AGE AND SEX DETERMINATION IN THE CALLIOPE HUMMINGBIRD

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The information available to distinguish adult female and young Calliope Hummingbirds (*Stellula calliope*) is incomplete. Using any one of the many field guides currently on the market, one can identify adult males with ease, but adult females and young often present more of a problem. Few attempts have been made until now to separate adult females from young birds of either sex because the technical information this requires has not been available. Such knowledge is particularly critical given the increasing number of people licensed to capture and band birds and the need to document properly the growing number of vagrant hummingbirds.

Of the major works dealing with hummingbird identification, relatively few have dealt with the Calliope Hummingbird. Elliot (1881), Ridgway (1892, 1911), Coues (1903), and Johnsgard (1983) all noted the diagnostic shape of the middle rectrices, contracted in the middle and wider subterminally, i.e., somewhat spatulate or pandurate. Banks and Johnson (1961) addressed identification as it relates to presumed hybrid adult males, while Stiles (1971) provided criteria allowing one to distinguish both male and female Calliope Hummingbirds from other species.

Stiles' (1971) criteria to separate Calliope Hummingbirds from other hummingbird species include small size, very short bill, and a short, broad tail containing very little rufous. He also cited behavioral mannerisms, particularly the position of the tail while the bird is hovering (nearly perpendicular to the plane of body) and the degree of tail movement (held very still). The barbs of the rectrices (stiffened and flattened) differ from those of other species, as do many standard measurements. Stiles was unable, however, to find consistent plumage differences between adult female and young Calliope Hummingbirds. It can now be shown that there are consistent differences allowing distinction between young of either sex and adult females from young.

METHODS

I collected numerous Calliope Hummingbirds over a ten-year period and, through dissection, aged and sexed them. Having established a set of criteria for identification, I expanded my sample size through the use of museum specimens.

Ortiz-Crespo (1972) developed and I (Baltosser 1987) further refined a method for aging hummingbirds based on the presence and extent of corrugations on the bill. In juvenile birds, bill corrugations are obvious, being deeply incised and extending the length of the bill. This is in sharp contrast to the bills of adult birds, which lack corrugations and appear to be smoothly polished. Corrugations in subadult birds are shallow, confined to the base of the bill, and often very faint; older subadults may lack corrugations (see Baltosser 1987 for figures).

I used bill corrugations as my primary means of aging Calliope Hummingbirds, supplementing it to some extent by feather wear and plumage characteristics (e.g., buffy feather fringes, often characteristic of young birds). The molt of Calliope Hummingbirds takes place on the wintering grounds in Mexico, so in the U.S. buffy-tipped plumage is generally useful to indicate hatching-year birds only during summer and fall.

Measurements were made with 10-cm dial calipers, accurate to the nearest 0.05 mm. I tested differences among the age and sex classes for statistical significance with one-way analyses of variance (SAS Institute 1988). For each character I calculated 95% confidence intervals about the mean.

Quantitative measurements used to characterize hummingbirds were described by Baldwin et al. (1931) and depicted by Baltosser (1987). I measured the length of the exposed culmen from its tip to the point where

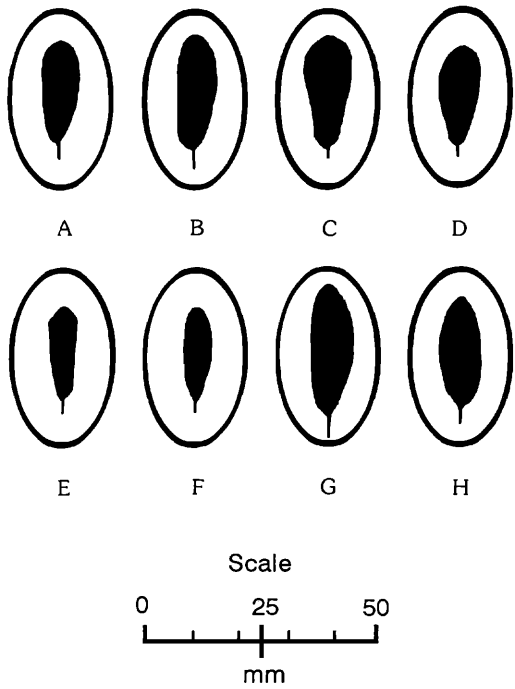

Figure 1. Diagnostic size and shape of rectrix 1 in the Calliope Hummingbird (sexes similar) compared to the size and shape of rectrix 1 in other, potentially confusing, hummingbird species (females only). A, Ruby-throated (*Archilochus colubris*); B, Black-chinned (*A. alexandri*); C, Anna's (*Calypte anna*); D, Costa's (*C. costae*); E, Calliope (*Stellula calliope*); F, Bumblebee (*Atthis heloisa*); G, Broad-tailed (*Selasphorus platycercus*); H, Rufous (*S. rufus*) and Allen's (*S. sasin*).

