C. t. insectivora.—
PERÚ:
Chilpes, 2 ♂;
Culumachay, 1 ♂;
Tambo de Aza, 1 ♂.
C. t. omissa.—
PERÚ:
Huaisampillo, 3 ♂ (incl. type), 1 ♀;
Limbani, 1 ♂, 1 ♀;
below Limbani, 2 ♂;
Oconeque, 3 ♂[1], 3 ♀[1], 1 ♀;
Urubamba Cañon, 1 ♂;
Santa Rita, 2 ♂;
San Miguel, 1 ♂.
C. t. inca.—
BOLIVIA:
Cillutincara, 2 ♂, 1 ♀;
Nequejahuira, 2 ♂;
Chaco, Yungas, 4 ♂, 1 (?);
Incachaca, 2 ♀[1], 1 (?).

American Museum of Natural History
New York, N. Y.

PROBABILITY IN SUBSPECIFIC IDENTIFICATION OF SINGLE SPECIMENS

BY A. L. RAND

INTRODUCTION

POPULATIONS, represented in museum collections by series of specimens, are the proper units in the study of geographical variation. This study, with some of its formal presentations—the naming of subspecies, the allocation of specimens, and the outlining of ranges—deals with the average characters of populations. But occasionally an individual specimen, because of its characters and its geographical origin, demands special consideration. Sometimes it is the only specimen from a wide area. In such a case there is little to do but assess its characters, and identify it subspecifically accordingly. The assumption is made that its characters are normal or average. But sometimes, from an area well represented in the collection, there comes a specimen that in appearance accords better with the average

of some other subspecies than with the average of the subspecies that usually occurs where it was taken. The correct evaluation of such specimens is important, for on them is based such conclusions as known range of variation, extent of casual geographical occurrence, and formal entries in faunal lists.

Such specimens admit of two quite different interpretations. The first is that they are actually far wanderers from their normal ranges. The second is that they may belong to the subspecies that usually occurs in that region, but through individual variation approach more closely in appearance the average of some other subspecies than their own.

WANDERERS

The first class of phenomena—that individuals may wander far from their usual range—is amply documented. The Western Tanager (*Piranga ludoviciana*) has been taken in Quebec, the Scissor-tailed Flycatcher (*Muscivora forficata*) at James Bay, the Scarlet Tanager (*Piranga erythromelas*) at Point Barrow, the Black-billed Cuckoo (*Coccyzus erythropthalmus*) and the Sora (*Porzana carolina*) in Great Britain, the Old World Fieldfare (*Turdus pilaris*) in the Canadian Arctic, and the White Wagtail (*Motacilla alba*) in Quebec. Taverner (Auk, 59: 235, 1942) has even suggested that horned owls of one race may occasionally breed in the normal range of another. Some records of accidental occurrence outside of the range of the species have proved to be referable, not to the nearest known subspecies, but to a more distant one. The Melancholy Kingbird (*Tyrannus melancholicus*) recorded on Vancouver Island and in Maine proved to belong to the subspecies *T. m. chloronotus* of southern México and southward, rather than to the race *T. m. couchii* which occurs in the southern United States (A. O. U. Check-List of North American Birds, ed. 4: 202, 1931), and the Solitary Sandpiper (*Tringa solitaria*) recorded from the arctic coast of Alaska proved to be *T. s. solitaria*, the southern subspecies, rather than the more northern *T. s. cinnamomea* (Conover, 1944: 539).

Grinnell (1922: 373–380), in his article on the role of the accidental, has even postulated that "accidentals" are not accidental but the rule (though this seems like another way of saying that accidents will happen), and that the far wandering of individuals is part of the ordinary evolutionary program.

Thus there is nothing impossible in a specimen that looks more like some far distant subspecies rather than the one of usual occurrence where it was taken, actually being a far-wandering example of the subspecies it resembles.

VARIANTS

The second possible explanation of a non-conforming specimen is that it is an extreme variant of the local population. This is well known, but it is less widely accepted, and should be more often considered in making or evaluating any identifications.

The differences between subspecies often are only average ones. It is a currently accepted convention that if seventy-five per cent of the individuals of a sex or age class are identifiable by means of 'characters,' the subspecies be considered valid. It is not necessary that the unidentifiable twenty-five per cent be intermediates; individually their characters may overlap widely and approach the average characters or even the extremes of some other subspecies.

