

WING-STRIPE METRICS FOR IDENTIFYING SUBSPECIES OF THE ROCK SANDPIPER

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ABSTRACT: Identification in formative and basic plumage of two of the three subspecies of the Rock Sandpiper breeding in Alaska—*Calidris ptilocnemis tschuktschorum* and *C. p. couesi*—remains problematic, although a difference in the white wing stripe has been reported qualitatively. For all three of Alaska's breeding subspecies, including *C. p. ptilocnemis*, I used three criteria to quantify the wing stripe on each of the inner primaries and on the outer and middle secondaries of numerous specimens and birds photographed. The white stripe is significantly more extensive in *tschuktschorum* than in *couesi*, and even more extensive in *ptilocnemis*, but there is overlap, especially near the zones of contact between the subspecies. The combined criteria can support subspecific identification, of at least some Rock Sandpipers, even in the formative and basic plumages.

The three subspecies of the Rock Sandpiper (*Calidris ptilocnemis*) known to breed in Alaska (Gibson and Withrow 2015, Withrow 2015, Gill et al. 2020) are nominate *ptilocnemis* on the Pribilof, St. Matthew, and Hall islands; *tschuktschorum* from the Chukotsky Peninsula east along the coast of the Seward Peninsula and the Yukon–Kuskokwim delta to the north side of Bristol Bay, including St. Lawrence and Nunivak islands; and *couesi* along the Aleutian Islands northeast to Ugashik Bay on the northwest side of the Alaska Peninsula, and east to the Shumagin, Chirikof, and Kodiak islands (Figure 1). Zones of contact are presumed to exist between *ptilocnemis* and *tschuktschorum* on St. Lawrence Island, and between *tschuktschorum* and *couesi* in upper Bristol Bay and on the Alaska Peninsula (e.g. Withrow 2015, Gill et al. 2020). In winter these three breeding subspecies largely remain in Alaska (Gibson and Withrow 2015, Gill et al. 2020), although *tschuktschorum* also ranges along the Pacific coast south to northern California, where there is also one photo-supported record of nominate *ptilocnemis* (Pyle 2025), and Paulson (2005) inferred *couesi* may also be a potential vagrant. The subspecies breeding in eastern Russia are *quarta*, which occurs in Alaska only as a probable casual visitor to the western Aleutians in spring (Gibson and Byrd 2007), and *kurilensis*, yet to be documented in North America.

Identification of the three Alaska-breeding subspecies in juvenile and alternate plumages has been detailed by Pyle (2008) and Gill et al. (2020), but in formative and basic plumages the distinction between *tschuktschorum* and *couesi* remains problematic. The subspecies have been reported to differ in the white wing stripe, but only in qualitative terms which are hard to apply with a single bird (e.g. Paulson 2005, O'Brien et al. 2006, Sibley 2014, Dunn and Alderfer 2017, Gill et al. 2020). Here I present three criteria—two previously published and one new—that quantify the differences in the wing stripe on the inner primaries and outer and middle secondaries and can aid identification of the Alaska-breeding subspecies of the Rock Sandpiper in all plumages.

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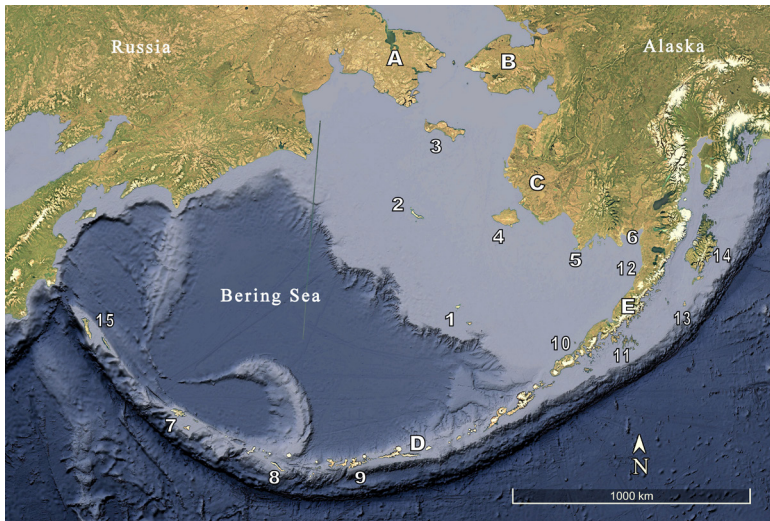


