IDENTIFICATION OF THE SALTON SEA RUFOUS-NECKED SANDPIPER

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On 17 August 1974, G. McCaskie, P. Unitt, J. L. Dunn, and J. Butler discovered and collected a small sandpiper near the mouth of the Alamo River at the south end of the Salton Sea, Imperial County (McCaskie 1975). They identified the bird as a Rufous-necked Sandpiper (*Calidris ruficollis*); the specimen is now number 38887 at the San Diego Natural History Museum. The specific identification of the bird as *C. ruficollis* was influenced by the distribution of previous records; *C. ruficollis* was known to breed in Alaska and had occurred as a vagrant in Ohio and California. The very similar Little Stint (*C. minuta*) had not at the time been recorded in North America. Since the latter species has now occurred several times in North America (A. O. U. 1983), and twice in California (juvenile, Bolinas Lagoon, Marin County, 14-22 September 1983, Roberson 1986; juvenile, Elkhorn Slough, Monterey County, 10-21 September 1985, Campbell et al. 1986, Dunn 1988), a reexamination of the Salton Sea specimen to ascertain whether it is *C. ruficollis* or *C. minuta* seems appropriate. The California Bird Records Committee has not yet published any opinion concerning this specimen; the information I present here may help the committee with its evaluation.

The Salton Sea specimen was in first alternate plumage when collected. In their first summer, *Calidris* sandpipers often grow a partial alternate plumage that is virtually indistinguishable from the basic plumage (Veit and Jonsson 1984, p. 858). A fully adult *Calidris* would not ordinarily *begin* primary molt until August at the earliest (Prater et al. 1977, Cramp and Simmons 1983), whereas this specimen had already replaced all but two of its primaries by 17 August. This replacement pattern is typical of one-year-old birds that summer south of the breeding range.

Prater et al. (1977) cited the ratio of wing length to tarsus length as a diagnostic difference between *C. ruficollis* and *C. minuta*. Unitt (in litt.) pointed out that the Salton Sea specimen should be identified as *minuta* on the basis of this criterion (Figure 1). On the specimen's left wing, the outer (juvenal) primaries have dropped and the new ones have not emerged, so that wing's measurement is meaningless. On the right wing, primaries one through eight have been replaced but numbers nine and ten, which are heavily worn, still remain. The wing chord on the right side measures 80.5 mm, and the specimen's tarsi average 18.4 mm, so the ratio of wing chord to tarsus length is 4.38. Prater et al. (1977) stated that ratios below 5.0 indicate *minuta* whereas ratios above 5.1 indicate *ruficollis*. The degree of wear on the specimen's juvenal primaries, however, casts doubt upon the usefulness of this criterion for classifying this specimen.

Other than the wing:tarsus ratio, there seems to be no single character that definitively separates these two species in basic or first alternate plumage (e.g., Veit and Jonsson 1984). The differences between the two species (overall gray vs. brown tone to upperparts, prominence of shaft streaks in scapulars, wing coverts, and tertials, extent of white on forecrown) are subtle and subject to change through wear. Several ornithologists (G. McCaskie, J. R. Jehl Jr., J. L. Dunn, P. Unitt) having extensive experience with shorebirds have examined the Salton Sea specimen and are unable to assign it confidently to one species or another. Because of this ambiguity, I decided to use multivariate analysis to identify the specimen.

METHODS

To form a basis for comparison, I selected six specimens each of *C. ruficollis* and *C. minuta* from the collection at the Los Angeles County Museum of Natural History (LACM) (Table 1). On each specimen, I measured six characters: (1) tarsus length, (2) wing chord, (3) culmen length, (4) distance from front end of the nares to the bill tip, (5) bill depth at the front end of nares, and (6) bill width at the front end of the nares. I measured each character three times and used the mean of the three measurements in the statistical analysis. I used alternate-plumaged adults, so that the specific identity of each was unquestionable, and used all specimens of *minuta* and *ruficollis* in good condition available in the LACM collection. Because there are approximately equal numbers of males and females present in my selection of specimens, my statistical analyses should not be biased on the basis of sex. Since the specimen in question was at least 11 months old when collected, its bill and

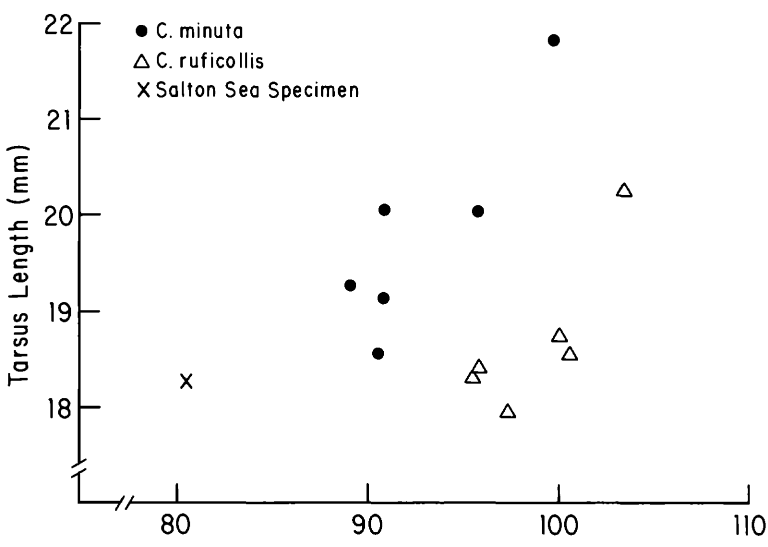

Figure 1. Wing length vs. tarsus length of twelve LACM specimens of the Rufous-necked Sandpiper and the Little Stint and of the Salton Sea specimen.

legs can be assumed to have achieved adult size. It is therefore appropriate to draw comparisons with adult, rather than juvenile, specimens.

