movement to conifers for several weeks and occasionally through the winter. According to Ivan R. Massey, (personal communication), dusky grouse often use snow roosts in the mixed-brush type range on the Uncompahgre Plateau and remain relatively localized the year round. Evidence of a snow roost in the ponderosa pine type was found in 1964.

TOPOGRAPHY

Dusky grouse were observed in almost every type of terrain: nesting and feeding in flat hay meadows, feeding and roosting on steep slopes, and feed-

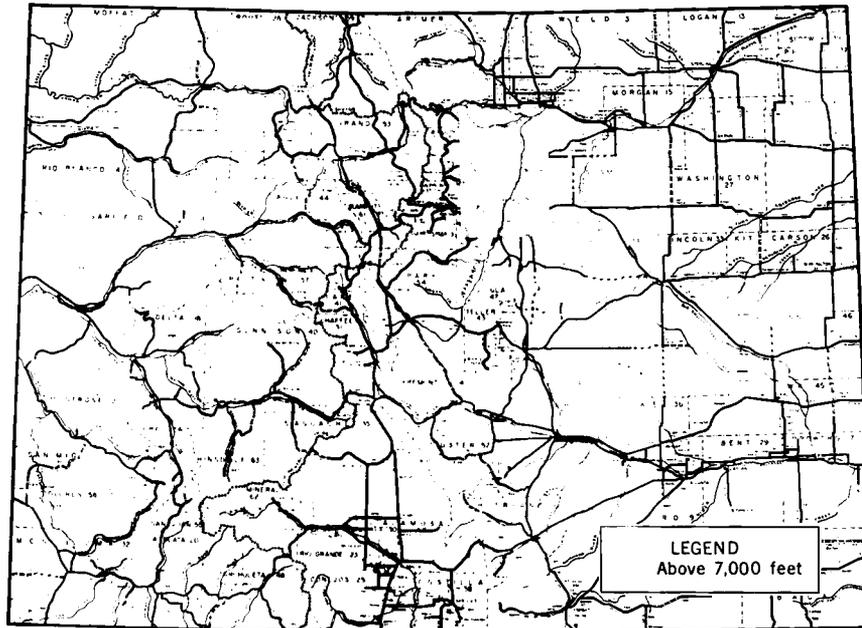


FIG. 7— Lower boundary of the 7000-foot elevational zone in Colorado.

ing in narrow valleys and on ridgetops and benches. Perhaps because steep slopes are prevalent in mountains, and perhaps as a protection maneuver, dusky grouse were observed most often near slopes that permitted easy escape flight. Occasionally, on being flushed from the ground, they would fly up into a tree, but if flushed again, would sail out and down. Young birds particularly appeared to be weak flyers and, if flushed on a relatively flat area, would fly only a short distance; but with any downward break in topography they would sail down the slope for several hundred yards before alighting. The greatest number of brood observations was noted on small flats within areas of steep to gently rolling slopes. When approached from the downhill side, the birds appeared confused and did not flush until hard-pressed, but when approached from the uphill side they flushed readily.

GEOLOGY

Although a map showing all geological formations of the region was prepared from a revised U. S. Geological Survey map (1954), it is not used in this publication because of overdetail. After correlating this map with dusky grouse distribution, a simplified map showing igneous, metamorphic, and sedimentary rock occurrence was drafted (Fig. 8).

Until a complete and thorough soil study can be made of the mountainous areas of Colorado, generalities will have to prevail. Steinhoff (1958) stated that soils derived from igneous rock should be present on dusky grouse range because they are preferred over soils of shale and sandstone origin. However, good dusky grouse populations were found on all types of parent ma-

terials, with no noticeable relationship between soils and populations. Three areas with high grouse density (Red and White Mountain, Red Table Mountain, and Uncompahgre Plateau) have sedimentary soils, while other areas (Crested Butte, Homestake Creek, and Shrine Pass) have equally high populations living on igneous soils.

According to the Department of Agriculture Yearbook, *Soils and Men*, 1938, “. . . the character of the ultimate soil product derived from any given rock will depend in a large degree on the activity of the other factors of soil formation.” There is so much variation in soils derived from all groups — sedimentary, igneous, and metamorphic — as well as within rock classifications, that generalized statements are inadmissible. Sandstone soils range from fertile to infertile in the same general area, depending on the materials contained in them.

CLIMATE

Most of the dusky grouse range in Colorado is within the 20- to 40-inch precipitation zone. The few areas inhabited outside of this zone are where Douglas fir occurs on north or shaded slopes (Fig. 6).

The mean temperature is varied (15 to 64 F) on occupied range, but is more varied as to temperature extremes (-24 to 97 F) on dusky grouse range. High temperature may tend to restrict grouse range more than low temperature, for these birds are seldom present in areas with readings in excess of 95 F; they are common where lows reach -40 F.

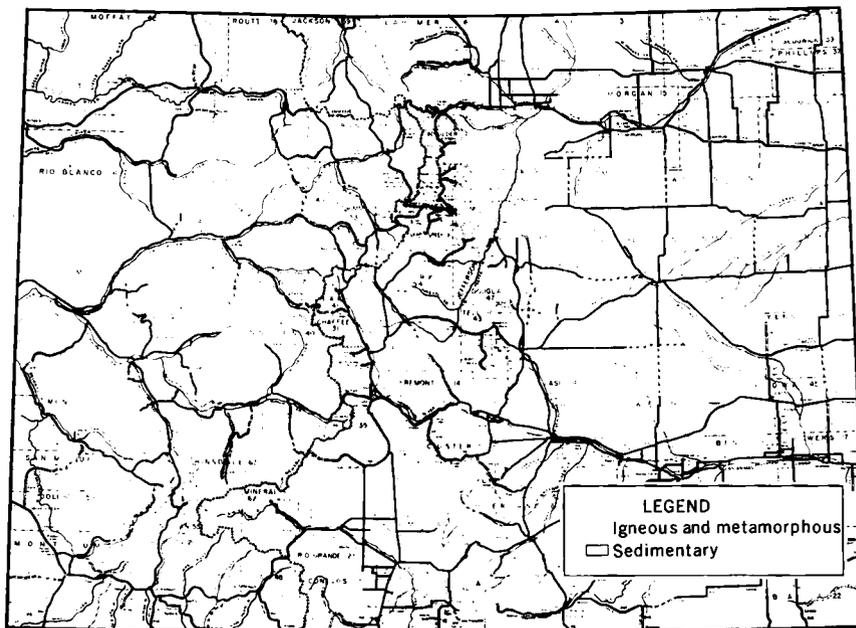


FIG. 8 — A simplified geological map of Colorado.



POPULATIONS

Ability to measure yearly fluctuations in populations have long been considered basic to proper game management. Under ideal conditions all population measurements, in the light of productivity, harvest, weather, season length, bag limits, and other factors, would apply to specific area units.

Since 1955, harvest data for blue grouse have been collected in Colorado through the use of random questionnaires. States in the Pacific Northwest and provinces in southeast Canada obtain harvest data from random questionnaires or checking stations, where the sample of hunters in both instances is greater than in Colorado (Rogers, 1963).

Census information is collected by these states and provinces through general counts, "hooting" counts, and brood counts, executed singly or in combination. Transects employed in counts may be vehicular or foot, extensive or intensive.

In Colorado, roads were selected in wildlife conservation officer districts reporting high densities of dusky grouse. Repeated trips were made over these roads at varying times of the day during spring and summer. Types of census trends tested were limited to road transects to conform with workload limitations of conservation officer personnel. Initially, 11 transects were established, but due to low grouse densities, efforts the last 3 years were concentrated on the Uncompahgre Plateau and the Grand Mesa in western Colorado.

Size of sample and consistency among trials were low on all road transects. For this reason time was given to study of behavioral characteristics of the dusky grouse in an attempt to delineate reasons for failure. Results of all grouse population measurements are given under the following headings.

DENSITY

It is doubtful if dusky grouse density in Colorado in the 1800s was appreciably higher than at the present time, although the total population was probably greater. The grouse range was perhaps in better condition, with more area available. Future changes in density and distribution will probably depend more on habitat change than any other factor.

It became apparent in initial interviews that reported grouse numbers and distribution were directly correlated with location and frequency of travel by the observer. During a special Forest Service study, summer of 1961, and in all project travel, effort was made to separate total mileage into individual trips so that grouse seen could be translated to a miles-per-bird figure. Counts of birds observed on a representative area during specific day periods were made in an effort to determine how sightings between 8:00 A.M. to 5:00 P.M. concurred with early morning and late afternoon observations. Studies reported under *Broods* indicated little difference in number seen during three times of day.

In remote National Forest areas, where travel was by foot or horseback, an average of one dusky grouse per 6.25 miles was recorded. Where National Forest travel was by motor vehicle, the average was 27.3 miles per grouse. It would appear, therefore, that remote areas contained four times more grouse than road areas, or that four times as many are observed while traveling on foot or horseback than by vehicle.

Besides general distribution studies, breeding display and brood observations contributed some density figures. A minimum of three males were observed on a 0.6-mile road transect on Grand Mesa National Forest. In two instances, related under *Breeding*, two males were observed from a single point. However, for all travel, only 25 displaying males, excluding probable repeats, were observed during the 3 years.

In all trips (4,491 miles) over the 62.5-mile Uncompahgre Plateau brood-trend route, 1961-1963, an average of 0.039 blue grouse was seen per mile traveled, but on one 15-mile section 0.090 grouse per mile was seen. There were density variations by years, the highest in 1963 with 0.097 bird per mile, followed by 0.036 bird in 1961 and 0.025 bird in 1962 (Table 1). Stated as the inverse ratio of miles per bird, one grouse per 26.07 miles of travel was observed during the 3 years. On the best 15-mile section for all times of day,

TABLE 1 — Blue grouse observed from vehicles, Uncompahgre and Grand Mesa study areas, Colorado, 1961-1963.

