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THE HUMMINGBIRDS OF CALIFORNIA.

COMMENTS ON THEIR HABITS AND CHARACTERISTICS.

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(Plates XV–XVII)

ALTHOUGH the Hummingbirds comprise one of the largest families of American Birds, including some five hundred species, but nineteen have been found within the United States, and of these only one occurs east of Texas and the Rocky Mountains. Of the nineteen, two species, both of which were taken in California, are thought to have been mere adventitious hybrids, while nine others are restricted to within about 100 miles of the Mexican border in Arizona, New Mexico and Texas, several of these latter being represented only by casual visitants or stragglers from their true homes farther to the south. Of the remaining eight which may be considered more definitely a part of our fauna, six species are of common occurrence over large portions of California, while a seventh has also been found within the borders of the State.

Before proceeding to the more specific discussion of the California Hummingbirds, it is interesting to note that although green is the prevailing color on the throats or other luminous parts of the plumage of the Mexican, Central American and West Indian species, occurring oftener than all other colors combined, this color is not found on the throat of any of the eight Hummingbirds whose range lies largely within the United States. In four of these the gorget is red, in two it is reddish purple or rose pink and in the remaining two, violet. In only five or six others of the 140

1. FEMALE COSTA'S HUMMINGBIRD FEEDING YOUNG.
2. NEST OF COSTA'S HUMMINGBIRD—BITS OF PAPER USED FOR ORNAMENT. NEST, ATTACHED TO UPRIGHT STUB BY COBWEBS.

species (exclusive of subspecies) listed by Mr. Ridgway in 'Birds of North and Middle America' does the red color appear, and in none of the 30 species living in or near the Panama Canal Zone. The impression is thus gained that northern latitudes must in some way be conducive to the development of red areas in the plumage of the Trochilidae, and this impression is strengthened when we consider that the Rufous and the Ruby-throated Hummingbirds, which reach the highest latitudes in summer, and likewise Anna's and Allen's Hummingbirds, which winter farthest north, all have red gorgets, while the Rufous Hummingbird, the hardiest pioneer of all, is unique in the reddish color of its back as well. Despite the predominance of yellow flowers, pure yellow is entirely lacking in the plumage of North American Hummingbirds.

However scanty in numbers as compared to the multitude of species inhabiting such countries as Ecuador, Colombia or even Costa Rica, with respect to brilliancy of coloring the California Hummingbirds need not suffer by comparison with the tropical species, many of which are of plain and somber garb. Mr. Ridgway declares that "of all the gorgeted Hummingbirds by far the finest are the two species of the genus *Calypte* which inhabit parts of Mexico and California and the single one found in Cuba," and quotes Mr. Gould to the effect that the Rufous, Costa's and Anna's Hummingbirds "are unequaled for the rich metallic brilliancy of certain parts of their plumage, by any other members of the family." (Report of National Museum, 1890, pp. 301 and 336.)

Omitting from consideration the very rare Floresi's and Violet-throated Hummingbirds, thought to have been hybrids of *Selasphorus* and *Archilochus*, respectively, with *Calypte anna*, the manner of occurrence of the various species within the State of California may be briefly indicated as follows:

Archilochus alexandri. BLACK-CHINNED HUMMINGBIRD.—Summer visitant to southern California and northward on both sides of the Sierra Nevada. Absent from the northern coast region and the Santa Barbara Islands.

Calypte costae. COSTA'S HUMMINGBIRD.—Summer visitant to the mesas and deserts of southern California, ranging as far northward as Santa Barbara and Inyo Counties.

Calypte anna. ANNA'S HUMMINGBIRD.—Resident, mainly west of the high mountains, northward through the San Francisco Bay region and the Sacramento Valley.

Selasphorus rufus. RUFOUS HUMMINGBIRD.—Spring migrant through the valleys and foothills of the Pacific slope; late summer and fall migrant, principally along the mountain ranges.

Selasphorus alleni. ALLEN'S HUMMINGBIRD.—Spring and summer visitant to the humid coast belt, as far south, locally, as Santa Barbara and Ventura Counties. Resident on the Santa Barbara Islands. Migrant through the southern end of the State.

Selasphorus platycercus. BROAD-TAILED HUMMINGBIRD.—Summer visitant to the higher mountain ranges of eastern Inyo and Mono Counties.

Stellula calliope. CALLIOPE HUMMINGBIRD.—Summer visitant to the Sierra Nevada and the higher mountains of southern California. Spring migrant along their bases.

OBSERVATIONS IN THE SAN GABRIEL VALLEY.