Unusually plumaged birds are not at all uncommon. Excessive paling or darkening of plumage is perhaps the most common, but other variations giving unusual patterns for the species have been recorded, and it sometimes happens that such a mutant may resemble, to a greater or lesser extent, the condition in another species; thus Wetmore (1931: 33) mentions Black-capped Chickadees (*Parus atricapillus*) and Carolina Chickadees (*P. carolinensis*), both normally with a wholly black crown, that had white feathers on the side of the crown, in the areas where a related species, the Mountain Chickadee (*Parus gambeli*), always has a white stripe.

Glover Allen (1914: 558) calls attention to various sparrows such as the Song and the Lincoln Sparrow (*Melospiza melodia*) and (*M. lincolnii*) that normally do not have white outer tail feathers, as having them, recalling the normal condition in some other sparrows such as the Junco (*Junco hyemalis*) and Vesper Sparrow (*Pooecetes gramineus*). Swarth (1913: 22) has shown the extreme variation in the white collar and the black throat bar in the Canada Goose (*Branta canadensis*). Also inthe National Museum of Canada is a Canada Goose head that closely follows the color and pattern of that of the Barnacle Goose (*Branta leucopsis*).

Harrison (1946: 69) reports on two aberrant specimens of the Robin (*Erithacus rubecula*), taken in England, that show a character in color distribution very similar to that of the related Japanese Robin (*Luscinia akahige*).

Mayr (1942: 81) has shown that a chestnut belly may appear in an island race of the flycatcher, *Monarcha castaneoventris*, which is usually all black, while another, distant island race of the same species, that usually has a chestnut belly, occasionally may have entirely black individuals.

Thus extreme variants may occur. They sometimes approach the normal condition in some other race or species. This tendency to repeat a condition occurring elsewhere has been attributed to a latent potentiality, or to the basic potentialities of related forms tending to be similar and with mutational channels more or less prescribed (*see* Mayr, 1942: 74).

These extreme variants are just as much parts of their local populations and the subspecies to which they belong as are the individuals that show characters near the average of the subspecies, and should be so named.

PRINCIPLE OF PROBABILITY

Confronted with the task of identifying a non-conforming individual —one that more nearly resembles the average of another population— the two alternatives given above must be considered. In some cases one, in some the other, alternative will be correct. Which one to adopt must be decided on the basis of probability, after considering all the factors.

Identification by probability is commonly used by field observers. It is well illustrated by the case of the Blue-winged Teal (*Anas discors*) in eastern North America. Few field students that see in the East a bird that looks like a female Blue-winged Teal, hesitate to call it a Blue-winged Teal. But it would be indistinguishable in the field from a female Cinnamon Teal (*Anas cyanoptera*), and the latter species has been recorded as far east as New York and Florida. The specific identification of female Blue-winged Teals in the East is purely on probability. Persons working with skins in the laboratory also use this principle of probability. It is well illustrated by the case of the European and the American Green-winged Teals (*Anas crecca* and *Anas carolinensis*).[1] The males are quite distinct. But the females are alike in every respect except one; in *A. carolinensis* in all sexes and ages the anterior buff wing-bar is usually of a richer color, especially in the outer half of the bar; in the European bird this bar is almost always very pale buff or pure white, especially at the outer end. Probably nine out of ten specimens can be placed correctly by this character alone (Phillips, 1923: 232). The point to be made is that an American bird, with a pale or white anterior wing-bar is not necessarily *A. crecca*. In the National Museum of Canada there is such a specimen from Wood Buffalo Park, and I consider it *carolinensis*. But it is possible that it is *crecca*, as there are many American records of the latter, just as there are records of *carolinensis* in Europe (pre-

[1] Whether they are considered species or subspecies is immaterial here.

sumably based on males that can be recognized with certainty). Here we come to the principle of probability; a species (or subspecies) is identified on probability, even against the evidence of the average morphological characters. But when strays are taken in Greenland, where either *A. crecca* or *A. carolinensis* is to be expected, and probability is thus even, it becomes necessary to identify the females by morphological characters with a nine to one chance of being right, and this is what Hørring and Salomonsen have done (1941: 7).

Another case of the principle of probability being used by a taxonomist is with the Spruce Grouse (*Canachites canadensis*). In the two subspecies, *C. c. canadensis* and *C. c. canace*, the females are fairly distinct, but the males are inseparable. Yet Uttal, in his review of the species (1939: 460–464), in listing material, refers males to subspecies on the basis of their origin with the ranges determined by a study of the females.

In considering probability, a number of factors may afford a clue. The normal and extreme ranges of known variation in the species and subspecies must be ascertained. If the non-conforming specimen falls outside this it may be a new record of extreme variation for that form. To decide that, the known variation in other species must also be considered. Another factor that may be indicative is the place of origin and the habit of the birds concerned; Red Crossbills (*Loxia curvirostra*), for example, are more likely to wander than Spruce Grouse. The season of occurrence may also be indicative.