FIGURE 1. Breeding region of the Rock Sandpiper with place names mentioned in the text (letters for geographic areas, numbers for specific locations). A, Chukotsky Peninsula; B, Seward Peninsula; C, Yukon-Kuskokwim River delta; D, Aleutian Islands; E, Alaska Peninsula. 1, Pribilof Islands; 2, St. Matthew and Hall islands; 3, St. Lawrence Island; 4, Nunivak Island; 5, Cape Peirce; 6, Bristol Bay; 7, Attu Island; 8, Amchitka Island; 9, Adak Island; 10, Cold Bay/Izembek Lagoon; 11, Shumagin Islands; 12, Ugashik Bay; 13, Chirikof Island; 14, Kodiak Island; 15, Commander Islands.

Source: Google Earth

METHODS

Since 2020 I have been observing the racial affinity, molt schedules, and plumage aspects of Rock Sandpipers wintering on the lower Kenai Peninsula, Alaska. To support that I examined the extensive collection of Rock Sandpipers in the University of Alaska Museum (UAM), as well as photographs of birds with fully extended wings. Using the feather-numbering scheme in Pyle (2008), I explored quantifiable differences in the wing stripe according to three criteria. First, according to Gill et al. (2020: Appendix A), in *ptilocnemis* the white on the outer vane of the primaries (p) reaches the shaft in p1-p4 or p1-p5, in *tschuktschorum* it reaches or nearly reaches the shaft in p1-p3, but in *couesi* it does not reach the shaft of any primary. Second, according to Pyle (2008), the typical pattern of white on the outer vane of the distal secondary (s1) varies from “extensive” (covering over half the vane) in *ptilocnemis* to “intermediate” in *tschuktschorum* to none in *couesi*. The third criterion involves an approach considered several years ago by Peter Pyle (pers. comm.), an approach I enhanced by quantifying the white stripe through the middle secondaries (s6-s8). In this, I scored the proportion of each feather marked with dark. If a dark mark covered half or more of the portion of the secondary exposed beyond its covert (the white tip and fringe excluded) the feather scored 5, if a mark covered between one half and one

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quarter of the feather it scored 4, if a mark covered roughly one quarter of the feather but more than just a single small patch it scored 2, if the feather bore just a single small dark mark it scored 1, and a feather with no dark mark scored 0 (see examples in Figures 2 to 4). In a few examples the dark mark appeared intermediate between two integer scores, in which case I used a half-integer score for my analysis (e.g., assigned a score of 3.5 if the mark appeared to be between categories 3 and 4).

To improve confidence in the identification of the wing samples reviewed, I considered only specimens or photographs obtained from within the breeding range of each subspecies between mid-May and early July (the breeding period). I inspected 175 specimens at UAM (97 flat wings or study skins with an extended wing and 78 traditional study skins with folded wings), plus photographs of 27 different birds (most at <http://www.macaulaylibrary.org>). The total of 202 samples included 55 of *ptilocnemis* from St. Paul and St. Matthew islands, 47 of *tshuktschorum* from mainland Alaska, Nunivak Island, and St. Lawrence Island, and 66 of *couesi* from the Aleutian Islands (mostly Amchitka Island) and Cold Bay near the southwestern end of the Alaska Peninsula. The set also included 27 specimens from the southeast coast of the base of the Alaska Peninsula (Wide Bay) and the Chirikof Islands to the east of there. These have been considered *couesi* or possibly intergrades with *tshuktschorum*; I treated them as an independent group (see Figure 1 for locations). To further evaluate differences between and possibly within the subspecies, I also divided the samples of *tshuktschorum* into two subsets, consisting of 33 from Cape Peirce west to the Seward Peninsula, spanning the



FIGURE 2. Examples of scores for dark marks on the portion of the secondaries exposed below the tip of the corresponding covert. Values range from 5 for a dark mark covering half or more of the exposed secondary (excluding its white tip and fringe), 4 for a mark covering between one half and one quarter of the exposed secondary, 3 for a mark covering roughly one quarter of the exposed secondary, 2 for a mark covering less than one quarter of the exposed secondary but more than in category 1, 1 for a single small mark, and 0 for a feather with no dark mark. (A) UAM 6861, subspecies *Calidris ptilocnemis couesi*, shows scores (left to right) on s8, s7, and s6, producing a $\Sigma s6-8$ of 8. (B) UAM 6826, also subspecies *couesi*, shows scores (left to right) on secondaries s9, s8, s7, and s6, producing a $\Sigma s6-8$ of 11.