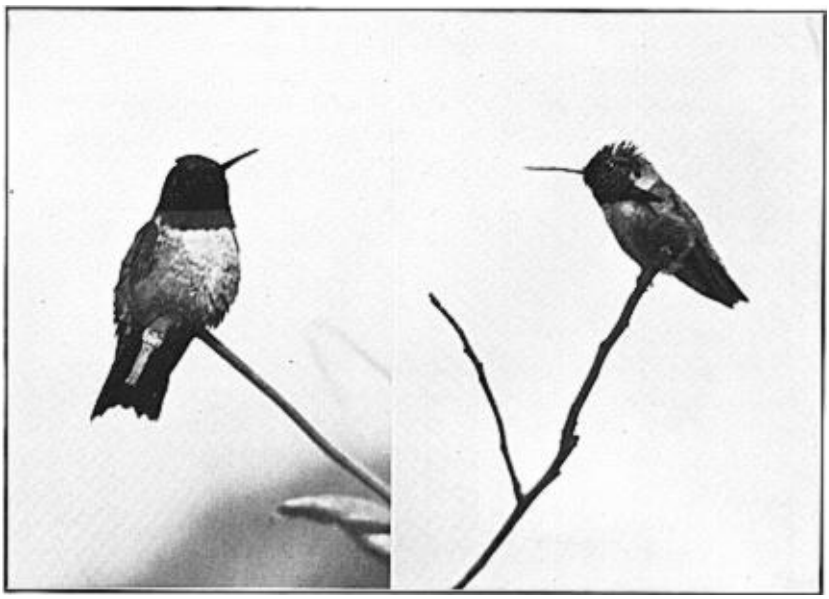
A dozen years' experience in raising oranges and other subtropical fruit at Azusa, California, not far from the mouth of the San Gabriel Canyon, in Los Angeles County, have given the writer an opportunity to become more or less familiar with six of the Californian species of Hummingbirds, which gather in considerable numbers in and about the orange groves during the blooming season, which usually coincides with the spring migration of most of these species. I have seen all six here within less than 30 days, and at times in the month of April all but Allen's Hummingbird appeared to be present together.

Allen's Hummingbird is not very common in this locality, but occasionally, from the last of January until the vernal equinox, a metallic screeching sound draws one's attention to a male of this species as it tarries briefly among the flowers. The Rufous Hummingbird is the next of the migrants to appear, usually arriving early in March and leaving late in April. During part of this time it is the commonest species. My earliest record for the Rufous is February 17 (1926) and the latest for the spring migration May 1 (1924). The adult male is only an occasional visitant on the southward migration in late summer, though the females, or more probably immature birds of both sexes, are seen more frequently. Costa's Hummingbird is irregular in its arrival, but may be looked for at any time after the middle of March (the

earliest was noted on March 16, 1923), and stays until June or the first of July, being the only species which I have found nesting about the grove. The Black-chinned Hummingbird is a very transient visitant in the month of April, but returns after the breeding season, sometimes as early as the last of June, and is likely to remain in the Valley for a month or more after the Costa's have departed. The Calliope Hummingbird makes only a short stay, being present in small numbers, if at all, for a week or two in April. Anna's Hummingbird is apt to be seen at any season, except possibly in midsummer, but never in abundance.

The spring migrants, and likewise Costa's Hummingbird when it first arrives, are almost constantly in a state of activity, so that it is often difficult to obtain more than a fleeting glimpse of them as they chase one another about. At these times there appears to be a great preponderance of males, which is partly accounted for, no doubt, by the quieter and more retiring habits of the females. Anna's Hummingbird, being a resident, does not seem to share to any great extent in the feverish activities of the migrants, but for the most part sits aloof upon a dead twig at the top of some bush, and as the season advances the male Costa's also follows that example. Hummingbirds feel the heat, and on hot days they are likely to abandon their exposed perches and seek a shady spot. A high wind also will cause them to remain in a sheltered place, but on a cloudy, misty day they are apt to be much in evidence.

A Hummingbird darting about at top speed is not a convenient subject for identification by the use of the usual keys; hence, a more intimate knowledge of certain habits and characteristics is often of assistance. The gradations in size are not distinct enough to be of great service as a means of recognition, though when the Anna's and Calliope Hummingbirds are seen together the contrast is rather striking. In the Black-chinned Hummingbird it is particularly hard to make out the color of the throat, because of the comparative dullness as well as the restricted area of the metallic coloring. The male of this species may always be known, however, by the square-cut gorget and the general blackish color of the sides of the head, in sharp contrast to the white of the neck and the conspicuous postocular spot.



1. BLACK-CHINNED HUMMINGBIRD.
2. COSTA'S HUMMINGBIRD.
3. NEST OF COSTA'S HUMMINGBIRD PARTLY SUPPORTED BY LEAF WHICH BECAME DETACHED LEAVING IT HANGING BY ONE EDGE.

A pronounced metallic screeching or rattling sound accompanies the flight of the male Rufous and Allen's Humming birds and in a slightly lesser degree that of the male Black-chinned Hummingbird. The flight of the Calliope Hummingbird is not definitely metallic, but sometimes is characterized by a shrill, strident quality not exhibited by any of the other kinds. The male of this species is able to produce at will a loud buzzing like that made by a large fly entangled in a spider's web. I have seen one leave his perch repeatedly and hover near by to buzz in this way, apparently for his own entertainment. The only sound ordinarily heard in connection with the flight of the male Anna's and Costa's Hummingbirds, as with that of the females of all species, is a soft, deep hum which increases in volume and pitch when the bird accelerates its speed, and has at times a certain silken rustling quality.

If the male Anna's and Costa's Hummingbirds lack distinguishing peculiarities of flight, they are the most easily recognized through their vocal utterances. The squeaky, metallic song of the Anna's Hummingbird, in which it indulges quite persistently with little regard for season, is a sure indication of the species, while the presence of a Costa's Hummingbird is frequently announced by the two-or-three-syllabled whistling call with which he greets passing members of the tribe from his perch or salutes his mate as he hovers before her. The young males begin practicing on these whistling notes, which are doubtless among the highest-pitched sounds audible to the human ear, before they have yet attained their brilliant gorgets, with results that sometimes rather resemble the song of the Anna's Hummingbird, though much fainter and less sustained. The other species seem less given to vocalization, aside from the feeding note and the excited twittering accompanying the chase, which are common to all species and both sexes alike.

