

A REVIEW OF CENTERS OF DIFFERENTIATION FOR BIRDS IN THE WESTERN GREAT BASIN REGION

By ALDEN H. MILLER

The expressions "center of differentiation" and "differentiation area" have found frequent application in western North America because of the restriction of many geographic races of birds and other animals to small, well circumscribed regions. The implications are that these areas have been especially potent in causing local differentiation. Recognition of a center of this kind must, it would seem, rest upon several conditions. To begin with, if it is to have any general significance, one should be able to show that several geographic races of different species and genera focus in it. If the ranges of the races are not conterminous, they must have much ground in common, and should center about a common point or show the greatest development of their racial characters there. Obviously it is not enough to judge of the existence of such centers by the grouping of type localities. The range of each race must be well known and the possible variation in degree of its characters should be ascertained. The race may in fact be only a segment of an extensive cline and thus afford no evidence of a particular "center of differentiation" either in the sense of origin or accentuation of characters.

Factors which underlie development of a center are features of the environment which will affect, indirectly, race formation in representatives of many genera. This means that these genera have something in common in their dependence on environment, which will result in parallel modifications. To find aspects of the environment sufficiently broad to produce such parallelisms, we turn usually to matters of climatic regime, zonation, and the attendant differences in vegetation. But equally important is isolation of the region, if these parallelisms are to be preserved. Also, if different generic representatives do not respond in comparable fashion to the prevailing features of the area, they are likely to show the same limits in range because of spread to common barriers. In other words the emphasis may be even more importantly upon common limitation of random differentiation than on parallel environmental induction.

For these reasons, insular or semi-insular regions of peculiar climate are those which most often take on the aspects of differentiation centers and do so most strikingly. Examples are the Cape district of Lower California, with 46 differentiates centering in it, according to Grinnell (*Univ. Calif. Publ. Zool.*, 32, 1928:5), and the San Pedro Mártir district of northern Lower California with 28 differentiates. Other areas are Vancouver Island, the San Francisco Bay region, and the Monterey coastal district.

As soon as we deal with areas in northern and interior continental regions where isolation is weakened by poor or diverse barriers, and by migration, differentiation centers are likely to be poorly defined or nonexistent. Less coincidence in the distributional pattern of various race groups is manifest. Each species is able to exhibit its own peculiar reactions to limiting factors; there is no common mold.

The specific purpose of the present review is to examine two supposed areas of differentiation in the light of these principles governing the constitution and significance of such centers. The two are the Warner Valley area of southern Oregon, near the junction of California, Nevada and Oregon, and the White Mountains on the central California-Nevada boundary southeast of Mono Lake. The idea that these are differentiation centers was voiced principally in the introduction of Oberholser's paper on the Warner region (*Sci. Publ. Cleveland Mus. Nat. Hist.*, 4, 1932:1), as follows: "One of

the significant developments of ornithology in western North America has been the discovery and exposition of the centers of subspecific differentiation. Such centers are represented by the Victoria Mountains of southern Lower California, the San Pedro Mártir Mountains . . . , the White Mountains, . . . , the Charleston Mountains of southwestern Nevada. . . . A recent ornithological investigation of the region including the Warner Valley and Warner Mountains of central southern Oregon has shown that this is another such area, and one of unusual importance. . . . The birds described in the following pages [18] have in most cases their center of distribution in this area, and although some of them have a rather wide range in the western United States, and one occurs only on the Pacific slope, most of them are either confined to the Warner Valley or Warner Mountains or have a somewhat limited distribution north and south of this region." The only specific statement concerning the White Mountains as a center appears to be that of Grinnell's (*Auk*, 45, 1928:213): "This eastern portion [lat. 35° to Lake Tahoe, east of Sierra] of California includes what I have termed the Inyo sub-faunal district, characterized by not a few peculiar races of birds [10 named up to 1941] which have been described from the White, Inyo, Panamint, or others of the numerous mountain ranges of that territory, or from the adjacent or intervening valleys. Resident birds of plastic groups many of them show well-marked characters of pale coloration and large size, as compared with related forms to the west or south." It will be noted that there is no intent to limit this area to the White Mountains, although such limitation seems implied in Oberholser's listing of areas quoted above.

The Warner Valley area was visited by me in 1937 in company of a party from the Museum of Vertebrate Zoology with a view to gaining acquaintance with this differentiation center and of obtaining topotypes of races described from there. In both of these quests we were reasonably successful. One is immediately impressed with the diversity of the area from the standpoint of avian habitats. The Warner Mountains present belts of coniferous timber along a more or less isolated uplift which extends into California. The piñon-juniper association of the lower levels is continuous with like areas in the regions to the east and south in the Oregon and Nevada deserts and on the Modoc-Lassen plateaus. The valley itself, with sagebrush lands, streamside thickets, and meadows, is a fairly deep basin delimited sharply at least on the west. It appears definitely to be the westernmost of a series of desert valleys which are typical of the northern Great Basin region. The brushlands of it are widely continuous with like country to the east. From this brief characterization it should be apparent that the problem of differentiates in these three main divisions of the area are likely to be different. The montane section is isolated, but in general is an outlier of the Sierra-Cascade Mountain system, whereas the valley itself represents merely the western edge of the Oregon desert. The apparent environmental causes of differentiation and the barriers in these divisions are not at all the same. We are not dealing with one possible center but a composite with several environments and with various barriers that happen to fall close together or happen partly to coincide in this section of the country.