Some British ornithologists have adopted the latter of the two alternatives given above in regard to accepting apparently widely wandering examples of a subspecies as such. For example, the common Starling of Britain is *Sturnus vulgaris vulgaris*, with a greenish metallic head. There occur in the British Isles, in winter at least, and not very uncommonly, individuals with a purplish gloss on the head. These purple-headed Starlings resemble a Siberian race (*S. v. poltaratskyi*) and have been identified as wandering examples of that race by some authorities. However, Tucker (1945: 36–38) reports that there are intermediates between the purple and green-headed birds, and prefers to consider the British-taken purple-headed birds as variants of the nominate race which more or less closely resemble the Siberian race. Another similar case was reported by Harrison (1944: 58–60). The Greenland Mallard (*Anas platyrhynchos conboschas*), is resident in Greenland, to which it is confined. It differs from the common Mallard (*A. p. platyrhynchos*), of the British Isles, in a variety of characters, including grayer upper parts, scapulars and wing-coverts; flanks more coarsely vermiculated and with more gray and

white contrast; the chest shield marked with black; and size slightly larger (wing, 280–295, against 256–278 mm.). Harrison had three British-taken specimens that showed the color characters of the Greenland race; two were somewhat small, but the third also matched the Greenland race in size. However, Harrison considered all three birds aberrant specimens of *A. p. platyrhynchos*. In the United States, Aldrich evidently had the same idea in mind in his review of the Bob-white (*Colinus virginianus*) when he listed a number of out-of-range specimens with a footnote to the effect that they were either aberrant local birds or introduced examples of another subspecies (1946: 493–508).

Below I have summarized a number of examples of identification of aberrent specimens that have come to my attention while working on variation in Canadian birds. Most cases have been identified as variants, extending the known range of variation of the forms concerned; a few have been identified as belonging to the subspecies they most resemble, extending the known geographical range of the subspecies.

Examples of Continuous Individual Variation

These examples are cases in which variation is continuous, with the extremes connected with the average by intermediates.

Spruce Grouse (*Canachites canadensis*).—The subspecies from southern Ontario southward and eastward, *C. c. canace*, is richer and browner in the female than the subspecies *C. c. canadensis* which ranges from Labrador to northern Alberta. The females are variable, and though the average difference between the above two subspecies is good, individual specimens may depart widely from the average of a population. Thus 17 females from Wood Buffalo Park (northern Alberta and Mackenzie District) are rather clearly referable to *canadensis*, as one would expect. But the eighteenth specimen is much browner and richer in color, and taken by itself compares much better with many *canace* from southern Ontario. There is little doubt that this *canace*-like bird from the range of *canadensis* belongs with the rest of the local population, and should be considered as belonging to the subspecies *canadensis*, in spite of the fact that it looks more like *canace*.

Pileated Woodpecker (*Ceophloeus pileatus*).—The eastern subspecies, *C. p. abieticola*, which ranges from Nova Scotia to northern Alberta at least, is fairly distinct on the average from the western race of southern British Columbia, *C. p. picinus*, in the larger bill, and in the well-developed white spots on the tips of the longest pri-

maries (other described characters are not evident in the Canadian National Museum material). However there are two birds in the eastern series (one from New Brunswick and one from Ontario) without any white on the primaries. Through individual variation they equal the most distinctively marked *picinus* in this character. The bill size is not distinctive in these two specimens, since it falls into the range of overlap. It is improbable that these two eastern birds are actually *picinus;* they rather must be considered to be *abieticola,* overlapping *picinus* by individual variation. With the probability from known ranges in mind, there is little doubt in this case. The case would be otherwise if both subspecies migrated to a common wintering ground and had to be identified there; then the two eastern specimens mentioned above, referred to *abieticola* on geographical probability, would almost surely have been identified as *picinus.*

AMERICAN ROBIN (*Turdus migratorius*).—The black-backed subspecies (*T. m. nigrideus*) is known to range over Newfoundland and the eastern part of the Labrador Peninsula and migrate through the Maritime Provinces. It is characterized by being generally darker with a blacker back than the common Eastern Robin (*T. m. migratorius*) which ranges at least from Nova Scotia and southwestern Quebec to Yukon. But through the courtesy of Mr. R. W. Tufts, I have seen one breeding Nova Scotia bird that is identical with *nigrideus* in appearance, and in the large series of birds in the National Museum of Canada from the breeding range of *migratorius,* there are individual specimens from western Ontario, Manitoba, and northern Mackenzie that are inseparable from Newfoundland material. These specimens are extremes of individual variation, and must be called *migratorius* despite their resemblance to *nigrideus.*