Year	Miles Traveled	No. of Grouse	Birds per Mile	% Change	No. of Broods	Broods per Mile	% Change
1961	2,753.6	100	0.036	00.0	17	0.006	00.0
1962	1,549.0	40	0.025	- 30.5	6	0.003	- 50.0
1963	185.5	18	0.097	+288.0	3	0.016	+400.0

one grouse per 11.05 miles of travel was recorded during the 3 years. Variation by years on the entire trend route ranged from 10.3 miles per bird in 1963 to 38.72 miles per bird in 1962.

HOOTING COUNTS

Behavior of the blue grouse male during the breeding season varies, although season and time of day may influence the degree of activity. In general, the male's behavior is distinctive according to presence of females, absence of females and other males, and presence of other males. However, there are overlaps in sound, movement, and plumage display in the three situations.

Courtship behavior was studied in the hope of developing roadside census-trend routes based on mating display for use in Colorado. California, Oregon, Montana, and British Columbia obtain census information on blue grouse by means of hooting-count routes involving subspecies *D. o. fuliginosus* and *D. o. pallidus*. They are conducted from a vehicle along 10- and 20-mile road segments or by foot on small study plots, and are often made in conjunction with drumming counts of western ruffed grouse.

General — Observations on displaying grouse were begun in 1962 and continued through the spring of 1965. The number of individual birds observed is not known, but 53 different observations were made of displaying males. The observations ranged in time from a few seconds, where the bird was inadvertently flushed to a maximum of 3 hours and 24 minutes.

The search for displaying males was begun in March and continued through the summer. Varying range types and elevations were covered: dense coniferous forests near timberline, aspen-conifer stands, mountain parks, aspen stands, mixed-shrub range at median elevations, irrigated hay meadows, dry-farmed lands, and sagebrush ranges at lower elevations. Most observations were during May; and comparison in consistency of observations was limited to this month except for the Grand Mesa area. The daily period of search was concentrated from daybreak to 3 hours after sunrise. After an initial sighting of a displaying male, however, repeat trips included not only the sunrise hours but at least one midday and one late-evening check.

The breeding characteristics of blue grouse were separated by Brooks (1929) and Ridgway and Friedman (1946) into two divisions: one for the inland or "Dusky" group; the other for the coastal or "Sooty" group. Separation of subspecies is based on morphology of the gular hooting sacs. Those of the sooty group are described as thick, large, tuberculate, and deep yellow in color, while those of the dusky group are described as thinner, smaller, glabrate, and purplish in color. Differences in construction of the gular sac may be reflected in the volume of sound produced by the two groups. Hooting of sooty grouse is louder, with great carrying power in comparison to dusky grouse. Some authors have extrapolated breeding characteristics of observed subspecies in each group.

Blue grouse males move down to the breeding range, beginning in late March and generally remain through May (Bendell, 1955a; Mussehl, 1960), the peak of movement occurring about the middle of April. Since yearling males are seldom observed on the breeding range (Bendell, 1955a), indications are that they seldom leave the wintering areas.

Breeding ranges in Colorado may be from one to several thousand feet lower, higher, or at the same altitude as the winter range, depending on vegetative composition. Open conifer-aspen stands with a shrub understory, or areas where shrubs adjoin conifers, appear to be preferred. Breeding ranges are a portion of the summer brood range, but are not all-inclusive since the males tend to congregate into competitive groups.

The consensus of most references is that displaying begins shortly after arrival of males and establishment of territories on the breeding grounds. Strutting activities and defense of territories may continue through July (Mussel, 1960), although they are greatly reduced in consistency and intensity after about the second week of May. Observations in Colorado showed peak display to be from the first week in May through the first week of June. Although search was begun in March and continued through the summer, the earliest strutting dusky grouse was observed on April 30 and the latest on July 6. In 1965, a 3-day snowstorm ending on April 28 deposited six inches of fresh snow on Grand Mesa. On April 30, dusky grouse tracks were traced in a zigzag route up the slope for over 1/2 mile from a display site. In 1962, the first displaying male was observed on May 8, while May 7 was the first date of observations in 1963 and 1964.

TABLE 2 — Comparison of male courtship coloration and behavior between dusky and sooty grouse^a.

Factor	Dusky Grouse Group ^b	Sooty Grouse Group ^c
Coloration:		
Body plumage	Brownish to blue-gray	Mottled brown to blue-black
Undertail coverts	Gray tipped with white Black with white tips in <i>richardsonii</i>	Brown to gray, black-tipped with white
Feather rosette	Small, white, tipped with gray	Large, white, tipped with black
Eye combs	Orange to red; yellow to red	Yellow to orange
Air sacs	Purplish	Yellow
Behavior:		
Audibility	10 to 100 yards	300 feet to several miles
Territoriality	Weak, occasionally communal	Strong, defended
Rhythm	Single or 5, rarely 6, hoots	Single or 5, rarely 6, hoots
Dance	Present	Absent or present
Site	Ground or tree	Tree or ground

^aThese data compiled from various authors, with some contradictions, such as Munro (1919) and Skinner (1927) listing orange-red gular sacs on *richardsonii*, not shown above.

^bDusky grouse group includes *D. o. obscurus*, *oreinus*, *richardsonii*, and *pallidus* subspecies

^cSooty grouse group includes *D. o. fuliginosus*, *howardi*, *sierrae*, and *sitkensis* subspecies

Although some contradictions are present, general courtship characteristics of the two subspecies groups are given in Table 2. Findings on *D. o. obscurus* showed some variation from the literature, as compared to other subspecies of the dusky group. There appear to be some features of intergradation from *D. o. richardsonii* in the far northwest to *D. o. obscurus* in the southeast, with central subspecies *D. o. pallidus* showing characteristics and difference from each extreme. However, the small number of birds observed by some authors, changes in taxonomy, individual differences in behavior, and kinds of motivation present during observation may account for the behavior variations attributed to each subspecies. Descriptions of behavior for *D. o. howardi*, *D.o. oreinus*, *D. o. sierrae*, and *D. o. sitkensis* were not found in the literature.

Site Characteristics — Displaying dusky grouse have been observed in aspen-ponderosa pine, mixed fir and aspen, open and dense aspen, mixed shrubs, sagebrush, wheatfields, and on roadbeds. Preference appeared to be for relatively open stands of trees or shrubs.

Within these vegetative types, males tend to utilize earth mounds, rocks, logs, cut banks, and occasionally, if disturbed, tree limbs for displaying (Figs. 9 and 10). In general, the preference seemed to be for open, flat ground, although steep slopes may be present on one or more sides allowing view, or permitting the female to view, the male. However, individual males were observed in dense cover and in valley bottoms, perhaps partly the result of disturbance, but also in response to a rival male or interest in a female.

Hooting males may be close to heavy vegetative cover. They frequently retreat into heavier ground cover or fly to a tree branch if disturbed; but they prefer to dance at ground level and be in full view. In only two instances were hooting birds observed at more than 20 feet from some type of trees or tall shrubs. The attraction of a group of dancing sharp-tailed grouse caused one blue grouse male to strut on a rock in the middle of a wheatfield. Rivalry may have caused two other males to extend their performance to an open hay meadow.



FIG. 9 — Male blue grouse frequently use rocks, logs, mounds of earth and other elevations for hooting.



FIG. 10 — Male blue grouse hooting from an aspen branch.

Variations in stimuli and disturbance may result in the utilization of different display sites. During less active periods, without hens or other males challenging, the male chooses the display site that affords the best observation of an area, enabling him to combine looking and listening with hooting and feeding.

Females may walk or fly to the male or may remain in areas of denser cover, signaling their presence by wing flutters or calls, whereupon the male moves in with quickened display patterns. Human disturbance may cause the male to flush during any activity. Flight is usually short in distance, often to a tree limb where display is resumed.

On only one occasion have two male dusky grouse been observed displaying with tolerance, but no hen was present and one male was smaller than the other. On other occasions when two male dusky grouse came to within a few feet of each other, approach was stiff-legged and threatening until one or both flushed from the disputed area.

Hooting blue grouse have been observed at varied elevations from 6,900 to 11,300 feet. Most sightings, however, were between 8,000 and 9,000 feet, partially the result of disproportionate travel at these elevations. The presence of suitable vegetation and terrain, rather than elevation, appears to be a governing factor in the choice of display site. While under observation, males used 2 to 11 display sites, but to what degree the observer's presence contributed to these patterns was not determined.

Movements — Different methods of observing movement were tried, including staying within a stationary vehicle close to the bird or at binocular range; observing from outside a vehicle using binoculars and, at the same time, listening for sounds to determine movements. On five occasions, attempts to attain continuous observation of the male were made by following on foot as described by Blackford (1958, 1963).

Under no set of conditions did grouse appear unaware of the observer's presence for an appreciable period. However, when females or other males were in the vicinity, no noticeable attention was given to the observer unless one of the birds flushed or gave a warning call. In almost every instance, females appeared more cognizant of the observer and tended to flush more quickly than males.

Reaction of the displaying male to the observer was varied, and it was often difficult to determine if subsequent movements were correlated with his presence. The male under observation sometimes flushed completely out of the area. At other times he remained at the same site for nearly 2 hours and then slowly moved away, feeding as he went. Some males changed display sites immediately, by only a few feet or as much as 400 feet, then continued hooting or displaying; others changed sites by several feet at frequent intervals in a steady progression away from the observer. Males sometimes flushed, flying to a tree limb and continued alternately to display and feed on buds or leaves. A few challenged the observer and remained at the same site, or challenged and moved toward the observer, and then retreated to a new vantage point.