The evidence for the Warner center lies in 17 forms described from it plus one described earlier by Swarth (*Proc. Biol. Soc. Wash.*, 31, 1918:162) from the Warner Mountains of California. The study of these races has in effect been done to test out Swarth's (*Condor*, 35, 1933:44-45) critical comments made of the wholesale and sketchy descriptions of forms from that area. So far as possible the limits of each recognizable race have been traced and variations within the race looked for. With the large number of genera involved, the treatment of each form could not be exhaustively revisionary, but certainly some progress has been made toward a better under-

standing of the differentiates of the region. Grateful acknowledgment is made of assistance given by Harvey I. Fisher and Joe T. Marshall, Jr., in assembling data for this study.

Of the 18 forms, 6 are thought to be without basis in fact. In general, no geographic variation can be detected in our material for these forms; all variation appears to be merely individual and seasonal. A synopsis of our findings concerning these proposed races follows:

Lophortyx californica orecta. California Quail. Van Rossem (Auk, 56, 1939:69) examined 11 specimens (8 males) in fresh fall plumage from Adel, 9 miles north of the type locality, and found that the color difference in comparison with *L. c. californica* reversed that claimed by Oberholser, concluding that they were not distinguishable from the latter. His size comparison, giving extremes, likewise failed to reveal tangible difference. Oberholser had fresh fall material, 12 males and 4 females, mentioned as adults. Our series of 6 males and 1 female, taken in the early breeding season at the type locality show no color difference compared with *L. c. californica*, nor do birds from the Warner Mountain region in California. Perhaps a larger proportion might be classed as paler and less olivaceous. Size differences are not apparent in our comparison any more than in van Rossem's. Conclusion: the race is unrecognizable; the situation is perhaps complicated locally by introductions, since these are known to have been made in Surprise Valley in Modoc County, California.

Empidonax trailli adastus. Traill Flycatcher. The only character claimed for this race, the color of the upper parts, I find exceedingly variable individually. Oberholser states that the color is more greenish brown (less yellowish or rufescent). A near-topotypical series of 11 June-taken birds, 12 birds from the Blue Mountains to the north, and a good representation from Nevada, the Sacramento Valley of California and western Oregon have been compared. In each I find greenish brown, bright green, and dull gray-green birds which do not separate sharply into phase categories. These different types are of about the same abundance in each area. Certainly the pale grayish green birds present in the Warner series are duplicated in breeding birds west of the Sierra with fair regularity. Conclusion: race not recognizable and no clear cut trends indicated; the range originally ascribed is suspiciously "unnatural."

Stelgidopteryx ruficollis aphractus. Rough-winged Swallow. We have a topotypical series of this supposed race consisting of 12 individuals, and in addition large numbers from some of the western states included in the range ascribed to *aphractus*. Although only a small number of eastern birds has been compared, no suggestion of the color differences and the small size attributed to them can be made out. Even in the few eastern birds at our disposal most of the range in wing length of the topotypical series of *aphractus* is represented. Admittedly the comparison in this species has not been pursued as far as could be wished. But on the grounds that we are quite unable to sort out individuals of the supposed races on the characters ascribed, we must conclude that no useful purpose is served in recognizing *aphractus*. I am even doubtful that a trend in geographic differentiation exists.

Euphagus cyanocephalus aliastus. Brewer Blackbird. Eleven males and 12 females from the Warner Mountains, many of them topotypes, have been used in comparison with Rocky Mountain material (5 males and 4 females) considered representative of *E. c. cyanocephalus*. Females from the Warner region usually are darker above and below than the Rocky Mountain examples, that is, are less brownish, but some are indistinguishable. Much of this variation is dependent on wear of the brown tippings of the feathers, which fluctuates even in specimens of the same dates taken in May and June. Large series of fall specimens from both regions would be necessary to eliminate fully the possibility of difference in color in females. The variations in the type of metallic green of the breasts of males, whether yellowish or greenish, in our series follow no geographic lines.

Oberholseria chlorura zapolia. Green-tailed Towhee. Twenty-seven males and 8 females from the Warner Mountains were compared with 9 males and 10 females from the Rocky Mountains from whence the type of *chlorura* was taken (Blackfoot, Idaho). Oberholser characterized *zapolia* as more grayish (less greenish, brownish or rufescent) above; flanks more grayish (less buffy), and anterior lower surface more clearly gray. The race is supposed to range along the Sierran-Cascade Mountain system and into northeastern Nevada. All the color differences cited are likely to be confused by wear, as Oberholser of course realized. Nevertheless it seems possible that not enough heed was given to this factor. We can arrange our spring-taken material in a chronologic scale and find that it then makes a roughly graded series ranging from brown to gray. Also, two June-taken females from Iron County, Utah, in the range of the supposed brown race, are the grayest of all our spring and early summer material. A survey of possible size differences has shown nothing of positive nature. Conclusion: no decisive evidence of a geographic grouping of characters can be found; race invalid.

