# HYBRIDIZATION OF A BLUE-THROATED HUMMINGBIRD IN CALIFORNIA

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A relatively large number of North American hybrid hummingbirds have been described (Banks and Johnson 1961, Short and Phillips 1966, Mayr and Short 1970), representing at least 12 hybrid combinations, mostly intergeneric (Wells et al. 1978). Nearly all known hybrids have been adult males, and the evidence for their presumed hybrid origin has been based primarily upon the external characters of specimens.

In late December 1977 a female Blue-throated hummingbird (*Lampornis clemenciae*) was discovered visiting a feeder near Three Rivers, Tulare County, California. This bird, the first of the species recorded in California (Luther et al. 1979), subsequently nested twice in the vicinity. Because of the apparent absence of a male Blue-throated Hummingbird, as well as certain characteristics of the young, we believe that these nesting attempts involved hybridization. In the following account the nesting attempts and the resultant offspring are described, and the possible identity of the male parent is discussed. We are unaware of a previous report of a hummingbird hybridization discovered during the nesting stage.

## THE BLUE-THROATED HUMMINGBIRD IN CALIFORNIA

The female Blue-throated Hummingbird was first seen about 28 December 1977 by Gertrude Schuckert at a feeder at her home on Heidi Road, 3 km S of Three Rivers. The bird returned to the feeder daily and was photographed on 16 January 1978 by F.A.B. It remained in the vicinity throughout the winter, and on 30 April it was captured, photographed, measured and released by F.A.B. and R.B.H. It was last seen in the area on 27 May 1978.

The species normally breeds from the southwestern United States south to the state of Oaxaca, Mexico (AOU 1957). Within the United States the subspecies *L. c. bessophilus* breeds in isolated mountain ranges of southeastern Arizona (Phillips et al. 1964) and extreme southern New Mexico (Hubbard 1978). The nominate race ranges north to southwestern Texas and probably breeds there, although actual nesting has not been documented (Oberholser 1974). The species normally winters in the Mexican lowlands (AOU op cit.).

The two races can probably be separated only by the intensity of the green coloration of the dorsum and the gray coloration of the underparts, *bessophilus* being generally paler (Mayr and Short 1970). After examining large series of Blue-throated Hummingbird skins in the Museum of Vertebrate Zoology (University of California, Berkeley), California Academy of Sciences and

Western Foundation of Vertebrate Zoology, we agree with Van Tyne (1953) that measurements are of little use in distinguishing the two forms. As we did not have comparative material available when the Three Rivers blue-throat was in hand, its subspecific identity could not be determined and inferences about its region of origin therefore could not be drawn.

## STUDY AREA

The female blue-throat wintered on the canyon floor of the South Fork of the Kaweah River, 3 km S of Three Rivers, where the elevation is about 300 m. Sycamores (*Platanus racemosa*), Fremont Cottonwoods (*Populus fremontii*), and Valley and Interior Live oaks (*Quercus lobata* and *Q. wislizenii*) dominate the overstory; the understory is primarily scattered Whiteleaf Manzanitas (*Arctostaphylos viscida*) and Wedgeleaf Ceanothus (*Ceanothus cuneatus*). This riparian woodland is associated with Digger Pine (*Pinus sabiniana*)-oak woodlands of central California. Marshall (1957) noted a basic similarity of the breeding avifauna of the pine-oak woodlands of southeastern Arizona and the Digger Pine-oak woodlands of central California. Certainly the canyon is physiognomically similar to the canyons of southeastern Arizona where the blue-throat is a summer resident.

Average annual rainfall in the area is 331 mm (records from nearby Kaweah Lake), but is highly variable. The winter of 1976-1977 was the driest on record, whereas the winter of 1977-1978 was the wettest. Minimum temperatures recorded in January and February 1978 were significantly higher than those recorded in 1977.