On two mornings, a week apart and within a few minutes after parking on the Outlaw Mesa Road of the Uncompahgre Plateau, a male was observed several hundred feet away walking toward the vehicle. In the first instance he circled the vehicle twice before moving out of sight; in the second instance, he displayed for 7 minutes on the barrow bank before leaving.

A male sometimes responded to the sound of a female or another male, moved out of sight, and later returned to his original position unless followed by the observer. All males kept under constant observation by following them tended to move more and to cease displaying at an earlier hour than when not followed.

Frequency of movement and decrease in display, generally to an erratic feeding and hooting combination, occurred about an hour after sunrise. Bendell (1955a) found that display activity increased at twilight. Observations in Colorado during the evening hours were too few to discern a pattern. Regardless of the time of day, calls or the presence of the female generally induced an increase in activity.

Plumage — The over-all plumage coloration of hooting male grouse is from light blue to brownish-gray, with areas of white on the breast, undertail coverts, and neck rosettes. The feathers are a darker blue-gray on the head and tail retrices, except for the light-gray terminal tailband. The enlarged eyecombs range from yellow to red with tints of orange predominant. Air sacs are reddish-purple with some variation in tinge according to degree of expansion and excitement. Blackford (1958) described the "combs" as normally yellow in *D. o. richardsonii*, but stated that they may change to red

under sexual stress. The "comb" color for most *D. o. obscurus* males observed was orange, but yellow and red were noted for individuals; and in several instances the change from yellow to red and red to yellow were observed. In five instances, when "combs" were red, fear and anger could have been involved rather than sexual excitement, as females were not in the vicinity. However, yellow, orange, and red were repeatedly present in one male mounting a dummy hen.

Plumage display characteristics should be divided into three categories: plain (without display features), the hooting display, and the full or breeding display. At various times and for various reasons, the male ceased all display and, except for general coloration, could not be distinguished from the female. The sudden proximity of the observer or a predator, the absence of hens, the desire to feed, and occasionally when no explanation could be postulated, caused the male to revert to normal plumage. With a rival male displaying within 150 feet, a male in full display for two females suddenly reverted to normal plumage and movement when a third female approached. This male then followed the third female from the area without noticeable display.



FIG. 11 — At times only the eye combs are enlarged while hooting. Note papillary-like surface of combs.

The courting male is most often observed in the hooting display. Generally, this male is stationary, with the air sacs and eye-combs showing to some degree (Fig. 11). When the air sacs are inflated, the rosette of white feathers around them may be only partly showing or may form a complete circle (Figs. 12 and 13). The eye-combs seldom remain fully inflated, but increase and decrease in size throughout display. The tail is generally in normal position and unspread, but it may be raised and not fanned, raised and fanned, or fanned partially and not raised. Wings and body remain in their normal positions.

The full display position is assumed as the bird lowers his head, bringing the body close to and parallel with the ground. The tail is raised to the vertical and fanned to a complete half circle. Wings are extended slightly out and down with the distal primaries separated. Air sacs and eye-combs are expanded, and the white rosette around the air sacs forms a complete circle (Figs. 14-16).

Behavior — Many of the male's movements were a part of the courting act and probably were influenced very little by the observer. Frequently the male reacted to the presence of the observer or vehicle. He would jump about a foot in the air, beat his wings two to four times, make a half-turn, and land in full-display position, tail up and spread and air sacs inflated. This same jump, half-turn, and wing beat were given upon the approach of another male, or when the wing beats of another male were heard. Usually, sight or sound of another male would induce full display — head and wings down with primaries slightly extended and tail up and fanned. He then moved with fast, short steps in the direction of the challenger, wings beating, and jumping off the ground at irregular intervals.

The fast, short steps had the appearance of a dance. They were not observed unless the male was in full display and moving toward a male or a female. Tracks of this quick-step in snow and dust were frequently found, sometimes moving in a line, sometimes back and forth in a path, and, twice, as a circling dance to the right. The diameters of these circles were 18 and 19 inches, only an inch in variance. No actual contact was observed between males. The closest antagonistic approach was approximately 2 feet, where each bird made another challenge jump-turn, circled in a sidewise movement facing the other, and then flew back in the directions from which they had come.

The sight or sound of an approaching female caused a similar reaction in the male, with some differences in sound and movement. The full display position was assumed, but the challenging jump-turn was not given. However, single or multiple wing beats may be given as the male quick-steps and runs towards the female. When the male neared a female (within 3 to 4 feet) he tended to circle to a position above the female. Often on flat areas this may include the use of logs and rocks to attain height. Then, during the last 3 to 4 feet, the quick-step was abandoned and a fast run was made to the female. Circling and dashing may be repeated until the female flushes from the area, another female or male appears, or copulation is consummated.

With females or rivals absent, the movement of hooting males does not appear to have the continuity attributed to other grouse species; instead, it



FIGS. 12-13—Air sac sequence in hooping blue grouse. Near closed (12); near maximum extension (13). Use of dummy female to induce reactions in male suggested by S. D. McDonald.



FIG. 14— Air sac, eye combs and tail of blue grouse male nearing full extension.



FIG. 15— Lowering of body to horizontal with ground and extension of wings would give this male blue grouse the full display posture.



FIG. 16—Male blue grouse approaching female. Note canted tail and turned head showing neck rosette.

almost appears that his main interest is to test the functional aspects of the various display organs and appendages. Males have been observed to inflate and deflate air sacs and eye-combs a number of times without nodding the head or making the hooting sounds generally associated with these manipulations.

Long periods of silent looking, feeding, and listening on the part of the male (Fig. 17) may be followed by several minutes of intermittent hooting, and then by a stately walk around or away from the hooting site. The tail may be held erect or horizontal, spread or closed, its position having no set pattern through the hooting sequence (Fig. 18).

Vocalizations and Audibility—Sounds of the courting blue grouse can be separated into three groups: (1) call not involving air sacs; (2) calls involving air sacs; and (3) beat of the wings. While sounds in the last two categories can definitely be assigned to courtship, it is much more difficult to relate ordinary calls. Audibility of sounds vary with the condition and vigor with which they are given.



FIG. 17— At times the blue grouse male may quietly stand, look and listen.



FIG. 18— Male blue grouse in typical hooting position and site.

Blackford (1958) mentioned three calls not involving the air sacs: an alarm note, "kut-kut-kut;" a low warning note given by hens in flight, "kr-r-r;" and the hen's in-flight call, "kutter-r-r-r." Later, Blackford (1963) added the following calls: low, guttural, throaty notes given as a female arrives or alights near the male; a loud cackle by the female resembling the sound of a domestic fowl; a weird complaint or alarm note of the female, "cac-rrrr-cac-rrrr-cac-rrrr;" and the "kut-kut-kut" previously mentioned, but given for 2 to 3 minutes, sometimes in flight.

The most common call heard during the study was that given by dusky grouse hens in flight. It varied from a soft, low-pitched "kut-kut-kut" or "ca-ca-ca" if the bird was not alarmed, to a rather loud, high-pitched cackle if the bird was flushed. The calls were audible up to 300 feet and some may have been from a greater distance. However, judging by the reaction of males observed, they were different in characteristics other than volume. Some calls induced no noticeable reaction; for others, males showed alertness and moved toward the call in full display.

Two other calls, by the same male, were heard on one occasion: at 5:15 A.M., May 30, 1964, the bird under observation looked at the sky, flushed to an aspen branch using a clapping wing beating, and, on alighting, gave a "gobbling" sound similar to that made by the sharp-tailed grouse. At 5:33 A.M., after this male had resumed intermittent hooting from the limb, a single two-note "ca-caw" was emitted. Unless the "gobbling" was partially from the air sacs, as it appears to be in the sharp-tailed grouse, only two distinct hooting calls were otherwise noted, a series of notes and a single note.

The series of notes is described by Brooks (1926) as five or rarely six deliberately even-spaced hoots or grunts. Ridgway and Friedmann (1946) stated that the hooting of the sooty group is audible for several miles, while that of the dusky group is audible for less than 100 yards. In specific reference to the subspecies *D. o. obscurus*, Brooks (1929), quoting Ligon, credited the blue grouse of New Mexico with an audibility range of 40 yards, while Flint (1928) stated the distance as $\frac{1}{4}$ mile.

Blackford (1963) separated series calls into two categories, "grunting" and "hooting," based on volume, tone, and execution. In all series hooting heard in this study, five notes or pulsations of the air sacs were always given. They were not evenly spaced, but it is difficult to state whether the first was longer than the four following, or whether the second note was shorter than the others. In tone, the second note was softer. Audibility of the series hoot never exceeded 105 feet in distance, and on many occasions, although pulsation of the air sacs was visible, no sound could be heard at 20 feet.

There was a difference in the volume of series hooting, as described by Blackford, according to whether the air sacs were fully or only partially inflated. In many instances, the male appeared to move the air sacs as an exercise rather than to produce sound. The time between hooting series varied by motivation, time of day, and probably other factors. The shortest period between series was 6 seconds, while the longest periods approached 30 minutes. For example, at 5:07 A.M., on May 18, 1963, a male began hooting. The time between series was 23, 12, 7, 8, 19, 12, and 6 seconds, when hooting was stopped only to begin again 13 minutes later.

During the first 3 years of observations, the single hoot "oops," as phoneticized by Brooks (1926), was heard only twice as a single execution during the 14th and 22nd observations. In contrast, the first male observed in 1965 executed the single hoot six times in 21 minutes. Altogether in 1965, the single hoot was recorded by the observer 16 times by five different males. One male gave the single hoot six times in 9 minutes, at intervals of 1 to 3 minutes. The single hoot is a loud, explosive sound clearly audible at 510 feet, apparently given only at the completion of the male's dash toward the female.