The weight of deciding evidence in the Nova Scotia specimen comes, of course, from its season of occurrence. If it had been taken earlier during the season of migration it would probably have been referred to *nigrideus.*

The identification of *nigrideus* from the Maritime Provinces must take season into account in considering probability. Additional evidence would be supplied by data on the proportion of Black-backed Robins present. When, during migration, the proportion of *nigrideus*-like birds increased, it could safely be assumed that they were actually *nigrideus.*

With the discovery that occasional *nigrideus*-like individuals breed as far west as the Mackenzie, it is obvious that when they migrate southward they may be mistaken for actual wandering *nigrideus.* For a final decision as to their identity, geographical probability must

be considered, and western records of *nigrideus* must be viewed with suspicion.

HAIRY WOODPECKER (*Dendrocopos villosus*).—On Vancouver Island there is a dark subspecies (*D. v. harrisi*), and on the Queen Charlotte Islands a still darker, blacker race with a reduced amount of white in several parts of its plumage (*D. v. picoideus*) represents the species. The adults in our series are all identifiable by physical characters. But this is not the case with the immatures; of our seven immature, fall-taken *harrisi*, five have some of the characters of *picoideus*, and one, at the dark end of the scale of individual variation, on a combination of characters falls well within the range of variation of our five immature *picoideus*. It is just possible that it actually is a wandering example of *picoideus*, but as it fits in so well as an extreme of our variable *harrisi* series, it seems advisable to call it *harrisi*. It would seem desirable to scrutinize closely any Vancouver Island record of *picoideus* based on a fall immature.

DOWNY WOODPECKER (*Dendrocopos pubescens*).—The subspecies of eastern Canada, from Nova Scotia to central Alberta, is *D. p. medianus* with a wing of 91–96.5 mm. in the male (Ridgway). From north Alberta, northward and westward, occurs another subspecies, *D. p. nelsoni*, distinguished by being larger (wing, male, 95–101.5) (Ridgway), having the white parts purer white, and with less barring in the tail. However it is sometimes said that *nelsoni* is of casual occurrence farther east, probably to northern New England. In the large series of *D. pubescens* in the Canadian National Museum there are specimens from New Brunswick (wing, 100; taken in June) that approach *nelsoni* in size, and several Ontario specimens that show a reduction in the tail barring. None of our material shows a combination of the two characters, but such could be expected, and specimens with this combination would be very similar to *nelsoni*. May not the basis for the statement that *nelsoni* is casual in the east, probably as far as New England, rest on such variants of *medianus?*

AMERICAN THREE-TOED WOODPECKER (*Picoides tridactylus*).—In Canada two races occur; an eastern form (*P. t. bacatus*) with little white in the back, represented in Canadian National Museum material by specimens from localities west to Manitoba; and a western form (*P. t. fasciatus*), with considerably more white in the back, represented in the collection by material from northern and western Alberta, Yukon, Alaska, and British Columbia. The material indicates that a regular cline does not exist; birds from Quebec to Manitoba are very similar (*bacatus*); Alberta birds are definitely different, with no overlap; there is still more white in the Alaska specimens (*fasciatus*).

However, the birds from southern British Columbia while referable to *fasciatus* on the basis of the amount of white in the back, have less white than northern Alberta birds, and approach the far-distant *bacatus* in appearance. They show what appears to be overlap through individual variation; thus two of thirteen specimens from southern British Columbia could be confused with three specimens of *bacatus* (one from Quebec and two from Manitoba).

The 1931 A. O. U. Check-List (p. 200) gives the range of *bacatus* as southern Mackenzie eastward, and casual in winter in southern British Columbia. Our two *bacatus*-like birds from southern British Columbia were taken in July, and were presumably part of the breeding population. They also correlate well as part of the picture of individual variation. On geographical probability, on season of occurrence, and on known variations of the local population, they are referable to *fasciatus* rather than to *bacatus* which they resemble.

EXAMPLES OF DISCONTINUOUS VARIATION

The examples listed above are of individuals more or less connected with their main population by intermediates. But in a number of other cases the individuals concerned differ sharply from the populations they have been assumed to represent. This is the type of variation called discontinuous by Mayr (1942: 72). Some examples follow.

