

hooklets, and in the larger size of those belonging to the barbs of this region of the feather, whereby the vane becomes more resistant to the rush of air caused by the wings during the descent."

There are doubtless other references to which I have not access, but I think those which I have quoted are sufficient to leave little doubt that the phenomenon of drumming or bleating in Snipe is entirely attributable to the action of the outer tail-feathers and has nothing whatever to do with the remiges as was formerly supposed.

Kelowna, British Columbia, December 2, 1924.

THE HOOTERS OF SKYLINE RIDGE

By JOHN M. EDSON

SKYLINE RIDGE is a steep-sided elevation that extends north-northwesterly from Mount Baker for a distance of about two miles. It has an altitude of some 5400 feet at its northerly extremity, and with some intervening irregularities and undulations trends upward to over 7000 feet as it merges with the snow fields of the big mountain. Throughout its length the snow lingers in sheltered spots till late in summer. Lupine, heliotrope, the dog-tooth violet and dozens of other flowers make the open spaces radiant with color as rapidly as the snow recedes. The dark forests that clothe the lower slopes send up a ragged fringe of alpine hemlock and sub-alpine fir wherever they can break into the snow-line. These stunted trees dwindle to mere shrubs, matted in dense patches, mingling with the heather along the higher reaches. Besides the park-like beauty of the foreground, the higher eminences afford a remarkably wide and inspiring cyclorama of the wild mountain scenery of northern Washington and southern British Columbia.

From July 9 to 16, 1925, Doctor W. T. Shaw, professor of zoology of the State College of Washington, and myself, were encamped on the most northerly brow of Skyline, where there were a few square rods of ground sufficiently horizontal for the purpose. A mass of snow lay along the east side of the camping spot and extended far down the slope. This afforded convenient refrigeration for our eatables, also for mammal and bird specimens, a few of which we collected. On the north the ridge sloped downward sharply, presenting a rocky spine scantily covered with soil and herbage. To the west the slope was less steep and there were scattered clusters of trees, to which we looked for fuel. South of us was an open space just vacated by the retiring snow, where the heliotrope and other plants were pushing up to the sunlight. This extended on up the ascent that led to the main ridge.

Skyline offers an acceptable summer home for Juncos, Pipits, Slate-colored Sparrows and Solitaires, with occasional Rosy Finches and Ptarmigan, not to mention frequent visitors from the lower levels. But it is the Sooty Grouse (*Dendragapus obscurus fuliginosus*) that is the special subject of this paper, and particularly the hooting of the male of the species. Our opportunities happened to be somewhat unusual for observing the vocal efforts and accompanying behavior of the cock bird. We saw a number of single grouse of both sexes at different points along the ridge, all apparently adult birds, and at favorable times heard from various quarters the more or less distant hooting that is characteristic of the species. We were unable to determine just what weather conditions were most favorable for hooting, nor could

we tell just how many potential hooters were within hearing distance at a particular time. On a cloudy and breezy evening when the conditions were rather threatening there were a number of vocalists tuning in from various directions. But on a clear, calm, sunny day, following one of clouds and fog, only an occasional note was heard, the evening being particularly quiet. Yet subsequently these precedents were not adhered to. Foggy weather seemed to have no effect.

The voice of the grouse has an almost ventriloquial carrying power. Although in reality his notes are not loud, they often may be heard for very considerable distances. Still, it happens as frequently that the supposedly distant hooter is in fact close at hand. The hooting appeared to commence about 4 A. M., or perhaps a bit earlier, and was heard off and on till after 9 P. M., and sometimes even as late as 9:45. The notes of the hooting Sooty Grouse may perhaps be described as deep bass, but soft in quality, expressed as: "Oot, oot, oot, oot, t-oot", the second and fifth notes being noticeably subdued. Different individuals vary this slightly. Frequently the last note is omitted, and occasionally but three notes are given. The watch was held on one bird that had been vociferating steadily for some time, one afternoon about 3 o'clock, and it was found that his performances numbered just seven per minute for each of four minutes, following which he became silent for a time. This bird gave only four notes.