A male Hummingbird, when too far away to be distinctly seen, can often be identified by the manner of its "nuptial flight," so called; or even when not visible, by the utterance accompanying such flight. It may be questioned whether the term "nuptial flight" is correctly used in this connection, as the Hummingbird frequently directs his attention on these occasions toward one of a different species or, as often as not, toward a bird of another

sort entirely. The fact that this maneuver is practiced only by the adult males, however, would imply some sexual significance, so for lack of a more accurately descriptive name the present one may well be retained. Perversely enough, the females, which are often so difficult to identify by their appearance, have no such distinguishing characteristics of voice or flight.

The most elaborate nuptial flight is that of the Anna's Hummingbird. When carried out in its complete form the bird mounts almost vertically to a lofty height, then suddenly descends with terrific speed; when within a short distance of the object of its attention it turns rather sharply upward again, at the same time giving utterance to a loud, explosive chirp resembling the bark of a ground squirrel, and returns to a point directly overhead, where it pauses for a few seconds to render its song, after which it again ascends more slowly and repeats the process until it tires or the other bird departs, with the Hummingbird in hot pursuit. The Costa's Hummingbird, instead of making a more or less abrupt turn, sweeps through a great arc to describe an immense letter U, then passes overhead to shoot downward again, either from the same direction or at a new angle. A continuous shrill whistle or miniature shriek accompanies most of the downward course and part of the upward—in other words, that part of the circuit in which the velocity is highest. This Hummingbird often ends his series of loops by darting away at high speed in an erratic, zigzagging flight. The Calliope Hummingbird also performs a nuptial flight of rather similar character, but in form tending toward the hyperbolic and marked at the lowest point by a curiously muffled yet explosive squeak, quite characteristic of the species.

In addition to this lofty type of nuptial flight, which seems to be shared to some extent by all the species, other forms are used by certain of them. Allen's Hummingbird flies rather slowly back and forth along a path such as would be described by a giant pendulum, with a sort of lateral writhing movement of the body and extended tail and a vibratory metallic noise, but without vocal sound. Again it will poise itself close in front of another bird and rapidly shuttle to and fro sidewise through a space of perhaps a foot or two. My observation of the Allen's and Rufous Hummingbirds has not been extensive enough to determine whether

their practices in this respect are identical, but a close similarity would be expected from the nearness of their relationship. During its stay in southern California, however, the type of nuptial flight favored by the Rufous Hummingbird is a swooping dive like that of the Calliope Hummingbird, punctuated at the bottom of its course by what might be described as a tremulant squeak or a rapid succession of about four thin, vibrant notes. This sound, like that of the Calliope Hummingbird, is of so peculiar a nature and so different in quality from the normal voice of the bird that the only reason for assuming that it is produced by the throat rather than the wings is the unmistakably vocal origin of the sound in the case of some of the other species.

The shuttling of the Black-chinned Hummingbird, which follows a path like a narrow figure 8 lying on one side, has often been mentioned in accounts of the species. Its other form of nuptial flight most closely resembles that of the Rufous Hummingbird, just described, but the vocalization is more prolonged and of rather different character—a long-drawn, pulsating, plaintive, liquid note, probably the most pleasing utterance of any of our Hummingbirds. The heavy droning sound of its flight, so noticeable in the shuttling movement, is heard in this case only while momentum is first being gained on the downward swing. The shuttling flight, it may be noted, is practiced almost solely by those species in which the wings of the male are specially modified for noise-making purposes.

To see an Anna's Hummingbird, hovering motionless in the air with body nearly horizontal, suddenly begin to rise rapidly and vertically, as if by a reversal of the force of gravity, is to obtain some idea of the bird's remarkable mastery of the air. Despite the Duke of Argyle's postulate that "no bird can ever fly backwards," the ability of the Hummingbird to fly backwards or in any other direction it wishes can hardly be questioned by one who has watched an aerial tilt between two of these birds, during which they advance and retreat at every angle, performing all manner of evolutions with the appearance of utmost ease. In the matter of flight, the difference between work and play seems to be well recognized by the Hummingbirds. Considering the great amount of unnecessary flying which they do, it is amusing to see one hang

almost upside down rather than use its wings while probing a flower.

No one who possesses an appreciation for color can tire of studying the changing hues of a Hummingbird's throat. The statement has been made by an eminent naturalist that the luminous reflection appears only as a single spot ever varying in position with the movements of the bird. But if an Anna's Humming bird, for example, is viewed directly from the front, with the light at the observer's back, the whole head and gorget glow in their full resplendence. Sometimes when it approaches and hovers in front of one, as it is apt to do, the effect is as if a coal of fire was suspended in mid-air.

The color of the head and throat of Anna's Hummingbird is less changeable than are the colors of some species, but in certain aspects the beauty of the brilliant rose-pink gorget is enhanced by a border of richest gold. Costa's Hummingbird, on the other hand, shows a wide variation in its coloring according to the conditions of the light. The head and gorget of a single individual will sometimes appear violet-blue and at other times magenta, approaching the color of Anna's Hummingbird.

