IDENTIFICATION OF ADULT MALE RUFOUS AND ALLEN'S HUMMINGBIRDS, WITH SPECIFIC COMMENTS ON DORSAL COLORATION

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Our understanding of the status of vagrant hummingbirds across eastern North America has changed dramatically over the past three decades (Conway and Drennan 1979; see fall and winter seasonal reports in *American Birds/Field Notes*). Although an increase in hummingbird feeders and observers' expertise undoubtedly has contributed to our knowledge of extralimital hummingbirds, Hill et al. (1998) hypothesized that the significant increase in transient and wintering Rufous Hummingbirds (*Selasphorus rufus*) in the East is primarily a result of a relatively recent change in this hummingbird's innate migratory behavior. Regardless of the reason(s), not all *Selasphorus* hummingbirds in the eastern United States have been Rufous; banding and in-hand measurements have documented Allen's (*S. sasin*) in several states east of the Rockies (Newfield 1983, Andrews and Baltosser 1989, Stedman 1992, Grzybowski 1993, Jackson 1993, Davis 1994, Texas Ornithological Society 1995). There are now more than 15 records for this species in both Mississippi and Alabama (R. Sargent pers. comm.).

The conventional field characters for distinguishing adult males of the Rufous and Allen's hummingbirds have been dorsal coloration and aggression displays: the Rufous has a rufous back and an oval display flight, whereas Allen's has an all-green back and an "arching pendulum-like (= J-shaped)" courtship display (Pough 1957, Johnsgard 1983, National Geographic Society 1983, Peterson 1990). These authors, however, apparently overlooked cautionary statements in the literature about the dorsal coloration of adult males. An exhaustive compilation of molt, age, and identification criteria for hummingbirds does not mention the possibility of mostly or wholly green-backed adult male Rufous Hummingbirds (Pyle 1997). Loye Miller (in Willett 1933) was the first to state that some adult male Rufous Hummingbirds have entirely green backs. Phillips et al. (1964) reiterated this same point, and Phillips (1975) specifically mentioned a wholly green-backed adult male specimen that he identified as a Rufous Hummingbird. More recently, Kaufman (1990) underscored that dorsal coloration of adult males is not diagnostic, and he advanced the notion that Allen's is not identifiable under field conditions away from its breeding grounds. Because none of these papers presented supportive data, coupled with many authors' apparent oversight of this literature, the merit of back coloration as a diagnostic field character remains controversial. Therefore, some ornithologists and state bird records committees have been reluctant to accept field identifications of adult males of these two species without additional measurements obtained in the hand (see Langridge 1988, Lasley and Sexton 1991, Lasley and Sexton 1992). In this

paper we address variation in the back color of adult male Rufous and Allen's hummingbirds and its bearing on field identification.

METHODS

We examined 202 specimens of adult male Rufous and Allen's hummingbirds from 14 museums and universities (see Acknowledgments for list of institutions). All specimens had complete gorgets with the lateral feathers elongated (Pyle 1997, fig. 99H) and lacked bill corrugations (Ortiz-Crespo 1972, Yanega et al. 1997). Therefore we presumed them to be in at least their second calendar year (Pyle 1997). Robbins measured wing chord (unflattened), tail length (central rectrices), exposed culmen, and width of the fifth (outermost) rectrices with calipers to the nearest 0.1 mm. Although we measured the width of rectrix 1 (central), we consider this character to be too variable, because it varies considerably as the result of how the specimen was prepared. We excluded specimens lent by the Museum of Vertebrate Zoology, University of California (15 specimens of each species), from our morphological analysis so that our sample would be independent of Stiles' (1972).

Our examination of 153 adult male specimens of the Rufous Hummingbird clearly demonstrated a continuum in dorsal coloration from individuals with almost entirely rufous backs (most have a few green feathers) to those with entirely green backs (Figure 1). To minimize the inclusion of potential hybrids, we analyzed specimens with <50% and >50% of the back green separately, using only those with <50% of the back green to characterize the measurements of the adult male Rufous. We characterized adult male Allen's with specimens of the nominate subspecies only; all of these specimens had entirely green backs. We excluded subspecies *sedentarius* because our sample of it was small; however, as Stiles (1972) noted and our inspection of nine specimens also indicated, the only difference between the two subspecies is culmen length.

RESULTS

Our measurements of the 125 adult male Rufous with <50% of the back green and 28 Allen's are very similar to Stiles' (1972) (Table 1). As mentioned above, Stiles' sample (30 individuals/species) was independent of ours. In addition to the significant difference in the width of rectrix 5 (outermost) (Table 1; t test = 16.14, df = 148, $P < 0.025$), we found that adult male Rufous have longer wings (t test = 13.78, df = 150, $P < 0.025$) and tails (t test = 16.08, df = 149, $P < 0.025$) than adult male Allen's. In our samples, the two species' exposed culmen lengths did not differ statistically (t test = 1.19, df = 137, $P > 0.05$). In none of the 125 Rufous specimens with <50% of the back green did measurements suggest hybridization. Furthermore, all males in this group had the "deep emargination" at the tip of rectrix 2 characteristic of adult male Rufous (Stiles 1972; Figure 2). All 28 specimens used for defining the measurements of Allen's had a non-emarginated tip on rectrix 2.