The tameness of the grouse at our Skyline camp was very noticeable. Perhaps this may be accounted for on the supposition that the Washington National Forest is esteemed as a sanctuary by the wild creatures, and that they see in Supervisor Park and his rangers only good pals, more likely to befriend than to harm them. When I reached camp at about 6:30 one afternoon, I found Doctor Shaw acting apparently as host to a visiting delegation of five Sooty Grouse. As he employed himself about the camp-fire the birds were ranging around the slope between him and the adjacent snow-bank, intent on picking up an occasional insect or vegetable morsel. A hen walked up to our refrigerator on the snow beneath a fir bough; she inspected the contents, but evidently saw nothing that appealed to her taste. There were two cocks and three hens in the party, apparently all adults. At first we comported ourselves as very quiet spectators of this gallinacean exhibition, but eventually our own thoughts turned to the subject of an evening meal and we were stimulated to activity. But this did not seriously disturb the birds. The nearest one, a hen, stood like a statue and watched us for a long time while the rest continued feeding among the rocky projections of the slope. Gradually they worked down to where they could no longer be seen. For probably twenty minutes they were all within half a stone's throw of us, feeding unconcernedly. Later, we saw one crossing the snow far below us, the others not again coming to our attention.

At 6:10 in the afternoon of the 14th, a grouse began hooting and continued till 8:35, without at any time stopping for a rest of a full minute. His rendition was somewhat lacking in regularity in a minor way. Sometimes it was as rapid as five per minute; again at the rate of four, dropping toward the last frequently to three or two. The average was likely between three and four.

The most interesting incident in connection with our grouse acquaintanceship occurred on the morning of the 11th. The weather was pleasant, with a few fleecy clouds and a southwest breeze. Somewhere down the rocky ridge that pitched to the north from our camp, a grouse had been hooting since 4 o'clock. As we sat by our camp-fire at breakfast the hooting seemed to draw nearer, and eventually as if the bird might be out in the open space that commenced not far below the camp. I rose to peep over a near-by rock that obstructed my view, wondering if the bird might not be

in sight. And indeed he was. Standing upon another small, flat rock immediately behind the first and just eight paces from where I stood, was our performer all posed for his act. I moved out cautiously till he was in full view, then stood motionless. The bird seemed not the least disturbed by my presence, and after giving me an inquisitive glance, soon started the hooting ceremony once more. Standing with his side toward me, his body pitched at an angle of about 45 degrees, the tail slightly drooping, head well up and neck and breast feathers somewhat puffed out, he began by drawing down his head and further inflating his feathers till the bill and head, except from the eyes up, were concealed. Then throwing open the pocket of his neck feathers he showed a horizontally elongated patch of white lining, in the midst of which was distinguishable the yellowish air-sac peculiar to the genus. It was not greatly distended or conspicuous, being partially concealed by the feathers. With his effort of giving voice to his feelings, the bird's whole form pulsated with each note, the half-spread tail vibrating vertically. After the concluding note, he would raise his head, close the neck pocket and calmly look about. He repeated this numerous times for six or seven minutes. Occasionally a whiff of smoke from the camp-fire would sweep past, and this would take his instant attention but caused no serious alarm. Finally he became restive and changed his position once or twice. Elevating and spreading his tail and with up-stretched neck, he threw open his pockets much wider than when hooting, giving a clear view of the air-sacs, which still did not appear much enlarged.

Almost at the same moment that I discovered the grouse, a Gray Jay descended from a tree above to our fireside and was occupying the attention of Doctor Shaw. This rendered my silent efforts to gain his interest unavailing, while he audibly commented on the activities of the jay. The sound of his voice seemed to have no effect upon the grouse, so I ventured orally to apprise him of the scene I was witnessing. He joined me, and our continued conversation was not at all disturbing to the performer, although the jay quickly retired. My companion withdrew and attempted to unearth his camera, which unfortunately had not been unpacked.