Chondestes grammacus actitus. Lark Sparrow. The characters claimed for this race are paler

upper parts (except head stripes) and somewhat longer wing, these in comparison with *strigatus* of "Mexico and southern Arizona." Here again we have not been able to see duplicated in our topotypical (10) and near topotypical material the color differences claimed. Oberholser makes no reference to California material and it is not clear whether he considers such to pertain to *strigatus* or *actitus*. Our topotypes of *actitus* differ not at all from series from southern California and from Humboldt County, Nevada, nor from birds in comparable stages of wear from southern Arizona and New Mexico. Larger representations from these latter regions and Mexico would be desirable, but there seems to be no doubt that the Warner Valley birds are like those from other parts of the Pacific coast and Great Basin regions. In wing length, *actitus* averages (males) slightly smaller than sample series from Arizona and New Mexico, northeastern Nevada, the Coachella Valley of California, and Modoc County, California; it is slightly larger than a group from San Diego County. All these differences are unreliable statistically but the trend they show is, if anything, the reverse of that claimed. Conclusion: race probably invalid and certainly not as yet properly demonstrated.

We now turn to a group of 6 proposed races that signify observable geographic trends but which because they are too weakly differentiated or because they are parts of intergrading complexes seem unworthy of recognition.

Phalaenoptilus nuttallii nyctophilus. Poor-will. The 7 birds from the south end of the Warner Valley in our collection suggest as a group an approach to *californicus*, yet they can be perfectly matched by individuals of *nuttallii* from Utah, Wyoming, Idaho and Nevada. In measurements of wing length and in amount of white on the rectrices, the averages of the Warner birds coincide with those for *P. n. nuttallii*; there is broad overlapping of the races in these features. The proportion of birds with dark dorsal ground color and large dark spots on the scapulars is greater than in *nuttallii* and less than in *californicus*. Otherwise the coloration closely resembles that of *nuttallii*. The type locality of *nyctophilus* is north and east of the place where our series was taken, but this can scarcely be viewed as important. One bird that we have from Alkali Lake, north of the type locality, is typical *nuttallii*. It is concluded that *nyctophilus* does not differ importantly from *P. n. nuttallii* and such departure as it does show indicates intergradation toward western populations.

Tyrannus tyrannus hespericola. Kingbird. This race was found difficult to recognize by Zimmer (Am. Mus. Nov. No. 962, 1937:12), who says: "In general, western birds are slightly larger than eastern ones and may be slightly paler than eastern ones, but the overlap appears to be too large to warrant separation." Wetmore (Proc. U. S. Nat. Mus., 86, 1939:199) comments that this race "is marked mainly by slightly grayer dorsal coloration, the alleged difference of larger size holding only for part of the individuals examined. The white band on the tip of the tail averages slightly wider in the western race but is subject to considerable abrasion, so that in numerous specimens from the west no difference is to be noted." Wetmore concludes that the race should be recognized, although he grants that the difference between the two races is slight.

In an effort to lay out the facts supporting the contention of racial distinctness of *hespericola*, I have examined the following birds with respect to wing, tail and tarsal dimensions, extent of the white tip of the tail, back color, and breast color: Western group: Camrose, Alberta, 1; Hazelton, B. C., 2; Powder River County, Montana, 1; Rosebud County, Montana, 10; Missoula County, Montana, 4; Bonner County, Idaho, 1; Washington County, Idaho, 2; Adams County, Idaho, 1; Fremont County, Idaho, 1; Benton County, Washington, 2; Crook County, Oregon, 3; Lake County, Oregon (near topotypes), 3; Humboldt County, Nevada, 2; Los Angeles County, California (migrant), 1; total, 34. Eastern group, east of latitude 100°:18.

The dimensions in millimeters (averages and extremes) are as follows:

	No.	Wing	Tail	Tarsus
Eastern males	13	116.3 (112.8-122.2)	83.1 (80.3-85.4)	18.8 (17.7-20.0)
Western males	18	116.9 (110.8-121.4)	82.1 (77.8-88.1)	18.6 (17.8-19.5)
Eastern females	5	116.9 (110.4-120.0)	80.4 (77.2-85.3)	18.7 (18.0-19.2)
Western females	16	112.8 (109.2-116.6)	81.0 (76.5-85.2)	18.9 (17.6-20.1)

These figures alone, even without special statistical treatment, show that there are no significant size differences. This is particularly evident in the well-represented group of males. The difference in the wings of females, in a direction the reverse of that heretofore claimed, is fairly clearly attributable to the small sample from the east. It should be cautioned that the measurements do not coincide in absolute value with those given by Oberholser, apparently because of some unknown deviations in method of measuring.

The white tip of the central tail feathers was measured only if unworn. The variability is so great as to make insignificant the small average differences. This is shown in the following table, in which

individual western birds are represented by an "o," eastern birds by an "x." Averages are: eastern males, 8.6 mm.; western males, 9.9; eastern females, 9.6; western females, 9.8.

Mm.	Length of white tip of central rectrices									
	6	7	8	9	10	11	12	13	14	
Males	x	o	o	o	o	o		o	o	
		x	o	o	o	o		o		
			o	o	o	x				
			o	o	o	x				
			x	x	x					
			x	x						
			x							
			x							
Females	o	o	x	o	o	o	o			
				o	o	x	o			
				o	o					
				x	o					
					o					
					o					
					o					

Obviously the white tail tip cannot be used as a means of identification, even though the eastern population may lack the extremely white variants of the western group. Neither in this character nor in others have local differences within the western group been detected.

In back color, some difference is apparent, as also in the degree of darkening on the breast, the eastern birds being darker in both respects. As has been remarked, however, these differences are slight and there is much overlapping. Birds from both geographic regions were mixed and sorted according to color. Using the back, only 60 per cent success was had in segregating them into the correct geographic groups. With the breast, barely 70 per cent success was had and this could not be improved upon by using breast and back in combination.