STELLER'S JAY (*Cyanocitta stelleri*).—This species supplies a good demonstration of the fact that the presence or absence of a 'good' key character is not necessarily diagnostic. *C. s. stelleri*, without a white spot over the eye, is the form of the British Columbia coast; *C. s. annectens* of interior British Columbia was characterized by Ridgway (1904: 357) as differing by having a white spot above the eye, as well as some other characters. Later work has shown that the spot over the eye may be present or absent in interior British Columbian *annectens*. When present it is a good 'key' character for *annectens*, but specimens without it may also be *annectens* (Taverner, 1934: 305).

RED-TAILED HAWK (*Buteo jamaicensis*).—This is a confusing group taxonomically, with several color phases (*see* Taverner, 1936), but here only one example of the normal color phase will be mentioned.

From Alberta westward occurs the subspecies *B. j. calurus*, in which the normal phase is darker than eastern *B. j. borealis* that ranges from Nova Scotia to Alberta. *B. j. borealis*, according to Taverner (1936: 69), is the most constant form of the species, but even in the apparent centers of its range occasional *calurus*-like birds appear. Whether these are spontaneous variants, the results of occasional .previous

calurus matings, or stray wanderers from the west, is uncertain. Until eastern breeding of such individuals is demonstrated it seems prudent to place them in the latter category according to Taverner. But since Taverner wrote in 1936 the Canadian National Museum has received a bird, an adult in normal plumage, which was shot at its nest in Prince Edward Island, that differs from all others of the Museum specimens of eastern *borealis*, and is inseparable from western *calurus*. It differs from *borealis* in the rusty wash on breast, flanks and legs and in the distinct but incomplete barring on all rectrices, comparing better, in this respect, with British Columbia birds in normal plumage than with eastern birds.

It seems advisable to consider this specimen as an aberrant *borealis*, rather than to say that *B. j. calurus* breeds on Prince Edward Island.

YELLOW-BELLIED SAPSUCKER (*Sphyrapicus varius*).—The two races concerning us here are *S. v. varius*, which ranges from Nova Scotia to north British Columbia and (rarely) Yukon, and the very distinct *S. v. nuchalis*, which ranges in southern and central British Columbia and western Alberta. The latter is characterized in the male chiefly by the presence of a red nuchal bar; by the greater extent of the red throat patch; by less white in the back; and by less yellowish under parts. Rarely, in North Alberta and Ontario specimens of *varius*, a trace of red appears in the nuchal area. But from Quebec the National Museum of Canada has a male, taken May 31, that has a red nuchal bar and an extensively red throat patch. In these striking characters it resembles *nuchalis*. Though the red bar is smaller than in most males, it matches one male from Kamloops, B. C., and is about like most females of *nuchalis*. However, in the character of white in the back and of yellow in the under parts, it is closer to *varius*. If it were taken on the edge of the range of *nuchalis* it would be considered a hybrid closer to *nuchalis*. However from its geographical origin and date, it seems advisable to consider it as an unusual variant of *varius*.

DOWNY WOODPECKER (*Dendrocopos pubescens*).—*Dryobates pubescens gairdneri* of coastal British Columbia is distinguished from *D. p. leucurus* of the interior by the pronounced brownish tinge of the under parts. In a series of fifteen specimens from interior British Columbia from the general area of Penticton, in the Okanagan Valley, there is one specimen (Penticton, April 13, 1903) that falls completely outside the general range of variation of *leucurus* in having brownish-tinged under parts, thus resembling *gairdneri*.

Apparently a similar specimen was recorded from Vernon as *D. p. gairdneri* and accepted as such by Brooks and Swarth (1925: 65). It is quite possible that it is a variant of *leucurus*.

WHITE-CROWNED SPARROW (*Zonotrichia leucophrys*).—Two subspecies occur in Alberta: *Z. l. gambelii*, which ranges south in the mountains to Banff, and is characterized by its dark color and white lores; and *Z. l. oriantha*, which ranges north to the Cypress Hills and Waterton Lakes Park, and is characterized by its paler coloration and its black lores; east of Alberta, from Manitoba eastward, there is another black-lored bird, dark in general coloration, *Z. l. leucophrys*, and on the Pacific coast is a white-lored bird with an olive rather than red brown back, *Z. l. pugetensis*.