Another single hoot was observed and heard one time. At 4:30 A.M., May 24, 1965, while parked on the Outlaw Mesa Road of the Uncompahgre Plateau near where a male had displayed previously, a blue grouse approached from the north. The light was too poor to ascertain sex of the bird, which circled the car at a distance of 1 to 5 feet. On the second trip around, the bird gave a single "ump" at the rear of the car, then moved to the front where, enlarging his air sacs, he gave another "ump." This "ump" did not compare either in tone or volume with sounds of either the five-note series or the single hoots previously related.

Blackford (1958, 1963) described and named seven or eight different "signals" or "wing notes." Varied sounds produced by wing beats were audible at long distances, usually unmeasured since movement of the bird between the time heard and located could not be determined. Some sounds appear to be restricted to the male, while others may be made by either male or female. Other wing sounds heard were mainly of flight. Sometimes these sounds invoked a reaction in males in the vicinity, but consistency of reaction could not be determined.

Territoriality — Bendell (1955a) recorded 30 to 80 observations on each of five blue grouse males (*D. o. fuliginosus*) during April and May and found that each occupied, defended, and rarely left a territory of one to 2 acres in size. In studies on *D. o. richardsonii*, Blackford (1958, 1963) found similar territorial restrictions for each male observed. The size of territories defended by *D. o. richardsonii* were similar to *D. o. fuliginosus*. Despite the apparent restriction of a territory boundary, two males observed by Blackford (1963) showed wide variance in use of specific sites on the same day and on different days.

Marking of males to study movements has not been done in Colorado. Inferences can be drawn from observations, but validity and irregularity cannot be evaluated. Of nine males observed in breeding display from 1962 to 1964 in 57 trips on the Uncompahgre Plateau, only one was observed or heard twice near the same site or even within a mile of a previous observation. Two males were observed displaying together on May 8, 1962, and after diligent search on May 24, 1964, a single male was flushed within 100 yards of this location.

In 1965, on nine trips to a square-mile area on the Uncompahgre Plateau where only a single male had been seen in 12 trips in 1964, three males were observed on one trip, two males on two trips, one male on two trips, and no birds on four trips. During neither year was a bird seen at the specified site of a previous observation, except a blue grouse that came to the parked car on two mornings, May 24 and May 31, before moving back to a display location.

Greater consistency was attained in observation of male grouse along the Mesa Lakes Road on the Grand Mesa National Forest. Only twice in 16 trips during May, 1964, were no birds observed. In eight trips during the first 3 weeks of June, birds were not observed on three trips.

In the 18 successful trips to the Grand Mesa in 1965, a single bird was observed on 11 trips, two birds were observed on five trips, and three birds on two trips, with some variation in pattern from previous years. Once, when two males, and once when three males were seen, an additional male was heard, indicating that three or four males were using the area. In all, nine different sites were used for displaying on the Grand Mesa area during the 3 years of observations; but all males observed used two or more display sites during each period of observation (Fig. 19).

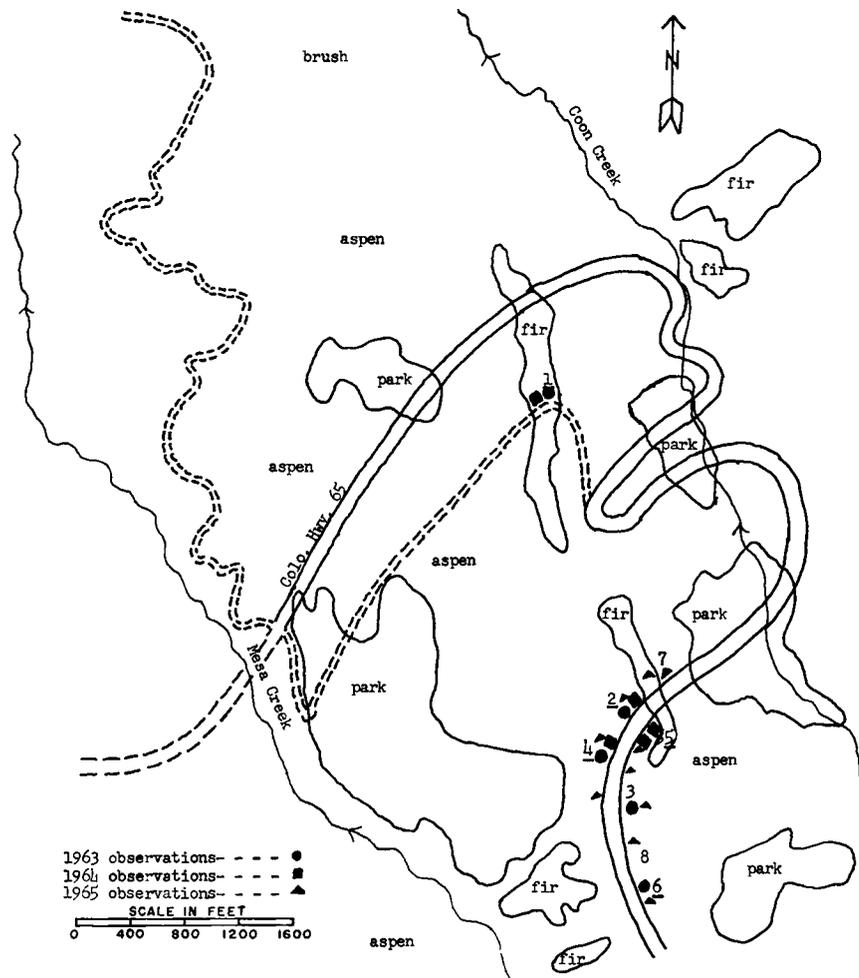


FIG. 19—Observation sites of male blue grouse on one area of the Grand Mesa National Forest.

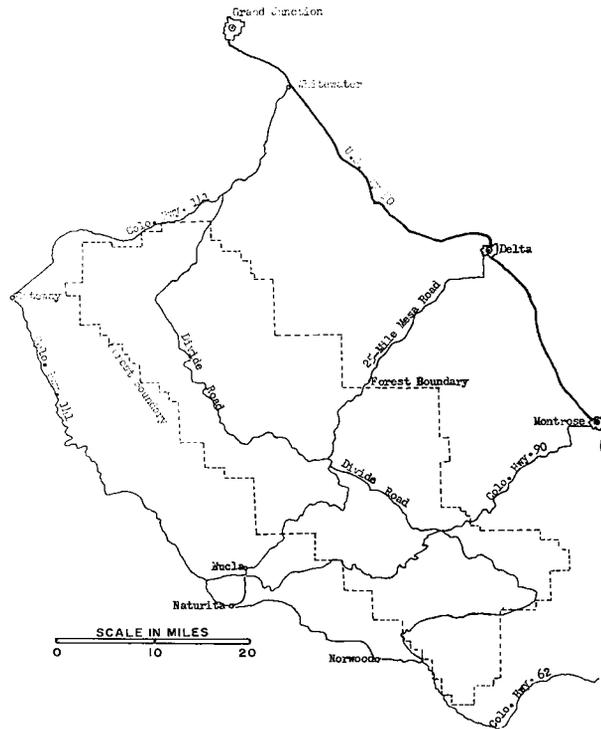


FIG. 20—Divide Road, Uncompahgre Plateau, along which blue grouse studies were conducted. 1961-1963. The plateau, a part of the Uncompahgre National Forest, is in west-central Colorado.

In the only other location where repeat sightings were made, near the Mystic School northwest of Steamboat Springs, three males were seen on two of 24 trips.

One explanation for the difference between resighting of males on Grand Mesa and the lack of repeat observations on the Uncompahgre Plateau may lie in the relationship of territories to topography and road location. The Grand Mesa Road winds across the Plateau, allowing view of both valley and the ridge characteristic of territories. Hooting sites along the road permit a good view of either valley. Even though each male could and did move frequently to different hooting sites, he tended to remain within view of the road most of the time. Males flushed from this area generally flew to the bottom of the valley or to the far hillside, an airline distance of over a mile, rather than circling back to remain on territory.

On the Uncompahgre Plateau, the road gently curves through the relatively flat area (Fig. 20). Unless the chosen hooting site was within about 50 feet of the road, or unless the male crossed the road, he was not observed. Foot travel after fresh snow indicated that most of the preferred hooting sites were away from the road, allowing for few roadside observations. Males flushed on the Uncompahgre tended to fly only a few hundred feet, often circling back around the observer.

The sounds of courting activity, especially if hens were present, would often bring another male or males into view. Hens seemed to show a preference for a specific male; two to three hens were often in front of one male, presumably passing through the territories of surrounding males.

One displaying male on the Uncompahgre was kept under observation for over 600 feet as he moved to a calling hen. At no time before or after reaching the hen was he challenged by another male. Low population density might tend to increase the size of territories, but generally if one male was observed, close search would disclose a competitor.

BROOD COUNTS

Measurements of reproduction success are prerequisite to determining population trends for all game species. Methods vary as to application and evaluation, but all involve young-to-adult ratios. For birds, data on hatching dates, brood-rearing range, brood numbers, number and percentage of successful hens, and brood losses are collected. In addition, standardized trend routes may involve transects providing birds or broods-per-mile data to be collected for year-to-year comparison.

Bendell (1955) found the peak of hatch for blue grouse (Oregon grouse) on Vancouver Island to be between June 15 and 21, while Mussehl (1960), in Montana, calculated the peak of hatch (Swarth's grouse) as the third week of June, with a hatching-day range from May 25 to July 14.