In conclusion it is recommended that the race not be recognized because it is not possible to identify a large enough percentage of individuals. This is a practical consideration. The fact is interesting nonetheless that there is a weak differentiation, not sharply defined structurally or geographically, which follows a pattern familiar in many other bird species. However, the differentiation does not center in the Warner Valley, which is at the western margin of the range of the species.

Petrochelidon albifrons arophata. Cliff Swallow. Van Rossem (Pac. Coast Avif. No. 24, 1936:33) in discussing *P. a. hypopolia*, and *P. a. arophata* states that he does "not believe it practical to acknowledge more than one large, light-colored race from the Great Basin and northwestern interior." Thus *arophata* is considered a synonym of *hypopolia*, and this is probably correct. More needs to be known of the relation of Great Basin birds and those of the Mackenzie region. Leaving this question aside, the birds of the Great Basin are, in wing length at least, consistently different from the birds of the Pacific coast (*P. a. albifrons*) and are reasonably uniform among themselves. Along the east side of the Sierra, cliff swallows show larger size, some groups as in Mono County (van Rossem, *loc. cit.*) being fairly representative of *hypopolia*, others, as in the Tahoe district, being intermediate. Our series of topotypes of *arophata* from the Warner Valley are similarly intermediate, most of the individuals falling in the size-range of *P. a. albifrons*. Only 4 out of 13 fall well into the size range of *hypopolia*. For this species, the Warner Valley is an area of intergradation, as might be expected from its position at the western margin of typical Great Basin country.

Cyanocitta stelleri syncolla. Steller Jay. Stevenson (Condor, 36, 1934:75-76) gave extended attention to this form in a review of jays of this species. The material he had was much more adequate than Oberholser's and he examined the type series. Since then fifteen topotypes or near topotypes have been acquired. Review of the material reveals no evidence at variance with Stevenson's exposition of the facts. In brief, the Steller Jays of the Warner Mountains represent in coloration a part of the trend northward in *frontalis* toward the darker *paralia* of coastal Oregon. They are a large-sized extreme of *frontalis*, suggesting a trend toward the large *annectens* of eastern Oregon. This size difference, though real, does not permit sufficient segregation of individuals to make advisable the recognition of the race. As regards the Warner differentiation center, it is not certain that the differences in the jays afford contributory evidence; they may be thought of as part of a discontinuous cline, running northeastward, the character of which is in some measure shaped by the isolation and geographic position of the Warner Mountains.

Hylocichla guttata oromela. Hermit Thrush. McCabe and McCabe (Condor, 35, 1933:122-123) have brought to notice the confusing situation concerning the type of *oromela* and the application of the name. The birds to which the name apparently was intended to apply are those of the Cascade Mountains, which although slightly larger than *slevini* and occasionally of darker dorsal coloration, are not sufficiently different to warrant recognition as a separate race. The Cascade birds and those of the Siskiyou Mountains form a gradient in color and size leading north toward *H. g. guttata* of British Columbia. Those of Oregon at least are much closer to *slevini* in average coloration. The large-sized *sequoiensis* has already been modified in the Lassen Peak area, and the birds of northeastern California are not typical of either *sequoiensis* or *slevini*. They may be viewed as *slevini* grading in the direction of the distinctly large *polionota* to the eastward or as *sequoiensis* diminished in size northward toward *slevini*. Full treatment of this complex of size groups will not be detailed here. It is sufficient to indicate that the Warner Mountain birds form a group lying between three size races and as such they display the expected intermediacy. Birds on the east flank of the Cascades in central Oregon show evidence of mixture with *polionota* to the eastward through the presence of occasional unusually large individuals. Whether the type of *oromela* was a bird representative of the Warner Mountains intermediates or a migrant from the northern part of the range of *slevini* can not be determined without full study of the type, especially its measurements, which have not been reported upon.

Pooecetes gramineus definitus. Vesper Sparrow. The principal character claimed for this race in contrast to *confinis* described from the Great Plains is less white in the tail. The best quantitative expression of this is gained through the following measurements:

Length of white area on inner web of outer rectrix in males

No.	Group	Average and extremes
9	Alberta, Wyoming, Colorado	40.4 (34.0-43.3) mm.
	Oberholser's figures for <i>P. g. confinis</i>	40.9 (33. -61.5)
10	Oberholser's figures for <i>P. g. definitus</i>	32.5 (26.5-42.5)
5	Topotypes of <i>definitus</i> in Mus. Vert. Zool.	39.3 (32.9-46.4)
16	Northwest Nevada; Modoc-Lassen region, California	34.8 (29.5-44.0)
9	Mono Lake, California	35.4 (31.2-41.0)
11	Death Valley; Owens Valley (spring migrants in part)	40.3 (34.7-45.0)

The dangers involved in reliance on small samples are here apparent. The original type series of *definitus* is seen to be distinctly different from five measurable topotypes taken by our party. Without presenting here the complete picture of the variance in this measurement, it may be stated that there is complete overlap of the two geographic groups, namely, Great Basin and Rocky Mountain-Great Plains. It will be noted that the individuals with absolute maximum and minimum of white both came from the type locality of *definitus*. Disregarding the group from the Death Valley-Owens Valley region which was partly composed of migrants, there is a lesser average in white in the Great Basin groups; but considering the magnitude of individual variation in each sample, these average differences are small and of uncertain validity. With larger samples one might establish statistically a slight difference of this sort, but the difference is not useful as a basis for nomenclature. The absence of white on the inner web of the next to outermost rectrix was not found to be invariable in Great Basin birds.