## BEHAVIORAL OBSERVATIONS

The Blue-throated Hummingbird's wintering activity was centered about an Interior Live Oak in which a feeder was suspended. The feeder and the live oak in which the blue-throat normally perched and roosted usually were defended. The bird's sugar solution diet was supplemented by insects, which were relatively abundant because of the wet, mild winter. She collected insects near the feeder tube and in short erratic flights, similar to those described by Wagner (1946), over an adjacent small marsh.

During late February and early March the female was observed less often in the vicinity of the feeder. The reason for the bird's frequent absences became apparent on 12 March when it was found on a nest 270 m NW of the feeding station. The nest was built around a telephone wire approximately 3 m off the ground under the west-facing eaves of a residence (Figure 1). The house is situated on a dry, steep hillside above the belt of riparian vegetation where the bird had confined its winter activities. Observations were made intermittently at the site throughout the nesting period, often with a second observer stationed at the riparian feeding station.

Figure 1. Female Blue-throated Hummingbird (*Lampornis clemenciae*) feeding young of first clutch, Three Rivers, Tulare Co., California, 13 April 1978. Mirror above was used to check development of young.

*Photo by Frank Baldridge*

When found, the nest contained two eggs, although it was as yet unlined. During the remainder of the incubation period, the bird added a lining, consisting of bits of thread and feathers from her own abdomen. Details of the bird's incubation behavior are summarized in Table 1. Constancy of incubation was calculated to be 84% (Skutch 1962), somewhat higher than the figures the same author reported for five neotropical hummingbird species (range 65-81%). During her absences from the nest, the female usually visited the riparian feeding station for periods ranging from 2 to 7 minutes. Three days prior to hatching of the eggs, the amount of time spent at the feeders per visit declined from a mean of 3.75 minutes (S.D. ± 1.9) to a mean of 1.91 minutes (S.D. ± 0.67), as the bird began spending relatively more time foraging for insects near the nest. Furthermore, the female appeared to be more restless while she was on the nest during the late stages of incubation. She was also more aggressive towards other birds in the immediate vicinity of the nest, especially near a *Ceanothus* shrub where she perched regularly.

The first egg hatched before 1045 on 26 March. At that time the female was unusually aggressive at the nest, and the site was not visited again until 28 March. By then the second egg had hatched, and the size difference between the young suggested that hatching was asynchronous.

Table 1. Incubation behavior and weather conditions during first and second nesting attempts of a Blue-throated Hummingbird at Three Rivers, California.

| | First Clutch | Second Clutch |
|---|---|---|
| Incubation behavior | | |
| Attentive periods (min) | | |
| Mean | 35.0 | 52.6 |
| N | 11 | 23 |
| S.D. | ±15.1 | ±38.8 |
| Range | 15-61 | 22-179 |
| Inattentive periods (min) | | |
| Mean | 6.6 | 10.0 |
| N | 11 | 23 |
| S.D. | ±6.5 | ±12.2 |
| Range | 2-16 | 1-63 |
| Time attentive (%) | 81 | 84 |
| Weather conditions during observation periods | | |
| Temperature range (C°) | 16-22 | 10-37 |
| Precipitation | | |
| Days | 7 | 0 |
| Amount (mm) | 70 | 0 |
| Observation periods | 4 | 11 |
| Total hours observed | 10.8 | 28.5 |

Aspects of the female's care of the young are summarized in Table 2. Midday brooding ceased on the 10th day after the first young hatched, and early morning brooding was not observed after the 16th day, when the young were well feathered. Our limited data suggest that the rate at which the young were fed did not change significantly during the nesting period, thus agreeing with Wagner's (1952) observations of nesting Blue-throated Hummingbirds in Mexico.

On 16 April the nestlings were removed from the nest, photographed, banded, marked on the back with red and blue paint, respectively (cf. Stiles and Wolf 1973), and returned to the nest. They fledged on the following day, 21 days after the first young hatched. This is markedly shorter than the nestling periods of 24-29 days recorded by Wagner (1952) for this species in Mexico. On the day of hatching two hummingbird feeders were placed about 30 m from the nest site, and the female blue-throat ceased visiting the riparian feeding station. After fledging, the young remained in nearby shrubs, where they were fed by the female. Within a week they were exploring the general vicinity and apparently gleaning insects from vegetation, but they were still being fed periodically by the female. By 29 April both nestlings were using the feeders that had been placed near the nest site.

