

Article IX.—THE GEOGRAPHICAL DISTRIBUTION OF COLOR
AND OF OTHER VARIABLE CHARACTERS IN THE
GENUS *JUNCO*: A NEW ASPECT OF SPECIFIC
AND SUBSPECIFIC VALUES

BY JONATHAN DWIGHT, M. D.

PLATES XI-XIII, AND FIVE MAPS

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INTRODUCTION

Perhaps the most vexing problem that systematic ornithology presents is that of relationship. Nomenclature hinges on how we decide that one group of birds is related to another, and it has been divergence of opinion quite as much as divergence of structure and plumage that has added so greatly to our burden of scientific names. The recognition of geographical races with the use of trinomials has broadened the field of nomenclature and led many a novice to believe that the naming of a new race is the highest aim of ornithology. Furthermore, there has been a growing tendency hastily to apply names to every sort of variation, letting the facts catch up with the names as best they may — a procedure that is a good deal like putting the cart before the horse. The intensive search for differences has greatly exaggerated their importance and true perspective of values is often completely lost so that, with vision narrowed to seek only differences, nothing can be seen except a variation to be named. Ornithology is really suffering from an indigestion of names — a malady that our specialists augment rather than cure, if we may judge by the confusion that may still be found in groups of birds that have been revised by them. This is largely because the analytical side has overbalanced the synthetical, the result being that names, good and bad, accumulate.

Like many another group, the Juncos from time to time and here and there have been subjected to occasional subdivision and critical analysis and, as a consequence, we now have to deal with a mixed assemblage of names representing species, subspecies, and hybrids, concerning the status of which there is general lack of accord even among the highest authorities. Many important facts have been brought out in a very considerable literature but great diversity of opinion still prevails as to how the Juncos should be classified and named. It is not, however, as much my purpose to attempt a complete revision as it is to focus attention upon them from a new angle, for I am convinced that current explanations and conclusions are inadequate and based upon false premises. We need to break away from beaten paths and to measure or weigh variation and relationship according to new and, if possible, more stable standards. How this may perhaps be accomplished I shall presently show, for my task practically resolves itself into two parts: the marshalling of scattered facts, and the offering of explanations that seem to fit them best.

One of the great stumbling blocks in systematic work in any group of birds is usually the lack of breeding specimens, for only by means of them is it possible to learn definitely the limits of variation at different localities. However unsatisfactory their plumage may be because of its worn and often tattered condition, they are indispensable in fixing the geographical ranges of species and races and, without them, the naming of new forms is so beset with uncertainties that the literature is positively clogged with wrong and untenable names, based on winter specimens taken far from their breeding grounds. Fortunately for me, not less than five hundred breeding Juncos have passed through my hands, as well as several thousand others taken at all times of the year. The exact number is immaterial, for mere quantity means nothing unless sex, age, plumages, and localities are well represented. If we are not sure of the sex of a specimen, do not know if it is a young bird or an old one, and are, perhaps, unfamiliar with the regular plumages of the species, the folly of giving it a name because it *seems* to be different, becomes apparent; and yet this has been done time and again to the discredit of the aspirant to "a place in the sun" — and the folly is by no means confined to amateurs. My special endeavor for a number of years has been to obtain reliable specimens, and a large number collected by me have been examined when fresh, so that I can speak with some assurance upon all of these points. It is surprising how many birds wrongly sexed and without even a question mark we find in all collections. However, in spite of difficulties, the series of Juncos at my disposal has been fairly adequate and I am greatly indebted to museums and private collectors for the loan of valuable material, especially to the following: Academy of Natural Sciences, American Museum of

Natural History, Museum of Comparative Zoology, U. S. National Museum, Victoria Memorial Museum, Carnegie Museum, Mr. C. F. Batchelder, Dr. L. B. Bishop, Mr. Wm. Brewster, Mr. J. H. Fleming, and Mr. P. M. Silloway.

The colored plates to illustrate the plumages of the Juncos have been prepared by Mr. Henry Thurston and they are somewhat diagrammatic in order that comparisons may be made. These plates and the maps have been prepared under my supervision.

GEOGRAPHICAL RANGE OF THE GENUS

There are reasons why it seems desirable to consider first of all the distribution of the genus as a whole, chief emphasis being laid on the breeding range. The birds of the genus *Junco* are rather abundantly distributed in the breeding season throughout most of the forested parts of the Hudsonian and Canadian faunal zones of North America. This distribution corresponds quite closely to that of the coniferous forests of the North, especially of spruces and firs, while south in the mountains of Mexico and Guatemala the Juncos occur in the more or less isolated pine forests of the higher ranges and peaks. After a considerable gap in Central America where no Juncos have been recorded (although pine forests are found), an aberrant form occurs in the bushy zone below the cones of some of the highest volcanic peaks of Costa Rica and Panama. The breeding range of the northern birds reaches its southern limit at or near the summer isotherm of 60°, and it is possible that a like temperature governs their range on the mountains farther south. Their northward range in the Hudsonian Zone reaches tree limits in some of the wooded river valleys extending finger-like into the Arctic Zone; but from the northern limit of trees southward, approximately to the United States boundary, they range across the continent in a wide belt from the Atlantic to the Pacific, and from sea-level to timber line on the mountains. In the East they extend irregularly southward on the Appalachian Mountains wherever the conditions of the Canadian Zone prevail; and in the West a similar extension southward on the Rockies, the Sierras, and the coast ranges carries their distribution somewhat disconnectedly along the higher mountains of western Mexico to those of Central America. They breed at sea-level as far south as the Maine coast in the East, and south to northern California in the West. They reach southern California in the mountains at over 4000 feet, but southward in the Rocky Mountains of Wyoming and Colorado they remain near or above 7500 feet, and farther south in Arizona and Mexico they range from 7000

to 12,000 feet, reaching the highest altitudes in southern Mexico, Guatemala and Panama. Isolated groups are also found in the Black Hills of South Dakota (5000 to 7000 feet), in the San Pedro Martir (6000 to 10,000 feet), and the Cape San Lucas mountains (6000 to 8000 feet) of Lower California and in Guadalupe Island. The "Junco" (*Junco siemsseni*), described from China (Martens, 1906, Ornith. Monatsberichte, XIV, pp. 192-194), need not occupy us here, for it evidently has no affinities with this genus and was rightly put among the Buntings (*Emberiza*) by Dr. Sharpe (1909, Hand List, V, p. 283).

The winter distribution of the southern breeding Juncos is effected largely by altitudinal migration from the mountains down to the sheltered valleys and lowlands; but the northern birds of Canada and the United States migrate, driven by the rigors of a northern winter, entirely out of their summer habitat and are found, from October to May, over nearly all of the United States and a portion of Mexico. Their appearance in flocks among the shrubbery even before the first flakes of winter snow have fallen along the Atlantic seaboard gave rise to the name "Snow-bird," by which appellation they are still known in many localities. The slaty birds, flashing their white tail-feathers as they flit away when disturbed, are familiar objects to many of us. This outline of distribution will be filled out more in detail when we take up the different forms by name.

Could we trace the geological history of the Juncos, it would throw a flood of light on their present-day relationships, but we must content ourselves largely with surmise and conjecture. The limited migration range would seem to indicate a comparatively recent origin for them, and the fact that they form a homogeneous group, not considerably differentiated, also points this way. There are reasons, too, for supposing that the interplay of divergence and convergence may account for some of the differentiation we find today, and we may well speculate as to the significance of the almost constant association of the genus with coniferous forests; but these matters may well be left to the consideration of the palæontologist.

GEOGRAPHICAL DISTRIBUTION OF COLOR CHARACTERS

Maps 1-4

In following out my lines of investigation we are to view the Juncos from a new angle, first determining their most essential characters by analysis, then tracing the geographical distribution of these characters, and, finally, grouping the birds synthetically according to similarities rather than differences.

What then are their characters? They are of two kinds, qualitative and quantitative, which include all differences of structure, size, proportions, pattern, and coloration. In structure, the Juncos are Sparrows, and they are all practically alike; in size and proportions, their differences are quantitative; but, in pattern and coloration, the variations are both quantitative and qualitative. With one exception, the pattern of plumage is very similar, so we must turn chiefly to coloration in order to find characters or differences by which they may be separated into groups.

Color variations, therefore, give us most of the characters on which the various species and subspecies of the group are based, and they alone give us characters that may be considered wholly qualitative. No analysis would be complete if it did not take into account and weigh each factor that necessarily counts in determining rank and relationship. However, it is not my purpose to consider every demonstrable character; rather, I wish to fix attention upon the method by which it may be done. The *pattern* of plumage of most of the Juncos does not show much variation, although the *color* of certain areas of plumage varies widely at different parts of the birds' range. By mapping the geographical range of the colors of these plumage areas, it may be demonstrated that certain colors or combinations of color are peculiar to definite geographical areas. The Juncos, with colored areas of plumage sharply defined, lend themselves admirably to illustrating the principle involved in analysis of this sort, which may be extended so as to include colors of other parts than the plumage.

Basing my conclusions on the evidence afforded by breeding males, I have selected the following nine areas and parts in order to trace the geographical distribution of color in them, viz.: (1) Head; (2) Breast; (3) Back; (4) Sides; (5) Wing-coverts; (6) Tail; (7) Lores; (8) Iris; and (9) Bill.

1. *Head* (Map 1)

The area of plumage involved includes the top of the head down to the eyes and back to the nape. Three distinct types of coloration may be recognized in it; slate-gray, black, and ash-gray.

The range of the slaty heads, roughly stated, is over a large part of Alaska, Canada, New England and the higher Alleghanies; that of the black heads includes southern Alaska, British Columbia, western Washington and Oregon, and California; while the ashy heads are found south of the Canadian boundary in the Rocky Mountains and in the mountains of western Mexico and Central America as far as Panama. In these three types the color differences are qualitative and constant over definite areas



Map 1.— Distribution of color in heads of Juncos.

of country, although where the areas meet we find a merging or gradation from one color to the other. It may be urged that the differences between these colors, if such they may be called, are not qualitative; but my contention is that in quality they are elementally so different that one, when typical, cannot be mistaken for either of the others. It is a qualitative difference of color with black, slate, and ash as the three standards for comparison without regard to intermediate shades. How the three may have been evolved need not concern us here; we find three types of coloration today that, according to prevailing standards, call for specific names.