The recognizable races of the Warner region total six. Two of these are wide-ranging, namely the White-crowned Sparrow and the Warbling Vireo.

Zonotrichia leucophrys oriantha. White-crowned Sparrow. This race is apparently well marked in contrast to birds of the eastern part of the continent, showing the characters as given by the describer. We have not seen as much eastern material as is desired, but there seem to be good grounds for recognizing the race if all eastern material is as dark-colored as the specimens we have at hand. Close comparison of groups of breeding birds from the Cascades, Sierra Nevada, and Wallowa Mountains, Oregon, and Rocky Mountains of Wyoming and Utah, shows no differences between western populations. There are no peculiar features displayed in the Warner group, nor is there accentuation of characters here.

Vireo gilvus leucopolius. Warbling Vireo. This race shows considerable overlapping with *swainsonii* in color of the back, the main feature that distinguishes it. Even though the geographic boundaries are not too sharply defined, the race seems worthy of recognition. Sibley (Condor, 42, 1940:255-258, fig. 76) in a recent study of this group makes the following statements about this race, in which I concur: "In the collection of the Museum of Vertebrate Zoology are 125 specimens, including 12 topotypes referable to this race. The characters agree with the original description but the form has a much greater range than Oberholser . . . gave. He stated that it was, 'confined . . . in the Warner Valley

and to a narrow area north and south of this region Its range may be better characterized as the Great Basin. Examples of *leucopolius* have been examined from northeastern California, eastern Oregon and Washington, southern Idaho, western Wyoming, western Utah and practically all sections of Nevada. The range as now delimited lies between the Cascade-Sierran system on the west and the