Of the 16 Rufous with >50% of the back green, only three have characters suggesting they may be hybrids (Table 2). Ironically, the specimen

Figure 1. Variation in dorsal coloration of adult male Rufous Hummingbirds from all green to all rufous. Specimens (from left to right): UAM 5664, CMNH 115470, MVZ 5411, UW 38697, and LSUMZ 40256.

that Phillips (1975) reported as an adult male Rufous with an all-green back is likely a hybrid. Although he did not cite the number of the specimen taken at San Francisco Peaks, north of Flagstaff, Arizona, on 26 July 1969, it is obvious that Northern Arizona University 708 is the specimen. This specimen's wing length, 40.5 mm, and width of the fifth rectrix, 2.6 mm, fall within the variation for Rufous, whereas the tail length, 23.5 mm, is short even for adult male Allen's (Table 1); however, the very tip of the tail is somewhat worn. Unfortunately, several millimeters of the tips of both second rectrices are missing, apparently destroyed when the bird was collected, precluding assessment of this important character.

We found two other likely hybrids. One, collected on 28 February 1937 at Yuma, Arizona (San Diego Natural History Museum [SDNHM] 17485), has an all-green back and the wing length (38.7 mm) of Allen's. Its tail length (26.6 mm), however, is intermediate. Furthermore, the shape of the tip of the right rectrix 2 (the left is missing) is also intermediate—it is slightly emarginated. A second bird (Louisiana State University Museum of Natural Science [LSUMZ] 89623), taken on 6 January 1979 at Metairie, Jefferson Parish, Louisiana, was initially identified as a hybrid Rufous × Allen's (Hamilton 1979), but A. R. Phillips later annotated the specimen as an Allen's with the tip of rectrix 2 anomalously emarginated. We suspect that LSUMZ 89623 is a hybrid because its rectrix 2 is even more emarginated than that of SDNHM 17485. The wing chord (38.0) falls within the variation of Allen's; however, the wings are badly worn. But the tail is in good condition and is intermediate (25.7) in length (Table 1).

Table 1 Measurements (mm) of Adult Male Rufous[a] and Allen's[b] Hummingbirds

	This study			Stiles (1972)		
	n	Mean	SD[c]	*n*	Mean	SD
Wing length (chord)						
Rufous	124	40.62	0.87	30	40.32	0.87
Allen's	28	38.11	0.89	30	38.08	0.84
Tail length						
Rufous	123	27.90	0.90	30	27.36	0.91
Allen's	28	24.96	0.74	30	24.37	0.74
Width of rectrix 5 (outer)						
Rufous	123	2.64	0.29	—	—	—
Allen's	28	1.70	0.20	—	—	—

[a]Specimens with <50% of the back green only.

[b]Subspecies *Selasphorus sasin sasin* only.

[c]Standard deviation.

Figure 2. Tails of adult male Allen's (right) and Rufous (left) hummingbirds. Compare the width of the fifth rectrices (outer): narrow in Allen's versus relatively broad in the Rufous. Also note the difference in the shape of the tip of rectrix 2: nonemarginated in Allen's versus notched or emarginated in the Rufous.

Finally, although our sample sizes from the breeding range are small, we found no geographical component to the amount of green on the back of adult male Rufous Hummingbirds. Breeding birds near the zone of contact with Allen's in southwestern Oregon and northwestern California show no increase in green on the back.

DISCUSSION

Our results reveal considerable variation in back color, from all rufous to entirely green, in adult male Rufous Hummingbirds (Figure 1). In our sample of 153 presumed pure Rufous Hummingbirds, seven (5%) have the back at least 75% green, and two have the back 95–100% green (Table 2). Thus Miller (in Willett 1933), Phillips et al. (1964), and Kaufman (1990) were correct in stating that entirely green-backed adult males of the Rufous/Allen's complex cannot be reliably identified under field conditions. If an adult male has some rufous in the back, however, it is a Rufous or perhaps a hybrid, because adult male Allen's invariably have all-green backs. Some Allen's have a few back feathers that are rufous-fringed, but these are only visible when the bird is in the hand. Nonetheless, Pyle (1997) reported that some adult male Allen's Hummingbirds have up to 40% of the back rufous. Pyle's information was based on accounts by Patterson (1988, 1990; Pyle pers. comm.). Patterson's reports, however, failed to consider hybridization as a possible explanation for the anomalous characters of both an adult male and female *Selasphorus* that he banded and identified as Allen's from the northern coast of Oregon. In fact, the presence of rufous on the lower back, the intermediate width (2.2 mm) of rectrix 5, and the slight emargination of rectrix 2 of the Oregon adult male closely fit the specimens that we have identified as possible hybrids. Unfortunately, neither Oregon bird was collected nor were diagnostic tail feathers saved. Specimen confirmation will be required to establish that adult male Allen's have anything other than all-green backs.