The mountains around the Lynn Canal in Alaska act as a snowy barrier and separate the slaty-headed from the black-headed birds, and a rather sharp transition from one to the other type takes place within a comparatively few miles. Farther south, a similar transition takes place but it is spread over a much wider area of country. Along the Canadian Pacific Railroad, for instance, we find black-headed birds as far east as Banff, Alberta, and gray-headed ones as far west as Sicamous, British Columbia, while in the region between we often find both types of head in birds nesting almost side by side. Some, too, are neither slaty nor black but show intermediate shades with, sometimes, ashy shades that suggest an intrusion of the ashy element from the south. This ashy element seems barely to touch the slaty in southeastern Alberta, but it meets the black on a considerable frontage in northern Idaho and adjacent territory. It is obvious that, if a mixture of the black and the slaty elements produces various grays, so too a mixture of the ashy and the slaty elements will also produce various grays. Consequently, it is impossible to map with accuracy the exact dividing lines between these three types of color which, unless I misread the evidence, are not merely quantitative variations but are distinctly qualitative.

The slaty type of head, however, does show slight quantitative variations in the birds of the southern Alleghanies and of the Black Hills of South Dakota; the black of the heads of birds on the coast of California near Monterey is less intense; and the ashy head is paler in the arid regions of Arizona and northern Mexico and at Cape San Lucas. The ashy head is darkest in birds from Guatemala and is obscured with a greenish or olive-brown tinge which is also found in specimens from Costa Rica and Panama. In the last group we find, in addition, faint dusky longitudinal streaking.

It is evident then that, judged by the head alone, the Juncos may be divided into three groups showing qualitative characters, these groups in turn being marked by lesser quantitative differences.

Map 2.—Distribution of color in breasts of *Juncos*.

2. *Breast* (Map 2)

This area of plumage is usually set off from the white abdomen by a decided line of demarkation. Four types of coloration may be made out: slate-gray, black, ash-gray, and smoky gray or dull white.

The slate-gray breast, associated with a similarly colored head, occupies the same geographical area; and the black breast and head also belong together in their distribution. The ash-gray breast, however, is associated with a similar head only as far south as Colorado for, throughout this state south to Arizona, the gray of the breast becomes paler than that of the head, while in southern Arizona and northern Mexico the gray is scarcely perceptible, the whole lower parts of Juncos from this portion of their range being of a smoky gray or dingy white. In the less arid mountains of southern Mexico and Guatemala the gray is again slightly deeper, although much paler than that of the head; while in Costa Rica and Panama it has a peculiar, slightly yellowish tinge.

While these various types of coloration merge more or less gradually at their points of contact, like the types of coloration of the head, they are sufficiently distinct qualitatively to be assigned to definite geographical areas. There are also some slight quantitative differences just as with the head.

3. *Back* (Map 3)

Four distinct types of coloration mark the back: slate-gray, brown, red, and black-streaked.

The slaty type of back is associated with a similar head and breast, and has the same distribution; the brown back is associated with all of the black-headed, black-breasted birds and with a part of those of the ash-gray type; the red back belongs wholly with the ash-gray type; and the streaked back is confined to the peculiar Juncos of the highest volcanic peaks of Costa Rica and Panama.

The slate-gray and the red types are evidently based on more stable colors than is the brown, and show very little variation either seasonal or geographical; but the brown type is susceptible to considerable variation, due apparently to climatic influences. On the Queen Charlotte Islands and the adjacent mainland where the rainfall is heavy, we find a deep and ruddy brown, while southward on the coast the brown averages slightly paler; eastward and southward to the Rocky Mountains of British Columbia and Alberta, the brown loses in depth and ruddiness, becoming more of a wood-brown at its extreme eastward extension in Idaho, Montana, and Wyoming.



Map 3.—Distribution of color in backs of Juncos.

This last type of back is also very similar to that of the isolated groups of Juncos on Guadalupe Island and in the San Pedro Martir Mountains. In California, the brown is paler than it is farther north and with a distinct pinkish instead of reddish tint, except in a damp coast belt near Monterey where the back is again dark, approaching in this respect the specimens from Alaska. Although, through wear, the brown backs of some birds may become ruddier or more rufescent in the breeding season, they never approach in color the much brighter red that is characteristic of the birds of the southern Rocky Mountains and Mexico.

With comparatively little variation, the red type of back ranges on the mountains from southern Wyoming to Guatemala. At the latter point, however, the red is diminished and much diluted or obscured by a greenish or olive-brown element, perhaps derived in the past from the Juncos to the south. These southernmost Juncos of the peaks of Costa Rica and Panama have backs quite unlike any other in adult plumage, for the color is an olive-brown with dull black streaks, resembling in this respect the juvenal plumage of the other Juncos although it seems as if this character might have been derived from an ancestor that was not a Junco. It is of interest to observe that in the birds of Mexico the red runs over into the wings extensively, while in the more northern birds of Colorado the red diminishes to a small "saddle," the scapulars being without any traces of red. In arid regions the red is a little paler and the palest red is in birds of the Cape San Lucas region of Lower California. Again, we have here at least four distinct types of qualitative coloration referable to definite geographical areas, while quantitative variations are also demonstrable between certain limits.

4. *Sides* (Map 4)

The wash of color along the sides and flanks is a very variable character that is not easily classified, but it seems possible to resolve it into five types: slate-gray, pink or vinaceous (rarely brownish), ash-gray, greenish or olive-brown, and cinnamon-pink.

The distribution of the slaty sides coincides with that of the slaty head, breast and back; the pinkish sides of varying shades and extent, with that of the brown back; the ashy sides, with that of the red back as far south as New Mexico; the olive-brown is peculiar to birds farther south; and the cinnamon tint, to those of Cape San Lucas. The last is a peculiar color that may be related to the pinkish wash but it is so unlike it that it appears to be a matter of quality rather than of quantity. It is a striking fact that the pink type not only intrudes itself between slaty and ashy types north and south of it, but it displays its maximum intensity where this finger of

Map 4.—Distribution of color in sides of *Juncos*.

color is thrust eastward across the Rocky Mountains. It may be that the color originated in this area and has spread westward to the Pacific Coast, where it is diminished in extent and darkened somewhat by the heavier rainfall; but it is a very stable color and varies more in quantity than it does in quality.

5. *Wing-coverts*

The upper wing-coverts, especially the greater, are usually colored much like the back, although brown-backed birds usually have gray coverts which are sometimes tinged with brown; some red-backed birds, too, have gray coverts, and white wing-bands in one small group of Juncos is also an exception. We may, therefore, classify the coverts and recognize four types: slate-gray, red, white, and olive-brown.

The slaty coverts are peculiar to all Juncos as far south as southern Arizona; the red, to those of Mexico and Guatemala; the white, to those of the Black Hills of South Dakota; and the olive-brown, to the birds of Costa Rica and Panama. While there is wide range in these variations, they are susceptible of being grouped. We do not, for example, ever find red coverts in Canada or white ones forming a wing-band anywhere else than in the Black Hills, although occasional specimens of Juncos from elsewhere may have coverts slightly tipped with white. These differences are certainly qualitative and have definite ranges, although there is no sharp line between them. Birds of the intermediate areas show intermediate characters.

6. *Tail*

The amount of white on the outer tail-feathers of the Juncos is a character that may well be considered as on the border-line between qualitative and quantitative. If weighed by its presence or absence, we must consider it as the former; and, if by its degree or extent, we must regard it as the latter. Assuming quality as the standard, we shall find only the peculiar Juncos of Costa Rica and Panama without white in the tail, and all the others with more or less of it; assuming quantity as a standard, all of the Juncos would belong in one group differing only in degree, for, although there is much individual, sexual, and geographical variation in the amount of white, it varies (geographically considered) from the involvement of three or four feathers to the vanishing point. The isolated group in Panama and Costa Rica has none, although a suggestion of white is visible if specimens are held to the light at a certain angle; in Mexico only the outer pair, on an average, is largely white; in the southern Rockies at least two pairs are white; in Montana and Idaho three pairs are white; while northward and

westward from the Canadian boundary the average is again only two white. The maximum is reached in the group of Juncos in the Black Hills, where as many as four pairs may show white. Excepting the southernmost group, all of the differences between the others are quantitative.

7. *Lores*

Like the white of the tail, the blackness of the lores is mostly a quantitative character; but it, too, may be present or absent, and it shows a great deal of variation in extent, even in birds of the same locality. It is usually absent in slaty-headed birds, although often strongly indicated; it cannot be demonstrated in the black-headed birds for obvious reasons; and it is found in all ashy-headed birds, reaching its average maximum of intensity in Mexico.

8. *Iris*

Judged according to the color of the eyes, the Juncos fall into two distinct groups: those with a brown iris and those with a yellow. All birds north of Arizona and those of northern Lower California and Guadalupe Island have brown eyes; all others have yellow ones, and the line dividing the two groups is sharp. There are, perhaps, lesser shades of color to be made out, but these two major divisions are conspicuous and the character is obviously qualitative.

9. *Bill*

Two types of coloration mark the bill: in one both mandibles are flesh-colored; in the other the upper mandible is dusky and the lower bright yellow. The first, like the brown iris, is peculiar to all birds north of Arizona and to the singular Juncos of Costa Rica and Panama; the second embraces all the other Juncos, the one found at Cape San Lucas varying in having the upper mandible brownish rather than dusky. Here again, in so slight a character as the color of the bill might seem to be, we have a difference that is qualitative beyond all question; and yet where the ranges of the two come together in Arizona there are found intermediate specimens with upper mandibles more or less dusky and the lower ones more or less flesh-colored.

This sort of analysis might be carried out to include other parts of the birds, but we have, I think, gone far enough to illustrate the possibilities of classifying them by characters that have a demonstrable geographical range. A little superimposing of such maps of color distribution will show

in a composite way how a grouping of Juncos according to color similarities may be effected. Before, however, it is possible to apply names to the groups, attention must be directed to the question of relationships because the specific or other name applied depends upon the point of view we take.

RELATIONSHIPS OF SPECIES, SUBSPECIES, AND HYBRIDS

Systematic ornithology has found it convenient to consider a species to be a group of birds, breeding true to type, that shows no intergradation with another group; a subspecies, or geographical race, as merely a variable portion of the species; and a hybrid as an individual resulting from the cross-breeding of species. The species is the unit; the subspecies is part of the unit; and the hybrid is an individual that is a part of two units. The usual hypothesis is that at one time there was but one species and that gradually differentiation of this species into the others took place. A glacial epoch, a folding of the earth's crust, environment, or some other reason is required to explain why there is now more than one of the entities we call species. Originally they have been like a chain, and if it broke into pieces or segments creating a gap or gaps in the continuity we have had new species. The links of the chain or of its segments are the subspecies. As long as the chain or the segments remain unbroken — no matter how different may be the two ends — it, or they, are species. We assume that a process of differentiation is constantly going on, and where we find several species in a group today we think of them as being remnants of a broken chain. With each remnant we have links, the subspecies or geographical races or variations within the species, and they are also called incipient species because a break in continuity may at any time elevate a segment of links, or even one of them, to full specific dignity. As long as intermediate specimens or connecting links occur — intergradation it is called — we must recognize but one species, these intergrades, no matter how great their variation, being the basis on which subspecies are founded. This rather crudely expresses current ideas regarding the derivation of species and subspecies. Nomenclaturally, we bestow a binomial upon the species, a trinomial upon the subspecies, and deem the hybrid to be such a freak that it gets no name except by mistake.