the feathers of the forehead impinge on the culmen. Length of wing chord was measured from the anterior edge of the wrist joint to the tip of the longest primary (number 10), without the primaries being flattened. Tail length, only to the nearest millimeter, was measured from the insertion of the two middle rectrices to the longest feather of the unspread tail. The "area" of white at the tip of the third rectrix (rectrices numbered from center out) was calculated by multiplying the length of white along the rachis by its maximum width (see Baltosser 1987).

RESULTS AND DISCUSSION

In female and young Calliope Hummingbirds the size of rectrix 1 in conjunction with its shape (expanded near the tip) is species-specific (Figure 1). In immatures, the presence of rufous along the edges of rectrix 1 is

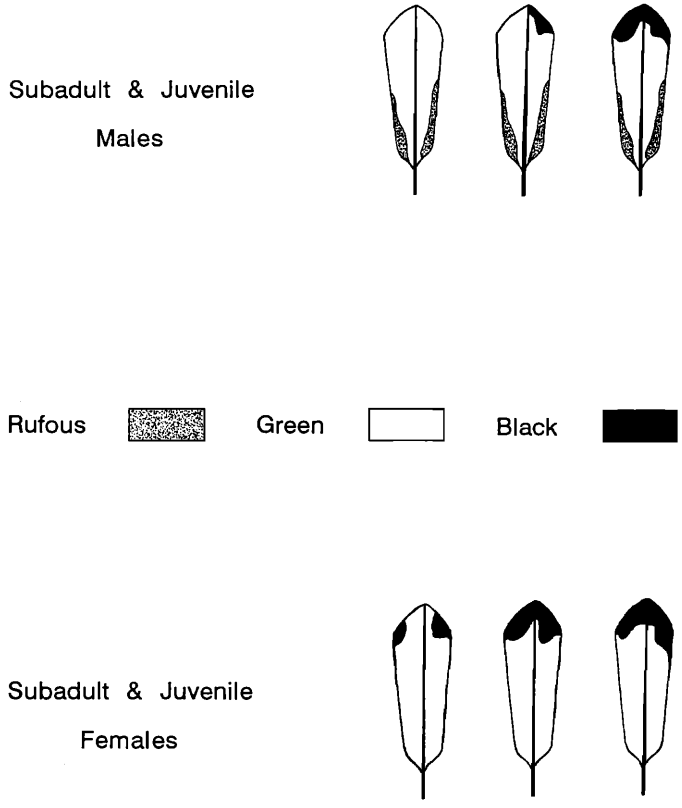

Figure 2. Diagnostic color patterns of rectrix 1 distinguishing male and female juvenile Calliope Hummingbirds. Three examples of each to show range of variation.

Table 1 Measurements of Adult Calliope Hummingbirds[a]

	Exposed culmen (mm)	Wing chord (mm)	Tail (mm)
Male			
Mean	14.20	39.55	20.20
Standard deviation	0.35	0.70	0.90
N	10	10	10
Range	13.75–14.65	38.65–40.70	19–21
95% Confidence interval	13.95–14.45	39.05–40.05	19.55–20.85
Female			
Mean	15.40	42.00	21.80
Standard deviation	0.50	0.60	0.70
N	15	15	15
Range	14.65–16.35	41.05–43.30	21–23
95% Confidence interval	15.10–15.70	41.65–42.35	21.40–22.20

[a]Differences between males and females significant in every case ($P < 0.05$).

diagnostic of males; absence of rufous is diagnostic of females (Figure 2). Adult females, however, like those of many other western hummingbirds (Baltosser 1987), show the entire spectrum of variability in rectrix 1, though they frequently exhibit at least some rufous. Sex determination is thus complicated and can be established only after aging, which in summer and

Table 2 Measurements of Juvenile Calliope Hummingbirds[a]