Grouse chicks are precocial, capable of short flights at 2 weeks of age (Bendell, 1955). Chicks tend to escape danger by "freezing," and may prefer areas with cover of large-leaved forbs. Brood movements in Montana were restricted from 440 to 1,320 yards between July and September (Mussehl, 1960). Type and quality of vegetation are directly correlated to movements during this period. Brood break-up may begin as early as mid-July (Bendell, 1955), but usually not before August and may be delayed until late September. Fall migration of hens and young also varies between these dates, depending, apparently, on food and weather.

In 1961, Colorado initiated study on dusky grouse production, utilizing a specific roadside trend route on the Uncompahgre National Forest. The main purpose was to determine the feasibility of counting birds on specific production routes, using wildlife conservation officers for gathering information (Fig. 20.).

Major problems encountered included the small size of the sample, optimum time of day, period of year, adverse weather conditions, and yearly variation in food, cover, and water.

Area Consistency — The portion of the Uncompahgre Divide road used as a census route is 62.5 miles long. It was divided into five sections as nearly equal in length as physical features allowed. Each section varied as to range type (Figs. 21-25), elevation, and water proximity (Table 3). The observer logged 2,753 miles of travel in 1961, 1,549 miles in 1962, and 183.5 miles in 1963 (Table 1).



FIG. 21 — Section 1 of the Uncompahgre Plateau trend route is mixed ponderosa pine-Gambel oak range, with open parks, brush and aspen interspersed.



FIG. 22 — Section 2 of the Uncompahgre Plateau trend route is sagebrush interspersed with brush, aspen and grass.



FIG. 23 — Section 3 of the Uncompahgre Plateau trend route is aspen and mixed mountain brush, with small stands of spruce and fir.



FIG. 24 — Section 4 of the Uncompahgre Plateau trend route is a mixed aspen-ponderosa pine-spruce-fir type, with a light understory of brush and a few open parks.



FIG. 25 — Section 5 of the Uncompahgre Plateau trend route is in spruce forest, with light fir-aspen-brush understory and open parks.

The highest population densities in 1961 and 1962 were in Section 3, with 22 dusky grouse each year (0.063 and 0.154 bird-per-mile, respectively); and in 1963, in Section 4 with 8 grouse (0.225 bird-per-mile), Table 4. Grouse were seldom observed at the same location or within 100 yards of it during the 3 years. Over-all, a minimum of 4.42 miles of travel was required to see one dusky grouse on the Uncompahgre trend route.

Time of Day — The exact time of each dusky grouse observation was recorded, and all observations were subsequently grouped into time periods for analysis. Period length was 3 hours, with some variation in the first (daylight) and the last (darkness) periods as the season progressed. All transect sections were not sampled equally in terms of miles driven or daily periods. Table 5 is a direct comparison by years for birds-per-mile and broods-per-mile observed during each 3-hour period of the day.

In 1961, the 8:00 AM to 11:00 AM and the 5:00 PM to dark periods were most productive, yielding, respectively, 0.071 and 0.063 bird-per-mile of travel. The high-density period in 1962 was 2:00 to 5:00 PM with 0.083 bird-per-mile, followed by sunrise to 8:00 AM with 0.024 bird-per-mile.

The workload in 1963 did not permit sampling at all periods, but sunrise to 8:00 AM was more productive, with 0.311 bird-per-mile, than 5:00 PM to dark or 2:00 to 5:00 PM. However, transect sections with higher grouse densities were not traveled from 2:00 to 5:00 PM. Variance in optimum observation hours may be due partially to variance in sampling procedures, size of samples, and change in weather conditions.

TABLE 3—Physical characteristics of five census sections, Uncompahgre Divide Road, Uncompahgre National Forest, Colorado.

Section	Length, Miles	Altitude, Feet	Range Type		Canopy Density	Proximity to Water
			Dominant	Secondary		
1	16.2	9,600 - 9,100	Spruce	Aspen	Heavy	Near
2	11.9	9,100 - 9,275	Spruce-fir	Aspen	Medium	Far
3	14.6	9,275 - 9,175	Aspen	Brush	Light	Very near
4	10.2	9,175 - 8,675	Brush	Aspen	Light	Near
5	9.9	8,675 - 8,025	Ponderosa	Aspen-brush	Medium	Far

TABLE 4—Blue grouse adults and broods observed on five census sections, Uncompahgre Divide Road, Uncompahgre National Forest, Colorado, 1961-1963.

Year	Section 1			Section 2			Section 3			Section 4			Section 5		
	Total			Total			Total			Total			Total		
	Miles	Birds	Broods												
1961	311.7	14	2	340.3	0	1	345.4	22	4	112.2	0	0	58.2	0	0
1962	224.0	2	0	197.2	3	1	142.9	22	4	100.2	1	0	94.4	0	0
1963	28.6	0	0	30.5	5	1	42.4	4	1	35.4	8	1	48.7	0	0

TABLE 5—Blue grouse adults and broods observed in ratio to miles traveled during five periods of daylight, Uncompahgre Divide Road, Uncompahgre National Forest, Colorado, 1961-1963.

Year	Daylight to 8 AM		8:00 to 11:00 AM		11:00 AM to 2:00 PM		2:00 to 5:00 PM		5:00 PM to Dark	
	Birds per Mile	Broods per Mile	Birds per Mile	Broods per Mile	Birds per Mile	Broods per Mile	Birds per Mile	Broods per Mile	Birds per Mile	Broods per Mile
1961	0.003	—	0.071	0.011	0.053	0.012	0.017	0.004	0.063	0.007
1962	0.024	0.004	0.005	—	—	—	0.083	0.013	0.016	—
1963	0.311	0.044	—	—	—	—	—	—	0.047	0.011

Time of Year --- Brood counts for management purposes in Colorado should be completed by August 15 for two reasons: (1) the grouse season is approved by the Game, Fish and Parks Commission on the Friday nearest to the first day of September, and is based on previously compiled season recommendations; and (2) brood break-up may occur by mid-August, giving decreased validity to information collected after that date. Therefore, brood counts obtained after August 15 have been excluded from this analysis, even though more birds, both young and adults, were observed per mile of travel after September 1 than for any comparable period.

On the Uncompahgre Plateau trend route only seven broods were observed from July 15 through August in 1961, one brood in 1962, and two broods in 1963. This small sample invalidates any conclusion on hatching success. However, since July 15 was the earliest date of brood observation on the trend area, concentrated effort between July 15 and August 15 should give the best census results. At lower elevations, broods were observed on June 19, 26, 29, and on July 10.

Brood Size --- For 26 broods observed during the 3 years, the average size was 4.12 in 1961, 2.6 in 1962, and 3.0 in 1963. In 1961, only one broodless hen was observed, there were three in 1962, and none in 1963. From these small samples, both brood size and young-per-hen, 1961 was the best production year for the Uncompahgre Plateau; 1963 and 1962 followed in this order. Judging from the total number of birds observed per mile of travel, the highest blue grouse population occurred in 1963.

Weather and Vegetative Relationships --- Plant species within 100 square feet of each blue grouse sighted were recorded on a form, along with elevation, soil type, nearest water, nearest conifers, type and degree of grazing, and disturbance factors. When compiled, there were 40 forbs (not including separate species), 19 grasses, 17 shrubs, and 7 trees. Table 6 lists plant genera which occurred 10% or more of the time at brood sightings.

Growing conditions for the 3 years were different. Wetter and cooler than normal weather in the summer and fall of 1961 affected vegetative growth in the spring of 1962. Extremely dry weather in May, June, and August of 1962 resulted from less than ½-inch of precipitation per month, and in July the figure was only slightly more (0.56 inch). Dry conditions prevailed in 1963 except for August, which was the wettest in 50 years.

The cold, wet springs of 1961 and 1962 improved production of some foods and limited production of others. For example, there were very few acorns in 1961 and 1962, but production was good after the warm, dry spring of 1963. The effect of moisture on vegetative conditions between years may have affected reproduction, census, and harvest of dusky grouse to varying degrees. The extremely dry summer of 1962 and early 1963 did eliminate many of the ponds and seeps close to the census route, and may have caused adults and broods to disperse from the ridge roads to less accessible canyon areas.

Personnel making upland game-bird brood counts are usually instructed to run census trends only when weather conditions are clear, calm, and dry. However, while establishing sage grouse trends (Rogers, 1964), it was noted

TABLE 6 — Percentage occurrence of plant species at blue grouse sightings, Uncompahgre and Grand Mesa National Forests, 1961 and 1962.

Type	Genera	July	August	September
Grasses:	<i>Poa</i>	37.5	50.0	33.3
	<i>Bromus</i>	75.0	40.0	—
	<i>Festuca thurberi</i>	12.5	40.0	33.3
	<i>Stipa</i>	—	30.0	33.3
	<i>Agrostis</i>	—	10.0	—
Forbs:	<i>Senecio</i>	25.0	60.0	—
	<i>Erigeron</i>	50.0	60.0	—
	<i>Potentilla</i>	37.5	40.0	33.3
	<i>Achillea</i>	62.5	40.0	—
	<i>Astragalus</i>	50.0	—	—
	<i>Delphinium</i>	12.5	20.0	—
	<i>Cirsium</i>	12.5	40.0	—
	<i>Lathyrus</i>	25.0	40.0	33.3
	<i>Taraxacum</i>	50.0	50.0	33.3
	<i>Helenium hoopesii</i>	37.5	10.0	66.6
	<i>Ligusticum</i>	25.0	20.0	—
Shrubs:	<i>Symphoricarpos</i>	75.0	70.0	100.0
	<i>Prunus</i>	12.5	40.0	—
	<i>Rosa</i>	25.0	30.0	66.6
	<i>Artemisia tridentata</i>	25.0	30.0	—
	<i>Chrysothamnus</i>	25.0	10.0	—
	<i>Sambucus</i>	—	20.0	—
Trees:	<i>Populus tremuloides</i>	62.5	60.0	33.3
	<i>Picea</i>	—	10.0	—
	<i>Pinus ponderosa</i>	—	10.0	—
	<i>Juniperus utahensis</i>	12.5	—	—

that counts were often high following a storm since birds moved to open areas to escape wet vegetation.