One theory is as good as another, provided it is supported by the facts; and because we have been explaining things for years in one way is no reason why another explanation may not be equally pertinent. My study of the Juncos has convinced me that some parts of our theories are inadequate and that our nomenclature in some respects is lacking in scientific accuracy.

It is not necessary to call utterly dissimilar groups races simply because we find intermediate specimens. We need only to assume either that such groups have differentiated to a point where their characters are now what we recognize as specific, or that specific characters were acquired in a geological past and that the species are now convergent and hybridizing on a large scale. In the first case we break, for convenience, the continuity of the theoretical chain today without waiting for the future dislocation that is evidently on the way; and, in the second, we assume that the break has already been accomplished long ago. It has been convenient to consider intergradation as a test of species; why may it not be more convenient to test species by qualitative characters? The question may well be asked "How can we decide that certain characters are specific?" and another equally important question is "What is the evidence of hybridization?" It seems to me that Juncos answer both these questions, if we weigh their characters qualitatively and quantitatively according to the following formulæ which indicate essential (usually plumage) differences between species, subspecies, and hybrids.

1. A *species* has one or more intrinsic characters or a combination of characters not shared by another species. The characters are qualitative.

2. A *subspecies* shares *all* the characters of its parent species in greater or less degree. The characters are quantitative and without a break in the continuity of the quantity. It connects similar extremes or may be one of them.

3. A *hybrid*, as ordinarily recognized, shows, in more or less irregular proportions, the characters or some of the characters of both of the species between which it is a cross. It connects dissimilar extremes. (The results of Mendelian experiments seem to modify this definition.)

Weighed or tested in this manner, the strikingly different groups of Juncos need no longer be lumped together as races of a single species because of specimens with intermediate characters. If such groups did not today overlap at their borders they would be unhesitatingly pronounced species. The gray-headed and the black-headed Juncos, for example, may be separated specifically on the character of grayness alone in the one and of blackness in the other. Our present theories oblige us to call these dissimilar groups one species because they freely intergrade. Is it better to blindly follow the convenient rule of thumb or to endeavor to so analyze such characters as may be found that they can be weighed and an estimate made of their relative value? We have, I believe, a valid reason for a specific name in a qualitative difference and for a subspecific name in a quantitative variation. We need only to determine which it is.

If we do not hesitate to call imperfect or "spotty" blends of plumage

hybrids, why may not more perfect blends or crosses result from the continuous action of hybridization? Until actual experiments in cross-breeding along this line have been made more extensively, we cannot settle the question positively; but, at present, it looks as if our conceptions of hybrids and of geographical races have been confused. If so, the trinomial has been applied to two quite different things: the race and the hybrid.

DIAGNOSES AND BREEDING RANGES OF THE JUNCOS

Map 5

It seems to be perfectly possible to group and name the Juncos by application of the principles just set forth, and considerable agreement with the work of earlier students will be found. I hope, now, to present facts that, even if they are not convincing, will at least lead to more careful study and exact diagnoses of species and races. Differential color variations are often very slight and difficult to put into words, but so far as possible I have followed Ridgway's "Color Standards," 1912 edition. In describing plumages it is far more difficult to find terms to express the average of many specimens than it is to describe a single specimen. I have endeavored to present a broad, as well as brief, review of the various plumages, avoiding the exceptional and omitting an unnecessary wealth of confusing details which may be found in almost every book to which we turn. No localities are included in my lists (except a few involving *hyemalis*) unless I have personally verified specimens from them. The winter ranges are not given and other matters of indirect interest are not taken up because they scarcely come within the scope of this particular study of the Juncos.

1. *Junco hyemalis*. The Slaty Juncos

- a.—*Junco hyemalis hyemalis*. Slate-colored Junco
- b.—*Junco hyemalis carolinensis*. Carolina Junco

Plate XI, figures 1 and 1a

A.) Differential Characters of Male.

General slatiness of head, breast, back, and sides separates *hyemalis* qualitatively from *oregonus* with black head and breast, brown back and pinkish sides, and from *mearnsi* with ashy head and breast, brown back and pinkish sides. The geographical race *carolinensis* averages slightly paler on the head and is a trifle larger, with a darker bill in fresh specimens.

B.) Breeding Range.

The Canadian and Hudsonian Zones of North America, from the Atlantic seaboard west in Canada to the Rocky Mountains and to the Yukon Valley and the Seward and Kenai Peninsulas of Alaska. The race *carolinensis* is peculiar to the Canadian Zone of the southern Alleghanies, at an elevation usually above 4000 feet. It is interesting to notice how closely the range of *hyemalis* coincides with that of the Black Spruce (*Picea marianæ*) and of the White Spruce (*Picea canadensis*), following their extension to the sheltered valleys of Arctic rivers and to timber line on snow-capped mountains.

C.) Breeding Localities.

a.) *hyemalis*.

Labrador (L'Anse au Loup, Rigolet); Newfoundland (Bay of Islands); Nova Scotia (Baddeck, Whycocomagh, Newport); New Brunswick (Hillsborough, Salisbury, Grand Manan, Point Lepreau, Bathurst); Prince Edward Island (Souris, Summerside, Tignish); Quebec (Tadousac); Ontario (Missanabe, Charlton Island, Fort George, Muskoka, Parry Sound, Bruce Co., Middlesex Co.); Maine (Fort Fairfield, Long Lake); New Hampshire (Mt. Washington, Campton Village); New York (Berlin, Haines Falls, High Peak, Overlook Mountain, Summit, Stamford); Pennsylvania (North Mountain, Gallitzin, Cresson, Altoona, McKean Co.); Michigan (Cadillac); Manitoba (Norway House); Alberta (Athabaska Landing, Grand Rapid, Ft. Chipewyan, Ft. Smith); Mackenzie (Tsalwar Lake, Tazin River, Hay River); Keewatin (Ft. Churchill); Yukon (Ft. Norman); Alaska (Lake Bennett, Caribou Crossing, Dawson, Circle City, Seldovia, Homer, Sheep Creek, Ft. Yukon, Nulato, Kowak River, Chulitna River).

b.) *carolinensis*.

Virginia (Mountain Lake); West Virginia (Davis, Cold Knob, Manning's Knob); North Carolina (Roan Mountain, Black Mountain, Craggy Mountain)

D.) Plumage.

Adult males in fresh fall or winter plumage are of several shades of dark bluish slate and neutral gray set sharply off from a rather dull white abdomen. They are slightly veiled on the breast with grayish or brownish edgings; the back, nape, crown, and scapulars usually much browner and more broadly edged, but the slaty element that prevails throughout the plumage is striking. The average bird is slightly darker on the crown than on the back, although at one extreme of a large series are uniformly slaty specimens and at the other are birds showing a faint dusky cap obscurely outlined against the grayer nape. The flanks and under tail-coverts are

usually faintly buffy. Two outer tail-feathers and part, or rarely all, of a third show white. The bill is flesh-color, sometimes dusky at the extreme tip. The iris is brown.

Young males are usually more veiled and browner than adults, especially on the back, and the white of the tail-feathers is usually less extensive, but some birds are grayer and very like adult males and again some are browner like adult females.

Adult females are, with a few exceptions, of a paler slate and much browner than any but the dullest males, the brown obscuring the back and crown still more and in most specimens there is a strong brownish or sometimes slightly pinkish wash on the sides and flanks. The tail has not more than two outer pairs of feathers white and both the outer and inner edge of the second pair is often brown.

Young females are duller and browner than adults and show a large amount of variation in the shade of slate, in the amount of brown veiling, and in the extent and tint of the brownish sides. Females can seldom be mistaken for males but some, unless carefully sexed, might easily pass for them. The size of the largest females just about equals the average dimensions of males.

Juvenal Plumage of both sexes. Above, dark grayish brown, varying in depth, with broad interrupted dusky streaks; below, dull yellowish white thickly streaked on the breast and sides with dull black. There is a great deal of variation, some specimens being darker, some lighter, some very brown, some gray, and the streaking may be broad or narrow. A large part of the yellowish and brownish shades of color is soon lost by fading. This plumage in all the species of *Junco* is worn but a short time and the remiges and rectrices are the only feathers not replaced at the post-juvenal molt in August and September. By the middle of the latter month, the first winter, an "immature" plumage has been almost completely assumed.

Breeding plumage. A limited prenuptial molt chiefly in early April renews a few of the body feathers, but wear is the chief factor in modifying the autumn plumages of both sexes, adults and young. Fading and loss of feather edgings during the winter gradually (and even by April almost completely) obliterates the brown tints in males and greatly diminishes them in females, so that birds become almost wholly slaty and look a darker, duller slate, especially on the back where there is an obscurely mottled effect partly due to the shadows of the broken edges of the overlapping feathers.

It is well to remember that some young males cannot be distinguished from adults by their plumage and some adult females cannot be told from young males, but the plumage differences outlined above obtain in the average *hyemalis* as determined chiefly by my own work in dissecting upwards

of one hundred and twenty specimens taken at all seasons of the year. The differences are only average but they are quite important if we wish to make comparison of like plumages among the other Juncos where like conditions prevail.

E.) Discussion.

In size and color *hyemalis* is remarkably uniform over a large part of North America in a wide belt extending from Alaska to the Atlantic. At the southern extremity of the Alleghanies, however, there is a true geographical race, *carolinensis*, differing a little from the parent stock but merely in degree or quantitatively, as it possesses all of its characters. It is a trifle larger and paler, and the bill is darker, while the crown is uniformly gray like the back. Occasional northern specimens of *hyemalis* scarcely differ, if at all, from *carolinensis*, but the race, although based on very small average differences, seems fairly distinguishable.

Series of *hyemalis* taken in Pennsylvania, compared with others from eastern Canada and these in turn with series from the Mackenzie River Valley and from the Kenai Peninsula of Alaska, show such slight variation in size and color that I can find no grounds on which to base another geographical race.