In the meantime the performer decided to put on his next act, which began with his stooping forward, bringing his body to the horizontal, and erecting and spreading his tail. Then with head up in a somewhat duck-like but affected and supercilious pose, he proceeded to mincingly advance along the slope, crossing in front of me. His body, head and tail were held rigid, only his legs showing muscular movement. The performance was somewhat suggestive of the strutting of a turkey or peacock, although the wings were kept closed. Having gone about ten yards, he paused and relaxed, to hoot a few times; then deliberately resuming his pose he moved onward as before. After repeating this two or three times he arrived at the snow-field, which he proceeded to cross, pausing once on the snow to hoot, and again to display his neck ornamentation. By the time he was across the snow his dramatic ardor had cooled, and it was wholly evaporated as he scrambled up the steep bank at the farther side. There he hooted a few times and passed on up the slope.

On the morning of the 16th, we were accorded a return engagement with our bird of the 11th; at least it was presumably the same one. The hooting commenced at about 4 o'clock and some distance down the ridge. His notes were heard 32 times in ten minutes; and a little later, 27 times in an equal period. Twice a frequency as high as six per minute was noted, but in general the utterances were quite irregular, although always composed of the familiar five notes. Eventually it became apparent that the performer was drawing near our camp, and very soon I spied him a few feet from our tent door. He was moving very leisurely along, picking occasionally at

something on the ground, and now and then straightening up to hoot. This was done without the ceremony of the former occasion. He merely straightened up, puffed his feathers, with open neck pockets, and gave the usual utterance, but without drawing his head so low as previously, the bill remaining in full view. He did not appear to open his beak, but with the stress of each note there was a bulging and contracting of the feather tracts of the neck and breast. Once he hooted three times without changing his pose; usually this was done but once or twice.

The hooting over, he promptly turned to feeding again. It was 5:15 when he first appeared before our tent, and he strayed scarcely 100 feet from it till about 7:40, being in plain sight practically all the time. At first he roved complacently about, but as I passed near him on my way to the spring he flitted to a bough of a small fir tree that stood by the path, where he resumed his hooting. Soon he moved to a taller tree close by and perched on a shaded bough about 20 feet up, and there continued his piping. It did not disconcert him in the least to have me pass beneath the tree or stop in plain view to watch and mimic him. While at breakfast, I again timed his hooting as he sat in the tree, counting 52 renditions in the course of 20 minutes without an interval of as much as a minute. At 7:40 we missed him, he having glided away very quietly. Shortly afterward we heard him again from a tree farther down the slope. From that locality he did not move nor cease hooting for any very long period till at least 2:30 P. M., when we, having broken camp, took our departure. On the way down I passed beneath his perch and heard him numerous times while still within hearing distance. It would seem probable that after the morning feeding period on the open ridge, it was his habit to spend the following hours in the trees lower down, presumably returning later in the afternoon to the feeding grounds, and anon going to roost in some tree at the close of day. He appeared to respond to the hooting impulse whenever and wherever he happened to feel its urge. His solitary habits and the lateness of the season would indicate that the hooting and strutting had no nuptial significance.

The open Skyline region and the ragged fringe of forest below are typical of the Hudsonian life zone. Here the grouse find a satisfactory food supply quite early in summer, which improves with the advance of the season. The Canadian zone, next below, is characterized by heavy evergreen timber and dearth of deciduous vegetation and undergrowth, and grouse are rarely found in this environment. Farther down, the Transition zone affords an abundance of underbrush and plant life, and here broods of half-grown young are to be found at this time. We heard hooting only in the upper zone. A subsequent visitor to Skyline Ridge reports that on August 2 he saw downy young of the Sooty Grouse there that could have been but a few days old. This in connection with our experience indicates late incubation at high altitudes.

Bellingham, Washington, August 8, 1925.