A COMPARISON OF THE AVIFAUNAS OF SANTA CRUZ AND SANTA ROSA ISLANDS, CALIFORNIA

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Santa Cruz and Santa Rosa islands, the two largest members of the northern Channel Islands off the coast of southern California, lie 19 and 27 miles, respectively, from the nearest points of the mainland. Between Santa Cruz Island and the coast, Anacapa Island intervenes and is only 12 miles offshore. These islands, with San Miguel, the westernmost member, are a continuation westward of the Santa Monica Mountain uplift, and the channels between the units along this axis are nowhere more than 750 feet deep; all but the easternmost are only 180 feet deep. Almost certainly the islands have been connected with the mainland at periods in the Pleistocene time. Both the greater separation of Santa Rosa from the mainland and its position to windward of Santa Cruz in this island chain would appear to make it more difficult at present for birds from the mainland to disperse to it than to Santa Cruz. Yet the fact that Santa Rosa lies only six miles away from Santa Cruz points to the probability of a close similarity in the avifaunas of the two.

Santa Rosa Island is approximately the same area as Santa Cruz, so that difference in size does not appear to be a factor in causing differences in the birds. More important is the fact that the terrain of Santa Cruz is more rugged than that of Santa Rosa and that there is an inland valley lying between two main east-west ridges that is sheltered from winds and coastal influences. However, habitat types for terrestrial birds on the two islands are more similar than has generally been supposed. Both have grassland, chaparral (both tall and open, and low and wind-cropped), oak woodland, and an artemisia-opuntia (cactus)-grass association. Pines are present on both islands and on Santa Cruz in a few places form dominant stands which, however, evidently are not of sufficient extent to harbor breeding populations of pine forest birds as was at one time thought might prove true (Howell and van Rossem, Condor, 13, 1911:209-210). The pines on Santa Rosa are so few as to be ecologically unimportant to resident birds. There is a decided difference in the proportion of the areas of the several habitats on the two islands, although this cannot be expressed in exact terms at this time. Oak woodland is much more limited in extent on Santa Rosa, being confined to the eastern fourth of the island and chaparral is less plentiful and is more often low and windswept than on Santa Cruz. But there are canyon bottoms and slopes on Santa Rosa where these habitats cover many acres and appear qualitatively identical with the same habitats on Santa Cruz. Conversely grassland is much more extensive on Santa Rosa. The artemisia-opuntia-grass association is perhaps roughly of equal amount on the two.

Santa Cruz Island has been visited many times and its avifauna is well sampled; yet almost every visit to it by an ornithologist yields further information. A prolonged ecologic study on this island by a resident worker would certainly be rewarding. On the other hand Santa Rosa Island has been only rarely visited by bird students. C. H. Townsend visited the island on January 7, 1889, and reported 13 specimens taken. Clark P. Streator collected there from July 1 to 3, 1892, and George Willett observed a few birds on June 9, 1910. Much the best list of birds for this island was presented by Pemberton in 1928 (Condor, 30:146-148) as a result of a visit by him and H. W. Carriger, Dudley DeGroot, and O. W. Howard to the eastern section on April 2, 3, and 4, 1927. Apparently no skins were collected by them. Willett and others from the Los Angeles Museum made other trips to Santa Rosa but reported only on the systematics of the Allen Hum-

mingbirds and Song Sparrows which were obtained (Willett, Bull. So. Calif. Acad. Sci., 44, 1945:51-54). The scanty attention given Santa Rosa and the presumption that its avifauna would be similar to that of Santa Cruz have lead to oversight of some significant differences. Moreover, there has been a necessary dependence on single reports of occurrence derived from hasty visits, which understandably has obscured certain contrasts in the dominantly established terrestrial species on the two land areas.

In March of 1950 I had the good fortune to visit Santa Cruz and Santa Rosa islands as a member of the staff aboard the research ship "Orca." For this opportunity and for many courtesies and aid rendered, I am much indebted to Mr. J. W. Sefton, Jr., and the J. W. Sefton Foundation. For the privilege of landing and working on the islands and for hospitalities extended I should like to thank Messrs. Edwin L. Stanton, Ed. N. Vail and Al. Vail. John R. Hendrickson also was most helpful in carrying out the field work. The days of March 5, 6, 7, 11, and 12 were spent on Santa Cruz, visiting Prisoner's Harbor, the Stanton Ranch in the central valley, Forney's Cove on the west end and Willows Anchorage on the south side. March 8, 9, 10, and 13 on Santa Rosa permitted work on Black Mountain, the hills back of Becher's Bay, and at East Point. It will be seen that we crossed back and forth between adjacent points of the two islands and had opportunity for repeated verification of certain contrasts in the avifaunas.