The color of the lores—black or white—makes a good key character. In the population of this species that lives along the Rocky Mountains from Waterton Lakes to Jasper there is a change in the percentage of each type as follows:

		Number of specimens	
	Locality	*Black lores*	*White lores*
gambelii	North of Jasper	0	all
	Jasper	1	16
oriantha	Banff	3	1
	Waterton Lakes	6	1

Now the single black-lored bird breeding (presumably) at Jasper is just as much a part of the *gambelii* population, with which it agrees in general color, as are the sixteen white-lored birds, and should be so identified. The white-lored bird from Waterton Lakes (presumably breeding) is as much a part of the *oriantha* population, with which it agrees in general color tone, as are the six black-lored birds, and should be so identified. It follows that occasional, isolated individuals of black-lored birds need not necessarily be either *oriantha* or *leucophrys*. There is a single specimen of a black-lored bird from Lac la Nonne taken on September 27 when many white-lored *gambelii* were migrating southward. It is too dark for *oriantha*, but is similar to *leucophrys*. It is possibly a variant of *gambelii* and I so consider it rather than record *Z. l. leucophrys* as straying to Alberta.

Another case, showing how variants may appear in this species, is of a Manitoba specimen, taken in September at Shoal Lake. It differs strikingly from both *leucophrys* and *gambelii* in having the color of the upper parts and flanks dull brown and olive, quite similar to *pugetensis* of the Pacific coast. However *pugetensis* has white lores, and this Manitoba specimen has dark lores. We can assume from geographical probability that the general color is due to a marked variation as striking as a black mark in the lores. Is it not just as reasonable to assume that the Lac la Nonne specimen with black lores is also a variant?

WANDERERS

In some instances the evidence has seemed to indicate that the specimens really were part of the populations they resembled. In the following two cases I have identified individuals as wanderers or migrants, because the evidence seems to indicate that that is probably the correct interpretation.

PALM WARBLER (*Dendroica palmarum*).—The Western Palm Warbler (*D. p. palmarum*) is smaller and paler than the eastern Yellow Palm Warbler (*D. p. hypochrysea*). The differences are so apparent that many field observers in eastern North America, where both occur in migration, identify them in life. The two forms intergrade in the Ottawa area. In the National Museum of Canada there is one specimen of the Western Palm Warbler, taken far out of its normal range on the north shore of the Gulf of St. Lawrence, near breeding time. This I consider a stray *D. p. palmarum*, because it falls so far out of the range of variation of *D. p. hypochrysea* in both size and color, and agrees so well with the western form, despite the unlikely date and locality (Rand: 1944).

BELTED KINGFISHER (*Megaceryle alcyon*).—The Eastern Belted Kingfisher, ranging from Nova Scotia to Yukon, is smaller than the western bird that inhabits British Columbia and the area to the southward.

Two specimens from southern British Columbia I have called *Megaceryle alcyon alcyon* rather than small *M. a. caurina* because: (1) they fall completely outside the range of variation of the Canadian National Museum series of *caurina;* (2) they fall within the lower part of the known range of variation of *alcyon;* and (3) they were taken in winter, when migrants from Yukon would be expected. If they had been taken in summer at the same place I probably would have referred them to *caurina*, and increased my allowance for the range of variation of that form.

DISCUSSION

Two quite different interpretations are possible when a specimen from a given area resembles a distant subspecies more than it does the one of normal local occurrence. It may be a wanderer, or it may be an extreme variant. Which explanation to accept must be decided on the basis of probability, treating each case individually.

Wanderers may appear almost anywhere, but some species are much more given to wandering than others. From our knowledge of the sedentary nature of Spruce Grouse, it is extremely improbable that far-wandering strays occur. With the Robin, strays would be much

more likely, and with Red Crossbills they would be expected. But this last is perhaps a special case in which whole populations move, and the evidence is based on quantitive data.

Variation is the normal thing in bird populations. As little as seventy-five per cent of a population may be identifiable to subspecies by morphological characters. Some of the remaining twenty-five per cent may be intermediates between it and the next subspecies, but some extreme variants may at least reach the average of some other subspecies. Some variants may be extreme, and there is a tendency for them to reduplicate some character already existing in another section of the species or in a related species.

The recognition, by most bird students, of the variability in populations seems to have lagged behind the recognition that individuals wander widely. Reported extensions of geographic range by casual occurrence are much more numerous in our current literature than are reports of the discovery of increased range of variation in a population, and it is not impossible that some phenomena reported as representing the first category actually belong to the second. Possibly there is an unconscious bias, due in part to the competitive making of local lists.

The wanderer has its place in our set of theories, as Grinnell (1922) has pointed out. The wanderers are the explorers and the colonizers. It is through them that species spread, and new areas are occupied. In these new areas, under new conditions, new races tend to evolve. That extensions of the ranges of species occur is one of the prerequisites for accepting the ably documented theory that most bird species have evolved in geographical isolation, and later spread to co-inhabit an area with their nearest relatives.

