

## NON-DRUMMING MALES IN A RUFFED GROUSE POPULATION

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The drumming display of male Ruffed Grouse (*Bonasa umbellus*) and persistent use of easily identified sites for this purpose (site association) has provided a basic population parameter for many studies of this species in recent years. This display has been a basis for extensive population inventories (Petraborg et al. 1953, Hungerford 1953, Dorney et al. 1958, Ammann and Ryel 1963, Porath and Vohs 1972), for studies of survival (Frank 1947, Hardy 1950, Dorney and Kabat, 1960, Gullion and Marshall 1968, Rusch and Keith 1971, Stoll et al. 1979), for studies of response to habitat change (Gullion et al. 1962; Doerr et al. 1970; Gullion 1970a, 1977; Boag 1976) and as a basis for judging the influence of various extrinsic factors upon populations of these birds (Gullion 1970b, 1970c; Rusch and Keith 1971; Fischer and Keith 1974; Rusch et al. 1978). The underlying assumption in these studies is that most, if not all, male Ruffed Grouse engage in this display during the peak of the spring drumming season each year, or at least that a relatively constant percentage of birds do so each season.

Earlier papers (Dorney et al. 1958, Gullion 1966) have documented that the percentage of site-associated males which can be heard in the drumming display is not constant from year to year. Furthermore, my 1966 paper agreed with the findings of Eng (1959) Dorney and Kabat (1960) and Rusch and Keith (1971) that a number of males not associated with a definite display site are usually present in the population.

The size of this non-drumming segment is an important consideration in any work dealing with Ruffed Grouse densities or population fluctuations since each male (both drumming and non-drumming) appears to represent an equal number of females in the breeding population. The work of Bump et al. (1947:516), Gullion and Marshall (1968:141) and Rusch and Keith (1971:816) indicates that the sex ratio is essentially 1:1 as the breeding season commences.

The purpose of this paper is to document the variations in the size of the "non-drummer" and presumably non-territorial component of a Ruffed Grouse population in east-central Minnesota from 1959-1978. In the context of this paper, the non-drummer is a male Ruffed Grouse which could not be identified as an occupant of a known drumming activity center and who is believed to have been a non-territorial bird for 1 or more seasons (spring and fall are each considered 1 drumming season). While there may

be some question as to whether or not drumming constitutes territorial defense, in the context of this paper I consider male grouse associated with particular display sites (i.e., drumming logs) for several weeks or months to be occupying a territory. Since active defense of a well defined territorial perimeter has not been demonstrated for this species I prefer to call these occupied areas "activity centers." The fairly even, predictable spacing (normally about 200–250 m apart) of occupied centers usual in good, homogeneous habitat strongly suggests that drumming is a mechanism for spacing and at least partially territorial in function. As used here the term non-drummer does not include males which were identified as occupying specific activity centers but which were not heard drumming during the period when most other site-associated males were actively drumming.

#### METHODS

Data for this paper were collected during a long-term study of the impact of forestry practices upon a grouse population that began in 1956 and is continuing on the Cloquet Forestry Center of the University of Minnesota. The area and the procedures used have been adequately described elsewhere (Gullion 1965, 1966, 1967; Gullion and Marshall 1968). The terminology concerning drumming activity used here has also been defined previously (Gullion et al. 1962; Gullion 1966, 1967) and has been used by subsequent authors (cf. Boag and Sumanik 1969, Archibald 1975, Boag 1976, Stoll et al. 1979).

In this study, we recorded activity on about 2300 drumming logs in several hundred activity centers performed by over 1200 banded male Ruffed Grouse on a study area which has varied over the years from 13–37 km<sup>2</sup>. Numbers of occupied centers varied from 61 in 1964 to at least 254 in 1970–71. Each spring we have attempted to identify every male grouse associated with a drumming log (by trapping or reading colored leg band codes) and our success has varied from 90% in 1961 (among 144 established males in a 17.8 km<sup>2</sup> area) to a low of 54% in 1968 (171 established males on a 37 km<sup>2</sup> area).

I have drawn on information collected from the entire Cloquet study area. However, the population specifically considered in this paper is that on the 13 km<sup>2</sup> Cloquet Forestry Center.

