

Brood-Defense Behavior of a Ruffed Grouse, *Bonasa umbellus*

HUGH P. McISAAC

Department of Physiology and Neurobiology, University of Connecticut, Storrs, Connecticut 06269

Current address: Raptor Research Center, Boise State University, Boise, Idaho 83725

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Observations are reported concerning the reactions of a Ruffed Grouse (*Bonasa umbellus*) and its offspring to an intruder. At my approach the adult bird appeared to scatter its offspring from a common hiding-place into separate hiding-places. Later the young birds were apparently gathered together by the adult and they vanished into the woods. The grouse's behavior may have reduced the risk that a predator could capture the entire brood.

Key Words: Ruffed Grouse, *Bonasa umbellus*, brood defense.

Ruffed Grouse (*Bonasa umbellus*), like many bird species (see Gochfeld 1984; Hudson and Newborn 1990), defend their offspring with distraction displays. Feigning injury, grouse attempt to lead intruders away from their offspring (Bent 1932; Sawyer 1923). Additionally, a female may noisily rush an intruder, thereby distracting the intruder while her offspring scatter and hide. Apparently both distraction displays are relatively common and on occasion have been used as indices of aggression (see Davies and Bergerud 1988; Hudson and Newborn 1990). Despite this, a detailed description of the "rush" distraction display has not been published for any species of the Tetraoninae; although, Bent (1932) and Bump et al. (1947) each briefly mentioned the display. I report here detailed observations of a "rush" distraction display, and present a possible interpretation of this behavior.

I came upon a mature red-phased Ruffed Grouse in northeastern Connecticut (Tolland County, near the village of Storrs) while walking along a woodland trail. It was approximately 17:00 EDT on 13 June 1993, and the times listed below are rough estimates. Some 60 - 80 m into the woods off a well-traveled road I first saw the grouse. The day was sunny and warm ($\approx 28^{\circ}\text{C}$ in the woods) and a light breeze quietly animated the green leaves. A fairly even-aged stand of open second-growth oak (*Quercus* sp.), maple (*Acer* sp.), and Black Cherry (*Prunus serotina*) dominated the overstory. A few shrubs (e.g., Pink Azalea, *Rhododendron nudiflorum*) and saplings composed the understory. The ground cover was moderately thick although I could see the forest floor to a distance of 2 - 3 m when standing. Ferns covered much of the ground with some grasses and wildflowers interspersed (e.g., Jack-in-the-pulpit, *Arisaema atrorubens*; Wild Geranium, *Geranium maculatum*; and Wood Strawberry, *Fragaria vesca*). The ground cover rose as high as 30 - 50 cm but taller plants were widely separated, allowing me a reasonable view of the grouse.

I first sighted the grouse when it was 8 - 10 m

away and 2 - 3 m off the trail. It was slinking away from me with its head down, its tail held straight back and folded tight, and its wings held tight to its body. Suddenly, and quite unexpectedly, it turned and ran straight toward me. It held its head up with crest erect, its wings were spread slightly with tips dropped and shoulder ruffs expanded, and its tail was held straight up and fanned. It called, but I do not recall the notes. At 2 - 3 m from me, yet still off the trail, the bird suddenly stopped and simultaneously 6 - 8 sparrow-sized birds exploded out from the ferns immediately around the mature grouse. I had failed to notice the small birds before that moment. The small birds flew off in all directions except toward me and landed as far away as 10 m, disappearing quickly among the ground cover.

Immediately following the departure of small birds the mature bird ran 8 - 10 m away from me and started calling loudly. It made no noticeable attempt to conceal itself. The call, a three syllable (occasionally four) "whoi-wohi-whoooo", was hoarse and nasal, and sounded somewhat like the alarm call of the Eastern Gray Squirrel (*Sciurus carolinensis*). The call was repeated perhaps 6 - 10 times per minute with each call lasting several seconds. The last note of the call lasted approximately as long as the first two combined. The first several minutes of calling were conducted from the ground with the bird hopping onto fallen branches and logs from time to time. It appeared quite agitated because of its frequent and loud calling and its nearly constant movement.

After perhaps 5 - 8 minutes on the ground the grouse flew 7 - 8 m up into a tree and perched on a branch. In the tree calling continued for a couple of minutes. The grouse then flew back to the ground where it continued its agitated calling and motion. While in the tree the grouse was more easily visible to me, and vice versa (I presume). It returned to the trees three more times; each time to about the same height. On the second flight into a tree, the return to the ground was only a minute or two after ascent. Upon descent the landing placed the mature grouse in the hiding spot of one of the small birds, causing the

small bird to fly to a new hiding spot several meters away. The mature bird spent several minutes in a tree after its third ascent. Finally, on its fourth and ultimate ascent the bird spent 15 - 20 minutes in a tree. Its calling rate and amplitude gradually decreased; however, the calls never stopped completely.

After approximately 5 - 10 minutes into the fourth tree ascent, I walked further into the woods along the trail in an attempt to put the bird at its ease. I walked away from the road until I was 50 - 60 m from the mature bird. I stood quietly at this distance, concealed behind a large cherry tree.

Eventually, the grouse dropped to a dead branch about 1 m above the ground and called. These calls were not as loud as those given earlier in our encounter; instead they were similar in amplitude to the last calls uttered in the tree. It now rapidly called "whi-whi-whi", sounding somewhat like the "yank" call of the White-breasted Nuthatch (*Sitta carolinensis*). Again this call was hoarse and nasal. After a minute or two of calling the grouse jumped to the ground and thereafter was completely silent.