Table 2. Parental care during first nesting attempt of female Blue-throated Hummingbird.

| | Week #1 | Week #2 | Week #3 |
|---|---|---|---|
| Midday brooding behavior | | | |
| Attentive periods (min) | | | |
| Mean | 26.0 | 6.4[1] | |
| N | 11 | 4 | |
| S.D. | ±13.0 | ±7.4 | |
| Range | 15-60 | 4-18 | |
| Inattentive periods (min) | | | |
| Mean | 15.0 | 27.3 | |
| N | 11 | 4 | |
| S.D. | ±5.6 | ±15.8 | |
| Range | 7-24 | 16-48 | |
| Time attentive (%) | 48 | 19 | |
| Midday feeding intervals (min) | | | |
| Mean | 46.0 | 34.3 | 48.9 |
| N | 10 | 6 | 7 |
| S.D. | ±14.6 | ±14.5 | ±13.3 |
| Range | 40-75 | 19-52 | 26-65 |
| Total minutes observed | 597 | 155 | 396 |

[1]Midday brooding ceased on day 10.

The young were recaptured on 30 April and photographed. On this date two rectrices were removed from the tail of each fledgling for diagnostic purposes; these are now on deposit at the Western Foundation of Vertebrate Zoology. One of the young was last seen in the nesting area on 11 May, whereas the other remained until at least 17 May.

Four days after the first brood fledged, the blue-throat began refurbishing the nest with bits of green moss. Ten days later (2 May) the first egg of a second clutch was laid. Incubation did not commence until a second egg was laid on 4 May. Hatching of the two eggs was asynchronous, occurring on 20 and 21 May after 17 and 18 days of incubation, respectively. Identical incubation periods were found for this species in Mexico by Wagner (1952). As with the first clutch, the female continued to add various material, including thread, bits of wool from a discarded blanket, and her own feathers, to the nest lining throughout the incubation period.

Percent attentiveness was identical during the two incubation periods, but there was significant ($p = 0.05$) variation in the length of attentive and inattentive periods between the two clutches (Table 1). Unusually long periods of incubation and inattentiveness occurred in the late afternoons during the second period, coinciding with temperatures of over 35° in the nest vicinity. During the same period, the blue-throat employed different insect foraging methods. Whereas insects had previously been collected while the bird hovered over *Ceanothus* flowers, during this period foliage gleaning and several successful attempts at hawking alfalfa butterflies (Pieridae) were observed. On 21 May the female revisited the riparian feeding station area after a long absence and was observed collecting insects there.

During the first 2 days of the second nestling period, intervals between feedings averaged significantly longer (59 vs. 46 minutes) than those observed with the first brood (Table 2), and this may have been a further indication of insect scarcity in the area at that time. On 24 May an unusually long inattentive period was observed at the nest, and the female did not appear at the nest site at all on 25 May. Examination of the nest on that date revealed that the nestlings had died probably 1-3 days after hatching. The female blue-throat continued to visit the riparian feeding station at half hour intervals until 27 May; she was not seen thereafter in the Three Rivers area.

## DESCRIPTION OF OFFSPRING FROM FIRST NESTING

When the hybrid offspring from the first nesting were recaptured on 30 April the red-marked fledgling had an exposed culmen length of 15.6 mm, a wing chord of 54.5 mm, and it weighed 3.2 g. The blue-marked bird had an exposed culmen of 16.7 mm, a wing chord of 57.1 mm, and it weighed 3.5 g. The ramphotheca of the upper mandible of both birds exhibited the corrugations that are diagnostic of juvenile hummingbirds (Ortiz-Crespo 1972).