Studies in the region of potential overlap in southwestern Oregon and northwestern California are needed to ascertain to what extent hybridization may occur. Another means in which hybridization might occur is on the wintering grounds or during migration, when these two species are broadly sympatric (AOU 1998). Males of both Rufous and Allen's hummingbirds frequently display during migration and on the wintering grounds (McKenzie pers. obs.). Quay (1989) demonstrated in passerines that insemination can occur prior to arrival on the breeding grounds; nevertheless, it is not known if fertilization and eventual offspring result from such inseminations and if this phenomenon is possible with hummingbirds.

We offer the following recommendations for identifying extralimital Rufous/Allen's hummingbirds of all age classes: (1) Field identification of adult male Allen's and some adult male Rufous cannot be made unless the diagnostic courtship flight is observed; nonetheless, both courtship and aggression displays, which superficially can appear similar, have been noted during migration and on the wintering grounds. Consequently, caution should be exercised in using displays for distinguishing these species away from the breeding grounds (R. Sargent pers. comm.). (2) Licensed banders should capture the bird and carefully measure its wing and tail length; the

Table 2 Measurements (mm) of Rufous Hummingbirds with > 50% of Back Green and Possible Hybrids

Specimen[a]	Wing length (chord)	Tail length	Width of rectrix 5	Rectrix 2 emarginated	Fraction of back green[b]
CMNH 115470	41.6	27.6	2.8	yes	2
MCZ 304927	40.7	—	2.7	yes	1
CMNH 162244	39.5	28.8	2.7	yes	1
WFVZ 6592	39.9	27.5	2.8	yes	2
UW 31256	40.4	27.3	2.7	yes	1
UW 37221	40.7	27.8	2.9	yes	1
UW 53596	39.6	27.3	3.0	yes	2
AMNH 49363	39.7	28.2	2.6	yes	1
UAM 5664	42.1	28.3	3.0	yes	3
UA 962	42.0	27.8	2.8	yes	2
FMNH 138817	39.0	28.5	2.7	yes	3
FMNH 138816	41.7	28.5	2.7	yes	1
SDNHM 46886	40.3	27.7	2.8	yes	2
SDNHM 17485[c]	38.7	26.6	1.9	slightly	3
NAU 708[c]	40.5	23.5	2.6	?	3
LSUMZ 89623[c]	38.0	25.7	1.9	yes	3

[a]See Acknowledgments for initials of institutions.

[b]1, 50–74%; 2, 75–94%; 3, 95–100%.

[c]Possible hybrid.

first, second, and fifth rectrix from one side of the bird's tail should be removed and preserved; these feathers will grow back. Permits issued by the U.S. Fish and Wildlife Service should explicitly state that removal of diagnostic feathers is approved. (3) Pulled rectrices and measurements should be forwarded to relevant state/provincial bird records committees, and ultimately these feathers should be deposited in an appropriate museum. (4) Individuals with measurements that do not fully agree with those of one species could be hybrids and should be listed as Rufous/Allen's. (5) Care should be taken to eliminate other species, especially the Broad-tailed (*Selasphorus platycercus*) and Calliope (*Stellula calliope*), because adult females and immatures of these two are very similar to females and immatures of the Rufous/Allen's complex (see Kaufman 1990 for an excellent discussion on how to distinguish these species).

ACKNOWLEDGMENTS

We thank the following people and institutions (listed alphabetically by institution) for access to specimens under their care: George Barrowclough and Paul Sweet (American Museum of Natural History [AMNH], New York), Sievert Rohwer and Chris Wood (Burke Museum, University of Washington [UW], Seattle), Brad Livezey and Robin Panza (Carnegie Museum of Natural History [CMNH], Pittsburgh), Tom Schulenberg and David Willard (Field Museum of Natural History [FMNH], Chicago), J. V. Remsen and Steven Cardiff (Louisiana State University Museum of Natural Science, Baton Rouge), Raymond Paynter, Jr. (Museum of Comparative Zoology [MCZ], Harvard

Figure 3. Similarity in dorsal coloration among two adult male Allen's Hummingbirds (outer birds, MCZ 33022 at left, and LSUMZ 13183 at right) and a mostly green-backed adult male Rufous Hummingbird (middle, FMNH 138817).

University, Cambridge, Massachusetts), Ned Johnson and Carla Cicero (Museum of Vertebrate Zoology, University of California, Berkeley), Gary Graves (National Museum of Natural History, Smithsonian Institution), Scott Moody (Ohio University, Athens), Philip Unitt (San Diego Natural History Museum), Daniel Gibson (University of Alaska Museum [UAM], Fairbanks), William Baltosser (University of Arkansas [UA], Little Rock), Russell Balda (University of Northern Arizona [NAU], Flagstaff), and Sam Sumida (Western Foundation of Vertebrate Zoology [WFVZ], Camarillo, California). We are indebted to Peter Pyle for providing information on adult male *Selasphorus* hummingbirds in Oregon. William Baltosser, Kimball Garrett, J.V. Remsen, Robert Sargent, and Philip Unitt provided valuable comments on the manuscript.

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Accepted 4 February 1999