

A DISCUSSION OF FAUNAL INFLUENCES IN SOUTHERN ARIZONA

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In a paper entitled "Faunal Areas of Southern Arizona: A Study in Animal Distribution"* Mr. Harry S. Swarth presents a complete, annotated list of the specimens collected by representatives of the California Academy of Sciences in brief trips to the vicinity of the Santa Rita Mountains of Arizona in the late spring and early autumn of 1927. The notes appertain mainly to local distribution, with frequent systematic comments and occasional remarks on plumages and molts.

Prefacing these notes is a discussion of the "Western Desert Area" and the "Eastern Plains Area", whose faunas Swarth finds differentially characterized by certain avian and mammalian forms. Appended is a bibliography of pertinent literature and six excellent plates from photographs taken by Mr. Joseph Mailliard. The latter seem particularly well selected to illustrate the types of terrain with which the paper deals.

Mr. Swarth observes that the contiguous limits of these more or less dovetailed Eastern and Western Areas present no tangible barriers, though, associationally, lower altitudes (100 to 4000 feet) and shrub-and-cactus-covered desert to the westward may be distinguished from higher (4200 to 5000 feet) grassy plains to the eastward. The Santa Rita Mountains mark the meridian that fairly divides these two areas. Three other faunal units for Arizona are suggested: a "Central Plateau Area", a "Northeastern Desert Area", and that area north and west of the Colorado River for which no name is proposed. The earlier "Tracts" distinguished by Mearns are rejected as untenable.

Many valuable data are presented in Swarth's usual painstaking manner and his discussion of faunal conditions is concise and to the point, rather too much to the point, it seems to me, on the basis of the species which he uses as indicators, though he explains in various ways that a number of the species do not actually respect the "intangible barrier" that he has laid down for them.

The Zonal Concept. Swarth and I seem to have evolved in our respective minds two very different pictures of faunal influences in southern Arizona. Part way up slope, where grassy lands begin, Swarth draws his faunal boundary. Birds down slope he groups as one fauna, those up slope as another. Because both are composed mainly of Lower Sonoran forms he concludes that some non-zonal factor erects an intangible barrier between the two. My concept, derived, as is Swarth's, from numerous journeys to various parts of the state for the purpose of collecting vertebrates and of studying faunal problems, is purely one of zonal and subzonal controls, everywhere responsive to topographic and meteorologic variations. Each species of bird and mammal responds in its own way to the several associational factors present, so that the local and the limital range of no two quite telescope.

Zoogeography. These several associational factors concern the vertebrate fauna mainly as they supply it with food, water, shelter, and a nursery for young. Since style of food, style of shelter, and style of nursery are dictated for each species by innate impulses, and food, shelter, and nursery are for the most part products of vegetation, Nature's differentiation into floral belts or subzones exerts a positive control on the vertebrate fauna.

Factors of gradient and exposure, soil content, surface and subsurface irriga-

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tion, humidity and aridity, which influence floral horizons, all yield ultimately to and hence are primarily controlled by their position in respect to altitude and to latitude. In no state that I know of, with the possible exception of California, is there such a complete exposition of zonal factors as in Arizona. In no other state do we find the fusing ground of three, at least, great faunas.

Involved in the zoogeography of the region are assemblages of species which have probably long been indigenous, and mixed with them are other assemblages of species which appear to be more recently immigrant from outside this region. These immigrations, if I see aright, have not been by groups or faunas, which advanced together or are advancing together along an event front, as Swarth's intangible barrier might lead one to suppose. Nor do the indigenous assemblages, in the light of additional data herewith submitted, appear to have been controlled by his barrier any more consistently.

To any one who has worked afield in Arizona, its faunal problems, even in the lowlands, seem legion. So localized are many of the birds and mammals, owing to the variety and abrupt delimitations of floral associations, that one may work almost on the edge of the habitat of a species and fail utterly to sense its presence. The presence or absence of a given species in any given area, therefore, becomes a matter of exploring every niche within the area, a thing which, to date, has been done very meagerly in southern Arizona. Most of such activities, so far as published records tell, have been confined to a narrow strip between the Santa Catalina Mountains on the north and the Huachuca Mountains on the south. On a few scattered records must one who has not visited the border regions to the east and to the west of this strip base his concept of its probable faunas or lack of faunas.

Topography and Associations. Altitudinally, Arizona extends from sea level to spectacular heights of boreal aspect. It has vast drainages south, vast drainages north, and vast drainages west, with their attendant gradient problems complicated by changing altitudes and latitudes.

Beginning at sea level in the southwestern corner of the state one has only to follow up stream via the Gila and its tributaries, and out of the stream beds onto the attendant slopes, to encounter every zone, subzone, and association which occurs in the southern half of Arizona. As he proceeds up gradient he encounters, traverses, and leaves behind, association after association and belt after belt of characteristic floras, and with them their characteristic faunas. Gradiental variations and stream beds carry long fingers of lower or higher associations above or below the belts they occupy on other gradients and away from the streams.