In this study, we classify Ruffed Grouse as immature from the time the 8th primary is completely grown in the post-juvinal molt until they are 1 year old (the following June); as yearlings, 12–23 months of age; and as adults, 24 months and older. Birds which have molted their juvinal 9th and 10th primaries before being handled the first time are segregated in a special category of adults, since some may be less than 24 months old. These age classes differ from those used by some other authors (cf. Dorney and Kabat 1960, Rusch and Keith 1971).

#### RESULTS

There are 4 sources of evidence for a population of non-drumming males in a Ruffed Grouse population. One is a group of birds I have called "alternate drummers" (Gullion 1967:92). These are birds which appear to be secondary birds associated with specific activity centers, although they are not site-associated and are not heard drumming. They would be missed

in population inventory procedures based upon drumming activity or log occupancy.

A second indication of the presence of non-drumming males is the existence of young male grouse which were banded during summer and fall lily-pad trapping, and were later determined to have been alive during subsequent drumming seasons, but were not identified as drumming birds. For an individual to be included in this category there had to be evidence that the bird in question had been present in areas where all known site-associated males were identified during the period this bird was alive. Third, information was obtained by using the lily-pad trapping technique during the April–May drumming season to capture males not associated with drumming logs.

The fourth segment of the non-drumming component is comprised of unbanded yearling and adult males either appearing on logs for the first time in centers where there was no indication of activity the previous season, or as replacements for males which were identified the year before but subsequently killed. While there is some possibility of birds moving into the area from outside, our 22 years of data concerning Ruffed Grouse mobility indicate that this factor is of little consequence. From 120 records of movements by males from fall or wintering areas to drumming logs the mean distance moved was 436 m; only 11 records indicated movements of over 1 km. Also, emigration from the area would be as likely as immigration. From 1959–1976 we monitored and trapped at all of the drumming activity centers in a 400 m wide buffer zone around the Cloquet Forest as intensively as on the Forest in order to determine the extent of egress and ingress. Movement of adult male grouse was found to be slight.

Male Ruffed Grouse sharing an activity center in “satellite” status are considered territorial, drumming males in this analysis. Birds in this group are usually immatures and are always nearly identical in size to the primary drummer whose activity center they are sharing. This represents 2 male grouse in 1 activity center, and complicates population determinations based on occupied activity centers. These birds have to be counted as drumming, territorial birds since they often engage in drumming duels with the primary bird and are certain to be heard during inventories of drumming grouse. Logs used by satellite males are usually within 10–30 m of the log occupied by the primary male.

Fig. 1 shows the fluctuations in numbers of both drumming and non-drumming male Ruffed Grouse on the Cloquet Forestry Center from 1959–1978 (and drumming bird numbers to 1979). Also shown is the variation in year-to-year survival among territorial drumming males during this period.