Brood trends for blue grouse were not covered equally under wet and dry conditions. Most unimproved mountain roads are slick and difficult to drive in wet weather, and in this respect the Uncompahgre Divide Road is probably worse than average. Mountain showers come up quickly and, although dry conditions may prevail at the start of trend-route coverage, heavy rain may create impossible driving conditions before it is finished.

In 1961, while less than 10% of trend-route travel was under wet or rainy conditions, one of the seven broods was observed while rain was falling; five of seven were observed while vegetation was wet from rain; four of seven when cloud cover exceeded 50%; and five of seven while the sun was not shining.

Only one trip was made in 1962 when a 50% or greater cloud cover prevailed, and there was no trip during or immediately after a rainstorm. With only 0.56 and 0.43 inches of precipitation in July and August, it was seldom that the vegetation was damp from dew. However, two of five broods were observed when the sun was not shining.

With equal coverage in 1963 under wet and dry conditions, one of three broods was observed in damp vegetation, light showers having occurred early in the morning; two of three were observed under clear, dry conditions; and none were observed during wet and cloudy conditions.

The average wind velocity was recorded at the start and end of the census route and at each observation. In only one instance during the 3 years was a brood observed when wind velocity exceeded 14 miles-per-hour.



MANAGEMENT

BACKGROUND

Lack of information on dusky grouse populations and harvests before 1955 precludes study on the effect of season length and bag limits on population trends before this date. References (cited under *Early Colorado Seasons*) indicate that kills in the early 1900s were greater than now. This is not surprising for then year-round human populations were greater in mountainous areas; there was little or no law enforcement; and early explorers, homesteaders, miners, and timber cutters "lived off the land" as much as possible.

Since 1955 the number of dusky grouse harvested has been estimated from information collected by random sampling of hunters via questionnaires. A special questionnaire mailed in 1961 to 11 western states, 5 Cooperative Wildlife Research Units, 4 Canadian provinces, and 2 universities sought information on inventory procedures used elsewhere in blue grouse management. Seven states, one province, and the University of British Columbia and Washington State University indicated that their personnel collect some type of production information. In Montana, Nevada, New Mexico, Oregon and Wyoming, department personnel collect information incidental to work on other species, or as a group effort between state conservation and federal land agencies.

California, Washington, British Columbia, and the University of British Columbia and Washington State University use specified routes, banding, and selected personnel in collecting data (Rogers, 1963). States (except California) and provinces employing specific studies are in areas of higher blue grouse densities than those using general counts. The degree of research and management are closely correlated to numbers of birds harvested. Montana, Washington, and British Columbia, accounting for over 75% of the total estimated annual harvest of blue grouse, understandably lead in management and research of the species.

While major contributions to blue grouse census have been developed through intensive studies on specific and limited areas, some broad management indications have been established through general counts, "hooting" counts, brood counts, and hunter checks. All of these methods have been tried in Colorado, but without the intensity required for unquestioned evaluation.

To date, management of dusky grouse in Colorado has been based mainly on opinion and trial and error. The long period (1937-1952) during which dusky grouse hunting was not allowed, and the highly restrictive seasons of 1953-1960 (2 to 4 days), reflect the general misconception that this species can easily be overharvested. Somewhat more liberal seasons have been set since 1961, with an increase in length, first, to 9 and then to 18 days, and doubling of the possession limit from three to six. While there remains some public opposition to the hunting of dusky grouse, the Game, Fish and Parks Department, on the evidence of sustained populations, is now able to counteract some of this feeling.

EARLY COLORADO SEASONS

The first law that afforded protection for grouse in Colorado was passed in 1877 (Chapter 41 of the General Laws). Although intended to protect all insectivorous birds except grouse, it helped them, too, by abolishing year round hunting and by establishing a grouse season from October 1 to November 15. However, bag and possession limits were not specified.

The first official mention of the relative abundance of game birds in Colorado was by Game and Fish Commissioner John M. Woodard in 1904, who stated: "The deer have increased to a marked degree, as also have the grouse and sage chickens." In 1906, Woodard stated, "The most numerous game birds of the state are grouse, sage chickens, quail, doves, prairie chickens, ducks and geese." The legislature apparently agreed with him, for the first licensed grouse season in 1905 was from September 1 to October 20, with a daily bag limit of 25, and a possession limit of 50 birds. In 1907, the grouse season was one month earlier, August 1 to October 1.

By 1911, this early opening date was believed responsible for the grouse decline, and Commissioner James Shinn recommended that the season not begin before September 1. A new commissioner in 1913, Walter B. Fraser, requested the legislature to reduce daily bag and possession limits to 20 and 30 birds, respectively. Also, but to no avail, he recommended a later season on grouse and sage chickens, stating that, ". . . sage hen no bigger than meadow larks are being killed." In 1916, Commissioner Fraser stated, "These birds are the prey of predatory animals, and it is generally conceded that the open season on both grouse and sage chickens opens too early. Young birds being killed in large numbers by hunters at mid-season during the hatching period is extremely detrimental." In 1916 the legislature reduced the bag limit to 10 birds a day and 15 in possession. Bag and possession limits were again reduced in 1921 and 1923, increased in 1926, and reduced again in 1931. The season was closed in 1937 by authority of the first Colorado Game and Fish Commission and remained closed until 1953. Dusky grouse have been hunted annually in some parts of Colorado since that year (Table 7).

TABLE 7 — Dusky grouse hunting seasons in Colorado, 1905-1967.

Year ^a	Hunting Season Dates	Bag Limit	Poss. Limit	Open Areas
1905-07	9/1-10/20	25	50	Statewide
1908-12	8/20-10/1	25	50	Statewide
1913-16	8/1-9/1	20	30	Statewide
1917-20	9/15-10/1	10	15	Statewide
1921-22	9/15-10/1	5 ^b	5 ^b	Statewide
1923-24	9/15-10/1	3 ^b	3 ^b	Statewide
1925-27	10/1-10/15	8 ^b	8 ^b	Statewide
1928-32	10/1-10/15	8 ^b	8 ^b	Statewide
1933-36	10/12-10/21	8 ^b	8 ^b	Statewide
1937	10/12-10/18	6 ^b	6 ^b	Statewide
1938-44	Closed	—	—	None
1945	9/1 only	3 ^b	3 ^b	Statewide except Yuma, & Kit Carson counties.
1946-52	Closed	—	—	None
1953	9/20 only	2 ^b	2 ^b	West of U.S. 85 except Routt county.
1954	9/19-9/20	2 ^b	2 ^b	West of U.S. 85 except Devil Cr. drainage, Archuleta Co.
1955	9/18-9/20	2 ^b	2 ^b	West of U.S. 85 (Saguache & Gunnison Co. only 1 day)
1956	9/15-9/18	3	3	West of U.S. 85
1957	9/13-9/16	3 ^c	3 ^c	West of U.S. 85
1958	9/13-9/16	3	3	West of U.S. 85
1959	9/12-9/14	3 ^c	3 ^c	West of U.S. 85
1960	9/17-9/20	3 ^c	3 ^c	West of U.S. 85 except Eagle and Grand counties
1961	9/16-9/24	3 ^c	6 ^c	West of U.S. 85 except portions of Moffat Co.
1962	9/15-9/23	3 ^c	6 ^c	West of U.S. 85
1963	9/14-9/22	3 ^c	6 ^c	West of U.S. 85
	10/5-10/13	3 ^c	6 ^c	
1964	9/12-9/20	3	6	West of U.S. 85
	10/3-10/11	3	6	
1965	8/28-9/19	3 ^c	6 ^c	Designated Wilderness areas only
	9/11-9/19	3	6	West of Interstate 25
	10/2-10/10	3	6	San Luis Valley, North Park, all Western Slope except portions of Moffat County and portions of Larimer County
1966	8/27-9/4	3	6	Designated Wilderness Areas only
	9/10-9/25	3	6	West of Interstate 25 to Cont. Divide, except San Luis Valley
	9/10-9/18	3	6	West of Continental Divide and San Luis Valley
1967	9/2-9/17	3	6	Designated Wilderness Areas only
	9/9-9/17	3	6	West of Interstate 25

^aSeasons set by legislature from 1905 to 1936 in odd-numbered years only; counties could further restrict seasons.

^bAggregate bag with one or more grouse species.

^cAggregate bag limit included only blue grouse and ptarmigan.

POPULATION TRENDS

In search of population trends, general counts of all game species were begun in 1955. A form, "Game Management Sex Ratio Trend Count," was furnished to each fieldman for recording observations. For various reasons the forms were not accepted and their use was discontinued. In 1961, Forest Service personnel were requested to record all dusky grouse observations per trip during the summer. Although the total number of grouse seen would appear to be enough for an adequate sample (1,454), there was no way to determine repeat sightings, densities, or trends, or to make a reliable population evaluation.

On all personal travel the writer kept records from 1961 to 1963 for all grouse observed per mile of travel, both random and on specific transect routes. Although there were yearly variations in birds-per-mile, the total number of observations was extremely low (Table 2), leading to the conclusion that such counts are not reliable because of changing food and weather patterns, inconsistency in counting procedures, and difficulty in evaluation. It is believed, however, that counts over a number of years on specific transects, and at set dates, would give population trend information adequate for management use.