Westward then, approximately to the eastern slopes of the Rocky Mountains, the slaty type of *Junco* prevails and there, apparently without marked climatic change or other contributing causes, *hyemalis* rather suddenly merges into the black-headed *oregonus* west of the mountains and less obviously into the ashy-headed *mearnsi* to the south. Many confusing plumages are found on the borders where the ranges of these three different Juncos come together and, unless the three are recognized as full species with the intermediate or connecting specimens considered as hybrids, it does not seem to me that they can be adequately explained. If no intermediates or intergrades existed, there would be no question as to the validity of the three species based on their color differences. The current theory is that these three groups, because they intergrade, are now only geographical races that will be species when the intermediate links are lost. My contention is that probably either they have been separate species which are now converging and hybridizing, or that they have diverged already to a point where each has evolved one or more characters not seen in the others and therefore each may be considered as *now* specifically distinct. It is merely a question of explaining the facts as we find them and a quite different hypothesis may be equally pertinent, but each of these Juncos shows an independent combination of qualitative characters and there is just as much reason for considering the intermediate specimens hybrids as there is for assuming they

are connecting links in incipient species. A number of breeding birds and hundreds of winter specimens have passed through my hands, and many of them tend to bear out my hypothesis, some at least having all the ear-marks of hybrids. It cannot be denied that the majority of intermediate specimens are what we usually call "intergrades" with a regular blending of color and that they lack the irregular mixing of characters or spottiness that we associate with hybrids, but there are some that do show just such irregularities.

A number of specimens taken chiefly in winter in the West have a curious black mottling or spotting on the back, usually associated with a more or less distinct black cap and with the slate color of the rest of the plumage verging towards black; the backs range from gray to deep brown and the sides are slaty. While we may consider these birds as being merely melanistic (because similar breeding specimens occasionally occur in the East), they strongly suggest a strain derived from the black-headed *oregonus*. The next step towards *oregonus* is shown by specimens with faintly pinkish instead of slaty sides, such birds having slaty or slightly brown-tinged backs in contrast to a nearly black head. Pinkish sides is a character peculiar to *oregonus* and it is not found in males of *hyemalis*. I have examined breeding males of these intermediate types taken at the White Pass in Alaska where the change from *hyemalis* to *oregonus* is effected in a short distance, at Brazeau Lake and other places near the Yellowhead Pass in Alberta, and at several places between Banff in Alberta and Sicamous in British Columbia where the belt of intergradation is widest. The *mearnsi* strain from the south may also account in part for the gray-headed birds that are found breeding side by side with black-headed ones at many localities along the Canadian Pacific Railway, all of them having more or less pinkish sides. The variation in females of the three species complicates the question still more, for the average females of the three differ much less from one another than do the males, and the hybrids between them would seem therefore to be much more numerous. Further discussion of this important matter will be found under the sections dealing with *Junco oregonus* and *Junco mearnsi*.

This is perhaps an appropriate place to discuss briefly and to dispose of the "*Junco hyemalis connectens*" of Coues. The original description (1884, Key North Amer. Birds, 2d ed., p. 378) is a curious mixture of fact and fancy but, fortunately, the type is extant in the collection of Mr. Wm. Brewster (No. 7046, ♀, April 26, 1882, Colorado Springs, Colo.). I have examined it and, as correctly stated by Mr. Ridgway (1901, Birds North and Middle Amer., Pt. 1, p. 276, footnote), it is clearly a specimen of *hyemalis*, and shows the characters common to sex and season. The name "*connectens*" therefore becomes a synonym of *hyemalis* and is not available,

although in the A. O. U. Check-List, 3d ed., 1910, it is revived and applied to "Shufeldt's Junco" which is quite a different bird, as will presently be shown.

2. *Junco aikeni*. The White-winged Junco

A.) Differential Characters of Male.

White wing-bands distinguish this Junco qualitatively from all the others. Except for this character it closely resembles *hyemalis*, although averaging larger, being of a paler slate, and with more white in the tail.

B. and C.) Breeding Range and Localities.

The Black Hills of South Dakota and the mountains adjacent in Wyoming.

D.) Plumage.

Adult males in fresh fall or winter plumage resemble *hyemalis*, but average paler, are uniformly gray above, and have the best part of four outer pairs of tail-feathers white. The wing-bands are usually broad and conspicuous but vary in extent.

Young males are usually slightly more veiled with brown than adults, and with less white in the wing-bands and tail.

Adult females are a little duller and paler than males, the wing-bands less extensive, and tail-feathers with the white reduced to about three of the outer pairs.

Young females are duller and browner than the adults.

Juvenal plumage is not appreciably different from *hyemalis*, except for the wing-bands and the white in the tail.

Breeding plumage. The gray loses the veiling and becomes a little dingy with wear, the prenuptial molt being slight.

E.) Discussion.

Virtually isolated as to its breeding range, its affinities, however, seem to lie with *hyemalis*, although it is geographically nearer to *mearnsi*. It shows the qualitative character of white wing-bands which is, according to my standard, specific. Only very occasional specimens of other Juncos show slight white edgings on the wing-coverts, which rarely amount to a band. It is much the largest of the Juncos and has the most white in the tail, but size and extent of white are merely quantitative characters and not specifically diagnostic. The young of this species was erroneously described as new under the name "*Junco hyemalis danbyi*" (Coues, 1895, Nidologist, III, October, p. 14), but later correction of the error was made (Coues, 1897, Auk, XIV, pp. 94-95).

3. *Junco oregonus*. The Black-headed Juncos

- a.— *Junco oregonus oregonus*. Oregon Junco
- b.— *Junco oregonus thurberi*. Thurber's Junco
- c.— *Junco oregonus couesi*. Coues's Junco
- d.— *Junco oregonus pinosus*. Point Pinos Junco

Plate XI, figures 2 and 2a; and Plate XIII

A.) Differential Characters of Male.

A black head and breast distinguishes this species from all the other Juncos. The geographical races may be recognized chiefly by the color of the back which in *oregonus* and *pinosus* is a deep ruddy brown, in *thurberi* paler and pinkish, and in *couesi* a plain dark brown.

Neither the name "*connectens*" nor "*shufeldti*" is applicable to the brown-backed bird and I therefore propose to name it in honor of the late Dr. Elliott Coues, choosing for the type a breeding male from southern British Columbia.

Junco oregonus couesi, new subspecies (Plate XIII, figs. 1 and 2)

Type: No. 16969, collection of J. Dwight; ♂; May 14, 1906; Okanagan, British Columbia. Collected by Allan Brooks.

Whole head and breast black; the back mummy-brown; the sides and flanks washed with light vinaceous-cinnamon; the rump deep neutral gray; lower parts, except breast and sides, white; the two outer pairs of tail-feathers and a dash on the third are white; bill and feet flesh-color; iris brown.

Measurements.—Wing, 79 mm.; tail 70 mm.; tarsus, 21 mm.; toe with claw, 21 mm.; culmen, 11 mm.; depth of bill at base, 6 mm.

On examination, the type of *oregonus* (U. S. Nat. Mus., No. 1949; ♂; October 5, 1834; Columbia River), a fall bird, proves to be ruddier and darker than average specimens of this race, of which we know the exact breeding range. Some of them are as deeply colored as the type but the average breeding bird of the Queen Charlotte Islands and the adjacent parts of the coast, where heavy rainfall occurs, is somewhat paler than these very dark ones. An examination of the type of "*shufeldti*" (U. S. Nat. Mus., No. 106035; ♂; October 13, 1885; Fort Wingate, New Mexico) develops the fact that this type specimen is evidently one of the slightly paler birds, apparently an *oregonus* that has wandered far south in migration. There are both light and dark ruddy-backed specimens mingled with brown-backed birds to be found in winter at many equally southern localities.

The lightest specimens are referable to *thurberi*, but in many cases it is difficult to decide whether the specimen in hand is *oregonus*, *thurberi*, or *couesi*. The brown birds doubtless originate, for the most part, inland and are the ones that I have named *couesi* because, with "*connectens*" a synonym of *hyemalis* and "*shufeldti*" a synonym of *oregonus*, there remains no old name which is applicable.

B.) Breeding Range.

Southern Alaska and British Columbia west of the Rocky Mountains, western Washington and Oregon, and the mountains of California. True *oregonus* is restricted to the islands and coastal strip of southern Alaska and western British Columbia; *thurberi* ranges chiefly over northern California and western Oregon; *couesi* extends from the western part of Washington and British Columbia to the Rocky Mountains; and *pinosus* is very local and confined to the coast region north and south of Monterey Bay, California.

C.) Breeding Localities.

a.) *oregonus*.

Alaska (Yakutat, Gustavus Point, Haines, Douglas Island, Sitka, Wrangell); British Columbia (Queen Charlotte Islands).

b.) *thurberi*.

Washington (Upper Quinault); Oregon (Elgin, Maury Mts., Paulina Lake, Tillamook); California (Ft. Jones, Siskiyou, Caleta, Sherwood, Sisson, Snow Mountain, Placerville, Fyffe, Echo, Blue Cañon, Donner, Mount Wilson, Witch Creek, Cuyamaca, San Jacinto Mountains, Smith Mountain, Laguna Mountains).

c.) *pinosus*.

California (Monterey, Santa Cruz).

d.) *couesi*.

Alaska (White Pass City, Glacier); British Columbia (Cowichan, Victoria, Wellington, Goldstream, Shawinigan Lake, Lund, Howe Sound, New Westminster, Mt. Lehman, Chilliwack, Agassiz, Spence's Bridge, Lilloet, McGillivray Creek, Ashcroft, Sicamous, Okanagan, Midway, Trail, Lower Arrow Lake, Revelstoke, Glacier); Alberta (Banff, Little Red Deer, Jasper House, Henry House, Brazeau Lake); Washington (Lummi Island, Seattle, Tenino, Mt. Ranier, Mt. St. Helens); Oregon (Forest Grove).

D.) Plumage.

Adult males in fresh fall or winter plumage have the black areas of head and throat slightly veiled (more broadly on the crown and nape) with pale brownish or grayish edgings, and the browns of the back are slightly modi-

fied with paler edgings. The amount and depth of color in the vinaceous or pinkish sides is variable and it is sometimes brown in deeply colored birds. The bill is flesh-color. The iris is brown. Two outer tail-feathers and rarely a touch on the third are white in *oregonus* and *pinosus*; more of the third is white in *thurberi* and *couesi*. The breast of *pinosus* is usually paler than the head and averages a shade grayer than the deep black of *thurberi*, and in size *pinosus* is smaller except the bill.

Young males are rather more heavily veiled and the black of the average specimen is apparently a trifle duller than that of the adult. There is usually less white in the tail.

Adult females show unusually great variation; some are like young males but they average a much duller black and are much browner, with less white in the tail. In about forty per cent the head and throat are both dull black (some identical with males); in another fifty per cent the *throat only* is dull black, the head being more or less gray mixed with black streaking or mottling; while in perhaps a scant ten per cent both the head and the throat are chiefly a slaty gray.

Young females are the dullest plumaged birds as a rule, but they show the greatest variation and the widest extremes.