But while recorded range extensions have their place, so does evidence concerning normal and abnormal variation. Variation is the raw material that makes evolution possible. Through the action of selection on a local population under its peculiar conditions those characters most advantageous are retained, and thus subspecies may be built up.

One criticism of much current taxonomic work is that the range of variation—the overlap of subspecies through individual variation, and the proportion of unidentifiable specimens or specimens that have the characters of some other subspecies—is minimized. To make lists and categories and fit every specimen into a pigeonhole on the basis of its characters does not accord with the modern concept of subspecies. It is populations, with average characters, that we identify. From the viewpoint of a study of speciation, the minimizing of variation is disadvantageous, as it implies a static condition, and fails to recognize the actual dynamic variability that exists.

One must guard against examining a selected series, drawing up a diagnosis, and then identifying all subsequent individuals by this diagnosis, irrespective of other factors. Some conspicuous and convenient 'key character' such as the 'islanded spots' in the primaries of the Black Pigeon Hawk (*Falco columbarius suckleyi*) is occasionally likely to break down. This is equally true of such key characters as "wing 126 mm. or more" as given for *Dryobates villosus septentrionalis*.

If an additional specimen does not correspond with the diagnosis of the form usually occurring in the area, the diagnosis may well be reviewed to see if it accords with the characters of the subspecies. That is, the range of variation of a subspecies may prove to be greater than the definition has allowed.

Cases will occur in which a decision guided by probability is difficult, and error may be unavoidable.

Gross appearance, matching of many characters, and season of occurrence as well as geographical probability, are about the only guides to the probability of the specimens being wanderers.

In examining the probability that the specimens are variants, geographical probability, and the known range of variation of the subspecies and of related species, may be taken into account. If a conspicuous character is the one showing most divergence, other less conspicuous characters may not show it; and the season of occurrence may also be a guide.

Questions of course arise. Is there, if we knew all the facts, a criterion as to whether an individual belongs to a certain subspecies or not? It would seem that if an individual is part of a breeding population, and the population, on average characters, is definitely assignable to one subspecies, the individual should be considered as belonging to that subspecies irrespective of individual morphological characteristics. The fact that there are intermediate populations not assignable to any subspecies form a separate case.

There is then the difficulty of knowing whether or not an individual is actually part of a breeding population. Breeding specimens are, of course, ideal evidence. Usually a series from an area taken during the breeding season, with the evidence from examination of gonads, is the evidence that is used but, even in such cases probability may play a part. When specimens are taken in migration, it is necessary to infer their relationships. In identifying them it is necessary to go back and consult specimens assumed to be breeding, to obtain the range of variation throughout the subspecies, and not a selected series only.

The following question could arise. If an individual from the range

of one subspecies wandered and bred in the range of another, would it change its subspecific status? Its progeny would probably be absorbed in the population with which it bred and would become part of it, perhaps adding to its variability. It seems that the wandering individual, itself, would also change its status. Such a view is a corollary to the view that two subspecies cannot have a geographical or ecological range in common.

CONCLUSIONS

From a practical point of view, when individual specimens do not agree with the general series, the case should be examined with a view as to which is more probable, whether the specimen represents a stray or an individual variant. It is improbable that every case can be decided correctly. But in as much as identification as a wanderer may necessitate another heading in the faunal list, the addition of another form to the tally of those known from the area, and a range extension, it seems to me that the conservative view, other things being equal, is to consider doubtful cases as variants. It is not desirable to suppress the facts of their occurrence; under subspecies 'A' a line might follow stating that occasional individuals approaching (or similar to, or identical with) subspecies 'B' occur, as the data may require.

Some examples of this treatment for Canada are:

Turdus migratorius migratorius.—Common summer resident generally, from Nova Scotia to Yukon; a few winter in the south; occasional breeding specimens indistinguishable from *T. m. nigrideus* occur west to the Mackenzie Delta.

Picoides tridactylus fasciatus.—Resident from Yukon and western Mackenzie, southward through northern and western Alberta and British Columbia. The southern British Columbia population intergrades with eastern *bacatus* through individual variation.

Sphyrapicus varius varius.—Nova Scotia to northern British Columbia, southern Mackenzie, and rarely to southern Yukon; one Quebec variant is very similar to *S. v. nuchalis.*

In revisions, when listing material examined, it would be well to point out, that which shows the differences given and that which does not.

Despite the widely published caution that populations be assigned subspecific names only if specimens are available, it seems that at times the surer way of allocating the proper subspecific name to a population is to examine a revision, if one exists, and from it find if the area concerned has been definitely assigned to the range of one or

another subspecies on the basis of adequate data. If it has, subspecific allocation can be fairly sure, or if the area were one in doubt, or an area of intergradation, the population would need to be listed as "subspecies?" unless material were available for examination.