Unlike the latter species, the coloring of Costa's Hummingbird is not exhibited to the best advantage when directly reflecting the brightest rays of the sun, as the intense brilliancy causes a paling of the delicate violet tints. In a more diffused light rich blue and red high tints may often be observed on different parts of the head at the same time. The gorgets of the Rufous and Allen's Hummingbirds are normally of an intense scarlet, but at some angles appear as if pure burnished gold. The reddish-purple throat of the Calliope Hummingbird varies little in shade, but the odd color pattern and serrated edges of its gorget, together with the interest that attaches to it from its position as the smallest of our birds, make it by no means the least attractive of the Hummingbirds.

Numerous statements, some of them directly contradictory, have been made regarding the disposition and comparative aggressiveness of the several species. From my own observation I have been unable to detect any constant differences in this respect, and believe that those noted by others may perhaps be attributed

1. ANNA'S HUMMINGBIRD FEEDING AT THE WILD FUCHSIA OR HUMMINGBIRD FLOWER (ZAUSCHNERIA CALIFORNICA) TAKEN IN OCTOBER.
2. ALLEN'S HUMMINGBIRD AND TREE TOBACCO. THE LUSTER OF THE METALLIC GREEN BACK IS CLEARLY DISCERNIBLE. TAKEN IN FEBRUARY.

to season or circumstances. The Calliope Hummingbird, for example, which has been described as retiring and peace-loving, taking no part in the contests of the larger species, does not, in fact, hesitate to attack Anna's Hummingbird and when chased away immediately returns to renew the challenge. On the other hand, I have seen Allen's Hummingbird, to which Mr. Allen ascribed unusual aggressiveness, meekly turn tail when an Anna's or a Rufous Hummingbird resented an infringement of its territory. (Report of National Museum, 1890, pp. 349 and 357.)

In the same connection Mr. Allen referred to the great activity of Allen's Hummingbird, as contrasted with the Rufous. While passing through the San Gabriel Valley Allen's Humming bird is indeed very active, though hardly more so than the other spring migrants; but on Santa Catalina Island during the nesting season the same restful disposition is apparent that is shown by other species under similar conditions. There the males remain perched on wires or exposed twigs for quite long periods and appear to confine themselves largely to certain restricted areas when not feeding. Towards evening, like other species, they make short sallies in Flycatcher fashion after passing insects too minute to be discerned by the human eye.

As to the motive for the frequent contests and pursuits, it is of course impossible to speak with certainty, though there is no doubt that a Hummingbird, having laid claim to a particular feeding ground, resents any competition within its limits. These vested rights seem to be recognized by the intruders, who seldom tarry to dispute possession. In general, however, and especially during migrations and among the young birds in midsummer, when such activities are most pronounced, they impress one as being mainly the result of exuberance of spirits and a sportive disposition. This is borne out by the lack of injury and, usually, of any contact between the contestants; also by the fact that the diversion seems to be equally enjoyed by pursuer and pursued, as the latter will often return and hover in front of the former as an invitation to another race. Sometimes a sound is heard as of the clash of wings, but by close attention it will be seen that this noise is often produced when the birds are entirely separated and occasionally by a solitary individual, probably by striking the wings together over the back.

A sick Hummingbird, however, seems to receive little sympathy from its fellows. I had wondered what would be the result if a Hummingbird quietly refused to take part in these skirmishes, and on a certain occasion when one of the three or four which were frequenting the garden seemed to be sick or injured and hence averse to unnecessary activity, I was able to note the outcome. Another, apparently a young male Black-chinned Hummingbird, with a single dark spot on the throat, would shuttle back and forth in front of it as it sat on some twig, darting at it at the end of every few oscillations, sometimes striking it with its bill, until the unfortunate bird would be compelled to take flight.

I am convinced that the Hummingbird's actions towards other birds are usually free from hostile intent, even when near its nest. As an indication of this, I have known a Dove to make its nest in the same tree and within a few feet from where a Hummingbird was rearing her young, which would hardly have been likely had the Hummingbird maintained an unfriendly attitude. The Hummingbird's pursuit of other birds seems to be due to its love of the chase and depends upon its mood, as it often ignores their near approach and even allows itself to be bullied by them without showing resentment. Similar deductions may be drawn from the lack of fear evidenced by birds as small as the Goldfinches, though the Hummingbird could undoubtedly make itself disagreeably felt if it were so inclined.

Some of our Hummingbirds seem to be in a measure, at least, independent of the presence of flowers, since Anna's Hummingbird manages to subsist at times when, on account of severe frosts, flowers are extremely scarce. During the nesting season it has seemed to me that the female Costa's Hummingbird visits the flowers much less than does the male. At such times the female may often be seen buzzing about inside non-flowering trees and shrubs. While the search may be primarily for cobwebs or other nesting material, numerous minute insects and spiders might incidentally be obtained.