Photographs by Robert L. Scher

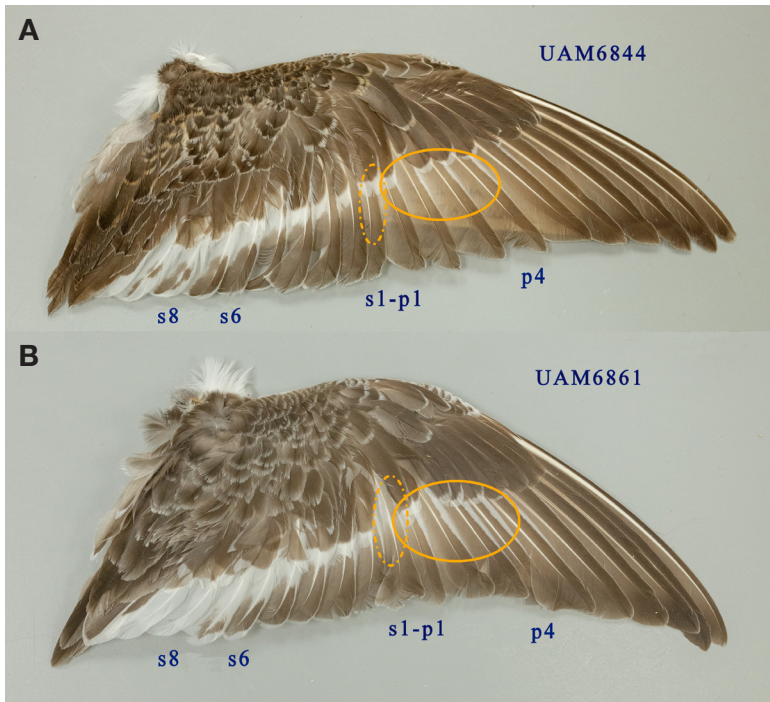


FIGURE 3. Example wings of subspecies *Calidris ptilocnemis ptilocnemis* (A) from St. Paul Island in May 1988 (most extensively dark-marked middle secondaries of 26 specimens examined) and *C. p. couesi* (B) from Cold Bay in May 1987 (least extensively dark-marked middle secondaries of 61 specimens examined). On UAM 6861 (A) the white on the outer vane of p1–p4 reaches the primary’s shaft (orange solid ellipse); the white on the outer vane of secondary s1 (orange dot-dash ellipse) is extensive, matching pattern “C” in figure 440 of Pyle (2008:600); and the dark marks on the middle secondaries are scored 3, 2, and 0 on s6, s7, and s8, respectively, producing a $\Sigma s6-8$ of 5. On UAM 6861 (B) the white on the primaries’ outer vane does not reach any feather’s shaft; the outer vane of s1 lacks white, matching pattern “A” in figure 440 of Pyle (2008:600); and the dark marks on the middle secondaries are scored 5, 3, and 0 on s6, s7, and s8, respectively (see Table 1, footnote b), producing a $\Sigma s6-8$ of 8.

Photographs by Robert L. Scher

mainland portion of the subspecies’ range, and 14 from St. Lawrence Island on the northwest. Similarly, I divided the samples of *couesi* into a subset of 30 from the western Aleutian Islands (Attu, Amchitka, and Adak) and a subset of 36 from Cold Bay to the east.