I lost sight of it almost as soon as it jumped to the ground and never caught sight of the small birds. Two or three minutes later I walked over to the spot where I had last seen the grouse and searched the area. I found neither the mature grouse nor any of the small birds.

I suggest the following interpretation of the mature grouse's behavior; other interpretations are possible for some aspects. This interpretation assumes the grouse's behavior to have been adaptive. Furthermore, I expect the intensity and type of behavior to vary from one context to another. For example, the bird's behavior might vary with different types of intruders, in different habitat types, with younger or older offspring, and with the number of offspring (Gochfeld 1984; Montgomerie and Weatherhead 1988).

I presumed the small birds to be offspring of the mature grouse. I also presumed the mature grouse to be female, as male Ruffed Grouse do not participate in brooding or rearing of offspring (Bump et al. 1947; Johnsgard 1973). The grouse apparently detected me before I noticed it and hid its brood among the ground cover. The initial slinking behavior of the mature bird may have been an attempt to slip away without drawing attention to its brood or itself. Alternatively, this behavior may have reduced risk to the brood by drawing the intruder away from its hidden brood. As the intruder approached the offspring too closely, the parent ran in among the brood, scattering the small birds from their common hiding place into separate hiding places. Dispersing the brood might reduce the risk of capture of the entire brood (Andersson et al. 1980; Lazarus and Inglis 1986; Sandercock 1994). After scattering its offspring, the squirrel-like calls of the parent appar-

ently kept the offspring in hiding as long as the intruder remained nearby, and may have provided the offspring with information concerning the location and mood of the parent. The calls also may have relayed information concerning the intruder, such as the risk posed by the intruder. The bold behavior of the mature grouse, including its calls, flights into trees, and lack of effort to conceal itself on the ground, may have reduced risk to the brood by distracting the intruder away from its offspring. Such behavior also may have improved the grouse's efficacy in monitoring the position and behavior of the intruder. The mature grouse's second descent from the trees, which flushed one of the youngsters, may have forced the chick out of a poor hiding spot; alternatively, the landing of the grouse in the chick's hiding spot may have been simply coincidence. Finally, the nuthatch-like calls of the parent after its final descent from the trees may have pulled the offspring out of hiding and back to the parent when it was safe to re-aggregate and leave the area.

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Horn Growth of a Castrated Bighorn Sheep, *Ovis canadensis*

ROBERT E. HENDERSON and JOHN E. FIREBAUGH

Montana Department of Fish, Wildlife and Parks, 3201 Spurgin Road, Missoula, Montana 59804

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In 1987 a 21 month-old Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis*) was captured, castrated, and released into a free-ranging population. In September 1995, the ram was recovered and examined. When compared to normal mature rams from the same population, measurements indicated that following castration both basal and linear horn growth were greatly diminished.

Key Words: Bighorn Sheep, *Ovis canadensis*, horn growth, castration, hormonal control.

Rocky Mountain Bighorn Sheep, *Ovis canadensis canadensis*, Populations provide prized opportunities for hunting, viewing, and photography in the western United States and Canada. Horn and body size are sexually dimorphic characters of individuals greater than one year of age. Adult males typically are larger and produce longer and heavier horns than adult females (Cowan 1940). Social dominance and reproductive advantage have been attributed to males with more massive horns (Geist 1971). Factors believed to affect rates of horn growth are individual, genetic, environmental, date of birth, health and nutritional variability (Cowan 1940; Taylor 1962; Geist 1971).

Castration of Bighorn Sheep has not been reported. The role of sex hormones in horn growth in Bighorn Sheep has received little attention. A review of the literature resulted in only one, speculative citation. Jensen and Seabloom (1989) observed a Bighorn ewe with larger than normal horns and masculine behaviors, and suggested that either a genetic defect or unusually high levels of testosterone might have been responsible.

We report on the horn growth of a 10-year-old Rocky Mountain Bighorn ram, which had been castrated at approximately 21 months of age, and compare those measurements with those of normal mature rams from the same population.

Methods

In March 1987 five Bighorn sheep near Thompson Falls, Sanders County (approximately latitude 47°N and longitude 115°15'W) were captured and relocated to Lower Rock Creek, Granite County (approximately latitude 46°40'N and longitude 113°35'W),

near Missoula, Montana. Before release, the sheep were sexed, aged, and eartagged with sequentially numbered metal tags, using standard methods.

In an unusual action, a heavy rubber band was wrapped around the scrotum and above the testicles of one yearling male (approximately 21 months-old). In September 1995, a licensed hunter with an adult-ewe permit mistakenly shot the bighorn which had been castrated in 1987. The animal was field dressed, caped, quartered, removed from the field, and turned over to state wildlife personnel in Missoula. The hunter reported that this sheep had a penis, but that no scrotum nor testicles were evident. No attempt was made to verify the hunter's observations by trying to locate sex organs in the field.

Age was determined by counting annual growth rings (annuli) on the horns (Cowan 1940; Taylor 1962). For comparison, 2 incisors (I_1) also were extracted and sent to Matson's Laboratory, Milltown, Montana, for examination of cementum layers.

Horns were measured to both the nearest 1/8 inch (in) and millimeter (mm) with a steel tape measure and calipers. Measurements were of the circumferences at the bases and each annulus, and of linear distances between the base, tip and annuli on the outside curve of the horns.

Comparison to Normal Mature Rams

Comparative horn measurements were compiled from 11 normal mature rams, 6 to 9 years-old, harvested in the same area during 1991 and 1995. Horn dimensions were recorded to the nearest one-eighth inch, and later were converted to millimeters for this analysis. Measurements included tip-to-tip distance, total length on outside curve, tip-to-ring 1, tip-to-



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