The most impressive differences in the resident birds were those in the sparrows, jays, and shrikes. With respect to resident sparrows, it was at once evident that the artemisia-opuntia-grass association on Santa Cruz was well and exclusively populated by the Rufous-crown (*Aimophila ruficeps*) whereas across the channel in identical vegetation and on the same type of sloping terrain on Santa Rosa nothing but Song Sparrows (*Melospiza melodia*) occurred. This habitat is a normal one, in terms of mainland conditions, for Rufous-crowned Sparrows. But, the island population of the endemic race *A. r. obscura* is, I think. somewhat more dense in it than is the population of the southern Californian coast. On Santa Rosa the Song Sparrows of the race *M. m. clementae* occupy this cover without limitation to stream courses or canyon bottoms in a way not done by the mainland race of southern California even on slopes facing the ocean. Song Sparrows have spread out ecologically, so to speak, to occupy the habitat of *Aimophila* and at times situations remindful of that of the resident White-crowned Sparrows (*Zonotrichia leucophrys nuttalli*) of the coast of San Luis Obispo County. It is rather clear that with lack of competition from somewhat similar kinds of sparrows and with a range of adaptability, quite possibly enhanced by inherent adaptive changes, *Melospiza* has come to dominate an unusual range of vegetative conditions on Santa Rosa. The foggy climate of the island doubtless is an aiding factor, enabling the moisture-seeking Song Sparrows to occupy brushlands near the sea as do other races much farther north in an even more humid belt. Yet it should not be forgotten that on the adjoining point of Santa Cruz Island in equally fog-swept cover Song Sparrows are absent.

If it is granted that this contrast is real, what is the significance of the existing records of Song Sparrows on Santa Cruz? Before 1900 this species was collected there on several occasions in the nesting season (Mailliard, Bull. Cooper Ornith. Club, 1, 1899:44; Beck, *ibid.*:86) but only in a very few places and apparently always in canyon or valley bottoms near streams. Not once has an actual nesting been reported, which is remarkable inasmuch as W. L. Dawson often visited the island hunting persistently for the nests of island endemics. Pitelka (MS) in September of 1948 found but one Song Sparrow at Prisoner's Harbor. I could find none there or along the stream system draining the central valley, although I did not hunt extensively for them in this valley. There is probably little doubt that a few pairs have and may still breed on the island, along

stream courses, as does *M. m. cooperi* on the mainland. But my experience, as also that of other visitors, early and more recent, when carefully reviewed, make it clear that the Song Sparrow is not a dominant species on the island and indeed is apparently lacking in the artemisia-opuntia-grass and chaparral habitats.

Concerning the presence of *Aimophila ruficeps* on Santa Rosa Island, we have only the report by Pemberton (Condor, 30, 1928:148) that O. W. Howard noted a pair on April 2, 1927. No record specimen was taken and there is a chance of misidentification. After my failure to note these sparrows on my first day ashore on Santa Rosa, I searched specially, exploring the most suitable places and squeaking for them, as I had done successfully on Santa Cruz. Not one could be found. I am led to think that if Howard was not actually mistaken, they are rare and certainly not a dominant resident on Santa Rosa, in spite of the presence of suitable habitat.

Another sparrow looked for carefully on Santa Rosa was the Bell Sparrow. If present, they like the Song Sparows and the Rufous-crowns of Santa Cruz should have been singing and conspicuous in their breeding activities. No trace of them was detected in the most likely appearing brushlands. I am inclined to doubt, therefore, the significance of the single previous record by Willett in 1910 (Condor, 12, 1910:171). He noted Bell Sparrows commonly in the brush at Johnson's Lee when ashore a few hours in June, but he made no mention of Song Sparrows, which must have been common there as they were in 1949 at East Point. Song Sparrows of this island race with their long tails and rather sparse ventral striping do not look just like mainland Song Sparrows and more often undertake long flights between bushes. Could Willett, as did Cooper on Santa Barbara Island, even with specimens in hand (Howell, Pac. Coast Avif. No. 12, 1917:79), have mistaken Song Sparrows for Bell Sparrows? In any event, in the absence of substantiating records and in view of the failure of both Pemberton's party and our party to find Bell Sparrows, we should not conclude that they are breeding residents of Santa Rosa. They have never been reported on Santa Cruz.