The markings on the side of the head and throat varied in intensity between the two fledglings and between the sides of the head on each individual. The red-marked bird had a definite white postocular dot with an indistinct white postocular line which was partly obscured by darker auricular feathers. A faint rictal line formed by the off-white dorsal margins of the malar feathers was also present. The blue-marked bird lacked a rictal line on the left side of the head, but showed a distinct postocular stripe on that side. The pattern was essentially reversed on the right side of the head with a definite rictal line being present, but with the postocular stripe being indistinct.

The throat of each bird was dark gray with the central portion of these feathers being green under proper light. Each throat feather had a well-defined thin white margin. The breasts and abdomens of the birds were lighter gray than the throat with scattered bronzy green flecks on the grayish flanks. The undertail coverts were gray with whitish edges. There was no rufous on the underparts or on the rectrices. None of the remiges or rectrices exhibited the sort of emargination that is typical of the genera *Calypte* or *Archilochus*.

The blue-marked bird was recaptured 21 October, by which time it had nearly completed the post-juvenal molt. On that date the bird weighed 3.52 g, had a wing chord of 58.0 mm, exposed culmen of 20.2 mm, and a tail length of 30.0 mm (Table 3). By this time it lacked the bill corrugations observed in April. Rectrices 3, 4 and 5 were collected from the bird on this date and were also deposited in the WFVZ collection for identification purposes. The markings on the side of the head were similar to those observed in April with the rictal line still lacking on the left side, but with a broad, distinct postocular stripe. On the right side only a postocular dot was distinct. An indistinct whitish line extended posteriorly from the dot and was mostly obscured by auricular feathers. Two white malar feathers formed a rictal dot below the lores. The appearance of the underparts was little changed from the juvenal plumage observed in April; there was still no rufous on the underparts or tail.

In general, the fledglings resembled the adult female Blue-throated Hummingbird in color, although the head markings were indistinct in some areas. However, the young were strikingly smaller than the female parent (Table 3), offering strong support to our assumption that the mating was hybrid in nature. At the time of its recapture the blue-marked bird had been observed intermittently at the riparian feeding station for several days. In confrontations with other hummingbirds, it was invariably subordinate. The hybrid had a markedly slow wingbeat, apparently the result of its relatively long wings and small body size, and its flight was somewhat butterfly-like.

## IDENTIFICATION OF THE MALE PARENT

Juvenile hummingbirds often are difficult to identify and establishing the parentage of juvenile hybrids is potentially even more difficult. Male secondary sexual characteristics, which have generally been used to detect previous hybrids, were lacking in the offspring of the first hybrid nesting, and the young

from the second nesting did not survive long enough to develop any recognizable characters. Furthermore, the size discrepancy between the Blue-throated Hummingbird and all potential mates of other species makes measurements and weights of the offspring virtually useless for diagnostic purposes. Therefore, we have relied mainly on known distribution, breeding phenology, and minor plumage characteristics in attempting to identify the male parents of the hybrid offspring. The following discussion is restricted to hummingbird species that normally breed in California.

*Calypte anna*: Anna's Hummingbird is the most common local hummingbird species, and it is the only one that is a permanent resident in the Three Rivers area. The species breeds as early as December in California (Stiles 1973) and at the time of the first hybrid nesting, local male Anna's Hummingbirds were establishing breeding territories.

The hybrid offspring resembled *Calypte anna* in the color of the interramal region and underparts, and the tails of the hybrids were similar to Anna's in color and shape (Figure 2). However, the hybrids lacked the shallow "W" indentation typical of the tip of the adult secondaries of Anna's Hummingbirds (Williamson 1956), and they weighed 0.2 g less than the lightest *Calypte anna* weighed locally under similar conditions (Table 3, Figure 3).