Juvenal plumage. Above, similar to *hyemalis* but with a ruddy, pinkish or brownish back; *oregonus* and *couesi* are darkest below, and sometimes not distinguishable from *hyemalis*, but usually with a decided pinkish wash on the sides. The variation is very considerable even in the same brood.

Breeding plumage. A limited prenuptial molt is insignificant in its effect. Wear removes from the autumn dress most of the veilings and edgings, the black appearing to become blacker, although fading may give it a somewhat brownish tinge. The brown of the back may fade or, if it has a ruddy or pinkish tinge, it actually becomes brighter or rufescent through loss of feather edgings. The pinkish tints of the sides are more stable and not subject to much fading.

E.) Discussion.

Some two hundred and fifty breeding specimens of this species have passed through my hands, no less than one hundred of them being males from a single locality, El Dorado County, California. A careful examination of the California series is most instructive. Seventy-five to eighty per cent of these birds have the pale, pinkish brown back of *thurberi*; about fifteen per cent have browner backs, some being identical with *couesi*; and a small percentage have deeply ruddy backs indistinguishable from the paler specimens of *oregonus*; a few also have backs almost gray and with only a slight tinge of brown almost identical with the intermediates or

hybrids, as I consider them, between *oregonus* and *hyemalis* such as are found chiefly on the eastern slopes of the Rockies. These plumage variations at one locality show that breeding birds referable to no less than three recognized races occur at the same place, although only a very small percentage of them are other than *thurberi*. The aberrant percentage is made up of birds that are merely average, or more often under average, *oregonus* and *couesi*. It must be remembered, however, that we are dealing with very small differences of size and color in these races and only when specimens are laid out in series do the average differences become really obvious, except with the most typical examples. With races so finely discriminated that possibly only eighty per cent of the breeding males from the most typical localities and a smaller percentage of the females are definitely recognizable, it is easy to realize that the naming of winter specimens taken perhaps far from their breeding range involves careful matching and measuring of skins and, in a good many doubtful cases, merely clever guessing at the name most applicable.

And here the question naturally arises whether the name we are using applies to the bird or to the locality. If to the latter, we must, in the present instance, call ruddy-backed and pinkish-backed and brown-backed birds by one name, because they all occur in the same locality; if to the former, we may recognize three races by name, with the understanding that breeding specimens of any one or two of them may occur occasionally well within the limits of the breeding range of the other. The fact stands out that several different degrees of the *oregonus* plumage are found in one and the same locality; this is true at more than one point of its range. At the same time, the *average* variation may be named and restricted to a fairly definite range, so that winter specimens may be named with some assurance that the characters they show indicate their probable origin within this range, although there is no certainty of this. We can name a bird according to its plumage, but in the winter we can never be quite sure where its summer residence was, although the stronger its subspecific characters the stronger the probability that we are guessing right. The finer the distinctions of races, the less the chances of guessing right; but, if we do not name a bird from its plumage, what is there to name? It seems to me we are not naming a locality but the variations of plumage; otherwise, a name becomes a needless synonym of the name of a place. I do not see how we can escape the necessity of calling a specimen *oregonus* or *thurberi*, or any other name, if it shows the characters of the form, no matter where it is taken. We must name a bird by the plumage it *is* wearing not by the one that it ought to be wearing because it has been captured within the bounds assigned to another geographical race.

Another important question which arises is How shall hybrids be named, if at all? As indicated when discussing *hyemalis*, the meeting of this species and *oregonus* gives us two types of hybrids and the meeting of *mearnsi* and *oregonus* gives a third. The third was described long ago as a new species, "*Junco montanus*" (Ridgway, 1898, Auk, XV, October, p. 321), but it may be considered as either *mearnsi* darkened with the *oregonus* strain, or *oregonus* grayed with the *mearnsi* strain, as you please. In the same way, east of the Rocky Mountains we have a *hyemalis* darkened or blackened by the *oregonus* strain that, for convenience, might be called "*cismontanus*," while chiefly west of them we find an *oregonus* with the gray back of *hyemalis* that might be called "*transmontanus*." If these names could be restricted to definite geographical areas there would be some grounds for admitting the existence of three races but, as a matter of fact, breeding birds bearing these characters turn up at many localities. Birds of the "*montanus*" type occur far north in the Mackenzie Valley and west to the Frazar Valley; those of the "*cismontanus*" type occasionally appear as far east as Quebec; and those of the "*transmontanus*" type reach the Cascade Mountains, in Washington and Oregon, especially at the higher elevations which seem to have a "graying" influence. It will be observed, however, that these three types of plumage are not merely variations in color from *mearnsi*, *hyemalis*, or *oregonus*, but blends of their color characters. The birds are intermediates or intergrades between dissimilar extremes — extremes that are well deserving of specific rank, because their color characters are intrinsic or qualitative. Instead of naming the hybrids, it is probably simpler to follow the old-fashioned method of using an \times to indicate them. If a specimen is nearest to *hyemalis* we would write *Junco hyemalis* \times *oregonus*, or if to *oregonus*, the name should be written *Junco oregonus* \times *hyemalis*, etc.

The brown of the back of *oregonus* is evidently sensitive to climatic influences, but it persists in some birds of the Rocky Mountains that breed with those of the "*transmontanus*" type. This fact alone provides a good reason, on the one hand, for considering *couesi* as a race of *oregonus* and, on the other, for considering "*transmontanus*" as the result of hybridization between *hyemalis* and *oregonus*. The line of cleavage between the species and their differentiation may, perhaps, stand in direct relation to the ice sheet of the last glacial period rather than to the Rocky Mountains themselves which, after all, form today a very weak barrier to the distribution of these hardy Sparrows.

4. **Junco mearnsi.** The Pink-sided Juncos

- a.— *Junco mearnsi mearnsi*. Pink-sided Junco
- b.— *Junco mearnsi insularis*. Guadalupe Junco
- c.— *Junco mearnsi townsendi*. Townsend's Junco

Plate XI, figures 3 and 3a

A.) Differential Characters of Males.

The ashy head and breast, brown back, and sides heavily washed with a deep buff-pink separate it specifically from *hyemalis* to the north; the ashy head and breast separate it from *oregonus* to the west; and the brown back and pinkish sides separate it from the Juncos to the south. The race *insularis* differs only in degree, being slightly darker (especially the brown of the back), slightly smaller, and with a somewhat larger bill. The race *townsendi* also differs only in degree, although the head and throat are about as dark a slate as the paler specimens of *hyemalis*, but it has a pinkish wash on the sides and the back faintly brown.

B.) Breeding Range.

Southern Alberta, western Montana and Wyoming, and northern and eastern Idaho chiefly in the mountains. The race *insularis* is isolated in Guadalupe Island, and the race *townsendi* in the San Pedro Martir Mountains of northern Lower California.

C.) Breeding Localities.

a.) *mearnsi*.

Saskatchewan (Cypress Hills); Alberta (Banff); Montana (Belt River Cañon, Big Snowy Mountains, Mystic Lake, St. Mary's Lake, Flathead Lake, Columbia Falls, Thompson Pass, Tobacco Plains); Idaho (Salmon River Mountains, Coeur d'Alene, Stanley Lake); Wyoming (Yellowstone National Park, Big Horn Mountains); Utah (Rich County).

b.) *insularis*.

Guadalupe Island.

c.) *townsendi*.

Lower California (San Pedro Martir Mountains).

D.) Plumage.

Adult males in fresh fall or winter plumage have the head and throat of a rather dark, neutral gray; and the lores black, faintly veiled with grayish or pale brownish edgings; the back is a pale mummy or sepia-brown with slightly paler edgings; the sides and flanks have a broad conspicuous wash of a buffy or vinaceous pink, varying in depth of color. A large part of the

three outer pairs of tail-feathers is white. The bill is flesh-color. The iris is brown.

Young males are usually more veiled with brown on the crown, nape, and back, and often with less white in the tail-feathers.

Adult females average a trifle paler than the males; are more veiled with brown; and have less white in the tail-feathers, the third pair seldom having even a white dash.

Young females are regularly the dullest specimens, with colors less developed.

Juvenal plumage. Above, very like *oregonus* but paler; below, the pinkish wash is more marked in average specimens than it is in *oregonus*, but at this stage birds of the two species are not very different.

Breeding plumage. A slight renewal of feathers by a limited prenuptial molt takes place, but wear is the chief factor in modifying the winter dress. The gray tints become a trifle browner or dingier, the brown of the back fades and so does the pink of the sides to a small extent. Occasionally the back is slightly reddened by loss of feather edging.

E.) Discussion.

This *Junco* occupies a considerable geographical area between dissimilar *Juncos* to the north and to the south. None to the south has pinkish sides and none to the north has ash-gray head and breast. Therefore *Junco mearnsi* has a combination of color characters not shared by any of the others and, according to our proposed standards, it may be considered a species. It combines, rather than connects, dissimilar extremes or there would be reason for considering it a hybrid. An argument against hybridization, however, lies in the fact that the species breeds true throughout its range and only breaks off into hybrids at the points of contact with other species.

The occurrence of *Juncos* on Guadalupe Island that only vary a little in size and color from typical *mearnsi*, and of *Juncos* in the San Pedro Martir Mountains that are very close to the so-called "*montanus*" is most suggestive of a wider distribution of the species at an earlier geological time. A shrinkage of the area seems to have left these two "oases" which are now cut off from the parent stock with dissimilar *Juncos* for their nearest neighbors, but that *insularis* and *townsendi* are anything else than geographical races of *mearnsi* there seems to be little doubt.

My reasons for believing "*Junco montanus*" to be the hybrid between *mearnsi* and *oregonus* have been given already, the chief one being that the hybrid shows evidence either of a darkening of the ashy areas of *mearnsi* through the black element in *oregonus* or a lightening of the black of *oregonus*

with an infusion of the slaty element in *hyemalis*. Another possibility is the darkening of *mearnsi* with the slaty element of *hyemalis* or the lightening of *hyemalis* with the ashy of *mearnsi*, although the ranges of these two species barely touch if at all. There is apparently no climatic cause for this darkening of *mearnsi* or we might have reason for considering "*montanus*" as a geographical race but, on account of its irregular characters and its somewhat sporadic occurrence over a wide area in Alberta, British Columbia, and Montana where it is often found breeding on the same hillside with *Junco oregonus couesi*, or east of the Rockies breeding with *Junco hyemalis hyemalis*, it would seem to be nothing more than a hybrid.