Hummingbirds are attracted to flowers initially by their coloring. A bunch of carrots will sometimes arouse the interest of a Hummingbird, and I have seen one probing clusters of bright orange Crataegus berries. But when once established in a locality they

will habitually pass over some of the showiest flowers as unsuited to their uses, seeking out others, perhaps much less conspicuous, which minister to their needs. An important addition, from the Hummingbird's standpoint, to native and cultivated flowering plants is the Tree Tobacco (*Nicotiana glauca*) (Pl. XVII). This rank-growing, drought-resistant South American shrub, now naturalized and widely distributed in southern California, bears a profusion of tubular flowers throughout the entire year. In connection with this plant may be seen an instance of the discrimination exercised by Hummingbirds when food is plentiful, in that they ignore the yellow mature flowers, probing instead the greenish newly opened blossoms. Costa's Hummingbird, for some reason, seems less partial to the Tree Tobacco than do the larger species.

Running water draws the attention of Hummingbirds, but they fear to enter it if it is of any appreciable depth, though they will sometimes drink while hovering over it. Most of their bathing is done in the dew collected on the foliage of plants. They will occasionally hover in a fine spray when available, and in winter I have seen Anna's Hummingbird alight on the lawn under the spray and indulge in a very thorough bath. As with other birds, early morning and cool weather are the favored times for bathing.

Owing to their close relationship in structure and habits, the nidification of all of the above mentioned species is very similar, and the variations due to individuality or adaptation to external conditions are often greater than the constant specific differences. The following account of the nesting of Costa's Hummingbird will therefore apply in many respects to the other kinds as well.

FAMILY LIFE OF COSTA'S HUMMINGBIRD

The family life of the male Costa's Hummingbird may be easily disposed of with the simple statement that he has none. No male Costa's has ever in my experience shown enough interest in family affairs to indicate his relationship with any particular brood. His mate, however, amply makes up for his deficiencies and finds no difficulty in managing the household without his aid.

The admirably delicate architecture of this Hummingbird's nest is well known and need not be enlarged upon here. Those which I have examined were about one and one-half inches in

outside diameter and were constructed with a framework of fibers, small flexible stems and pieces of string affixed to the supporting branch by means of cobwebs, and with a thick, soft lining of plant down and small feathers, the exterior being ornamented with numerous bits of bark, paper or miscellaneous dry vegetable matter securely bound thereon with cobwebs. Much of the soft material, as well as the ornamentation of the exterior, is added after the eggs are laid, so that the latter may be almost hidden for a time. This material is compacted by treading and turning about in the nest, the bill often being thrust beneath to rearrange some part of it. The quality of the construction varies considerably. Some of the nests are so flimsy that after the young are partly grown the nest becomes flattened out or broken down at the sides. Others are so solidly and compactly built that they retain their shape with no appreciable change as long as they are in use and for many months afterward. The first stage of the construction requires but two or three days, after which, however, an equal period of inactivity is likely to ensue before the first egg is laid.

At Azusa, California, the nests have been found at heights ranging from two to nine feet, but most commonly in the neighborhood of four feet. When a bush or small tree is selected, as is frequently the case, the nest is almost invariably located at a height of approximately one-half of the total height of the tree, but near the outside rather than the center, and in a position from which a reasonably clear outlook may be obtained. On this account trees of dense, leafy growth, such as an orange tree in thrifty condition, are not favored. The great majority of the nests discovered in this particular grove were placed in avocado trees or in bushes of the *Feijoa sellowiana* or Paraguay Guava, which together made up a corner of the orchard. If in a large tree, the nest is usually on a small twig near the end of a projecting lower limb. In an orchard under cultivation the latter location is a very hazardous one, since the nest is apt to be wrecked by the passage of team or implements, and furthermore is subject to destruction by strong winds or by the drooping of the slender twig under the increasing weight of the young.

It may be assumed that the scant height at which this species prefers to nest is the result of an inherited habit due to the fact

that large trees were originally absent from much of its range. The danger of injury through the tilling of the soil is, of course, something that the bird's instinct could not be expected to provide against, and the failure to recognize the possibility of disaster from wind or the sagging of the supporting twig might be accounted for by the fact that the natural vegetation of the arid regions is inclined to be more or less rigid, but poor judgment is sometimes shown too in building upon an inadequate or unstable base, which may in time result in the tilting or entire loosening of the nest. (Pl. XVI) The nest is frequently, and wisely, placed on a fair-sized horizontal branch, at the base of a twig or spur, to which it is securely anchored. Occasionally a limb an inch or more in diameter is chosen, which adds to the stability of the nest, but would render it more accessible to climbing predatory animals.

The eggs, as with all Hummingbirds, are two in number, white, tinged with pink when freshly laid, and oblong in form. An interval of about two days separates the laying of the eggs. Incubation, in every case that I have observed, has begun with the laying of the first egg, and the young are usually hatched out a day or more apart. If we are to accept the widely differing periods reported—from nine to eighteen days—the time of incubation must be regarded as extremely variable. On account of absences I have not succeeded in collecting as full information on this subject as could be desired, but data of varying accuracy obtained during five successive years indicate that the normal incubation period for Costa's Humming bird in the San Gabriel Valley is about sixteen days, lengthening in certain instances to as much as eighteen days, but never falling below fifteen days. These figures do not differ materially from the time of seventeen days given by Mr. Dawson for Anna's Hummingbird, whose incubation he regarded as lasting "a good deal longer than is customary with our other Hummers." (Birds of California, p. 942.) This is a longer time than is required by the eggs of the commoner passerine birds, notwithstanding the larger size of the latter.