*Calypte costae*: Costa's Hummingbird has not been recorded at Three Rivers, and we know of only three records for Tulare County. However, one is of an adult male that wintered in 1978-1979 in Dinuba, 35 mi NW of Three Rivers. There are no breeding records for the general area. Elsewhere in the state, Costa's Hummingbirds breed from about January to March in desert areas and from late March to May in coastal chaparral habitats (Stiles pers. comm.). The hybrids were similar in color to juvenile Costa's Hummingbirds, although the latter species is generally somewhat paler on the underparts. The hybrids weighed slightly more than normal Costa's Hummingbirds (Table 3, Figure 3).

A *Lampornis clemenciae* × *Calypte costae* hybrid has been reported previously (Mayr and Short 1970). This bird is a juvenile male (University of Arizona 9359) that was found in a mummified condition in the Huachuca Mountains in southeastern Arizona on 26 April 1968. We examined this specimen and found that its measurements (wing chord 59 mm, exposed culmen 20.3 mm) are virtually identical to those of the blue-marked hybrid from Three Rivers (Table 3).

*Archilochus alexandri*: The Black-chinned Hummingbird is a common summer resident in the Three Rivers area, but it arrives later (about the first week of April) than the date of the first hybrid nesting. No Black-chinned Hummingbirds were seen in the study area until after the first clutch had hatched. There is nothing about the color of the hybrids that is incompatible with black-chin parentage, and the weight of the blue-marked bird was very close to mean black-chin weight (Table 3, Figure 3). The acuteness of the outer rectrices of the hybrids relative to those of the adult female blue-throat may be due to the influence of *A. alexandri*. However, the emargination of

