VARIATION IN THE SPRUCE GROUSE IN CANADA

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IN the material in the National Museum of Canada the female Spruce Grouse (*Canachites canadensis*) from northwestern Canada separate clearly from most of the rest of the series, while more than half of the females from the Maritime Provinces and Gaspé are indistinguishable from many southern Ontario birds. This accords so ill with the recent revision by Uttal (Auk, 56: 460–464, 1939) and with Friedmann's treatment (U. S. Nat. Mus., Bull. 50 [10]: 143–153, 1946) that further investigation seemed indicated. Through the kindness of Mr. L. L. Snyder I was able to borrow the splendid series from the Royal Ontario Museum of Zoology, some 184 specimens in all. Mr. Hoyes Lloyd lent eight specimens from his private collection. These with the specimens in the National Museum gave a total of some 309 specimens. Many of these are males or downy young in which little geographical variation is evident, or are otherwise unusable, leaving 134 females on which the following study is based for the most part. The race *C. c. atratus* Grinnell of the Alaska coast, said to be well characterized in both male and female, is not represented and is not discussed. The races *osgoodi* (not recognized by Uttal nor by Friedmann), *canadensis*, *canace*, and *torridus* (described by Uttal in 1939 and recognized by Friedmann) are well represented, and the large series permit an evaluation of the range of variation which is considerable, and of subspecific limits which do not agree with those set by Uttal and Friedmann.

VARIATION IN THE MALE

The adult males vary but little, and provide no characters sufficiently marked to use in diagnosing races in Canada, as Friedmann has pointed out and contrary to Uttal's findings. However, there is a slight geographical variation. Males from Wood Buffalo Park and northward and westward tend occasionally to have more distinct grayish white or whitish tips to the upper tail-coverts, and tend to be slightly more grayish. However, a male from Didsbury, Little Red Deer River, Alberta, and another from about 40 miles northwest of Entrance, Alberta, still have the upper tail-coverts and rectrices typical of *C. canadensis* with no approach to the condition in *C. franklinii*. However, the Didsbury specimen is somewhat more brownish olive in general color—more like many male *franklinii* than like the other *canadensis* in our series. These specimens from localities

approaching the range of *franklinii* but showing no approach to it in tail characters indicate that the zone of hybridization is narrow.

As the males do not show diagnostic features, there is no point in listing the specimens in detail. The material examined is as follows:

Nova Scotia, 8; New Brunswick, 8; Gaspé, 11; rest of Quebec, 21; Ontario, 47; Manitoba, 8; Saskatchewan, 3; Alberta, 4; Wood Buffalo Park, 15; northern British Columbia, 1; Northwest Territories, 6; Yukon, 11; Total, 143.

VARIATION IN THE FEMALE

In view of the pronounced individual variation in the females, evaluation of the trends in geographical variation must be on a quantitative basis. Uttal had 58 females of the forms here treated, but did not discuss individual variation. Friedmann considered the females to have two color phases, one rufous, the other gray. However, the present material indicates that while some birds are very gray and others very rufous, many are intermediate. It seems better to consider the variation as individual. This is well illustrated by the tabular presentation of types of plumages arranged geographically as given beyond.

Friedmann compared corresponding color phases, and found that the rufous phase of *canace* was not distinguishable with certainty from the rufous phase of *canadensis;* and the gray phase of *torridus* only slightly different from the corresponding phase in *canace.*

If the proportion of sharply differentiated color phases was constant throughout the range of a species, the comparison of one type of plumage with its corresponding type, only, might be sufficient. But when the types of plumage are not clearly separable into two color phases, and when there is pronounced geographical variation in the proportion of the types occurring, it is necessary to compare the average of one population with the average of the next. The difference in proportion of types of plumage in various populations is one expression of geographical variation. Indeed it might be said that many subspecies are thus separable.

After some trial and error it was found advisable to admit nine different types of plumage. (Because wear made certain specimens of doubtful allocation, two more were added for worn specimens.) Each specimen was allocated to its category, irrespective of its geographical origin, on its average characters, using chiefly the amount and intensity of brown or gray in the plumage, the intensity and abundance, or the reverse, of the tawny markings in the upper parts, the extent and intensity of the rusty wash below, and to a lesser extent

the width of the gray edgings above and of the white edgings below. Wear must be considered; not only does it reduce gray and white feather edgings, but also on the upper parts it may expose concealed tawny markings.