I used SYSTAT (Wilkinson 1986), a software package developed for personal computers, to conduct the statistical analyses. Discriminant analysis is the most appropriate multivariate technique for assigning unknown specimens to the correct species (Sneath and Sokal 1973). I performed two discriminant analyses, one using all six variables, and a second with wing length excluded. The second analysis was necessary because the specimen in question is of indeterminate wing length owing to abrasion and feather loss.

In each analysis, the discriminant functions were calculated on the basis of the individuals of known species, and the unknown individual was subsequently assigned to species according to its discriminant score. The coefficients of the discriminant functions are based on standardized values of the original variables, so that SYSTAT gives equal weight to each variable. The null hypothesis, in this case that the two species are indistinguishable on the basis of the measurements taken, is accepted or rejected on the basis of the value of Wilks' lambda (W). W is related to the inverse of the eigenvalue of the discriminant functions by the formula

$$W = 1/(1 + L_i)$$

where L_i equals the eigenvalue associated with the ith function. (In this analysis, there is only one discriminant function because there are only two groups, i.e., species). Thus, values of W near zero indicate high discrimina-

Table 1 Measurements of *Calidris minuta*, *Calidris ruficollis*, and the Specimen from the Salton Sea

Sex	Tarsus	Wing Chord	Culmen	Bill from nares	Bill depth	Bill width
			Calidris minuta			
M	18.6	90.5	16.8	14.0	4.4	3.5
M	19.2	89.1	17.6	14.4	5.2	3.5
F	20.2	95.7	19.1	16.2	4.7	3.4
M	20.3	90.8	17.4	13.9	4.8	3.4
F	21.8	99.7	19.2	15.6	5.1	4.1
F	19.1	90.8	18.2	15.2	4.1	3.1
			Calidris ruficollis			
?	18.7	99.8	18.8	15.2	4.4	4.1
M	17.9	97.2	15.5	12.5	4.1	3.3
F	20.3	103.3	17.9	14.3	3.9	3.6
F	18.3	95.3	16.8	13.4	4.6	3.4
M	18.4	95.5	15.5	12.2	4.9	3.3
F	18.5	100.5	18.4	13.1	4.9	3.4
			SDNHM 38887			
M	18.3	80.5	15.6	12.7	4.3	3.3

tion and values near one indicate low discrimination. The statistical significance of *W* is computed by converting its value to an approximation of the *F* distribution (Klecka 1980).

RESULTS

In both analyses, all of the individuals of known species were correctly classified by the discriminant function. *W* was equal to 0.078 (F = 14.243, p = 0.003) with wing length included, and to 0.219 (F = 4.984 , p = 0.07) with wing length excluded. Thus, these analyses indicate that wing length is the single most useful criterion for distinguishing between the two species. However, since the wings of the Salton Sea specimen are shorter than those of the shortest-winged *minuta* available in the LACM, its classification by this first analysis is uninterpretable. Therefore, I ran the analysis again without using wing length as a variable. The second analysis succesfully classifies all the LACM specimens, although with reduced confidence (Figure 2). In the second analysis, the variables most strongly influencing identification were bill length from nares, culmen length, bill depth, and tarsus length, decreasing in that order. Thus, the second analysis confirmed the field impressions of many observers—*C. ruficollis* has a shorter and stubbier bill than *C. minuta*.

DISCUSSION

Identification of the Salton Sea sandpiper based upon these discriminant analyses alone would be questionable. However, the results of the multivariate analyses *combined* with evaluation of the comparative importance of each mensural character yield, in my opinion, a firm conclusion. Figure 1 shows that the Salton Sea specimen's tarsus is shorter than that of any *minuta* measured at the LACM but within the range of *ruficollis*. Tarsus length is a character much less subject to variability than is wing length. Second, the classification of the Salton Sea specimen by the discriminant scores (Figure 2) makes sense because they are based mainly on bill structure, a distinguishing

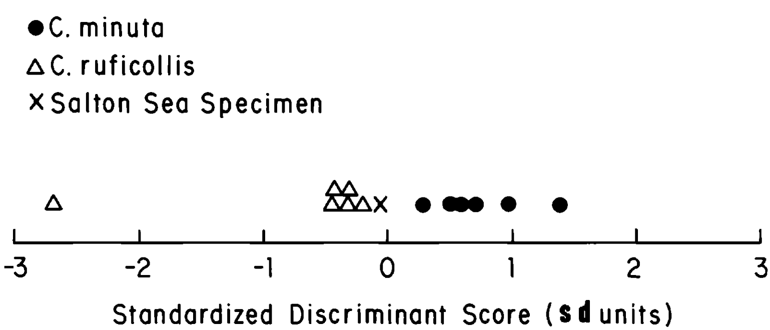

Figure 2. Discriminant scores of same specimens as in Figure 1. Units are standard deviations.

feature that has been cited by numerous authors (Wallace 1974, Jonsson and Grant 1984, Veit and Jonsson 1984). Thus, the Salton Sea specimen is a typical Rufous-necked Sandpiper that, when collected, had abnormally short wings because of abrasion.

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