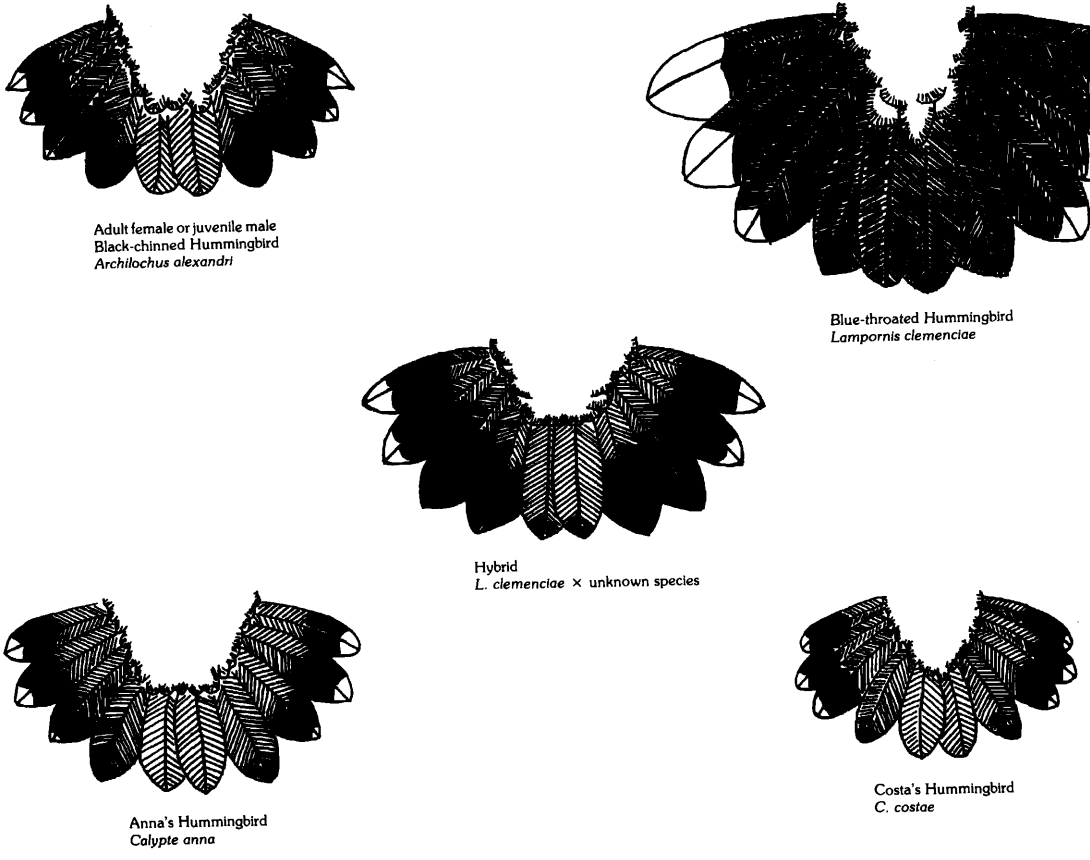


Figure 2. Tails of the female Blue-throated Hummingbird, the hybrid, and females of possible parental species.

these feathers, characteristic of adult female and juvenile male Black-chinned Hummingbirds (Baldridge 1983), was not evident. Other factors in addition to the timing of the first nesting attempt tend to rule out a black-chin parent, especially the short bill length of the blue-marked hybrid in October (Figure 3).

During the period when the blue-throat was refurbishing the nest in preparation for the second nesting attempt, Black-chinned Hummingbirds were the most common species in the area. On several occasions during this period, individual male black-chins were seen displaying to the perched female blue-throat. However, the nestlings of this second attempt died before enough plumage had developed to permit identification of the male parent.

*Selasphorus* and *Stellula* species: Though it is possible that male *Selasphorus* hummingbirds might occur in the study area at about the time of the first hybridization, a Rufous Hummingbird (*Selasphorus rufus*) then would be unusually early (Short and Phillips 1966) and an Allen's Hummingbird (*Selasphorus sasin*) would be a vagrant (Phillips 1975). Calliope Hummingbirds (*Stellula calliope*) normally arrive in the southern Sierra Nevada later than the first nesting attempt (Grinnell and Miller 1944) and have not been recorded in the Three Rivers area. Perhaps more importantly, some rufous coloration has been evident in the tails of all known hybrids involving *Selasphorus* or *Stellula* parentage (Banks and Johnson 1961, Lynch and Ames 1970), and these genera can probably be eliminated from consideration on this basis alone.

Table 3. Mensural characteristics of the female *Lampornis clemenciae*, hybrid (X18371, 21 October 1978), and females of possible parental species.

| | *L. clemenciae* | Hybrid | *C. anna* | *A. alexandri* | *C. costae*[1] |
|---|---|---|---|---|---|
| Weight (gm) | | | | | |
| N | 1 | 1 | 24 | 17 | 25 |
| $\bar{x}$ | 7.5 | 3.52 | 4.27 | 3.56 | 3.25 |
| S.D. | | | ±0.42 | ±0.31 | ±0.26 |
| Wing chord (mm) | | | | | |
| N | 1[2] | 1 | 16 | 17 | 25 |
| $\bar{x}$ | 80.0 | 58.0 | 49.78 | 46.17 | 44.72 |
| S.D. | | | ±1.56 | ±0.92 | ±0.88 |
| Exposed culmen (mm) | | | | | |
| N | 1 | 1 | 20 | 16 | 25 |
| $\bar{x}$ | 26.3 | 20.2 | 18.23 | 20.46 | 17.56 |
| S.D. | | | ±0.74 | ±0.69 | ±0.62 |
| Tail length (mm) | | | | | |
| N | 0 | 1 | 25 | 25 | 25 |
| $\bar{x}$ | | 30.0 | 25.42[1] | 26.53[1] | 23.30 |
| S.D. | | | ±0.94 | ±0.87 | ±1.00 |

