

occurred when a bird lowered its head and bill to the horizontal and, with wings held slightly away from the body, charged another bird forcing it to run or fly.

"V" chases.—A more common chase resulted when one bird approached another with outspread wings lifted high in a "V" (Fig. 1E). The pursued bird squatted as the pursuer approached to within 0.5 m, but when the pursuer closed to within 25 cm, the pursued bird rose and walked rapidly away. Occasionally this sequence was repeated several times. On other occasions the pursued bird either ran or flew without squatting and, on three occasions the pursuing bird attempted to mount.

The percent of males (51%) and females (54%) participating in "V" chasing was similar. Significantly more males were pursuers (Table 2), and pursued females most often squatted while being approached, whereas pursued males moved away. These encounters may be adolescent sexual displays because Sheldon (1967) described similar behavior preceding copulation and most birds at puddles (79.1%) were hatching year individuals, based on mist net captures. Also, no marked adults participated in the "V" chases. Since Sheldon (1967) reports similar behavior by a male attempting to copulate on a singing ground, these encounters could be adolescent sexual displays.

Arc flight.—At CFC, after alert posture, birds farthest from the puddle often moved closer by flying in a low "arc flight" which was usually less than 15 m long. The percent of males and females performing arc flights was not significantly different (Table 2).

Flutter leap.—At CFC, woodcock often leaped 5–30 cm into the air, fluttered their wings and returned to the same place on the ground (Fig. 1F). Over 91% of those recorded were from the alert position, although flutter leaps also occurred from the squatting or tail flare position. Flutter leaps were performed by 41% of the observed males and 50% of the females (Table 2).

Frequently, pursued woodcock would flutter leap when approached by another bird, and the pursuer would follow suit. There may be a relationship between flutter leaps and precopulatory behavior, as discussed by Sheldon (1967). Flutter leaps, after preening, may have aided in restoring plumage to its proper position. On a few occasions, a bird, stitching near a puddle, would flutter leap. A flutter leap was seen once in St. Paul when a cottontail rushed to within 1 m of the bird.

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Non-territorial adult males and breeding densities of Blue Grouse.—Although it previously was believed that all adult male Blue Grouse (*Dendragapus obscurus*) held territories during the breeding season (Zwicker, *J. Wildl. Manage.* 36:1141–1152, 1972), recent studies have shown that non-territorial adult (≥ 2 years of age) males were present in populations in coastal British Columbia (Lewis and Zwicker, *Can. J. Zool.* 58:1417–1423, 1980; Jamieson and Zwicker, *Auk* 100:653–657, 1983). Non-territorial males are physiologically able to breed (Hannon et al., *Can. J. Zool.* 57:1283–1289, 1979), yet in the absence of occupying

territories they are presumed to be non-breeders (Bendell and Elliott, Can. Wildl. Serv. Rept. Ser. 4, 1967; McNicholl, Ph.D. diss., Univ. Alberta, Edmonton, Alberta, 1978). The presence of non-reproductive adults is pertinent to understanding how breeding densities are determined. Here, I present further evidence for the existence of non-territorial adult male Blue Grouse and provide information on their abundance within a natural population on Hardwicke Island, British Columbia (50°28'N, 125°48'W).

I conducted a study concerning aspects of territoriality in male Blue Grouse on a recently logged 95-ha portion of the island from 1980–1982. Almost daily from mid-March or early April through July each year I searched this area for territorial males, these being individuals that were localized on small areas and that were heard hooting (singing) (Bendell and Elliott 1967, McNicholl 1978). Throughout the study period each year these males were resighted repeatedly to determine the exact locations of their territories.

Numbers of territorial males on the study area declined from 28 in 1980 to 25 and 17 in 1981 and 1982, respectively. Of the territorial males that were color-banded (87%), all were adults. Additionally, four marked adults in 1980 and two in 1981 were non-territorial. Three of these were seen between three and eight times and their movements encompassed the territories of three to four other males. The other three were seen only once but were considered non-territorial because they were on the territories of other males during non-migratory periods. At least three of the non-territorial adults from 1980 and one from 1981 survived and took territories in 1981 and 1982, respectively.

I removed original occupants and subsequent replacements from 14 territorial sites in 1982. Six of 10 replacements were adults, all having been banded as yearlings in 1981. These males took territories later in the spring than was typical for males in this population in non-removal years, and they did so only after original occupants had been removed. Therefore, in the absence of my removal experiment I believe that all, or most, of these adults would have remained non-territorial throughout 1982 (see also Lewis and Zwickel 1980). Thus, non-territorial adults were present each year even though the number of territorial males declined.

Because non-territorial males do not hoot they are not found as easily as males that do. Consequently, it is difficult to determine precisely the percentage of young adults that do not take territories. Nonetheless, seven of the eight males that first took territories after my study began had been banded in previous years, and four of these were 3 years of age or older when first taking territories. Additionally, 4 of 10 two-year-old males that were radio-tracked on another area of Hardwicke Island were non-territorial (Jamieson and Zwickel 1983). Thus, evidence from Hardwicke Island corroborates that from Vancouver Island (Lewis and Zwickel, Can. J. Zool. 62:1881–1884, 1982), and suggests that non-territorial adult males are not uncommon within populations of breeding Blue Grouse in coastal British Columbia.

Vacant areas that apparently are suitable for territories are present within the areas where non-territorial males have been found (Lewis and Zwickel 1981). Why these males do not take territories must therefore be explained if we are to understand how breeding densities of male Blue Grouse are determined. Current evidence suggests that these males remain non-territorial because areas that are available are of low quality (Lewis and Zwickel 1980, 1981). Although some physiologically mature males do not hold territories, this does not seem to affect densities of females or production in the population as neither number of breeding females nor production per female were reduced when numbers of territorial males were greatly lowered in 1982 (Lewis, Can. J. Zool. 62:1556–1560, 1984).

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