It is of course well known that the distinctive island form of Scrub Jay (*Aphelocoma coerulescens insularis*) is confined to Santa Cruz Island. Other groups, like ours, have looked carefully for jays on Santa Rosa and the Vail family fully corroborated the fact that they are absent. Yet within sight of Santa Cruz on the east slopes of Santa Rosa there are oak and brush-filled canyons that are ideal for this species.

Possibly related to the absence of jays is the fact that Loggerhead Shrikes seem much more numerous on Santa Rosa Island than on Santa Cruz. Shrikes of course occur regularly on Santa Cruz, but one must search particular areas, chiefly about the ranches, for them. On my recent trip I saw none, although I took one in 1922. Contrarily, on Santa Rosa shrikes were seen every day, not only about the ranch at Becher's Bay, but in the canyons, perched over brush patches and at the edges of oaks, places that on Santa Cruz would have been used by jays, although with more attention by them to the brush and oak cover itself than in the shrikes. Five shrikes were taken in one morning and at least nine additional individuals were detected in the days I was ashore on Santa Rosa.

Notable absentees other than jays in the brush and oaks on Santa Rosa were Bush-tits (*Psaltriparus minimus*) and Anna Hummingbirds (*Calypte anna*), both of which are resident on the other island. DeGroot (Pemberton, *op. cit.*:147) saw an Anna Hummingbird on Santa Rosa in April and there is no reason to doubt that the species visits the island. Yet there was no indication in March of 1949 that a breeding population was present. Territorial males would certainly have been in evidence as they were on

Santa Cruz and as were Allen Hummingbirds on both islands. Some doubt has been entertained, indeed, that the Anna breeds on Santa Cruz (see Grinnell and Miller, Pac. Coast Avif. No. 27, 1944:219), but this now is fully removed by the fact that a female with an egg in the oviduct was taken on March 6 in an area near where singing males were common in the central valley.

Certain points concerning the differentiation of island races have been determined by study of the material taken. It has been logical to assume that island endemics occurring on Santa Rosa and Santa Cruz were the same. The new material bears this out for the Allen Hummingbird (*Selasphorus sasin sedentarius*), the Horned Lark (*Eremophila alpestris insularis*), the Loggerhead Shrike (*Lanius ludovicianus anthonyi*), the Orange-crowned Warbler (*Vermivora celata sordida*), and the Song Sparrow (*Melospiza melodia clementae*). Differences appear, however, in the samples of Bewick Wrens (*Thryomanes bewickii*), House Finches (*Carpodacus mexicanus*) and Spotted Towhees (*Pipilo maculatus*).

Bewick Wrens taken on Santa Cruz by Pitelka and me generally confirm the distinctness of *T. b. nesophilus* named from that island, although the race is not strongly differentiated in its dark color of the back and flanks from *correctus* of the mainland; the tail of *nesophilus* is usually relatively short as shown by Swarth (Proc. Calif. Acad. Sci., ser. 4, 6, 1916:53-85). Oberholser (Proc. U. S. Nat. Mus., 21, 1898:442) in describing this race apparently had only one July-taken adult female and two juveniles from Santa Rosa. No one since has reported on material in better plumage from this island to substantiate the inclusion of it in the range of *nesophilus*. In 1900 Oberholser (Proc. U. S. Nat. Mus., 22:234) did mention that the two juveniles were paler than juveniles from Santa Cruz. The March-taken material obtained in 1950 consists of plumages that are only moderately worn; the birds were in the early part of the breeding season, with the females just laying. Six of seven skins from Santa Rosa are distinctly grayer and lighter on the back than four from Santa Cruz taken in the same week. The other is a perfect match for the Santa Cruz specimens. The measurements of wing and tail show that with one exception (another individual) the tail is shorter than the wing, a characteristic of *nesophilus* in contrast to *T. b. catalinae* and *T. b. correctus*. The bill is not long as in *catalinae*. It is to be realized that there is some overlapping in all the characters of the races of wrens mentioned.

We may conclude, then, that the Santa Rosa wrens, although showing some departures from *nesophilus* are not worth naming as a further slightly differentiated subspecies. The color of all but one of the birds is much like that in *correctus* and *catalinae,* but the dimensions relate them to *nesophilus*. For practical purposes they may be called *nesophilus* but probably if this form had never been described we would include them in *correctus* without much concern. The significant fact is that this slight amount of distinction in color of the Santa Rosa and Santa Cruz wrens relates the former more closely to the mainland birds than is true of the Santa Cruz birds in spite of the more isolated position of Santa Rosa Island. It is not impossible that the color of the Santa Rosa wrens is actually a parallel or converging differentiation toward the mainland type after a history of derivation from the neighboring *nesophilus* stock of Santa Cruz. The species is absent on San Miguel and this suggests that the most probable avenue of dispersal of this weak flying species to Santa Rosa has been via Santa Cruz and Anacapa either when they were part of a peninsula or while they were islands. Of course it is also possible that there has been a chance dispersal over water to Santa Rosa directly from the opposite mainland some time in the past.