[1]Stiles 1971
[2]Study skin, WFVZ

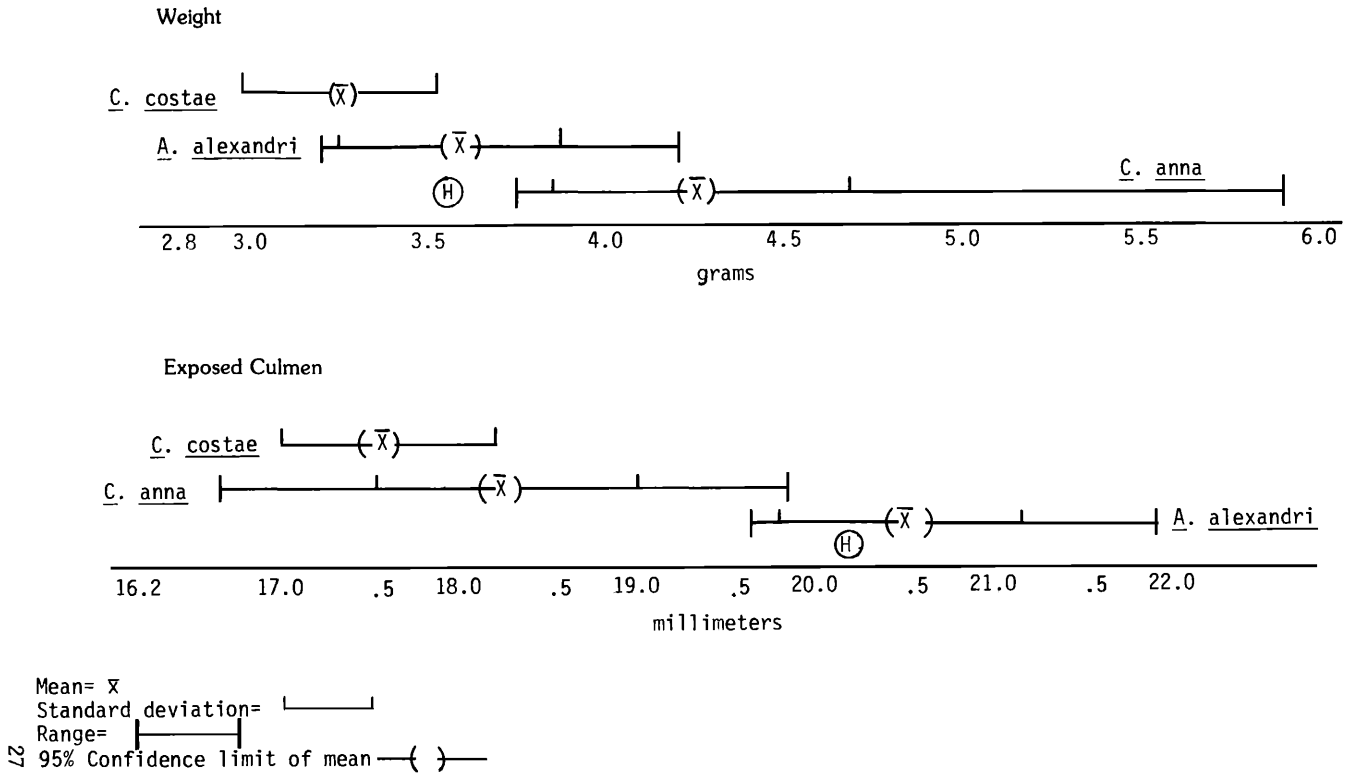


Figure 3. Comparison of weight/exposed culmen of hybrid (21 October 1978) and of females of possible parental species.

## DISCUSSION

Of the three types of information—color, known distribution, and breeding phenology—available to us for determining the identity of male parents involved in the nesting attempts, color is useful only in eliminating the genera *Selasphorus* and *Stellula* from consideration. Usual distribution patterns probably eliminate another species, Costa's Hummingbird, although the possibility of a vagrant male Costa's occurring in the area cannot be totally discounted.

Of the two remaining species, one, Anna's Hummingbird, was common and breeding in the study area during the first nesting attempt, and for this reason it is the most likely male parent for the first nesting, the light weight of the hybrids notwithstanding. Similarly, the most abundant hummingbird locally at the beginning of the second nesting attempt was the Black-chinned Hummingbird, and individuals of this species were actually seen displaying to the female blue-throat. We suggest that this species is a likely candidate for the second parent along with Anna's Hummingbird, which presumably was reproductively active throughout the spring.