As we have the hybrid "*montanus*" to the north so, too, we have another hybrid to the south where dissimilar extremes, *mearnsi* and *caniceps*, meet and blend. This bird, named "*Junco annectens*" originally (Baird, 1870, Cooper Ornith. California, p. 564) and later independently described as "*Junco ridgwayi*" (Mearns, 1890, Auk, VII, July, p. 243), has the pink sides of *mearnsi* combined with the red back of *caniceps*. Perhaps because of isolation on the mountains, there is but a small area of contact between the species (in southwestern Wyoming) so that "*annectens*" is not a frequent type of plumage. I have examined about a dozen birds, including breeding specimens from Fort Bridger, Wyoming, and Arc Dome, Nevada, besides winter birds, all of them with more or less pinkish sides and with more or less red on the back, in some the red extending faintly to the wing-coverts.

In my opinion Ridgway, (1901, Birds of North and Middle Am., Pt. 1, p. 276) rightly considers all such specimens as hybrids and the A. O. U. Check-List (1910 ed., p. 268) is wrong in recognizing them as "*Junco hyemalis annectens*." In rectifying Baird's mistake in describing a hybrid ("*annectens*") it was necessary for Ridgway to name *mearnsi* (1897, Auk, XIV, p. 94).

5. *Junco caniceps*. The Gray-headed Junco

Plate XI, figures 4 and 4a

A.) Differential Characters of Male.

A red back and ashy sides separate it from *mearnsi* on the north and the ashy breast, sides, scapulars, and wing-coverts separate it from the *phaenotus* group on the south.

B.) Breeding Range.

Western Colorado, southern Wyoming, northern New Mexico and parts of Utah and Nevada, being found on the mountains at above 7000 to 8000 feet.

C.) Breeding Localities.

Wyoming (Ft. Bridger, Laramie Mts.); Colorado (Dillon, Mt. Ptarmigan, Fremont Co., Estes Park, New Castle, Ft. Meeker, Mill City); New Mexico (Amizett, Willis, Twining); Utah (Uintah Mts.); Nevada (Ruby Mts.).

D.) Plumage.

Adult males in fresh fall or winter plumage have an ashy or cinereous head and breast (the latter paler), slightly veiled with grayish or pale brownish edgings, and a rather bright mahogany-red back, veiled with greenish or yellowish edgings. The sides are ashy. The lores are black. Red, like the back, sometimes edges the crown feathers. The bill is flesh-color. The iris is brown. The tail-feathers average less white on the third pair than in *mearnsi*.

Young males are a trifle more veiled on an average.

Adult females average slightly paler, especially on the crown and nape, and are more veiled, although the sexes are often alike.

Young females are duller and more veiled.

Juvenal plumage. Above, the back is dull red with dusky streaks; the head gray with narrower streaks. Below, dull white, grayer on the breast and streaked with dull black. Birds resemble *oregonus* but have a redder back even at this stage.

Breeding plumage. The red of the back through wear becomes brighter and paler (a burnt sienna or even paler) and the gray dingier.

E.) Discussion.

While the red back indicates a distinct affinity with the Juncos to the south, the ones immediately to the north have pink sides which seems to indicate that *caniceps* has no direct relationship with them. Its ashy sides are much paler than those of *hyemalis*, from which species they may perhaps have been derived. It is a sort of an intermediate or connecting link between the northern and southern groups, but its characters are so combined that we may consider them as specific. It breeds true over a definite geographical area and only at its northern and southern borders is there evidence of hybridization with the adjacent species.

We have a hybrid in "*Junco annectens*" connecting *caniceps* with *mearnsi* to the north, and another hybrid in "*Junco dorsalis*" (Henry, 1858, Proc. Acad. Nat. Sci. Phila., X, May, p. 117) connecting it with *phaenotus* to the south.

The areas of contact which we may suppose once existed between *caniceps* and *phaenotus* are now largely obliterated because of mountain isola-

tion. The hybrid "*dorsalis*" is perhaps a reminder of former conditions and, except for the bill, it shows strong affinities, even to the brown eye, with *caniceps*. The bill is about the same size as that of *caniceps* but the *phænotus* element has blackened the maxilla and diluted the gray of the breast to a paler shade. It is the association of dissimilar characters in series of birds with irregularities in the characters that points to its being a hybrid. The variation is not of the sort that marks the geographical race nor have the characters become established to such an extent that they can be considered specific.

The hybrid "*dorsalis*" occurs at points between the ranges of *caniceps* and *phænotus* on the higher mountains (at over 7000 feet) of Arizona and New Mexico, and specimens examined show a good deal of variation in plumage, some most resembling one species and some the other.

6. *Junco phænotus*. The Red-backed Juncos

a.—*Junco phænotus phænotus*. Mexican Junco

b.—*Junco phænotus palliatus*. Arizona Junco

Plate XII, figures 1 and 1a

A.) Differential Characters of Male.

A black upper and a yellow lower mandible, a yellow iris, and smoky or dull white underparts separate this species from all the northern Juncos, including *caniceps* which alone shares the red back. The race *palliatus* differs only in degree and not in quality from the parent stock, being merely a paler desert form.

B.) Breeding Range.

The pine forest regions of Mexico and of southern Arizona and New Mexico: *phænotus* at about 8000 to 14,000 feet in the less arid mountains of southern Mexico: *palliatus* at about 7000 to 8000 feet in northern Mexico and the adjacent parts of the United States.

C.) Breeding Localities.

a.) *phænotus*.

Mexico: Vera Cruz (Las Vigas, 8000 ft.), Hidalgo (Real del Monte), San Luis Potosi (Sierra de San Luis Potosi, 9000 ft.), Jalisco (San Sebastian, Volcan de Nieve, Colima, 10,000 to 14,000 ft.), Michoacan (Patzcuaro), Zacatecas (Sierra Valparaiso).

b.) *palliatus*.

Arizona (Mt. Graham, Chiricahua Mts., Santa Catalina Mts., Santa

Rita Mts., Huachuca Mts.). Mexico: Sonora (San José Mountain), Chihuahua (Pinos Altos, Pacheco), Durango (Arroyo del Buey).

D.) Plumage.

Adults of both sexes are practically alike in plumage, although some females are duller. In fresh fall or winter dress the head is an ashy or neutral gray and very much darker than the breast, which shows scarcely any line of demarkation as its very faint, smoky gray merges into the dull white of the abdomen. The back is a mahogany-red, more or less veiled with a greenish gray, which extends to the greater coverts and tertiaries. The head is somewhat veiled with pale brownish edgings, and occasional specimens have a few red edgings. The outer tail-feathers and part of the next pair are white with brown outer edges. There is a brownish wash on the flanks, diminished in extent, paler, and somewhat grayer in *palliatius*.

Juvenal plumage. This is much like *caniceps*, but paler below and without the darker gray of the breast.

Breeding plumage. A limited prenuptial molt and wear result in a bird that is a dingier smoky gray or brownish white below, with the red back much brighter and somewhat paler through loss of the feather edgings.

E.) Discussion.

This species was originally described as "*Fringilla cinerea*" (Swainson, 1827, Philos. Mag., new ser., I, p. 435) and *palliatius* was described as "*Junco cinereus palliatius*" (Ridgway, 1885, Auk, II, Oct., p. 364). The name *phænotus* was first used by Wagler (1831, Isis, p. 526), and revived by Ridgway (1895, Auk, XII, p. 391), *cinereus* being preoccupied.

The colors of the bill and of the iris furnish characters that set apart this group of Juncos, which shows little variation throughout its range from near the United States boundary to the Isthmus of Tehuantepec.

The bright red back, yellow (sometimes almost white) eyes, and black and yellow bill are characters that obtain over an extensive north and south range. The Little Colorado River in Arizona seems to mark the northern limits of the species, but even south of this the influence of the northern Juncos is felt where we find the hybrid "*dorsalis*" (discussed already under *caniceps* the species it most resembles).

At the southern limits of the range of *phænotus* the Isthmus of Tehuantepec causes a considerable gap in the continuity of the Juncos and, if a connecting link ever existed between this species and the next to the south, it has been lost. The same thing is true of the group of Juncos at the tip of Lower California, which shows a strong affinity with *phænotus*.

7. *Junco bairdi*. Baird's Junco

Plate XII, figures 2 and 2a

A.) Differential Characters of Male.

The sides and flanks are broadly washed with a pinkish cinnamon color that is unlike that of any other Junco.

B. and C.) Breeding Range and Localities.

The mountains (Sierra de la Victoria, 6000 to 8000 feet) at the southern extremity of Lower California, where it is isolated and resident.

D.) Plumage.

In *fresh fall or winter plumage*, the sexes are alike and resemble very pale or faded-out *phænotus*, except for the cinnamon-pink wash of the sides. The back and wing-coverts are redder than the sides. The white of the tail-feathers is much like *phænotus*. The upper mandible is dark brown instead of black.

The *juvenal plumage* is much like that of *phænotus*, but the cinnamon tint of the sides is marked.

Breeding plumage. Similar to the winter, but faded.

E.) Discussion.

This Junco, with its red back, shows an ancestral affinity with the red-backed birds of the adjacent mainland, but the cinnamon wash on the sides is diagnostic and may be considered as specific. It was described by Ridgway (1883, Proc. U. S. Nat. Mus., VI, p. 155) and is the palest of the Juncos.

8. *Junco alticola*. The Guatemala Junco

a.—*Junco alticola alticola*. Guatemala Junco

b.—*Junco alticola fulvescens*. Chiapas Junco

Plate XII, figures 3 and 3a

A.) Differential Characters of Male.

A greenish or olive-brown element suffuses the indistinctly reddish back and darkens the flanks. Otherwise, we find merely quantitative characters which connect this Junco with *phænotus* in color, in dimensions, and in diminution of white on the tail-feathers. The race *fulvescens* is a little paler and smaller.

B.) Breeding Range.

The pine forests on the high volcanic peaks of Guatemala, the race *fulvescens* occupying a somewhat similar region adjacent in Mexico.

C.) Breeding Localities.

a.) *alticola*.

Guatemala (Volcan de Fuego, 10,200 to 12,000 ft.), Quezaltenango, El Rincon, San Marcos).

b.) *fulvescens*.

Mexico (San Cristobal, Chiapas).

D) Plumage.

In fresh fall or winter plumage the sexes are practically alike, although some females are duller. The head is rather deep neutral gray; the lores are black in contrast. The breast is much paler, hardly set off at all from the still paler abdomen. The back is a dull, indistinct mahogany-red, suffused with a greenish or olive-brown tint. The sides have a deep greenish or pale olive-brown wash. The bill is very large, the upper mandible black, the lower yellow. The iris is orange-yellow. The outer pair of tailfeathers only is partly white.

Breeding plumage. Generally paler through wear.

E.) Discussion.

This *Junco*, described by Salvin (1863, Proc. Zool. Soc. London, p. 189), is isolated on the high mountains but the red back, derived doubtless from the north, and the greenish tint, perhaps from the south, point to a closer relationship in the past with adjacent forms. The race *fulvescens* was described as a full species (Nelson, 1897, Auk, XIV, p. 61) but it seems to be a variation towards *phaenotus*, although a wide gap occurs between their ranges where lowlands present conditions today (whatever may have prevailed in the past) that preclude the existence of *Juncos*.