There is a remarkable difference in the shyness of the various individuals when on the nest. Some will leave as soon as a person comes into sight, perhaps forty feet away; others will permit one

to reach within a few inches, or possibly, with care, even to touch them, without leaving the nest. The shyer ones, however, are inclined to hold to the nest more closely as the incubation advances, and especially around the time of hatching. Most of them, though easily frightened from the nest, will soon return if one stands quietly a few feet away, a decided reversal of the tendencies of the majority of nesting birds. Apparently the Hummingbird requires but little time for the procuring of food, since the eggs are seldom found uncovered.

The growing period of the young is even more markedly prolonged than is the incubation. Some eight broods for which the time was determined with fair accuracy remained in the nest from twenty to twenty-three days after hatching, with all but two approximating the higher figure. A similar period was sufficient for a pair of Western Chipping Sparrows not only to rear their young but to incubate their eggs as well. At the same locality the young of such birds as the House Finch, Green-backed Goldfinch, Western Lark Sparrow, Anthony's Towhee and Western Mockingbird were found to leave the nest in from ten to sixteen days, according to individual variations. The Phainopepla more closely approached the Hummingbird's time with nineteen days, the incubation period being sixteen days. Taking a species more nearly comparable in size to the Hummingbird, two broods of Black-tailed Gnatcatchers occupied their nests nine and ten days. Whether two or only one young Hummingbird was being reared made no difference in the rate of growth. It is possible that they develop more rapidly in other districts, since Mr. Dawson, who has observed this species near Santa Barbara, states that "under favorable circumstances the young birds fly in from ten to fourteen days" (Birds of California, p. 953); but in view of the notable uniformity of the Azusa records this variance would seem quite remarkable.

Even more pronounced than in most other altricial birds is the contrast between the newly hatched Hummingbird and its parents. The minute grub-like creature is black above and brownish below, with the body entirely bare except for a row of yellowish filaments along each side of the median line of the back. The bill is yellow and triangular, its length being but slightly greater than its width

at the base. The eye-sockets project beyond the base of the bill. Until about the sixth day, when the pin-feathers begin to appear, the most noticeable change, aside from the increase in size, is the gradual lengthening and darkening of the bill. The first part of the young Hummingbirds' lives is spent stretched out on the bottom of the nest, but after a time they become longer than the interior of the nest, so that they are gradually forced to raise their heads against its sides until at one stage of their growth their bills are pointing directly upward. After this their development is more rapid, and when they begin habitually to hold up their heads and assume an alert appearance, they are nearly ready to fly. The last few days before leaving the nest, the young birds frequently exercise their wings, sometimes perching on the edge of the nest for freer action. Finally a time is reached when, contrary to their former indifference, they are likely to leave on very slight provocation. A person may be quietly standing and watching them when as with one impulse both spring from the nest and fly in different directions. It sometimes so happens that the younger of the two is thus induced to venture forth before its wings are capable of sustained flight or of enabling it to obtain a foothold in a tree. On two such occasions I found that the bird might readily be picked up and when restored to its nest gladly settled itself to await more adequate strength.

The young Hummingbirds are fed by regurgitation, of necessity, at intervals of about half an hour. The feeding requires perhaps half a minute in all and is accomplished by a violent pumping process, with the bill thrust deep into the open mouth of the young bird. One would not judge that the slow growth of the Hummingbird was due to inability to supply sufficient food, since the mother, though bearing the entire care of her offspring, does not seem overworked, but has plenty of time to rest, preen her plumage and engage in skirmishes with other Hummers. Her care of the young continues for some time after they have left the nest. Then their call for food may be heard at intervals, a shrill cheep resembling the cries of other young birds rather than the voice of the adult Hummingbird. After the young have attained their full growth in other respects, they may still be recognized by the comparative shortness and straight, subulate form of the bill.

In no case within my knowledge has a second brood been successfully raised, and only twice have eggs been found late enough in the season to have represented a possible attempt to do so. In 1922 a set of eggs was laid about June 6, but was abandoned before hatching. In 1923 the season was unusually early; the first male Costa's Hummingbird was noted on March 16, and fledged young were seen by May 7. Later a set of eggs was discovered which hatched about June 2, but one of the nestlings fell to the ground, while the other failed to develop properly and was unable to fly even after thirty days in the nest. The following year a brood was still in the nest as late as July 4, but the nesting had begun much later than the previous year and this was doubtless the second attempt of a parent who had lost her first set of eggs. The males do not feel it necessary to await the outcome of their mates' labors; in 1924, following a very dry winter, the Costa's Hummingbirds nested in quite large numbers, but very few males were to be seen after the early part of the season.

For the purpose of affording an idea of the percentage of success and the causes of failure, a table is appended summarizing the results of several years' observations of the nesting of the Costa's Hummingbird. In order that the proportions may be more truly representative, only those nests have been included which were discovered before the eggs were hatched. The figures in each case indicate the number of nests, without reference to the number of eggs or young contained.