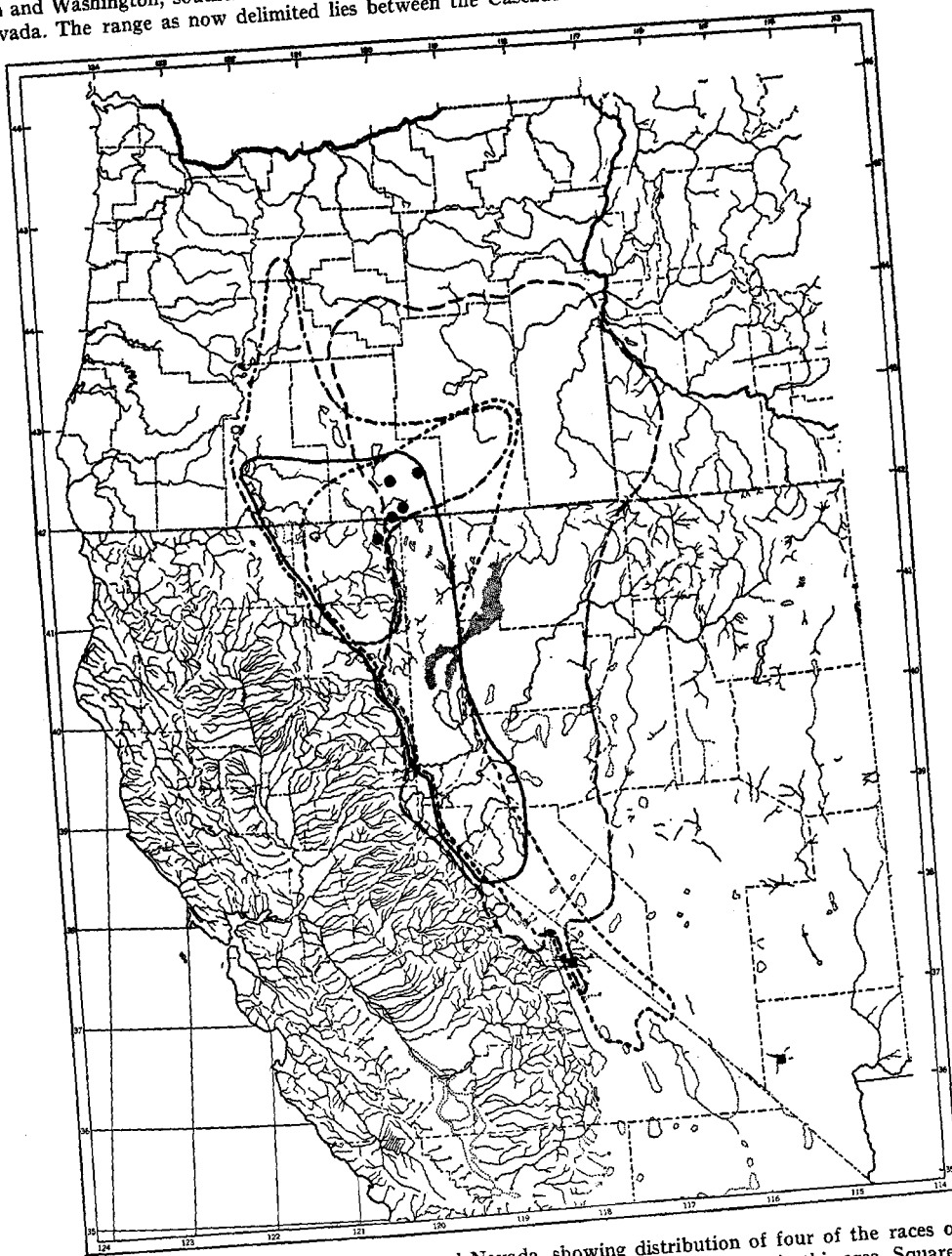


Fig. 74. Map of Oregon, California, and Nevada, showing distribution of four of the races of birds described from the Warner area. Dots represent all type localities in this area. Squares mark the White Mountains and the Charleston Mountains. Solid line outlines range of *Thryomanes bewickii atrestus*; long dash, *Otocoris alpestris lamprochroma*; dash and dot, *Passerella iliaca fulva*; short dash, *Baeolophus inornatus zaleptus*.

eastern slope of the Rocky Mountains to the east. It extends from southern Idaho to southern Nevada." As with the White-crowned Sparrow, the Warner Mountains are of no more significance than other points in the Great Basin in the biology of this race.

Four races are of more restricted distribution and these have been mapped (fig. 74). The outlines of range do not mean that each form is of continuous distribution within the area shown. The lines are drawn on the basis of the best information available, and on surmise. Although I disapprove of the inaccuracies inherent in such a plan of representation, it seemed necessary to resort to this kind of aid in visualizing the relation of the races to the Warner region.

The Horned Lark (*Otocoris alpestris lamprochroma*) has been studied in detail by Behle who has an extensive report in press on this group. Behle remarks that the most typical specimens of the race occur in that part of the range extending from the Warner Valley to Mono Lake, California. Note that the range includes the White Mountains of California.

The Plain Titmouse (*Baeolophus inornatus zaleptus*) has been recognized by Linsdale (Condor, 40, 1938:37-38) and the characterization of it reviewed and corrected. The apparent extension of this form south into the Inyo region has been discussed by Grinnell and Behle (Condor, 39, 1937:226).

The Bewick Wren (*Thyromanes bewickii atrestus*), a well-marked race, has recently been shown (Miller, Condor, 43, 1941:251) to be more wide-ranging than originally described. Even so it is the most restricted in distribution of any of the valid forms described from the Warner region; it extends south only to Lyon County, in west-central Nevada.

The Fox Sparrow (*Passerella iliaca fulva*), described by Swarth, is a well-known race with range extending to the north of the Warner Mountains but with the best development of characters in the Warner area. The distribution here shown is modified from that given by Swarth on the basis of later reports and state lists.

To summarize, the four races of more or less restricted range include two that extend south to the supposed White Mountains center (Horned Lark and Titmouse). The other two (Fox Sparrow and Bewick Wren) do not impress one as centering geographically in the Warner region. In fact they merely overlap here. In only two (Horned Lark and Fox Sparrow) is there indication that characters are extreme in the Warner region, although not exclusively here in the case of the Horned Lark.

We may conclude that the Warner area is not a true center of racial differentiation. There is not one true endemic form. There are several races typical of the Great Basin or of the northwestern section of the Great Basin or of the east slope of the Sierran uplift that have been named from here. In like fashion some valid Great Basin forms (races of *Agelaius*, *Molothrus*, *Pipilo*, *Passerculus* and *Melospiza*) have been described from the Pine Forest Mountains of northwestern Nevada.

As an afterthought, we wonder what the score for the Warner area would be if all proposed forms were recognizable. Perhaps I am unable to detect differences that exist because of inadequate material or faulty perception. If this were the case, we find nevertheless that only 7 of the 18 forms were thought originally to be limited chiefly to this area, judging from the statements about range given for each form. Two of these (races of *Petrochelidon*, *Cyanocitta*) we now view as intergrades, recognizing that there are differences. Three are adequately marked races but are now shown to be of more extensive range (*Baeolophus*, *Thyromanes*) or of very wide range (*Zonotrichia*). The other two (*Lophortyx* and *Chondestes*) we might for argument concede are valid, and still the evidence would be poor indeed for a center of differentiation.

The Inyo area, like the Warner area, is characterized by a diversity of terrain and habitat. The several mountain ranges are isolated from the Sierran mass on the west and from scattered high ranges in southern and central Nevada, with which they are nevertheless related faunally. The lower desert sinks of the Inyo region resemble in part the Mohave Desert, but also the Great Basin region.