Succession of Subzonal Associations. Perhaps no better example of subzonal associations and their altitudinal successions can be found than about the Santa Catalina Mountains near Tucson. Here at one place or another one finds most of the elements, associational and faunal, which Swarth attributes to his two Areas. At the base of the east slope is the San Pedro River. Along its stream bed are the usual cottonwoods and willows. On the alluvial shelf along side is the belt of mesquite forest. At the base of the slopes this suddenly yields to giant cactus, palo verde, and dwarf mesquite. Up slope the giant cactus dwindles in size and finally disappears, to be succeeded by dense and almost pure stands of cholla cactus. Higher, on the mesa benches are grassy areas dotted with tree yuccas and cactus. On the northwest slopes the grass areas are more extensive. A little higher are the oaks, and so on through the various zonal indicators as one climbs.

The Sulphur Springs Valley reverses the floral characteristics of the San Pedro

and the Santa Cruz valleys, since its drainage is to the southward. Mesquites in its northern portions are mere shrubs, but at its southern and lower end large mesquite trees accompany the Whitewater River and, if one travelled on down drainage toward the Rio Yaqui, I dare say that a belt of giant cactus would ultimately appear just as a giant cactus belt appears as one descends the San Pedro drainage to the northward.

Reversed Characteristics. The Sulphur Springs Valley in Swarth's Eastern Plains Area exhibits much the same floral characters, including grassy slopes, that occur on the high benches of the Catalina Mountains at the same altitudes. Had Swarth searched these benches of the Catalinas he would have found some of the birds, such as Horned Lark and Scaled Quail, with which he characterizes his Plains Area. On the other hand, had he traversed the lower portion of the Sulphur Springs Valley he would probably have envisioned, as I do, a Tucson fauna along the upper and lower reaches of the Whitewater River. When Drs. Stone and Wetmore and I were there for a day in early July, 1919, we found such representative birds as White-winged Dove, Blue Grosbeak, Lucy Warbler, and Least Vireo.

Again, I cannot believe that Swarth is correct in his expressed opinion that there are no faunally important grassy plains and slopes in the elevated valleys along the border plateau west of his intangible barrier. A journey taken along the Altar Valley and on south in 1884 by that intrepid and now venerable collector, Mr. Frank Stephens, is illuminating in this connection. Its anecdote is related in the Auk for 1885 (vol. 2, pp. 225-231). Mr. Stephens tells of taking on one side or the other of the border such grass loving birds as *Colinus ridgwayi* (type), *Callipepla squamata*, *Otocorys*, *Peucaea arizonae*, *P. cassini*, and *P. carpalis* (to copy the terminology then used).

Recurrence of Associations. No one will question Swarth's observations that there is much faunal and floral difference between the east and the west slopes of the Santa Ritas, but the same is true of the opposite basal slopes of any of the higher ranges of southern Arizona, and the associations which distinguish the two sides of the Santa Ritas recur again and again in the regions to the east and to the west of these mountains and with each its characteristic birds.

Complications. It seems to me that if we are to differentiate a Western Desert Area from an Eastern Plains Area, as Swarth does, or a Western Desert Tract from an Elevated Central Tract, as did Mearns, we must define these tracts by isotherms which will wind in and out of valleys and around mountain ranges in direct coordination with zonal associations. For Mearns's Tracts this would be about the 1600 foot level and would circle a lower basin area. Swarth's line would wind north and eastward to the upper Gila and westward from the Santa Ritas to encircle the border plateau west of the Baboquivaris and back southeastward in northern Sonora: that is, when he has more accurately fitted his associations and his faunal representatives to the regions of their known occurrence. If we accept Swarth's Areas they must be cut out of Mearns's Tracts without replacing them. If we accept either we must accept a dozen other faunal areas just as valid, but as purely subzonal as are the ones under criticism.

Additional Data. Aside from my belief that Swarth's two areas owe any faunal differences which they possess to purely subzonal factors, it seems to me that the following pertinent data tend to challenge the restricted ranges assigned to the species that he has used as indicators. To simplify presentation of these data I have

used tabulated annotations. In the first column Swarth's lists are repeated, and in the second column evidence is submitted that these species are inhabitants of the "Area" from which he excludes them.