Material from Santa Rosa has apparently not been examined in later studies of the problem of inclusion, or exclusion, of the House Finches of the northern Channel Islands in the insular race *Carpodacus mexicanus clementis* (see van Rossem, Condor, 27, 1925: 176-177; Willett, Pac. Coast Avif. No. 21, 1933:162; Moore, Condor, 41, 1939:193). I am inclined to regard large bill size as the best character of *clementis*. Two males taken on Santa Rosa are as large billed as any in a large series from San Clemente Island. Another male and a female are normal for *C. m. frontalis* in bill size, although the latter is heavily streaked as frequently is true of females of *clementis*. Six males from Santa Cruz are normal for *frontalis* in bill size and the females are not especially heavily streaked. It is probably best to continue to designate all the island birds of the northern chain as intermediates closest to *frontalis* but to note that thus far in the Santa Rosa material there is more indication of the characters of *clementis*, a situation not unlike that in the House Finch population on Santa Barbara Island.

The Spotted Towhees of Santa Rosa have been thought by Howell (Pac. Coast Avif. No. 12, 1917:86) to be *Pipilo maculatus clementae* and, more logically on geographic grounds, by Swarth (Condor, 15, 1913:171) to be *P. m. megalonyx* as on Santa Cruz and the mainland. The species was abundant on Santa Rosa and eight males and three females were taken. These prove rather conclusively to be *clementae* in spite of "geographic logic." When specimens were separated by age (see Sibley, Univ. Calif. Publ. Zool., 50, 1950:114) and sex and compared, they showed much grayer, less black, dorsal coloration than in *megalonyx* and matched satisfactorily birds from Santa Catalina and San Clemente islands. They also showed the longer tarsi of *clementae* (see measurements by Swarth); I am not able to confirm a consistent difference in bill size between *megalonyx* and *clementae*. My examination of material from Santa Cruz Island again substantiates its identity with *megalonyx*. The Santa Rosa towhees do have call notes like those of the mainland and Santa Cruz birds and unlike those of *clementae* which are strikingly different and more jay-like in quality. This differentiation, even if it is genetic, does not negate the structural affinity of the Santa Rosa birds with *clementae*. In other groups vocal differentiation does not necessarily closely parallel other types of differentiation.

The towhees of Santa Rosa, then, like the Song Sparrows and also possibly to a slight extent the House Finches, indicate racial affinities toward populations on the more southern Channel Islands. There is a moderate submarine elevation that extends from Santa Rosa Island southward toward but not all the way to the southern islands that may represent an old line of land approach. Possibly an especially direct involvement of Santa Rosa in such a southward extension in the past is an element in history that still shows its effect in the affinities of the Spotted Towhees and Song Sparrows.

Summary.—As a background appropriate to a review of the differences in the avifaunas of Santa Cruz and Santa Rosa islands, a list of the native terrestrial breeding birds common to the two is useful. Excluded from this list, which follows, are a few species whose breeding status on one or both islands is particularly doubtful, although included are some for which there is merely strong presumptive evidence of nesting.

Buteo jamaicensis calurus
Haliaeetus leucocephalus leucocephalus
Falco peregrinus anatum
Falco sparverius sparverius
Zenaidura macroura marginella
Tyto alba pratincola
Speotyto cunicularia hypugaea
**Selasphorus sasin sedentarius*
[1] *Colaptes cafer collaris*
Balanosphyra formicivora bairdi
Sayornis nigricans semiatra
[1,2] *Empidonax difficilis difficilis*
**Eremophila alpestris insularis*
[2] *Hirundo rustica erythrogaster*
Corvus corax sinuatus
**Thryomanes bewickii nesophilus*
Salpinctes obsoletus obsoletus
Mimus polyglottos leucopterus
**Lanius ludovicianus anthonyi*
[1] *Vireo huttoni huttoni*
**[2] Vermivora celata sordida*
Sturnella neglecta
Carpodacus mexicanus frontalis
Spinus psaltria hesperophilus
[2] *Spizella passerina arizonae*
**Melospiza melodia clementae*

*An insular endemic race.
[1] An insular race has been proposed but is not substantiated by examination of new and old material.
[2] Migrates to and from the mainland regularly.