"Hooting" count routes are not feasible in Colorado as dusky grouse are audible for only a short distance, usually less than 100 yards; hooting frequency varies from a minimum of 5 seconds to over 30 minutes; and many breeding ranges are inaccessible due to snow and road conditions.

Many states with effective management programs use brood-count transects, or brood counts on intensive study areas, in obtaining population trend information. Sample sizes (number of birds recorded) are small for the amount of work involved. An average of 13.5 birds per day was observed on four transects in Washington (Zwickel, 1958). Brood transects in Colorado were even less adequate in sightings, averaging only 1.3 birds per day on one transect.

It is believed that the most feasible population trend method for Colorado is designation of a series of road transects read during the first week in August, with all observations recorded by mileage and the number of birds by sex and age.

CENSUS AND CHECK STATION DATA

The state of Washington found little correlation between dusky grouse census trends and harvest success (Zwickel, 1958; Mussehl, 1960). Due to a variety of factors, it is probable that hunter success is not a valid criterion for determining dusky grouse population trends. Inaccessible habitat occupied by these birds, differential between migration and hunting-season dates, changes in food availability, weather conditions that influence movements, and road location (ridge tops or in valleys) all tend to affect hunting success.

Although check-station records may not give population trend information for these grouse, the data collected may furnish information regarding the suitability of present season dates and their relationship to differential sex and age harvest.

HARVESTS AND HARVEST TRENDS

Current hunting seasons, beginning on the second Saturday in September, afford grouse greater protection than if the season was a month earlier or a month later. By September the birds have started to migrate to higher elevations, leaving few along valley roads. Likewise, they are not easily accessible from ridge roads unless storms prior to the season, or certain food conditions, force them to move more rapidly than normal. Since modern-day sportsmen are primarily road hunters, except for elk and bighorn sheep, dusky grouse harvest success is correlated with the number of birds close to roads during the grouse season (Fig. 26).



FIG. 26 — Blue grouse broods appear along roads more frequently in early fall.

Dusky grouse are most often hunted in aspen and conifer types in the higher mountain areas (Fig. 27). Here, whether on the ground or in trees, there is little chance of confusion with other grouse, although some hunters have been misled by band-tailed pigeons. However, in September, dusky grouse are often found in open brushy areas, along with sage and sharp-tailed grouse. Here and at this time of the year, the three species tend to walk and feed on the ground, and it is difficult for some hunters to distinguish among them. The good hunter must, of course, be able to identify each species quickly and surely if he is to take advantage of the longer seasons and separate bag limits presently allowed on dusky grouse.

During the past 12 years, the kill of dusky grouse has ranked eighth among harvested small game species in Colorado. The average yearly kill for this period was 15,897, if the ptarmigan kill is computed at 1% of the total. However, separate harvest estimates for dusky grouse and ptarmigan in 1963 indicate that the latter may comprise 11% of the total (Grieb and Hunter, 1955-1964, inclusive). The highest estimated dusky grouse kill occurred in 1964, with 26,581 birds; the two next highest harvests were 24,027 in 1963 and 23,596 in 1966. The lowest estimated kill was in 1955 with 5,666 birds, while that of 1960 was only slightly greater with 6,799 birds, Table 8.



FIG. 27 — Typical blue grouse hunting scene in late September. (Photo by C. D. Tolman)

TABLE 8— Season restrictions, estimated hunting pressure and kill of blue grouse in Colorado, 1953 to 1967.

Year	Opening Day	Length of Season, Days	Hours	Bag Limit	Poss. Limit	Kill Data from Random Questionnaires			
						Hunters	Kills ^a	Birds per Hunter	Remarks
1953	9/20	1	9 - 5	2	2	—	—	—	Not available
1954	9/19	2	8 - 5	2	2	—	—	—	Not available
1955	9/18	2	8 - 5	2	2	6,159	5,666	0.91	Aggregate w/ptarmigan
1956	9/15	4	8 - 5	3	3	8,730	17,460	2.00	Blue grouse only
1957	9/13	4	8 - 5	3	3	12,172	16,067	1.31	Aggregate w/ptarmigan
1958	9/13	4	8 - 5	3	3	10,189	14,570	1.42	Aggregate w/ptarmigan
1959	9/12	3	8 - 5	3	3	11,617	17,774	1.52	Aggregate w/ptarmigan
1960	9/17	4	8 - 5	3	3	6,295	6,799	1.08	Aggregate w/ptarmigan
1961	9/16	9	8 - 5	3	6	9,119	13,426	1.47	Aggregate w/ptarmigan
1962	9/15	9	SR-SS	3	6	8,750	15,752	1.80	Aggregate w/ptarmigan
1963	9/14	9	SR-SS	3	6	12,646	24,027	1.9	Blue grouse only
	10/5	9							
1964	9/12	9	SR-SS	3	6	14,767	26,581	1.8	Blue grouse only
	10/3	9	SR-SS	3	6				
1965	8/28 ^b	23	SR-SS			7,536	9,043	1.2	Blue grouse only
	9/11	9	SR-SS	3	6				
	10/2	9	SR-SS						
1966	8/27 ^b	9	SR-SS			12,894	23,596	1.8	Blue grouse only
	9/10 ^c	16	SR-SS	3	6				
	9/10 ^d	9	SR-SS						
1967	9/2 ^b	16	SR-SS	3	6	—	—	—	Not available
	9/9	9							

^aKill data adjusted 1 percent for ptarmigan kill, except for 1963.

^bWilderness areas only.

^cWestern Slope.

^dEastern Slope and San Luis Valley.

The random questionnaire, originally designed in 1953 to measure waterfowl harvest, has been used since 1955 (Grieb and Hunter, 1955-1966, inclusive) to estimate the harvest of all small game species. Blue grouse and ptarmigan kills were lumped together on questionnaires sent to hunters for seasons 1955 through 1961 except 1956, when there was no season on ptarmigan. From 1962 through 1966, the kill of blue grouse and ptarmigan have been separate on the questionnaires. Even with broad grouping, the hunter sample remained small with some mistakes apparent in identification within and between the groups of grouse.

Although there is considerable variation in the estimated kill between random-questionnaire and check-station figures for the Uncompahgre area, they are comparative in harvest trend (Fig. 28). Both samples are small and the validity of their use in determining trend is questionable, even if other factors governing harvest were consistent.

An intensive check of dusky grouse hunters was conducted on the Uncompahgre National Forest of western Colorado from 1961 to 1963. Here, check station operations were modified because of the large area covered. Wildlife Conservation Officer John Howlett and I field-checked grouse hunters on and near the brood census route until 2:00 PM. Shortly thereafter, a roadblock was established at the north end of the Uncompahgre Divide road and hunters returning home were checked and interviewed until 8:00 PM (Fig. 29). Data evaluation was limited to information collected the first 2 days (Saturday and Sunday) of each season (Table 9), although hunters were contacted by conservation officers throughout the season.

At the Ohio Creek check station about 5 miles north of Gunnison, the sage grouse harvest has been measured since 1953. Also, dusky grouse were recorded except in 1959 when seasons for the two species did not coincide. This station has been operated consistently during the first 2 days of the grouse season over a 10-year period. Trend in blue grouse harvest has varied (Table 10) from a low of 11 birds in 1957 to a high of 94 in 1956. For 1961 to 1963 inclusive, the harvest trend, as indicated at this station, was inversely correlated with Uncompahgre Plateau Check Station figures in total birds killed. Since most hunters checked at the Ohio Creek station were hunting sage grouse, comparative figures for blue grouse per hour were not obtained.

According to a 3-year average of data from random questionnaires, 1961-1963, Gunnison, Eagle, Routt, and Mesa counties, respectively, received the most hunting pressure. In terms of harvest, the four leading counties are Eagle, Mesa, Grand, and Routt, with Gunnison sixth despite its higher rank in hunting pressure. While there was less than 25% variation in hunting pressure between the first- and fourth-ranked counties, the harvest in Eagle County exceeded the second-ranked county by about 100%. Vegetation, terrain, and remoteness of blue grouse habitat, as well as the bird's daily and seasonal habits, have required the average Colorado hunter to spend 4 hours or more for each grouse killed, regardless of population density.

The number of hunters hunting and total blue grouse killed were greatest in 1964, when questionnaire results showed 14,767 hunters harvested 26,581 grouse, or 1.8 birds per hunter. The kill per hunter was slightly less than the record years of 1956 and 1963, when hunters took 2.0 and 1.9 birds per hunt-

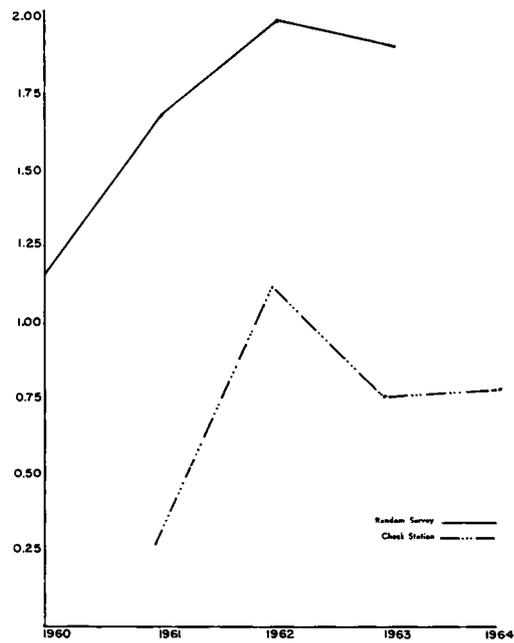


FIG. 28—Comparison of hunter success trend between random questionnaire and check station results, based on birds-per-hunter.