Eastern Plains Area	Western Desert Area (Typified by Altar Valley and Tucson)
<i>Colinus ridgwayi</i>	Most of the Arizona records are from the Altar Valley.
<i>Callipepla squamata</i> , subsp.	Found by Stephens both in the Altar Valley and about Tucson.
<i>Buteo swainsoni</i>	Stephens found it breeding in the Altar Valley.
<i>Otocoris a. adusta</i>	Stephens reports on <i>Otocorys</i> from the Altar Valley. Bruner confirms its presence there. The species appears to breed on the grassy mesas west of the Catalinas.
<i>Corvus cryptoleucus</i>	Common about Tucson. Bruner reports it along the Baboquivaris.
<i>Sturnella m. hoopesi</i>	Whether <i>S. neglecta</i> breeds at all in southern Arizona is open to question. On the other hand, I am not willing to believe that Meadowlarks do not now breed in the alfalfa fields about and west of Tucson.
<i>Aimophila carpalis</i>	Many of the recorded specimens were taken about Camp Lowell among the mesquites. Others south of the Baboquivaris.
Western Desert Area	Eastern Plains Area (Typified by Sulphur Springs Valley)
<i>Lophortyx g. gambelii</i>	Common in the brushy areas and in all the lower canyons on both sides of the Chiricahuas. J.E.L. collection.
<i>Melopelia a. trudeaui</i>	Abundant breeder in Rucker Canyon.
<i>Scardafella inca</i>	Occurs in Rucker Canyon.
<i>Asturina plagiata</i>	Occasionally seen (twice by me) in the Chiricahuas during breeding season.
<i>Micropallas w. whitneyi</i>	Occurs in the oak region on both east and west slopes of the Chiricahuas. Parents and young in J.E.L. collection.
<i>Dryobates s. cactophilus</i>	Common everywhere that yuccas and mesquites occur. Both shrubs are a conspicuous part of the landscape. J.E.L. collection.
<i>Corvus c. sinuatus</i>	By no means rare along the base of the Chiricahuas. J.E.L. collection.
<i>Sturnella neglecta</i>	Great numbers frequent the Sulphur Springs Valley in the cooler months. J.E.L. collection.
<i>Cardinalis c. superbus</i>	It is not demonstrated that these two do not both occur along the Whitewater.
<i>Pyrrhuloxia s. sinuata</i>	Occurs along the base of the Chiricahuas.
<i>Guiraca c. interfusa</i>	J.E.L. collection.
<i>Piranga r. cooperi</i>	Another probability in Rucker Canyon.
<i>Vireo bellii</i> , subsp.	Present in Rucker Canyon in July.
<i>Vermivora luciae</i>	Present in Rucker Canyon in July.
<i>Dendroica aestiva</i> , subsp.	Present in Rucker Canyon in July.
<i>Polioptila m. melanura</i>	Occurs in the Sulphur Springs Valley in winter, at least. J.E.L. collection.

Status of Remainder. This leaves unchallenged from Swarth's list of faunal indicators:

Eastern Plains Area
Agelaius p. nevadensis
Ammodramus s. bimaculatus
Petrochelidon l. melanogastra
Toxostoma c. curvirostra

Western Desert Area
Agelaius p. sonoriensis
Melospiza m. saltonis
Petrochelidon l. lunifrons
Toxostoma bendirei
Colaptes c. mearnsi
Myiarchus t. magister

Of these, two, at least, when exhaustive search is made, may be found to have wider range than is now supposed. These are *Toxostoma bendirei* and *Ammodramus s. bimaculatus*. I think it probable that the latter may once have bred in the Altar Valley, even though it may have by now disappeared from there owing to destruction of the cover which it frequents. I question if anyone has worked the Altar Valley intensively enough to establish its absence from there. Careful search may reveal *Toxostoma bendirei* in the San Pedro and Whitewater watersheds, though the probabilities are confessedly less.

Colaptes c. mearnsi and *Myiarchus t. magister* seem to be peculiarly limited in their distribution to the vicinity of the giant cactus, a control which for reasons already stated must be regarded as subzonal.

Perhaps the two subspecies of *Agelaius* and of *Petrochelidon* support Swarth's contention, though, until we know more about these forms south of the border, their derivation is uncertain. *Petrochelidon l. melanogastra* has undoubtedly come from the south. The subspecies of *Agelaius* which Swarth refers to *nevadensis*, may likewise prove to have closest relations with forms farther south. Since no barriers restrain either species, the two Arizona forms of each are unquestionably in contact and the line of fusion will travel with the dominant form.

That is, if we accept as demonstrated these finer analyses on the conclusions of which two taxonomists so rarely can agree. One cannot but be impressed by Swarth's naïve discovery that diagnosis of some recently named Black Phoebes rests on the difference between museum-seasoned skins and fresh skins. Hear! Hear! Is it possible that this is only an isolated case among the latter day epidemics?

Conclusion. While there is room for diversity of opinion with regard to the definition and characterization of Arizona's varied faunas, it seems to me that an attempt to assign faunal definition to any broad section is exceedingly precarious. This, for the reasons that habitats are everywhere spotty and that representatives of any lowland species of bird are pretty sure to recur wherever the association they demand occurs. The floral associations which control bird distribution in southern Arizona must be considered as mainly a matter of altitude and of water supply, since at one place or another about any mountain range of the region each of the various soils and slope exposures are apt to occur. In other words, the faunas in southern Arizona today appear to be controlled by zonal and subzonal factors too complicated and too recurrent to permit of unchallengeable definition of even a single valley as characteristic of a faunal area.

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