	1922	'23	'24	'25	'26	Total
Number of nests containing eggs	2	6	9	9	3	29
Destroyed in cultivation or by wind			3	2		5
Both eggs disappeared				1		1
Abandoned before hatching	1	1		2		4
One egg only hatched		1	1	2		4
Both eggs hatched	1	4	5	2	3	15
Died or abandoned after hatching			1	1	1	3
Destroyed by animals			1			1
Lost by tilting or loosening of nest		1	1			2
Failed to develop properly		1				1
One young fledged		1	1	2	1	5
Two young fledged	1	2	2	1	1	7

Though the initial figures in the table do not represent the entire number of pairs nesting in the area, they probably furnish

a fairly accurate index to the relative yearly abundance, with the possible exception of 1922, when the search for nests may have been less systematic than in succeeding years. 1924 and 1925 were exceptionally dry seasons, which may have caused the Hummingbirds to concentrate to an unusual extent in the irrigated districts. The Los Angeles rainfall records show that 1923 was also deficient in moisture, though a cool spring and heavy late rains along the foothills kept the wild flowers blooming well into the summer. In 1926 the precipitation was somewhat above normal, and in 1922 still more so. It will be observed that the net results in the various years were more nearly uniform than the original number of nests. Incidentally, I find no evidence in support of the belief that a Hummingbird prefers to return and build again on the site of its previous nest.

The totals in the above table show the number of young fledged to be almost exactly one-third of the number of eggs laid. While some of those whose eggs were destroyed undoubtedly built new nests, relatively few were found which had been started after the main nesting period in April or May. Unless results are more favorable in other localities, the small increase indicates that the Hummingbird must enjoy a long life for a creature of its size. As an offset to the destruction by teams or implements, which usually occurred at an early stage, a number of the nests were tied up to prevent their occupants from being spilled out by reason of the faulty construction previously alluded to. Lacking this assistance, the losses under that heading would certainly have been much larger. It is notable that in only one instance were natural enemies clearly responsible for loss. Although this nest was on a small limb about four feet from the ground and the young were killed during the daytime, strong circumstantial evidence in the shape of footprints pointed to the Spotted Skunk as the culprit.

Mr. Dawson's 'Birds of California' contains the information that Allen's Hummingbird, among others, rears two broods each year, while the Costa's and Calliope Hummingbirds have but one. Without desiring to discredit these statements, which may be based on the most careful investigation, it is hard to see why the more prolific species would not gain in numbers at the expense of the others, so nearly identical in structure and habits and subject to the same hazards.

None of the other species share the preference of Costa's Hummingbird for arid regions, nor breed so generally in the Lower Sonoran zone, to which the Costa's is largely confined. Anna's Hummingbird, according to Dr. Grinnell (Distributional List of the Birds of California), breeds almost entirely in the Upper Sonoran zone. Its breeding range lies wholly within the State of California and northern Lower California, while its migration is only partial and it is a common resident of all the more densely populated sections of the State, abounding in city parks and gardens. How fitting it would have been, then, if M. Lesson, instead of attaching to this species for all time the name of a member of the European nobility who probably never saw a live Hummingbird, had named it for the great province of which it is so characteristically a part! Perhaps even yet this splendid species might by common consent become officially known as the California Humming bird; if so, the writer respectfully offers this suggestion to publishers of future handbooks and check-lists.

The Black-chinned Hummingbird is typical of the foothills and canyons of the less humid portions of the West, and is said to be more dependent upon the presence of water than any other species. That it can on occasion dispense with this desirable commodity was made evident to the writer upon meeting with this species in an Upper Sonoran canyon in southern Arizona at a time when, owing to unprecedented drought, the stream had long since run dry. Aside from a very few scattered mescals, there was an entire lack of flowers, in lieu of which the Hummingbirds were systematically probing the clusters of leaves at the ends of the live oak twigs.

The Broad-tailed Hummingbird, preëminently a mountain dweller, is a comparatively recent addition to the recorded avifauna of California, since the limited portion of the State in which it occurs is one of the least frequented regions in the United States. It seems reasonable to suppose that it may eventually be found as a migrant, at least, farther south in the mountains of eastern San Bernardino County.

The appearance of the Broad-tailed Hummingbird is not especially distinctive in any way. The color of the gorget, aside from its somewhat inferior brilliancy, is very similar to that of

Anna's Hummingbird, though showing at some angles a more purplish cast. A convenient recognition mark of the male is the rufous edging of certain of the tail feathers, in conjunction with the solid green color of the back and upper tail-coverts. It may safely be said that the Broad-tailed Hummingbird is much more readily identified by ear than by eye. The loud metallic noise produced by the flight of the male is an agreeable, almost musical sound, clearer in tone than that made by the Rufous, Allen's or Black-chinned Hummingbirds, while the notes of the female seem more liquid than those of other species. A rather faint, muffled staccato note is uttered twice in quick succession at the lowest point of its vertically diving nuptial flight.

To digress slightly from the subject at hand, the rather unusual distribution of the large genus *Selasphorus* is worthy of notice. In addition to the three wide-ranging North American species, the genus contains five species of small size, all of which are confined to the highlands of Costa Rica and western Panama. Since none of the northern species migrate farther south than Guatemala, there is no contact whatever between the two groups.

MENTALITY.