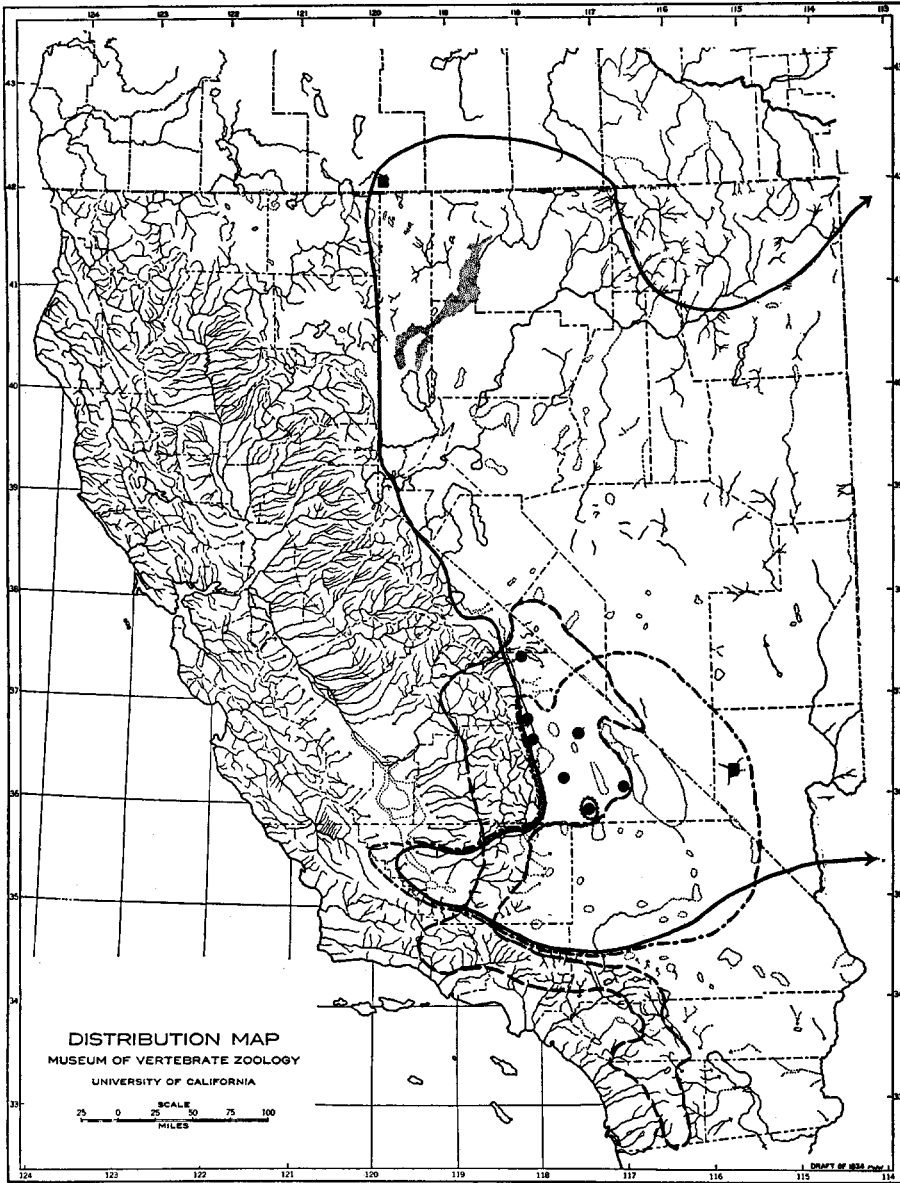


Fig. 75. Map showing ranges of four of the races of birds described from the Inyo area. Dots represent all type localities in this area. Squares mark the Warner area and the Charleston Mountains. Solid line, *Lanius ludovicianus nevadensis*; long dash, *Oreortyx picta eremophila*; dash and dot, *Otocoris alpestris ammophila*; dots, *Pipilo fuscus eremophilus*.

Ten races of birds have been named on the basis of type material from the Inyo section. Five races relate to the montane regions, five to lower levels. In surveying the distribution of these, less critical attention has been given to their characters than to those of the birds of the Warner area because most of them are forms of long standing recognition or they have been treated in detailed revisionary studies in late years. Least known are the races of California Quail and Screech Owl.

Lophortyx californicus canfieldae. California Quail. This race, described by van Rossem (Auk, 56, 1939:68), has not been studied by me because of lack of material. Its range is probably not yet fully known and therefore it is not mapped. Van Rossem ascribes it to Owens Valley.

Otus asio inyoensis. Screech Owl. Originally this race was known only from Owens Valley. Since then material from Fallon, Churchill County, Nevada, has been shown to belong to this form (Hall, Condor, 40, 1938:259). Oberholser (Jour. Washington Acad. Sci., 27, 1937:356) has even referred specimens from northern Utah to this race. The occurrences are thus too few and too greatly scattered to plot the range, but enough is known to show that the form ranges beyond the Inyo region and probably over a large sector of the Great Basin.

In figure 75 are shown the ranges of *Lanius ludovicianus nevadensis*, *Otocoris alpestris ammophila*, *Pipilo fuscus eremophilus* and *Oreortyx picta eremophila*.

The shrike (*L. l. nevadensis*) is a Great Basin form, the western part of its range here shown being essentially as mapped at an earlier date by me (Univ. Calif. Publ. Zool., 38, 1931:75). The Horned Lark (*O. a. ammophila*), based on Behle's work in press, is a race that occupies both the Mohave Desert and Inyo regions and in the southwest coincides with the range of the shrike. The Brown Towhee (*P. f. eremophilus*) is a narrowly restricted endemic found in the middle levels of the Argus Mountains (van Rossem, Trans. San Diego Soc. Nat. Hist., 8, 1935:69-72), its closest relatives occurring to the west in the Kern River basin. The race of the Mountain Quail (*O. p. eremophila*), a bird of the mountains but not of the highest levels, is inseparable from populations in the southern Sierra Nevada and the mountains of southern California (van Rossem, Condor, 39, 1937:21).