FIG. 29—A successful blue grouse hunting party at the Uncompahgre Check Station.

TABLE 9—Blue grouse hunting pressure and harvest at check station, Uncompahgre Plateau, Colorado.

Year	Date	Number of Hunters	Blue Grouse Checked	Hours Hunted	Birds per Hunter	Birds per Hour
1961	Sept. 16 - 17	132	35	409	0.26	0.08
1962	Sept. 15 - 16	87	95	396	1.09	0.24
1963	Sept. 14 - 15	85	64	542	0.75	0.12
1964	Sept. 12 - 13	48	37	242	0.77	0.15

TABLE 10—Blue grouse kill by year from the Ohio Creek Sage Grouse Check Station, Gunnison National Forest, Colorado, 1953 to 1963.

Year	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Blue grouse checked	17	43	29	94	11	53	Not open in season	51	66	27	57

er, respectively. A differential kill by sex and age, perhaps related to a delay in hen and brood migration, is indicated by the 1963 harvest when 40% of the total kill was adult males.

HUNTER-HARVEST RELATIONSHIPS

Studies in Washington and Montana, states with much higher blue grouse populations, hunting pressure, and harvest than Colorado, show little correlation between hunting success and population trends (Zwickel, 1958; Mussehl, 1960), as previously stated. Many factors, singly or in combination, including not only hunting methods but variations in hunting seasons, weather conditions, foods, and behavior patterns, may influence hunter success.

The Colorado grouse seasons of 1961 and 1962 were the same in length, weapons and in bag and possession limits. They varied in shooting hours, opening date (one day), and weather. The first part of the 1963 season was comparable to that of 1962 in every respect except in opening one day earlier. However, an additional 9-day season was established in early October to coincide with the 1963 turkey season (Table 8).

The first combined blue grouse-turkey season was October 5-13, 1963. Commenting on the season, Myers (1965) said:

The season was favored by 95 percent of the 92 hunters questioned. None believed that grouse hunters had interfered with turkey hunting, or that turkey hunters had hurt grouse hunting. Three hunters opposed the season, mainly because they thought that there were not enough grouse to withstand additional hunting. Forty-six grouse were checked during the season, giving a success ratio of .56 grouse per hunter. Hunters observed 105 grouse which indicates that additional hunting of grouse during the turkey season did not seriously decimate the grouse population . . .

Available facts indicate that grouse hunting during the regular turkey season in early October is a sound management practice, provided grouse are reasonably abundant in the area.

Nine-day postseasons on blue grouse were also established in 1964 and 1965 which ran concurrently with the regular wild turkey seasons.

In 1961, 3.93 inches of rain fell in September and hindered road travel, particularly in back areas, and discouraged hunters from walking through the wet vegetation. September was dry in both 1962 and 1963 and all parts of the Uncompahgre National Forest were readily accessible.

Grouse foods, except acorns, were abundant in 1961 but scarce in 1962 and 1963. Scarcity was alleviated somewhat in specific localities by a good acorn crop in 1963. Variations in food and water during the 3 years may have influenced grouse movement and, therefore, hunting success.

Interviews of hunters indicated that, with present dusky grouse densities, season lengths, and bag limits, few Colorado sportsmen are bona-fide dusky grouse hunters. When food and weather conditions combine with grouse migration to induce concentrations of birds along roads during the first part of

the season, the harvest increased; if the opposite occurred, the harvest decreased. Hunting pressure is always relatively high the opening day of the season and, if hunters are successful, it decreases slowly. When hunting success is poor, hunting often takes the form of a family trip to see the changing fall colors — with a gun in the car!



SUMMARY AND CONCLUSIONS

1. The one subspecies of dusky grouse inhabiting Colorado is only one of eight in the genus *Dendragapus*, widely distributed in western North America. The Colorado form is *D. obscurus obscurus*. Physical measurements of all subspecies are similar, but there are variations among subspecies in plumage and behavior.

2. Distribution in Colorado, in general, is confined to elevations above 6,000 and below 12,700 feet, regardless of topography or geology; to areas where brush, trees, or both, taller than 6 inches, are present; and to where free water or succulent forage is available.

3. Observed densities for 3 years, 1961-1963, ranged from 0.097 to 0.025 bird-per-mile of transect route during the brood and harvest seasons, and from 4.000 to 0.027 birds-per-mile in the breeding seasons. Study areas were on the Uncompahgre and the Grand Mesa national forests in west-central Colorado.

4. Breeding display behavior varied by individual birds, with few indications of strong territoriality for specific sites. Peak activity was from the first week in May to mid-June. Preferred display sites were on small, flat, open areas near slopes and heavier vegetation. In observed instances, movement of the male to the female, or the female into a male's territory, caused change in display behavior.

5. A 5-hoot series is the predominate vocalization of the breeding male and was audible at distances under 100 feet. A single nasal note, audible over 300 feet, may be uttered at the peak of excitement. Wing clapping and drumming are additional sounds given during the breeding display.

6. Lack of audibility, predictability, and consistency in use of a single "hooting" site precludes accurate censusing of males along road transects. However, there appears to be enough uniformity in year-to-year use of specific areas to justify research on the feasibility of obtaining census trend data by intensive studies with marked birds.

7. The peak of hatch probably occurs during the latter part of June. Optimum time of day for brood observations varied, partly due to moisture conditions; early morning, late evening, and from 2:00 to 5:00 PM, were most productive. Dusky grouse broods were not consistent in use of roads. No broods were observed where shrubs were absent.

8. A survey of blue grouse states and provinces indicated that the hooting and brood-count routes are favored as methods of determining population trends in the Pacific states and Montana, while general counts are utilized in other states and provinces. Study in Colorado indicated that none of the commonly used census methods are adequate because of the bird's habits, and low population densities. An intensive study is needed to confirm these conclusions.

9. The first hunting season for dusky grouse in Colorado was established by restrictive law in 1877. Regular seasons and bag limits were set by the Colorado State Legislature from 1905 to 1937, and by the Game and Fish Commission from 1937 to the present time. Early seasons averaged 60 days in length with bag and possession limits of 25 and 50 birds, respectively. The season was closed in 1938 and remained closed until 1953. A season has been held annually since 1953 to the present (1968).

10. Since 1955, the dusky grouse harvest has been determined through a system of random questionnaires mailed to a sample of 3,000 to 10,000 license buyers. Kill estimates obtained in this manner may indicate trend in harvest, but small sample size and stratified distribution of hunters and birds preclude the desired degree of accuracy in estimating number of birds harvested by area.

11. Regular season length was increased from 1 to 3 days in the 1950s, and to 9 and 16 days in the 1960s, with a slight increase in bag limit and doubling of the possession limit, three to six birds. Harvest and hunting pressure are estimated from a random questionnaire for small game, initially devised to measure waterfowl harvest. In 1963, 1964, and 1965, postseason hunts coinciding with the turkey season were permitted. Preseasons in wilderness areas have been permitted since 1965.

12. The estimated blue grouse harvest has averaged 15,897 birds during the 12-year period of record, 1964 being the highest with 26,581 birds, followed by 24,027 in 1963 and 23,596 in 1966. The smallest harvests were in 1955 with 5,666 birds and 1960 with 6,799 birds.

13. Kill trends estimated by random questionnaires and from check stations data were generally similar, but fluctuated between methods and among years in indicating high and low kills.

14. Current season dates and lengths are unfavorable to maximum dusky grouse harvests during most years. The migratory habits of blue grouse, and

weather and food conditions, may control harvest to a greater extent than season length unless open dates are prior to, or extend beyond, the month of September. Postseason hunts running concurrently with the regular wild turkey seasons in October are good management in that they provide for additional harvests.

15. Check stations, except for one on the Uncompahgre Plateau, have been of the roadblock variety in the interest of law enforcement and checking of other upland game species. Data collected were limited by hunting pressure and success. The number of hunters sampled has been too few for adequate statistical validity. Additional data on age and sex of birds harvested is needed to determine if current season dates are conducive to a differential kill by age and sex classes.

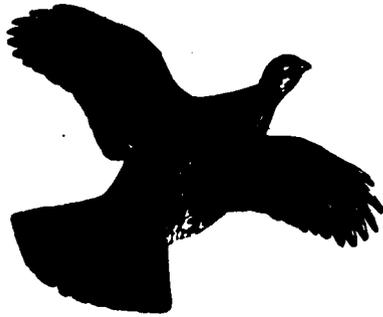
16. Dusky grouse hunting is limited mainly to range adjacent to roads and other easily accessible areas. Hunter success is closely related to ecological factors that may or may not bring birds near to roads. Extension of the dusky grouse season, after closure for other grouse, could be more safely done with improvement in hunters' ability to identify grouse. It is probable that, due to the accessibility of sage, sharp-tailed, and prairie grouse, these species will always require a shorter season than blue grouse, presently underharvested in Colorado.

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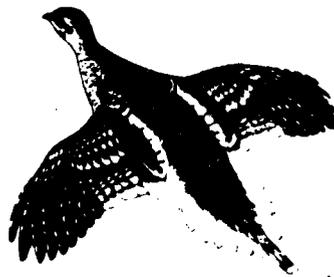
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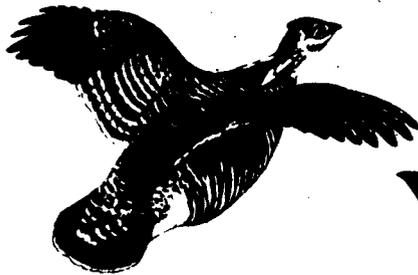
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Blue Grouse



Sharp-Tailed Grouse



Greater Prairie Chicken



Sage Grouse



Colorado Grouse



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