For each specimen and photograph I noted (1) the specific inner primaries with white on the outer vane extending to or nearly to the shaft; (2) the pattern of white on the outer vane of secondary s1, using letters A, B, or C corresponding with figure 440 in Pyle (2008:600); and (3) the score for the dark mark on secondaries s6, s7, and s8—the secondaries in which subspe-



FIGURE 4. Rock Sandpiper in formative plumage (note bold white fringes on the upper wing coverts and several juvenile scapulars and rump feathers) on 18 September 2023, along the southwest coast of the Kenai Peninsula, Alaska. The white on the outer vanes of primaries p1–p3 appears to reach the shaft; the white on the outer vane of secondary s1 appears intermediate to extensive, between patterns B and C in figure 440 of Pyle (2008:600); and the dark marks on the middle secondaries are scored 4 on s6, 2 on s7, and 0 on s8, producing a $\Sigma s6-8$ of 6. Combined, these wing-stripe metrics support the bird's identification as mainland *Calidris ptilocnemis tschuktschorum*, the subspecies of the Rock Sandpiper common in this area during winter.

Photograph by Robert L. Scher

cific differences in extent of dark markings are greatest. I summed the scores for these three secondaries as “ $\Sigma s6-8$.” Note that these three criteria do not address the contribution to the wing stripe from the white, often broad tips on the primary and greater coverts. According to a Jarque–Bera test, within each subset the data were distributed normally. Figure 3 illustrates the least distinct wing stripe in the samples of *ptilocnemis* and the most distinct in the samples of *couesi*—the extent of the wing stripes observed in examples of *tschuktschorum* was intermediate.

RESULTS

All of the examples (specimens and photographs) of *ptilocnemis* and *couesi* had white in the outer vanes of both the inner primaries and outermost secondary (s1) consistent with the patterns (described above) reported respectively by Gill et al. (2020) and Pyle (2008)—although white in the outer vane reached the shaft of primaries p1–p2 in only three examples of *ptilocnemis* from St. Matthew Island, and the white reached the shaft of primary p2 in two examples of *couesi* from Cold Bay. In *tschuktschorum*, however, these patterns overlapped somewhat with the general patterns reported as more

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typical of the other two subspecies. For example, among the 47 specimens and photographs of *tschuktschorum*, in seven (about 15%) white on the outer vanes of the inner primaries reached or nearly reached the shafts of p1–p4 (as in *ptilocnemis*), while in at least 14 (about 30%) no white reached any primary shaft (as in *couesi*). Similarly, in nearly half of the examples of *tschuktschorum* the white on the outer vane of s1 was lacking (as in *couesi*), and in several others even extensive (as in *ptilocnemis*).

The subspecies also overlapped in their ranges of scores for the dark mark on the secondaries, summarized in Table 1, although the values for $\Sigma s6-8$ differed significantly according to a two-tailed *t*-test: *ptilocnemis* versus *tschuktschorum* $t = 12.9$, $df = 106$, $p < 0.001$; *ptilocnemis* versus *couesi* $t = 33.2$, $df = 125$, $p < 0.001$; and *tschuktschorum* versus *couesi* $t = 18.2$, $df = 109$, $p < 0.001$. The percentage of examples with a dark mark on secondary s8 also differed notably by subspecies, being <2% in *ptilocnemis*, about 26% in *tschuktschorum*, and about 94% in *couesi*. The differences in values of $\Sigma s6-8$ between the examples of *ptilocnemis* and the closest geographic subset of *tschuktschorum* from St. Lawrence Island were also significant ($t = 7.3$, $df = 74$, $p < 0.001$), as were those between the closest geographic subsets of *couesi* from Cold Bay and of mainland *tschuktschorum* ($t = 13.4$, $df = 65$, $p < 0.001$). Within the breeding range of *tschuktschorum* (Table 2), the average values of $\Sigma s6-8$ of the two subsets increased from west to east but not significantly. And within the breeding range of *couesi* (Table 2) there was no significant difference between the subsets from the western Aleutian Islands (Attu or Adak) and Cold Bay on the Alaska Peninsula to the east.

The overlap in wing-stripe metrics typically involved samples taken near the interpreted boundaries between the breeding ranges of *tschuktschorum* and *couesi* on the Alaska Peninsula, and between the ranges of *ptilocnemis* and *tschuktschorum* on St. Lawrence Island—consistent with previous observations (e.g., Withrow 2015, Gill et al. 2020). Nevertheless, to confirm the subspecific identification of those samples with overlapping values of $\Sigma s6-8$, I also evaluated the body plumage (i.e., upperparts, scapulars, and lower breast patch).