	Exposed culmen (mm)	Wing chord (mm)	Tail (mm)	White tip rectrix 3 (mm^2)
Male				
Mean	13.25	41.35	21.65	5.60
Standard deviation	0.50	0.90	0.75	2.00
N	16	15	14	16
Range	12.40–13.95	39.25–42.70	21–23	3.20–10.00
95% Confidence interval	13.00–13.50	40.85–41.85	21.20–22.10	4.55–6.65
Female				
Mean	14.55	43.70	22.75	17.95
Standard deviation	0.50	0.50	0.90	4.15
N	10	11	11	10
Range	13.80–15.20	42.85–44.30	21–24	11.35–26.50
95% Confidence interval	14.20–14.90	43.35–44.05	22.15–23.35	15.05–20.85

[a]Differences between males and females significant in every case ($P < 0.05$).

fall is accomplished on the basis of bill corrugations, feather wear, and buff-tipped plumage (primarily that of the head and neck).

Further complicating identification are adult females having iridescent rose-colored feathers on the throat. Such females are undescribed in popular field guides; I confirmed their sex only through careful dissection. Females with iridescent throat feathers I presume, on the basis of their extensively worn bills lacking corrugations, to be relatively old. Fortunately, few birds exhibit this condition and their small iridescent rose feathers only superficially resemble the brighter and broader gorget feathers frequently found on young males.

Measurements of adult males and females are presented in Table 1, those of immatures in Table 2. Note that all comparisons between adults are significantly different ($P < 0.05$), as are those between immatures. In addition to differences in standard measurements, young males and females are separable on the basis of the amount of white at the tip of the third rectrix.

CONCLUSIONS

In the Calliope Hummingbird the central rectrix is sufficient for species identification; plucking and preserving it can serve as documentation. The pandurate form of the central rectrix will separate Calliope Hummingbirds from Rufous (*Selasphorus rufus*), Allen's (*S. sasin*), and Broad-tailed (*S. platycercus*) hummingbirds and from members of the genera *Calypte*, *Archilochus*, and *Atthis*. The Bumblebee (*A. heloisa*) and Wine-throated (*A. ellioti*) hummingbirds of Mexico resemble the Calliope, which occurs in the former's range in migration and winter, but their central rectrices are smoothly tapered, not pandurate (Figure 1).

Calliope Hummingbirds may be sexed on the basis of the central rectrix once they have been aged. Aging is easily accomplished during summer and early fall by examining the bill for the presence or absence of corrugations. On wintering grounds in Mexico, aging is more problematic, as knowledge of feather wear and molt sequence must be considered.

Wagner (1957) described the molt of Calliope Hummingbirds as occurring during March and April. He reported no data for species like the Black-chinned (*Archilochus alexandri*), which nests in the western United States and presumably follows a migratory route similar to the Calliope's to wintering areas in Mexico. Most Black-chins molt between November and March (pers. obs.), so I suspect that the Calliope's molt is underway before March. Determining the age of female Calliope Hummingbirds may thus be difficult after October if bill corrugations and buffy feather fringes have been lost.

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LITERATURE CITED

Baldwin, S. P., Oberholser, H. C., and Worley, L. G. 1931. Measurements of birds. Sci. Publ. Cleveland Mus. Nat. Hist. 2.

Baltosser, W. H. 1987. Age, species, and sex determination of four North American hummingbirds. N. Am. Bird Bander 12:151–166.

Banks, R. C. and Johnson, N. K. 1961. A review of North American hybrid hummingbirds. Condor 63:3–28.

Coues, E. 1903. Key to North American Birds, vol. 2, 5th ed. Dana Estes and Co., Boston.

Elliot, D. G. 1881. A classification and synopsis of the Trochilidae. Smithsonian Contr. Knowledge. 23:1–277.

Johnsgard, P. A. 1983. The Hummingbirds of North America. Smithsonian Inst. Press, Washington, D.C.

Ortiz-Crespo, F. I. 1972. A new method to separate immature and adult hummingbirds. Auk 89:851–857.

Ridgway, R. 1892. The Humming Birds. Report of the United States National Museum for 1890, pp. 253–383.

Ridgway, R. 1911. The birds of North and Middle America, part V. U.S. Natl. Mus. Bull. 50:300–681.

SAS Institute. 1988. SAS/STAT User's Guide, version 6.03. SAS Inst., Cary, N.C.

Stiles, F. G. 1971. On the field identification of California hummingbirds. Calif. Birds 2:41–54.

Stiles, F. G. 1972. Age and sex determination in Rufous and Allen hummingbirds. Condor 74:25–32.

Wagner, H. O. 1957. The molting periods of Mexican hummingbirds. Auk 74:251–257.

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