Banks and Johnson (1961) noted that "once a specimen is determined to be a natural hybrid, assumptions as to the natural parentage of such a bird are only 'best guesses' and cannot, except in rare instances, be established with certainty." Despite the fact that in the present instance one parent involved in the hybridizations is known with certainty, the identity of its hybrid mates must still remain a matter of the "best guess."

## SUMMARY

A female Blue-throated Hummingbird, the first recorded in California, was discovered in Three Rivers, Tulare County, in late December 1977. The bird remained in the vicinity until late May 1978. During its stay it nested twice. Two young were successfully produced from the first nesting attempt, but the second attempt failed in the early nestling stage. Because of the apparent lack of a conspecific male and the appearance of the young from the first nesting attempt, we believe these attempts were hybridizations. Although the male parents involved could not be identified unequivocally, we suggest that Anna's Hummingbird was the most likely parent in the first nesting and that either an Anna's or Black-chinned Hummingbird was the male parent in the second attempt.

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## LITERATURE CITED

American Ornithologists' Union. 1957. Check-list of North American birds. 5th ed. Am. Ornithol. Union, Baltimore, MD.

Baldridge, F.A. 1983. Plumage characteristics of juvenile Black-chinned Hummingbirds (*Archilochus alexandri*). Condor 85:102-103.

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

Grinnell, J. & A.H. Miller. 1944. The distribution of the birds of California. Pac. Coast Avif. 27.

Hubbard, J.P. 1978. Revised check-list of the birds of New Mexico. New Mexico Ornithol. Soc. Publ. No. 5.

Luther, J.S., G. McCaskie & J. Dunn. 1979. Third report of the California Bird Records Committee. West. Birds 10:169-187.

Lynch, J.F. & P.L. Ames. 1970. A new hybrid hummingbird, *Archilochus alexandri* × *Selasphorus sasin*. Condor 72:209-212.

Marshall, J.T., Jr. 1957. Birds of the pine-oak woodland in southern Arizona and adjacent Mexico. Pac. Coast Avif. 32.

Mayr, E. & L.L. Short, Jr. 1970. Species taxa of North American birds, a contribution to comparative systematics. Publ. Nuttall Ornithol. Club No. 9.

Oberholser, H.C. 1974. The birdlife of Texas. Vol. 1. Univ. Texas Press, Austin.

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

Phillips, A.R. 1975. Migration of Allen's and other hummingbirds. Condor 77: 196-205.

Phillips, A.R., J. Marshall & G. Monson. 1964. The birds of Arizona. Univ. Arizona Press, Tucson.

Short, L.L., Jr., & A.R. Phillips. 1966. More hybrid hummingbirds from the United States. Auk 83:253-265.

Skutch, A.F. 1962. The constancy of incubation. Wilson Bull. 74:115-152.

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

Stiles, F.G. 1973. Food supply and the annual cycle of the Anna's Hummingbird. Univ. California Publ. Zool. 97:1-116.

Stiles, F.G. & L.L. Wolf. 1973. Techniques for color-marking hummingbirds. Condor 75:244-245.

Van Tyne, J. 1953. Geographic variation in Blue-throated Hummingbirds (*Lampornis clemenciae*). Auk 70:207-209.

Wagner, H.O. 1946. Food and feeding habits of Mexican hummingbirds. Wilson Bull. 58:69-93.

Wagner, H.O. 1952. Beitrag zur Biologie des Blaukehkolibris *Lampornis clemenciae* (Lesson). Veroff, Mus. Bremen, Reihe A, Bd. 2:5-44.

Wells, S., R.A. Bradley & L.F. Baptista. 1978. Hybridization in *Calypte* hummingbirds. Auk 95: 537-549.

Williamson, F.S.L. 1956. The molt and testis cycle of the Anna Hummingbird. Condor 58: 342-366.

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Blue-throated Hummingbird *Sketch by Keith Hansen*