Each group (except the single specimen in Group IX) intergrades with other groups and all represent continuous variation. Some characters vary independently of each other, so a strictly linear arrangement is perhaps not quite correct for all characters, but in general the series grades from the brownest (Group I) to the grayest (Group IX). The allocation of specimens is, of course, arbitrary, and another person would undoubtedly give different average values to the general effect produced by the many varying characters in some specimens. But it is doubtful if this would materially affect the whole picture.

Below is given the list of female Spruce Grouse, arranged into groups on average color characters regardless of geographical origin.

GROUP I.—Total, 4 specimens. The brownest specimens, browns and tawny intense and extensive.

Gaspé, 4: (Berry Mountain Road, 1; Federal Mine, 1; Ste. Anne River Portage, 2).

GROUP II.—Total, 8 specimens. Like I but browns less intense.

New Brunswick, 1: (near Bathurst).
Gaspé, 1: (Federal Mine).
Ontario, 6:(Petawawa, 1; Algonquin Park, 1; Muskoka area, 3; Parry Sound area, 1).

GROUP III.—Total, 7 specimens. Like II but rusty markings of dorsal plumage less conspicuous and more restricted; rusty wash below somewhat reduced.

Nova Scotia, 1: (Cape Breton Island).
Gaspé, 1: (Berry Mountain Road).
Ontario, 4: (Algonquin Park, 1; Temagami, 1; Parry Sound, 1; Sprague, 1).
Wood Buffalo Park, 1.

GROUP IV.—Total, 20 specimens. Like III but slightly duller brown.

Nova Scotia, 2: (Cape Breton Island).
Quebec, 6: (Bonne Esperance 5; Black River, Schyan Depot, Pontiac Co., 1).
Ontario, 11: (near Ottawa, 1; Ottawa Valley, 1; Hastings County, 1; Parry Sound area, 2; Lake Nipissing, 1; Lake Nipigon, 2; Lac Seul, 1, Favorable Lake, 2).
Franklin District, 1: (Charlton Island, James Bay).

GROUP V.—Total, 17 specimens. Like IV but browns duller and paler; grays more conspicuous, and rusty markings in dorsal plumage more plentiful and brighter, but not as much so as in Group II.

Nova Scotia, 2: (Lower Sackville, 1; Margaretsville, 1).
Gaspé, 2: (Table-top Mountain, 1; Ste. Anne River Portage, 1).

Ontario, 12: (Whitney, 1; North Bay, 2; Lake Nipissing, 1; Warren, 1; Timiskaming, 1; Muskoka area, 2; Parry Sound area, 1; Amyot, 1; Savanne, 1; Favorable Lake, 1).
Manitoba, 1; (Flin Flon area).

GROUP VI.—Total, 11 specimens. Like V but browns duller, and grays and blacks more conspicuous in dorsal plumage, white edgings more extensive below, with less rusty wash.

Ontario, 4: (Temagami, 1; Biscotasing, 1; Smoky Falls, Cochrane district, 1; near Armstrong, Thunder Bay district, 1).
Manitoba, 4: (Lake St. Martin, 1; Lake Andy, 1; The Pas, 1; Jack Head Indian Reserve, 1).
Saskatchewan, 2: (Montreal Lake, 1; Du Brocket Lake, 1).
Wood Buffalo Park, 1.

GROUP VI–VII.—Total, 17 specimens. Worn-plumaged birds that from their general appearance were probably similar to either Group VI or VII when in fresh plumage.

Quebec, 1: (Natashquan).
Ontario, 12: (Genier, 1; Moosonee, 1; Amyot, 3; Ingolf, 1; Lake Attawapiskat, 2; Favorable Lake, 4).
Wood Buffalo Park, 2.
British Columbia, 1: (Muncho Lake).
Yukon, 1: (Teslin Lake).

GROUP VII.—Total, 27 specimens. Like VI but with less tawny, and the browns grayer.

Quebec, 2: (Johan Beetz Bay, 1; Clova, Abitibi Co., 1).
Ontario, 8: (North Bay, 1; Timiskaming, 1; Franz, Algoma, 1; Nakina—Armstrong, 1; Lake Nipigon, 1; Larson, Thunder Bay district, 1; Favorable Lake, 2).
Manitoba, 5: (The Pas, 2; Lake St. Martin, 1; Duck Mountain, 1; Thicket Portage, 1).
Saskatchewan, 1: (Reindeer Lake).
Wood Buffalo Park, 11.

GROUP VII–VIII.—Total, 10 specimens. Worn specimens, which when fresh would probably resemble either Groups VII or VIII.

Quebec, 1: (Havre St. Pierre).
Ontario, 3; (Lake Attawapiskat, 1; Savanne, 1; Favorable Lake, 1).
Yukon, 6: (Sheldon Lake, 1; Nisutlin River, 1; Teslin Lake, 3; Kluane, 1).