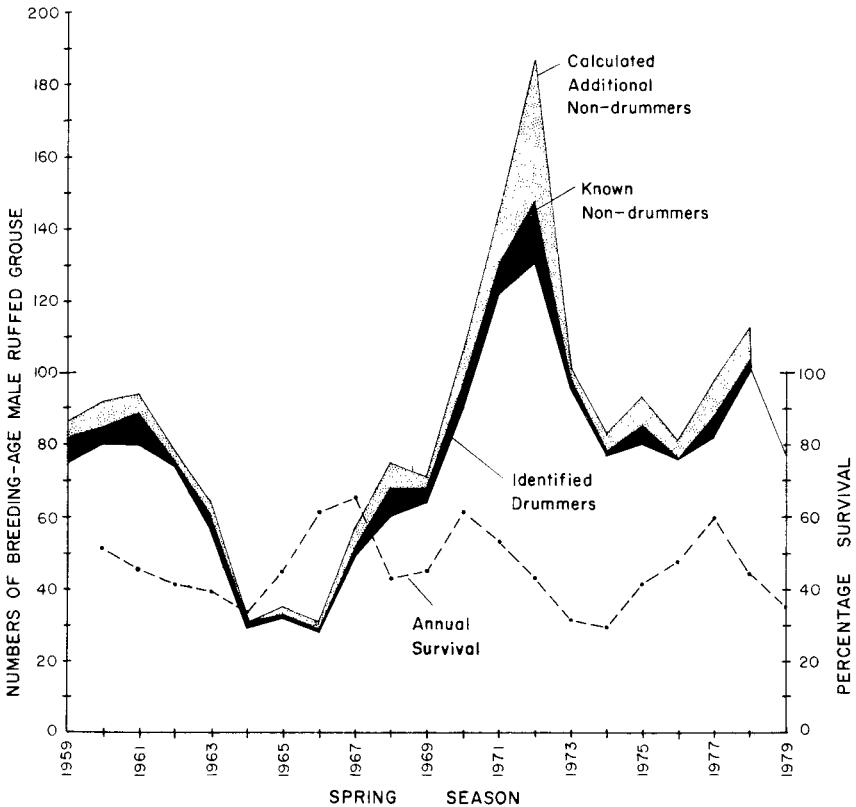


FIG. 1. Numbers of identified and known active drumming and non-drumming male Ruffed Grouse on the Cloquet Forestry Center, 1959–1979.

The figures for non-drumming males were based on the following computations. The numbers of known, banded non-drummers and alternate drummers present in the population were taken at face value, i.e., 5 banded males known to be in the population in April but not associated with a drumming log. For birds banded in the fall but not appearing on drumming logs the following season I used the annual survival rates for immatures during their first 6 months and adult survival rates for the remainder of the time (see Gullion and Marshall 1968 and Fig. 1 this paper). These 3 groups are the “known non-drummer” portion in Fig. 1.

The “calculated non-drummer” fraction was determined by applying the survival rate of the preceding year to the number of unbanded adults that appeared on logs. That is, if the 1962–63 survival rate among estab-

lished drummers was 50%, and 6 unbanded adults appeared on logs in 1963, the number of "calculated non-drummers" present in 1962 would have been 12.

#### DISCUSSION

The presence of non-displaying and presumed non-territorial males is known among some Tetraonidae. The Red Grouse (*Lagopus lagopus*) studies in Scotland (Jenkins et al. 1967, and others) have consistently shown an excess of males which are non-territorial and usually relegated to a surplus which dies or emigrates fairly quickly. Hoffman and Braun (1975) reported the existence of non-territorial sub-adult males in a Colorado White-tailed Ptarmigan (*Lagopus leucurus*) population and Ellison (1971) documented the existence of a non-territorial segment in a Spruce Grouse (*Canachites canadensis*) population in Alaska. The work of Bendell and his co-workers (Bendell and Elliott 1967, Zwickel and Bendell 1967, and others) has shown that a non-territorial immature (yearling) segment is an integral part of the Blue Grouse (*Dendragapus obscurus*) population structure. Among Blue Grouse, immature males have little opportunity to hold territories unless substantial new habitat becomes available through habitat modification (Redfield 1974) or a population of established birds is destroyed (Zwickel et al. 1977).

Among the lekking grouse the identification of non-displaying males is somewhat more difficult due to the daily fluctuations in lek attendance. While recognizing the problems associated with this fluctuating lek attendance in Sage (*Centrocercus urophasianus*) and Sharp-tailed (*Pediocetes phasianellus*) grouse and the Greater (*Tympanuchus cupido*) and Attwater's (*T. c. attwateri*) prairie chickens none of several studies of these species in the 1930–1950 period suggested the presence of a non-territorial segment in the male population (cf. Lehmann 1941, Grange 1948, Patterson 1952, Ammann 1957, Baker 1953). However, Robel (1969) documented the existence of a non-territorial component among lekking Black Grouse (*Lyrurus tetrix*) populations in Scotland and Rippin and Boag (1974) have found the same to be true in an Alberta population of Sharp-tailed Grouse.

Ruffed Grouse seem to be intermediate in status. Young male Ruffed Grouse frequently become established as territory holders when only 4 months old. In 1970, 24 (27%) of 87 territorial male grouse on the Cloquet Forest were on new logs where we had never recorded drumming activity previously. Ten of these were adults drumming for the first time, while 7 of 14 immatures on new logs evidently had commenced using their respective logs as 4- or 5-month-old birds in the fall of 1969. If large enough, young males may even displace older established males, forcing the latter

to move to other, usually inferior sites (Dorney and Kabat 1960:19; Gullion 1967:95, 1970d:76).