Three of the other four montane races (Hermit Thrush, *Hylocichla guttata polionota*; Mountain Chickadee, *Penthestes gambeli inyoensis*; and White-breasted Nuthatch, *Sitta carolinensis tenuissima*) correspond in the southern, eastern and western limits of their ranges (fig. 76), occupying the southern Great Basin mountain ranges, but they vary in their northward extension, the Hermit Thrush extending north through the Great Basin to southeastern Washington and central Idaho. The Fox Sparrow (*Passerella iliaca canescens*) has a restricted distribution eastward across central Nevada, replacing in this section the race *schistacea* of the northern Great Basin. Viewed in a different way, the five montane forms are either widely spread in the Great Basin (2), are limited to the southern Great Basin (2), or are limited to western mountain systems, spilling over into the edge of the Great Basin (1). Three of the montane forms occur also on the Charleston Mountains which have been viewed, with good reason, as themselves constituting a differentiation center. (The Charleston and Sheep mountains, of more southerly location, are well isolated and possess at least three endemic birds; but in comparison with the San Pedro Mártir Mountains, they are of small significance.)

With respect to the White Mountains, we may conclude that this range is not in itself a differentiation center for birds. The Inyo area in which it is included may be so regarded, with somewhat more evidence to support this view than there was in support of the Warner area. However, more correctly, the Inyo sector should be viewed as representative of either the southern or southwestern Great Basin, to which larger areas

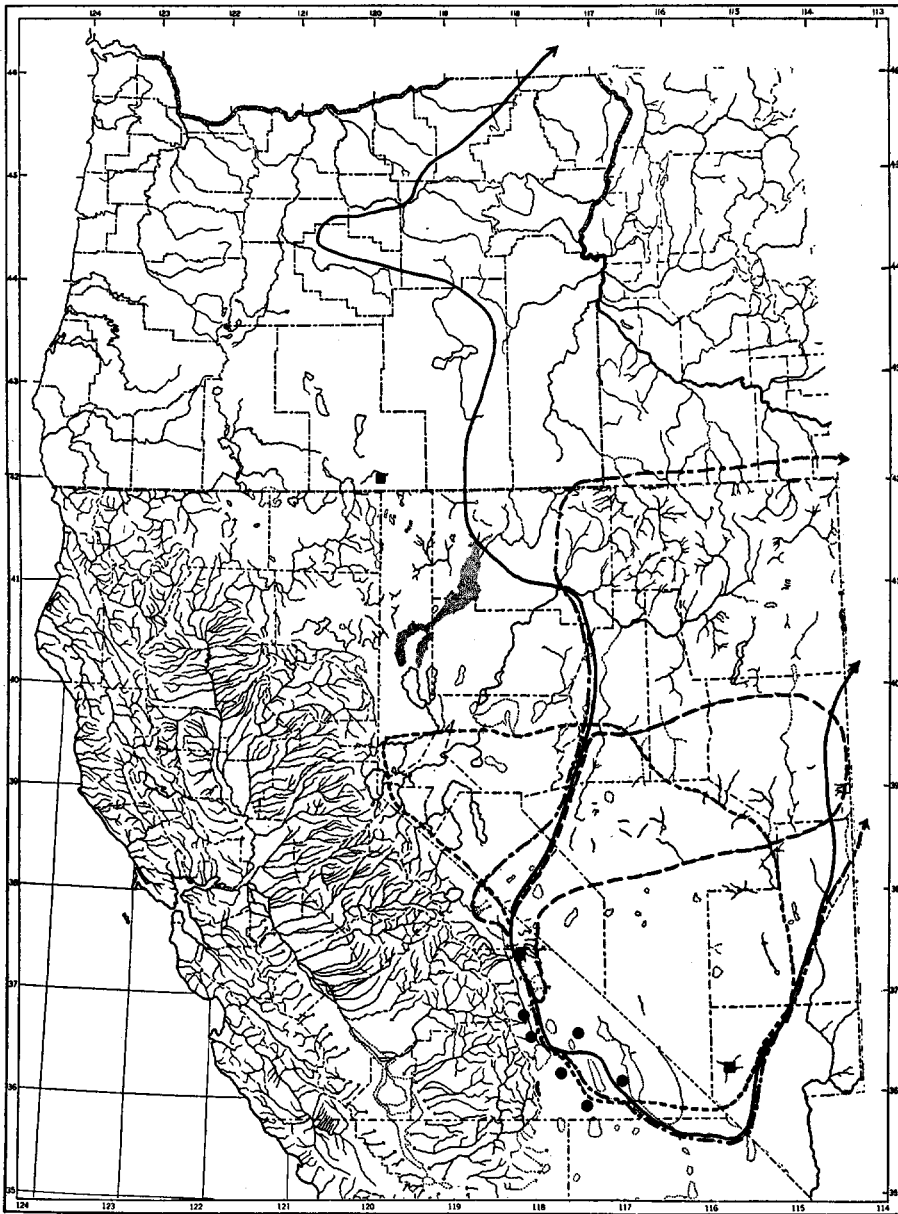


Fig. 76. Map showing distribution of four additional races described from the Inyo area. Solid line, *Hylocichla guttata polionota*; long dash, *Passerella iliaca canescens*; dash and dot, *Penthestes gambeli inyoensis*; short dash, *Sitta carolinensis tenuissima*.

several races are confined. These races are not more extremely developed in the Inyo sector than elsewhere. Their boundaries are most likely to coincide closely here because of the sharp westward limitation of habitats along the east side of the Sierra Nevada.

Museum of Vertebrate Zoology, Berkeley, California, August 25, 1941.