GROUP VIII.—Total, 12 specimens. Like VII but browns and rusty still more reduced.

Manitoba, 3: (Vivian, 1; Winnipeg, 1; The Pas, 1).
Wood Buffalo Park, 3.
British Columbia, 2: (Gardiner Creek, 1; Wilson Creek, Atlin, 1).
Yukon, 3: (Rose River, 1; Lapie River, 2).
Alaska, 1: (Chitina River).

GROUP IX.—Total, 1 specimen. Like VIII but considerably grayer than the grayest in that group, with browns and tawny very much reduced.

Mackenzie district, 1: (Norman Wells).

TABLE SHOWING GEOGRAPHICAL DISTRIBUTION OF TYPES OF PLUMAGE IN ADULT FEMALES.

	I	II	III	IV	V	VI	VI–VII	VII	VII–VIII	VIII	IX
Nova Scotia			1	2	2						
New Brunswick		1									
Gaspé	4	1	1		2						
Quebec											
North shore, Gulf of St. Lawrence				5			1	1	1		
Pontiac Co.				1							
Abitibi Co.								1			
Ontario											
Southern, north to Temagami and Georgian Bay areas		6	4	6	8	1		1			
Northern and western				2	3	2	11	4	2		
Southwest, Nakina to Lac Seul and south				3	1	1	1	3	1		
James Bay				1							
Manitoba											
The Pas and north					1	2		3		1	
South of The Pas						2		2		2	
Saskatchewan						2		1			
Wood Buffalo Park			1			1	2	11		3	
British Columbia, north							1			2	
Mackenzie District											1
Yukon Territory							1		6	3	
Alaska										1	

In examining this table it is seen that the extremes are very different, but there is intergradation. Certain types of plumage predominate over considerable areas, and it is on this partial separation that subspecies must be recognized.

From Gaspé to Nova Scotia an intensely brown type of plumage occurs as follows: from southern Quebec and southern Ontario a deep brown type prevails; from northern Quebec to northern Alberta a paler brown type is commonest; and in the northwest, is a gray type. It is on these that the names *torridus, canace, canadensis* and *osgoodi* have been based. But the overlap between each of the groups is considerable, and it is necessary to examine each population for the amount of overlap. Using the convention of requiring 75% of the population (in this case the females in all types of plumage) to be separable before it is entitled to subspecific status, the following would be necessary:

	torridus	*canace*	*canadensis*	*osgoodi*
Total number of specimens	14	35	70	15
75% expected to be separable	10.5	26.2	52.5	11.2

Tabulating the above "races" to see how they compare in this respect gives the following:

GEOGRAPHICAL DISTRIBUTION OF PLUMAGE TYPES IN ADULT FEMALES, WITH 75% OF EACH "SUBSPECIES" COMPARED WITH NEXT FOR OVERLAP

Plumage type	I	II	III	IV	V	VI	VI–VII	VII	VII–VIII	VIII	XI
torridus	4	2	2	2	4						
10.5 = 75%											
canace		6	4	12	8	1	1	2	1		
26.2 = 75%											
canadensis			1	6	5	10	14	25	3	6	
52.5 = 75%											
osgoodi							2		6	6	1
11.2 = 75%											

From this table it is evident that 75% of the specimens of *canace* are separable from 75% of the specimens of *canadensis*. This is true even though northern and southwestern Ontario are areas of intergradation and this material is included. If part of it were excluded from the summary as being from an area of intergradation, the difference would be still more apparent.

With *torridus*, however, it is a different matter; 75% of the specimens from the supposed range of *torridus* are not separable from 75% of the specimens from the range of *canace*. This is due to a nearly similar range of individual variation in distant areas; our good series of southern Ontario birds shows that a rich red-brown plumage commonly occurs there also.

From the above table, *osgoodi* appears as a recognizable race. Though qualitatively the overlap with *canadensis* is great, quantitatively 75% of the individuals from the range of *osgoodi* are distinguishable from 75% of the individuals of *canadensis*.

VARIATION IN THE JUVENAL PLUMAGE

A Teslin Lake juvenal (*osgoodi*) falls within the range of variation of 12 juvenals from the range of *canadensis* from Ontario, and is not grayer as might be expected. It is much browner than any adult from the range of *osgoodi*.

VARIATION IN THE DOWNY YOUNG

We have the following downies:

osgoodi, Yukon, Kluane Lake, 1 specimen.
canadensis, 16 specimens:
  Saskatchewan, 1 (Reindeer Lake);
  Ontario, 15 (Amyot, 11; Lake Nipigon, 3; Favorable Lake, 1).
canace, 2 specimens:
  Ontario, 2 (Algonquin Park, 1; Lake Nipissing, 1).