It cannot be said that the large number of non-drummers at Cloquet in the 1971–72 period represented birds which could not find suitable sites for drumming. In this period, there were at least 17 activity centers in relatively static habitats on the Cloquet Forest which had been acceptable to drummers in the 1960–1962 period, but which were not occupied by the non-drummers in the 1971–72 period. This is all the more interesting when one considers that 33% (29) of the males on the Cloquet Forest in 1970 were crowded onto 86.2 ha of 13–25-year-old aspen (*Populus*) regeneration (6% of the forest area), at a density of a male per 3.0 ha (or 33.6/100 ha). One can speculate that in this prime cover the non-drummers preferred to await their turn to occupy an activity center rather than use the poorer quality habitat that had been acceptable as drumming cover a decade earlier (see below).

Some birds never become drummers. Bird 188 was banded as a chick in August 1969, and then killed by a hunter in October 1972, 2.4 km from where he was trapped, without being associated with a drumming log. Two other birds, 1372 and 1374, both banded as young males in November 1970, were recaptured in both 1971 and 1972, but never appeared on a drumming log. In 1971, 1372 was 620 m from where he was originally banded, and in 1972 only 220 m from his 1971 location. Bird 1374 was retaken at the site of his original trapping in the fall of both 1971 and 1972, and was found as a predator kill only 164 m distant in May 1973.

A male associated with a drumming log may rarely relinquish his territory and become a non-drummer. Bird 319 was an active drummer only in 1957 and then deserted his log and activity center, and was last seen alive 1530 m distant on 22 December 1960. Bird 2123 used a log in both 1966 and 1967, then was replaced and not subsequently associated with a known log, although he was seen alive on 29 April 1971, 1520 m distant from the log he occupied earlier. Territory abandonment seems to be unusual however, for among the records for more than 1200 site-associated males only these two are known to have acted in this manner.

The Cloquet Forest has undergone considerable change in the past 25 years and this change has affected the abundance and distribution of these male grouse. Sizeable tracts of mixed conifer-hardwood forest little used by Ruffed Grouse were changed to open, unoccupied, clear-cut areas, which within 10–12 years developed into excellent aspen sapling habitat (with displaying male densities of 24/100 ha). During this period other aspen tracts in almost continuous use for as long as 15 years matured and were no longer acceptable habitats for drummers. Other habitats in less

dynamic, mixed aspen-conifer forest types have remained fairly constantly occupied at lower densities throughout the past quarter century.

These habitat changes have had some obvious effects upon the Ruffed Grouse population, as seen in Fig. 1. For example, the lowest population level during the 1974–1976 “cyclic” decline stood at 95% of the highest peak population in 1960–61, and 2.7 fold above the 1964–1966 lows. The number of drumming, site-associated males in 1972 was 1.6 times larger than in 1960–61, and there were at least 6.5 times as many non-drumming males in the population.

It appears to me that much of this increase was the result of more secure habitat being available in 1972 as compared to 1961. In the earlier years the established drummers not only occupied the best quality habitats available to them, but also occupied many sites which we now consider to have been sub-marginal. Some individual grouse survived for as long as 5 years in these sub-marginal coverts. Only a few activity centers were adequate to allow the sharing of resources between a primary and a non-drumming occupant. Young birds that could not fit into that system were lost from the population, one way or another.

As the forested lands cut over in the 1950's began to develop into acceptable coverts in the early 1970's (Gullion 1972:19) the increased numbers of territorial males showed marked shifts in the type of habitats used (Gullion 1970c:108). Additionally, a greatly increased number of non-drumming males survived in these better habitats awaiting their opportunity to occupy an activity center.

These changes may also have altered the perceptions of young Ruffed Grouse concerning habitat quality. This is reflected partly by their unwillingness to occupy vacant activity centers in areas of essentially static habitat which had been acceptable to earlier generations. Instead, many chose to await their turn to occupy a territory in this newly developed superior habitat.

Male Ruffed Grouse increase significantly in weight and size (unpubl. data) from their first to second year which means that if they are in cover which allows another season's growth their larger size places them in a better competitive position for occupying a drumming log and activity center. Five of 6 banded non-territorial males on the Cloquet area in the spring of 1970 occupied activity centers in 1971. But only 2 of the 9 banded non-drumming birds in 1971 were established in activity centers for the 1972 season. Among the 13 banded non-drummers in 1972, 5 occupied centers in 1973.