9. *Junco vulcani*. The Volcano Junco

Plate XII, figures 4 and 4a

A.) Differential Characters.

A back with black streaks sets this *Junco* apart from all the others, nor does it fit into the genus in other particulars, although it seems more nearly related to *Junco* than to any other group of Sparrows. There is no white in the tail although there is a suggestion of it if a specimen be held in a certain way to the light. The feet and bill are large, the latter being flesh-colored unlike its nearest ally, and similar to that of the *Juncos* of the United States.

B. and C.) Breeding Range and Localities.

In bushy areas above 10,000 feet and below the cones of some of the highest volcanoes of Costa Rica (Irazú and probably Turrialba and Poas) and the Chiriqui peaks of Panama.

D.) Plumage.

The few specimens examined have been breeding birds taken in May and June and a good deal worn. Below, the resemblance to *alticola* is very great, although the tone is slightly yellowish and there is practically no white in the ventral region. Above, the back is greenish or pale olive-brown, with heavy, dull black streaks. The head is neutral gray obscured with a brown, similar to the back, and indistinctly streaked with a deeper dusky brown. The lores are obscurely black. The breast and throat are a pale neutral or smoky gray paling in the anal region, and no line of demarkation shows. The bill is flesh-color. The iris is yellow.

Juvenal plumage. Above, much like the adult but browner, especially on the head. The color is a dark, olive-tinged cinnamon, rather broadly streaked with dull black. Below, a yellowish, smoky gray or olive-buff, narrowly streaked on breast, sides, and flanks with dull black. The lores are obscurely dusky; the wing-coverts and secondaries are cinnamon-edged; and the tail is slightly tipped with pale buff.

E.) Discussion.

Junco vulcani is certainly an aberrant species of Junco, for in color pattern it is unlike any of the others. It was described as *Zonotrichia vulcani* (Boucard, 1878, Proc. Zool. Soc. London, p. 57, Pl. iv), and it has a superficial resemblance to this genus, as well as to other tropical genera from which its characters may have been derived. It is probably a survival and is now isolated in a few restricted areas at least 600 miles from the nearest Junco in Guatemala.

SUMMARY

After all, I have little more than touched upon the surface of problems that go much deeper than appearances indicate. The immediate problem before us has been the classification of the Juncos so that names might be applied to the various groups. Instead of accepting the presence or absence of intergradation as a guide by which to separate species from subspecies, I have endeavored to show that species may be recognized by qualitative, and subspecies by quantitative characters. Specific and subspecific characters in most of the Juncos are almost wholly confined to color and therefore by mapping the geographical distribution of color we are able to gain from a new angle a fairly distinct impression of relationships in this genus.

The principle of recognizing qualitative and quantitative characters as specific and subspecific respectively has far-reaching possibilities. Its application is beset with difficulties, for opinions will differ as to the relative

value of characters, but the personal equation must always be reckoned with and it is no greater an obstacle here than elsewhere. There is no conflict with the usually accepted principles of avian evolution, for there are several possible ways of explaining the facts as we find them. The trouble is to name the birds, and I am only pointing out a new and convenient way that adapts itself to conditions actually confronting us and avoids the uniting of dissimilar birds under a specific name because intermediate specimens occur. Even if I am over-estimating the rôle played by hybrids we very much need a nomenclature that will indicate better than at present the intermediate as well as the extreme portions of lines of variation. Zoologists and botanists, by actual experiment, have of late years so revolutionized ideas regarding species and hybrids that systematic ornithologists are likely to be looked upon as backward and unscientific unless they learn more of fluctuations and mutations, of manifestations of Mendelian and other laws, and all the modern theory that goes with them. It is asserted that the criterion for a species is the behavior of the gamete in which unit characters reside. If the union of two gametes carrying the same character gives purity of breed and if two carrying dissimilar characters give hybrids, then the ornithologist of the future has a new and broad field of experiment lying before him. The accumulated facts and theories of the present day will be cleverly fitted together in a new era of synthetical ornithology and converted by experiment into a substantial and enduring edifice well worthy of the labor expended.

Table of Measurements of *Juncos* (breeding males)

	Specimens	Wing mm.	Tail mm.	Tarsus mm.	Toe (with claw) mm.	Culmen mm.	Depth of bill mm.
<i>hyemalis</i>	51	75-83(78.2)	64-71(67.7)	17-22 (20.9)	17-20.5(18.8)	10-12 (10.9)	5.5-6.5(5.9)
<i>carolinensis</i>	27	76-82(79.5)	66-73(70.7)	21-22 (21.5)	17-21 (19.3)	11-12 (11.9)	6-7 (6.2)
<i>aikeni</i>	21	82-91(86.5)	71-83(78.0)	20-22 (21.)	19-21 (19.6)	10.5-13(11.8)	6.5-8 (6.9)
<i>oregonus</i>	18	72-78(74.4)	61-68(64.9)	19-21.5(20.6)	18-20 (18.9)	10-12 (10.9)	5.5-6 (5.9)
<i>tharberi</i>	30	73-80(76.5)	63-70(67.6)	18-21 (19.5)	17-19 (17.8)	9.5-11(10.5)	5-6 (5.6)
<i>covei</i>	30	73-81(76.9)	63-74(67.6)	18-21.5(20.2)	17-19.5(17.9)	10-11.5(10.7)	5.5-6 (5.8)
<i>pinosus</i>	18	70-74(72.4)	60-69(64.7)	19-21 (19.8)	17-19 (18.1)	10-12 (11.1)	5-6 (5.8)
<i>mearnsi</i>	11	75-81(78.3)	68-72(70.0)	19.5-21(20.5)	18-20 (18.9)	10-12 (11.1)	5.5-6 (5.8)
<i>insularis</i>	28	65-73(69.5)	58-64(61.6)	19-22 (20.1)	17.5-20(18.7)	11.13 (12.2)	6-7 (6.4)
<i>townsendi</i>	28	74-82(78.8)	67-74(70.3)	20-22 (20.9)	17-19.5(17.9)	10-12 (11.1)	5.5-6.5(6.0)
<i>caniceps</i>	14	78-84(81.2)	68-76(72.6)	19.5-21(20.3)	17-20 (18.8)	10.5-12(11.3)	5.5-6 (5.9)
<i>phaenotus</i>	11	72-83(76.6)	71-78(72.4)	21-24 (22.)	18-20 (18.7)	10-12 (11.3)	6-7 (6.5)
<i>palliatius</i>	21	74-83(78.2)	69-80(73.4)	20-22.5(21.3)	18-20.5(19.1)	11-12 (11.5)	6-7.5(6.6)
<i>alticola</i>	6	75-78(76.2)	70-77(73.3)	24.5-25(24.7)	21.5-24(22.4)	11.5-13(12.6)	6.5-8 (7.7)
<i>fulvescens</i>	8	69-75(71.2)	62-68(64.5)	20-23 (22.6)	19-21 (20.1)	12-13 (12.8)	7.5-8 (7.9)
<i>bairdi</i>	25	68-74(71.3)	62-69(65.7)	20-22 (21.)	18-20 (18.8)	8-9 (8.7)	6-7 (6.4)
<i>vulcani</i>	12	73-80(76.2)	67-77(71.8)	26-29 (27.6)	21.5-24(22.7)	12.5-14(13.5)	6.5-7 (6.9)

Table of Differential Color Characters of *Juncos*

	Head	Breast	Back	Sides	Wing-coverts	Tail-feathers	Lores	Iris	Bill
<i>Junco hyemalis</i>	slate	slate	slate	slate	slate	2½ white	slate	brown	flesh
" " <i>carolinensis</i>	slate	slate	slate	slate	slate	2½ white	slate	brown	flesh
" <i>aikeni</i>	slate	slate	slate	slate	white	4 white	slate	brown	flesh
" <i>oregonus</i>	black	black	brown	pink	slate	2½ white	black	brown	flesh•
" " <i>thurberi</i>	black	black	brown	pink	slate	2½ white	black	brown	flesh
" " <i>couesi</i>	black	black	brown	pink	slate	2½ white	black	brown	flesh
" " <i>pinosus</i>	black	black	brown	pink	slate	2½ white	black	brown	flesh
" <i>mcarrusi</i>	ash	ash	brown	pink	ash	3 white	black	brown	flesh
" " <i>insularis</i>	ash	ash	brown	pink	ash	3 white	black	brown	flesh
" " <i>townsendi</i>	ash	ash	brown	pink	ash	3 white	black	brown	flesh
" <i>caniceps</i>	ash	ash	red	ash	ash	2½ white	black	brown	flesh
" <i>phaenotus</i>	ash	smoky	red	brown	red	1½ white	black	yellow	black and yellow
" " <i>pallidus</i>	ash	smoky	red	brown	red	1½ white	black	yellow	black and yellow
" <i>alicola</i>	ash	smoky	red	brown	red	1½ white	black	yellow	black and yellow
" " <i>fulvescens</i>	ash	smoky	red	brown	red	1½ white	black	yellow	black and yellow
" <i>bairdi</i>	ash	smoky	red	cinnamon	red	2½ white	black	yellow	brown and yellow
" <i>vulcani</i>	ash	smoky	streaked	brown	brown	0 white	black	yellow	flesh

EXPLANATION OF PLATES

PLATE XI

Species of *Junco*, ventral and dorsal aspects.

- Figures 1 and 1a.—*Junco hyemalis*.
 " 2 " 2a.—*Junco oregonus*.
 " 3 " 3a.—*Junco mearnsi*.
 " 4 " 4a.—*Junco caniceps*.