The *canadensis* chicks are rather uniform except for one of the three Lake Nipigon birds which has only a faint yellowish tinge below, instead of being conspicuously yellow.

The Reindeer Lake, Sask. (*canadensis*) and the Kluane Lake (*osgoodi*) chicks, with many feathers showing, are slightly whiter only than most Ontario *canadensis*.

Of the two downy *canace*, one (Algonquin Park) is about like the yellowest *canadensis;* the other is considerably yellower.

SUBSPECIES RECOGNIZED

From the preceding it appears that the subspecies of the Spruce Grouse in Canada should stand as follows:

Canachites canadensis canace (Linnaeus).

From Nova Scotia and New Brunswick to southern Quebec (including Gaspé), east on the north shore of the Gulf of St. Lawrence to Bonne Esperance; north to Lake St. John (Uttal) and southern Ontario north to Temagami and Georgian Bay (Sprague) areas; overlaps the following subspecies through individual variation and tends to be more reddish brown in eastern Canada (Gaspé, especially).

Uttal had five females from the vicinity of Bonne Esperance (borrowed from the National Museum of Canada) that are definitely *canace* in appearance; however he had two females from Natashquan and Havre St. Pierre (also from the National Museum) that looked more like *canadensis*, and came from areas between Bonne Esperance and the type locality of *canace* (Quebec City). On the basis of the two *canadensis*-like specimens, he referred the seven to *canadensis*. It seems advisable to refer the seven to *canace* on the basis of the five specimens that look like *canace*, and extend its range to Bonne Esperance until additional quantitative data are received.

Uttal, who described *torridus* (here synonymized with *canace*), apparently had too few birds to show the range of variation of *canace*. Uttal also postulated differences between the males of *torridus* and *canace* that are not apparent in the present series.

Canachites canadensis canadensis (Linnaeus).

From Labrador and eastern Quebec, north to Chimo (Uttal), and south to Lance au Loup (Uttal) through northern and western Ontario to Alberta and southern Mackenzie (Wood Buffalo Park).

Differs from *canace* in the female sex by averaging more grayish brown, less reddish brown on the upper parts; with paler and less extensive tawny markings in the dorsal plumage and reduced tawny wash below; and with wider gray edgings above and white edgings below. Through individual variation it overlaps both the preceding (especially in Ontario) and the following races.

It is customary to consider *canace* as occurring in southwestern Ontario and in southern Manitoba. While birds resembling average *canace* occur north to James Bay, and to Lac Seul in western Ontario,

and birds approaching average *canace* are found still farther away, on the average of the populations, *canace* appears not to extend much westward of Georgian Bay.

Canachites canadensis osgoodi Bishop.

From central Mackenzie west through Yukon and south into northern British Columbia (to Gardiner Creek near Fort Nelson) and to the St. Elias Range (Chitina River), at least in Alaska.

Differs from *canadensis* in the female sex by being grayer, with less brown and less tawny in the plumage. There is considerable qualitative overlap with *canadensis* through individual variation, but this form is separable on a quantitative basis.

The additional, fresh-plumaged specimens, especially from Yukon in the Canadian National Museum, make the recognition of this race necessary, despite the fact that both Uttal and Friedmann did not recognize it. It must be noted that Wood Buffalo Park birds are not *osgoodi*. The males of both *osgoodi* and western *canadensis* show a slight paling and a tendency toward more distinct pale tips on the upper tail-coverts.

Note on Identifying Single Specimens

The variability in the Spruce Grouse female is such that a single specimen may be far from the average for the population from which it comes (see preceding table). For instance, a Wood Buffalo Park specimen is more like average *canace* than it is like the rest of the Wood Buffalo Park specimens which are *canadensis*. These non-conforming specimens are just as much a part of the population from which they come as are those that have the characters of the subspecies well developed. Despite their resemblance to some other subspecies, they belong with the average of their own population. In practice this is sometimes forgotten. Uttal (*tom. cit.:* 462) referred a female Spruce Grouse from Table Top Mountain, Gaspé Co., Quebec, to *canace*, despite the fact that he had several females from Gaspé localities west of Table Top Mountain, including Ste. Anne River Portage (two females) only six miles to the west, that he referred to *torridus*. Such identifications are quite unjustified, resulting in a false evaluation of the range of variation of a population, and in erroneous delimiting of ranges.

The mapping of the ranges of Spruce Grouse must depend on the identifications of material adequate enough to show the range of variation.

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