It may be that losses among the non-drumming component are greater than among the activity center occupants. This is probably true among young grouse moving into inadequate habitats during their first fall and

winter. Losses among young males which are cohabiting with site-associated males in satisfactory habitats do not appear to be greater than among the drummers. Elsewhere we have shown that drumming males associated with perennially-used drumming logs have significantly shorter survival than those on "new" logs (Gullion and Marshall 1968:132). At least 19 non-drumming males who lived for 2 or 3 years before they occupied logs lived longer than many drummers from the same cohort.

Among these 19 banded non-drummers which were finally successful in occupying activity centers 11 survived less than 12 months longer, 3 survived less than 2 years, 3 survived less than 3 years and the last 2 less than 4 years.

The data presented here do not agree with the findings of Rusch and Keith (1971:809) that the number of non-drumming males is inversely proportional to the size of the population. Data from this Minnesota study indicate the opposite: the lower the population the smaller the proportion of non-drumming males. But as noted earlier (Gullion 1966:726), the lower the population the greater the proportion of site-associated males who are not likely to be heard drumming. The presence of these birds can be determined, however, by the signs they leave at their logs and by trapping (Gullion and Marshall 1968:128).

For the biologist attempting to quantify Ruffed Grouse populations this non-territorial component presents a problem, since it can only be detected through intensive and expensive trapping and banding activities. But consolation lies in knowing that the greatest error in making inventories occurs when Ruffed Grouse are most numerous, and the least error when these birds are most scarce.

Insofar as population processes are concerned, these non-drumming birds appear to provide "momentum" to the population upswing at a time when annual survival of adult males is declining sharply (Fig. 1). During the 1970-1972 period when annual survival declined from 61.3 to 43.3% among site-associated males, the overall population continued to rise. When survival of drumming males dropped in the 1972-1974 period it was this portion of the population that filled some of the vacancies left by the death of established males and buffered the rate of adult male decline. This non-drumming population from the 1971-72 period was then at least partly responsible for maintaining the population at a higher level during the ensuing years than would have been sustained had it not been present.

#### SUMMARY

A non-drumming and presumably non-territorial component is a persistent characteristic of male Ruffed Grouse populations on the Cloquet Forestry Center in east-central Minnesota. Based upon a 23-year study involving more than 1200 banded male grouse using in excess



of 2300 drumming logs, it was found that the non-drumming component was least when the Ruffed Grouse population was lowest and greatest when the population reached peak abundance. During the 1972 period of peak abundance there was at least 1 non-drumming male grouse for every 2.3 known drumming grouse on this 13 km<sup>2</sup> study area. A change in the quality of available habitats resulting from earlier logging resulted in a marked increase in the density of drumming male grouse in this forest. Also, there was an apparent change in what male grouse perceived to be acceptable habitat for drumming. Although at least 17 activity centers (i.e., territories) in relatively stable forest situations which had been used earlier remained available and vacant, the non-drummers chose to await their turn in better quality habitats. Survival among this non-drumming component of the male Ruffed Grouse population equalled or exceeded that of birds successfully established in activity centers as drumming males.

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### ASSOCIATION OF SYSTEMATICS COLLECTIONS PROGRAM EVALUATION

The Division of Environmental Biology of the National Science Foundation (NSF) is evaluating how the Systematic Biology and Biological Research Resources programs might better serve the systematic biology community in the U.S. Two surveys, developed by the Association of Systematics Collections (ASC) under contract with NSF, will gather data concerning the physical resources available to the research community and demographic information on the individuals who comprise the community.

The first survey, to be mailed to collection curators and managers in November 1981, will request information regarding management, financial resources available for support, services provided, and future needs of their collections. The second survey, to be mailed in July 1982, will collect data on individual systematic biologists.

If you do not receive a survey form by 15 November 1981 please write: Nancy Wert, NSF Project Coordinator, Association of Systematics Collections, Museum of Natural History, University of Kansas, Lawrence, Kansas 66045 or phone (913) 864-4867. Please indicate the taxonomic emphasis of your collection. A preliminary report of the results of the survey will be presented at the ASC annual meeting in May 1982.