Few animals have aroused such widely divergent opinions regarding their mental capacity as have the Hummingbirds. By most naturalists, probably, they have been credited with a high degree of intelligence. It would seem, however, that many of the instances cited as evidence of reasoning ability, usually in connection with the construction of their nests, might as readily be assigned to accident or instinct. On the other hand, I believe that few observers will concur in the judgment of the late W. H. Hudson, who devoted a chapter of 'The Naturalist in La Plata' to a discussion of the characteristics of the Hummingbirds as a group, in the course of which, while greatly admiring their physical endowments, he classes them with the insects as to intelligence; in fact, in the case of the bumblebees, even to the advantage of the latter. Hummingbirds, says Mr. Hudson, "possess the avian body but do not rank mentally with birds. The pleasure one takes in their beauty soon evaporates, and is succeeded by no fresh interest, so monotonous and mechanical

are all their actions; and we accordingly find that those who are most familiar with them from personal observation have very little to say about them. A score of humming-birds of as many distinct species, are less to the student of habits than one little brown-plumaged bird haunting his garden or the rush-bed of a neighboring stream. . ."

With all due respect to Mr. Hudson's eminence as a naturalist, one cannot but feel that his attitude was unusual—certainly far different from that of John Gould, author of the 'Monograph of the Trochilidae,' who says: "That our enthusiasm and excitement with regard to most things become lessened, if not deadened, by time, particularly when we have acquired what we vainly consider a complete knowledge of the subject, is, I fear, too often the case with most of us; not so, however, I believe, with those who take up the study of the family of Humming Birds. Certainly I can affirm that such is not the case with myself; for the pleasure which I experience on seeing a Humming Bird is as great at the present moment as when I first saw one."

Many of Mr. Hudson's arguments do not seem convincing. He says: "It has frequently been remarked that humming-birds are more like insects than birds in disposition. . . . Their aimless attacks on other species approaching or passing near them, even on large birds like hawks and pigeons, is a habit they have in common with many solitary wood-boring bees. They also, like dragon-flies and other insects, attack each other when they come together while feeding. . . . Again, like insects, they are undisturbed at the presence of man while feeding, or even when engaged in building and incubation; and like various solitary bees, wasps, etc., they frequently come close to a person walking or standing, to hover suspended in the air within a few inches of his face; and if then struck at they often, insect-like, return to circle round his head. All other birds, even those which display the least versatility, and in districts where man is seldom seen, show as much caution as curiosity in his presence; they recognize in the upright unfamiliar form a living being and a possible enemy."

The similarity of the Hummingbird's habits to those of certain insects unquestionably creates the impression of an equal similarity in mental traits. It is quite possible, however, that though certain

actions are performed mechanically by insects, the same actions on the part of the Hummingbird may be entirely volitional. Considering the difficulty of drawing definite lines of demarcation between reason, instinct and reflex action even in the case of one's own accustomed activities, it would be rash to make dogmatic assertions as to the psychology of so distantly related a creature as a Hummingbird; but it may be observed that the habits which it is said to have in common with insects are also shared to a greater or less extent by some other birds and mammals, so it would seem fair to assume that its mental reactions in connection therewith would most closely resemble those of the higher animals to which it is related. The matter of its attacks on other birds has already been discussed.

The Hummingbird's indifference to the presence of man, which as a matter of fact is by no means so complete as would be inferred, might be justified on the grounds of its quickness of movement and its comparative freedom from molestation. It is true that it resembles the insects in its apparent recognition of possible enemies rather through their movement than by their form, but this applies to a certain extent to most birds and many mammals, while on the other hand, those who have attempted to photograph Hummingbirds under various conditions probably will have discovered that they are sometimes quite as suspicious of unfamiliar objects, whether living or inanimate, as are most other birds—one female even refused to approach the nest and feed her young while the camera was standing about three feet away. And as to curiosity, if that is to be regarded as an indication of deficient mentality, naturalists must be assigned a very low position on the scale of intelligence!

To again quote Mr. Hudson: "Humming-birds often fly into open rooms, impelled apparently by a fearless curiosity, and may then be chased about until they drop exhausted or are beaten down and caught, and as Gould says, 'if then taken into the hand, they almost immediately feed on any sweet, or pump up any liquid that may be offered to them, without betraying either fear or resentment at the previous treatment.' " Mr. Hudson then cites the similar behavior of dragon-flies, and continues: "Only in beings very low in the scale of nature do we see the

instinct of self-preservation in this extremely simple condition, unmixed with reason or feeling, and so transient in its effects. The same insensibility to danger is seen when humming-birds are captured and confined in a room, and then, before a day is over, they will flutter about their captor's face and even take nectar from his lips."

In the comparison of the behavior of Hummingbirds and dragon flies, the true test would appear to be, not in their actions when first caught, but when again approached after being released. In such circumstances an insect would doubtless use exactly the same effort to avoid recapture that it had used in the first place, modified only by physical exhaustion. The action of the Hummingbird would be quite different, according to Mr. Hudson's own statement and many other accounts of the ease with which it may be tamed, a trait which it shares with no less sagacious a beast than the elephant, and which in itself would seem to imply a certain degree of intelligence.

Though compelled to admit that I have so far been able to detect no indication of the Hummingbird's possession of reasoning ability—an accomplishment which, after all, is rarely enough displayed even by the human race—and that it may be lacking in some of those finer emotions which make many of the birds seem so akin to mankind, nevertheless its actions and attitudes, its alert interest in its surroundings, its apparent love of sport and its ability to recognize those who befriend it, as attested by many writers, certainly furnish competent evidence of an acutely conscious intelligence. Suffice it to say, in conclusion, that the Hummingbird's equipment—physical and mental—is sufficient to enable it to maintain its numbers successfully with an unusually small potential annual increase, comparable in general only to that of certain birds and mammals of many times its size.

Azusa, California.