Compared with this list of 26 forms that are present on both islands, the following points of difference may be summarized from the foregoing discussions. Santa Rosa Island lacks breeding populations of four species present on Santa Cruz: *Calypte anna, Aphelocoma coerulescens, Psaltriparus minimus,* and *Aimophila ruficeps*. Ecologic contrasts in dominance or abundance involve two additional species: *Melospiza melodia* and *Lanius ludovicianus,* both dominant or at least common on Santa Rosa in the absence of species possibly partly competitive that are present on Santa Cruz. A difference in racial characters of *Pipilo maculatus* of the two islands and two slight trends of differentiation involving *Thryomanes bewickii* and *Carpodacus mexicanus* reflect distinctness of the populations of these species on the two land areas.

The differences in the avifaunas are somewhat more numerous than previously thought. Most of them do not seem explicable clearly on the grounds of habitat differerences on the two islands but rather by the vagaries of insular dispersal or island hopping and particularly by the somewhat more isolated position of Santa Rosa from the mainland, the actual gap isolating it from Santa Cruz, and the prevailing wind direction working against movement from Santa Cruz to Santa Rosa. A possible former relation of Santa Rosa to the southern Channel Islands more directly than was true of Santa Cruz may have had some influence on the avifaunal differentiation.

MISCELLANEOUS RECORDS

Additional data on permanent residents. Santa Rosa Island.—Actual nests of Black Phoebes were seen in canyon cliffs; it had been merely assumed before that this species nested here. A Burrowing Owl was taken, substantiating the reports of the ranchers on the island that the species is established on it.

Santa Cruz Island.—Acorn Woodpeckers were noted near the Stanton Ranch on March 6, substantiating Pitelka's view (Condor, 52, 1950:43) that they are resident. A Saw-whet Owl (*Aegolius acadicus acadicus*) was taken on March 6 in a large dense oak grove at the base of a hillslope in Cañon del Puerto. It was a male with testes 6 mm. long that had started calling of its own volition in the late afternoon after the sun had left the oak grove. This occurrence and Hoffmann's sight record (Condor, 33, 1931:171) of a Saw-whet Owl on April 15, 1931, makes it seem likely that the species breeds on the island. At the same time of year Saw-whet Owls are underway with nesting in oak and madrone woods in the San Francisco Bay region and are calling similarly. The size of the testis of the island specimen is normal for birds of this species taken in the middle of the nesting season. Killdeers (*Charadrius vociferus*) were present along the stream

at Prisoner's Harbor and apparently were stationed for nesting. This tends to support Pitelka's surmise (*loc. cit.*) that the species is resident on the island. California Quail (*Lophortyx californica*) have been planted on the island in recent years, but this has not been reported in the literature. They are said to be Catalina Island stock and specimens verify identification with the island race *catalinensis* as is true also of those planted on Santa Rosa. Quail were seen on Santa Cruz near the Stanton Ranch and also at Willows Anchorage, 3 miles southwest across a high ridge, and they were noted commonly on Santa Rosa.

Data on winter visitants. Santa Rosa Island.—Specimens of the Mountain Bluebird and Blue-gray Gnatcatcher were taken and examples were seen of the following: Black Brant, Blue-winged Teal, Ancient Murrelet, Ruby-crowned Kinglet, and Purple Finch. None of these has been specifically reported from the island or its shores before.

Santa Cruz Island.—Specimens were taken of the White-crowned Sparrow of the race *Zonotrichia leucophrys pugetensis* on March 6 near the Stanton Ranch, of the Red-backed Sandpiper at Forney's Cove on March 12 and of the Black-chinned Sparrow on March 11 at Willows Anchorage. The last was one of a scattered group of at least four of this species that on this day were seeking retreat from the wind in dense low patches of opuntia on a flat a little above the bottom of a wash. Occasionally they sang but only once in the heavy wind could I see one. The bird taken proved to have the dark gray coloration above and below and the dull brown back color of *Spizella atrogularis caurina*. Its measurements are not diagnostic for this subspecies but neither do they preclude it whereas the color characters are extreme. This record is the first information obtained concerning the winter range of this rare race which breeds in the coast ranges of California from Alameda County to San Benito County. Surf Birds were seen at Forney's Cove on March 8, and Red-winged Blackbirds at Prisoner's Harbor on March 7.

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