Finally, as mentioned previously it remains unclear which subspecies

TABLE 1 Geographic Variation in Scores for the Dark Marks on Secondaries 6–8 of the Rock Sandpiper

Secondary	Subspecies ^a		
	<i>ptilocnemis</i>	<i>tschuktschorum</i>	<i>couesi</i>
s6	1 (62, 0–3)	3 (47, 2–4)	4–5 (66, 3–5)
s7	0–1 (62, 0–2)	2 (46, 0–3)	3–4 (65, 2–5)
s8	0 (62, 0.5)	0–1 (46, 0–2)	2 (66, 0 ^b –3)
$\Sigma s6-8^c$	1.5 ± 0.8 (62, 0–5)	4.6 ± 1.4 (46, 2.5–8)	10.2 ± 1.7 (65, 6–13)

^aDetermined from specimens and photographs of the Alaska subspecies taken within their respective breeding ranges between mid-May and early July. Values for individual secondaries s6, s7, and s8 are the mode, with the number of samples and range in parentheses.

^bOnly four of the 66 birds evaluated had no dark mark on secondary s8 (see Figure 2).

^cValues for $\Sigma s6-8$ are the average and standard deviation, with the number of samples and range in parentheses.

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TABLE 2 Variation in Scores for the Dark Marks on Secondaries 6–8 ($\Sigma s6-8$) within Subspecies *Calidris ptilocnemis tschuktschorum* and *C. p. couesi*

Subspecies and subarea	Mean \pm standard deviation	<i>n</i>	Range
<i>tschuktschorum</i>			
Mainland (Cape Peirce to Seward Peninsula)	4.9 \pm 1.4	32	2.5–8
St. Lawrence Island	3.9 \pm 1.1	14	2.5–5.5
<i>couesi</i>			
Cold Bay, Alaska Peninsula	10.0 \pm 1.7	35	6–12
Aleutian Islands (Unalaska to Attu)	10.5 \pm 1.8	30	6–13
Upper Alaska Peninsula and Chirikof Island	7.8 \pm 1.2	27	6–11.5

breeds on the upper Alaska Peninsula (including islands to the east), and this area may represent a zone of intergradation (e.g. Withrow 2015, Gill et al 2022) between *couesi* and *tschuktschorum*. While that question is beyond the scope of my study, I did inspect an additional 27 specimens at UAM, all labeled as *couesi*, that had been collected during the breeding season from Wide Bay on the southeast side of the peninsula ($n = 8$) and Chirikof Island ($n = 19$). The body plumage of all of these samples is generally more consistent with *couesi* than with *tschuktschorum* (Withrow 2015, pers. obs.). The white in the outer vanes of both the inner primaries and outermost secondary (s1) in all these specimens was also consistent with the patterns (described above) in *couesi*. Nevertheless, while these two upper Alaska Peninsula subsets did not differ from each other, their values for $\Sigma s6-8$ differed significantly from those of the nearest samples of *tschuktschorum* and *couesi* (Table 2) according to a two-tailed *t*-test: Wide Bay/Chirikof Island versus the mainland *tschuktschorum* $t = 8.3$, $df = 57$, $p < 0.001$; Wide Bay/Chirikof Island versus the Cold Bay *couesi* $t = 5.9$, $df = 60$, $p < 0.001$.

DISCUSSION

I found no single wing-stripe criterion to be diagnostic for all the subspecies, but, with the specimen in hand or with high-resolution photographs of an extended wing, a Rock Sandpiper can be identified as *ptilocnemis* when the white on the inner primaries and secondary s1 meets the criteria in Gill et al. (2022) and Pyle (2008), respectively, and $\Sigma s6-8$ is less than 3. It can be identified as *tschuktschorum* when $\Sigma s6-8$ is 4–6. It can be identified as *couesi* when the white on the inner primaries and secondary s1 meets the criteria in Gill et al. (2022) and Pyle (2008), respectively, and $\Sigma s6-8$ is 9 or greater. Birds whose values are intermediate between these conditions, however, may still not be identified conclusively. Figure 4 illustrates application of the three criteria to a live bird in formative plumage, which points to its subspecific identification as *tschuktschorum*.

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