PLATE XII

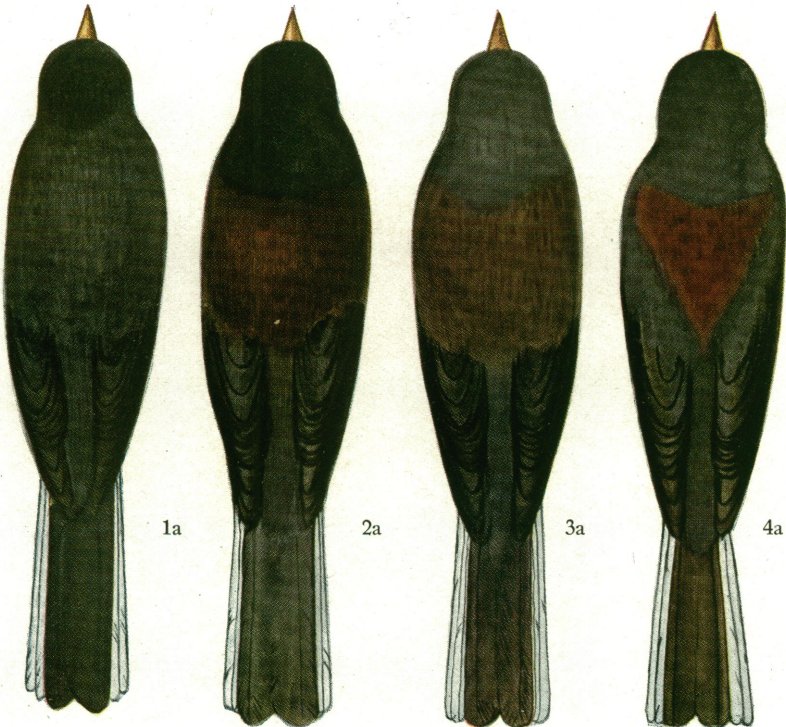
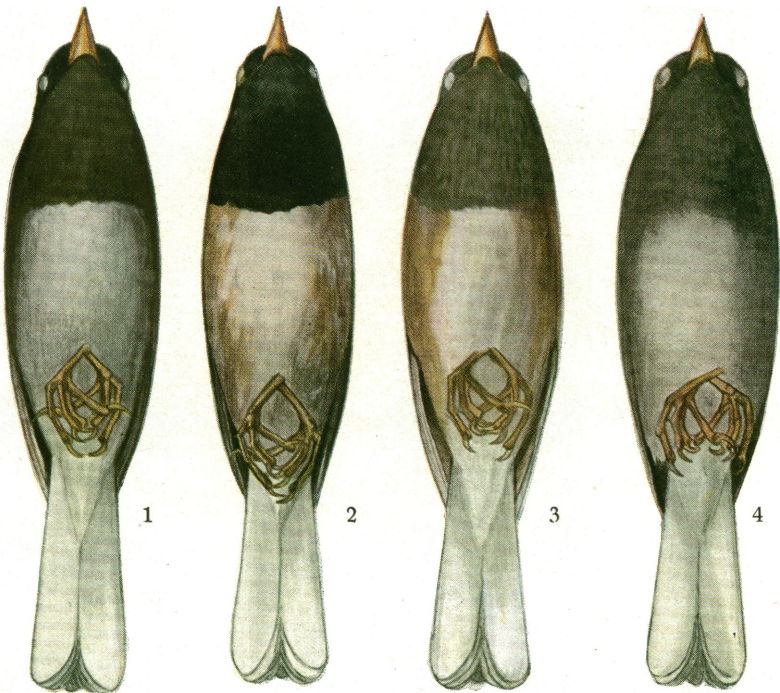
Species of *Junco*, ventral and dorsal aspects

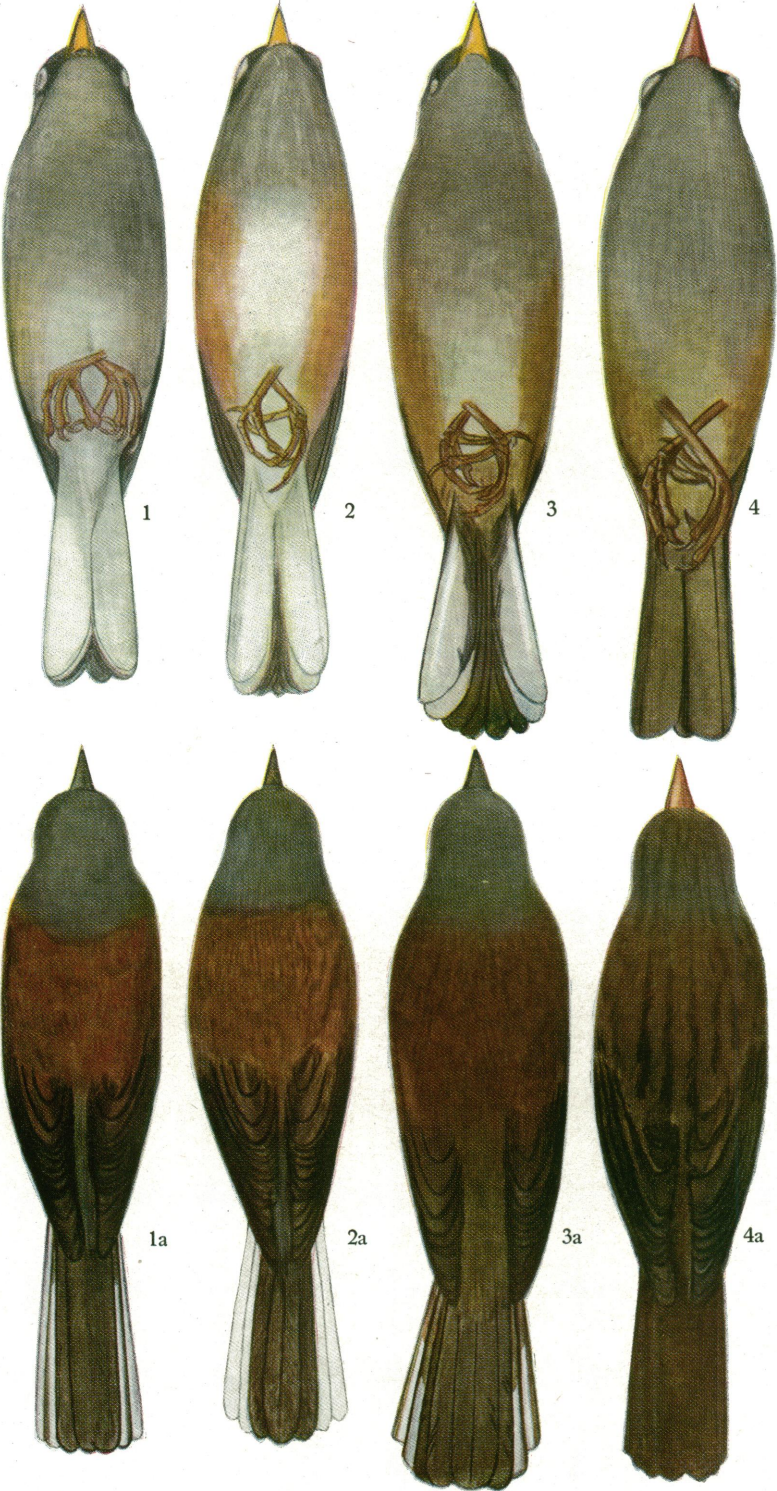
- Figures 1 and 1a.—*Junco phænotus*.
 " 2 " 2a.—*Junco bairdi*.
 " 3 " 3a.—*Junco alticola*.
 " 4 " 4a.—*Junco vulcani*.

PLATE XIII

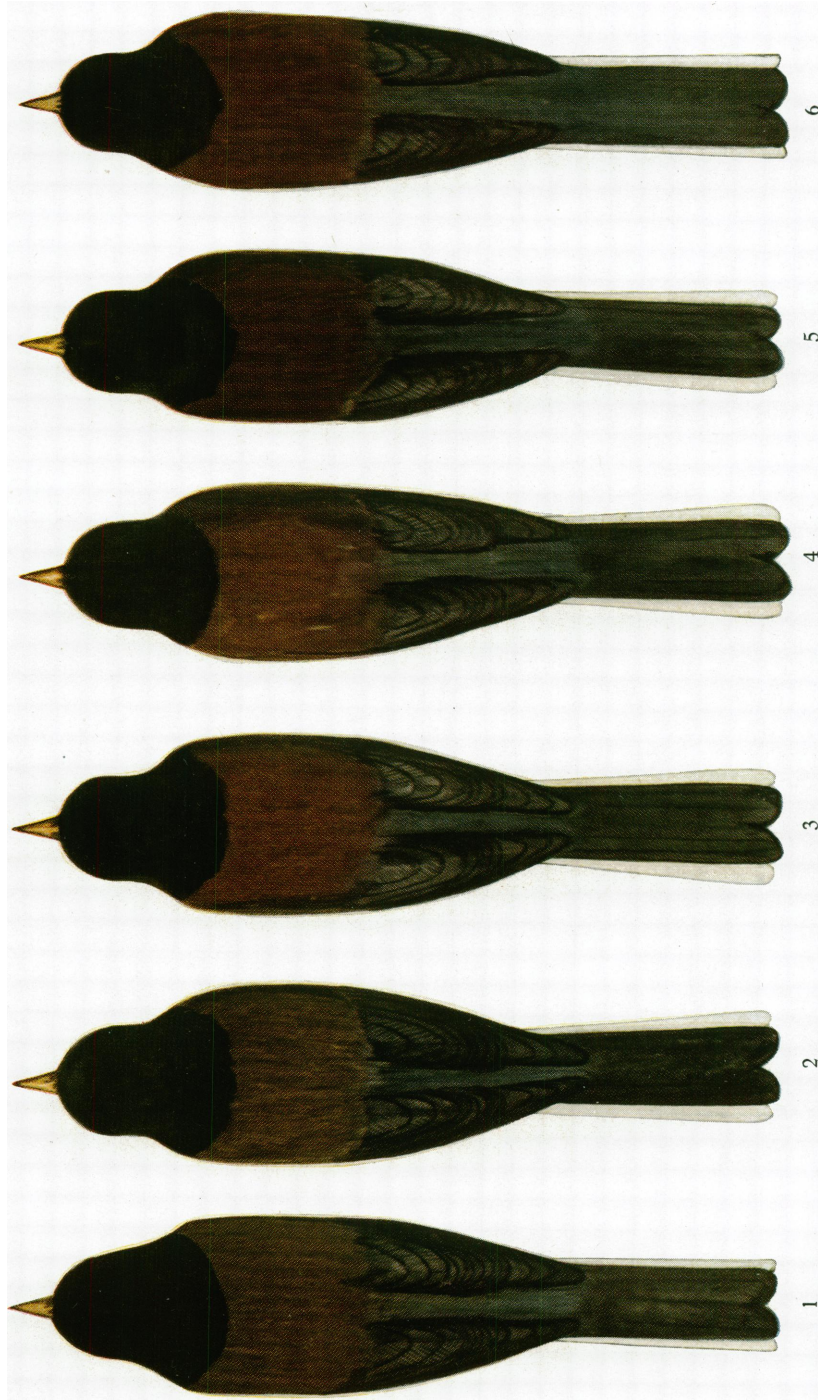
Color variation in *Junco oregonus*.

- Figure 1.—*Junco oregonus couesi*, dark average specimen.
 " 2.— " " light " "
 " 3.— " " *thurberi*, dark " "
 " 4.— " " " light " "
 " 5.— " " *oregonus*, dark " "
 " 6.— " " " light " "





SPECIES OF JUNCO



JUNCO OREGONUS