But here also a change is necessary in faunal treatments. The area of intergradation and overlap should be stated, as well as the range of the subspecies in typical form.

Suggested treatments are:

Zonotrichia leucophrys leucophrys.—Quebec to Ontario; in northern Manitoba, overlaps and intergrades with *Z. l. gambelii.*

Colaptes auratus luteus.—Nova Scotia and Quebec to Yukon; shows a cline throughout; increases in size to the north and west; overlaps and intergrades with *C. cafer* from southern Saskatchewan to southern British Columbia; occasional hybrid specimens as far east as Ontario.

REFERENCES CITED

ALDRICH, J. W.
1946. The United States races of the Bob-white. Auk, 63: 493–508.

ALLEN, G.
1914. Pattern development in mammals and birds. Amer. Nat., 48: 385–412, 467–484, 551–566.

AMERICAN ORNITHOLOGISTS' UNION
1931. Check-List of North American birds, 4th edition, 526 pp.

BROOKS, A., AND SWARTH, H. S.
1925. A distributional list of the birds of British Columbia. Pacific Coast Avifauna, No. 17, 158 pp.

CONOVER, B.
1944. The races of the Solitary Sandpiper. Auk, 61: 537–544.

GRINNELL, J.
1922. The role of the "accidental." Auk, 39: 373–380.

HARRISON, J. M.
1946. Exhibition of two varieties of the Robin *Erithacus rubecula* (Linn.). Bull. B. O. C., No. 66: 69.

HARRISON, J.
1944. The races of Mallard. Bull. B. O. C., No. 453: 58–60.

HØRRING, RICHARD, AND SALOMONSEN, F.
1941. Further records of rare or new Greenland birds. Med. om Grønland, 111, No. 5: 1–86.

MAYR, E.
1942. Systematics and the origin of species, 334 pp. (New York).

PHILLIPS, J. C.
1923. A natural history of the ducks, Vol. 2, 409 pp. (Boston and New York.)

RAND, A. L.
1944. Notes on the Palm Warbler, *Dendroica palmarum* (Gmelin) in Canada. Canadian Field-Naturalist, 58: 181, 182.

RIDGWAY, R.
1904. The birds of Middle and North America. Bull. U. S. Nat. Mus., No. 50, Pt. 3, 801 pp.

SWARTH, H.
1913. A study of a collection of geese of the *Branta canadensis* group from the San Joaquin Valley, California. Univ. Calif. Pub. Zool., 12: 1–22, 2 plates.
TAVERNER, P. A.
1942. Canadian races of the Great Horned Owls. Auk, 59: 234–245.
1934. Birds of Canada. Nat. Mus. Can., Bull. No. 72, 445 pp.
1936. Taxonomic comments on Red-tailed Hawks. Condor, 38: 66–71.
TUCKER, B. W.
1945. Purple-headed Starlings in the British Isles. Bull. B. O. C., No. 457: 36–38.
UTTAL, L. J.
1939. Subspecies of the Spruce Grouse. Auk, 56: 460–464.
WETMORE, A.
1931. Warm blooded vertebrates, part 1, Birds. Smith. Sci. Ser., 9, 166 pp.

Chicago Natural History Museum
Chicago
Illinois

THOMAS BARBOUR, 1884–1946

BY JAMES L. PETERS

Plate 12[1]

THOMAS BARBOUR was born on Martha's Vineyard, Massachusetts, August 19, 1884, eldest of the four sons of William and Julia Adelaide (Sprague) Barbour. His father, a director of the great linen mills of William Barbour and Son, located near Lisburn, Ireland, made frequent business trips to Europe, on which he was often accompanied by his family; hence Tom began his travels at an early age.

Private tutors and Browning's School in New York prepared him for college. During his boyhood he had many contacts with the outdoors but none so surely influenced and guided an instinctive bent for natural science as did his first visit to Florida in 1898. Following an attack of typhoid fever in that year he was sent to recuperate at his Grandmother Barbour's winter home at Eau Gallie, Florida. She, Sarah Elizabeth Barbour, was a most unusual character, a born naturalist, an excellent shot and an expert with a fly rod. She and her fourteen-year-old nephew fished in Lake Washington and travelled about southern Florida. It was she, also, at this time who took him to Nassau in the Bahamas for his first glimpse of the American tropics for which he then and there developed a lifelong absorbing interest.

Tom's mother had no outdoor interests whatsoever, but his father

[1] Photograph by Joseph Dixon.